ATOMIC ENERGY LEVELS

As Derived From the Analyses of Optical Spectra

Volume I

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NATIONAL BUREAU OF STANDARDS

UNITED STATES DEPARTMENT OF COMMERCE, Charles Sawyer, Secretary
NATIONAL BUREAU OF STANDARDS, E. U. Condon, Director

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Volume I

The Spectra of Hydrogen, Deuterium, Tritium, Helium, Lithium, Beryllium, Boron, Carbon, Nitrogen, Oxygen, Fluorine, Neon, Sodium, Magnesium, Aluminum, Silicon, Phosphorus, Sulfur, Chlorine, Argon, Potassium, Calcium, Scandium, Titanium, and Vanadium

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Preface

The present volume is the first of a series being prepared at the National Bureau of Standards as part of a general program on atomic energy levels derived from observations of optical spectra. This program can be traced back to 1924 when the Division of Physical Sciences of the National Research Council created a Committee on Line Spectra of the Elements. The general plan was to encourage and contribute to the structural analysis of atomic spectra and eventually to publish the results in a series of monographs. For twenty years the lure of complex spectra gave emphasis to analysis rather than to compilation and publication of Committee Reports.

In 1932 an extremely timely and useful book entitled "Atomic Energy States as Derived from the Analyses of Optical Spectra" was published by Robert F. Bacher and Samuel Goudsmit. That book set a precedent for omitting experimental details (wavelengths, intensities, Zeeman patterns, etc.) and summarized the terms then known for 231 spectra of 69 elements. Now structure has been recognized in more than 460 spectra, representing 83 elements, and the earlier analyses have in almost all cases been greatly extended.

The accumulation of spectroscopic data is now too vast for publication in a reasonable number of monographs, but the energy levels derived from them are so important for physics, chemistry, and astronomy that a revision of "Bacher and Goudsmit" is urgently needed; it can probably be condensed into three or four volumes. In the spring of 1946 it was determined that neither Bacher nor Goudsmit contemplated such a revision, and it was decided to undertake this at the National Bureau of Standards. Details of this project were discussed at a meeting of the National Research Council Committee on Line Spectra of the Elements, called by the Chairman, Henry Norris Russell, and held in Washington in May 1946. It was then decided to send to interested workers in various fields a questionnaire regarding the most useful form of presentation of the data on atomic energy levels. The present form represents the majority vote resulting from that inquiry.

It was originally planned to issue sections in pamphlet form as the manuscript was completed, and to assemble the sections into volumes of about 400 pages each. Section 1 has been published separately.

This volume comprises the first three sections of Circular 467 of the National Bureau of Standards as follows:

Section 1. The Spectra of Hydrogen, Deuterium, Tritium, Helium, Lithium, Beryllium, Boron, Carbon, Nitrogen, Oxygen, and Fluorine. (Pages 1 to 75.)

Section 2. The Spectra of Neon, Sodium, Magnesium, Aluminum, Silicon, Phosphorus, Sulfur, and Chlorine. (Pages 76 to 210.)

Section 3. The Spectra of Argon, Potassium, Calcium, Scandium, Titanium, and Vanadium. (Pages 211 to 309.)

It has since been decided not to publish sections 2 and 3 separately because they are simultaneously in press and complete Volume I.

The manuscript has been prepared by Charlotte E. Moore under the direction of William F. Meggers, Chief of the Spectroscopy Section of the Atomic and Molecular Physics Division. Sincere appreciation is hereby expressed for the cordial cooperation of the National Research Council Committee on Line Spectra of the Elements, and for the heretofore unpublished contributions of many spectroscopists. Because the current volumes of Atomic Energy Levels disclose many gaps in our knowledge in addition to some uncertainties and occasional irregularities, it seems certain that they will inspire further researches in experimental and theoretical spectroscopy, and thus in turn advance the specialized subjects of atomic and nuclear physics.

E. U. Condon, *Director*.

Washington, D. C., June 1948.

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1. Introduction

Since the publication in 1932 by Bacher and Goudsmit of their book "Atomic Energy States,"[1] the number of energy levels determined from the analyses of optical spectra has increased by a factor of perhaps 4 or 5 and yet no critical compendium of these data exists. In order to meet this need, the present compilation has been undertaken at the National Bureau of Standards.

A handbook of "Atomic Energy Levels" is an indispensable tool for workers in many fields of science today. For the spectroscopist it reveals the gaps in our knowledge of atomic spectra—both those spectra that are incompletely analyzed because of insufficient observations and those that have not yet been observed. For the theoretical as well as the experimental investigators, the detailed comparison of data on related spectra, uniformly arranged, is a useful guide in the study of series, intervals, electron configurations, and many other related problems of atomic structure.

Many interesting spectroscopic problems also arise in connection with microwave spectroscopy, with ultraviolet solar spectra observed from rockets, with infrared spectra observed with a sensitive detector, and in general with types of observation that have developed comparatively recently. If the analysis of a spectrum is complete the positions of the lines can be calculated from the known energy levels, including in many cases those of lines in the far infrared or ultraviolet. The present term tables are now being used in connection with some problems of this sort.

The needs of the nuclear as well as the atomic physicist, of the chemist interested in atomic structure, of the astrophysicist interested in the study of stellar structure and cosmical abundances, and of those in many other fields of science all provide the inspiration for this work.

2. Scope of the Present Tables

Ten of the fourteen members of the National Research Council Committee on Line Spectra of the Elements attended the meeting held in Washington in May 1946, to consider details of this program. Two members who were unable to attend, I. S. Bowen and R. A. Sawyer, made personal visits to the Bureau before the meeting for this purpose. A number of other spectroscopists, including B. Edlén, have also been consulted in private conference.

On the recommendation of the committee a questionnaire regarding details of arrangement of the tables was sent to 94 interested workers in various fields of science. Sixty-one replied to this inquiry. The scope, uses, and format of the book have been discussed at length and the general form adopted is a direct outgrowth of these conferences and recommendations.

The cordial collaboration of those who have been contacted is gratifying. The Chairman of the Committee, H. N. Russell, has read all of the manuscript, provided much material, and made many helpful suggestions. The writer has had the benefit of his broad experience with spectroscopic problems. The committee and others as well are giving their wholehearted support to this program.

Requests to extend the scope of the tables have been seriously considered. It was finally decided to include only the energy levels derived from observations of atomic spectra, exclusive of hyperfine structure ascribed to atomic nuclei (with the exception of H, D). With full appreciation of the importance of critical data on nuclear and X-ray spectra, on isotopes, and on other subjects related to atomic structure the present policy was adopted for several reasons. The usefulness of the tables might well be vitiated by the inclusion of too many kinds of data. The critical editing of the enormous amount of literature entailed by extending the program would of necessity delay by years the publication of data on any one phase of the subject. Finally, the preparation of the volumes of "Atomic Energy Levels" is an appropriate sequel to the work on the revised edition of "A Multiplet Table of Astrophysical Interest,"[2] hereinafter referred to as RMT.[3] These two types of tables used in conjunction with each other provide a condensed and unified picture of many atomic spectra—the one containing the energy levels and term designations used to compile the multiplets and excitation potentials recorded in the other.

In view of the limitations imposed here, reference is made under the relevant spectra to the excellent summary and bibliography of data on hyperfine structure by Meggers, in his paper entitled "Spectroscopy, Past, Present, and Future."[4] In addition, selected later papers on hyperfine structure and isotope shifts are listed for certain spectra. The reader is warned, however, that the individual references on these subjects included here are highly selected and that the present book is inadequate for workers in these fields.

[1] McGraw-Hill Book Co., Inc., New York, N. Y., and London (1932).

[2] Princeton Univ. Obs. Contr. No. 20 (1945).

[3] This edition is limited to lines of wavelength longer than 3000 A. Along with the tabulation of energy levels, the writer is also preparing an ultraviolet extension to the Revised Multiplet Table.

[4] J. Opt. Soc. Am. **36**, 431 (1946).

3. Nomenclature

(Atomic Energy Levels, Spectroscopic Terms, Multiplets)

Briefly summarized, the atoms of a gas or vapor, when excited by radiation, absorb certain wavelengths corresponding to transitions of their outer electrons from lower energy levels to higher ones. When the transitions are from higher to lower energy levels the lines are emitted. Each chemical element can emit as many atomic spectra as it has electrons. If, for example, a sample of pure vanadium is placed in an electric arc and light from the arc is observed through a spectroscope, a complex array of spectral lines of various intensities appears. Most of these lines are produced by neutral vanadium atoms and are characteristic of the first (or arc) spectrum of vanadium, V I.

If vanadium atoms are excited by an electric spark instead of an arc the higher energy of the spark will cause a large proportion of them to lose an electron. The atoms with one less electron in turn exhibit their own characteristic array of spectral lines, i. e., the second spectrum of vanadium, V II. Similarly, with suitable sources of excitation, spectra of higher ionization can be observed corresponding to the loss of 2, 3, etc., electrons, the total number possible being equal to the atomic number of the element in question, in the case of vanadium, 23. To date, however, nothing is known about the vanadium spectra beyond V XIV. The present volume contains the energy levels of all atomic and ionic spectra in which structure has been recognized, for the 23 chemical elements hydrogen through vanadium, H, He I, He II, Li I, . . . V XIV, and includes 206 spectra.

The wavelengths, or positions of the lines observed in a given spectrum are carefully measured, and estimated intensities of the lines recorded. The *wavelengths* are then converted into *wave numbers in vacuo* from standard tables.[5] By studying differences among the *wave numbers* of the observed lines the *energy levels* can be found, since each spectral line is produced by a transition between two such *levels*. From a careful study of groups of lines that have similar characteristics, such as intensity behavior when produced at different temperatures in the laboratory, the levels involved in the production of the lines are grouped to form spectroscopic *terms*. The terms result from definite configurations and motions of the outer electrons of the atom and are explained by a well-established theory of spectral structure.[6] For any given electron configuration the array of terms to be expected in a given spectrum can be predicted from the quantum theory. Conversely, the energy levels and the terms formed from them furnish fundamental information, based on observation, concerning the outer electrons of the atom. The energy levels are, therefore, important constants of nature.

A group of related lines produced by transitions between two complex terms was first called a *multiplet* by M. A. Catalán in 1922.[7] The Multiplet Tables mentioned above (RMT, sec. 2) give the observed wavelengths of the lines that form the leading multiplets of many different spectra.

4. Arrangement

An attempt has been made to follow the general plan adopted by Bacher and Goudsmit in 1932, but some major changes have been introduced. In the present work the elements are arranged in order of increasing atomic number rather than in the alphabetical order of their chemical symbols. The tables on pages XL and XLI should facilitate cross reference to the earlier book. For a given element the arc spectrum is followed by the successive spark spectra in order of increasing stage of ionization, as was done previously. Gaps occurring in the run of spark spectra for a given element indicate that structure has not yet been recognized in the missing spectrum.

Contrary to the earlier arrangement, in the present compilation the energy levels of *all* spectra are listed upward from the ground state *zero*. Absolute values are not given, but can be found for series spectra by consulting the references to the analysis or by subtracting the tabulated values from the limit quoted for a given spectrum.

4.1. Headings, Remarks

For each spectrum descriptive remarks which are self-explanatory, are preceded by headings as follows: Those on the left give (1) the number of electrons in the atom, and, except for arc spectra, the isoelectronic sequence to which the spectrum belongs (see sec. 8.4); (2) the ground state of the atom with its complete electron configuration; (3) the absolute value of the ground level in cm^{-1}, i. e., the limit referred to the ground state of the ion of next higher ionization. The headings on the right give (1) the atomic number Z and (2) the ionization potential in electron volts obtained by multiplying the limit quoted

[5] H. Kayser, *Tabelle der Schwingungszahlen*, Revised Edition (Edwards Brothers, Inc., Ann Arbor, Mich., 1944).

[6] F. Hund, *Linienspektren und Periodisches System der Elemente* (Julius Springer, Berlin, 1927).

[7] Phil. Trans. Roy. Soc. London (A) **223**, 127 (1922); Rev. Acad. Madrid **25**, 20 (1922).

on the left by the factor 0.00012395, which was recommended by Birge in 1941.[8] [9]

In the remarks the word "author" refers to the investigator who has worked on the analysis of the spectrum, in contrast to the word "writer," which applies to the present compiler of these data.

4.2. References

In 1914 W. F. Meggers started a card catalog of all literature references on the description and analysis of atomic spectra, which has been carefully kept up to date and is doubtless the most complete of its kind in existence today. This catalog, together with the valuable and extensive collection of spectroscopic reprints of Meggers and Kiess, furnish the basic material requisite to the present program.

Following the descriptive remarks, literature references are given for each spectrum. It is not the purpose of this book to list all references to the analysis of each spectrum. The writer has attempted to make a careful appraisal of the literature and to list all the references needed to cover the complete analysis, including, of course, those used in the present work, and those giving the classified lines, energy or Grotrian diagrams, and observed *g*-values. A few selected references to hyperfine structure and isotope shift are also included, as mentioned in sec. 2.

In many spectra important regularities have been found by an author whose name does not appear in the references quoted here. This occurs when later and more complete papers include the earlier results and references. For example, Bowen and Millikan first discussed a number of the spectra described in Edlén's Monograph,[10] but only the later reference is listed. Full recognition should be given to all such contributors in spite of the arbitrary limitations imposed here.

4.3 Reference Symbols

Most of the literature references are followed by letters in parentheses, which describe the scope and content of the paper, as follows:

I P	Ionization potential.
T	Terms.
C L	Classified lines.
G D	Grotrian diagram.
E D	Energy diagram.
Z E	Zeeman effect.
I S	Isotope shift.
hfs	Hyperfine structure.

Several of these topics are frequently discussed in one paper, in which case all the symbols that are applicable are mentioned with the reference. If, for example, the symbols (I P) (T) (C L) follow a reference, it signifies that the paper gives an ionization potential, terms, and classified lines.

In a few selected cases, self-explanatory descriptions follow the reference, as, for example, in C I "(Solar data)."

Some papers are described in abstracts or letters to the editor in the Physical Review. These are indicated by (A) or (L) preceding the date in the reference, as is customary, but they should not be confused with the above symbols.

References for which no symbol is given are described in the remarks on the spectrum. Many of these are theoretical in character, as for example, the one to Racah's paper (see Ne I) which deals with *jl*-coupling in the spectra of the Ne I type (sec. 5.2). Symbols have been omitted in general from references that are specialized in character as compared with those that can be more concisely described by the array of letters given above.

5. Spectroscopic Notation

Some details of spectrum analysis should perhaps be mentioned in order to explain the plan of presentation of spectroscopic data adopted here. According to the quantum theory each energy level is defined by an inner quantum number commonly known as *J*. The terms (groups of related levels) have multiplicities which are all odd (1, 3, 5, 7, . . .) or all even (2, 4, 6, 8, . . .) in a given spectrum. For terms of odd multiplicity the *J*-values are always integers, 0, 1, 2, 3, . . .; for those of even multiplicity the *J*-values are odd multiples of the fraction ½, denoted as ½, 1½, 2½, 3½, etc. Terms are further defined by azimuthal quantum numbers *L* that have for terms labeled S, P, D, F, G, H, I, K, etc., the values 0, 1, 2, 3, 4, 5, 6, 7, etc., respectively.

A term of a given kind and multiplicity consists of a definite number of energy levels whose inner quantum numbers are stipulated by the quantum theory. For example, an "S" term of multiplicity three has only one level with *J*-value equal to 1. This term is designated as $^3S_1$. A "D" term of multiplicity four consists of four levels whose *J*-values are 3½, 2½, 1½, ½, respectively, designated as $^4D_{3½}$, $^4D_{2½}$, $^4D_{1½}$, $^4D_{½}$. Tables giving the *J*-values of terms of each multiplicity are discussed in sec. 6.7.

The designation is further described by two other quantities discussed in sec. 5.1 and sec. 5.3: (1) a prefix that

[8] Rev. Mod. Phys. **13**, No. 4, 233 (1941).

[9] The discrepancies between the ionization potentials in this book and those given by the writer in the RMT are, in general, due to the use of the older factor, 0.00012345, in calculating data for the Multiplet Tables.

[10] Nova Acta Reg. Soc. Sci. Uppsala (IV) **9**, No. 6 (1934).

serves to distinguish terms of the same type and multiplicity from each other and which, for simpler spectra, gives information about the electron configuration, and (2) a superscript "°" denoting that a term belongs to the odd set (sec. 5.1). The complete multiplet designation of any spectral line includes all of these quantities: multiplicity, azimuthal quantum number, and inner quantum numbers for both the lower and higher energy levels involved in the production of the line.

The lines normally observed in a spectrum, i. e., the permitted lines, do not result from differences among the levels of each term and every other term, but from differences (called combinations) between two sets of terms, one "even" and one "odd." Permitted lines are further restricted by the rules governing the J-values. Only those J-value combinations between even and odd terms for which J changes by 0 or ± 1 are permitted, and normally no combinations occur between levels with $J=0$. Under special conditions "Forbidden" lines are observed, in which case these selection rules for odd and even terms and for J-values do not hold.

A relatively limited number of terms can thus account for a complex array of spectral lines. It is obviously desirable to describe these terms by a uniform notation that defines the quantum properties as completely as possible, and is also adaptable to all the varieties of spectra that have been and are likely to be observed.

A general scheme of notation was outlined in 1929,[11] which has been widely used. This scheme has been interpreted so freely by various investigators that a serious lack of uniformity has resulted in the literature. When this question arose in connection with the RMT the writer did not anticipate the present project, which is far wider in scope. She did, however, attempt to introduce uniformity and, in order to avoid further confusion, she has adopted here the notation of the RMT with only slight modifications. It is admittedly far from ideal, but is perhaps justifiable if it serves only to stimulate serious consideration of the question and the general adoption of a more satisfactory scheme.

The "Designation" (sec. 6.3) adopted for the less complex spectra that exhibit conspicuous series differs from that used for the more complex spectra that do not.

5.1. Series Spectra

For many elements the spectra become more complex as the degree of ionization decreases. The terms of each spark spectrum are the parent terms or "limits" of the series of terms in the spectrum of next lower degree of ionization. The term arrays resulting from the addition of s, p, d, f, etc., electrons to each limit are well known from theory (sec. 7). Consequently, for the simpler spectra the electron configurations of the observed terms can be assigned without ambiguity by a study of the limits in the spectrum of next higher degree of ionization.

The spectrum of O VI may be used as an illustration. Here the lowest term of O VII, $1s^2\,{}^1S$, is so much lower than any other that no other limit need be considered. The addition of a "running" s, p, d, f, etc., electron to this state produces a series of doublet S, P°, D, F°, etc., terms in O VI. In this case the electrons and terms are of the same type. The ground term of O VI is $1s^2({}^1S)2s\,{}^2S$, the next term is $1s^2({}^1S)2p\ {}^2P°$, etc., where (${}^1S$) signifies the parent term or limit in O VII. The "Designations" adopted for these terms are $2s\,{}^2S$, $2p\,{}^2P°$, etc.[12] The number "2" in the prefix $2s$, etc., denotes the total quantum number, which depends on the shell occupied by the outer electrons giving rise to the term (see sec. 7). This number increases by unity for the series terms of a given type, as for example, for the series $2s\,{}^2S$, $3s\,{}^2S$, $4s\,{}^2S$, etc.

An additional electron is effective in the production of the spectrum of O V. The configuration $1s^2\,2s^2$ gives the ground term ${}^1S$, designated here as $2s^2\,{}^1S$; and $1s^2\,2p^2$ gives the terms $2p^2\,{}^3P$, $2p^2\,{}^1D$ and $2p^2\,{}^1S$. The spectrum of O V is more complex because, in addition, there are two low terms in O VI, both of which are important parent terms or "limits" giving rise to terms in O V. The addition of running electrons to these limits gives, among others, the following theoretical or predicted array of terms:

O VI		O V					
Config.	Limit	Added Electron	Config.	Terms			
$1s^2\ 2s$	${}^2S$	$3s$	$1s^2\ 2s({}^2S)3s$	${}^3S$, ${}^1S$			
"	"	$2p$	$1s^2\ 2s({}^2S)2p$		${}^3P°$, ${}^1P°$		
"	"	$3d$	$1s^2\ 2s({}^2S)3d$			${}^3D$, ${}^1D$	
$1s^2\ 2p$	${}^2P°$	$3s$	$1s^2\ 2p({}^2P°)3s$		${}^3P°$, ${}^1P°$		
"	"	$3p$	$1s^2\ 2p({}^2P°)3p$	${}^3S$, ${}^1S$	${}^3P$, ${}^1P$	${}^3D$, ${}^1D$	
"	"	$3d$	$1s^2\ 2p({}^2P°)3d$		${}^3P°$, ${}^1P°$	${}^3D°$, ${}^1D°$	${}^3F°$, ${}^1F°$

Terms are "odd" (denoted by the superscript "°") when the configuration contains an odd number of p, f, h, etc. electrons, ${}^3P°$, for example. In the case of O V, since one limit is even and the other one odd, no ambiguity occurs if a designation consisting of the running electron and term is used for terms from both limits, i. e., for terms from ${}^2S$ in O VI, $3s\,{}^3S$, $3s\,{}^1S$, $2p\,{}^3P°$, $2p\,{}^1P°$,

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[11] H. N. Russell, A. G. Shenstone, and L. A. Turner, Phys. Rev. **33**, 900 (1929).

[12] In the RMT the notation 2 ${}^2S$, 2 ${}^2P°$, etc. was used for series of this kind when the term and running electron were of the same type.

$3d\,^3D$, $3d\,^1D$; and for terms from $^2P°$ in O VI, $3s\,^3P°$, $3s\,^1P°$, $3p\,^3S$, $3p\,^3P$, . . . $3d\,^1F°$. This notation has been adopted for those spectra that have two low limits, one even and one odd.

When two or more of the effective limits are all even or all odd, an addition to this notation is required. The limit terms are always listed in the term arrays (sec. 7) from lowest to highest, i. e., according to increasing value of the terms, starting from zero. In O V the ground term is ^2S and the next higher is $^2P°$. Consequently, ^2S is listed first in the above array and in the one on page 57. For terms from the lowest of a group of limits the running electron is used as described above. For those from the *next higher* or *second* limit a prime is affixed to the running electron, for those from the third limit a double prime, etc. The use of primes is well illustrated by the term arrays: (1) of O IV, p. 55, where the lowest limit is even and the next odd, in which case primes are first introduced for the *third* limit; and (2) that of O II, p. 50, where the primes are used for the *second* limit, since the two lowest limits are even.

With the exception of the spectra of the inert gas type (sec. 5.2), the notation giving the running electron with primes affixed as described above has been used for the spectra of all isoelectronic sequences through K and for the spectrum of Ca I. The rest of the Ca I sequence and the Sc I, Ti I, and V I sequences have the notation adopted for complex spectra (secs. 5.3 and 7.5).

5.2. Inert Gases

The first spectra of the inert gases form a special class of series spectra that must be discussed separately. In these neutral atoms the last electron required to close the different shells is added. Terms are not definitely distinguishable for many types of higher series members owing to the departure from *LS*-coupling, and the *J*-values of the components of the limit term must be indicated. A detailed account of the theory of the couplings of various types will not be attempted here. Briefly summarized, when *LS*-coupling does not hold, *jl*- or *jj*-coupling becomes important, the Landé *g*-values (tables 1 to 4), (sec. 6.7) do not hold, and levels are grouped by pairs rather than by terms. For further details, special treatises on the subject should be consulted.[13]

The present volume contains two sequences of this type: Ne I and A I. In these spectra the last of the six *p*-electrons is added and completes these shells.

As stated in the remarks for Ne I, Edlén suggested that a pair-coupling notation be adopted for Ne I-like spectra to take into account the departure from *LS*-coupling. The *jl*-coupling notation in the general form suggested by Racah[14] has, consequently, been adopted, on Shortley's suggestion. Shortley has also prepared a detailed array of the theoretical arrangement of the pairs, for the writer to use as a guide in preparing the tables of spectra of this type.

A few general remarks will suffice to explain the general plan of presentation. All levels from a given configuration are in one group. The groups are listed in order of increasing value of the smallest level in each group. Within a group the levels are paired and the pairs form two subgroups, each of which has as a limit one of the two components of a $^2P°$ term, $^2P°_{1\frac{1}{2}}$ and $^2P°_{\frac{1}{2}}$, the former being the lower. Within the subgroup members of a pair are listed together in order of increasing value of the lower member, unless they are widely separated numerically, in which case the lower pairs precede the higher member of the wide pair. Each pair consists of two levels whose *J*-values are known from theory, and differ by only one unit. The designation of the pair gives the running electron, followed by the mean value of the two quantum numbers given in brackets. As usual, a prime is used with the running electron to indicate the higher limit.

The spectrum of Ne I may be used as an illustration. The pairs from the 3*s*-configuration form one group. The next group in order of increasing numerical value of the lowest member is 3*p*, the next is 4*s*, etc. Within the 3*s* group one pair having $J=2$, 1, respectively, has the limit ($^2P°_{1\frac{1}{2}}$) in Ne II, and is designated as $3s[1\frac{1}{2}]°$, where the "°" has the usual meaning. The second pair in the 3*s* group has the higher limit ($^2P°_{\frac{1}{2}}$) in Ne II and *J*-values 0 and 1, respectively. The designation is, therefore, $3s'[\frac{1}{2}]°$. In the group having the 3*p*-configuration the components of pair 1, 0 are widely separated, 148259 and 150919, respectively. They are listed separately in numerical order within the subgroup having the limit ($^2P°_{1\frac{1}{2}}$), each member being labeled $3p[\frac{1}{2}]$. Then follows the related subgroup $3p'[1\frac{1}{2}]$, etc., with the pairs listed in increasing order.

The spectra to which the pair-coupling applies are listed under the Ne I and A I isoelectronic sequences in table 26.

For convenience of cross reference to Bacher and Goudsmit's book and to other publications, the Paschen notation for these spectra has been retained in column 1. Unfortunately, the *jl*-coupling notation was not used in the RMT, but it is hoped that the style adopted there can be translated into the present form by means of the table on page XVII of that Contribution.[15]

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[13] E. Back and A. Landé, *Zeemaneffekt und Multiplettstruktur der Spektrallinien*, (Julius Springer, Berlin, 1925).
F. Hund, *Linienspektren und Periodisches System der Elemente* (Julius Springer, Berlin, 1927).
R. F. Bacher and S. Goudsmit, *Atomic Energy States* (McGraw-Hill Book Co., Inc., New York, N. Y. and London, 1932).
H. E. White, *Introduction to Atomic Spectra* (McGraw-Hill Book Co., Inc., New York, N. Y., and London, 1934).
E. U. Condon and G. H. Shortley, *The Theory of Atomic Spectra* (The Macmillan Co., New York, N. Y.; The University Press, Cambridge, Eng., 1935).

[14] Phys. Rev. **61**, 537 (L) (1942).

[15] *A Multiplet Table of Astrophysical Interest*, Princeton Univ. Obs. Contr. No. 20 (1945).

5.3. Complex spectra

In the majority of complex spectra the terms are so numerous that it is impracticable to designate them by their configurations. For these spectra the prefixes, *a*, *b*, *c*, *d* are assigned to the low terms of each type (even or odd) and *z*, *y*, *x*, etc., to those that combine with them (odd or even). The high terms of the same type as the low ones start with the prefix *e* and continue through *f*, *g*, etc.

This notation for complex spectra is first used for Sc II in the present volume. It is also used for all subsequent spectra of the Ca I sequence and for the spectra of the Sc I, Ti I, and V I sequences. These spectra are discussed further in sec. 7.5.

In many complex spectra it is impossible to group all known levels into spectroscopic terms. Miscellaneous levels are assigned numbers, and the superscript "°" if they belong to the odd set.

6. Columns of the Table

The data on atomic energy levels are presented in a maximum number of seven columns in the tables. These columns may be described as follows, although the numbers on the left serve only as a guide to the order of presentation, since all are not needed for every spectrum.

Column	Description	Tabular Entry
1	Author	Edlén, Paschen, Author
2	Configuration	Config.
3	Designation	Desig.
4	Inner Quantum Number	*J*
5	Atomic Energy Level	Level
6	Interval	Interval
7	Observed *g*-value	Obs. *g*

6.1. Author

Column one gives the notation used in individual papers on the analysis of certain spectra. For many spectra discussed by Edlén, i. e., mostly spectra of the light elements, the heading "Edlén" is used to indicate his notation.

As stated above, the heading "Paschen" is given for spectra of the inert gas type, meaning that the column contains Paschen's notation.

Frequently "Author" or "Authors" and, occasionally, initials are used as a heading. This is explained in the remarks and references for the spectrum in question.

This column is used only when necessary to enable the reader to translate the notation in the literature into that adopted in the "Designation" column for the sake of uniformity. It is omitted for the simpler spectra and for those in which no ambiguity can occur in the interpretation of the individual papers on analysis.

6.2. Configuration

Column two gives the electron configuration. For the simpler spectra, where only one limit term is involved, the limit is not repeated in the configuration for each term. Similarly, the electrons in closed shells are given only when necessary. For example, in Li I, p. 9, all terms have the limit (^{1}S) in Li II, and two electrons form the closed 1*s* shell. The complete configuration of the ground term 2*s* ^{2}S is 1*s*^{2}(^{1}S)2*s*, here called 2*s* for brevity. Similarly, for the next term, 2*p* ^{2}P°, it is 1*s*^{2}(^{1}S)2*p*, called 2*p*, etc. For each spectrum, any electrons not mentioned in the configuration column may be found in the heading giving the ground state.

In more complex spectra, all electrons and limits needed to explain the terms are given, the limit terms being in parentheses, as usual. In C II, p. 24, for example, the term at 116537.88 has the limit (^{1}S) in C III, as indicated by the configuration 2*s*^{2}(^{1}S)3*s*. The rules governing the use of primes for terms from different limits have been described in detail in sec. 5.1.

The *J*-value indicating the component of the limit term responsible for certain terms or levels is of considerable theoretical interest. Many papers discuss this question. No attempt has been made to list here the *J*-values for the limit terms except in the case of inert gas spectra (sec. 5.2).

6.3. Designation

The designation column has been explained in sec. 5. Spectra have been divided into three classes and a uniform designation adopted for each class. For series spectra, the running electron without or with primes is given as a prefix to the term. For inert gas spectra the *jl*-coupling notation of the related pairs of levels is used. For complex spectra the prefixes *a*, *b*, . . . *e*, *f*; *z*, *y*, *x*, . . . are given.

Miscellaneous levels are assigned numbers and odd levels are indicated throughout by the symbol "°."

Other miscellaneous designations, which are usually self-explanatory, are also used. In F I, p. 60, for example, the type of notation adopted by Edlén for miscellaneous levels from the 3*d* and 4*d* configurations, 3*d* X_2, etc., has been retained. Edlén remarks that it is impossible to assign term designations to these levels because of the departure from LS-coupling.

6.4. Inner Quantum Number *J*

This column gives the inner quantum number J for each level when known, or the quantum numbers of all components of a term if the term is unresolved into its component levels. For brevity the end quantum numbers of a term are frequently given for unresolved terms. For example, the term of F II, p. 63, at 264610 is an unresolved ^{5}F term. A ^{5}F term consists of 5 components with J-values of 5, 4, 3, 2, 1, respectively. They are denoted as "5 to 1" in the column headed J. The J-values for terms of the various types, S, P, D, etc., and multiplicities are given in tables 1 and 2. A blank in this column indicates that the author has not defined the J-value. In sec. 6, following, J-values are discussed further.

As a rule, J-values can be determined from the observed combinations. In the spectra of Ne I and A I, however, Shortley has suggested that special care be taken to indicate those that are verified by observation in the case of levels produced by f-electrons, since some pairs overlap and some are unresolved. As an aid in the theoretical interpretation of these spectra, the J-values that are derived from the observed combinations involving f-electrons are entered in italics in the tables.

6.5. Atomic Energy Level

This column gives the atomic energy levels of the individual spectra, odd levels being in italics throughout. With the exception of H-like spectra they are, in general, *observed* values.[16] In a number of spectra extrapolated values estimated from isoelectronic sequence data are also included to supplement incomplete observational results. Brackets are used to denote extrapolated values.

For every spectrum the levels are listed from the ground state *zero*, i. e., *absolute values* are *not* given in these tables. The levels are grouped by terms, or by pairs in the case of the inert gas spectra (sec. 5.2). The terms are listed in order of increasing numerical value of the smallest level in each. Miscellaneous levels are given in proper numerical order between terms. For unresolved levels the effective mean value of the components is given. For terms in which only certain components have been observed, those levels that are known are listed with the known J-value, and blanks occur in the table opposite the J-values of the missing members.

The value of the limit referred to the *ground state of the atom of next higher stage of ionization*, i. e., the limit giving the *principal ionization potential*, is entered in bold face in the table. In spectra having terms with negative absolute values, the limit appears in the correct numerical place in the table and is followed by higher terms. More often, it appears at the end of the table, following a row of leaders which indicate that many high terms have not yet been found. The value of the limit given in the heading is repeated in the table, throughout. Two limits are given for Ne I- and A I-like spectra, when the absolute values of both components of the limit term $^2P^{\circ}_{1\frac{1}{2},\frac{1}{2}}$ are known, the lower limit being in bold-face type (see sec. 5.2).

The selection of the numerical value of the limit adopted here is frequently arbitrary, and those who are seriously interested in the best value should consult the references. The length and type of the series, the series formula used, the type of extrapolation, and many other factors affect the accuracy of the limit. The remarks contain relevant details regarding the evaluation of the limit. Higher limits, if any, can be calculated by the addition of the appropriate term values of the succeeding spectrum to the limit quoted here.

In many spectra no intersystem combinations connecting the terms of different multiplicity within a spectrum, have been observed. For these spectra a constant correction, x, which may be either positive or negative, must, therefore, be applied to the terms of one multiplicity, and a different constant y to those of another in spectra where terms of three multiplicities have been detected, in order to put all terms on the same scale. In the tables the entries "$+x$" and "$+y$" follow the levels of all such sets of terms.

If long series have been observed the relative positions of the terms of different multiplicity can be determined accurately from the series limits, and the correction x is small.[17] In many cases series are short or lacking and the error may be considerable. Estimated relative positions of terms have, however, frequently been used in order to place all terms in the order that is approximately correct. The remarks on the spectrum and the use of brackets to denote estimated values should suffice to explain the procedure in the individual cases.

The uncertainty x is also occasionally used to indicate groups of detached terms that have not yet been connected by observation with the rest of the spectrum, but whose multiplicity is the same as that of terms that are known. This is true for a group of terms of Sc I, for example (p. 260).

6.6. Interval

The term intervals in this column are, with a very few exceptions, the differences between the level values of the

[16] For spectra of the H sequence the values calculated by J. E. Mack from the series formula are given, as is explained in the remarks.

[17] In a few spectra x has been omitted for this reason, as noted in the remarks.

components of terms in the preceding column. If, for a given term, the level of smallest J has the smallest numerical value, and this succession holds for all components from the lowest to the highest, the intervals are positive and the term is *normal*. On the contrary, if the level of smallest numerical value has the largest J, etc., thoughout the term, the intervals are negative and the term is *inverted*. The general run of intervals is positive or negative in a given spectrum according to whether the shell of outer electrons is less than or greater than half full (see sec. 7.1), although many exceptions to this general rule occur.

If some components of a term are missing, the order in which the J-values are listed is governed either by the foregoing rules concerning the shell, or by the behavior of other series members of the same type within the spectrum or the sequence.

The J-values are always given either in increasing or decreasing order for a term, even if the term may be partially inverted. For example, a ^{3}P term has its J-values listed either in the order 2, 1, 0 or 0, 1, 2 even if this arrangement causes the levels to be given out of numerical order. For such terms the signs of the intervals call attention to the irregularity, since both positive and negative intervals occur whenever the term is partially inverted. The term $3d$ ^{5}D of O III, p. 52, starting with the value 398135.0, is a term of this kind.

Estimated intervals are in brackets and are explained in the remarks.

6.7 Observed g-Value (Tables 1 to 4, Landé g-Values)

When a spectrum is observed in a magnetic field of suitable strength most lines are broken up into groups of related components arranged in definite patterns. The separations of the components are proportional to the magnetic field strength and to magnetic splitting factors (g-values) characteristic of the atomic energy levels. The g-values can be derived from a study of the observed patterns. These determine the multiplicity and the azimuthal and inner quantum numbers of the individual atomic energy levels. The theoretical g-values are well known for the individual levels of terms of all types. Consequently Zeeman patterns furnish one of the most reliable criteria for the correct interpretation of a complex spectrum.

Details of the theoretical and experimental aspects of this important subject will not be given here. Back and Landé, Bacher and Goudsmit, H. E. White,[18] and many others discuss it.

Observed g-values are given in the last column of the tables. There is a surprising scarcity of reliable data on observed Zeeman patterns among the spectra of the light elements. The first entries in the table are for N I.

Some papers state that the analysis is confirmed by the observed Zeeman effect but give no details. The general policy is to list here only those references that give observed g-values or sufficient data from which to calculate them. The accuracy of the Zeeman material varies greatly and depends on such factors as the determination of the magnetic field used for the observational data, the resolving power of the spectroscope, the interpretation of the observed effect, and many others. As a result the listed g-values vary greatly in accuracy.

For spectra in which LS-coupling holds the observed values agree well with the Landé theoretical g-values. Because of their importance in spectrum analysis, these theoretical values are given in tables 1, 2, 3, and 4. Table 1 contains J- and g-values for terms of types S, P, D . . . Q of odd multiplicity, i. e., singlet, triplet, quintet, . . . undecet terms. For example, the theoretical g-value of a $^3F_4$ level is 1.250; that of a $^7I_6$ level is 1.143. Since the data are identical for odd and even terms alike, one table suffices for both sets of terms. Table 2 gives similar data for terms of even multiplicity: doublets, quartets, . . . decets.

For the convenience of those who are analyzing spectra, the theoretical g-values are also given in order of increasing numerical value followed by the designation of the level or levels for each g, for terms of odd multiplicity in table 3; and for those of even multiplicity in table 4. These g-values are quoted from the "Tables of Theoretical Zeeman Effects" by Kiess and Meggers,[19] supplemented by their unpublished data for terms of multiplicity greater than eight.[20] Their tables give also the theoretical Zeeman patterns for practically all of the multiplet designations that have been observed within the range of multiplicity they cover.

Tables of theoretical g-values for jj-coupling may be found in papers by J. B. Green and his collaborators.[21]

Finally, the date of completion of the manuscript of each spectrum is given at the end of the table of energy levels of the spectrum.

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[18] E. Back and A. Landé, *Zeemaneffekt und Multiplettstruktur der Spektrallinien* (Julius Springer, Berlin, 1925).
F. Hund, *Linienspektren und Periodisches System der Elemente* (Julius Springer, Berlin, 1927).
R. F. Bacher and S. Goudsmit, *Atomic Energy States* (McGraw-Hill Book Co., Inc., New York, N. Y. and London, 1932).
H. E. White, *Introduction to Atomic Spectra* (McGraw-Hill Book Co., Inc., New York, N. Y., and London, 1934).
E. U. Condon and G. H. Shortley, *The Theory of Atomic Spectra* (The Macmillan Co., New York, N. Y.; The University Press, Cambridge, Eng., 1935).

[19] Bur. Std. J. Res. **1**, 641, RP23 (1928).

[20] They have extended their tables of theoretical Landé g-values to include all types of terms and multiplicities (up to ^{11}Q) that are likely to be needed, in order that tables 1 to 4 may be complete. The writer is indebted to them for this useful contribution.

[21] Phys. Rev. **52**, 736 (1937); **54**, 876 (1938); **58**, 1094 (1940); **59**, 72 (1941); **64**, 151 (1943).

7. Tables of Predicted and Observed Arrays of Terms

With the exception of the simpler spectra and of those for which the analysis is seriously incomplete, arrays of observed terms are given following the individual tables of energy levels, the first being that of Be I, p. 13.

As stated above, the arrays of terms to be expected for a given configuration are well known from theory. A comparison of the terms observed in a given spectrum with those predicted reveals at once the completeness of the analysis. To facilitate this comparison, arrays of predicted terms arranged similarly to those of the observed terms are included here.

7.1. Shells

In the discussion of notation (sec. 5) reference was made to the "shells" of electrons and their importance in the production of spectroscopic terms. A clear description of these shells is quoted from White,[22] p. 80: "The various electrons are classified under so-called *shells* of electrons. *All electrons belonging to the same shell are characterized by the same total quantum number n.* . . ."

"The shells $n=1, 2, 3, 4$, . . . are sometimes called (from x-ray spectra) the *K, L, M, N*, . . . shells, respectively."

"The electrons in any shell *n* are further divided into *subshells* so that *electrons belonging to the same subshell have the same azimuthal quantum number l.* Electrons for which $l=0, 1, 2, 3$, . . . are called *s, p, d, f*, . . . electrons, respectively, . . .". For example, $2s$ is used to specify one electron with $l=0$ and in the shell $n=2$.

No shell can contain more than 2 type–*s* electrons starting with $n=1$, 6 type–*p* electrons starting with $n=2$, 10 type–*d* electrons starting with $n=3$, or 14 type–*f* electrons starting with $n=4$, etc. The successive periods 1 to 7 in the periodic system (sec. 8.3) can, therefore, contain only 2, 8, 8, 18, 18, 32, and 32 elements, respectively. These are consequences of Pauli's exclusion principle.

This is illustrated in the following brief tabular excerpt from White's complete Table of Electron Configurations:

Shell		*K* $n=1$	*L* $n=2$	
Subshell		$l=0$	$l=0$	$l=1$
1	H	$1s$		
2	He	$1s^2$		
3	Li	$1s^2$	$2s$	
4	Be	$1s^2$	$2s^2$	
5	B	$1s^2$	$2s^2$	$2p$
6	C	$1s^2$	$2s^2$	$2p^2$
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[22] H. E. White, *Introduction to Atomic Spectra* (McGraw-Hill Book Co., Inc., New York, N. Y., and London, 1934).

Superscripts denote the number of electrons of a given type. Where no superscript is given unity is understood. He I, for example, has two electrons of the type $1s$, as indicated by $1s^2$ in the above array. These similar electrons are known as *equivalent* electrons. The terms produced by *equivalent* and *nonequivalent* electrons and detailed discussions of Pauli's exclusion principle may be found in many standard treatises on atomic spectra.[23]

All spectra having the same shells of electrons are similar. An *isoelectronic sequence* consists of spectra of different elements having the same shells of electrons. Each *arc* spectrum sets the pattern for the sequence, so far as the effective electrons are concerned. For example, the spectra of Be I, B II, C III, etc., form an isoelectronic sequence for which Be I, the *arc* spectrum of beryllium, sets the pattern, i. e., the Be I isoelectronic sequence. In B II, the first spark spectrum of B, the boron atoms have lost the outer electron, $2p$. This spectrum, therefore, resembles that of Be I having two $2s$ electrons (denoted by $2s^2$) outside the closed shell $1s^2$. Similarly the carbon atoms have lost both outer $2p$-electrons when the spectrum of C III is observed. This spectrum thus belongs in the same sequence. An array of predicted terms of each arc spectrum suffices, therefore, for all spectra of the sequence, as, for example, Be I.

No arrays are given for spectra of the H, He I, Li I, and similar sequences. Since only $1s$, $1s^2$, and $2s$ electrons are involved, the arrays of predicted and observed terms are simple.

7.2. Arrays of Predicted Terms of the Sequences Be I Through Ne I (Tables 5 to 11)

Starting with Be I, predicted arrays of terms of the isoelectronic sequences from Be through Ne are given in the following tables (pages XXVIII to XXXI):

Table	Sequence
5	Be I
6	B I
7	C I
8	N I
9	O I
10	F I
11	Ne I

In all of these tables the closed shells are indicated immediately under the heading "Config." ("$1s^2+$" for this group of spectra). The tables are divided into two sections. The upper half gives the terms from equivalent

[23] H. N. Russell, Phys. Rev. **29**, 782 (1927).
R. C. Gibbs, D. T. Wilbur, and H. E. White, Phys. Rev. **29**, 790 (1927).
F. Hund, *Linienspektren und Periodisches System der Elemente* (Julius Springer, Berlin, 1927).
C. L. B. Shudeman, J. Franklin Inst. **224**, 501 (1937). (Terms from equivalent *g, h*, and *i* electrons.)

electrons and, for simpler spectra, the first low series members. The lower half indicates the series to be expected from the various limit terms (sec. 5.1), with the running electron denoted as *nx*, where *n* is the total quantum number, and *x* the type of electron, *s*, *p*, *d*, *f*, . . ., etc.

The quantities *n* and *x* are indicated in the headings, *nx* ($n \geq 3$), etc., above the columns of the tables and are evaluated in the arrays of observed terms of the separate spectra of the sequence. For example, the $ns\,^3S$ series of Be I, p. 13, with the configuration $2s(^2S)nx$ has been observed from $n=3$ through $n=8$.

Many more terms can be predicted than are likely to be observed. The present tables are designed to contain enough predicted terms to suffice for all terms thus far observed in any spectrum of the sequence.

7.3. Arrays of Predicted Terms of the Sequences Mg I Through A I, (Tables 12 to 18)

Starting with Mg I, arrays of predicted terms of the isoelectronic sequences from Mg through A are given in the following tables (pages XXXII to XXXV):

Table	Sequence
12	Mg I
13	Al I
14	Si I
15	P I
16	S I
17	Cl I
18	A I

A comparison of these tables with the set described above, tables 5 to 11, shows that the same terms are predicted for spectra having the same numbers and types of electrons outside the closed shells. Beginning with table 12, the closed shells are $1s^2\ 2s^2\ 2p^6$ (entered directly under the heading "Config." in the tables). The total quantum number *n* of the running electron is one unit larger, but the term arrays are identical for similar spectra in the two sets of tables. For example, tables 5 and 12, 6 and 13, etc., are alike, except for the total quantum numbers and for the number of predicted terms included, which is governed by the terms that have been observed within the sequence.

7.4. Arrays of Predicted Levels of the Ne I and A I Sequences (Tables 11 and 18)

These tables give both predicted terms (*LS*-coupling) and predicted pairs of levels (*jl*-coupling) sec. 5.2. In the arrays of predicted and observed pairs of levels for these spectra, the pairs are listed in the general order of increasing value of the lower member of the pair, as suggested by Shortley. As some spectra in this sequence are of an intermediate type, more nearly *LS*-coupling, this order is not always obeyed numerically among the observed levels, but is retained in these tables for uniformity.

Similarly, in all of these tables (5 to 18, inclusive) and the corresponding arrays of observed terms, the limit terms are listed in the general order of increasing numerical value with primes added to indicate higher limits, as described in section 5.1.

7.5. Arrays of Predicted Terms of the Sequences Ca I Through V I (Tables 19 to 22)

Brief mention has been made of the special notation adopted for complex spectra (sec. 5.3). An examination of the tables for the sequences Ca I, Sc I, Ti I, and V I, tables 19 to 22, inclusive, reveals the rapid increase in the number of terms after *d* electrons are included in the structure of the unexcited atom. The use of primes is retained to indicate the different limits in Ca I and in table 19. For Sc II and subsequent spectra in the sequence, the notation for complex spectra is introduced (see below). Since the limits are carefully specified, no difficulty should arise in comparing the arrays of observed and predicted terms in this sequence.

For the configurations involving equivalent electrons, listed in the upper section of each array, Pauli's principle restricts the array of resulting terms, and the latter cannot be unequivocally assigned to specific limits.

When only *s* and *p* electrons appear in the low configurations the ground state is always to be found in the upper section, but in the lower, when *d* electrons are present in a configuration involving one *s* electron. Examples among arc spectra may be found in table 23, and others occur for singly ionized atoms.

Beginning with the Sc I sequence terms from eight limits must be considered. For this reason, a simple type of prefix *a*, *b*, *c*, . . . *z*, *y*, *x*, etc., is adopted for the terms from the different limits. In the Ti I group 15 limits must be handled, and in V I the number increases to 22. For these complex spectra the limits in the tables of predicted terms are tabulated in order of increasing numerical value of the terms in the arc spectrum of the sequence, Ti I for example. The same order does not necessarily apply to the other spectra in the sequence. In the arrays of observed terms the prefixes *a*, *b*, etc., of the *limit* terms are given in order to avoid confusion in comparing the different sets of tables.

As the complexity of the spectra increases there is a serious overlapping of families of terms from the various limits. The assignment of electron configurations is ambiguous in many cases. Beginning with Ti I, a number of question marks and colons appear in the arrays of observed terms, denoting the uncertainty of many suggested configurations.

8. The Periodic Table

8.1. The Chemical Elements by Atomic Number, Ionization Potentials (Table 23)

In the present work the elements are handled in order of increasing atomic number and they are listed in this order in table 23. Column one gives this number, Z; column two, the name of the element; and column three, the chemical symbol. Columns four and five give, respectively, the principal ionization potential and configuration of the ground state of the neutral atom. For elements with $Z>23$, i. e., for those beyond the range of the present volume, these data are taken from table 1, columns 5 and 9, respectively, of the key to the Periodic Chart of the Atoms revised in 1947 by Meggers.[24] Additional data on the ground states of the rare earths are given in his paper on this subject.[25]

8.2. The Chemical Elements by Chemical Symbol (Table 24)

Bacher and Goudsmit arranged the spectra in the alphabetical order of the chemical symbol of the element. Table 24 gives the elements in this order, with the chemical symbol in column one followed by the name of the element in column 2 and the atomic number in column 3.

8.3. The Periodic System (Table 25)

The Periodic System in table 25 is arranged in the form suggested by Catalán, who generously furnished an unpublished copy for inclusion here.

8.4. Index—Isoelectronic Sequences (Table 26)

This table contains the index to the data in Volume I of this work, the spectra from H through V. In the left margin the atomic number is given, followed by the chemical symbol. Across the top the successive stages of ionization appear, I denoting arc spectra, II first spark spectra, III second spark spectra, etc. The numbers in the table indicate the pages on which the individual spectra may be found. For example, F VIII is on page 75.

In this table, isoelectronic spectra appear on the diagonals. Every other diagonal is printed in bold face type in order to emphasize the spectra of each sequence. For example, S IX belongs to the O I sequence, printed in boldface along the diagonal. Similarly, Mg VI can be traced to N I along the diagonal not printed in bold face. Blanks occur for spectra that have not yet been analyzed.

No sequences are carried beyond V in this volume, but they will be continued in later volumes and indicated in tables arranged similarly to this one. The sequences started in Volume I but not completed there are listed below. The last spectrum in each sequence for which any data on analysis are known is indicated.

Sequence	Spectrum	Sequence	Spectrum
Ne I	Co XVIII	Cl I	Ni XII
Na I	Cu XIX	A I	Fe IX
Mg I	Co XVI	K I	Fe VIII
Al I	Ni XVI	Ca I	Ni IX
Si I	Ni XV	Sc I	Ni VIII
P I	(V IX)[1]	Ti I	Ni VII
S I	Ni XIII	V I	Cu VII

[1] This sequence is completed in the present volume.

9. Future Investigations

9.1. Need for Further Analysis

During the course of this compilation many interesting problems have presented themselves. The gaps in the sequences call attention to some spectra in which no structure has as yet been recognized. Within the sequences these gaps include the following spectra: Ne VII, VIII, IX; Na X; S XI; Cl XII, XIII; A XII, XIII; K XII, XIII, XIV; Ca XIV; and V X. If, in addition, F IX and Ne X could be observed, the spectra of all possible stages of ionization would be represented for these two elements.

A careful study of the configurations in which a $3d$ electron becomes effective, is desirable. In the F I sequence the terms with $3d$ and $4d$ electrons for Na III, Mg IV, Al V, and Si VI should be verified, as there are marked irregularities along this sequence.

In Si I the $3d\ ^3D^\circ$ term is lower than $3p^3\ ^3D^\circ$, but the reverse is true for the rest of the sequence.

In the P I sequence the configuration assignments of terms in which $3p^4$, $3d$, and $4s$ electrons are involved, should be examined along the sequence. More observations are also needed to verify the extensive extrapolations from K V on.

Similar remarks apply to some spectra of the Cl I sequence, particularly to Ca IV, where various authors disagree on the interpretation. Analogous terms along this sequence are strikingly irregular as regards both position and intervals. Many such irregularities could be pointed out. It is hoped that the present work will stimulate further study along these lines.

[24] W. M. Welch Scientific Co., 1515 Sedgwick St., Chicago 10, Ill., U. S. A. (Chart and key, $7.50; key, $1.00). For Mn I and Mo I Catalán's revised values are quoted. The data on Tc I are from Meggers.

[25] Electron Configurations of "Rare-Earth" Elements, Science **105**, 514, No. 2733 (May 16, 1947).

The arrays of observed terms enable one to detect a number of conspicuous missing terms whose positions can be estimated by analogy with neighboring related terms. For example, Russell [26] has suggested that the $3d''' \, ^2G$ term in O IV might be found. To quote him "It should give a strong combination with $3p''' \, ^2F^\circ$, lying in the violet or near ultraviolet." Similarly, the absence of the $3d \, ^2F$ term of Cl III is conspicuous. Russell has also commented on the incompleteness of the analyses of S III and S IV.

In He I the term $11s \, ^1S$ is missing from the series. In Mg I Shortley has called attention to the fact that the triplets are higher than the singlets, an anomaly that appears to be unexplained.

The general need for further analysis can perhaps best be visualized by a comparison of the arrays of observed and predicted terms of the various spectra. This procedure enables the user to grade each analysis for himself. For spectra whose energy levels are not yet tabulated for this program it is recommended that he consult the existing surveys of spectrum analysis.[27]

Perhaps the most urgent needs of the astrophysicist are extensions to the work on the second and third spark spectra in the first long period (except for Fe III, which is well known). Many spectra of the heavier elements are incompletely analyzed and much work remains to be done on the highly complex spectra of the rare earths.

9.2. Term Intervals

A careful examination of the term intervals within a spectrum and in related spectra affords a useful check on the correctness of the analysis. In regular terms the intervals are roughly proportional to the larger J-values of the term, and term separations of similar terms usually increase smoothly along the sequence. Enough data are presented here for an extensive survey of this subject. The theoretical as well as observational aspects of this topic and its important relation to configuration assignments need not be emphasized to workers on spectrum analysis.

9.3. Series Spectra—Rydberg Denominators

Requests have been made for a tabulation of absolute term values and Rydberg denominators of the series members of each spectrum in which series have been detected, including the J-values of the limit terms. The need for a critical compilation of this material is fully appreciated. It is felt, however, that such a project can best be handled in a program restricted to the study of series in atomic spectra. Standard treatises such as Fowler's *Report on Series in Line Spectra* and Paschen-Götze's *Seriengesetze der Linienspektren*, the paper by Catalán and Poggio,[28] etc., together with other references included under the separate spectra should provide some data for those who are interested.

[26] Letter (Aug. 1947).

[27] W. F. Meggers, J. Opt. Soc. Am. **36**, 433 (1946); C. E. Moore, RMT (1945).

9.4. Observed Zeeman Patterns

A glance at the data on Zeeman effect in this volume alone, reveals a glaring need of further observations. The first entry of g-values occurs in the spectrum of N I. An outstanding example may be found in Ti I. The best observed g-values obtainable from existing data are given, and they serve remarkably well to confirm the analysis. For Ti, and also for other elements, however, Harrison [29] has made extensive observations that doubtless show many excellently resolved patterns and would yield precise observed g-values, but his data for a number of complex spectra have not yet been utilized. A wealth of information is in store for future study in this field.

9.5. Energy or Grotrian Diagrams

There have been urgent requests to prepare a homogeneous set of energy diagrams to accompany these tables. This topic is handled very inadequately here. If the individual authors have included either an energy level diagram or a Grotrian diagram,[30] this fact is indicated by the symbol (E D) or (G D) following the references. If not, recourse to general references such as Grotrian's classical publication [31] or White's *Introduction to Atomic Spectra* [32] must be had. Readers are warned that the existing diagrams are far from uniform in style and scale and that many of them are not up to date, i. e., they do not represent the analysis as given in the tables. In many cases, the most notable being probably that of A I, the writer has been unable to locate diagrams representing the analysis.

The present work would be seriously delayed by the inclusion of diagrams, but the energy levels as recorded here furnish the requisite material for such a project.

Only a few of the many interesting subjects for future investigation have been touched upon. If this work provides the inspiration and stimulus for at least some of them, it will have been justified.

[28] Zeit. Phys. **102**, 461 (1936).

[29] Reports on Progress in Physics **8**, 228 (1941).

[30] In energy diagrams only the positions of the levels or terms are indicated. In Grotrian diagrams lines indicating observed combinations connect the terms.

[31] *Graphische Darstellung der Spektren von Atomen und Ionen mit ein, zwei und drei Valenzelektronen*, Part II (Julius Springer, Berlin, 1928).

[32] H. E. White, *Introduction to Atomic Spectra* (McGraw-Hill Book Co., Inc., New York, N. Y., and London, 1934).

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TABLE 1. LANDÉ *g*-VALUES

Term	Multiplicity											
	Singlets 1		Triplets 3		Quintets 5		Septets 7		Nonets 9		Undecets 11	
	J	*g*	*J*	*g*	*J*	*g*	*J*	*g*	*J*	*g*	*J*	*g*
S	0	0/0	1	2.000	2	2.000	3	2.000	4	2.000	5	2.000
P	1	1.000	2	1.500	3	1.667	4	1.750	5	1.800	6	1.833
			1	1.500	2	1.833	3	1.917	4	1.950	5	1.967
			0	0/0	1	2.500	2	2.333	3	2.250	4	2.200
D	2	1.000	3	1.333	4	1.500	5	1.600	6	1.667	7	1.714
			2	1.167	3	1.500	4	1.650	5	1.733	6	1.786
			1	0.500	2	1.500	3	1.750	4	1.850	5	1.900
					1	1.500	2	2.000	3	2.083	4	2.100
					0	0/0	1	3.000	2	2.667	3	2.500
F	3	1.000	4	1.250	5	1.400	6	1.500	7	1.571	8	1.625
			3	1.083	4	1.350	5	1.500	6	1.595	7	1.661
			2	0.667	3	1.250	4	1.500	5	1.633	6	1.714
					2	1.000	3	1.500	4	1.700	5	1.800
					1	0.000	2	1.500	3	1.833	4	1.950
							1	1.500	2	2.167	3	2.250
							0	0/0	1	3.500	2	3.000
G	4	1.000	5	1.200	6	1.333	7	1.429	8	1.500	9	1.556
			4	1.050	5	1.267	6	1.405	7	1.500	8	1.569
			3	0.750	4	1.150	5	1.367	6	1.500	7	1.589
					3	0.917	4	1.300	5	1.500	6	1.619
					2	0.333	3	1.167	4	1.500	5	1.667
							2	0.833	3	1.500	4	1.750
							1	−0.500	2	1.500	3	1.917
									1	1.500	2	2.333
									0	0/0	1	4.000
H	5	1.000	6	1.167	7	1.286	8	1.375	9	1.444	10	1.500
			5	1.033	6	1.214	7	1.339	8	1.431	9	1.500
			4	0.800	5	1.100	6	1.286	7	1.411	8	1.500
					4	0.900	5	1.200	6	1.381	7	1.500
					3	0.500	4	1.050	5	1.333	6	1.500
							3	0.750	4	1.250	5	1.500
							2	0.000	3	1.083	4	1.500
									2	0.667	3	1.500
									1	−1.000	2	1.500
											1	1.500
											0	0/0
I	6	1.000	7	1.143	8	1.250	9	1.333	10	1.400	11	1.455
			6	1.024	7	1.179	8	1.292	9	1.378	10	1.445
			5	0.833	6	1.071	7	1.232	8	1.347	9	1.433
					5	0.900	6	1.143	7	1.304	8	1.417
					4	0.600	5	1.000	6	1.238	7	1.393
							4	0.750	5	1.133	6	1.357
							3	0.250	4	0.950	5	1.300
									3	0.583	4	1.200
									2	−0.333	3	1.000
											2	0.500
											1	−1.500
K	7	1.000	8	1.125	9	1.222	10	1.300	11	1.364	12	1.417
			7	1.018	8	1.153	9	1.256	10	1.336	11	1.402
			6	0.857	7	1.054	8	1.194	9	1.300	10	1.382
					6	0.905	7	1.107	8	1.250	9	1.356
					5	0.667	6	0.976	7	1.179	8	1.319
							5	0.767	6	1.071	7	1.268
							4	0.400	5	0.900	6	1.191
									4	0.600	5	1.067
									3	0.000	4	0.850
											3	0.417
											2	−0.667

TABLE 1. LANDÉ g-VALUES—Continued

Term	Multiplicity											
	Singlets 1		Triplets 3		Quintets 5		Septets 7		Nonets 9		Undecets 11	
	J	g	J	g	J	g	J	g	J	g	J	g
L	8	1. 000	9	1. 111	10	1. 200	11	1. 273	12	1. 333	13	1. 385
			8	1. 014	9	1. 133	10	1. 227	11	1. 303	12	1. 365
			7	0. 875	8	1. 042	9	1. 167	10	1. 264	11	1. 341
					7	0. 911	8	1. 083	9	1. 201	10	1. 309
					6	0. 714	7	0. 964	8	1. 139	9	1. 267
							6	0. 786	7	1. 036	8	1. 208
							5	0. 500	6	0. 881	7	1. 125
									5	0. 633	6	1. 000
									4	0. 200	5	0. 800
											4	0. 450
											3	−0. 250
M	9	1. 000	10	1. 100	11	1. 182	12	1. 250	13	1. 308	14	1. 357
			9	1. 011	10	1. 118	11	1. 205	12	1. 276	13	1. 335
			8	0. 889	9	1. 033	10	1. 145	11	1. 235	12	1. 308
					8	0. 917	9	1. 067	10	1. 182	11	1. 273
					7	0. 750	8	0. 958	9	1. 111	10	1. 227
							7	0. 804	8	1. 014	9	1. 167
							6	0. 571	7	0. 875	8	1. 083
									6	0. 667	7	0. 964
									5	0. 333	6	0. 786
											5	0. 500
											4	0. 000
N	10	1. 000	11	1. 091	12	1. 167	13	1. 231	14	1. 286	15	1. 333
			10	1. 009	11	1. 106	12	1. 186	13	1. 253	14	1. 310
			9	0. 900	10	1. 027	11	1. 129	12	1. 212	13	1. 280
					9	0. 902	10	1. 055	11	1. 159	12	1. 244
					8	0. 778	9	0. 906	10	1. 091	11	1. 197
							8	0. 819	9	1. 000	10	1. 136
							7	0. 625	8	0. 875	9	1. 056
									7	0. 696	8	0. 944
									6	0. 429	7	0. 786
											6	0. 548
											5	0. 167
O	11	1. 000	12	1. 083	13	1. 154	14	1. 214	15	1. 267	16	1. 312
			11	1. 008	12	1. 096	13	1. 170	14	1. 233	15	1. 288
			10	0. 909	11	1. 023	12	1. 115	13	1. 192	14	1. 257
					10	0. 927	11	1. 045	12	1. 141	13	1. 220
					9	0. 800	10	0. 955	11	1. 076	12	1. 173
							9	0. 833	10	0. 991	11	1. 114
							8	0. 667	9	0. 878	10	1. 036
									8	0. 722	9	0. 933
									7	0. 500	8	0. 792
											7	0. 589
											6	0. 286
Q	12	1. 000	13	1. 077	14	1. 143	15	1. 200	16	1. 250	17	1. 294
			12	1. 006	13	1. 088	14	1. 157	15	1. 217	16	1. 268
			11	0. 917	12	1. 019	13	1. 104	14	1. 176	15	1. 238
					11	0. 932	12	1. 038	13	1. 126	14	1. 200
					10	0. 818	11	0. 955	12	1. 064	13	1. 154
							10	0. 845	11	0. 985	12	1. 096
							9	0. 700	10	0. 882	11	1. 023
									9	0. 744	10	0. 927
									8	0. 556	9	0. 800
											8	0. 625
											7	0. 375

TABLE 2. LANDÉ g-VALUES

Term	Doublets 2		Quartets 4		Sextets 6		Octets 8		Decets 10	
	J	g	J	g	J	g	J	g	J	g
S	½	2. 000	1½	2. 000	2½	2. 000	3½	2. 000	4½	2. 000
P	1½	1. 333	2½	1. 600	3½	1. 714	4½	1. 778	5½	1. 818
	½	0. 667	1½	1. 733	2½	1. 886	3½	1. 937	4½	1. 960
			½	2. 667	1½	2. 400	2½	2. 286	3½	2. 222
D	2½	1. 200	3½	1. 429	4½	1. 556	5½	1. 636	6½	1. 692
	1½	0. 800	2½	1. 371	3½	1. 587	4½	1. 697	5½	1. 762
			1½	1. 200	2½	1. 657	3½	1. 809	4½	1. 879
			½	0. 000	1½	1. 867	2½	2. 057	3½	2. 095
					½	3. 333	1½	2. 800	2½	2. 572
F	3½	1. 143	4½	1. 333	5½	1. 455	6½	1. 538	7½	1. 600
	2½	0. 857	3½	1. 238	4½	1. 434	5½	1. 552	6½	1. 631
			2½	1. 029	3½	1. 397	4½	1. 576	5½	1. 678
			1½	0. 400	2½	1. 314	3½	1. 619	4½	1. 758
					1½	1. 067	2½	1. 714	3½	1. 905
					½	−0. 667	1½	2. 000	2½	2. 229
							½	4. 000	1½	3. 200
G	4½	1. 111	5½	1. 273	6½	1. 385	7½	1. 467	8½	1. 529
	3½	0. 889	4½	1. 172	5½	1. 343	6½	1. 456	7½	1. 537
			3½	0. 984	4½	1. 273	5½	1. 441	6½	1. 549
			2½	0. 571	3½	1. 143	4½	1. 414	5½	1. 566
					2½	0. 857	3½	1. 365	4½	1. 596
					1½	0. 000	2½	1. 257	3½	1. 651
							1½	0. 933	2½	1. 772
							½	−1. 333	1½	2. 133
									½	4. 667
H	5½	1. 091	6½	1. 231	7½	1. 333	8½	1. 412	9½	1. 474
	4½	0. 909	5½	1. 133	6½	1. 282	7½	1. 388	8½	1. 467
			4½	0. 970	5½	1. 203	6½	1. 354	7½	1. 459
			3½	0. 667	4½	1. 071	5½	1. 301	6½	1. 446
					3½	0. 825	4½	1. 212	5½	1. 427
					2½	0. 286	3½	1. 048	4½	1. 394
							2½	0. 686	3½	1. 333
							1½	−0. 400	2½	1. 200
									1½	0. 800
									½	−2. 000
I	6½	1. 077	7½	1. 200	8½	1. 294	9½	1. 368	10½	1. 429
	5½	0. 923	6½	1. 108	7½	1. 239	8½	1. 337	9½	1. 414
			5½	0. 965	6½	1. 159	7½	1. 294	8½	1. 393
			4½	0. 727	5½	1. 035	6½	1. 231	7½	1. 365
					4½	0. 828	5½	1. 133	6½	1. 323
					3½	0. 444	4½	0. 970	5½	1. 259
							3½	0. 667	4½	1. 152
							2½	0. 000	3½	0. 952
									2½	0. 514
									1½	−0. 800
K	7½	1. 067	8½	1. 176	9½	1. 263	10½	1. 333	11½	1. 391
	6½	0. 933	7½	1. 090	8½	1. 207	9½	1. 298	10½	1. 371
			6½	0. 964	7½	1. 129	8½	1. 251	9½	1. 343
			5½	0. 769	6½	1. 015	7½	1. 184	8½	1. 307
					5½	0. 839	6½	1. 087	7½	1. 255
					4½	0. 545	5½	0. 937	6½	1. 179
							4½	0. 687	5½	1. 063
							3½	0. 222	4½	0. 869
									3½	0. 508
									2½	−0. 286

Table 2. Landé *g*-values—Continued

Term	Multiplicity: Doublets 2		Quartets 4		Sextets 6		Octets 8		Decets 10	
	J	*g*	*J*	*g*	*J*	*g*	*J*	*g*	*J*	*g*
L	8½	1. 059	9½	1. 158	10½	1. 238	11½	1. 304	12½	1. 360
	7½	0. 941	8½	1. 077	9½	1. 183	10½	1. 267	11½	1. 336
			7½	0. 965	8½	1. 108	9½	1. 218	10½	1. 304
			6½	0. 800	7½	1. 004	8½	1. 152	9½	1. 263
					6½	0. 851	7½	1. 059	8½	1. 207
					5½	0. 615	6½	0. 923	7½	1. 129
							5½	0. 713	6½	1. 015
							4½	0. 364	5½	0. 839
									4½	0. 545
									3½	0. 000
M	9½	1. 053	10½	1. 143	11½	1. 217	12½	1. 280	13½	1. 333
	8½	0. 947	9½	1. 068	10½	1. 164	11½	1. 242	12½	1. 307
			8½	0. 966	9½	1. 093	10½	1. 193	11½	1. 273
			7½	0. 824	8½	0. 997	9½	1. 128	10½	1. 230
					7½	0. 863	8½	1. 040	9½	1. 173
					6½	0. 667	7½	0. 918	8½	1. 096
							6½	0. 738	7½	0. 988
							5½	0. 462	6½	0. 831
									5½	0. 587
									4½	0. 182
N	10½	1. 048	11½	1. 130	12½	1. 200	13½	1. 259	14½	1. 310
	9½	0. 952	10½	1. 060	11½	1. 148	12½	1. 221	13½	1. 282
			9½	0. 967	10½	1. 081	11½	1. 172	12½	1. 247
			8½	0. 842	9½	0. 992	10½	1. 110	11½	1. 203
					8½	0. 873	9½	1. 028	10½	1. 147
					7½	0. 706	8½	0. 916	9½	1. 073
							7½	0. 761	8½	0. 972
							6½	0. 533	7½	0. 831
									6½	0. 626
									5½	0. 308
O	11½	1. 043	12½	1. 120	13½	1. 185	14½	1. 241	15½	1. 290
	10½	0. 957	11½	1. 054	12½	1. 135	13½	1. 203	14½	1. 261
			10½	0. 969	11½	1. 071	12½	1. 156	13½	1. 226
			9½	0. 857	10½	0. 990	11½	1. 096	12½	1. 182
					9½	0. 882	10½	1. 019	11½	1. 127
					8½	0. 737	9½	0. 917	10½	1. 056
							8½	0. 780	9½	0. 962
							7½	0. 588	8½	0. 836
									7½	0. 659
									6½	0. 400
Q	12½	1. 040	13½	1. 111	14½	1. 172	15½	1. 226	16½	1. 273
	11½	0. 960	12½	1. 049	13½	1. 124	14½	1. 188	15½	1. 243
			11½	0. 970	12½	1. 064	13½	1. 142	14½	1. 208
			10½	0. 870	11½	0. 988	12½	1. 084	13½	1. 165
					10½	0. 890	11½	1. 012	12½	1. 111
					9½	0. 762	10½	0. 919	11½	1. 043
							9½	0. 797	10½	0. 957
							8½	0. 632	9½	0. 842
									8½	0. 687
									7½	0. 471

TABLE 3. LANDÉ *g*-VALUES—TERMS OF ODD MULTIPLICITY IN ORDER OF INCREASING *g*

g	Desig.	*g*	Desig.	*g*	Desig.	*g*	Desig.
−1. 500	$^{11}I_1$	0. 744	$^{9}Q_9$	0. 955	$^{7}O_{10}$ $^{7}Q_{11}$	1. 076	$^{9}O_{11}$
−1. 000	$^{9}H_1$	0. 750	$^{3}G_3$ $^{5}M_7$ $^{7}H_3$	0. 958	$^{7}M_8$	1. 077	$^{3}Q_{13}$
−0. 667	$^{11}K_2$		$^{7}I_4$	0. 964	$^{7}L_7$ $^{11}M_7$	1. 083	$^{3}F_3$ $^{3}O_{12}$ $^{7}L_8$
−0. 500	$^{7}G_1$	0. 767	$^{7}K_5$	0. 976	$^{7}K_6$		$^{9}H_3$ $^{11}M_8$
−0. 333	$^{9}I_2$	0. 778	$^{5}N_8$	0. 985	$^{9}Q_{11}$	1. 088	$^{5}Q_{13}$
−0. 250	$^{11}L_3$	0. 786	$^{7}L_6$ $^{11}M_6$ $^{11}N_7$	0. 991	$^{9}O_{10}$	1. 091	$^{3}N_{11}$ $^{9}N_{10}$
0. 000	$^{5}F_1$ $^{7}H_2$ $^{9}K_3$	0. 792	$^{11}O_8$	1. 000	$^{1}P_1$ $^{1}D_2$ $^{1}F_3$	1. 096	$^{5}O_{12}$ $^{11}Q_{12}$
	$^{11}M_4$	0. 800	$^{3}H_4$ $^{5}O_9$ $^{11}L_5$		$^{1}G_4$ $^{1}H_5$ $^{1}I_6$	1. 100	$^{3}M_{10}$ $^{5}H_5$
0. 167	$^{11}N_5$		$^{11}Q_9$		$^{1}K_7$ $^{1}L_8$ $^{1}M_9$	1. 104	$^{7}Q_{13}$
0. 200	$^{9}L_4$	0. 804	$^{7}M_7$		$^{1}N_{10}$ $^{1}O_{11}$ $^{1}Q_{12}$	1. 106	$^{5}N_{11}$
0. 250	$^{7}I_3$	0. 818	$^{5}Q_{10}$		$^{5}F_2$ $^{7}I_5$ $^{9}N_9$	1. 107	$^{7}K_7$
0. 286	$^{11}O_6$	0. 819	$^{7}N_8$		$^{11}I_3$ $^{11}L_6$	1. 111	$^{3}L_9$ $^{9}M_9$
0. 333	$^{5}G_2$ $^{9}M_5$	0. 833	$^{3}I_5$ $^{7}G_2$ $^{7}O_9$	1. 006	$^{3}Q_{12}$	1. 114	$^{11}O_{11}$
0. 375	$^{11}Q_7$	0. 845	$^{7}Q_{10}$	1. 008	$^{3}O_{11}$	1. 115	$^{7}O_{12}$
0. 400	$^{7}K_4$	0. 850	$^{11}K_4$	1. 009	$^{3}N_{10}$	1. 118	$^{5}M_{10}$
0. 417	$^{11}K_3$	0. 857	$^{3}K_6$	1. 011	$^{3}M_9$	1. 125	$^{3}K_8$ $^{11}L_7$
0. 429	$^{9}N_6$	0. 875	$^{3}L_7$ $^{9}M_7$ $^{9}N_8$	1. 014	$^{3}L_8$ $^{9}M_8$	1. 126	$^{9}Q_{13}$
0. 450	$^{11}L_4$	0. 878	$^{9}O_9$	1. 018	$^{3}K_7$	1. 129	$^{7}N_{11}$
0. 500	$^{3}D_1$ $^{5}H_3$ $^{7}L_5$	0. 881	$^{9}L_6$	1. 019	$^{5}Q_{12}$	1. 133	$^{5}L_9$ $^{9}I_5$
	$^{9}O_7$ $^{11}I_2$ $^{11}M_5$	0. 882	$^{9}Q_{10}$	1. 023	$^{5}O_{11}$ $^{11}Q_{11}$	1. 136	$^{11}N_{10}$
0. 548	$^{11}N_6$	0. 889	$^{3}M_8$	1. 024	$^{3}I_6$	1. 139	$^{9}L_8$
0. 556	$^{9}Q_8$	0. 900	$^{3}N_9$ $^{5}H_4$ $^{5}I_5$	1. 027	$^{5}N_{10}$	1. 141	$^{9}O_{12}$
0. 571	$^{7}M_6$		$^{9}K_5$	1. 033	$^{3}H_5$ $^{5}M_9$	1. 143	$^{3}I_7$ $^{5}Q_{14}$ $^{7}I_6$
0. 583	$^{9}I_3$	0. 902	$^{5}N_9$	1. 036	$^{9}L_7$ $^{11}O_{10}$	1. 145	$^{7}M_{10}$
0. 589	$^{11}O_7$	0. 905	$^{5}K_6$	1. 038	$^{7}Q_{12}$	1. 150	$^{5}G_4$
0. 600	$^{5}I_4$ $^{9}K_4$	0. 906	$^{7}N_9$	1. 042	$^{5}L_8$	1. 153	$^{5}K_8$
0. 625	$^{7}N_7$ $^{11}Q_8$	0. 909	$^{3}O_{10}$	1. 045	$^{7}O_{11}$	1. 154	$^{5}O_{13}$ $^{11}Q_{13}$
0. 633	$^{9}L_5$	0. 911	$^{5}L_7$	1. 050	$^{3}G_4$ $^{7}H_4$	1. 157	$^{7}Q_{14}$
0. 667	$^{3}F_2$ $^{5}K_5$ $^{7}O_8$	0. 917	$^{3}Q_{11}$ $^{5}G_3$ $^{5}M_8$	1. 054	$^{5}K_7$	1. 159	$^{9}N_{11}$
	$^{9}H_2$ $^{9}M_6$	0. 927	$^{5}O_{10}$ $^{11}Q_{10}$	1. 055	$^{7}N_{10}$	1. 167	$^{3}D_2$ $^{3}H_6$ $^{5}N_{12}$
0. 696	$^{9}N_7$	0. 932	$^{5}Q_{11}$	1. 056	$^{11}N_9$		$^{7}G_3$ $^{7}L_9$ $^{11}M_9$
0. 700	$^{7}Q_9$	0. 933	$^{11}O_9$	1. 064	$^{9}Q_{12}$	1. 170	$^{7}O_{13}$
0. 714	$^{5}L_6$	0. 944	$^{11}N_8$	1. 067	$^{7}M_9$ $^{11}K_5$	1. 173	$^{11}O_{12}$
0. 722	$^{9}O_8$	0. 950	$^{9}I_4$	1. 071	$^{5}I_6$ $^{9}K_6$	1. 176	$^{9}Q_{14}$

TABLE 3. LANDÉ g-VALUES—TERMS OF ODD MULTIPLICITY IN ORDER OF INCREASING g—Continued

g	Desig.	g	Desig.	g	Desig.	g	Desig.
1. 179	$^{5}I_{7}$ $^{9}K_{7}$	1. 268	$^{11}K_{7}$ $^{11}Q_{16}$	1. 381	$^{9}H_{6}$	1. 625	$^{11}F_{8}$
1. 182	$^{5}M_{11}$ $^{9}M_{10}$	1. 273	$^{7}L_{11}$ $^{11}M_{11}$	1. 382	$^{11}K_{10}$	1. 633	$^{9}F_{5}$
1. 186	$^{7}N_{12}$	1. 276	$^{9}M_{12}$	1. 385	$^{11}L_{13}$	1. 650	$^{7}D_{4}$
1. 191	$^{11}K_{6}$	1. 280	$^{11}N_{13}$	1. 393	$^{11}I_{7}$	1. 661	$^{11}F_{7}$
1. 192	$^{9}O_{13}$	1. 286	$^{5}H_{7}$ $^{7}H_{6}$ $^{9}N_{14}$	1. 400	$^{5}F_{5}$ $^{9}I_{10}$	1. 667	$^{5}P_{3}$ $^{9}D_{6}$ $^{11}G_{5}$
1. 194	$^{7}K_{8}$	1. 288	$^{11}O_{15}$	1. 402	$^{11}K_{11}$	1. 700	$^{9}F_{4}$
1. 197	$^{11}N_{11}$	1. 292	$^{7}I_{8}$	1. 405	$^{7}G_{6}$	1. 714	$^{11}D_{7}$ $^{11}F_{6}$
1. 200	$^{3}G_{5}$ $^{5}L_{10}$ $^{7}H_{5}$	1. 294	$^{11}Q_{17}$	1. 411	$^{9}H_{7}$	1. 733	$^{9}D_{5}$
	$^{7}Q_{15}$ $^{11}I_{4}$ $^{11}Q_{14}$	1. 300	$^{7}G_{4}$ $^{7}K_{10}$ $^{9}K_{9}$	1. 417	$^{11}I_{8}$ $^{11}K_{12}$	1. 750	$^{7}P_{4}$ $^{7}D_{3}$ $^{11}G_{4}$
1. 201	$^{9}L_{9}$		$^{11}I_{5}$	1. 429	$^{7}G_{7}$	1. 786	$^{11}D_{6}$
1. 205	$^{7}M_{11}$	1. 303	$^{9}L_{11}$	1. 431	$^{9}H_{8}$	1. 800	$^{9}P_{5}$ $^{11}F_{5}$
1. 208	$^{11}L_{8}$	1. 304	$^{9}I_{7}$	1. 433	$^{11}I_{9}$	1. 833	$^{5}P_{2}$ $^{9}F_{3}$ $^{11}P_{6}$
1. 212	$^{9}N_{12}$	1. 308	$^{9}M_{13}$ $^{11}M_{12}$	1. 444	$^{9}H_{9}$	1. 850	$^{9}D_{4}$
1. 214	$^{5}H_{5}$ $^{7}O_{14}$	1. 309	$^{11}L_{10}$	1. 445	$^{11}I_{10}$	1. 900	$^{11}D_{5}$
1. 217	$^{9}Q_{15}$	1. 310	$^{11}N_{14}$	1. 455	$^{11}I_{11}$	1. 917	$^{7}P_{3}$ $^{11}G_{3}$
1. 220	$^{11}O_{13}$	1. 312	$^{11}O_{16}$	1. 500	$^{3}P_{2}$ $^{3}P_{1}$ $^{5}D_{4}$	1. 950	$^{9}P_{4}$ $^{11}F_{4}$
1. 222	$^{5}K_{9}$	1. 319	$^{11}K_{8}$		$^{5}D_{3}$ $^{5}D_{2}$ $^{5}D_{1}$	1. 967	$^{11}P_{5}$
1. 227	$^{7}L_{10}$ $^{11}M_{10}$	1. 333	$^{3}D_{3}$ $^{5}G_{5}$ $^{7}I_{9}$		$^{7}F_{6}$ $^{7}F_{5}$ $^{7}F_{4}$	2. 000	$^{3}S_{1}$ $^{5}S_{2}$ $^{7}S_{3}$
1. 231	$^{7}N_{13}$		$^{9}H_{5}$ $^{9}L_{12}$ $^{11}N_{15}$		$^{7}F_{3}$ $^{7}F_{2}$ $^{7}F_{1}$		$^{9}S_{4}$ $^{11}S_{5}$ $^{7}D_{2}$
1. 232	$^{7}I_{7}$	1. 335	$^{11}M_{13}$		$^{9}G_{8}$ $^{9}G_{7}$ $^{9}G_{6}$	2. 083	$^{9}D_{3}$
1. 233	$^{9}O_{14}$	1. 336	$^{9}K_{10}$		$^{9}G_{5}$ $^{9}G_{4}$ $^{9}G_{3}$	2. 100	$^{11}D_{4}$
1. 235	$^{9}M_{11}$	1. 339	$^{7}H_{7}$		$^{9}G_{2}$ $^{9}G_{1}$ $^{11}H_{10}$	2. 167	$^{9}F_{2}$
1. 238	$^{9}I_{6}$ $^{11}Q_{15}$	1. 341	$^{11}L_{11}$		$^{11}H_{9}$ $^{11}H_{8}$ $^{11}H_{7}$	2. 200	$^{11}P_{4}$
1. 244	$^{11}N_{12}$	1. 347	$^{9}I_{8}$		$^{11}H_{6}$ $^{11}H_{5}$ $^{11}H_{4}$	2. 250	$^{9}P_{3}$ $^{11}F_{3}$
1. 250	$^{3}F_{4}$ $^{5}F_{3}$ $^{5}I_{8}$	1. 350	$^{5}F_{4}$		$^{11}H_{3}$ $^{11}H_{2}$ $^{11}H_{1}$	2. 333	$^{7}P_{2}$ $^{11}G_{2}$
	$^{7}M_{12}$ $^{9}H_{4}$ $^{9}K_{8}$	1. 356	$^{11}K_{9}$	1. 556	$^{11}G_{9}$	2. 500	$^{5}P_{1}$ $^{11}D_{3}$
	$^{9}Q_{16}$	1. 357	$^{11}I_{6}$ $^{11}M_{14}$	1. 569	$^{11}G_{8}$	2. 667	$^{9}D_{2}$
1. 253	$^{9}N_{13}$	1. 364	$^{9}K_{11}$	1. 571	$^{9}F_{7}$	3. 000	$^{7}D_{1}$ $^{11}F_{2}$
1. 256	$^{7}K_{9}$	1. 365	$^{11}L_{12}$	1. 589	$^{11}G_{7}$	3. 500	$^{9}F_{1}$
1. 257	$^{11}O_{14}$	1. 367	$^{7}G_{5}$	1. 595	$^{9}F_{6}$	4. 000	$^{11}G_{1}$
1. 264	$^{9}L_{10}$	1. 375	$^{7}H_{8}$	1. 600	$^{7}D_{5}$		
1. 267	$^{5}G_{5}$ $^{9}O_{15}$ $^{11}L_{9}$	1. 378	$^{9}I_{9}$	1. 619	$^{11}G_{6}$		

Table 4. Landé g-values for Terms of Even Multiplicity in Order of Increasing g

g	Desig.	g	Desig.	g	Desig.	g	Desig.
−2. 000	$^{10}H_{1/2}$	0. 713	$^{8}L_{5½}$	0. 937	$^{8}K_{5½}$	1. 059	$^{2}I_{8½}$ $^{8}L_{7½}$
−1. 333	$^{8}G_{1/2}$	0. 727	$^{4}I_{4½}$	0. 941	$^{2}L_{7½}$	1. 060	$^{4}N_{10½}$
−0. 800	$^{10}I_{1½}$	0. 737	$^{6}O_{8½}$	0. 947	$^{2}M_{8½}$	1. 063	$^{10}K_{6½}$
−0. 667	$^{6}F_{1/2}$	0. 738	$^{8}M_{6½}$	0. 952	$^{2}N_{9½}$ $^{10}I_{3½}$	1. 064	$^{6}Q_{12½}$
−0. 400	$^{8}H_{1½}$	0. 761	$^{8}N_{7½}$	0. 957	$^{2}O_{10½}$ $^{10}Q_{10½}$	1. 067	$^{2}K_{7½}$ $^{6}F_{1½}$
−0. 286	$^{10}K_{2½}$	0. 762	$^{6}Q_{9½}$	0. 960	$^{2}Q_{11½}$	1. 068	$^{4}M_{9½}$
0. 000	$^{4}D_{1/2}$ $^{6}G_{1½}$ $^{8}I_{2½}$	0. 769	$^{4}K_{6½}$	0. 962	$^{10}O_{9½}$	1. 071	$^{6}H_{4½}$ $^{6}O_{1½}$
	$^{10}L_{3½}$	0. 780	$^{8}O_{8½}$	0. 964	$^{4}K_{6½}$	1. 073	$^{10}N_{9½}$
0. 182	$^{10}M_{4½}$	0. 797	$^{8}Q_{9½}$	0. 965	$^{4}I_{5½}$ $^{4}L_{7½}$	1. 077	$^{2}I_{6½}$ $^{4}L_{8½}$
0. 222	$^{8}K_{3½}$	0. 800	$^{2}D_{1½}$ $^{4}L_{6½}$ $^{10}H_{1½}$	0. 966	$^{4}M_{8½}$	1. 081	$^{6}N_{10½}$
0. 286	$^{6}H_{2½}$	0. 824	$^{4}M_{7½}$	0. 967	$^{4}N_{9½}$	1. 084	$^{8}Q_{12½}$
0. 308	$^{10}N_{6½}$	0. 825	$^{6}H_{3½}$	0. 969	$^{4}O_{10½}$	1. 087	$^{8}K_{6½}$
0. 364	$^{8}L_{4½}$	0. 828	$^{6}I_{4½}$	0. 970	$^{4}H_{4½}$ $^{4}Q_{11½}$ $^{8}I_{4½}$	1. 090	$^{4}K_{7½}$
0. 400	$^{4}F_{1½}$ $^{10}O_{6½}$	0. 831	$^{10}M_{6½}$ $^{10}N_{7½}$	0. 972	$^{10}N_{8½}$	1. 091	$^{2}H_{5½}$
0. 444	$^{6}I_{3½}$	0. 836	$^{10}O_{8½}$	0. 984	$^{4}G_{3½}$	1. 093	$^{6}M_{9½}$
0. 462	$^{8}M_{5½}$	0. 839	$^{6}K_{5½}$ $^{10}L_{5½}$	0. 988	$^{6}Q_{11½}$ $^{10}M_{7½}$	1. 096	$^{8}O_{11½}$ $^{10}M_{8½}$
0. 471	$^{10}Q_{7½}$	0. 842	$^{4}N_{8½}$ $^{10}Q_{9½}$	0. 990	$^{6}O_{10½}$	1. 108	$^{4}I_{6½}$ $^{6}L_{8½}$
0. 508	$^{10}K_{3½}$	0. 851	$^{6}L_{6½}$	0. 992	$^{6}N_{9½}$	1. 110	$^{8}N_{10½}$
0. 514	$^{10}I_{2½}$	0. 857	$^{2}F_{2½}$ $^{4}O_{9½}$ $^{6}G_{2½}$	0. 997	$^{6}M_{8½}$	1. 111	$^{2}G_{4½}$ $^{4}Q_{13½}$ $^{10}Q_{12½}$
0. 533	$^{8}N_{6½}$	0. 863	$^{6}M_{7½}$	1. 004	$^{6}L_{7½}$	1. 120	$^{4}O_{12½}$
0. 545	$^{6}K_{4½}$ $^{10}L_{4½}$	0. 869	$^{10}K_{4½}$	1. 012	$^{8}Q_{11½}$	1. 124	$^{6}Q_{13½}$
0. 571	$^{4}G_{2½}$	0. 870	$^{4}Q_{10½}$	1. 015	$^{6}K_{6½}$ $^{10}L_{6½}$	1. 127	$^{10}O_{11½}$
0. 587	$^{10}M_{5½}$	0. 873	$^{6}N_{8½}$	1. 019	$^{8}O_{10½}$	1. 128	$^{8}M_{9½}$
0. 588	$^{8}O_{7½}$	0. 882	$^{6}O_{9½}$	1. 028	$^{8}N_{9½}$	1. 129	$^{6}K_{7½}$ $^{10}L_{7½}$
0. 615	$^{6}L_{6½}$	0. 889	$^{2}G_{3½}$	1. 029	$^{4}F_{2½}$	1. 130	$^{4}N_{11½}$
0. 626	$^{10}N_{6½}$	0. 890	$^{6}Q_{10½}$	1. 035	$^{6}I_{5½}$	1. 133	$^{4}H_{6½}$ $^{8}I_{6½}$
0. 632	$^{8}Q_{8½}$	0. 909	$^{2}H_{4½}$	1. 040	$^{2}Q_{12½}$ $^{8}M_{8½}$	1. 135	$^{6}O_{12½}$
0. 659	$^{10}O_{7½}$	0. 916	$^{8}N_{8½}$	1. 043	$^{2}O_{11½}$ $^{10}Q_{11½}$	1. 142	$^{8}Q_{13½}$
0. 667	$^{2}P_{1/2}$ $^{4}H_{3½}$ $^{6}M_{6½}$	0. 917	$^{8}O_{9½}$	1. 048	$^{2}N_{10½}$ $^{8}H_{3½}$	1. 143	$^{2}F_{3½}$ $^{4}M_{10½}$ $^{6}G_{3½}$
	$^{8}I_{3½}$	0. 918	$^{8}M_{7½}$	1. 049	$^{4}Q_{12½}$	1. 147	$^{10}N_{10½}$
0. 686	$^{8}H_{2½}$	0. 919	$^{8}Q_{10½}$	1. 053	$^{2}M_{9½}$	1. 148	$^{6}N_{11½}$
0. 687	$^{8}K_{4½}$ $^{10}Q_{8½}$	0. 923	$^{2}I_{5½}$ $^{8}L_{6½}$	1. 054	$^{4}O_{11½}$	1. 152	$^{8}L_{8½}$ $^{10}I_{4½}$
0. 706	$^{6}N_{7½}$	0. 933	$^{2}K_{6½}$ $^{8}G_{1½}$	1. 056	$^{10}O_{10½}$	1. 156	$^{8}O_{12½}$

Table 4. Landé *g*-values for Terms of Even Multiplicity in Order of Increasing *g*—Continued

g	Desig.	*g*	Desig.	*g*	Desig.	*g*	Desig.
1. 158	$^{4}L_{9\frac{1}{2}}$	1. 255	$^{10}K_{7\frac{1}{2}}$	1. 394	$^{10}H_{4\frac{1}{2}}$	1. 714	$^{6}P_{3\frac{1}{2}}$ $^{8}F_{2\frac{1}{2}}$
1. 159	$^{6}I_{6\frac{1}{2}}$	1. 257	$^{8}G_{2\frac{1}{2}}$	1. 397	$^{6}F_{3\frac{1}{2}}$	1. 733	$^{4}P_{1\frac{1}{2}}$
1. 164	$^{6}M_{10\frac{1}{2}}$	1. 259	$^{8}N_{13\frac{1}{2}}$ $^{10}I_{5\frac{1}{2}}$	1. 412	$^{8}H_{8\frac{1}{2}}$	1. 758	$^{10}F_{4\frac{1}{2}}$
1. 165	$^{10}Q_{13\frac{1}{2}}$	1. 261	$^{10}O_{14\frac{1}{2}}$	1. 414	$^{8}G_{4\frac{1}{2}}$ $^{10}I_{9\frac{1}{2}}$	1. 762	$^{10}D_{5\frac{1}{2}}$
1. 172	$^{4}G_{4\frac{1}{2}}$ $^{6}Q_{14\frac{1}{2}}$ $^{8}N_{11\frac{1}{2}}$	1. 263	$^{6}K_{9\frac{1}{2}}$ $^{10}L_{9\frac{1}{2}}$	1. 427	$^{10}H_{5\frac{1}{2}}$	1. 772	$^{10}G_{2\frac{1}{2}}$
1. 173	$^{10}M_{9\frac{1}{2}}$	1. 267	$^{8}L_{10\frac{1}{2}}$	1. 429	$^{4}D_{3\frac{1}{2}}$ $^{10}I_{10\frac{1}{2}}$	1. 778	$^{8}P_{4\frac{1}{2}}$
1. 176	$^{4}K_{8\frac{1}{2}}$	1. 273	$^{4}G_{5\frac{1}{2}}$ $^{6}G_{4\frac{1}{2}}$ $^{10}M_{11\frac{1}{2}}$	1. 434	$^{6}F_{4\frac{1}{2}}$	1. 809	$^{8}D_{3\frac{1}{2}}$
1. 179	$^{10}K_{6\frac{1}{2}}$		$^{10}Q_{16\frac{1}{2}}$	1. 441	$^{8}G_{5\frac{1}{2}}$	1. 818	$^{10}P_{5\frac{1}{2}}$
1. 182	$^{10}O_{12\frac{1}{2}}$	1. 280	$^{8}M_{12\frac{1}{2}}$	1. 446	$^{10}H_{6\frac{1}{2}}$	1. 867	$^{6}D_{1\frac{1}{2}}$
1. 183	$^{6}L_{9\frac{1}{2}}$	1. 282	$^{6}H_{6\frac{1}{2}}$ $^{10}N_{13\frac{1}{2}}$	1. 455	$^{6}F_{5\frac{1}{2}}$	1. 879	$^{10}D_{4\frac{1}{2}}$
1. 184	$^{8}K_{7\frac{1}{2}}$	1. 290	$^{10}O_{15\frac{1}{2}}$	1. 456	$^{8}G_{6\frac{1}{2}}$	1. 886	$^{6}P_{2\frac{1}{2}}$
1. 185	$^{6}O_{13\frac{1}{2}}$	1. 294	$^{6}I_{8\frac{1}{2}}$ $^{8}I_{7\frac{1}{2}}$	1. 459	$^{10}H_{7\frac{1}{2}}$	1. 905	$^{10}F_{3\frac{1}{2}}$
1. 188	$^{8}Q_{14\frac{1}{2}}$	1. 298	$^{8}K_{9\frac{1}{2}}$	1. 467	$^{8}G_{7\frac{1}{2}}$ $^{10}H_{8\frac{1}{2}}$	1. 937	$^{8}P_{3\frac{1}{2}}$
1. 193	$^{8}M_{10\frac{1}{2}}$	1. 301	$^{8}H_{5\frac{1}{2}}$	1. 474	$^{10}H_{9\frac{1}{2}}$	1. 960	$^{10}P_{4\frac{1}{2}}$
1. 200	$^{2}D_{2\frac{1}{2}}$ $^{4}D_{1\frac{1}{2}}$ $^{4}I_{7\frac{1}{2}}$	1. 304	$^{8}L_{11\frac{1}{2}}$ $^{10}L_{10\frac{1}{2}}$	1. 529	$^{10}G_{8\frac{1}{2}}$	2. 000	$^{2}S_{\frac{1}{2}}$ $^{4}S_{1\frac{1}{2}}$ $^{6}S_{2\frac{1}{2}}$
	$^{6}N_{12\frac{1}{2}}$ $^{10}H_{2\frac{1}{2}}$	1. 307	$^{10}K_{8\frac{1}{2}}$ $^{10}M_{12\frac{1}{2}}$	1. 537	$^{10}G_{7\frac{1}{2}}$		$^{8}S_{3\frac{1}{2}}$ $^{8}F_{1\frac{1}{2}}$ $^{10}S_{4\frac{1}{2}}$
1. 203	$^{6}H_{5\frac{1}{2}}$ $^{8}O_{13\frac{1}{2}}$ $^{10}N_{11\frac{1}{2}}$	1. 310	$^{10}N_{14\frac{1}{2}}$	1. 538	$^{8}F_{6\frac{1}{2}}$	2. 057	$^{8}D_{2\frac{1}{2}}$
1. 207	$^{6}K_{8\frac{1}{2}}$ $^{10}L_{8\frac{1}{2}}$	1. 314	$^{6}F_{2\frac{1}{2}}$	1. 549	$^{10}G_{6\frac{1}{2}}$	2. 095	$^{10}D_{3\frac{1}{2}}$
1. 208	$^{10}Q_{14\frac{1}{2}}$	1. 323	$^{10}I_{6\frac{1}{2}}$	1. 552	$^{8}F_{5\frac{1}{2}}$	2. 133	$^{10}G_{1\frac{1}{2}}$
1. 212	$^{8}H_{4\frac{1}{2}}$	1. 333	$^{2}P_{1\frac{1}{2}}$ $^{4}F_{4\frac{1}{2}}$ $^{6}H_{7\frac{1}{2}}$	1. 556	$^{6}D_{4\frac{1}{2}}$	2. 222	$^{10}P_{3\frac{1}{2}}$
1. 217	$^{6}M_{11\frac{1}{2}}$		$^{8}K_{10\frac{1}{2}}$ $^{10}H_{3\frac{1}{2}}$ $^{10}M_{13\frac{1}{2}}$	1. 566	$^{10}G_{5\frac{1}{2}}$	2. 229	$^{10}F_{2\frac{1}{2}}$
1. 218	$^{8}L_{9\frac{1}{2}}$	1. 336	$^{10}L_{11\frac{1}{2}}$	1. 576	$^{8}F_{4\frac{1}{2}}$	2. 286	$^{8}P_{2\frac{1}{2}}$
1. 221	$^{8}N_{12\frac{1}{2}}$	1. 337	$^{8}I_{8\frac{1}{2}}$	1. 587	$^{6}D_{3\frac{1}{2}}$	2. 400	$^{6}P_{1\frac{1}{2}}$
1. 226	$^{8}Q_{15\frac{1}{2}}$ $^{10}O_{13\frac{1}{2}}$	1. 343	$^{6}G_{5\frac{1}{2}}$ $^{10}K_{9\frac{1}{2}}$	1. 596	$^{10}G_{4\frac{1}{2}}$	2. 572	$^{10}D_{2\frac{1}{2}}$
1. 230	$^{10}M_{10\frac{1}{2}}$	1. 354	$^{8}H_{6\frac{1}{2}}$	1. 600	$^{4}P_{2\frac{1}{2}}$ $^{10}F_{7\frac{1}{2}}$	2. 667	$^{4}P_{\frac{1}{2}}$
1. 231	$^{4}H_{6\frac{1}{2}}$ $^{8}I_{6\frac{1}{2}}$	1. 360	$^{10}L_{12\frac{1}{2}}$	1. 619	$^{8}F_{3\frac{1}{2}}$	2. 800	$^{8}D_{1\frac{1}{2}}$
1. 238	$^{4}F_{3\frac{1}{2}}$ $^{6}L_{10\frac{1}{2}}$	1. 365	$^{8}G_{3\frac{1}{2}}$ $^{10}I_{7\frac{1}{2}}$	1. 631	$^{10}F_{6\frac{1}{2}}$	3. 200	$^{10}F_{1\frac{1}{2}}$
1. 239	$^{6}I_{7\frac{1}{2}}$	1. 368	$^{8}I_{9\frac{1}{2}}$	1. 636	$^{8}D_{5\frac{1}{2}}$	3. 333	$^{6}D_{\frac{1}{2}}$
1. 241	$^{8}O_{14\frac{1}{2}}$	1. 371	$^{4}D_{2\frac{1}{2}}$ $^{10}K_{10\frac{1}{2}}$	1. 651	$^{10}G_{3\frac{1}{2}}$	4. 000	$^{8}F_{\frac{1}{2}}$
1. 242	$^{8}M_{11\frac{1}{2}}$	1. 385	$^{6}G_{6\frac{1}{2}}$	1. 657	$^{6}D_{2\frac{1}{2}}$	4. 667	$^{10}G_{\frac{1}{2}}$
1. 243	$^{10}Q_{15\frac{1}{2}}$	1. 388	$^{8}H_{7\frac{1}{2}}$	1. 678	$^{10}F_{5\frac{1}{2}}$		
1. 247	$^{10}N_{12\frac{1}{2}}$	1. 391	$^{10}K_{11\frac{1}{2}}$	1. 692	$^{10}D_{6\frac{1}{2}}$		
1. 251	$^{8}K_{8\frac{1}{2}}$	1. 393	$^{10}I_{8\frac{1}{2}}$	1. 697	$^{8}D_{4\frac{1}{2}}$		

Table 5. Predicted Terms of the Be I Isoelectronic Sequence

Config. $1s^2+$	Predicted Terms					
$2s^2$	^1S					
$2s(^2S)2p$	$^3P^{\circ}$ $^1P^{\circ}$					
$2p^2$	^3P ^1S ^1D					
	ns $(n\geq 3)$	np $(n\geq 3)$	nd $(n\geq 3)$	nf $(n\geq 4)$	ng $(n\geq 5)$	....
$2s(^2S)nx$	^3S ^1S	$^3P^{\circ}$ $^1P^{\circ}$	^3D ^1D	$^3F^{\circ}$ $^1F^{\circ}$	^3G ^1G	....
$2p(^2P^{\circ})nx$	$^3P^{\circ}$ $^1P^{\circ}$	^3S ^3P ^3D ^1S ^1P ^1D	$^3P^{\circ}$ $^3D^{\circ}$ $^3F^{\circ}$ $^1P^{\circ}$ $^1D^{\circ}$ $^1F^{\circ}$	^3D ^3F ^3G ^1D ^1F ^1G	$^3F^{\circ}$ $^3G^{\circ}$ $^3H^{\circ}$ $^1F^{\circ}$ $^1G^{\circ}$ $^1H^{\circ}$	....

Table 6. Predicted Terms of the B I Isoelectronic Sequence

Config. $1s^2+$	Predicted Terms		
$2s^2(^1S)2p$	$^2P^{\circ}$		
$2s\ 2p^2$	^4P ^2S ^2P ^2D		
$2p^3$	$^4S^{\circ}$ $^2P^{\circ}$ $^2D^{\circ}$		
	ns $(n\geq 3)$	np $(n\geq 3)$	nd $(n\geq 3)$
$2s^2(^1S)nx$	^2S	$^2P^{\circ}$	^2D
$2s\ 2p(^3P^{\circ})nx$	$^4P^{\circ}$ $^2P^{\circ}$	^4S ^4P ^4D ^2S ^2P ^2D	$^4P^{\circ}$ $^4D^{\circ}$ $^4F^{\circ}$ $^2P^{\circ}$ $^2D^{\circ}$ $^2F^{\circ}$
$2s\ 2p(^1P^{\circ})nx'$	$^2P^{\circ}$	^2S ^2P ^2D	$^2P^{\circ}$ $^2D^{\circ}$ $^2F^{\circ}$
$2p^2(^3P)nx''$	^4P ^2P	$^4S^{\circ}$ $^4P^{\circ}$ $^4D^{\circ}$ $^2S^{\circ}$ $^2P^{\circ}$ $^2D^{\circ}$	^4P ^4D ^4F ^2P ^2D ^2F
$2p^2(^1D)nx'''$	^2D	$^2P^{\circ}$ $^2D^{\circ}$ $^2F^{\circ}$	^2S ^2P ^2D ^2F ^2G
$2p^2(^1S)nx^{IV}$	^2S	$^2P^{\circ}$	^2D
	nf $(n\geq 4)$	ng $(n\geq 5)$	....
$2s^2(^1S)nx$	$^2F^{\circ}$	^2G	....
$2s\ 2p(^3P^{\circ})nx$	^4D ^4F ^4G ^2D ^2F ^2G	$^4F^{\circ}$ $^4G^{\circ}$ $^4H^{\circ}$ $^2F^{\circ}$ $^2G^{\circ}$ $^2H^{\circ}$	....
$2s\ 2p(^1P^{\circ})nx'$	^2D ^2F ^2G	$^2F^{\circ}$ $^2G^{\circ}$ $^2H^{\circ}$	....
$2p^2(^3P)nx''$	$^4D^{\circ}$ $^4F^{\circ}$ $^4G^{\circ}$ $^2D^{\circ}$ $^2F^{\circ}$ $^2G^{\circ}$	^4F ^4G ^4H ^2F ^2G ^2H	....
$2p^2(^1D)nx'''$	$^2P^{\circ}$ $^2D^{\circ}$ $^2F^{\circ}$ $^2G^{\circ}$ $^2H^{\circ}$	^2D ^2F ^2G ^2H ^2I	....
$2p^2(^1S)nx^{IV}$	$^2F^{\circ}$	^2G	....

Table 7.—Predicted Terms of the C I Isoelectronic Sequence

Config. $1s^2+$	Predicted Terms
$2s^2\ 2p^2$	^{3}P ^{1}S ^{1}D
$2s\ 2p^3$	^{5}S° ^{3}S° ^{3}P° ^{3}D° ^{1}P° ^{1}D°
$2p^4$	^{3}P ^{1}S ^{1}D

Config. $1s^2+$	ns $(n\geq 3)$	np $(n\geq 3)$	nd $(n\geq 3)$	nf $(n\geq 4)$	....
$2s^2\ 2p(^2P^\circ)nx$	^{3}P° ^{1}P°	^{3}S ^{3}P ^{3}D ^{1}S ^{1}P ^{1}D	^{3}P° ^{3}D° ^{3}F° ^{1}P° ^{1}D° ^{1}F°	^{3}D ^{3}F ^{3}G ^{1}D ^{1}F ^{1}G	....
$2s\ 2p^2(^4P)nx$	^{5}P ^{3}P	^{5}S° ^{5}P° ^{5}D° ^{3}S° ^{3}P° ^{3}D°	^{5}P ^{5}D ^{5}F ^{3}P ^{3}D ^{3}F	^{5}D° ^{5}F° ^{5}G° ^{3}D° ^{3}F° ^{3}G°	....
$2s\ 2p^2(^2D)nx'$	^{3}D ^{1}D	^{3}P° ^{3}D° ^{3}F° ^{1}P° ^{1}D° ^{1}F°	^{3}S ^{3}P ^{3}D ^{3}F ^{3}G ^{1}S ^{1}P ^{1}D ^{1}F ^{1}G	^{3}P° ^{3}D° ^{3}F° ^{3}G° ^{3}H° ^{1}P° ^{1}D° ^{1}F° ^{1}G° ^{1}H°	....
$2s\ 2p^2(^2S)nx''$	^{3}S ^{1}S	^{3}P° ^{1}P°	^{3}D ^{1}D	^{3}F° ^{1}F°	....
$2s\ 2p^2(^2P)nx'''$	^{3}P ^{1}P	^{3}S° ^{3}P° ^{3}D° ^{1}S° ^{1}P° ^{1}D°	^{3}P ^{3}D ^{3}F ^{1}P ^{1}D ^{1}F	^{3}D° ^{3}F° ^{3}G° ^{1}D° ^{1}F° ^{1}G°	....
$2p^3(^4S^\circ)nx^{IV}$	^{5}S° ^{3}S°	^{5}P ^{3}P	^{5}D° ^{3}D°	^{5}F ^{3}F	....

Table 8. Predicted Terms of the N I Isoelectronic Sequence

Config. $1s^2+$	Predicted Terms
$2s^2\ 2p^3$	^{4}S° ^{2}P° ^{2}D°
$2s\ 2p^4$	^{4}P ^{2}S ^{2}P ^{2}D
$2p^5$	^{2}P°

Config. $1s^2+$	ns $(n\geq 3)$	np $(n\geq 3)$	nd $(n\geq 3)$	nf $(n\geq 4)$	....
$2s^2\ 2p^2(^3P)nx$	^{4}P ^{2}P	^{4}S° ^{4}P° ^{4}D° ^{2}S° ^{2}P° ^{2}D°	^{4}P ^{4}D ^{4}F ^{2}P ^{2}D ^{2}F	^{4}D° ^{4}F° ^{4}G° ^{2}D° ^{2}F° ^{2}G°	....
$2s^2\ 2p^2(^1D)nx'$	^{2}D	^{2}P° ^{2}D° ^{2}F°	^{2}S ^{2}P ^{2}D ^{2}F ^{2}G	^{2}P° ^{2}D° ^{2}F° ^{2}G° ^{2}H°	....
$2s^2\ 2p^2(^1S)nx''$	^{2}S	^{2}P°	^{2}D	^{2}F°	....
$2s\ 2p^3(^5S^\circ)nx'''$	^{6}S° ^{4}S°	^{6}P ^{4}P	^{6}D° ^{4}D°	^{6}F ^{4}F	....
$2s\ 2p^3(^3D^\circ)nx^{IV}$	^{4}D° ^{2}D°	^{4}P ^{4}D ^{4}F ^{2}P ^{2}D ^{2}F	^{4}S° ^{4}P° ^{4}D° ^{4}F° ^{4}G° ^{2}S° ^{2}P° ^{2}D° ^{2}F° ^{2}G°	^{4}P ^{4}D ^{4}F ^{4}G ^{4}H ^{2}P ^{2}D ^{2}F ^{2}G ^{2}H	....
$2s\ 2p^3(^3P^\circ)nx^{V}$	^{4}P° ^{2}P°	^{4}S ^{4}P ^{4}D ^{2}S ^{2}P ^{2}D	^{4}P° ^{4}D° ^{4}F° ^{2}P° ^{2}D° ^{2}F°	^{4}D ^{4}F ^{4}G ^{2}D ^{2}F ^{2}G	....

TABLE 9. PREDICTED TERMS OF THE O I ISOELECTRONIC SEQUENCE

Config. $1s^2+$	Predicted Terms											
$2s^2\ 2p^4$	^1S	^3P	^1D									
$2s\ 2p^5$		$^3P^\circ$ $^1P^\circ$										
	ns $(n\geq 3)$			*np* $(n\geq 3)$				*nd* $(n\geq 3)$				
$2s^2\ 2p^3(^4S^\circ)nx$	$^5S^\circ$ $^3S^\circ$				^5P ^3P					$^5D^\circ$ $^3D^\circ$		
$2s^2\ 2p^3(^2D^\circ)nx'$			$^3D^\circ$ $^1D^\circ$		^3P ^1P	^3D ^1D	^3F ^1F	$^3S^\circ$ $^1S^\circ$	$^3P^\circ$ $^1P^\circ$	$^3D^\circ$ $^1D^\circ$	$^3F^\circ$ $^1F^\circ$	$^3G^\circ$ $^1G^\circ$
$2s^2\ 2p^3(^2P^\circ)nx''$		$^3P^\circ$ $^1P^\circ$		^3S ^1S	^3P ^1P	^3D ^1D			$^3P^\circ$ $^1P^\circ$	$^3D^\circ$ $^1D^\circ$	$^3F^\circ$ $^1F^\circ$	
$2s\ 2p^4(^4P)nx'''$		^5P ^3P		$^5S^\circ$ $^3S^\circ$	$^5P^\circ$ $^3P^\circ$	$^5D^\circ$ $^3D^\circ$			^5P ^3P	^5D ^3D	^5F ^3F	
$2s\ 2p^4(^2D)nx^{IV}$			^3D ^1D		$^3P^\circ$ $^1P^\circ$	$^3D^\circ$ $^1D^\circ$	$^3F^\circ$ $^1F^\circ$	^3S ^1S	^3P ^1P	^3D ^1D	^3F ^1F	^3G ^1G
$2s\ 2p^4(^2S)nx^{V}$	^3S ^1S				$^3P^\circ$ $^1P^\circ$					^3D ^1D		
$2s\ 2p^4(^2P)nx^{VI}$		^3P ^1P		$^3S^\circ$ $^1S^\circ$	$^3P^\circ$ $^1P^\circ$	$^3D^\circ$ $^1D^\circ$			^3P ^1P	^3D ^1D	^3F ^1F	

Config. $1s^2+$	*nf* $(n\geq 4)$					....
$2s^2\ 2p^3(^4S^\circ)nx$			^5F ^3F			....
$2s^2\ 2p^3(^2D^\circ)nx'$	^3P ^1P	^3D ^1D	^3F ^1F	^3G ^1G	^3H ^1H	....
$2s^2\ 2p^3(^2P^\circ)nx''$		^3D ^1D	^3F ^1F	^3G ^1G		....
$2s\ 2p^4(^4P)nx'''$		$^5D^\circ$ $^3D^\circ$	$^5F^\circ$ $^3F^\circ$	$^5G^\circ$ $^3G^\circ$		....
$2s\ 2p^4(^2D)nx^{IV}$	$^3P^\circ$ $^1P^\circ$	$^3D^\circ$ $^1D^\circ$	$^3F^\circ$ $^1F^\circ$	$^3G^\circ$ $^1G^\circ$	$^3H^\circ$ $^1H^\circ$	....
$2s\ 2p^4(^2S)nx^{V}$			$^3F^\circ$ $^1F^\circ$			....
$2s2p^4(^2P)nx^{VI}$		$^3D^\circ$ $^1D^\circ$	$^3F^\circ$ $^1F^\circ$	$^3G^\circ$ $^1G^\circ$		....

TABLE 10. PREDICTED TERMS OF THE F I ISOELECTRONIC SEQUENCE

Config. $1s^2+$	Predicted Terms		
$2s^2\,2p^5$	$^2P^\circ$		
$2s\,2p^6$	^2S		
	ns $(n\geq 3)$	*np* $(n\geq 3)$	*nd* $(n\geq 3)$
$2s^2\,2p^4(^3P)nx$	^4P ^2P	$^4S^\circ$ $^4P^\circ$ $^4D^\circ$ $^2S^\circ$ $^2P^\circ$ $^2D^\circ$	^4P ^4D ^4F ^2P ^2D ^2F
$2s^2\,2p^4(^1D)nx'$	^2D	$^2P^\circ$ $^2D^\circ$ $^2F^\circ$	^2S ^2P ^2D ^2F ^2G
$2s^2\,2p^4(^1S)nx''$	^2S	$^2P^\circ$	^2D
$2s\,2p^5(^3P^\circ)nx'''$	$^4P^\circ$ $^2P^\circ$	^4S ^4P ^4D ^2S ^2P ^2D	$^4P^\circ$ $^4D^\circ$ $^4F^\circ$ $^2P^\circ$ $^2D^\circ$ $^2F^\circ$
	nf $(n\geq 4)$	....	
$2s^2\,2p^4(^3P)nx$	$^4D^\circ$ $^4F^\circ$ $^4G^\circ$ $^2D^\circ$ $^2F^\circ$ $^2G^\circ$	....	
$2s^2\,2p^4(^1D)nx'$	$^2P^\circ$ $^2D^\circ$ $^2F^\circ$ $^2G^\circ$ $^2H^\circ$	....	
$2s^2\,2p^4(^1S)nx''$	$^2F^\circ$	....	
$2s\,2p^5(^3P^\circ)nx'''$	^4D ^4F ^4G ^2D ^2F ^2G	....	

TABLE 11. PREDICTED LEVELS OF THE Ne I ISOELECTRONIC SEQUENCE

Config. $1s^2+$	Predicted Terms				
$2s^2\,2p^6$	^1S				
	ns $(n\geq 3)$	*np* $(n\geq 3)$	*nd* $(n\geq 3)$	*nf* $(n\geq 4)$	....
$2s^2\,2p^5(^2P^\circ)nx$	$^3P^\circ$ $^1P^\circ$	^3S ^3P ^3D ^1S ^1P ^1D	$^3P^\circ$ $^3D^\circ$ $^3F^\circ$ $^1P^\circ$ $^1D^\circ$ $^1F^\circ$	^3D ^3F ^3G ^1D ^1F ^1G	....
$2s\,2p^6(^2S)nx$	^3S ^1S	$^3P^\circ$ $^1P^\circ$	^3D ^1D	$^3F^\circ$ $^1F^\circ$	....

jl-Coupling Notation

Config. $1s^2\,2s^2+$	Predicted Pairs				
	ns $(n\geq 3)$	*np* $(n\geq 3)$	*nd* $(n\geq 3)$	*nf* $(n\geq 4)$	....
$2p^5(^2P^\circ_{1\frac{1}{2}})nx$	[1½]°	[½] [2½] [1½]	[½]° [3½]° [1½]° [2½]°	[1½] [4½] [2½] [3½]	....
$2p^5(^2P^\circ_{\frac{1}{2}})nx'$	[½]°	[1½] [½]	[2½]° [1½]°	[3½] [2½]	....

TABLE 12. PREDICTED TERMS OF THE Mg I ISOELECTRONIC SEQUENCE

Config. $1s^2\ 2s^2\ 2p^6+$	Predicted Terms			
$3s^2$	^1S			
$3s(^2S)3p$	$^3P^\circ$ $^1P^\circ$			
$3p^2$	^3P ^1S ^1D			
	ns $(n\geq4)$	np $(n\geq4)$	nd $(n\geq3)$	
$3s(^2S)nx$	^3S ^1S	$^3P^\circ$ $^1P^\circ$	^3D ^1D	
$3p(^2P^\circ)nx$	$^3P^\circ$ $^1P^\circ$	^3S ^3P ^3D ^1S ^1P ^1D	$^3P^\circ$ $^3D^\circ$ $^3F^\circ$ $^1P^\circ$ $^1D^\circ$ $^1F^\circ$	
	nf $(n\geq4)$	ng $(n\geq5)$	nh $(n\geq6)$	....
$3s(^2S)nx$	$^3F^\circ$ $^1F^\circ$	^3G ^1G	$^3H^\circ$ $^1H^\circ$	....
$3p(^2P^\circ)nx$	^3D ^3F ^3G ^1D ^1F ^1G	$^3F^\circ$ $^3G^\circ$ $^3H^\circ$ $^1F^\circ$ $^1G^\circ$ $^1H^\circ$	^3G ^3H ^3I ^1G ^1H ^1I	....

TABLE 13. PREDICTED TERMS OF THE Al I ISOELECTRONIC SEQUENCE

Config. $1s^2\ 2s^2\ 2p^6+$	Predicted Terms					
$3s^2(^1S)3p$	$^2P^\circ$					
$3s\ 3p^2$	^4P ^2S ^2P ^2D					
$3p^3$	$^4S^\circ$ $^2P^\circ$ $^2D^\circ$					
	ns $(n\geq4)$	np $(n\geq4)$	nd $(n\geq3)$	nf $(n\geq4)$	ng $(n\geq5)$	....
$3s^2(^1S)nx$	^2S	$^2P^\circ$	^2D	$^2F^\circ$	^2G	....
$3s\ 3p(^3P^\circ)nx$	$^4P^\circ$ $^2P^\circ$	^4S ^4P ^4D ^2S ^2P ^2D	$^4P^\circ$ $^4D^\circ$ $^4F^\circ$ $^2P^\circ$ $^2D^\circ$ $^2F^\circ$	^4D ^4F ^4G ^2D $^2F^\circ$ ^2G	$^4F^\circ$ $^4G^\circ$ $^4H^\circ$ $^2F^\circ$ $^2G^\circ$ $^2H^\circ$	....
$3s\ 3p(^1P^\circ)nx'$	$^2P^\circ$	^2S ^2P ^2D	$^2P^\circ$ $^2D^\circ$ $^2F^\circ$	^2D ^2F ^2G	$^2F^\circ$ $^2G^\circ$ $^2H^\circ$	....

Table 14. Predicted Terms of the Si I Isoelectronic Sequence

Config. $1s^2\,2s^2\,2p^6+$	Predicted Terms										
$3s^2\,3p^2$	^3P ^1S ^1D										
$3s\,3p^3$	$^5S^\circ$ $^3S^\circ$ $^3P^\circ$ $^3D^\circ$ $^1P^\circ$ $^1D^\circ$										
$3p^4$	^3P ^1S ^1D										
	ns $(n\geq 4)$	np $(n\geq 4)$			nd $(n\geq 3)$			nf $(n\geq 4)$			....
$3s^2\,3p(^2P^\circ)nx$	$^3P^\circ$	^3S	^3P	^3D	$^3P^\circ$	$^3D^\circ$	$^3F^\circ$	^3D	^3F	^3G	....
	$^1P^\circ$	^1S	^1P	^1D	$^1P^\circ$	$^1D^\circ$	$^1F^\circ$	^1D	^1F	^1G	....
$3s\,3p^2(^4P)nx$	^5P	$^5S^\circ$	$^5P^\circ$	$^5D^\circ$	^5P	^5D	^5F	$^5D^\circ$	$^5F^\circ$	$^5G^\circ$	....
	^3P	$^3S^\circ$	$^3P^\circ$	$^3D^\circ$	^3P	^3D	^3F	$^3D^\circ$	$^3F^\circ$	$^3G^\circ$	....

Table 15. Predicted Terms of the P I Isoelectronic Sequence

Config. $1s^2\,2s^2\,2p^6+$	Predicted Terms																	
$3s^2\,3p^3$	$^4S^\circ$ $^2P^\circ$ $^2D^\circ$																	
$3s\,3p^4$	^4P ^2S ^2P ^2D																	
$3p^5$	$^2P^\circ$																	
	ns $(n\geq 4)$			np $(n\geq 4)$				nd $(n\geq 3)$					nf $(n\geq 4)$					....
$3s^2\,3p^2(^3P)nx$		^4P		$^4S^\circ$	$^4P^\circ$	$^4D^\circ$			^4P	^4D	^4F			$^4D^\circ$	$^4F^\circ$	$^4G^\circ$		....
		^2P		$^2S^\circ$	$^2P^\circ$	$^2D^\circ$			^2P	^2D	^2F			$^2D^\circ$	$^2F^\circ$	$^2G^\circ$		....
$3s^2\,3p^2(^1D)nx'$			^2D		$^2P^\circ$	$^2D^\circ$	$^2F^\circ$	^2S	^2P	^2D	^2F	^2G	$^2P^\circ$	$^2D^\circ$	$^2F^\circ$	$^2G^\circ$	$^2H^\circ$	....
$3s^2\,3p^2(^1S)nx''$	^2S				$^2P^\circ$					^2D					$^2F^\circ$			....

TABLE 16. PREDICTED TERMS OF THE S I ISOELECTRONIC SEQUENCE

Config. $1s^2\,2s^2\,2p^6+$	Predicted Terms																	
$3s^2\,3p^4$	^1S	^3P	^1D															
$3s\,3p^5$		$^3P^\circ$ $^1P^\circ$																
	ns $(n\geq 4)$			*np* $(n\geq 4)$				*nd* $(n\geq 3)$					*nf* $(n\geq 4)$					....
$3s^2\,3p^3(^4S^\circ)nx$	$^5S^\circ$ $^3S^\circ$				^5P ^3P					$^5D^\circ$ $^3D^\circ$					^5F ^3F			....
$3s^2\,3p^3(^2D^\circ)nx'$			$^3D^\circ$ $^1D^\circ$		^3P ^1P	^3D ^1D	^3F ^1F	$^3S^\circ$ $^1S^\circ$	$^3P^\circ$ $^1P^\circ$	$^3D^\circ$ $^1D^\circ$	$^3F^\circ$ $^1F^\circ$	$^3G^\circ$ $^1G^\circ$	^3P ^1P	^3D ^1D	^3F ^1F	^3G ^1G	^3H ^1H	....
$3s^2\,3p^3(^2P^\circ)nx''$		$^3P^\circ$ $^1P^\circ$		^3S ^1S	^3P ^1P	^3D ^1D			$^3P^\circ$ $^1P^\circ$	$^3D^\circ$ $^1D^\circ$	$^3F^\circ$ $^1F^\circ$			^3D ^1D	^3F ^1F	^3G ^1G		....
$3s\,3p^4(^4P)nx'''$		^5P ^3P		$^5S^\circ$ $^3S^\circ$	$^5P^\circ$ $^3P^\circ$	$^5D^\circ$ $^3D^\circ$			^5P ^3P	^5D ^3D	^5F ^3F			$^5D^\circ$ $^3D^\circ$	$^5F^\circ$ $^3F^\circ$	$^5G^\circ$ $^3G^\circ$		....
$3s\,3p^4(^2D)nx^{IV}$			^3D ^1D		$^3P^\circ$ $^1P^\circ$	$^3D^\circ$ $^1D^\circ$	$^3F^\circ$ $^1F^\circ$	^3S ^1S	^3P ^1P	^3D ^1D	^3F ^1F	^3G ^1G	$^3P^\circ$ $^1P^\circ$	$^3D^\circ$ $^1D^\circ$	$^3F^\circ$ $^1F^\circ$	$^3G^\circ$ $^1G^\circ$	$^3H^\circ$ $^1H^\circ$	....
$3s\,3p^4(^2S)nx^{V}$	^3S ^1S				$^3P^\circ$ $^1P^\circ$					^3D ^1D					$^3F^\circ$ $^1F^\circ$			....
$3s\,3p^4(^2P)nx^{VI}$		^3P ^1P		$^3S^\circ$ $^1S^\circ$	$^3P^\circ$ $^1P^\circ$	$^3D^\circ$ $^1D^\circ$			^3P ^1P	^3D ^1D	^3F ^1F			$^3D^\circ$ $^1D^\circ$	$^3F^\circ$ $^1F^\circ$	$^3G^\circ$ $^1G^\circ$		....
$3p^5(^2P^\circ)nx^{VII}$		$^3P^\circ$ $^1P^\circ$		^3S ^1S	^3P ^1P	^3D ^1D			$^3P^\circ$ $^1P^\circ$	$^3D^\circ$ $^1D^\circ$	$^3F^\circ$ $^1F^\circ$			^3D ^1D	^3F ^1F	^3G ^1G		....

TABLE 17. PREDICTED TERMS OF THE Cl I ISOELECTRONIC SEQUENCE

Config. $1s^2\,2s^2\,2p^6+$	Predicted Terms																	
$3s^2\,3p^5$		$^2P^\circ$																
$3s\,3p^6$	^2S																	
	ns $(n\geq 4)$			*np* $(n\geq 4)$				*nd* $(n\geq 3)$					*nf* $(n\geq 4)$					....
$3s^2\,3p^4(^3P)nx$		^4P ^2P		$^4S^\circ$ $^2S^\circ$	$^4P^\circ$ $^2P^\circ$	$^4D^\circ$ $^2D^\circ$			^4P ^2P	^4D ^2D	^4F ^2F			$^4D^\circ$ $^2D^\circ$	$^4F^\circ$ $^2F^\circ$	$^4G^\circ$ $^2G^\circ$		....
$3s^2\,3p^4(^1D)nx'$			^2D		$^2P^\circ$	$^2D^\circ$	$^2F^\circ$	^2S	^2P	^2D	^2F	^2G	$^2P^\circ$	$^2D^\circ$	$^2F^\circ$	$^2G^\circ$	$^2H^\circ$	....
$3s^2\,3p^4(^1S)nx''$	^2S				$^2P^\circ$					^2D					$^2F^\circ$			....
$3s\,3p^5(^3P^\circ)nx'''$		$^4P^\circ$ $^2P^\circ$		^4S ^2S	^4P ^2P	^4D ^2D			$^4P^\circ$ $^2P^\circ$	$^4D^\circ$ $^2D^\circ$	$^4F^\circ$ $^2F^\circ$			^4D ^2D	^4F ^2F	^4G ^2G		....

Table 18. Predicted Levels of the A I Isoelectronic Sequence

Config. $1s^2\,2s^2\,2p^6+$	Predicted Terms				
$3s^2\,3p^6$	^{1}S				
	$ns\ (n\geq 4)$	$np\ (n\geq 4)$	$nd\ (n\geq 3)$	$nf\ (n\geq 4)$	....
$3s^2\,3p^5(^2P^\circ)nx$	^{3}P° ^{1}P°	^{3}S ^{3}P ^{3}D ^{1}S ^{1}P ^{1}D	^{3}P° ^{3}D° ^{3}F° ^{1}P° ^{1}D° ^{1}F°	^{3}D ^{3}F ^{3}G ^{1}D ^{1}F ^{1}G	....
$3s\,3p^6(^2S)nx$	^{3}S ^{1}S	^{3}P° ^{1}P°	^{3}D ^{1}D	^{3}F° ^{1}F°	....

jl-Coupling Notation

Config. $1s^2\,2s^2\,2p^6\,3s^2+$	Predicted Pairs				
	$ns\ (n\geq 4)$	$np\ (n\geq 4)$	$nd\ (n\geq 3)$	$nf\ (n\geq 4)$	....
$3p^5(^2P^\circ_{1\frac{1}{2}})nx$	[1½]°	[½] [2½] [1½]	[½]° [3½]° [1½]° [2½]°	[1½] [4½] [2½] [3½]	....
$3p^5(^2P^\circ_{\frac{1}{2}})nx'$	[½]°	[1½] [½]	[2½]° [1½]°	[3½] [2½]	....

Table 19. Predicted Terms of the Ca I Isoelectronic Sequence

Config. $1s^2\,2s^2\,2p^6\,3s^2\,3p^6+$	Predicted Terms		
$4s^2$	^{1}S		
$3d^2$	^{1}S ^{3}P ^{1}D ^{3}F ^{1}G		
$4p^2$	^{1}S ^{3}P ^{1}D		
	$ns\ (n\geq 4)$	$np\ (n\geq 4)$	$nd\ (n\geq 3)$
$4s(^2S)nx$	^{3}S ^{1}S	^{3}P° ^{1}P°	^{3}D ^{1}D
$3d(^2D)nx'$	^{3}D ^{1}D	^{3}P° ^{3}D° ^{3}F° ^{1}P° ^{1}D° ^{1}F°	^{3}S ^{3}P ^{3}D ^{3}F ^{3}G ^{1}S ^{1}P ^{1}D ^{1}F ^{1}G
$4p(^2P^\circ)nx''$	^{3}P° ^{1}P°	^{3}S ^{3}P ^{3}D ^{1}S ^{1}P ^{1}D	^{3}P° ^{3}D° ^{3}F° ^{1}P° ^{1}D° ^{1}F°
	$nf\ (n\geq 4)$	$ng\ (n\geq 5)$	....
$4s(^2S)nx$	^{3}F° ^{1}F°	^{3}G ^{1}G	....
$3d(^2D)nx'$	^{3}P° ^{3}D° ^{3}F° ^{3}G° ^{3}H° ^{1}P° ^{1}D° ^{1}F° ^{1}G° ^{1}H°	^{3}D ^{3}F ^{3}G ^{3}H ^{3}I ^{1}D ^{1}F ^{1}G ^{1}H ^{1}I	....
$4p(^2P^\circ)nx''$	^{3}D ^{3}F ^{3}G ^{1}D ^{1}F ^{1}G	^{3}F° ^{3}G° ^{3}H° ^{1}F° ^{1}G° ^{1}H°	....

TABLE 20. PREDICTED TERMS OF THE Sc I ISOELECTRONIC SEQUENCE

Config. $1s^2\,2s^2\,2p^6\,3s^2\,3p^6+$	Predicted Terms
$3d\,4s^2$	^{2}D
$3d^3$	^{4}P ^{4}F ^{2}P ^{2}D ^{2}F ^{2}G ^{2}H ^{2}D

Config.	$ns\ (n\geq 4)$	$np\ (n\geq 4)$	
$3d\,4s(^3D)nx$	^{4}D ^{2}D	^{4}P° ^{4}D° ^{4}F° ^{2}P° ^{2}D° ^{2}F°	
$3d\,4s(^1D)nx$	^{2}D	^{2}P° ^{2}D° ^{2}F°	
$3d^2(^3F)nx$	^{4}F ^{2}F	^{4}D° ^{4}F° ^{4}G° ^{2}D° ^{2}F° ^{2}G°	
$3d^2(^1D)nx$	^{2}D	^{2}P° ^{2}D° ^{2}F°	
$3d^2(^1S)nx$	^{2}S	^{2}P°	
$3d^2(^3P)nx$	^{4}P ^{2}P	^{4}S° ^{4}P° ^{4}D° ^{2}S° ^{2}P° ^{2}D°	
$3d^2(^1G)nx$	^{2}G	^{2}F° ^{2}G° ^{2}H°	
$4p^2(^3P)nx$	^{4}P ^{2}P	^{4}S° ^{4}P° ^{4}D° ^{2}S° ^{2}P° ^{2}D°	

Config.	$nd\ (n\geq 3)$	$nf\ (n\geq 4)$	....
$3d\,4s(^3D)nx$	^{4}S ^{4}P ^{4}D ^{4}F ^{4}G ^{2}S ^{2}P ^{2}D ^{2}F ^{2}G	^{4}P° ^{4}D° ^{4}F° ^{4}G° ^{4}H° ^{2}P° ^{2}D° ^{2}F° ^{2}G° ^{2}H°	....
$3d\,4s(^1D)nx$	^{2}S ^{2}P ^{2}D ^{2}F ^{2}G	^{2}P° ^{2}D° ^{2}F° ^{2}G° ^{2}H°	....
$3d^2(^3F)nx$	^{4}P ^{4}D ^{4}F ^{4}G ^{4}H ^{2}P ^{2}D ^{2}F ^{2}G ^{2}H	^{4}D° ^{4}F° ^{4}G° ^{4}H° ^{4}I° ^{2}D° ^{2}F° ^{2}G° ^{2}H° ^{2}I°	....
$3d^2(^1D)nx$	^{2}S ^{2}P ^{2}D ^{2}F ^{2}G	^{2}P° ^{2}D° ^{2}F° ^{2}G° ^{2}H°	....
$3d^2(^1S)nx$	^{2}D	^{2}F°	....
$3d^2(^3P)nx$	^{4}P ^{4}D ^{4}F ^{2}P ^{2}D ^{2}F	^{4}D° ^{4}F° ^{4}G° ^{2}D° ^{2}F° ^{2}G°	....
$3d^2(^1G)nx$	^{2}D ^{2}F ^{2}G ^{2}H ^{2}I	^{2}F° ^{2}G° ^{2}H° ^{2}I° ^{2}K°	....
$4p^2(^3P)nx$	^{4}P ^{4}D ^{4}F ^{2}P ^{2}D ^{2}F	^{4}D° ^{4}F° ^{4}G° ^{2}D° ^{2}F° ^{2}G°	....

TABLE 21. PREDICTED TERMS OF THE Ti I ISOELECTRONIC SEQUENCE

Config. $1s^2\,2s^2\,2p^6\,3s^2\,3p^6+$	Predicted Terms																						
$3d^2\,4s^2$		^{3}P		^{3}F																			
	^{1}S		^{1}D		^{1}G																		
$3d^4$			^{5}D																				
		^{3}P	^{3}D	^{3}F	^{3}G	^{3}H																	
		^{3}P		^{3}F																			
	^{1}S		^{1}D	^{1}F	^{1}G		^{1}I																
	^{1}S		^{1}D		^{1}G																		
	$ns\ (n\geq 4)$							$np\ (n\geq 4)$							$nd\ (n\geq 4)$								....
$3d^2\,4s(^4F)nx$				^{5}F						^{5}D°	^{5}F°	^{5}G°				^{5}P	^{5}D	^{5}F	^{5}G	^{5}H			....
				^{3}F						^{3}D°	^{3}F°	^{3}G°				^{3}P	^{3}D	^{3}F	^{3}G	^{3}H			....
$3d^3(^4F)nx$				^{5}F						^{5}D°	^{5}F°	^{5}G°				^{5}P	^{5}D	^{5}F	^{5}G	^{5}H			....
				^{3}F						^{3}D°	^{3}F°	^{3}G°				^{3}P	^{3}D	^{3}F	^{3}G	^{3}H			....
$3d^2\,4s(^2F)nx$				^{3}F						^{3}D°	^{3}F°	^{3}G°				^{3}P	^{3}D	^{3}F	^{3}G	^{3}H			....
				^{1}F						^{1}D°	^{1}F°	^{1}G°				^{1}P	^{1}D	^{1}F	^{1}G	^{1}H			....
$3d^2\,4s(^2D)nx$			^{3}D						^{3}P°	^{3}D°	^{3}F°				^{3}S	^{3}P	^{3}D	^{3}F	^{3}G				....
			^{1}D						^{1}P°	^{1}D°	^{1}F°				^{1}S	^{1}P	^{1}D	^{1}F	^{1}G				....
$3d^3(^2G)nx$					^{3}G						^{3}F°	^{3}G°	^{3}H°				^{3}D	^{3}F	^{3}G	^{3}H	^{3}I		....
					^{1}G						^{1}F°	^{1}G°	^{1}H°				^{1}D	^{1}F	^{1}G	^{1}H	^{1}I		....
$3d^3(^4P)nx$		^{5}P						^{5}S°	^{5}P°	^{5}D°						^{5}P	^{5}D	^{5}F					....
		^{3}P						^{3}S°	^{3}P°	^{3}D°						^{3}P	^{3}D	^{3}F					....
$3d^3(^2P)nx$		^{3}P						^{3}S°	^{3}P°	^{3}D°						^{3}P	^{3}D	^{3}F					....
		^{1}P						^{1}S°	^{1}P°	^{1}D°						^{1}P	^{1}D	^{1}F					....
$3d^2\,4s(^4P)nx$		^{5}P						^{5}S°	^{5}P°	^{5}D°						^{5}P	^{5}D	^{5}F					....
		^{3}P						^{3}S°	^{3}P°	^{3}D°						^{3}P	^{3}D	^{3}F					....
$3d^3(^2D)nx$			^{3}D						^{3}P°	^{3}D°	^{3}F°				^{3}S	^{3}P	^{3}D	^{3}F	^{3}G				....
			^{1}D						^{1}P°	^{1}D°	^{1}F°				^{1}S	^{1}P	^{1}D	^{1}F	^{1}G				....
$3d^3(^2H)nx$						^{3}H						^{3}G°	^{3}H°	^{3}I°				^{3}F	^{3}G	^{3}H	^{3}I	^{3}K	....
						^{1}H						^{1}G°	^{1}H°	^{1}I°				^{1}F	^{1}G	^{1}H	^{1}I	^{1}K	....
$3d^2\,4s(^2G)nx$					^{3}G						^{3}F°	^{3}G°	^{3}H°				^{3}D	^{3}F	^{3}G	^{3}H	^{3}I		....
					^{1}G						^{1}F°	^{1}G°	^{1}H°				^{1}D	^{1}F	^{1}G	^{1}H	^{1}I		....
$3d^2\,4s(^2P)nx$		^{3}P						^{3}S°	^{3}P°	^{3}D°						^{3}P	^{3}D	^{3}F					....
		^{1}P						^{1}S°	^{1}P°	^{1}D°						^{1}P	^{1}D	^{1}F					....
$3d^3(^2F)nx$				^{3}F						^{3}D°	^{3}F°	^{3}G°				^{3}P	^{3}D	^{3}F	^{3}G	^{3}H			....
				^{1}F						^{1}D°	^{1}F°	^{1}G°				^{1}P	^{1}D	^{1}F	^{1}G	^{1}H			....
$3d^2\,4s(^2S)nx$	^{3}S								^{3}P°								^{3}D						....
	^{1}S								^{1}P°								^{1}D						....
$3d\,4s^2(^2D)nx$			^{3}D						^{3}P°	^{3}D°	^{3}F°				^{3}S	^{3}P	^{3}D	^{3}F	^{3}G				....
			^{1}D						^{1}P°	^{1}D°	^{1}F°				^{1}S	^{1}P	^{1}D	^{1}F	^{1}G				....

Table 22. Predicted Terms of the V I Isoelectronic Sequence

Config. $1s^2\,2s^2\,2p^6\,3s^2\,3p^6+$	Predicted Terms						
$3d^3\,4s^2$		^{4}P ^{2}P	^{2}D ^{2}D	^{4}F ^{2}F	^{2}G	^{2}H	
$3d^5$	^{6}S ^{2}S	^{4}P ^{2}P	^{4}D ^{2}D ^{2}D ^{2}D	^{4}F ^{2}F ^{2}F	^{4}G ^{2}G ^{2}G	^{2}H	^{2}I
$3d^3\,4p^2$†	^{6}S ^{4}S ^{2}S	^{6}P ^{4}P ^{2}P	^{6}D* ^{4}D* ^{2}D*	^{6}F ^{4}F ^{2}F	^{6}G ^{4}G ^{2}G		

Config. $1s^2\,2s^2\,2p^6\,3s^2\,3p^6+$	ns ($n\geq 4$)	np ($n\geq 4$)	nd ($n\geq 4$)	....
$3d^4(^5D)nx$	^{6}D ^{4}D	^{6}P° ^{6}D° ^{6}F° ^{4}P° ^{4}D° ^{4}F°	^{6}S ^{6}P ^{6}D ^{6}F ^{6}G ^{4}S ^{4}P ^{4}D ^{4}F ^{4}G	....
$3d^3\,4s(^5F)nx$	^{6}F ^{4}F	^{6}D° ^{6}F° ^{6}G° ^{4}D° ^{4}F° ^{4}G°	^{6}P ^{6}D ^{6}F ^{6}G ^{6}H ^{4}P ^{4}D ^{4}F ^{4}G ^{4}H	....
$3d^3\,4s(^3F)nx$	^{4}F ^{2}F	^{4}D° ^{4}F° ^{4}G° ^{2}D° ^{2}F° ^{2}G°	^{4}P ^{4}D ^{4}F ^{4}G ^{4}H ^{2}P ^{2}D ^{2}F ^{2}G ^{2}H	....
$3d^4(^3P)nx$	^{4}P ^{2}P	^{4}S° ^{4}P° ^{4}D° ^{2}S° ^{2}P° ^{2}D°	^{4}P ^{4}D ^{4}F ^{2}P ^{2}D ^{2}F	....
$3d^4(^3H)nx$	^{4}H ^{2}H	^{4}G° ^{4}H° ^{4}I° ^{2}G° ^{2}H° ^{2}I°	^{4}F ^{4}G ^{4}H ^{4}I ^{4}K ^{2}F ^{2}G ^{2}H ^{2}I ^{2}K	....
$3d^4(^3F)nx$	^{4}F ^{2}F	^{4}D° ^{4}F° ^{4}G° ^{2}D° ^{2}F° ^{2}G°	^{4}P ^{4}D ^{4}F ^{4}G ^{4}H ^{2}P ^{2}D ^{2}F ^{2}G ^{2}H	....

$3d^3\,4s(^5P)nx$		^{6}P ^{4}P						^{6}S° ^{4}S°	^{6}P° ^{4}P°	^{6}D° ^{4}D°							^{6}P ^{4}P	^{6}D ^{4}D	^{6}F ^{4}F						....
$3d^4(^3G)nx$					^{4}G ^{2}G						^{4}F° ^{2}F°	^{4}G° ^{2}G°	^{4}H° ^{2}H°					^{4}D ^{2}D	^{4}F ^{2}F	^{4}G ^{2}G	^{4}H ^{2}H	^{4}I ^{2}I			....
$3d^3\,4s(^3G)nx$					^{4}G ^{2}G						^{4}F° ^{2}F°	^{4}G° ^{2}G°	^{4}H° ^{2}H°					^{4}D ^{2}D	^{4}F ^{2}F	^{4}G ^{2}G	^{4}H ^{2}H	^{4}I ^{2}I			....
$3d^4(^1G)nx$					^{2}G						^{2}F°	^{2}G°	^{2}H°					^{2}D	^{2}F	^{2}G	^{2}H	^{2}I			....
$3d^4(^3D)nx$			^{4}D ^{2}D						^{4}P° ^{2}P°	^{4}D° ^{2}D°	^{4}F° ^{2}F°					^{4}S ^{2}S	^{4}P ^{2}P	^{4}D ^{2}D	^{4}F ^{2}F	^{4}G ^{2}G					....
$3d^3\,4s(^1G)nx$					^{2}G						^{2}F°	^{2}G°	^{2}H°					^{2}D	^{2}F	^{2}G	^{2}H	^{2}I			....
$3d^3\,4s(^3P)nx$		^{4}P ^{2}P						^{4}S° ^{2}S°	^{4}P° ^{2}P°	^{4}D° ^{2}D°							^{4}P ^{2}P	^{4}D ^{2}D	^{4}F ^{2}F						....
$3d^4(^1I)nx$							^{2}I						^{2}H°	^{2}I°	^{2}K°					^{2}G	^{2}H	^{2}I	^{2}K	^{2}L	....
$3d^4(^1S)nx$	^{2}S								^{2}P°									^{2}D							....
$3d^3\,4s(^3H)nx$						^{4}H ^{2}H						^{4}G° ^{2}G°	^{4}H° ^{2}H°	^{4}I° ^{2}I°					^{4}F ^{2}F	^{4}G ^{2}G	^{4}H ^{2}H	^{4}I ^{2}I	^{4}K ^{2}K		....
$3d^3\,4s(^3D)nx$			^{4}D ^{2}D						^{4}P° ^{2}P°	^{4}D° ^{2}D°	^{4}F° ^{2}F°					^{4}S ^{2}S	^{4}P ^{2}P	^{4}D ^{2}D	^{4}F ^{2}F	^{4}G ^{2}G					....
$3d^4(^1D)nx$			^{2}D						^{2}P°	^{2}D°	^{2}F°					^{2}S	^{2}P	^{2}D	^{2}F	^{2}G					....
$3d^3\,4s(^1P)nx$		^{2}P						^{2}S°	^{2}P°	^{2}D°							^{2}P	^{2}D	^{2}F						....
$3d^3\,4s(^1H)nx$						^{2}H						^{2}G°	^{2}H°	^{2}I°					^{2}F	^{2}G	^{2}H	^{2}I	^{2}K		....
$3d^3\,4s(^1D)nx$			^{2}D						^{2}P°	^{2}D°	^{2}F°					^{2}S	^{2}P	^{2}D	^{2}F	^{2}G					....
$3d^4(^1F)nx$				^{2}F						^{2}D°	^{2}F°	^{2}G°					^{2}P	^{2}D	^{2}F	^{2}G	^{2}H				....

†Incomplete—only limits of higher multiplicity considered.
*Two terms of this type predicted.

TABLE 23. THE CHEMICAL ELEMENTS—IONIZATION POTENTIALS*

Z	Element	Symbol	I. P.	Ground State	Z	Element	Symbol	I. P.	Ground State
1	Hydrogen	H	13. 595	$1s\ ^2S_{1/2}$	36	Krypton	Kr	13. 996	$(4s^2\ 4p^6)\ ^1S_0$
2	Helium	He	24. 580	$(1s^2)\ ^1S_0$	37	Rubidium	Rb	4. 176	$5s\ ^2S_{1/2}$
3	Lithium	Li	5. 390	$2s\ ^2S_{1/2}$	38	Strontium	Sr	5. 692	$5s^2\ ^1S_0$
4	Beryllium	Be	9. 320	$2s^2\ ^1S_0$	39	Yttrium	Y	6. 6	$4d\ 5s^2\ ^2D_{1\frac{1}{2}}$
5	Boron	B	8. 296	$2s^2\ 2p\ ^2P^{\circ}_{1/2}$	40	Zirconium	Zr	6. 95	$4d^2\ 5s^2\ ^3F_2$
6	Carbon	C	11. 264	$2s^2\ 2p^2\ ^3P_0$	41	Columbium	Cb	6. 77	$4d^4\ 5s\ ^6D_{1/2}$
7	Nitrogen	N	14. 54	$2s^2\ 2p^3\ ^4S^{\circ}_{1\frac{1}{2}}$	42	Molybdenum	Mo	7. 18	$4d^5\ 5s\ ^7S_3$
8	Oxygen	O	13. 614	$2s^2\ 2p^4\ ^3P_2$	43	Technetium	Tc		$4d^5\ 5s^2\ ^6S_{2\frac{1}{2}}$
9	Fluorine	F	17. 42	$2s^2\ 2p^5\ ^2P^{\circ}_{1\frac{1}{2}}$	44	Ruthenium	Ru	7. 5	$4d^7\ 5s\ ^5F_5$
10	Neon	Ne	21. 559	$(2s^2\ 2p^6)\ ^1S_0$	45	Rhodium	Rh	7. 7	$4d^8\ 5s\ ^4F_{4\frac{1}{2}}$
11	Sodium	Na	5. 138	$3s\ ^2S_{1/2}$	46	Palladium	Pd	8. 33	$4d^{10}\ ^1S_0$
12	Magnesium	Mg	7. 644	$3s^2\ ^1S_0$	47	Silver	Ag	7. 574	$5s\ ^2S_{1/2}$
13	Aluminum	Al	5. 984	$3s^2\ 3p\ ^2P^{\circ}_{1/2}$	48	Cadmium	Cd	8. 991	$5s^2\ ^1S_0$
14	Silicon	Si	8. 149	$3s^2\ 3p^2\ ^3P_0$	49	Indium	In	5. 785	$5s^2\ 5p\ ^2P^{\circ}_{1/2}$
15	Phosphorus	P	11. 0	$3s^2\ 3p^3\ ^4S^{\circ}_{1\frac{1}{2}}$	50	Tin	Sn	7. 332	$5s^2\ 5p^2\ ^3P_0$
16	Sulfur	S	10. 357	$3s^2\ 3p^4\ ^3P_2$	51	Antimony	Sb	8. 64	$5s^2\ 5p^3\ ^4S^{\circ}_{1\frac{1}{2}}$
17	Chlorine	Cl	13. 01	$3s^2\ 3p^5\ ^2P^{\circ}_{1\frac{1}{2}}$	52	Tellurium	Te	9. 01	$5s^2\ 5p^4\ ^3P_2$
18	Argon	A	15. 755	$(3s^2\ 3p^6)\ ^1S_0$	53	Iodine	I	10. 44	$5s^2\ 5p^5\ ^2P^{\circ}_{1\frac{1}{2}}$
19	Potassium	K	4. 339	$4s\ ^2S_{1/2}$	54	Xenon	Xe	12. 127	$(5s^2\ 5p^6)\ ^1S_0$
20	Calcium	Ca	6. 111	$4s^2\ ^1S_0$	55	Cesium	Cs	3. 893	$6s\ ^2S_{1/2}$
21	Scandium	Sc	6. 56	$3d\ 4s^2\ ^2D_{1\frac{1}{2}}$	56	Barium	Ba	5. 210	$6s^2\ ^1S_0$
22	Titanium	Ti	6. 83	$3d^2\ 4s^2\ ^3F_2$	57	Lanthanum	La	5. 61	$5d\ 6s^2\ ^2D_{1\frac{1}{2}}$
23	Vanadium	V	6. 74	$3d^3\ 4s^2\ ^4F_{1\frac{1}{2}}$	58	Cerium	Ce	(6. 91)	
24	Chromium	Cr	6. 76	$3d^5\ 4s\ ^7S_3$	59	Praseodymium	Pr	(5. 76)	
25	Manganese	Mn	7. 432	$3d^5\ 4s^2\ ^6S_{2\frac{1}{2}}$	60	Neodymium	Nd	(6. 31)	$4f^4\ 6s^2\ ^5I_4$
26	Iron	Fe	7. 896	$3d^6\ 4s^2\ ^5D_4$	61	Prometheum	Pm		
27	Cobalt	Co	7. 86	$3d^7\ 4s^2\ ^4F_{4\frac{1}{2}}$	62	Samarium	Sm	5. 6	$4f^6\ 6s^2\ ^7F_0$
28	Nickel	Ni	7. 633	$3d^8\ 4s^2\ ^3F_4$	63	Europium	Eu	5. 67	$4f^7\ 6s^2\ ^8S^{\circ}_{3\frac{1}{2}}$
29	Copper	Cu	7. 723	$(3d^{10})\ 4s\ ^2S_{1/2}$	64	Gadolinium	Gd	6. 16	$4f^7\ 5d\ 6s^2\ ^9D^{\circ}_2$
30	Zinc	Zn	9. 391	$4s^2\ ^1S_0$	65	Terbium	Tb	(6. 74)	
31	Gallium	Ga	6. 00	$4s^2\ 4p\ ^2P^{\circ}_{1/2}$	66	Dysprosium	Dy	(6. 82)	
32	Germanium	Ge	8. 13	$4s^2\ 4p^2\ ^3P_0$	67	Holmium	Ho		
33	Arsenic	As	10 ±	$4s^2\ 4p^3\ ^4S^{\circ}_{1\frac{1}{2}}$	68	Erbium	Er		
34	Selenium	Se	9. 750	$4s^2\ 4p^4\ ^3P_2$	69	Thulium	Tm		$4f^{13}\ 6s^2\ ^2F^{\circ}_{3\frac{1}{2}}$
35	Bromine	Br	11. 84	$4s^2\ 4p^5\ ^2P^{\circ}_{1\frac{1}{2}}$	70	Ytterbium	Yb	6. 2	$(4f^{14})\ 6s^2\ ^1S_0$

Table 23. The Chemical Elements—Ionization Potentials—Continued

Z	Element	Symbol	I. P.	Ground State	Z	Element	Symbol	I. P.	Ground State
71	Lutecium	Lu	5. 0	$5d$ $6s^2$ $^2D_{2\frac{1}{2}}$	88	Radium	Ra	5. 277	$7s^2$ $^1S_0$
72	Hafnium	Hf	5. 5 ±	$5d^2$ $6s^2$ $^3F_2$	89	Actinium	Ac		
73	Tantalum	Ta	6 ±	$5d^3$ $6s^2$ $^4F_{1\frac{1}{2}}$	90	Thorium	Th		$6d^2$ $7s^2$ $^3F_2$
74	Tungsten	W	7. 98	$5d^4$ $6s^2$ $^5D_0$	91	Protactinium	Pa		
75	Rhenium	Re	7. 87	$5d^5$ $6s^2$ $^6S_{2\frac{1}{2}}$	92	Uranium	U	4 ±	$5f^3$ $6d$ $7s^2$ $^5L^{\circ}_6$
76	Osmium	Os	8. 7	$5d^6$ $6s^2$ $^5D_4$	93	Neptunium	Np		
77	Iridium	Ir	9. 2	$5d^7$ $6s^2$ $^4F_{1\frac{1}{2}}$	94	Plutonium	Pu		
78	Platinum	Pt	8. 96	$5d^9$ $6s$ $^3D_3$	95	Americium	Am		
79	Gold	Au	9. 223	$(5d^{10})$ $6s$ $^2S_{\frac{1}{2}}$	96	Curium	Cm		
80	Mercury	Hg	10. 434	$6s^2$ $^1S_0$	97				
81	Thallium	Tl	6. 106	$6s^2$ $6p$ $^2P^{\circ}_{\frac{1}{2}}$	98				
82	Lead	Pb	7. 415	$6s^2$ $6p^2$ $^3P_0$	99				
83	Bismuth	Bi	8 ±	$6s^2$ $6p^3$ $^4S^{\circ}_{1\frac{1}{2}}$	100				
84	Polonium	Po			101				
85	Astatine	At			102				
86	Radon	Rn	10. 745	$(6s^2$ $6p^6)$ $^1S_0$	103				
87	Francium	Fa							

*Parentheses denote values that have been determined experimentally, but not yet confirmed by series.

Table 24. Chemical Symbols

Symbol	Element	Z	Symbol	Element	Z	Symbol	Element	Z	Symbol	Element	Z
A	Argon	18	Dy	Dysprosium	66	Mn	Manganese	25	S	Sulfur	16
Ac	Actinium	89	Er	Erbium	68	Mo	Molybdenum	42	Sb	Antimony	51
Ag	Silver	47	Eu	Europium	63	N	Nitrogen	7	Sc	Scandium	21
Al	Aluminum	13	F	Fluorine	9	Na	Sodium	11	Se	Selenium	34
Am	Americium	95	Fa	Francium	87	Nd	Neodymium	60	Si	Silicon	14
As	Arsenic	33	Fe	Iron	26	Ne	Neon	10	Sm	Samarium	62
At	Astatine	85	Ga	Gallium	31	Ni	Nickel	28	Sn	Tin	50
Au	Gold	79	Gd	Gadolinium	64	Np	Neptunium	93	Sr	Strontium	38
B	Boron	5	Ge	Germanium	32	O	Oxygen	8	Ta	Tantalum	73
Ba	Barium	56	H	Hydrogen	1	Os	Osmium	76	Tb	Terbium	65
Be	Beryllium	4	(D	Deuterium)		P	Phosphorus	15	Tc	Technetium	43
Bi	Bismuth	83	(T	Tritium)		Pa	Protactinium	91	Te	Tellurium	52
Br	Bromine	35	He	Helium	2	Pb	Lead	82	Th	Thorium	90
C	Carbon	6	Hf	Hafnium	72	Pd	Palladium	46	Ti	Titanium	22
Ca	Calcium	20	Hg	Mercury	80	Pm	Prometheum	61	Tl	Thallium	81
Cb	Columbium	41	Ho	Holmium	67	Po	Polonium	84	Tm	Thulium	69
Cd	Cadmium	48	I	Iodine	53	Pr	Praseodymium	59	U	Uranium	92
Ce	Cerium	58	In	Indium	49	Pt	Platinum	78	V	Vanadium	23
Cl	Chlorine	17	Ir	Iridium	77	Pu	Plutonium	94	W	Tungsten	74
Cm	Curium	96	K	Potassium	19	Ra	Radium	88	Xe	Xenon	54
Co	Cobalt	27	Kr	Krypton	36	Rb	Rubidium	37	Y	Yttrium	39
Cr	Chromium	24	La	Lanthanum	57	Re	Rhenium	75	Yb	Ytterbium	70
Cs	Cesium	55	Li	Lithium	3	Rh	Rhodium	45	Zn	Zinc	30
Cu	Copper	29	Lu	Lutecium	71	Rn	Radon	86	Zr	Zirconium	40
			Mg	Magnesium	12	Ru	Ruthenium	44			

TABLE 25. THE PERIODIC SYSTEM*

1	1s	H 1	**He** 2																														
2	2s	Li 3	Be 4																														
	2p			B 5	C 6	N 7	O 8	F 9	Ne 10																								
3	3s	Na 11	Mg 12																														
	3p			Al 13	Si 14	P 15	S 16	Cl 17	**A** 18																								
4	4s	K 19	Ca 20																														
	3d									Sc 21	Ti 22	V 23	Cr 24	Mn 25	Fe 26	Co 27	Ni 28	Cu 29	Zn 30														
	4p			Ga 31	Ge 32	As 33	Se 34	Br 35	**Kr** 36																								
5	5s	Rb 37	Sr 38																														
	4d									Y 39	Zr 40	Cb 41	Mo 42	Tc 43	Ru 44	Rh 45	Pd 46	Ag 47	Cd 48														
	5p			In 49	Sn 50	Sb 51	Te 52	I 53	**Xe** 54																								
6	6s	Cs 55	Ba 56																														
	4f																			La 57	Ce 58	Pr 59	Nd 60	Pm 61	Sm 62	Eu 63	Gd 64	Tb 65	Dy 66	Ho 67	Er 68	Tm 69	Yb 70
	5d									Lu 71	Hf 72	Ta 73	W 74	Re 75	Os 76	Ir 77	Pt 78	Au 79	Hg 80														
	6p			Tl 81	Pb 82	Bi 83	Po 84	At 85	**Rn** 86																								
7	7s	Fr 87	Ra 88																														
	5f																			Ac 89	Th 90	Pa 91	U 92	Np 93	Pu 94	Am 95	Cm 96	97	98	99	100	101	102
	6d									103	--	--	--	--	--	--	--	--	--														

*This arrangement is by Catalán. The electrons indicated in column two that are connected by braces have approximately the same binding energy. Consequently, for some elements one type of electron is preferred over another in the normal configuration, as for example, Cr, Cb, Pd, La, Ac, Th.

Table 26. Index—Isoelectronic Sequences

[The tabular entries are page numbers.]

Z	Element	Spectrum														
		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV
1	H, D, T	1, 3														
2	**He**	**4**	6													
3	Li	8	**10**	11												
4	**Be**	**12**	14	**14**	15											
5	B	16	**17**	19	**19**	20										
6	**C**	**21**	24	**26**	29	**30**	31									
7	N	32	**35**	38	**40**	42	**43**	44								
8	**O**	**45**	47	**50**	53	**56**	58	**59**	59							
9	F	60	**62**	64	**66**	69	**71**	74	**75**							
10	Ne	**76**	81	**83**	84	**86**	88									
11	Na	89	**91**	93	**95**	96	**98**	100	**103**	105						
12	**Mg**	**106**	108	**109**	111	**113**	114	**117**	119	**121**	122	**123**				
13	Al	124	**126**	129	**130**	131	**133**	135	**136**	138	**140**	142	**143**			
14	**Si**	**144**	147	**148**	150	**151**	152	**154**	156	**157**	159	**160**	162			
15	**P**	163	**164**	166	**168**	169	**170**	171	**173**	174	**176**	177	**179**	180		
16	**S**	**181**	183	**185**	187	**188**	189	**190**	191	**193**	194		194			
17	Cl	195	**197**	199	**201**	202	**204**	205	**206**	207	**209**	210				
18	**A**	**211**	216	**218**	220	**222**	223	**224**	224	**225**	226	**226**			226	
19	K	227	**230**	231	**233**	234	**236**	237	**238**	239	**239**	241				
20	**Ca**	**242**	245	**247**	248	**249**	251	**252**	253	**254**	255	**255**	257	**258**		**258**
21	Sc	259	**262**	263	**264**	265	**266**	267	**268**	269	**270**	271	**272**			
22	**Ti**	**273**	279	**281**	283	**284**	285	**286**	287	**288**	288	**289**	289	**290**		
23	V	291	**298**	301	**303**	304	**304**	305	**306**	306		307	**307**	308	**309**	

HYDROGEN

H

1 electron $Z=1$

Ground state $1s\ ^2S_{1/2}$

$1s\ ^2S_{1/2}$ **109678.758** cm^{-1} I. P. 13.595 volts

This table deals only with the light isotope of hydrogen, H^1; cf. page 3 for the other isotopes. The levels through $n=40$ have been calculated by J. E. Mack, "using $R_{H^1}=109677.581\ cm^{-1}$ and $\alpha^2=5.3256\times10^{-5}$, and taking into account the Lamb-Retherford shift of the s-levels as well as the Sommerfeld-Dirac fine structure, according to the equation

$$\text{Level}_n-\text{Level}_\infty=R_A\left\{-n^{-2}Z^2+\alpha^2n^{-3}Z^4\left[-(J+\tfrac{1}{2})^{-1}+3(4n)^{-1}+\Lambda_{nlZA}\right]+\cdots\right\}.$$

Here A is the atomic weight, and α is the Sommerfeld fine-structure constant. The s-shift parameter Λ is appreciable only for $l=0$, and depends slowly upon n and Z and probably negligibly upon A; it is found from the work of Lamb and Retherford to be 0.0485 $\pm$0.0002 for the 2s-level of hydrogen, and in the calculation of this table it is assumed to be independent of n.

The intervals are carried one place farther than the level values, insofar as they are accurately known.

The $1s\ ^2S_{1/2}$ level consists of two hyperfine structure components separated by 0.0473824 $\pm$0.0000008 cm^{-1}, the lower of which has $F=0$ and the other $F=1$.

In any one-electron spectrum the correction arising from any modification ΔR of the value accepted for the Rydberg constant may be calculated to a close approximation from the equation

$$\Delta(\text{level})=(1-n^{-2})Z^2\Delta R."$$

REFERENCES

A. Fowler, *Report on Series in Line Spectra*, p. 89 (Fleetway Press, London, 1922). (T) (C L)

F. Paschen und R. Götze, *Seriengesetze der Linienspektren*, p. 22 (Julius Springer, Berlin, 1922). (T) (C L)

H. E. White, *Introduction to Atomic Spectra*, p. 33 (McGraw Hill Book Co., Inc., New York, N. Y., 1934). (G D)

J. W. Drinkwater, O. Richardson, and W. E. Williams, Proc. Roy. Soc. (London) [A] **174,** 164 (1940). (Fine structure)

C. E. Moore, Princeton Obs. Contr. No. 20, 1 (1945). (C L)

H. A. Bethe, Phys. Rev. **72,** 339 (1947). (T)

D. E. Nagle, R. S. Julian, and J. R. Zacharias, Phys. Rev. **72,** 971 (L) (1947). (hfs)

J. E. Nafe and E. B. Nelson, Phys. Rev. **73,** 718 (1948). (hfs)

H. Kuhn and G. W. Series, Nature **162,** 373 (1948). (Fine structure)

W. E. Lamb, Jr., and R. E. Retherford, Bul. Am. Phys. Soc. **24,** No. 1, 59 (1949). (Fine structure)

M. M. Kroll and W. E. Lamb, Jr., Phys. Rev. **75,** 388 (1949). (T)

J. E. Mack, unpublished material (1949). (I P) (T) (C L)

H

Config.	Desig.	*J*	Level	Interval
$1s$	$1s$ ^{2}S	½	0. 000	
$2p$	$2p$ ^{2}P°	½	82258. 907	0.0354
$2s$	$2s$ ^{2}S	½	82258. 942	0. 3651
$2p$	$2p$ ^{2}P°	1½	82259. 272	
$3p$	$3p$ ^{2}P°	½	97492. 198	0. 010
$3s$	$3s$ ^{2}S	½	97492. 208	0. 1082
$3p$, $3d$	$3d$ ^{2}D, $3p$ ^{2}P°	1½	97492. 306	0. 0361
$3d$	$3d$ ^{2}D	2½	97492. 342	
$4p$	$4p$ ^{2}P°	½	102823. 835	0. 004
$4s$	$4s$ ^{2}S	½	102823. 839	0. 0456
$4p$, $4d$	$4d$ ^{2}D, $4p$ ^{2}P°	1½	102823. 881	0. 0152
$4d$, $4f$	$4d$ ^{2}D, $4f$ ^{2}F°	2½	102823. 896	0. 0076
$4f$	$4f$ ^{2}F°	3½	102823. 904	
$5p$	$5p$ ^{2}P°	½	105291. 615	0. 002
$5s$	$5s$ ^{2}S	½	105291. 617	0. 0233
$5p$, $5d$	$5d$ ^{2}D, $5p$ ^{2}P°	1½	105291. 638	0. 0078
$5d$, $5f$	$5d$, ^{2}D, $5f$ ^{2}F°	2½	105291. 646	0. 0039
$5f$, $5g$	$5g$ ^{2}G, $5f$ ^{2}F°	3½	105291. 650	0. 0024
$5g$	$5g$ ^{2}G	4½	105291. 652	
$6p$	$6p$ ^{2}P°	½	106632. 135	0. 001
$6s$	$6s$ ^{2}S	½	106632. 136	0. 0136
$6p$, $6d$	$6d$ ^{2}D, $6p$ ^{2}P°	1½	106632. 148	0. 0045
$6d$, $6f$	$6d$ ^{2}D, $6f$ ^{2}F°	2½	106632. 152	0. 0022
$6f$, $6g$	$6g$ ^{2}G, $6f$ ^{2}F°	3½	106632. 155	0. 0014
$6g$, $6h$	$6g$ ^{2}G, $6h$ ^{2}H°	4½	106632. 156	0. 0009
$6h$	$6h$ ^{2}H°	5½	106632. 157	
$7s$, etc.	$7s$ ^{2}S, etc.	½, etc.	107440. 425 to . 439	0. 014
$8s$, etc.	$8s$ ^{2}S, etc.	½, etc.	107965. 036 to . 045	0. 009
$9s$, etc.	$9s$ ^{2}S, etc.	½, etc.	108324. 706 to . 714	0. 008
$10s$, etc.	$10s$ ^{2}S, etc.	½, etc.	108581. 98	
$11s$, etc.	$11s$ ^{2}S, etc.	½, etc.	108772. 33	
$12s$, etc.	$12s$ ^{2}S, etc.	½, etc.	108917. 11	
$13s$, etc.	$13s$ ^{2}S, etc.	½, etc.	109029. 78	
$14s$, etc.	$14s$ ^{2}S, etc.	½, etc.	109119. 18	
$15s$, etc.	$15s$ ^{2}S, etc.	½, etc.	109191. 30	

H

Config	Desig.	*J*	Level	Interval
$16s$, etc.	$16s$ ^{2}S, etc.	½, etc.	109250. 33	
$17s$, etc.	$17s$ ^{2}S, etc.	½, etc.	109299. 25	
$18s$, etc.	$18s$ ^{2}S, etc.	½, etc.	109340. 25	
$19s$, etc.	$19s$ ^{2}S, etc.	½, etc.	109374. 94	
$20s$, etc.	$20s$ ^{2}S, etc.	½, etc.	109404. 57	
$21s$, etc.	$21s$ ^{2}S, etc.	½, etc.	109430. 06	
$22s$, etc.	$22s$ ^{2}S, etc.	½, etc.	109452. 15	
$23s$, etc.	$23s$ ^{2}S, etc.	½, etc.	109471. 428	
$24s$, etc.	$24s$ ^{2}S, etc.	½, etc.	109488. 346	
$25s$, etc.	$25s$ ^{2}S, etc.	½, etc.	109503. 274	
$26s$, etc.	$26s$ ^{2}S, etc.	½, etc.	109516. 513	
$27s$, etc.	$27s$ ^{2}S, etc.	½, etc.	109528. 309	
$28s$, etc.	$28s$ ^{2}S, etc.	½, etc.	109538. 863	
$29s$, etc.	$29s$ ^{2}S, etc.	½, etc.	109548. 345	
$30s$, etc.	$30s$ ^{2}S, etc.	½, etc.	109556. 894	
$31s$, etc.	$31s$ ^{2}S, etc.	½, etc.	109564. 629	
$32s$, etc.	$32s$ ^{2}S, etc.	½, etc.	109571. 651	
$33s$, etc.	$33s$ ^{2}S, etc.	½, etc.	109578. 044	
$34s$, etc.	$34s$ ^{2}S, etc.	½, etc.	109583. 881	
$35s$, etc.	$35s$ ^{2}S, etc.	½, etc.	109589. 225	
$36s$, etc.	$36s$ ^{2}S, etc.	½, etc.	109594. 130	
$37s$, etc.	$37s$ ^{2}S, etc.	½, etc.	109598. 643	
$38s$, etc.	$38s$ ^{2}S, etc.	½, etc.	109602. 804	
$39s$, etc.	$39s$ ^{2}S, etc.	½, etc.	109606. 649	
$40s$, etc.	$40s$ ^{2}S, etc.	½, etc.	109610. 210	
	∞=*Limit*	----------	**109678. 758**	

February 1949.

DEUTERIUM and TRITIUM

D and T

1 electron $Z=1$

Ground state 1*s* $^2S_{1/2}$

1*s* $^2S_{1/2}$ D (H^2) **109708.596** cm^{-1} I. P. D 13.598 volts

1*s* $^2S_{1/2}$ T (H^3) **109718.526** cm^{-1} I. P. T 13.600 volts

The term values have been calculated by J. E. Mack, "using $R_D=109707.419$ and $R_T=109717.348$ cm^{-1}, and taking into account the same fine structure as in hydrogen. Lamb and Retherford have found that the 2*s*-shift in deuterium is the same as in light hydrogen within about 0.5 percent. Levels not given here may be calculated from the hydrogen table with the aid of the correction equations

$$\text{Level}_D - \text{Level}_H = (1-n^{-2})29.838 \text{ cm}^{-1} \text{ and } \text{Level}_T - \text{Level}_H = (1-n^{-2})39.768 \text{ cm}^{-1}.$$

Nafe and Nelson have kindly communicated the results of their hyperfine structure measurements in tritium in advance of publication. In both isotopes the 1*s*-level has two hyperfine-structure components, the lower of which has the lower *F*-value. In deuterium the separation is $0.01092095 \pm 0.00000023$ cm^{-1}, and the *F*-values are 1/2 and 3/2. In tritium the separation is 0.0505945 ± 0.0000010 cm^{-1}, the *F*-values 0 and 1."

REFERENCES

J. W. Drinkwater, O. Richardson, and W. E. Williams, Proc. Roy. Soc. (London) [A] **174**, 164 (1940). (Fine structure) (I S)

D. E. Nagle, R. S. Julian, and J. R. Zacharias, Phys. Rev. **72**, 971 (L) (1947). (hfs)

J. E. Nafe and E. B. Nelson, Phys. Rev. **73**, 718 (1948); **75**, in press (1949). (hfs)

R. E. Retherford and W. E. Lamb, Jr., Bul. Am. Phys. Soc. **24**, No. 1, 59 (1949). (Fine structure)

J. E. Mack, unpublished material (1949). (I P) (T) (C L)

Config.	Desig.	*J*	D Level	T Level	Interval
1*s*	1*s* ^{2}S	½	0.000	0.000	
2*p*	2*p* ^{2}P°	½	82281.285	82288.733	0.0354
2*s*	2*s* ^{2}S	½	82281.320	82288.768	0.3652
2*p*	2*p* ^{2}P°	1½	82281.650	82289.098	
3*p*	3*p* ^{2}P°	½	97518.721	97527.547	0.010
3*s*	3*s* ^{2}S	½	97518.731	97527.558	0.1082
3*p*, 3*d*	3*d* ^{2}D, 3*p* ^{2}P°	1½	97518.829	97527.656	0.0361
3*d*	3*d* ^{2}D	2½	97518.865	97527.692	
4*p*	4*p* ^{2}P°	½	102851.808	102861.118	0.004
4*s*	4*s* ^{2}S	½	102851.812	102861.122	0.0456
4*p*, 4*d*	4*d* ^{2}D, 4*p* ^{2}P°	1½	102851.854	102861.163	0.0152
4*d*, 4*f*	4*d* ^{2}D, 4*f* ^{2}F°	2½	102851.869	102861.178	0.0076
4*f*	4*f* ^{2}F°	3½	102851.877	102861.186	
5*p*	5*p* ^{2}P°	½	105320.260	105329.792	0.002
5*s*	5*s* ^{2}S	½	105320.262	105329.795	0.0233
5*p*, 5*d*	5*d* ^{2}D, 5*p* ^{2}P°	1½	105320.283	105329.816	0.0078
5*d*, 5*f*	5*d* ^{2}D, 5*f* ^{2}F°	2½	105320.291	105329.824	0.0039
5*f*, 5*g*	5*g* ^{2}G, 5*f* ^{2}F°	3½	105320.294	105329.827	0.0024
5*g*	5*g* ^{2}G	4½	105320.297	105329.830	
6*p*	6*p* ^{2}P°	½	106661.144	106670.798	0.001
6*s*	6*s* ^{2}S	½	106661.145	106670.800	0.0136
6*p*, 6*d*	6*d* ^{2}D, 6*p* ^{2}P°	1½	106661.158	106670.812	0.0045
6*d*, 6*f*	6*d* ^{2}D, 6*f* ^{2}F°	2½	106661.162	106670.816	0.0022
6*f*, 6*g*	6*g* ^{2}G, 6*f* ^{2}F°	3½	106661.164	106670.818	0.0014
6*g*, 6*h*	6*g* ^{2}G, 6*h* ^{2}H°	4½	106661.166	106670.820	0.0009
6*h*	6*h* ^{2}H°	5½	106661.167	106670.821	
7*s*, etc.	7*s* ^{2}S, etc.	½, etc.	107469.654 to .669	107479.381 to .396	
	∞=*Limit*	------	**109708.596**	**109718.526**	

February 1949.

HELIUM

He I

2 electrons $Z=2$

Ground state $1s^2\ ^1S_0$

$1s^2\ ^1S_0$ **198305±15** cm^{-1} I. P. 24.580 volts

Most of the terms are taken from Paschen-Götze with the term values subtracted from Paschen's limit as quoted by Robinson in 1937. Higher members of the $^1F°$ and $^3F°$ series are taken from Meggers and Dieke. The term $2p\ ^3P°$ has been calculated from its combination with $2s\ ^3S_1$, using the resolved triplet as observed by Meggers, the intervals being $-0.078\ cm^{-1}$ and $-0.996\ cm^{-1}$. The components of $3p\ ^3P°$ are based on Paschen's value of $3p\ ^3P^{\circ}_2$ and the intervals observed by Gibbs and Kruger; $-0.165\ cm^{-1}$ and $-0.192\ cm^{-1}$.

Some doubt exists regarding the correct classifications of lines attributed to doubly excited helium, such as those observed at 309.04 A and 320.38 A by Compton and Boyce, and at 320.392 A and 357.507 A by Kruger. Approximate theoretical computations of the energies of doubly excited levels have been made by a number of authors and are summarized by Wu. His classification of the line observed at 320.4 A as $2p\ ^3P°-2p^2\ ^3P$ has been adopted and used for the calculation of $2p^2\ ^3P$.

Several references deal with intercombinations in He I, namely, those by Lyman, Hopfield, Paschen, Suga, and others. The term values based on the excellent long series have been adopted in the table, since it is believed that they are the most accurate.

REFERENCES

F. Paschen und R. Götze, *Seriengesetze der Linienspektren* p. 22 (Julius Springer, Berlin, 1922). (T) (C L)
T. Lyman, Astroph. J. **60,** 1 (1924). (T) (C L)
K. T. Compton and J. C. Boyce, J. Franklin Inst. **205,** 497 (1928). (C L)
F. Paschen, Sitz. Berlin Akad. Wiss. **30,** 662 (1929). (T) (C L)
J. J. Hopfield, Astroph. J. **72,** 133 (1930). (T) (C L)
P. G. Kruger, Phys. Rev. **36,** 855 (1930). (C L)
R. C. Gibbs and P. G. Kruger, Phys. Rev. **37,** 1559 (1931). (T)
W. F. Meggers and G. H. Dieke, Bur. Std. J. Research **9,** 121, RP462 (1932). (T) (C L)
F. Paschen and R. Ritschl, Ann. der Phys. [5] **18,** 888 (1933). (T) (C L)
H. E. White, *Introduction to Atomic Spectra* p. 209 (McGraw-Hill Book Co., Inc., New York, N. Y., 1934). (G D)
W. F. Meggers, J. Research Nat. Bur. Std. **14,** 487, RP781 (1935). (C L)
T. Suga, Sci. Papers Inst. Phys. Chem. Research (Tokyo) **34,** No. 740, 16 (1937). (C L)
H. A. Robinson, Phys. Rev. **51,** 14 (1937). (I P)
P. Jacquinot, Compt. Rend. **208,** 1896 (1939). (C L)
T.-Y. Wu, Phys. Rev. **66,** 291 (1944). (C L)
W. F. Meggers, J. Opt. Soc. Am. **36,** 431 (1946). (Summary hfs)

He I

Config.	Desig.	J	Level
1s^2	1s^2 ^{1}S	0	0±15
1s 2s	2s ^{3}S	1	159850. 318
1s 2s	2s ^{1}S	0	166271. 70
1s 2p	2p ^{3}P°	2	*169081. 111*
		1	*169081. 189*
		0	*169082. 185*
1s 2p	2p ^{1}P°	1	*171129. 148*
1s 3s	3s ^{3}S	1	183231. 08
1s 3s	3s ^{1}S	0	184859. 06
1s 3p	3p ^{3}P°	2	*185558. 92*
		1	*185559. 085*
		0	*185559. 277*
1s 3d	3d ^{3}D	3, 2, 1	186095. 90
1s 3d	3d ^{1}D	2	186099. 22
1s 3p	3p ^{1}P°	1	*186203. 62*
1s 4s	4s ^{3}S	1	190292. 46
1s 4s	4s ^{1}S	0	190934. 50
1s 4p	4p ^{3}P°	2, 1, 0	*191211. 42*
1s 4d	4d ^{3}D	3, 2, 1	191438. 83
1s 4d	4d ^{1}D	2	191440. 71
1s 4f	4f ^{3}F°	4, 3, 2	*191446. 61*
1s 4f	4f ^{1}F°	3	*191447. 24*
1s 4p	4p ^{1}P°	1	*191486. 95*
1s 5s	5s ^{3}S	1	193341. 33
1s 5s	5s ^{1}S	0	193657. 78
1s 5p	5p ^{3}P°	2, 1, 0	*193795. 07*
1s 5d	5d ^{3}D	3, 2, 1	193911. 48
1s 5d	5d ^{1}D	2	193912. 54
1s 5f	5f ^{1}F°	3	*193914. 31*
1s 5f	5f ^{3}F°	4, 3, 2	*193915. 79*
1s 5p	5p ^{1}P°	1	*193936. 75*
1s 6s	6s ^{3}S	1	194930. 46
1s 6s	6s ^{1}S	0	195109. 17
1s 6p	6p ^{3}P°	2, 1, 0	*195187. 21*
1s 6d	6d ^{3}D	3, 2, 1	195254. 37
1s 6d	6d ^{1}D	2	195255. 02
1s 6f	6f ^{1}F°	3	*195256. 7*
1s 6f	6f ^{3}F°	4, 3, 2	*195256. 82*
1s 6p	6p ^{1}P°	1	*195269. 17*
1s 7s	7s ^{3}S	1	195862. 63

He I

Config.	Desig.	J	Level
1s 7s	7s ^{1}S	0	195973. 19
1s 7p	7p ^{3}P°	2, 1, 0	*196021. 72*
1s 7d	7d ^{3}D	3, 2, 1	196064. 00
1s 7d	7d ^{1}D	2	196064. 31
1s 7f	7f ^{1}F°	3	*196065. 4*
1s 7f	7f ^{3}F°	4, 3, 2	*196065. 51*
1s 7p	7p ^{1}P°	1	*196073. 41*
1s 8s	8s ^{3}S	1	196455. 79
1s 8s	8s ^{1}S	0	196529. 03
1s 8p	8p ^{3}P°	2, 1, 0	*196561. 08*
1s 8d	8d ^{3}D	3, 2, 1	196589. 42
1s 8d	8d ^{1}D	2	196589. 73
1s 8f	8f ^{1}F°	3	*196590. 3*
1s 8f	8f ^{3}F°	4, 3, 2	*196590. 42*
1s 8p	8p ^{1}P°	1	*196595. 56*
1s 9s	9s ^{3}S	1	196856. 37
1s 9s	9s ^{1}S	0	196907. 13
1s 9p	9p ^{3}P°	2, 1, 0	*196929. 68*
1s 9d	9d ^{1}D	2	196949. 49
1s 9d	9d ^{3}D	3, 2, 1	196949. 63
1s 9f	9f ^{1}F°	3	*196950. 3*
1s 9f	9f ^{3}F°	4, 3, 2	*196950. 36*
1s 9p	9p ^{1}P°	1	*196953. 95*
1s 10s	10s ^{3}S	1	197139. 76
1s 10s	10s ^{1}S	0	197176. 36
1s 10p	10p ^{3}P°	2, 1, 0	*197192. 63*
1s 10d	10d ^{1}D	2	197207. 08
1s 10d	10d ^{3}D	3, 2, 1	197207. 30
1s 10f	10f ^{3}F°	4, 3, 2	*197208. 0*
1s 10p	10p ^{1}P°	1	*197210. 41*
1s 11s	11s ^{3}S	1	197347. 05
1s 11p	11p ^{3}P°	2, 1, 0	*197386. 98*
1s 11d	11d ^{1}D	2	197397. 62
1s 11d	11d ^{3}D	3, 2, 1	197397. 75
1s 11f	11f ^{3}F°	4, 3, 2	*197398. 6*
1s 11p	11p ^{1}P°	1	*197400. 18*
1s 12s	12s ^{3}S	1	197503. 69
1s 12s	12s ^{1}S	0	197524. 26

He I—Continued

Config.	Desig.	J	Level
$1s\ 12p$	$12p\ ^{3}P^{\circ}$	2, 1, 0	*197534. 44*
$1s\ 12d$	$12d\ ^{1}D$	2	197542. 54
$1s\ 12d$	$12d\ ^{3}D$	3, 2, 1	197542. 67
$1s\ 12p$	$12p\ ^{1}P^{\circ}$	1	*197544. 56*
$1s\ 13s$	$13s\ ^{3}S$	1	197624. 98
$1s\ 13p$	$13p\ ^{3}P^{\circ}$	2, 1, 0	*197649. 07*
$1s\ 13s$	$13s\ ^{1}S$	0	197649. 78
$1s\ 13d$	$13d\ ^{1}D$	2	197655. 19
$1s\ 13d$	$13d\ ^{3}D$	3, 2, 1	197655. 47
$1s\ 13p$	$13p\ ^{1}P^{\circ}$	1	*197656. 95*
$1s\ 14s$	$14s\ ^{3}S$	1	197721. 13
$1s\ 14p$	$14p\ ^{3}P^{\circ}$	2, 1, 0	*197739. 90*
$1s\ 14d$	$14d\ ^{1}D$	2	197744. 918
$1s\ 14d$	$14d\ ^{3}D$	3, 2, 1	197744. 94
$1s\ 14p$	$14p\ ^{1}P^{\circ}$	1	*197746. 15*
$1s\ 15s$	$15s\ ^{3}S$	1	197796. 63
$1s\ 15p$	$15p\ ^{3}P^{\circ}$	2, 1, 0	*197813. 11*
$1s\ 15d$	$15d\ ^{3}D$	3, 2, 1	197817. 05
$1s\ 15p$	$15p\ ^{1}P^{\circ}$	1	*197818. 12*
$1s\ 16p$	$16p\ ^{3}P^{\circ}$	2, 1, 0	*197872. 95*

He I—Continued

Config.	Desig.	J	Level
$1s\ 16d$	$16d\ ^{3}D$	3, 2, 1	197876. 41
$1s\ 16p$	$16p\ ^{1}P^{\circ}$	1	*197877. 04*
$1s\ 17p$	$17p\ ^{3}P^{\circ}$	2, 1, 0	*197922. 51*
$1s\ 17d$	$17d\ ^{3}D$	3, 2, 1	197925. 33
$1s\ 17p$	$17p\ ^{1}P^{\circ}$	1	*197925. 87*
$1s\ 18p$	$18p\ ^{3}P^{\circ}$	2, 1, 0	*197964. 02*
$1s\ 18d$	$18d\ ^{3}D$	3, 2, 1	197966. 75
$1s\ 18p$	$18p\ ^{1}P^{\circ}$	1	*197966. 80*
$1s\ 19p$	$19p\ ^{3}P^{\circ}$	2, 1, 0	*197999. 12*
$1s\ 19d$	$19d\ ^{3}D$	3, 2, 1	198001. 43
$1s\ 19p$	$19p\ ^{1}P^{\circ}$	1	*198001. 44*
$1s\ 20p$	$20p\ ^{3}P^{\circ}$	2, 1, 0	*198029. 07*
$1s\ 20p$	$20p\ ^{1}P^{\circ}$	1	*198031. 02*
$1s\ 20d$	$20d\ ^{3}D$	3, 2, 1	198031. 41
$1s\ 21p$	$21p\ ^{3}P^{\circ}$	2, 1, 0	*198054. 83*
$1s\ 21d$	$21d\ ^{3}D$	3, 2, 1	198056. 50
$1s\ 22p$	$22p\ ^{3}P^{\circ}$	2, 1, 0	*198077. 15*
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He II ($^{2}S_{1/2}$)	*Limit*	----------	198305
$2p^{2}$	$2p^{2}\ ^{3}P$	2, 1, 0	481198

August 1946.

He II

(H sequence; 1 electron) $Z=2$

Ground state $1s\ ^{2}S_{1/2}$

$1s\ ^{2}S_{1/2}$ He^{3} **438889.040** cm^{-1} I. P. He^{3} 54.400 volts

$1s\ ^{2}S_{1/2}$ He^{4} **438908.670** cm^{-1} I. P. He^{4} 54.403 volts

The levels have been calculated by J. E. Mack, "using $R_{He^4}=109722.264$ and taking into account the fine structure as in hydrogen, but with $\Lambda=0.0402\pm0.009$, from the work of Skinner and Lamb on the $2s$-level. The tentative experimental indication that Λ decreases with increasing n has been neglected. Assuming $R_{He^3}=109717.344$, the levels of He^3 may be calculated to a close approximation from those of He^4 by the equation

$$\text{Level}_{He^3\,II}-\text{Level}_{He^4\,II}=-(1-n^{-2})19.630\ cm^{-1}."$$

REFERENCES

A. Fowler, *Report on Series in Line Spectra*, p. 95 (Fleetway Press, London, 1922). (T) (C L)
F. Paschen und R. Götze, *Seriengesetze der Linienspektren*, p. 25 (Julius Springer, Berlin, 1922). (T) (C L)
H. E. White, *Introduction to Atomic Spectra*, p. 33 (McGraw-Hill Book Co., New York, N. Y., 1934). (G D)
C. E. Moore, Princeton Obs. Contr. No. 20, 1 (1945). (C L)
H. A. Bethe, Phys. Rev. **72,** 339 (1947). (T)
J. E. Mack and N. Austern, Phys. Rev. **72,** 972 (1947); **74,** 1262 (A) (1948). (Fine structure)
G. R. Fowles, Phys. Rev. **73,** 639 (L) (1948); **74,** 219 (L) (1948). (Fine structure)
H. Kopfermann and W. Paul, Nature **162,** 33 (L) (1948). (Fine structure)
M. Skinner and W. E. Lamb, Jr., Bul. Am. Phys. Soc. **24,** No. 1, 59 (1949). (Fine structure)
J. E. Mack, unpublished material (1949). (I P) (T) (C L)

Config.	Desig.	J	He³ II Level	He⁴ II Level	Interval
1s	1s ²S	½	0.000	0.000	
2p	2p ²P°	½	329164.390	329179.102	0.470
2s	2s ²S	½	329164.860	329179.572	5.8434
2p	2p ²P°	1½	329170.135	329184.945	
3p	3p ²P°	½	390123.179	390140.622	0.14
3s	3s ²S	½	390123.318	390140.761	1.7314
3p, 3d	3d ²D, 3p ²P°	1½	390124.910	390142.353	0.5771
3d	3d ²D	2½	390125.487	390142.930	
4p	4p ²P°	½	411458.517	411476.917	0.06
4s	4s ²S	½	411458.576	411476.976	0.7304
4p, 4d	4d ²D, 4p ²P°	1½	411459.248	411477.648	0.2435
4d, 4f	4d ²D, 4f ²F°	2½	411459.491	411477.891	0.1217
4f	4f ²F°	3½	411459.613	411478.013	
5p	5p ²P°	½	421333.629	421352.472	0.03
5s	5s ²S	½	421333.659	421352.502	0.3740
5p, 5d	5d ²D, 5p ²P°	1½	421334.003	421352.846	0.1247
5d, 5f	5d ²D, 5f ²F°	2½	421334.128	421352.971	0.0624
5f, 5g	5g ²G, 5f ²F°	3½	421334.190	421353.033	0.0374
5g	5g ²G,	4½	421334.228	421353.071	
6p	6p ²P°	½	426697.845	426716.928	0.02
6s	6s ²S	½	426697.862	426716.945	0.2164
6p, 6d	6d ²D, 6p ²P°	1½	426698.062	426717.145	0.0721
6d, 6f	6d ²D, 6f ²F°	2½	426698.134	426717.217	0.0361
6f, 6g	6g ²G, 6f ²F°	3½	426698.170	426717.253	0.0216
6g, 6h	6g ²G, 6h ²H°	4½	426698.192	246717.275	0.0144
6h	6h ²H°	5½	426698.206	426717.289	
7s, etc.	7s ²S, etc.	½, etc.	----------	429951.508 to .741	
8s, etc.	8s ²S, etc.	½, etc.	----------	432050.863 to1.023	
9s, etc.	9s ²S, etc.	½, etc.	----------	433490.169 to .283	
10s, etc.	10s ²S, etc.	½, etc.	----------	434519.693 to .777	
11s, etc.	11s ²S, etc.	½, etc.	----------	435281.423 to .486	
12s, etc.	12s ²S, etc.	½, etc.	----------	435860.778 to .828	
13s, etc.	13s ²S, etc.	½, etc.	----------	436311.653 to .692	
14s, etc.	14s ²S, etc.	½, etc.	----------	436669.407 to .439	
15s, etc.	15s ²S, etc.	½, etc.	----------	436957.026 to 8.052	
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	∞=*Limit*	----------	----------	**438908. 670**	

February 1949.

LITHIUM

Li I

3 electrons $Z=3$

Ground state $1s^2\ 2s\ ^2S_{\frac{1}{2}}$

$2s\ ^2S_{\frac{1}{2}}$ **43487.19±0.02** cm⁻¹ I. P. 5.390 volts

The analysis is from Fowler and Paschen-Götze. Meissner has generously furnished in advance of publication preliminary results of level splittings derived from observed fine structure of selected lines. These data are as follows:

Term	Interval (cm⁻¹)	Line resolved (A)	Term	Line resolved (A)
$2p\ ^2P^{\circ}$	0. 3366 ±0. 0005*	6707. 912, . 761	$3s\ ^2S$	8126. 452, . 231
$3d\ ^2D$	0. 037 ±0. 001	6103. 649, . 538	$4s\ ^2S$	4971. 745, . 661
$4d\ ^2D$	0. 015 ±0. 002	4602. 894, . 826	$5s\ ^2S$	4273. 127, . 066
$5d\ ^2D$	0. 010 ±0. 003	4132. 618, . 562†	$6s\ ^2S$	3985. 538, . 485
$6d\ ^2D$	0. 005 ±0. 003	3915. 346, . 295		

*Average of 6 determinations.
†Edlén and Lidén derive a mean value of 4132.60±0.02 A and the resulting corrected values quoted for $5d\ ^2D$ and the limit.

The values in the table for the above terms have been calculated from these wavelengths, except for $5d\ ^2D$. Jackson and Kuhn state that the multiplet splitting of $2p\ ^2P^{\circ}=0.3372\pm 0.0005$ cm.⁻¹.

The remaining terms given to two decimals have been calculated from the measures by France. The terms $ns\ ^2S$, $n=7$ to 11, and $nd\ ^2D$, $n=7$ to 12, are from Werner. All other term values are from Fowler's Report.

REFERENCES

N. A. Kent, Astroph. J. **40,** 337 (1914). (T) (Z E)

A. S. King, Astroph. J. **44,** 169 (1916). (T)

A. Fowler, *Report on Series in Line Spectra,* p. 96 (Fleetway Press, London, 1922). (T) (C L)

F. Paschen und R. Götze, *Seriengesetze der Linienspektren,* p. 54, (Julius Springer, Berlin, 1922). (T) (C L)

S. Werner, *Studier over Spektroskopiske Lyskilder til Frembringelse af Gnistspektre med Resultater for Lithiums Gnistspektrum,* p. 67 (A. Aschehoug & Co., Dansk Forlag, Kobenhavn, 1927). (I P) (T) (C L)

R. W. France, Proc. Roy. Soc. (London) [A] **129,** 354 (1930). (I P) (T) (C L)

H. E. White, *Introduction to Atomic Spectra,* p. 77, 87, (McGraw-Hill Book Co., Inc., New York, N. Y. 1934). (G D)

D. A. Jackson and H. Kuhn, Proc. Roy. Soc. (London) [A] **173,** 278 (1939). (I S)

W. F. Meggers, J. Opt. Soc. Am. **36,** 431 (1946). (Summary hfs).

K. W. Meissner, L. G. Mundie, and P. Stelson, Phys. Rev. **74,** 932 (1948); **75,** 891 (L) (1949). (T) (C L)

B. Edlén and K. Lidén, Phys. Rev. **75,** 890 (L) (1949). (I P) (T)

Li I

Config.	Desig.	J	Level
2s	$2s\ ^2S$	½	0.00
2p	$2p\ ^2P^\circ$	½ 1½	*14903.66* *14904.00*
3s	$3s\ ^2S$	½	27206.12
3p	$3p\ ^2P^\circ$	½, 1½	*30925.38*
3d	$3d\ ^2D$	1½ 2½	31283.08 31283.12
4s	$4s\ ^2S$	½	35012.06
4p	$4p\ ^2P^\circ$	½, 1½	*36469.55*
4d	$4d\ ^2D$	1½ 2½	36623.38 36623.40
4f	$4f\ ^2F^\circ$	2½, 3½	*36630.2*
5s	$5s\ ^2S$	½	38299.50
5p	$5p\ ^2P^\circ$	½, 1½	*39015.56*
5d	$5d\ ^2D$	1½ 2½	39094.93 39094.94
6f	$5f\ ^2F^\circ$	2½, 3½	*39104.5*
6s	$6s\ ^2S$	½	39987.64
6p	$6p\ ^2P^\circ$	½, 1½	*40390.84*
6d	$6d\ ^2D$	1½ 2½	40437.31 40437.32
7s	$7s\ ^2S$	½	40967.9
7p	$7p\ ^2P^\circ$	½, 1½	*41217.35*
7d	$7d\ ^2D$	1½, 2½	41246.5
10d	$10d\ ^2D$	1½, 2½	41489
8s	$8s\ ^2S$	½	41587.1
8p	$8p\ ^2P^\circ$	½, 1½	*41751.63*
8d	$8d\ ^2D$	1½, 2½	41771.3
9s	$9s\ ^2S$	½	42003.3
9p	$9p\ ^2P^\circ$	½, 1½	*42118.27*
9d	$9d\ ^2D$	1½, 2½	42131.3
10s	$10s\ ^2S$	½	42298
10p	$10p\ ^2P^\circ$	½, 1½	*42379.16*
11s	$11s\ ^2S$	½	42510
11p	$11p\ ^2P^\circ$	½, 1½	*42569.1*
11d	$11d\ ^2D$	1½, 2½	42578
12p	$12p\ ^2P^\circ$	½, 1½	*42719.14*
12d	$12d\ ^2D$	1½, 2½	42725
13p	$13p\ ^2P^\circ$	½, 1½	*42832.92*
14p	$14p\ ^2P^\circ$	½, 1½	*42923.39*
15p	$15p\ ^2P^\circ$	½, 1½	*42995.51*
16p	$16p\ ^2P^\circ$	½, 1½	*43055.34*
17p	$17p\ ^2P^\circ$	½, 1½	*43105.42*
18p	$18p\ ^2P^\circ$	½, 1½	*43146.96*
19p	$19p\ ^2P^\circ$	½, 1½	*43181.84*
20p	$20p\ ^2P^\circ$	½, 1½	*43211.39*
21p	$21p\ ^2P^\circ$	½, 1½	*43237.16*
22p	$22p\ ^2P^\circ$	½, 1½	*43259.14*
23p	$23p\ ^2P^\circ$	½, 1½	*43278.96*
24p	$24p\ ^2P^\circ$	½, 1½	*43296.03*
25p	$25p\ ^2P^\circ$	½, 1½	*43311.45*
26p	$26p\ ^2P^\circ$	½, 1½	*43324.81*
27p	$27p\ ^2P^\circ$	½, 1½	*43336.40*
28p	$28p\ ^2P^\circ$	½, 1½	*43346.39*
29p	$29p\ ^2P^\circ$	½, 1½	*43354.91*
30p	$30p\ ^2P^\circ$	½, 1½	*43363.71*
31p	$31p\ ^2P^\circ$	½, 1½	*43372.06*
32p	$32p\ ^2P^\circ$	½, 1½	*43378.31*
33p	$33p\ ^2P^\circ$	½, 1½	*43384.9*
34p	$34p\ ^2P^\circ$	½, 1½	*43390.3*
35p	$35p\ ^2P^\circ$	½, 1½	*43395.4*
36p	$36p\ ^2P^\circ$	½, 1½	*43400.5*
37p	$37p\ ^2P^\circ$	½, 1½	*43404.7*
38p	$38p\ ^2P^\circ$	½, 1½	*43408.6*
39p	$39p\ ^2P^\circ$	½, 1½	*43412.4*
40p	$40p\ ^2P^\circ$	½, 1½	*43416.9*
41p	$41p\ ^2P^\circ$	½, 1½	*43420.9*
42p	$42p\ ^2P^\circ$	½, 1½	*43424.3*
Li II ($^1S_0$)	*Limit*	----------	**43487.19**

December 1948.

Li II

(He I sequence; 2 electrons) $Z=3$

Ground state $1s^2\ ^1S_0$

$1s^2\ ^1S_0$ **610079±25** cm^{-1} I. P. 75.6193±0.0031 volts

Singlet series have been published by both Schüler and Werner, the longer ones by Schüler. In the term list Schüler's rounded off values have been used for the terms $4s$ to $7s\ ^1S$, $5d$ to $8d\ ^1D$ and $8f\ ^1F^\circ$. The limit is from Robinson and the $2p$ to $4p\ ^1P^\circ$ terms are from Edlén. All the remaining terms are from Werner, who gives also an extrapolated value of $2s\ ^1S_0$, entered in brackets in the table.

Intersystem combinations have not been observed, but the long series should give a reliable determination of the relative positions of the singlet and triplet terms.

REFERENCES

H. Schüler. Zeit. Phys. **37,** 568 (1926). (T) (C L)

S. Werner, Nature **116,** 574 (L) (1925); **118,** 154 (L) (1926). (T) (C L)

S. Werner, *Studier over Spektroskopiske Lyskilder til Frembringelse af Gnistspektre med Resultater for Lithiums Gnistspektrum*, p. 59 (H. Aschehoug & Co., Dansk Forlag, Kobenhavn, 1927). (I P) (T) (C L).

B. Edlén, Nova Acta Reg. Soc. Sci. Uppsala [IV] **9,** No. 6, 31 (1934). (T) (C L)

H. E. White, *Introduction to Atomic Spectra* p. 209 (McGraw-Hill Book Co., Inc., New York, N. Y., 1934). (G D)

H. A. Robinson, Phys. Rev. **51,** 14 (1937). (I P) (T) (C L)

W. F. Meggers, J. Opt. Soc. Am. **36,** 431 (1946). (Summary hfs)

Li II

Author	Config.	Desig.	J	Level
$1s^2\ ^1S$	$1s^2$	$1s^2\ ^1S$	0	0
$2s$	$1s\ 2s$	$2s\ ^3S$	1	476046
$2s$	$1s\ 2s$	$2s\ ^1S$	0	[490079]
$2p$	$1s\ 2p$	$2p\ ^3P^\circ$	2, 1, 0	*494273*
$1s\ 2p\ ^1P$	$1s\ 2p$	$2p\ ^1P^\circ$	1	*501816*
$3s$	$1s\ 3s$	$3s\ ^3S$	1	554761
3S	$1s\ 3s$	$3s\ ^1S$	0	558779
$3p$	$1s\ 3p$	$3p\ ^3P^\circ$	2, 1, 0	*559501*
$3d$	$1s\ 3d$	$3d\ ^3D$	3, 2, 1	561245
3D	$1s\ 3d$	$3d\ ^1D$	2	561276
$1s\ 3p\ ^1P$	$1s\ 3p$	$3p\ ^1P^\circ$	1	*561749*
$4s$	$1s\ 4s$	$4s\ ^3S$	1	579982
4S	$1s\ 4s$	$4s\ ^1S$	0	581590
$4p$	$1s\ 4p$	$4p\ ^3P^\circ$	2, 1, 0	*581897*
$4d$	$1s\ 4d$	$4d\ ^3D$	3, 2, 1	582612
4D	$1s\ 4d$	$4d\ ^1D$	2	582631
$4f$	$1s\ 4f$	$4f\ ^3F^\circ$	4, 3, 2	*582644*

Li II

Author	Config.	Desig.	J	Level
4F	$1s\ 4f$	$4f\ ^1F^\circ$	3	*582645*
$1s\ 4p\ ^1P$	$1s\ 4p$	$4p\ ^1P^\circ$	1	*582832*
$5s$	$1s\ 5s$	$5s\ ^3S$	1	591184
5S	$1s\ 5s$	$5s\ ^1S$	0	591984
$5p$	$1s\ 5p$	$5p\ ^3P^\circ$	2, 1, 0	*592141*
$5d$	$1s\ 5d$	$5d\ ^3D$	3, 2, 1	592505
5D	$1s\ 5d$	$5d\ ^1D$	2	592508
5F	$1s\ 5f$	$5f\ ^1F^\circ$	3	*592523*
$5f$	$1s\ 5f$	$5f\ ^3F^\circ$	4, 3, 2	*592527*
5P	$1s\ 5p$	$5p\ ^1P^\circ$	1	*592639*
$6s$	$1s\ 6s$	$6s\ ^3S$	1	597122
6S	$1s\ 6s$	$6s\ ^1S$	0	597574
$6p$	$1s\ 6p$	$6p\ ^3P^\circ$	2, 1, 0	*597666*
$6d$	$1s\ 6d$	$6d\ ^3D$	3, 2, 1	597876
6D	$1s\ 6d$	$6d\ ^1D$	2	597877
$6f$	$1s\ 6f$	$6f\ ^3F^\circ$	4, 3, 2	*597886*
6F	$1s\ 6f$	$6f\ ^1F^\circ$	3	*597886*

Li II—Continued

Author	Config.	Desig.	*J*	Level
7*s*	1*s* 7*s*	7*s* ^{3}S	1	600641
7S	1*s* 7*s*	7*s* ^{1}S	0	600925
7*d*	1*s* 7*d*	7*d* ^{3}D	3, 2, 1	601115
7D	1*s* 7*d*	7*d* ^{1}D	2	601115
7*f*	1*s* 7*f*	7*f* ^{3}F°	4, 3, 2	*601121*
7F	1*s* 7*f*	7*f* ^{1}F°	3	*601122*

Li II—Continued

Author	Config.	Desig.	*J*	Level
8*D*	1*s* 8*d*	8*d* ^{1}D	2	603214
8*f*	1*s* 8*f*	8*f* ^{3}F°	4, 3, 2	*603221*
8F	1*s* 8*f*	8*f* ^{1}F°	3	*603221*
	Li III (^{2}S$_{½}$)	*Limit*	----------	**610079**

May 1946.

Li III

(H sequence; 1 electron) $Z=3$

Ground state 1*s* ^{2}S$_{½}$

1*s* ^{2}S$_{½}$ Li^6 III **987644.9** cm^{-1} I. P. Li^6 III 122.419 volts

1*s* ^{2}S$_{½}$ Li^7 III **987657.8** cm^{-1} I. P. Li^7 III 122.420 volts

Edlén and Ericson found two lines of the Lyman series, and Gale and Hoag found three more and the first Balmer line. Edlén points out that careful measurement of the Lyman line in orders up to the twelfth showed it definitely to the red of the value calculated from the Dirac theory, with an average discrepancy of about 20 cm^{-1}. This disagreement vanishes when the 1*s*-shift, calculated at 19 cm^{-1}, is taken into account, according to Mack.

J. E. Mack has calculated the terms listed here, "using $R_{Li^7}=109728.723$ and the same value of Λ as in He II, which probably makes the listed ionization energy too low by something between 0 and 2 cm^{-1}. Assuming $R_{Li^6}=109727.295$, the levels of Li^6 may be found from the equation

$$\text{Level}_{Li^6}-\text{level}_{Li^7}=-(1-n^{-2})12.9\ \text{cm}^{-1}."$$

REFERENCES

H. G. Gale and J. B. Hoag, Phys. Rev. **37**, 1703 (A) (1931). (C L)

B. Edlén and A. Ericson, Nature **125**, 233 (1930); **127**, 405 (1931); Zeit. Phys. **59**, 656 (1930). (CL)

J. E. Mack, unpublished material (1949). (I P) (T) (C L)

Li III

Config.	Desig.	*J*	Level	Interval
1*s*	1*s* ^{2}S	½	0.0	
2*p*	2*p* ^{2}P°	½	740731.2	2.4
2*s*	2*s* ^{2}S	½	740733.6	29.58
2*p*	2*p* ^{2}P°	1½	740760.8	
3*p*	3*p* ^{2}P°	½	877915.9	0.7
3*s*	3*s* ^{2}S	½	877916.6	8.77
3*p*, 3*d*	3*d* ^{2}D, 3*p* ^{2}P°	1½	877924.7	2.92
3*d*	3*d* ^{2}D	2½	877927.6	
4*p*	4*p* ^{2}P°	½	925929.4	0.3
4*s*	4*s* ^{2}S	½	925929.7	3.70
4*p*, 4*d*	4*d* ^{2}D, 4*p* ^{2}P°	1½	925933.1	1.23
4*d*, 4*f*	4*d* ^{2}D, 4*f* ^{2}F°	2½	925934.3	0.62
4*f*	4*f* ^{2}F°	3½	925934.9	

Li III

Config.	Desig.	*J*	Level	Interval
5*p*	5*p* ^{2}P°	½	948152.2	0.2
5*s*	5*s* ^{2}S	½	948152.4	1.89
5*p*, 5*d*	5*d* ^{2}D, 5*p* ^{2}P°	1½	948154.1	0.64
5*d*, 5*f*	5*d* ^{2}D, 5*f* ^{2}F°	2½	948154.8	0.31
5*f*, 5*g*	5*g* ^{2}G, 5*f* ^{2}F°	3½	948155.1	0.19
5*g*	5*g* ^{2}G	4½	948155.3	
6s, etc.	6*s* ^{2}S, etc.	½, etc.	960223.7 to 5.5	
7s, etc.	7*s* ^{2}S, etc.	½, etc.	967502.3 to 3.5	
	∞=*Limit*	---------	**987657.8**	

February 1949.

BERYLLIUM

Be I

4 electrons $Z=4$

Ground state $1s^2\ 2s^2\ {}^1S_0$

$2s^2\ {}^1S_0$ **75192.29** cm^{-1} I. P. 9.320 volts

All but four of the terms are from the work of Paschen or Paschen and Kruger. According to Paschen no intersystem combinations have been observed. The relative positions of the singlet and triplet terms are, however, excellently determined by long series with a relative uncertainty x not exceeding ± 2 cm^{-1}.

The predicted position of the resonance line, $2s^2\ {}^1S_0 - 2p\ {}^3P^{\circ}_1$, is 4548.29 A. Paton and Nusbaum have observed a line at 4553.07 A to which they assign this classification, but their result has not been confirmed.

The term values of higher series members, calculated from the series formula but not substantiated by observation, are in brackets in the table.

Four terms are from Edlén's work: $2p^2\ {}^1D$, $3p\ {}^3P^{\circ}$, $2p^2\ {}^1S$, and $3p\ {}^3P$.

REFERENCES

R. F. Paton and R. E. Nusbaum, Phys. Rev. **33,** 1093 (A) (1929). (C L)
F. Paschen and P. G. Kruger, Ann. der Phys. [5] **8,** 1005 (1931). (T) (C L)
F. Paschen, Ann. der Phys. [5] **12,** 514 (1932). (I P) (T) (C L)
B. Edlén, Nova Acta Reg. Soc. Sci. Uppsala [IV] **9,** No. 6, 51 (1934). (T) (C L)
H. E. White, *Introduction to Atomic Spectra*, p. 179 (McGraw-Hill Book Co., Inc., New York, N. Y., 1934). (G D)
W. F. Meggers, J. Opt. Soc. Am. **36,** 431 (1946). (Summary hfs)

Be I

Config.	Desig.	J	Level	Interval
$2s^2$	$2s^2\ {}^1S$	0	0.00	
$2s(^2S)2p$	$2p\ {}^3P^{\circ}$	0	*21979.43* $+x$	
		1	*21980.11* $+x$	0.68
		2	*21982.46* $+x$	2.35
$2s(^2S)2p$	$2p\ {}^1P^{\circ}$	1	*42565.3*	
$2s(^2S)3s$	$3s\ {}^3S$	1	52082.07 $+x$	
$2s(^2S)3s$	$3s\ {}^1S$	0	54677.2	
$2p^2$	$2p^2\ {}^1D$	2	56432.5	
$2s(^2S)3p$	$3p\ {}^3P^{\circ}$	0, 1, 2	*58791.6* $+x$	
$2p^2$	$2p^2\ {}^3P$	0	59694.61 $+x$	
		1	59696.01 $+x$	1.40
		2	59698.04 $+x$	2.03

Be I

Config.	Desig.	J	Level	Interval
$2s(^2S)3p$	$3p\ {}^1P^{\circ}$	1	[*60187*]	
$2s(^2S)3d$	$3d\ {}^3D$	1, 2, 3	62054.8 $+x$	
$2s(^2S)3d$	$3d\ {}^1D$	2	64428.15	
$2s(^2S)4s$	$4s\ {}^3S$	1	64507.7 $+x$	
$2s(^2S)4s$	$4s\ {}^1S$	0	65245.4	
$2s(^2S)4p$	$4p\ {}^3P^{\circ}$	0, 1, 2	[*65949*] $+x$	
$2s(^2S)4p$	$4p\ {}^1P^{\circ}$	1	[*67228*]	
$2s(^2S)4d$	$4d\ {}^3D$	1, 2, 3	67943.6 $+x$	
$2s(^2S)4d$	$4d\ {}^1D$	2	68781.2	
$2s(^2S)5s$	$5s\ {}^3S$	1	69009.3 $+x$	

Be I—Continued

Config.	Desig.	J	Level	Interval
2s (^{2}S) 5s	5s ^{1}S	0	69322. 3	
2s (^{2}S) 5p	5p ^{3}P°	0, 1, 2	[*69634. 5*] +x	
2s (^{2}S) 5d	5d ^{3}D	1, 2, 3	70606. 7 +x	
2s (^{2}S) 5d	5d ^{1}D	2	71002. 3	
2s (^{2}S) 6s	6s ^{3}S	1	71161. 9 +x	
2s (^{2}S) 6s	6s ^{1}S	0	71320. 7	
2s (^{2}S) 6p	6p ^{3}P°	0, 1, 2	[*71482. 9*] +x	
2p^2	2p^2 ^{1}S	0	71498. 9	
2s (^{2}S) 6d	6d ^{3}D	1, 2, 3	72030. 6 +x	
2s (^{2}S) 6d	6d ^{1}D	2	72251. 1	
2s (^{2}S) 7s	7s ^{3}S	1	72355. 4 +x	
2s (^{2}S) 7s	7s ^{1}S	0	72448. 3	
2s (^{2}S) 7d	7d ^{3}D	1, 2, 3	72881. 9 +x	
2s (^{2}S) 7d	7d ^{1}D	2	73017. 2	
2s (^{2}S) 8s	8s ^{3}S	1	73089. 1 +x	
2s (^{2}S) 8s	8s ^{1}S	0	73146. 7	
2s (^{2}S) 8d	8d ^{3}D	1, 2, 3	73429. 6 +x	
2s (^{2}S) 8d	8d ^{1}D	2	73519. 7	
2s (^{2}S) 9s	9s ^{1}S	0	73608. 5	
2s (^{2}S) 9d	9d ^{3}D	1, 2, 3	73803. 2 +x	
2s (^{2}S) 9d	9d ^{1}D	2	73866. 9	
2s (^{2}S) 10s	10s ^{1}S	0	73930. 4	
2s (^{2}S) 10d	10d ^{3}D	1, 2, 3	74070. 6 +x	
2s (^{2}S) 10d	10d ^{1}D	2	74116. 7	
2s (^{2}S) 11s	11s ^{1}S	0	74163. 4	
2s (^{2}S) 11d	11d ^{3}D	1, 2, 3	74268. 6 +x	
2s (^{2}S) 11d	11d ^{1}D	2	74301. 4	
2s (^{2}S) 12d	12d ^{3}D	1, 2, 3	74416. 3 +x	
2s (^{2}S) 12d	12d ^{1}D	2	74443. 2	
Be II (^{2}S$_{½}$)	*Limit*	---------	75192. 29	
2p (^{2}P°) 3s	3s ^{3}P°	0	*85554. 96*+x	
		1	*85557. 01*+x	2. 05
		2	*85560. 93*+x	3. 92
2p (^{2}P°) 3p	3p ^{3}P	0		
		1		
		2	91901. 8 +x	
2p (^{2}P°) 3d	3d ^{3}D°	1	[*94189.51*]+x	
		2	*94190. 11*+x	0. 60
		3	*94191. 26*+x	1. 15
2p (^{2}P°) 3d	3d ^{3}P°	0	*95162. 1* +x	
		1	*95163. 1* +x	1. 0
		2	*95165. 0* +x	1. 9

May 1946.

Be I Observed Terms*

Config. 1s^2+	Observed Terms		
2s^2	2s^2 ^{1}S		
2s(^{2}S)2p	{2p ^{3}P° 2p ^{1}P°		
2p^2	{2p^2 ^{3}P 2p^2 ^{1}S 2p^2 ^{1}D		
	ns ($n \geq 3$)	*np* ($n \geq 3$)	*nd* ($n \geq 3$)
2s(^{2}S)nx	{3– 8s ^{3}S 3–11s ^{1}S	3p ^{3}P°	3–12d ^{3}D 3–12d ^{1}D
2p(^{2}P°)nx	3s ^{3}P°	3p ^{3}P	3d ^{3}P° 3d ^{3}D°

*For predicted terms in the spectra of the Be I isoelectronic sequence, see Introduction.

793829°—49——2

Be II

(Li I sequence; 3 electrons) $Z=4$

Ground state $1s^2\ 2s\ ^2S_{1/2}$

$2s\ ^2S_{1/2}$ **146881.7 cm^{-1}** I. P. 18.206 volts

The analysis has been taken from the paper by Paschen and Kruger.

REFERENCES

F. Paschen and P. G. Kruger, Ann. der Phys. [5] 8, 1014 (1931). (I P) (T) (C L)

H. E. White, *Introduction to Atomic Spectra* p. 98 (McGraw-Hill Book Co., Inc., New York, N. Y., 1934). (G D)

W. F. Meggers, J. Opt. Soc. Am. **36**, 431 (1946). (Summary hfs)

Be II

Config.	Desig.	J	Level	Interval
$2s$	$2s\ ^2S$	½	0.0	
$2p$	$2p\ ^2P^\circ$	½ 1½	*31928.8* *31935.4*	6.6
$3s$	$3s\ ^2S$	½	88231.2	
$3p$	$3p\ ^2P^\circ$	½ 1½	*96496.4* *96498.2*	1.8
$3d$	$3d\ ^2D$	1½, 2½	98053.2	
$4s$	$4s\ ^2S$	½	115465.2	
$4p$	$4p\ ^2P^\circ$	½ 1½	 *118760*	
$4d$	$4d\ ^2D$	1½, 2½	119422.2	
$4f$	$4f\ ^2F^\circ$	2½, 3½	*119444.6*	
$5s$	$5s\ ^2S$	½	127336.1	
$5p$	$5p\ ^2P^\circ$	½ 1½	 *128970.2*	
$5d$	$5d\ ^2D$	1½, 2½	129311.3	

Be II

Config.	Desig.	J	Level	Interval
$5f$	$5f\ ^2F^\circ$	2½, 3½	*129321.9*	
$6s$	$6s\ ^2S$	½	133559.1	
$6p$	$6p\ ^2P^\circ$	½ 1½	 *134485.6*	
$6d$	$6d\ ^2D$	1½, 2½	134682.0	
$6f$	$6f\ ^2F^\circ$	2½, 3½	*134688.1*	
$7s$	$7s\ ^2S$	½	137226.0	
$7p$	$7p\ ^2P^\circ$	½ 1½	 *137796*	
$7d$	$7d\ ^2D$	1½, 2½	137920.0	
$7f$	$7f\ ^2F^\circ$	2½, 3½	*137923.1*	
$8d$	$8d\ ^2D$	1½, 2½	140020.4	
Be III ($^1S_0$)	*Limit*	---------	**146881.7**	

April 1946.

Be III

(He I sequence; 2 electrons) $Z=4$

Ground state $1s^2\ ^1S_0$

$1s^2\ ^1S_0$ **1241225 ±100 cm^{-1}** I. P. 153.850 ±0.012 volts

Both Robinson and Edlén report six lines of the singlet series observed, although the earlier members have also been measured by others. The range is between 81 A and 100 A. The singlet terms have been taken from Robinson's paper.

The relative absolute values of the triplet and singlet terms have been determined by extrapolation of $3d\ ^3D$ from He I and Li II, according to Edlén, who has generously furnished his unpublished term values of the triplets. Apparently no intersystem combinations have been observed in Be III, but the existence of the observed line $1s^2\ ^1S_0-2p\ ^3P_1^\circ$ in the related spectra from B IV to Al XII, within the errors of measurement of the predicted positions, indicates that the uncertainty x is small.

REFERENCES

B. Edlén, Nova Acta Reg. Soc. Sci. Uppsala [IV] **9**, No. 6, 31 (1934). (T) (C L)

H. A. Robinson, Phys. Rev. **51**, 14 (1937). (I P) (T) (C L)

B. Edlén, unpublished material (Sept. 1947). (T)

Be III

Config.	Desig.	J	Level	Interval
$1s^2$	$1s^2\ {}^1S$	0	0	
$1s\ 2s$	$2s\ {}^3S$	1	956496+x	
$1s\ 2p$	$2p\ {}^3P^\circ$	0		
		1	*983348*+x	15
		2	*983363*+x	
$1s\ 2p$	$2p\ {}^1P^\circ$	1	*997466*	
$1s\ 3p$	$3p\ {}^1P^\circ$	1	*1132323*	
$1s\ 4p$	$4p\ {}^1P^\circ$	1	*1179830*	
$1s\ 5p$	$5p\ {}^1P^\circ$	1	*1201894*	
$1s\ 6p$	$6p\ {}^1P^\circ$	1	*1213931*	
$1s\ 7p$	$7p\ {}^1P^\circ$	1	*1221135*	
Be IV ($^2S_{1/2}$)	*Limit*	---------	**1241225**	

September 1947.

Be IV

(H sequence; 1 electron) $Z=4$

Ground state $1s\ {}^2S_{1/2}$

$1s\ {}^2S_{1/2}$ **1756004** cm^{-1} I. P. 217.657 volts

Edlén and Ericson first observed this spectrum. Tyrén has observed three, and Robinson six, members of the principal series.

The terms in the table have been calculated by J. E. Mack, who has used $R_{Be^9}=109730.623$ and $A=0.040$.

REFERENCES

B. Edlén and A. Ericson, Nature **125**, 233 (1930); **127**, 405 (1931); Zeit. Phys. **59**, 656 (1930). (C L)

H. A. Robinson, Phys. Rev. **50**, 99 (1936). (C L)

F. Tyrén, Zeit. Phys. **98**, 771 (1936). (C L)

J. E. Mack, unpublished material (1949). (I P) (T) (C L)

Be IV

Config.	Desig.	J	Level	Interval
$1s$	$1s\ {}^2S$	½	0	
$2p$	$2p\ {}^2P^\circ$	½	1316965	
$2s$	$2s\ {}^2S$	½	1316972	7
$2p$	$2p\ {}^2P^\circ$	1½	1317058	93. 5
$3p$	$3p\ {}^2P^\circ$	½	1560886	
$3s$	$3s\ {}^2S$	½	1560888	2
$3p$, $3d$	$3d\ {}^2D$, $3p\ {}^2P^\circ$	1½	1560913	27. 6
$3d$	$3d\ {}^2D$	2½	1560923	9. 2
$4p$	$4p\ {}^2P^\circ$	½	1646254	
$4s$	$4s\ {}^2S$	½	1646255	1
$4p$, $4d$	$4d\ {}^2D$, $4p\ {}^2P^\circ$	1½	1646266	11. 7
$4d$, $4f$	$4d\ {}^2D$ $4f\ {}^2F^\circ$	2½	1646270	3. 9
$4f$	$4f\ {}^2F^\circ$	3½	1646272	1. 9
$5p$	$5p\ {}^2P^\circ$	½	1685766	
$5s$	$5s\ {}^2S$	½	1685767	0. 5
$5p$, $5d$	$5d\ {}^2D$, $5p\ {}^2P^\circ$	1½	1685772	6. 0
$5d$, $5f$	$5d\ {}^2D$, $5f\ {}^2F^\circ$	2½	1685774	2. 0
$5f$, $5g$	$5g\ {}^2G$, $5f\ {}^2F^\circ$	3½	1695775	1. 0
$5g$	$5g\ {}^2G$	4½	1685776	0. 6
$6s$, etc.	$6s\ {}^2S$, etc.	½	1707229 to 234	
$7s$, etc.	$7s\ {}^2S$, etc.	½	1720170 to 173	
	∞=*Limit*	---------	**1756004**	

February 1949.

BORON

B I

5 electrons $Z=5$

Ground state $1s^2 2s^2 2p\ ^2P^\circ_{1/2}$

$2p\ ^2P^\circ_{1/2}$ ***66930*** cm^{-1} I. P. 8.296 volts

The spectrum is incompletely observed, but 34 lines have been classified in the interval between 1378 A and 2498 A. The terms for which there is an entry in the column of the table headed "Authors", are from Edlén, but a correction of 90 cm^{-1} has been added to the limit as quoted from Selwyn (66840 cm^{-1}). Whitelaw and Mack have recalculated the limit and derived the value B I $2s^2\ 2p\ ^2P^\circ_{\frac{1}{2}}$—B II $2s^2\ ^1S_0$=66930 cm^{-1}, using the ^2D series alone because of extra-configurational perturbations in the ^2S series. Selwyn averaged the limits from both the ^2S and ^2D series.

The remaining terms are from an unpublished manuscript kindly furnished by Clearman, who has extended the doublet series by further observations and confirmed the correction to the limit mentioned above. Clearman has also found two quartet terms. No intersystem combinations have been observed, as indicated by x in the table. Edlén estimates that $2p\,^2P^\circ_{1\frac{1}{2}}-2p^2\,^4P_{2\frac{1}{2}}$=28800 cm^{-1}, by analogy with the observed intersystem combinations in C II and N III. The corresponding value of $2p^2\ ^4P_{\frac{1}{2}}$ is entered in brackets in the table and has been added to all of Clearman's values of quartet terms.

REFERENCES

I. S. Bowen, Phys. Rev. **29**, 231 (1927). (T) (C L)

E. W. H. Selwyn, Proc. Phys. Soc. (London) **41**, 401 (1929). (T) (C L)

B. Edlén, Nova Acta Reg. Soc. Sci. Uppsala [IV] **9**, No. 6, 74 (1934). (T)

H. E. White, *Introduction to Atomic Spectra* p. 115 (McGraw-Hill Book Co., Inc., New York, N. Y., 1934). (G D)

N. G. Whitelaw and J. E. Mack, Phys. Rev. **47**, 677 (1935). (I P) (T)

B. Edlén, Zeit. Phys. **98**, 564 (1936). (C L)

W. Opeschowski and D. A. DeVries, Physica **6**, No. 9, 913 (1939). (I S)

W. F. Meggers, J. Opt. Soc. Am. **36**, 431 (1946). (Summary hfs)

H. E. Clearman Jr., unpublished material (Aug. 1947). (T) (C L)

B I

Authors	Config.	Desig.	*J*	Level	Interval
$2p\ ^2P_1$ $^2P_2$	$2s^2(^1S)2p$	$2p\ ^2P^\circ$	½ 1½	*0* *16*	16
  $2p'\ ^4P_3$	$2s\ 2p^2$	$2p^2\ ^4P$	½ 1½ 2½	[28805]+x 28810 +x 28816 +x	5 6
$3s\ ^2S_1$	$2s^2(^1S)3s$	$3s\ ^2S$	½	40040	
$2p'\ ^2D$	$2s\ 2p^2$	$2p^2\ ^2D$	{ 1½ 2½ }	47857	
$3d\ ^2D$	$2s^2(^1S)3d$	$3d\ ^2D$	{ 1½ 2½ }	54765	
$4s\ ^2S_1$	$2s^2(^1S)4s$	$4s\ ^2S$	½	55009	
$4d\ ^2D$	$2s^2(^1S)4d$	$4d\ ^2D$	{ 1½ 2½ }	59989	
$5s\ ^2S_1$	$2s^2(^1S)5s$	$5s\ ^2S$	½	60146	
	$2s^2(^1S)6s$	$6s\ ^2S$	½	62098	
$5d\ ^2D$	$2s^2(^1S)5d$	$5d\ ^2D$	{ 1½ 2½ }	62481	
	$2s\ 2p^2$	$2p^2\ ^2S$	½	63561	
$6d\ ^2D$	$2s^2(^1S)6d$	$6d\ ^2D$	{ 1½ 2½ }	63847	
	$2s^2(^1S)7s$	$7s\ ^2S$	½	64156	
	$2s^2(^1S)7d$	$7d\ ^2D$	{ 1½ 2½ }	64664	
	$2s^2(^1S)8d$	$8d\ ^2D$	{ 1½ 2½ }	65195	
	$2s^2(^1S)9s$	$9s\ ^2S$	½	65553	
	B II ($^1S_0$)	*Limit*	------	***66930***	
	$2s\ 2p^2$	$2p^2\ ^2P$	½ 1½	72535 72547	12
	$2p^3$	$2p^3\ ^4S^\circ$	1½	*97037*+x	

August 1947.

B I Observed Terms*

Config. $1s^2+$	Observed Terms	
$2s^2(^1S)2p$	$2p\ ^2P^\circ$	
$2s\ 2p^2$	{ $2p^2\ ^4P$ $2p^2\ ^2S$ $2p^2\ ^2P$ $2p^2\ ^2D$	
$2p^3$	$2p^3\ ^4S^\circ$	
	ns ($n\geq 3$)	*nd* ($n\geq 3$)
$2s^2(^1S)nx$	3–7s, 9s ^2S	3–8d ^2D

*For predicted terms in the spectra of the B I isoelectronic sequence, see Introduction.

B II

(Be I sequence; 4 electrons) $Z=5$

Ground state $1s^2\ 2s^2\ ^1S_0$

$2s^2\ ^1S_0$ **202895** cm^{-1} I. P. 25.149 volts

The terms are from Edlén, who remarks that the observed series, especially in the singlet system, are too short for the precise determination of the limits. By analogy with Be I, C III, and N IV, he interpolates the value of $2s^2\ ^1S_0-2p\ ^3P_1^\circ$ as 37340 cm^{-1}, which places the limit $2s^2\ ^1S_0$ at 202895.0 cm^{-1}. The absolute values of the singlet terms as published in Edlén's Monograph have therefore been increased by 249 cm^{-1}. The relative uncertainty x is probably less than this. No intersystem combinations have been observed.

An extrapolated value of $3s\ ^1S_0$ is given in brackets.

B II—Continued

REFERENCES

B. Edlén, Nova Acta Reg. Soc. Sci. Uppsala [IV] **9**, No. 6, 51 (1934). (T) (C L)
B. Edlén, Zeit. Phys. **98**, 561 (1936). (I P) (C L)

B II

Edlén	Config.	Desig.	J	Level	Interval
$2s\ ^1S_0$	$2s^2$	$2s^2\ ^1S$	0	0.0	
$2p\ ^3P_0$ $^3P_1$ $^3P_2$	$2s(^2S)2p$	$2p\ ^3P^\circ$	0 1 2	*37333.6+x* *37340.0+x* *37356.4+x*	6.4 16.4
$2p\ ^1P_1$	$2s(^2S)2p$	$2p\ ^1P^\circ$	1	*73396.7*	
$2p'\ ^3P_0$ $^3P_1$ $^3P_2$	$2p^2$	$2p^2\ ^3P$	0 1 2	98910.3+x 98918.7+x 98932.7+x	8.4 14.0
$2p'\ ^1D_2$	$2p^2$	$2p^2\ ^1D$	2	102362.1	
$2p'\ ^1S_0$	$2p^2$	$2p^2\ ^1S$	0	127662.0	
$3s\ ^3S_1$	$2s(^2S)3s$	$3s\ ^3S$	1	129772.9+x	
$3s\ ^1S_0$	$2s(^2S)3s$	$3s\ ^1S$	0	[135946]	
$3p\ ^3P_{01}$ $^3P_2$	$2s(^2S)3p$	$3p\ ^3P^\circ$	0, 1 2	*143989.7+x* *143993.4+x*	3.7
$3p\ ^1P_1$	$2s(^2S)3p$	$3p\ ^1P^\circ$	1	*144102.0*	
$3d\ ^3D$	$2s(^2S)3d$	$3d\ ^3D$	1, 2, 3	150649.0+x	
$3d\ ^1D_2$	$2s(^2S)3d$	$3d\ ^1D$	2	154686.9	
$4s\ ^3S_1$	$2s(^2S)4s$	$4s\ ^3S$	1	166344.4+x	
$4s\ ^1S_0$	$2s(^2S)4s$	$4s\ ^1S$	0	167934.2	

B II

Edlén	Config.	Desig.	J	Level	Interval
$4p\ ^3P$	$2s(^2S)4p$	$4p\ ^3P^\circ$	0, 1, 2	*171544.7+x*	
$4d\ ^3D$	$2s(^2S)4d$	$4d\ ^3D$	1, 2, 3	174072.6+x	
$4f\ ^3F$	$2s(^2S)4f$	$4f\ ^3F^\circ$	2, 3, 4	*174902.5+x*	
$4f\ ^1F_3$	$2s(^2S)4f$	$4f\ ^1F^\circ$	3	*174921.5*	
$4d\ ^1D_2$	$2s(^2S)4d$	$4d\ ^1D$	2	175546.0	
$5s\ ^3S_1$	$2s(^2S)5s$	$5s\ ^3S$	1	180896.5+x	
$3s'\ ^3P_0$ $^3P_1$ $^3P_2$	$2p(^2P^\circ)3s$	$3s\ ^3P^\circ$	0 1 2	*181645.2+x* *181655.0+x* *181675.9+x*	9.8 20.9
$5d\ ^3D$	$2s(^2S)5d$	$5d\ ^3D$	1, 2, 3	184633.1+x	
$5f\ ^3F$	$2s(^2S)5f$	$5f\ ^3F^\circ$	2, 3, 4	*184908.2+x*	
$3p'\ ^1P_1$	$2p(^2P^\circ)3p$	$3p\ ^1P$	1	189126.6	
$3d'\ ^3F_{23}$ $^3F_4$	$2p(^2P^\circ)3d$	$3d\ ^3F^\circ$	2, 3 4	*194748? +x* *194760? +x*	12
$3d'\ ^1D_2$	$2p(^2P^\circ)3d$	$3d\ ^1D^\circ$	2	*197721.0*	
$3d'\ ^3D$	$2p(^2P^\circ)3d$	$3d\ ^3D^\circ$	1, 2, 3	*200484.6+x*	
	B III ($^2S_{1/2}$)	*Limit*		**202895**	

May 1946.

B II Observed Terms*

Config. $1s^2+$	Observed Terms			
$2s^2$	$2s^2\ ^1S$			
$2s(^2S)2p$	$2p\ ^3P^\circ$ $2p\ ^1P^\circ$			
$2p^2$	$2p^2\ ^3P$ $2p^2\ ^1S$ $2p^2\ ^1D$			
	ns ($n\geq 3$)	np ($n\geq 3$)	nd ($n\geq 3$)	nf ($n\geq 4$)
$2s(^2S)nx$	3–5$s\ ^3S$ $4s\ ^1S$	3, $4p\ ^3P^\circ$ $3p\ ^1P^\circ$	3–5$d\ ^3D$ 3, $4d\ ^1D$	4, $5f\ ^3F^\circ$ $4f\ ^1F^\circ$
$2p(^2P^\circ)nx$	$3s\ ^3P^\circ$	$3p\ ^1P$	$3d\ ^3D^\circ$ $3d\ ^3F^\circ$ $3d\ ^1D^\circ$	

*For predicted terms in the spectra of the Be I isoelectronic sequence, see Introduction.

B III

(Li I sequence; 3 electrons) $Z=5$

Ground state $1s^2\,2s\ ^2S_{½}$

$2s\ ^2S_{½}$ **305931.1** cm^{-1} I. P. 37.920 volts

The terms are from Edlén. The absolute values are based on the assumption that n^* for $5g\ ^2G$ equals that of the corresponding term in C IV, where $5g\ ^2G-6h\ ^2H^{\circ}$ has been observed. The precision of this term in B III is estimated to be within ± 1 cm^{-1}. The series are well represented by a Ritz formula.

Edlén gives four extrapolated term intervals, which are entered in brackets in the table.

REFERENCES

A. Ericson and B. Edlén, Zeit. Phys. **59**, 676 (1930). (T) (C L)

B. Edlén, Nova Acta Reg. Soc. Sci. Uppsala [IV] **9**, No. 6, 37 (1934). (I P) (T) (C L) (G D)

B III

Edlén	Config.	Desig.	J	Level	Interval
$2s\ ^2S_1$	$2s$	$2s\ ^2S$	½	0.0	
$2p\ ^2P_1$ $^2P_2$	$2p$	$2p\ ^2P^{\circ}$	½ 1½	*48358.5* *48392.6*	34.1
$3s\ ^2S_1$	$3s$	$3s\ ^2S$	½	180201.8	
$3p\ ^2P_1$ $^2P_2$	$3p$	$3p\ ^2P^{\circ}$	½ 1½	*192949.2* *192959.4*	10.2
$3d\ ^2D_3$	$3d$	$3d\ ^2D$	1½ 2½	196071.2	[3.4]
$4s\ ^2S_1$	$4s$	$4s\ ^2S$	½	237695.5	
$4p\ ^2P_2$	$4p$	$4p\ ^2P^{\circ}$	½ 1½	*242832.4*	[4.3]
$4d\ ^2D_3$	$4d$	$4d\ ^2D$	1½ 2½	244138.9	[1.4]
$4f\ ^2F$	$4f$	$4f\ ^2F^{\circ}$	{ 2½ 3½ }	*244199.2*	
$5s\ ^2S_1$	$5s$	$5s\ ^2S$	½	263156.2	

B III

Edlén	Config.	Desig.	J	Level	Interval
$5p\ ^2P_2$	$5p$	$5p\ ^2P^{\circ}$	½ 1½	*265719.7*	[2.2]
$5d\ ^2D_3$	$5d$	$5d\ ^2D$	1½ 2½	266389.5	
$5f\ ^2F$	$5f$	$5f\ ^2F^{\circ}$	{ 2½ 3½ }	*266416.5*	
$5g\ ^2G$	$5g$	$5g\ ^2G$	{ 3½ 4½ }	266427.2	
$6d\ ^2D_3$	$6d$	$6d\ ^2D$	1½ 2½	278473.7	
$6f\ ^2F$	$6f$	$6f\ ^2F^{\circ}$	{ 2½ 3½ }	*278491.7*	
$6g\ ^2G$	$6g$	$6g\ ^2G$	{ 3½ 4½ }	278497.5	
	B IV ($^1S_0$)	*Limit*	------	**305931.1**	

April 1946.

B IV

(He I sequence; 2 electrons) $Z=5$

Ground state $1s^2\ ^1S_0$

$1s^2\ ^1S_0$ **2091960±200** cm^{-1} I. P. 259.298±0.025 volts

The singlet terms are from Tyrén and the observed singlet combinations are in the range from 48 to 60 A. The unit adopted by Tyrén, 10^3 cm^{-1}, has here been changed to cm^{-1}.

Relative absolute values of the triplet terms were derived by the extrapolation of $3d\ ^3D$ from He I and Li II, according to unpublished material generously furnished by Dr. Edlén. These calculations have confirmed the classification by Tyrén of a line at 61 A as the intersystem combination $1s^2\ ^1S_0-2p\ ^3P^{\circ}_1$. The triplet terms have been taken from Edlén's 1947 manuscript.

B IV—Continued

REFERENCES

B. Edlén, Nova Acta Reg. Soc. Sci. Uppsala [IV] **9**, No. 6, 31 (1934). (T) (C L)
H. A. Robinson, Phys. Rev. **51**, 14 (1937). (I P) (T) (C L)
F. Tyrén, Nova Acta Reg. Soc. Sci. Uppsala [IV] **12**, No. 1, 24 (1940). (I P) (T) (C L)
B. Edlén, unpublished material (Sept. 1947). (T)

B IV

Config.	Desig.	*J*	Level	Interval
$1s^2$	$1s^2\ {}^1S$	0	0	
$1s\,2s$	$2s\ {}^3S$	1	1601505	
$1s\,2p$	$2p\ {}^3P^\circ$	0	*1636898*	−16
		1	*1636882*	52
		2	*1636934*	
$1s\,2p$	$2p\ {}^1P^\circ$	1	*1658020*	
$1s\,3p$	$3p\ {}^1P^\circ$	1	*1898180*	
$1s\,4p$	$4p\ {}^1P^\circ$	1	*1982750*	
$1s\,5p$	$5p\ {}^1P^\circ$	1	*2022000*	
$1s\,6p$	$6p\ {}^1P^\circ$	1	*2043360*	
B v ($^2S_{1/2}$)	*Limit*	---------	**2091960**	

September 1947.

B V

(H sequence; 1 electron) $Z=5$

Ground state $1s\ {}^2S_{1/2}$

$1s\ {}^2S_{1/2}$ **2744063** cm^{-1} I. P. 340.127volts

Edlén first observed the Lyman line. Tyrén has observed three members of the series. The listed term values have been calculated by J. E. Mack for B^{11}v, "using $R_B{}^{11}=109731.835$ and $\Lambda=0.040$; a change of 1 percent in Λ would change the series limit by 1.46 cm^{-1}. For B^{10} the series limit is less by 13.6 cm^{-1} than for B^{11}."

REFERENCES

B. Edlén, Nova Acta Reg. Soc. Sci. Uppsala [IV] **9**, No. 6, 28, 152 (1934). (T) (C L)
F. Tyrén, Zeit. Phys. **98**, 771 (1936). (C L)
J. E. Mack, unpublished material (1949). (I P) (T) (C L)

B V

Config.	Desig.	*J*	Level	Interval
$1s$	$1s\ {}^2S$	½	0	
$2p$	$2p\ {}^2P^\circ$	½	2057954	18
$2s$	$2s\ {}^2S$	½	2057972	228.3
$2p$	$2p\ {}^2P^\circ$	1½	2058182	
$3p$	$3p\ {}^2P^\circ$	½	2439151	5
$3s$	$3s\ {}^2S$	½	2439156	67.6
$3p$, $3d$	$3d\ {}^2D$, $3p\ {}^2P^\circ$	1½	2439218	22.6
$3d$	$3d\ {}^2D$	2½	2439241	
$4p$	$4p\ {}^2P^\circ$	½	2572561	2
$4s$	$4s\ {}^2S$	½	2572563	28.5
$4p$, $4d$	$4d\ {}^2D$, $4p\ {}^2P^\circ$	1½	2572589	9.5
$4d$, $4f$	$4d\ {}^2D$, $4f\ {}^2F^\circ$	2½	2572599	4.8
$4f$	$4f\ {}^2F^\circ$	3½	2572603	
$5s$	$5s\ {}^2S$, etc.	½, etc,	2634306 to 330	
	∞=*Limit*	---------	**2744063**	

February 1949.

CARBON

C I

6 electrons $Z=6$

Ground state $1s^2\ 2s^2\ 2p^2\ {}^3P_0$

$2p^2\ {}^3P_0$ **90878.3** cm^{-1} I. P. 11.264 volts

The term assignments are taken from Edlén, who has revised and extended the earlier work on the analysis of this spectrum. Two extrapolated term values, derived from the irregular doublet law, are entered in brackets in the table.

The singlet and triplet terms are well connected by intersystem combinations. Only two quintet terms are known. They are connected with the rest by intersystem combinations based on the measures of the resonance lines by Shenstone.

One term, $5p\ {}^1S$, has been revised as suggested in the 1939 reference listed below.

Selected term values of C I have been improved from a study of the lines that have been clearly identified in the Infrared Solar Spectrum. Such precision cannot be expected from terms based on lines in the ultraviolet. As a starting point the value of $3s\ {}^3P_1^\circ=60353.00\ cm^{-1}$ was adopted as correct, to agree with Shenstone's recent measures. Excellent agreement was found between the laboratory measures of Kiess (8335 A to 11330 A) and solar wave-numbers of lines identified as C I in the solar spectrum. Further to the red solar wavelengths surpass laboratory values in accuracy and give consistent internal separations within the multiplets.

In the course of this work all term values have been recalculated. Consequently, most of the listed values differ slightly from those published by Edlén. No changes have been made in his analysis, but the level $3d\ {}^3P_0^\circ$, calculated from solar wave-numbers, has been added to his list.

REFERENCES

A. Fowler and E. W. H. Selwyn, Proc. Roy. Soc. (London) [A] **118**, 34 (1928). (T) (C L)

S. B. Ingram, Phys. Rev. **34**, 421 (1929). (T) (C L)

F. Paschen and G. Kruger, Ann. der Phys. [5] **7**, 1 (1930). (T) (C L)

B. Edlén, Nova Acta Reg. Soc. Sci. Uppsala [IV] **9**, No. 6, 104 (1934). (I P) (T) (C L)

H. E. White, *Introduction to Atomic Spectra* p. 266 (McGraw-Hill Book Co., Inc., New York, N. Y., 1934). (G D)

C. C. Kiess, J. Research Nat. Bur. Std. **20**, 33, RP1062 (1938). (C L)

W. F. Meggers, J. Opt. Soc. Am. **36**, 431 (1936). (Summary hfs)

Y. Ishida, T. Tamura, and M. Fukushima, Sci. Papers Inst. Phys. Chem. Research (Tokyo) **36**, No. 936, 417 (1939). (T) (C L)

H. D. Babcock and C. E. Moore, Carnegie Inst. Wash. Publ. 579 (1947). (Solar data)

B. Edlén, Nature **159**, No. 4030, 129 (1947). (C L)

A. G. Shenstone, Phys. Rev. **72**, 411 (1947). (T) (C L)

C I

Edlén	Config.	Desig.	J	Level	Interval
$2p\ ^3P_0$	$2s^2\ 2p^2$	$2p^2\ ^3P$	0	0.0	16.4
$^3P_1$			1	16.4	27.1
$^3P_2$			2	43.5	
$2p\ ^1D_2$	$2s^2\ 2p^2$	$2p^2\ ^1D$	2	10193.70	
$2p^1\ S_0$	$2s^2\ 2p^2$	$2p^2\ ^1S$	0	21648.4	
	$2s\ 2p^3$	$2p^3\ ^5S^\circ$	2	*33735.2*	
$3s\ ^3P_0$	$2s^2\ 2p(^2P^\circ)3s$	$3s\ ^3P^\circ$	0	*60333.80*	19.20
$^3P_1$			1	*60353.00*	40.52
$^3P_2$			2	*60393.52*	
$3s\ ^1P_1$	$2s^2\ 2p(^2P^\circ)3s$	$3s\ ^1P^\circ$	1	*61982.20*	
$2p'\ ^3D_3$	$2s\ 2p^3$	$2p^3\ ^3D^\circ$	3	*64088.56*	−4.63
$^3D_2$			2	*64093.19*	1.18
$^3D_1$			1	*64092.01*	
$3p\ ^1P_1$	$2s^2\ 2p(^2P^\circ)3p$	$3p\ ^1P$	1	68858	
$3p\ ^3D_1$	$2s^2\ 2p(^2P^\circ)3p$	$3p\ ^3D$	1	69689.79	21.20
$^3D_2$			2	69710.99	33.41
$^3D_3$			3	69744.40	
$3p\ ^3S_1$	$2s^2\ 2p(^2P^\circ)3p$	$3p\ ^3S$	1	70744.26	
$3p\ ^3P_0$	$2s^2\ 2p(^2P^\circ)3p$	$3p\ ^3P$	0	71352.81	12.42
$^3P_1$			1	71365.23	20.47
$^3P_2$			2	71385.70	
$3p\ ^1D_2$	$2s^2\ 2p(^2P^\circ)3p$	$3p\ ^1D$	2	72611.06	
$3p\ ^1S_0$	$2s^2\ 2p(^2P^\circ)3p$	$3p\ ^1S$	0	73976.23	
$2p'\ ^3P$	$2s\ 2p^3$	$2p^3\ ^3P^\circ$	2, 1, 0	*75256.3*	
$3d\ ^1D_2$	$2s^2\ 2p(^2P^\circ)3d$	$3d\ ^1D^\circ$	2	*77680.5*	
$4s\ ^3P_0$	$2s^2\ 2p(^2P^\circ)4s$	$4s\ ^3P^\circ$	0	*78105.23*	11.83
$^3P_1$			1	*78117.06*	31.30
$^3P_2$			2	*78148.36*	
$3d\ ^3F_2$	$2s^2\ 2p(^2P^\circ)3d$	$3d\ ^3F^\circ$	2	*78199.34*	16.48
$^3F_3$			3	*78215.82*	34.40
$^3F_4$			4	*78250.22*	
$3d\ ^3D_1$	$2s^2\ 2p(^2P^\circ)3d$	$3d\ ^3D^\circ$	1	*78300.8*	6
$^3D_2$			2	*78307*	9
$^3D_3$			3	*78316*	
$4s\ ^1P_1$	$2s^2\ 2p(^2P^\circ)4s$	$4s\ ^1P^\circ$	1	*78338*	
$3d\ ^1F_3$	$2s^2\ 2p(^2P^\circ)3d$	$3d\ ^1F^\circ$	3	*78531*	
$3d\ ^1P_1$	$2s^2\ 2p(^2P^\circ)3d$	$3d\ ^1P^\circ$	1	*78727.91*	
$3d\ ^3P_2$	$2s^2\ 2p(^2P^\circ)3d$	$3d\ ^3P^\circ$	2	*79311.10*	−7.96
$^3P_1$			1	*79319.06*	−4.26
			0	*79323.32*	
$4p\ ^3D_1$	$2s^2\ 2p(^2P^\circ)4p$	$4p\ ^3D$	1	80173.29	19.20
$^3D_2$			2	80192.49	30.25
$^3D_3$			3	80222.74	
$4p\ ^1P_1$	$2s^2\ 2p(^2P^\circ)4p$	$4p\ ^1P$	1	80563.57	
$4p\ ^3S_1$	$2s^2\ 2p(^2P^\circ)4p$	$4p\ ^3S$	1	81105.70	
$4p\ ^3P_0$	$2s^2\ 2p(^2P^\circ)4p$	$4p\ ^3P$	0	81311.52	14.81
$^3P_1$			1	81326.33	18.15
$^3P_2$			2	81344.48	
$4p\ ^1D_2$	$2s^2\ 2p(^2P^\circ)4p$	$4p\ ^1D$	2	81770.36	
$4p\ ^1S_0$	$2s^2\ 2p(^2P^\circ)4p$	$4p\ ^1S$	0	82252.31	

C I

Edlén	Config.	Desig.	J	Level	Interval
$4d\ ^1D_2$	$2s^2\ 2p(^2P^\circ)4d$	$4d\ ^1D^\circ$	2	*83500*	
	$2s^2\ 2p(^2P^\circ)4d$	$4d\ ^3F^\circ$	2		
$4d\ ^3F_3$			3	*83761*	
			4		
$4d\ ^3D_1$	$2s^2\ 2p(^2P^\circ)4d$	$4d\ ^3D^\circ$	1	*83830*	7
$^3D_2$			2	*83837*	10
$^3D_3$			3	*83847*	
$5s\ ^1P_1$	$2s^2\ 2p(^2P^\circ)5s$	$5s\ ^1P^\circ$	1	*83882.5*	
$4d\ ^1F_3$	$2s^2\ 2p(^2P^\circ)4d$	$4d\ ^1F^\circ$	3	*83949*	
$4d\ ^1P_1$	$2s^2\ 2p(^2P^\circ)4d$	$4d\ ^1P^\circ$	1	*84032*	
$4d\ ^3P_2$	$2s^2\ 2p(^2P^\circ)4d$	$4d\ ^3P^\circ$	2	*84102.6*	−9
$^3P_1$			1	*84112*	
$^3P_0$			0		
$5p\ ^1P_1$	$2s^2\ 2p(^2P^\circ)5p$	$5p\ ^1P$	1	84852.13	
	$2s^2\ 2p(^2P^\circ)5p$	$5p\ ^3D$	1		
$5p\ ^3D_2$			2	84952	34
$^3D_3$			3	84986.2	
$5p\ ^1D_2$	$2s^2\ 2p(^2P^\circ)5p$	$5p\ ^1D$	2	85400.38	
$5p\ ^1S_0$	$2s^2\ 2p(^2P^\circ)5p$	$5p\ ^1S$	0	85625.84	
$5d\ ^1D_2$	$2s^2\ 2p(^2P^\circ)5d$	$5d\ ^1D^\circ$	2	*86187*	
$5d\ ^3F_2$	$2s^2\ 2p(^2P^\circ)5d$	$5d\ ^3F^\circ$	2	*86319*	8
$^3F_3$			3	*86326.9*	
			4		
	$2s^2\ 2p(^2P^\circ)5d$	$5d\ ^3D^\circ$	1		
$5d\ ^3D_2$			2	*86371.3*	25
$^3D_3$			3	*86396*	
$6s\ ^1P_1$	$2s^2\ 2p(^2P^\circ)6s$	$6s\ ^1P^\circ$	1	*86413.96*	
$5d\ ^1F_3$	$2s^2\ 2p(^2P^\circ)5d$	$5d\ ^1F^\circ$	3	*86450*	
$5d\ ^1P_1$	$2s^2\ 2p(^2P^\circ)5d$	$5d\ ^1P^\circ$	1	*86491*	
$5d\ ^3P_2$	$2s^2\ 2p(^2P^\circ)5d$	$5d\ ^3P^\circ$	2	*86504*	−13
$^3P_1$			1	*86517*	
			0		
$6d\ ^1D_2$	$2s^2\ 2p(^2P^\circ)6d$	$6d\ ^1D^\circ$	2	*87632*	
$6d\ ^3F_2$	$2s^2\ 2p(^2P^\circ)6d$	$6d\ ^3F^\circ$	2	*87706*	7
$^3F_3$			3	*87713*	
			4		
	$2s^2\ 2p(^2P^\circ)6d$	$6d\ ^3D^\circ$	1		
$6d\ ^3D_2$			2	*87752*	21
$^3D_3$			3	*87773*	
$7s\ ^1P_1$	$2s^2\ 2p(^2P^\circ)7s$	$7s\ ^1P^\circ$	1	*87795.3*	
$6d\ ^1F_3$	$2s^2\ 2p(^2P^\circ)6d$	$6d\ ^1F^\circ$	3	*87807*	
$6d\ ^3P_2$	$2s^2\ 2p(^2P^\circ)6d$	$6d\ ^3P^\circ$	2	*87830*	−9
$^3P_1$			1	*87839*	
			0		
$6d\ ^1P_1$	$2s^2\ 2p(^2P^\circ)6d$	$6d\ ^1P^\circ$	1	*87831.3*	
$7d\ ^3F_2$	$2s^2\ 2p(^2P^\circ)7d$	$7d\ ^3F^\circ$	2	*88541.8*	5
$^3F_3$			3	*88547*	
$^3F_4$			4		
	$2s^2\ 2p(^2P^\circ)7d$	$7d\ ^3D^\circ$	1		
			2		
$7d\ ^3D_3$			3	*88607*	

C I—Continued

Edlén	Config.	Desig.	J	Level	Interval
$7d\ ^1F_3$	$2s^2\,2p(^2P^\circ)7d$	$7d\ ^1F^\circ$	3	*88624*	
$7d\ ^1P_1$	$2s^2\,2p(^2P^\circ)7d$	$7d\ ^1P^\circ$	1	*88632.44*	
$7d\ ^3P_2$	$2s^2\,2p(^2P^\circ)7d$	$7d\ ^3P^\circ$	2 1 0	*88639*	
	$2s^2\,2p(^2P^\circ)8d$	$8d\ ^3F^\circ$	4		
$8d\ ^3F_3$ $^3F_2$			3 2	*89081* *89082*	−1
	$2s^2\,2p(^2P^\circ)8d$	$8d\ ^3D^\circ$	1 2		
$8d\ ^3D_3$			3	*89146*	
$8d\ ^1F_3$	$2s^2\,2p(^2P^\circ)8d$	$8d\ ^1F^\circ$	3	*89155*	
$8d\ ^3P_2$	$2s^2\,2p(^2P^\circ)8d$	$8d\ ^3P^\circ$	2 1 0	*89158*	
	$2s^2\,2p(^2P^\circ)9d$	$9d\ ^3F^\circ$	4 3		
$9d\ ^3F_2$			2	*89450*	

C I—Continued

Edlén	Config.	Desig.	J	Level	Interval
	$2s^2\,2p(^2P^\circ)9d$	$9d\ ^3D^\circ$	1 2		
$9d\ ^3D_3$			3	*89514*	
$9d\ ^1F_3$	$2s^2\,2p(^2P^\circ)9d$	$9d\ ^1F^\circ$	3	*89517*	
	$2s^2\,2p(^2P^\circ)10d$	$10d\ ^3D^\circ$	1 2		
$10d\ ^3D_3$			3	*89779*	
	$2s^2\,2p(^2P^\circ)11d$	$11d\ ^3D^\circ$	1 2		
$11d\ ^3D_3$			3	*89968.4*	
	C II ($^2P^\circ_{1/2}$)	*Limit*	------	**90878.3**	
$2p'\ ^1D_2$	$2s\,2p^3$	$2p^3\ ^1D^\circ$	2	[*97878*]	
	$2s\,2p^2(^4P)3s$	$3s\ ^5P$	1 2 3	103541.8 103562.5 103587.3	20.7 24.8
$2p'\ ^3S_1$	$2s\,2p^3$	$2p^3\ ^3S^\circ$	1	*105800.5*	
$2p'\ ^1P_1$	$2s\,2p^3$	$2p^3\ ^1P^\circ$	1	[*119878*]	

September 1947.

C I Observed Terms*

Config. $1s^2+$	Observed Terms		
$2s^2\,2p^2$	$2p^2\ ^1S$, $2p^2\ ^3P$, $2p^2\ ^1D$		
$2s\,2p^3$	$2p^3\ ^5S^\circ$ $2p^3\ ^3S^\circ$, $2p^3\ ^3P^\circ$, $2p^3\ ^3D^\circ$		
	ns ($n \geq 3$)	np ($n \geq 3$)	nd ($n \geq 3$)
$2s^2\,2p(^2P^\circ)nx$	3, $4s\ ^3P^\circ$ 3–$7s\ ^1P^\circ$	3, $4p\ ^3S$ 3, $4p\ ^3P$ 3–$5p\ ^3D$ 3–$5p\ ^1S$ 3–$5p\ ^1P$ 3–$5p\ ^1D$	3–$8d\ ^3P^\circ$ 3–$11d\ ^3D^\circ$ 3–$9d\ ^3F^\circ$ 3–$7d\ ^1P^\circ$ 3–$6d\ ^1D^\circ$ 3–$9d\ ^1F^\circ$
$2s\,2p^2(^4P)nx$	$3s\ ^5P$		

*For predicted terms in the spectra of the C I isoelectronic sequence, see Introduction.

C II

(B I sequence; 5 electrons) $Z=6$

Ground state $1s^2\,2s^2\,2p\ ^2P^\circ_{\frac{1}{2}}$

$2p\ ^2P^\circ_{\frac{1}{2}}$ ***196659.0*** cm^{-1} I. P. 24.376 volts

The term values for the doublets are taken from Edlén's Monograph. He has since rejected his $5p'\ ^2D$ term. Intersystem combinations have been observed by Edlén (1936) and the resulting correction to the quartet terms as published in his Monograph, $+19.3\ cm^{-1}$, has been applied.

REFERENCES

A. Fowler and E. W. H. Selwyn, Proc. Roy. Soc. (London) [A] **120**, 312 (1928). (T) (C L)
B. Edlén, Nova Acta Reg. Soc. Sci. Uppsala [IV] **9**, No. 6, 74 (1934). (I P) (T) (C L) (G D)
B. Edlén, Zeit. Phys. **98**, 561 (1936). (C L)
B. Eldén, private communication (Dec. 1947). (T)

C II

Edlén	Config.	Desig.	J	Level	Interval
$2p\ ^2P_1$	$2s^2(^1S)2p$	$2p\ ^2P^\circ$	½	*0.0*	64.0
$^2P_2$			1½	*64.0*	
$2p'\ ^4P_1$	$2s\ 2p^2$	$2p^2\ ^4P$	½	43000.2	21.6
$^4P_2$			1½	43021.8	28.9
$^4P_3$			2½	43050.7	
$2p'\ ^2D_3$	$2s\ 2p^2$	$2p^2\ ^2D$	2½	74930.9	−2.3
$^2D_2$			1½	74933.2	
$2p'\ ^2S_1$	$2s\ 2p^2$	$2p^2\ ^2S$	½	96494.1	
$2p'\ ^2P_1$	$2s\ 2p^2$	$2p^2\ ^2P$	½	110625.1	41.2
$^2P_2$			1½	110666.3	
$3s\ ^2S_1$	$2s^2(^1S)3s$	$3s\ ^2S$	½	116537.88	
$3p\ ^2P_1$	$2s^2(^1S)3p$	$3p\ ^2P^\circ$	½	*131724.68*	11.13
$^2P_2$			1½	*131735.81*	
$2p''\ ^4S_2$	$2p^3$	$2p^3\ ^4S^\circ$	1½	*142024.4*	
$3d\ ^2D_2$	$2s^2\ (^1S)3d$	$3d\ ^2D$	1½	145549.99	1.45
$^2D_3$			2½	145551.44	
$2p''\ ^2D_3$	$2p^3$	$2p^3\ ^2D^\circ$	2½	*150462.8*	−5.1
$^2D_2$			1½	*150467.9*	
$4s\ ^2S_1$	$2s^2(^1S)4s$	$4s\ ^2S$	½	157234.43	
$4p\ ^2P_1$	$2s^2(^1S)4p$	$4p\ ^2P^\circ$	½	*162518.70*	5.92
$^2P_2$			1½	*162524.62*	
$3s'\ ^4P_1$	$2s\ 2p(^3P^\circ)3s$	$3s\ ^4P^\circ$	½	*166964.70*	23.76
$^4P_2$			1½	*166988.46*	44.97
$^4P_3$			2½	*167033.43*	
$4d\ ^2D_2$	$2s^2(^1S)4d$	$4d\ ^2D$	1½	168123.92	0.41
$^2D_3$			2½	168124.33	
$2p''\ ^2P_1$	$2p^3$	$2p^3\ ^2P^\circ$	½	*168731.6*	18.6
$^2P_2$			1½	*168750.2*	
$4f\ ^2F$	$2s^2(^1S)4f$	$4f\ ^2F^\circ$	{2½, 3½}	*168979.05*	
$5s\ ^2S_1$	$2s^2(^1S)5s$	$5s\ ^2S$	½	173348.18	
$5p\ ^2P_1$	$2s^2(^1S)5p$	$5p\ ^2P^\circ$	½	*175287.9*	7.3
$^2P_2$			1½	*175295.2*	
$3s'\ ^2P_1$	$2s\ 2p(^3P^\circ)3s$	$3s\ ^2P^\circ$	½	*178194.1*	26.7
$^2P_2$			1½	*178220.8*	
	$2s^2(^1S)5d$	$5d\ ^2D$	1½		
$5d\ ^2D_3$			2½	178494.8	
$5f\ ^2F$	$2s^2(^1S)5f$	$5f\ ^2F^\circ$	{2½, 3½}	*178956.46*	
$6s\ ^2S_1$	$2s^2(^1S)6s$	$6s\ ^2S$	½	181258	
$3p'\ ^4D_1$	$2s\ 2p(^3P^\circ)3p$	$3p\ ^4D$	½	181694.50	14.70
$^4D_2$			1½	181709.20	25.01
$^4D_3$			2½	181734.21	36.27
$^4D_4$			3½	181770.48	
$3p'\ ^2P_1$	$2s\ 2p(^3P^\circ)3p$	$3p\ ^2P$	½	182025.0	19.5
$^2P_2$			1½	182044.5	
	$2s^2(^1S)6d$	$6d\ ^2D$	1½		
$6d\ ^2D_3$			2½	184064.9	
$6f\ ^2F$	$2s^2(^1S)6f$	$6f\ ^2F^\circ$	{2½, 3½}	*184376.20*	
$3p'\ ^4S_2$	$2s\ 2p(^3P^\circ)3p$	$3p\ ^4S$	1½	184688.69	
$3p'\ ^4P_1$	$2s\ 2p(^3P^\circ)3p$	$3p\ ^4P$	½	186425.02	16.30
$^4P_2$			1½	186441.32	22.43
$^4P_3$			2½	186463.75	
$3p'\ ^2D_2$	$2s\ 2p(^3P^\circ)3p$	$3p\ ^2D$	1½	188579.3	33.4
$^2D_3$			2½	188612.7	
$3p'\ ^2S_1$	$2s\ 2p(^3P^\circ)3p$	$3p\ ^2S$	½	194571.9	
$3d'\ ^4F_2$	$2s\ 2p(^3P^\circ)3d$	$3d\ ^4F^\circ$	1½	*195750.8*	14.3
$^4F_3$			2½	*195765.1*	19.6
$^4F_4$			3½	*195784.7*	27.6
$^4F_5$			4½	*195812.3*	

C II—Continued

Edlén	Config.	Desig.*	J	Level	Interval
$3d'\ {}^4D_1$	$2s\ 2p(^3P^\circ)3d$	$3d\ {}^4D^\circ$	½	*196556.2*	
${}^4D_2$			1½	*196561.8*	5.6
${}^4D_3$			2½	*196570.5*	8.7
${}^4D_4$			3½	*196580.8*	10.3
	C III ($^1S_0$)	*Limit*	------	***196659.0***	
$3d'\ {}^2D_2$	$2s\ 2p(^3P^\circ)3d$	$3d\ {}^2D^\circ$	1½	*198426.4*	
${}^3D_3$			2½	*198437.2*	10.8
$3d'\ {}^4P_3$	$2s\ 2p(^3P^\circ)3d$	$3d\ {}^4P^\circ$	2½	*198842.0*	
${}^4P_2$			1½	*198863.5*	−21.5
${}^4P_1$			½	*198877.7*	−14.2
$3d'\ {}^2F_3$	$2s\ 2p(^3P^\circ)3d$	$3d\ {}^2F^\circ$	2½	*199941.4*	
${}^2F_4$			3½	*199984.2*	42.8
$3d'\ {}^2P_2$	$2s\ 2p(^3P^\circ)3d$	$3d\ {}^2P^\circ$	1½	*202180.3*	
${}^2P_1$			½	*202204.4*	−24.1
$4s'\ {}^4P_1$	$2s\ 2p(^3P^\circ)4s$	$4s\ {}^4P^\circ$	½	*209550.26*	
${}^4P_2$			1½	*209574.28*	24.02
${}^4P_3$			2½	*209620.36*	46.08
$4p'\ {}^2P_1$	$2s\ 2p(^3P^\circ)4p$	$4p\ {}^2P$	½	214406.6	
${}^2P_2$			1½	214429.7	23.1
$4p'\ {}^4D_1$	$2s\ 2p(^3P^\circ)4p$	$4p\ {}^4D$	½	214758.3	
${}^4D_2$			1½	214772.6	14.3
${}^4D_3$			2½	214794.6	22.0
${}^4D_4$			3½	214828.0	33.4
$4p'\ {}^4S_2$	$2s\ 2p(^3P^\circ)4p$	$4p\ {}^4S$	1½	215765.6	
	$2s\ 2p(^3P^\circ)4p$	$4p\ {}^4P$	½		
$4p'\ {}^4P_2$			1½	216378.0	
${}^4P_3$			2½	216397.7	19.7
	$2s\ 2p(^3P^\circ)4p$	$4p\ {}^2D$	1½		
$4p'\ {}^2D_3$			2½	216927	
$4d'\ {}^4F_2$	$2s\ 2p(^3P^\circ)4d$	$4d\ {}^4F^\circ$	1½	*219553.8*	
${}^4F_3$			2½	*219568.5*	14.7
${}^4F_4$			3½	*219589.2*	20.7
${}^4F_5$			4½	*219617.0*	27.8
	$2s\ 2p(^3P^\circ)4d$	$4d\ {}^4D^\circ$	½		
$4d'\ {}^4D_2$			1½	*220127.8*	
${}^4D_3$			2½	*220137.0*	9.2
${}^4D_4$			3½	*220147.6*	10.6
$4d'\ {}^2D_2$	$2s\ 2p(^3P^\circ)4d$	$4d\ {}^2D^\circ$	1½	*220601.1*	
${}^2D_3$			2½	*220614.2*	13.1
$4d'\ {}^4P_3$	$2s\ 2p(^3P^\circ)4d$	$4d\ {}^4P^\circ$	2½	*220808.47*	
${}^4P_2$			1½	*220828.97*	−20.50
${}^4P_1$			½	*220840.87*	−11.90
$4f'\ {}^2F_3$	$2s\ 2p(^3P^\circ)4f$	$4f\ {}^2F$	2½	221089.6	
${}^2F_4$			3½	221098.8	9.2
	$2s\ 2p(^3P^\circ)4f$	$4f\ {}^4F$	1½		
			2½		
$4f'\ {}^4F_4$			3½	221106.3	
${}^4F_5$			4½	221107.4	1.1

C II—Continued

Edlén	Config.	Desig.	J	Level	Interval
	$2s\ 2p(^3P^\circ)4d$	$4d\ {}^2F^\circ$	2½		
$4d'\ {}^2F_4$			3½	*221502*	
$4f'\ {}^4G_3$	$2s\ 2p(^3P^\circ)4f$	$4f\ {}^4G$	2½	221543.0	
${}^4G_4$			3½	221553.2	10.2
${}^4G_5$			4½	221574.5	21.3
${}^4G_6$			5½	221603.6	29.1
$4f'\ {}^2G_4$	$2s\ 2p(^3P^\circ)4f$	$4f\ {}^2G$	3½	221585	
${}^2G_5$			4½	221628	43
$4f'\ {}^4D_4$	$2s\ 2p(^3P^\circ)4f$	$4f\ {}^4D$	3½	221696.5	
${}^4D_3$			2½	221727.4	−30.9
${}^4D_2$			1½	221746.3	−18.9
			½		
$4f'\ {}^2D_3$	$2s\ 2p(^3P^\circ)4f$	$4f\ {}^2D$	2½	221707.9	
${}^2D_2$			1½	221752.9	−45.0
$4d'\ {}^2P_2$	$2s\ 2p(^3P^\circ)4d$	$4d\ {}^2P^\circ$	1½	*222259.1*	
${}^2P_1$			½	*222286.0*	−26.9
	$2s\ 2p(^3P^\circ)5s$	$5s\ {}^4P^\circ$	½		
			1½		
$5s'\ {}^4P_3$			2½	*225813*	
$5p'\ {}^2P$	$2s\ 2p(^3P^\circ)5p$	$5p\ {}^2P$	{½, 1½}	227901	
	$2s\ 2p(^3P^\circ)5d$	$5d\ {}^4D^\circ$	½		
			1½		
			2½		
$5d'\ {}^4D_4$			3½	*230763*	
$5d'\ {}^4P_3$	$2s\ 2p(^3P^\circ)5d$	$5d\ {}^4P^\circ$	2½	*231050*	
			1½		
			½		
$5f'\ {}^2F$	$2s\ 2p(^3P^\circ)5f$	$5f\ {}^2F$	{2½, 3½}	231221	
	$2s\ 2p(^3P^\circ)5f$	$5f\ {}^4F$	1½		
			2½		
			3½		
$5f'\ {}^4F_5$			4½	231226.8	
	$2s\ 2p(^3P^\circ)5f$	$5f\ {}^4G$	2½		
			3½		
			4½		
$5f'\ {}^4G_6$			5½	231499.3	
$5f'\ {}^4D_4$	$2s\ 2p(^3P^\circ)5f$	$5f\ {}^4D$	3½	231520.4	
			2½		
			1½		
			½		
	$2s\ 2p(^3P^\circ)6d$	$6d\ {}^4D^\circ$	½		
			1½		
			2½		
$6d'\ {}^4D_4$			3½	*236444*	
$6d'\ {}^4P_3$	$2s\ 2p(^3P^\circ)6d$	$6d\ {}^4P^\circ$	2½	*236605*	
			1½		
			½		

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C II Observed Terms*

Config. $1s^2+$	Observed Terms			
$2s^2(^1S)2p$	$2p\ ^2P^\circ$			
$2s\ 2p^2$	$2p^2\ ^4P$ $2p^2\ ^2S$ $2p^2\ ^2P$ $2p^2\ ^2D$			
$2p^3$	$2p^3\ ^4S^\circ$ $2p^3\ ^2P^\circ$ $2p^3\ ^2D^\circ$			
	ns $(n\geq 3)$	np $(n\geq 3)$	nd $(n\geq 3)$	nf $(n\geq 4)$
$2s^2(^1S)nx$	3–6s ^2S	3–5p $^2P^\circ$	3–6d ^2D	4–6f $^2F^\circ$
$2s\ 2p(^3P^\circ)nx$	3–5s $^4P^\circ$ 3s $^2P^\circ$	3, 4p ^4S 3, 4p ^4P 3, 4p ^4D 3p ^2S 3, 5p ^2P 3, 4p ^2D	3–6d $^4P^\circ$ 3–6d $^4D^\circ$ 3, 4d $^4F^\circ$ 3, 4d $^2P^\circ$ 3, 4d $^2D^\circ$ 3, 4d $^2F^\circ$	4, 5f ^4D 4, 5f ^4F 4, 5f ^4G 4f ^2D 4, 5f ^2F 4f ^2G

*For predicted terms in the spectra of the B I isoelectronic sequence, see Introduction.

C III

(Be I sequence; 4 electrons) $Z=6$

Ground state $1s^2\ 2s^2\ ^1S_0$

$2s^2\ ^1S_0$ **386159.7** cm^{-1} I. P. 47.864 volts

All but three terms are from Edlén's Monograph. For the terms $7d\ ^3D$, $8d\ ^3D$, and $9d\ ^3D$ the revised values of Whitelaw and Mack have been used. Edlén has since rejected his $4d'\ ^1P$ term.

No intersystem combinations have been found with certainty. The long D-series determine the limits to about ± 25 cm^{-1}. The uncertainty x in the relative positions of the singlets and triplets is, therefore, less than ± 50 cm^{-1} according to Edlén. No trace of the line predicted at 1910.7 ± 2 A, $2s^2\ ^1S_0 - 2p\ ^3P^\circ_1$, is visible on his plates. A line observed at 339 A (294314.1 cm^{-1}) agrees within 4 cm^{-1} with the calculated combination $2p\ ^3P^\circ_1 - 5d\ ^1D_2$. This identification is uncertain, since it is not confirmed by other intersystem combinations.

REFERENCES

B. Edlén, Nova Acta Reg. Soc. Sci. Uppsala [IV] **9**, No. 6, 51 (1934). (I P) (T) (C L) (G D)
N. G. Whitelaw and J. E. Mack, Phys. Rev. **47**, 677 (1935). (T)
B. Edlén, private communication (Dec. 1947). (T)

C III

Edlén	Config.	Desig.	J	Level	Interval
$2s\ ^1S_0$	$2s^2$	$2s^2\ ^1S$	0	0.0	
$2p\ ^3P_0$ $^3P_1$ $^3P_2$	$2s(^2S)2p$	$2p\ ^3P^\circ$	0 1 2	52315.0+x 52338.0+x 52394.8+x	23.0 56.8
$2p\ ^1P_1$	$2s(^2S)2p$	$2p\ ^1P^\circ$	1	102351.4	
$2p'\ ^3P_0$ $^3P_1$ $^3P_2$	$2p^2$	$2p^2\ ^3P$	0 1 2	137374.0+x 137403.4+x 137450.5+x	29.4 47.1
$2p'\ ^1D_2$	$2p^2$	$2p^2\ ^1D$	2	145875.1	
$2p'\ ^1S_0$	$2p^2$	$2p^2\ ^1S$	0	182520.2	
$3s\ ^3S_1$	$2s(^2S)3s$	$3s\ ^3S$	1	238160.7+x	
$3s\ ^1S_0$	$2s(^2S)3s$	$3s\ ^1S$	0	247169.5	
$3p\ ^1P_1$	$2s(^2S)3p$	$3p\ ^1P^\circ$	1	258931.4	

C III—Continued

Edlén	Config.	Desig.	J	Level	Interval
$3p\ ^3P_0$	$2s(^2S)3p$	$3p\ ^3P°$	0	259653.8+x	
$^3P_1$			1	259659.3+x	5.5
$^3P_2$			2	259672.1+x	12.8
$3d\ ^3D_1$	$2s(^2S)3d$	$3d\ ^3D$	1	269957.6+x	
$^3D_2$			2	269959.7+x	2.1
$^3D_3$			3	269962.9+x	3.2
$3d\ ^1D_2$	$2s(^2S)3d$	$3d\ ^1D$	2	276482.7	
$3s'\ ^3P_0$	$2p(^2P°)3s$	$3s\ ^3P°$	0	308162.9+x	
$^3P_1$			1	308196.2+x	33.3
$^3P_2$			2	308264.8+x	68.6
$4s\ ^3S_1$	$2s(^2S)4s$	$4s\ ^3S$	1	309404.5+x	
$3s'\ ^1P_1$	$2p(^2P°)3s$	$3s\ ^1P°$	1	310005.2	
$4s\ ^1S_0$	$2s(^2S)4s$	$4s\ ^1S$	0	311720.7	
$4p\ ^3P_{01}$	$2s(^2S)4p$	$4p\ ^3P°$	0, 1	317743 +x	
$^3P_2$			2	317748 +x	5
$3p'\ ^1P_1$	$2p(^2P°)3p$	$3p\ ^1P$	1	319719.4	
$4d\ ^3D_1$	$2s(^2S)4d$	$4d\ ^3D$	1	321358.8+x	
$^3D_2$			2	321375.1+x	16.3
$^3D_3$			3	321398.6+x	23.5
$4f\ ^3F_2$	$2s\ (^2S)4f$	$4f\ ^3F°$	2	321949.1+x	
$^3F_3$			3	321955.8+x	6.7
$^3F_4$			4	321964.7+x	8.9
$4p\ ^1P_1$	$2s(^2S)4p$	$4p\ ^1P°$	1	322403.1	
$4f\ ^1F_3$	$2s(^2S)4f$	$4f\ ^1F°$	3	322701.1	
$3p'\ ^3D_1$	$2p(^2P°)3p$	$3p\ ^3D$	1	323024.0+x	
$^3D_2$			2	323049.4+x	25.4
$^3D_3$			3	323088.2+x	38.8
$4d\ ^1D_2$	$2s(^2S)4d$	$4d\ ^1D$	2	324212.0	
$3p'\ ^3S_1$	$2p(^2P°)3p$	$3p\ ^3S$	1	327225.7+x	
$3p'\ ^3P_0$	$2p(^2P°)3p$	$3p\ ^3P$	0	329633.1+x	
$^3P_1$			1	329654.2+x	21.1
$^3P_2$			2	329690.9+x	36.7
$3d'\ ^1D_2$	$2p(^2P°)3d$	$3d\ ^1D°$	2	332690.3	
$3p'\ ^1D_2$	$2p(^2P°)3p$	$3p\ ^1D$	2	333116.4	
$3d'\ ^3F_2$	$2p(^2P°)3d$	$3d\ ^3F°$	2	333333.4+x	
$^3F_3$			3	333358.4+x	25.0
$^3F_4$			4	333395.0+x	36.6
$3d'\ ^3D_1$	$2p(^2P°)3d$	$3d\ ^3D°$	1	337602.9+x	
$^3D_2$			2	337616.4+x	13.5
$^3D_3$			3	337636.7+x	20.3
$5s\ ^3S_1$	$2s(^2S)5s$	$5s\ ^3S$	1	339881 +x	
$3d'\ ^3P_2$	$2p(^2P°)3d$	$3d\ ^3P°$	2	340049.5+x	
$^3P_1$			1	340075.8+x	−26.3
$^3P_0$			0	340090.3+x	−14.5
$3d'\ ^1F_3$	$2p(^2P°)3d$	$3d\ ^1F°$	3	341368.5	
$5p\ ^1P_1$	$2s(^2S)5p$	$5p\ ^1P°$	1	343255.7	
	$2s(^2S)5p$	$5p\ ^3P°$	0		
			1		
$5p\ ^3P_2$			2	344181 +x	
$3p'\ ^1S_0$	$2p(^2P°)3p$	$3p\ ^1S$	0	345093.9	

C III—Continued

Edlén	Config.	Desig.	J	Level	Interval
	$2s(^2S)5d$	$5d\ ^3D$	1		
			2		
$5d\ ^3D_3$			3	345444 +x	
	$2s(^2S)5g$	$5g\ ^3G$	3		
$5g\ ^3G_4$			4	346525.1+x	
$^3G_5$			5	346526.0+x	0.9
$5g\ ^1G_4$	$2s(^2S)5g$	$5g\ ^1G$	4	346577.5	
$5d\ ^1D_2$	$2s(^2S)5d$	$5d\ ^1D$	2	346656.0	
$3d'\ ^1P_1$	$2p(^2P°)3d$	$3d\ ^1P°$	1	346713.1	
$5f\ ^3F_2$	$2s(^2S)5f$	$5f\ ^3F°$	2	347099.5+x	
$^3F_3$			3	347101.3+x	1.8
$^3F_4$			4	347103.7+x	2.4
$5f\ ^1F_3$	$2s(^2S)5f$	$5f\ ^1F°$	3	348859.5	
$6s\ ^3S_1$	$2s(^2S)6s$	$6s\ ^3S$	1	354796 +x	
$6p\ ^1P_1$	$2s(^2S)6p$	$6p\ ^1P°$	1	357088	
	$2s(^2S)6d$	$6d\ ^3D$	1		
			2		
$6d\ ^3D_3$			3	358046 +x	
	$2s(^2S)6g$	$6g\ ^3G$	3		
$6g\ ^3G_4$			4	358638.3+x	
$^3G_5$			5	358639.0+x	0.7
$6g\ ^1G_4$	$2s(^2S)6g$	$6g\ ^1G$	4	358688.9	
$6d\ ^1D_2$	$2s(^2S)6d$	$6d\ ^1D$	2	358725.5	
	$2s(^2S)6f$	$6f\ ^3F°$	2		
			3		
$6f\ ^3F_4$			4	358800 +x	
$6f\ ^1F_3$	$2s(^2S)6f$	$6f\ ^1F°$	3	359122.2	
$7s\ ^3S_1$	$2s(^2S)7s$	$7s\ ^3S$	1	363561 +x	
$7p\ ^1P_1$	$2s(^2S)7p$	$7p\ ^1P°$	1	364896	
$7d\ ^3D$	$2s(^2S)7d$	$7d\ ^3D$	1, 2, 3	365585 +x	
$7d\ ^1D_2$	$2s(^2S)7d$	$7d\ ^1D$	2	366027.0	
$8p\ ^1P_1$	$2s(^2S)8p$	$8p\ ^1P°$	1	369926	
$8d\ ^3D$	$2s(^2S)8d$	$8d\ ^3D$	1, 2, 3	370438 +x	
$9d\ ^3D$	$2s(^2S)9d$	$9d\ ^3D$	1, 2, 3	373748 +x	
	$2p(^2P°)4s$	$4s\ ^3P°$	0		
			1		
$4s'\ ^3P_2$			2	376637 +x	
$4p'\ ^1P_1$	$2p(^2P°)4p$	$4p\ ^1P$	1	381104.8	
	$2p(^2P°)4p$	$4p\ ^3D$	1		
$4p'\ ^3D_2$			2	381919 +x	
$^3D_3$			3	381958 +x	39
	$2p(^2P°)4p$	$4p\ ^3P$	0		
$4p'\ ^3P_1$			1	384313 +x	
$^3P_2$			2	384350 +x	37
$4p'\ ^1D_2$	$2p(^2P°)4p$	$4p\ ^1D$	2	385637.5	
$4d'\ ^1D_2$	$2p(^2P°)4d$	$4d\ ^1D°$	2	385816.2	
	C IV $(^2S_{1/2})$	*Limit*	------	386159.7	

C III—Continued

Edlén	Config.	Desig.	J	Level	Interval
	$2p(^2P^\circ)4d$	$4d\ ^3D^\circ$	1		
			2		
$4d'\ ^3D_3$			3	*387646* $+x$	
$4d'\ ^3P_2$	$2p(^2P^\circ)4d$	$4d\ ^3P^\circ$	2	*388442* $+x$	
			1		
			0		
$4d'\ ^1F_3$	$2p(^2P^\circ)4d$	$4d\ ^1F^\circ$	3	*388772.2*	
$5p'\ ^1P_1$	$2p(^2P^\circ)5p$	$5p\ ^1P$	1	407430.4	
	$2p(^2P^\circ)5p$	$5p\ ^3D$	1		
			2		
$5p'\ ^3D_3$			3	407774 $+x$	
	$2p(^2P^\circ)5p$	$5p\ ^3P$	0		
			1		
$5p'\ ^3P_2$			2	408873 $+x$	
$5p'\ ^1D_2$	$2p(^2P^\circ)5p$	$5p\ ^1D$	2	409505.0	
$5d'\ ^1D_2$	$2p(^2P^\circ)5d$	$5d\ ^1D^\circ$	2	*409682.1*	
	$2p(^2P^\circ)5d$	$5d\ ^3D^\circ$	1		
			2		
$5d'\ ^3D_3$			3	*410534* $+x$	

C III—Continued

Edlén	Config.	Desig.	J	Level	Interval
$5d'\ ^3P_2$	$2p(^2P^\circ)5d$	$5d\ ^3P^\circ$	2	*410841* $+x$	
			1		
			0		
	$2p(^2P^\circ)6p$	$6p\ ^3D$	1		
			2		
$6p'\ ^3D_3$			3	421380 $+x$	
	$2p(^2P^\circ)6p$	$6p\ ^3P$	0		
			1		
$6p'\ ^3P_2$			2	421967 $+x$	
	$2p(^2P^\circ)6d$	$6d\ ^3D^\circ$	1		
			2		
$6d'\ ^3D_3$			3	*422881* $+x$	
$6d'\ ^3P_2$	$2p(^2P^\circ)6d$	$6d\ ^3P^\circ$	2	*423058* $+x$	
			1		
			0		
	$2p(^2P^\circ)7p$	$7p\ ^3D$	1		
			2		
$7p'\ ^3D_3$			3	429345 $+x$	
	$2p(^2P^\circ)7p$	$7p\ ^3P$	0		
			1		
$7p'\ ^3P_2$			2	429712 $+x$	

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C III Observed Terms*

Config. $1s^2+$	Observed Terms				
$2s^2$	$2s^2\ ^1S$				
$2s(^2S)2p$	$\{$ $2p\ ^3P^\circ$, $2p\ ^1P^\circ$				
$2p^2$	$\{$ $2p^2\ ^3P$, $2p^2\ ^1S$, $2p^2\ ^1D$				
	ns ($n\geq 3$)	np ($n\geq 3$)	nd ($n\geq 3$)	nf ($n\geq 4$)	ng ($n\geq 5$)
$2s(^2S)nx$	$\{$3–7$s\ ^3S$; 3, 4$s\ ^1S$	3–5$p\ ^3P^\circ$; 3–8$p\ ^1P^\circ$	3–9$d\ ^3D$; 3–7$d\ ^1D$	4–6$f\ ^3F^\circ$; 4–6$f\ ^1F^\circ$	5, 6$g\ ^3G$; 5, 6$g\ ^1G$
$2p(^2P^\circ)nx$	$\{$ 3, 4$s\ ^3P^\circ$; 3$s\ ^1P^\circ$	3$p\ ^3S$ 3–7$p\ ^3P$ 3–7$p\ ^3D$; 3$p\ ^1S$ 3–5$p\ ^1P$ 3–5$p\ ^1D$	3–6$d\ ^3P^\circ$ 3–6$d\ ^3D^\circ$ 3$d\ ^3F^\circ$; 3$d\ ^1P^\circ$ 3–5$d\ ^1D^\circ$ 3, 4$d\ ^1F^\circ$		

*For predicted terms of the Be I isoelectronic sequence, see Introduction.

C IV

(Li I sequence; 3 electrons) $Z=6$

Ground state $1s^2\,2s\ ^2S_{\frac{1}{2}}$

$2s\ ^2S_{\frac{1}{2}}$ **520177.8 cm⁻¹** I. P. 64.476 volts

The terms are from Edlén. His extrapolated values of three intervals and the term values of the two high series members $8f\ ^2F°$ and $8g\ ^2G$, etc., which were calculated from a well-determined series formula, are entered in brackets in the table.

REFERENCES

B. Edlén, Zeit. Astroph. **7**, 378 (1933). (T) (C L)
B. Edlén, Nova Acta Reg. Soc. Sci. Uppsala [IV] **9**, No. 6, 40 (1934). (I P) (T) (C L) (G D)
T.-Y. Wu, Phys. Rev. **58**, 1114 (1940). (C L)

C IV

Edlén	Config.	Desig.	J	Level	Interval
$2s\ ^2S_1$	$2s$	$2s\ ^2S$	½	0.0	
$2p\ ^2P_1$ $^2P_2$	$2p$	$2p\ ^2P°$	½ 1½	*64484.2* *64591.3*	[107.1
$3s\ ^2S_1$	$3s$	$3s\ ^2S$	½	302847.9	
$3p\ ^2P_1$ $^2P_2$	$3p$	$3p\ ^2P°$	½ 1½	*320048.5* *320080.0*	[31.5
$3d\ ^2D_2$ $^2D_3$	$3d$	$3d\ ^2D$	1½ 2½	324880.2 324890.9	[10.7]
$4s\ ^2S_1$	$4s$	$4s\ ^2S$	½	401346.7	
$4p\ ^2P_1$ $^2P_2$	$4p$	$4p\ ^2P°$	½ 1½	*408308.9* *408322.2*	13.3
$4d\ ^2D_2$ $^2D_3$	$4d$	$4d\ ^2D$	1½ 2½	410333.8 410338.2	4.4
$4f\ ^2F_4$	$4f$	$4f\ ^2F°$	2½ 3½	*410434.1*	[2.1]
$5s\ ^2S_1$	$5s$	$5s\ ^2S$	½	445366.1	
$5p\ ^2P_1$ $^2P_2$	$5p$	$5p\ ^2P°$	½ 1½	*448854* *448861*	[6.7]
$5d\ ^2D_3$	$5d$	$5d\ ^2D$	1½ 2½	449887.4	[2.2]
$5f\ ^2F$	$5f$	$5f\ ^2F°$	{2½ 3½}	*449938.2*	
$5g\ ^2G$	$5g$	$5g\ ^2G$	{3½ 4½}	449948.4	
$6s\ ^2S_1$	$6s$	$6s\ ^2S$	½	468765	
$6p\ ^2P$	$6p$	$6p\ ^2P°$	{½ 1½}	*470763*	

C IV

Edlén	Config.	Desig.	J	Level	Interval
$6d\ ^2D$	$6d$	$6d\ ^2D$	{1½ 2½}	471368	
$6f\ ^2F$	$6f$	$6f\ ^2F°$	{2½ 3½}	*471403.0*	
$6g\ ^2G$	$6g$	$6g\ ^2G$	{3½ 4½}	471407.4	
$6h\ ^2H$	$6h$	$6h\ ^2H°$	{4½ 5½}	*471407.9*	
$7s\ ^2S_1$	$7s$	$7s\ ^2S$	½	482659	
$7p\ ^2P$	$7p$	$7p\ ^2P°$	{½ 1½}	*483931*	
$7d\ ^2D$	$7d$	$7d\ ^2D$	{1½ 2½}	484309	
$7f\ ^2F$	$7f$	$7f\ ^2F°$	{2½ 3½}	*484343.8*	
$7g\ ^2G$	$7g$	$7g\ ^2G$	{3½ 4½}	484346.6	
$7h\ ^2H$	$7h$	$7h\ ^2H°$	{4½ 5½}	*484346.9*	
$8p\ ^2P$	$8p$	$8p\ ^2P°$	{½ 1½}	*492473*	
8F	$8f$	$8f\ ^2F°$	{2½ 3½}	[*492743*]	
8GHIK	8g, etc.	$8g^2G$, etc.	{3½ to 7½}	[492745]	
	C V ($^1S_0$)	*Limit*	------	520177.8	

April 1946.

C V

(He I sequence; 2 electrons) $Z=6$

Ground state $1s^2\ {}^1S_0$

$1s^2\ {}^1S_0$ **3162450±300** cm^{-1} I. P. 391.986±0.037 volts

The singlet terms are from Tyrén, who has reported (1940) nine lines visible on his spectrograms. His limit has been calculated from the series members $n=2$ to 6. The remaining singlet terms have been calculated from three classified lines at 32 A given in his 1936 paper. He has also classified a line at 40.731 A as the intersystem combination $1s^2\ {}^1S_0-2p\ {}^3P^\circ_1$. His unit, 10^3 cm^{-1} has here been changed to cm^{-1}.

The triplet terms are from an unpublished manuscript kindly furnished by Edlén, who states that the absolute term values of the triplets are based on an extrapolation of $3d\ {}^3D$ from He I and Li II. The relative positions of the singlet and triplet terms thus determined confirm the intersystem combination reported by Tyrén.

REFERENCES

B. Edlén, Nova Acta Reg. Soc. Sci. Uppsala [IV] **9**, No. 6, 31 (1934). (C L)
F. Tyrén, Zeit. Phys. **98**, 774 (1936). (C L)
H. A. Robinson, Phys. Rev. **51**, 14 (1937). (I P) (T) (C L)
F. Tyrén, Nova Acta Reg. Soc. Sci. Uppsala [IV] **12**, No. 1, 24 (1940). (I P) (T) (C L)
B. Edlén, unpublished material (Sept. 1947). (T)

C V

Config.	Desig.	J	Level	Interval
$1s^2$	$1s^2\ {}^1S$	0	0	
1s 2s	$2s\ {}^3S$	1	2411266	
1s 2p	$2p\ {}^3P^\circ$	0	*2455165*	−13
		1	*2455152*	136
		2	*2455288*	
1s 2p	$2p\ {}^1P^\circ$	1	*2483240*	
1s 3d	$3d\ {}^3D$	3, 2, 1	2857308	
1s 3p	$3p\ {}^1P^\circ$	1	*2859350*	

C V

Config.	Desig.	J	Level	Interval
1s 4p	$4p\ {}^1P^\circ$	1	*2991680*	
1s 5p	$5p\ {}^1P^\circ$	1	*3053060*	
1s 6p	$6p\ {}^1P^\circ$	1	*3086420*	
1s 7p	$7p\ {}^1P^\circ$	1	*3106750*	
1s 8p	$8p\ {}^1P^\circ$	1	*3118760*	
C VI ($^2S_{1/2}$)	*Limit*		**3162450**	

September 1947.

C VI

(H sequence; 1 electron) $Z=6$

Ground state 1*s* $^2S_{½}$

1*s* $^2S_{½}$ **3951950** cm^{-1} I. P. 489.84 volts

The first three members of the Lyman series have been observed by Tyrén. The terms listed below have been calculated by J. E. Mack, "using $R_{C^{12}}=109732.286$ and $\Lambda=0.040$. The series limit of C^{13} is higher by 14.0 cm^{-1} than the one shown here."

REFERENCES

F. Tyrén, Zeit. Phys. **98**, 771 (1936). (C L)
J. E. Mack, unpublished material (1949). (I P) (T) (C L)

C VI

Config.	Desig.	*J*	Level	Interval
1*s*	1*s* ²S	½	0	
2*p*	2*p* ²P°	½	2963768	
2*s*	2*s* ²S	½	2963806	38
2*p*	2*p* ²P°	1½	2964241	473.3
3*p*	3*p* ²P°	½	3512811	
3*s*	3*s* ²S	½	3512822	11
3*p*, 3*d*	3*d* ²D, 3*p* ²P°	1½	3512951	140.3
3*d*	3*d* ²D	2½	3512998	46.7
4*p*	4*p* ²P°	½	3704957	
4*s*	4*s* ²S	½	3704961	5
4*p*, 4*d*	4*d* ²D, 4*p* ²P°	1½	3705016	59.2
4*d*, 4*f*	4*d* ²D, 4*f* ²F°	2½	3705035	19.7
4*f*	4*f* ²F°	3½	3705045	9.9
5*s*, etc.	5*s* ²S, etc.	½, etc.	3793884 to 933	
	∞=*Limit*		**3951950**	

February 1949.

NITROGEN

N I

7 electrons $Z=7$

Ground state $1s^2\ 2s^2\ 2p^3\ {}^4S^\circ_{1\frac{1}{2}}$

$2p^3\ {}^4S^\circ_{1\frac{1}{2}}$ *117345* cm^{-1} I. P. 14.54 volts

The terms have been taken chiefly from the list prepared by Ekefors with extensions calculated from the classifications published in Tokyo. Unfortunately, no term list was included in the Tokyo papers. Consequently, considerable editing has been done in compiling terms from all the observational material. Revised values are suggested for a few levels and tentative values not in the literature are listed for $5d\ {}^4F_{2\frac{1}{2}}$, $5d\ {}^4F_{1\frac{1}{2}}$, $5d\ {}^4D_{3\frac{1}{2}}$, and $6d\ {}^4D_{3\frac{1}{2}}$. Further study is needed to verify the numerous blends resulting from practically coincident levels.

Intersystem combinations have been observed.

Kiess and Shortley have generously furnished g-values derived from the observed Zeeman effects of 18 infrared lines.

REFERENCES

O. S. Duffendack and R. A. Wolfe, Phys. Rev. **34**, 409 (1929). (C L)

S. B. Ingram, Phys. Rev. **34**, 421 (1929). (T) (C L)

E. Ekefors, Zeit. Phys. **63**, 437 (1930). (I P) (T) (C L)

H. E. White, *Introduction to Atomic Spectra* p. 260 (McGraw-Hill Book Co., Inc., New York, N. Y., 1934). (G D)

B. Edlén, Bergstrand's Festkskrift p. 135 (1938). (C L)

M. Kamiyama, Sci. Papers Inst. Phys. Chem. Research (Tokyo) **36**, No. 933, 375 (1939). (C L)

M. Kamiyama and T. Sugiura, Sci. Papers Inst. Phys. Chem. Research (Tokyo) **37**, Nos. 982 and 983, 479 (1940). (C L)

M. Kamiyama and H. Noguchi, Sci. Papers Inst. Phys. Chem. Research (Tokyo) **39**, No. 1100, 475 (1942). (C L)

J. R. Holmes, Phys. Rev. **63**, 41 (1943). (I S)

W. F. Meggers, J. Opt. Soc. Am. **36**, 431 (1946). (Summary hfs)

C. C. Kiess and G. Shortley, J. Research Nat. Bur. Std. **42**, 190, RP1961 (1949). (Z E)

N I

Config.	Desig.	J	Level	Interval	Obs. g
$2s^2\ 2p^3$	$2p^3\ {}^4S^\circ$	1½	*0*		
$2s^2\ 2p^3$	$2p^3\ {}^2D^\circ$	2½	*19223*	−8	
		1½	*19231*		
$2s^2\ 2p^3$	$2p^3\ {}^2P^\circ$	{1½, ½}	*28840*		
$2s^2\ 2p^2(^3P)3s$	$3s\ {}^4P$	½	83285.5	33.8	2.670
		1½	83319.3	46.7	1.735
		2½	83366.0		1.603
$2s^2\ 2p^2(^3P)3s$	$3s\ {}^2P$	½	86131.4	91.8	
		1½	86223.2		

N I

Config.	Desig.	J	Level	Interval	Obs. g
$2s\ 2p^4$	$2p^4\ {}^4P$	2½	88109.5	−43.9	
		1½	88153.4	−19.6	
		½	88173.0		
$2s^2\ 2p^2(^3P)3p$	$3p\ {}^2S^\circ$	½	*93582.3*		
$2s^2\ 2p^2(^3P)3p$	$3p\ {}^4D^\circ$	½	*94772.2*	22.6	0.002
		1½	*94794.8*	37.3	1.19
		2½	*94832.1*	51.0	1.36
		3½	*94883.1*		1.44
$2s^2\ 2p^2(^3P)3p$	$3p\ {}^4P^\circ$	½	*95476.5*	18.4	2.671
		1½	*95494.9*	38.3	1.737
		2½	*95533.2*		1.598

N I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$2s^2\,2p^2(^3P)3p$	$3p\ ^4S^\circ$	1½	*96751.7*		2.004
$2s^2\,2p^2(^3P)3p$	$3p\ ^2D^\circ$	1½ 2½	*96788.2* *96864.2*	76.0	
$2s^2\,2p^2(^3P)3p$	$3p\ ^2P^\circ$	½ 1½	*97770.1* *97805.8*	35.7	
$2s^2\,2p^2(^1D)3s$	$3s'\ ^2D$	2½ 1½	99665 99658	−7	
$2s^2\,2p^2(^3P)4s$	$4s\ ^4P$	½ 1½ 2½	103618.1 103668.1 103736.8	50.0 68.7	
$2s^2\,2p^2(^3P)4s$	$4s\ ^2P$	½ 1½	104142.2 104227.4	85.2	
$2s^2\,2p^2(^3P)3d$	$3d\ ^2P$	1½ ½	104615.4 104654.9	−39.5	
$2s^2\,2p^2(^3P)3d$	$3d\ ^4F$	1½ 2½ 3½ 4½	104665 104684 104718 104767	19 34 49	
$2s^2\,2p^2(^3P)3d$	$3d\ ^2F$	2½ 3½	104810.9 104882.7	71.8	
$2s^2\,2p^2(^3P)3d$	$3d\ ^4P$	½ 1½ 2½	104864 104890 104957	26 67	
$2s^2\,2p^2(^3P)3d$	$3d\ ^4D$	½ 1½ 2½ 3½	104987 104998 105011 105020	11 13 9	
$2s^2\,2p^2(^3P)3d$	$3d\ ^2D$	1½ 2½	105120.8 105144.3	23.5	
$2s^2\,2p^2(^3P)4p$	$4p\ ^2S^\circ$	½	*106478.6*		
$2s^2\,2p^2(^3P)4p$	$4p\ ^4D^\circ$	½ 1½ 2½ 3½	*106760.5* *106780.1* *106816.1* *106870.7*	19.6 36.0 54.6	
$2s^2\,2p^2(^3P)4p$	$4p\ ^4P^\circ$	½ 1½ 2½	*106982.7* *106998.3* *107039.0*	15.6 40.7	
$2s^2\,2p^2(^3P)4p$	$4p\ ^4S^\circ$	1½	*107447.2*		
$2s^2\,2p^2(^3P)5s$	$5s\ ^4P$	½ 1½ 2½	109813.5 109857.8 109927.9	44.3 70.1	
$2s^2\,2p^2(^3P)5s$	$5s\ ^2P$	½ 1½	110029.2 110108.5	79.3	
$2s^2\,2p^2(^3P)4d$	$4d\ ^4F$	1½ 2½ 3½ 4½	110196 110214 110248 110304	18 34 56	
$2s^2\,2p^2(^3P)4d$	$4d\ ^4D$	½ 1½ 2½ 3½	110221 110275 110288 110339	54 13 51	
$2s^2\,2p^2(^3P)4d$	$4d\ ^2P$	1½ ½	110221.7 110244.6	−22.9	
$2s^2\,2p^2(^3P)4d$	$4d\ ^2F$	2½ 3½	110311 110373	62	

N I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$2s^2\,2p^2(^3P)4d$	$4d\ ^4P$	½ 1½ 2½	110325 110351 110403	26 52	
$2s^2\,2p^2(^3P)4d$	$4d\ ^2D$	1½ 2½	110448.3 110470.5	22.2	
$2s^2\,2p^2(^1D)3p$	$3p'\ ^2D^\circ$	1½ 2½	*110521.9* *110545.8*	23.9	
$2s^2\,2p^2(^1D)3p$	$3p'\ ^2P^\circ$	½ 1½	*112294.8* *112320.8*	26.0	
$2s^2\,2p^2(^3P)6s$	$6s\ ^4P$	½ 1½ 2½	112565.9 112610.6 112682.6	44.7 72.0	
$2s^2\,2p^2(^3P)6s$	$6s\ ^2P$	½ 1½	112735 112823	88	
$2s^2\,2p^2(^3P)5d$	$5d\ ^4F$	1½ 2½ 3½ 4½	112751? 112763? 112799 112862	12 36 63	
$2s^2\,2p^2(^3P)5d$	$5d\ ^2P$	1½ ½	112801 112816	−15	
$2s^2\,2p^2(^3P)5d$	$5d\ ^2F$	2½ 3½	112820 112890.2	70	
$2s^2\,2p^2(^3P)5d$	$5d\ ^4D$	½ 1½ 2½ 3½	 112825 112892?	67	
$2s^2\,2p^2(^3P)5d$	$5d\ ^4P$	½ 1½ 2½	112855 112874 112912	19 38	
$2s^2\,2p^2(^3P)5d$	$5d\ ^2D$	1½ 2½	112929.2 112947.5	18.3	
$2s^2\,2p^2(^3P)7s$	$7s\ ^4P$	½ 1½ 2½	114015? 114072? 114146	57 74	
$2s^2\,2p^2(^3P)7s$	$7s\ ^2P$	½ 1½	114130 114163	33	
$2s^2\,2p^2(^3P)6d$	$6d\ ^4F$	1½ to 4½	114160		
$2s^2\,2p^2(^3P)6d$	$6d\ ^4D$	½ 1½ 2½ 3½	 114182 114248?	66	
$2s^2\,2p^2(^3P)6d$	$6d\ ^2P$	1½ ½	114193 114209	−16	
$2s^2\,2p^2(^3P)6d$	$6d\ ^2F$	2½ 3½	114196 114275	79	
$2s^2\,2p^2(^3P)6d$	$6d\ ^2D$	1½ 2½	114232.2 114290.5	58.3	
$2s^2\,2p^2(^3P)6d$	$6d\ ^4P$	½ 1½ 2½	 114259 114274	15	
$2s^2\,2p^2(^3P)8s$	$8s\ ^4P$	½ 1½ 2½	114809 114890 114942	81 52	

N I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$2s^2 2p^2(^3P)8s$	$8s\ ^2P$	½, 1½	114950		
$2s^2 2p^2(^3P)7d$	$7d\ ^4D$	½ to 3½	114988		
$2s^2 2p^2(^3P)7d$	$7d\ ^2F$	2½, 3½	115004		
$2s^2 2p^2(^3P)7d$	$7d\ ^2P$	1½, ½	115017		
$2s^2 2p^2(^3P)7d$	$7d\ ^2D$	1½ 2½	115057. 5 115100. 1	42. 6	
$2s^2 2p^2(^3P)7d$	$7d\ ^4P$	½ 1½ 2½	115103		
$2s^2 2p^2(^3P)9s$	$9s\ ^2P$	½, 1½	115480		
$2s^2 2p^2(^3P)9s$	$9s\ ^4P$	½ to 2½	115483		
$2s^2 2p^2(^3P)8d$	$8d\ ^4D$	½ to 3½	115524		
$2s^2 2p^2(^3P)8d$	$8d\ ^2P$	1½, ½	115530		
$2s^2 2p^2(^3P)8d$	$8d\ ^2F$	2½, 3½	115535		
$2s^2 2p^2(^3P)8d$	$8d\ ^2D$	1½ 2½	115597 115622	25	
$2s^2 2p^2(^3P)8d$	$8d\ ^4P$	½ to 2½	115618		
$2s^2 2p^2(^3P)10s$	$10s\ ^2P$	½, 1½	115842		
$2s^2 2p^2(^3P)10s$	$10s\ ^4P$	½ to 2½	115855		
$2s^2 2p^2(^3P)9d$	$9d\ ^4D$	½ to 3½	115887		
$2s^2 2p^2(^3P)9d$	$9d\ ^2P$	1½, ½	115889		
$2s^2 2p^2(^3P)9d$	$9d\ ^2F$	2½, 3½	115902		
$2s^2 2p^2(^3P)9d$	$9d\ ^2D$	1½ 2½	115973 115991	18	
$2s^2 2p^2(^3P)9d$	$9d\ ^4P$	½ to 2½	115990		

Config.	Desig.	J	Level	Interval	Obs. g
$2s^2 2p^2(^3P)11s$	$11s\ ^2P$	½, 1½	116107		
$2s^2 2p^2(^3P)11s$	$11s\ ^4P$	½ to 2½	116124		
$2s^2 2p^2(^3P)10d$	$10d\ ^2P$	1½, ½	116155		
$2s^2 2p^2(^3P)10d$	$10d\ ^2F$	2½, 3½	116159		
$2s^2 2p^2(^3P)10d$	$10d\ ^4D$	½ to 3½	116164		
$2s^2 2p^2(^3P)10d$	$10d\ ^2D$	1½, 2½	116240		
$2s^2 2p^2(^3P)10d$	$10d\ ^4P$	½ to 2½	116259		
$2s^2 2p^2(^3P)12s$	$12s\ ^2P$	½, 1½	116305		
$2s^2 2p^2(^3P)12s$	$12s\ ^4P$	½ to 2½	116312		
$2s^2 2p^2(^3P)11d$	$11d\ ^2P$	1½, ½	116351		
$2s^2 2p^2(^3P)11d$	$11d\ ^2F$	2½, 3½	116359		
$2s^2 2p^2(^3P)11d$	$11d\ ^4D$	½ to 3½	116367		
$2s^2 2p^2(^3P)11d$	$11d\ ^2D$	1½, 2½	116436		
$2s^2 2p^2(^3P)11d$	$11d\ ^4P$	½ to 2½	116441		
$2s^2 2p^2(^3P)13s$	$13s\ ^2P$	½, 1½	116467		
$2s^2 2p^2(^3P)12d$	$12d\ ^2P$	1½, ½	116502		
$2s^2 2p^2(^3P)12d$	$12d\ ^4P$	½ to 2½	116581		
$2s^2 2p^2(^3P)12d$	$12d\ ^2D$	1½, 2½	116625		
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N II ($^3P_0$)	*Limit*	------	***117345***		

October 1947.

N I Observed Terms*

Config. $1s^2+$	Observed Terms								
$2s^2\ 2p^3$	$\{2p^3\ ^4S^\circ$ $2p^3\ ^2P^\circ$ $2p^3\ ^2D^\circ$								
$2s\ 2p^4$	$2p^4\ ^4P$								
	ns ($n\geq3$)	np ($n\geq3$)			nd ($n\geq3$)				
$2s^2\ 2p^2(^3P)nx$	3–12s ^4P 3–13s ^2P	3, 4p $^4S^\circ$ 3, 4p $^2S^\circ$	3, 4p $^4P^\circ$ 3p $^2P^\circ$	3, 4p $^4D^\circ$ 3p $^2D^\circ$	3–12d ^4P 3–12d ^2P	3–11d ^4D 3–12d ^2D	3– 6d ^4F 3–11d ^2F		
$2s^2\ 2p^2(^1D)nx'$	3s' ^2D		3p' $^2P^\circ$	3p' $^2D^\circ$					

*For predicted terms in the spectra of the N I isoelectronic sequence, see Introduction.

N II

(C I sequence; 6 electrons) $Z=7$

Ground state $1s^2\ 2s^2\ 2p^2\ ^3P_0$

$2p^2\ ^3P_0$ **238846.7** cm^{-1} I. P. 29.605 volts

Edlén has revised and extended the earlier analysis of this spectrum. The terms are all taken from his Monograph, except those from the 4f configuration, which are from his 1936 paper, and his 3s' ^3P and 5f-terms, which he has generously furnished in a private communication.

The singlet and triplet terms are well connected by intersystem combinations but the quintets are not so connected with the others. Edlén also suggests that by analogy with C I and O III the published absolute values of the quintet terms should be decreased by about 500 cm^{-1}. This correction has been applied in the table and should diminish the uncertainty x appreciably.

REFERENCES

A. Fowler and L. J. Freeman, Proc. Roy. Soc. (London) [A] **114,** 662 (1927). (T) (C L)

L. J. Freeman, Proc. Roy. Soc. (London) [A] **124,** 666 (1929). (T) (C L)

B. Edlén, Nova Acta Reg. Soc. Sci. Uppsala [IV] **9,** No. 6, 109 (1934). (I P) (T) (C L) (G D of singlets)

B. Edlén, Zeit. Phys. **98,** 564 (1936). (T) (C L)

J. B. Green and H. N. Maxwell, Phys. Rev. **51,** 243 (1937). (Z E)

B. Edlén, unpublished material (Dec. 1947). (T).

N II

Edlén	Config.	Desig.	J	Level	Interval
$2p\ ^3P_0$	$2s^2\ 2p^2$	$2p^2\ ^3P$	0	0.0	49.1
$^3P_1$			1	49.1	82.2
$^3P_2$			2	131.3	
$2p\ ^1D_2$	$2s^2\ 2p^2$	$2p^2\ ^1D$	2	15315.7	
$2p\ ^1S_0$	$2s^2\ 2p^2$	$2p^2\ ^1S$	0	32687.1	
$2p'\ ^5S_2$	$2s\ 2p^3$	$2p^3\ ^5S^\circ$	2	47167.7+x	
$2p'\ ^3D_3$	$2s\ 2p^3$	$2p^3\ ^3D^\circ$	3	92237.9	−13.4
$^3D_2$			2	92251.3	−1.6
$^3D_1$			1	92252.9	
$2p'\ ^3P_{12}$	$2s\ 2p^3$	$2p^3\ ^3P^\circ$	2, 1	109218.2	−6.6
$^3P_0$			0	109224.8	
$2p'\ ^1D_2$	$2s\ 2p^3$	$2p^3\ ^1D^\circ$	2	144189.1	
$3s\ ^3P_0$	$2s^2\ 2p(^2P^\circ)3s$	$3s\ ^3P^\circ$	0	148909.37	31.60
$^3P_1$			1	148940.97	136.36
$^3P_2$			2	149077.33	
$3s\ ^1P_1$	$2s^2\ 2p(^2P^\circ)3s$	$3s\ ^1P^\circ$	1	149188.74	
$2p'\ ^3S_1$	$2s\ 2p^3$	$2p^3\ ^3S^\circ$	1	155129.9	
$3p\ ^1P_1$	$2s^2\ 2p(^2P^\circ)3p$	$3p\ ^1P$	1	164611.60	
$3p\ ^3D_1$	$2s^2\ 2p(^2P^\circ)3p$	$3p\ ^3D$	1	166522.48	60.78
$^3D_2$			2	166583.26	96.19
$^3D_3$			3	166679.45	
$2p'\ ^1P_1$	$2s\ 2p^3$	$2p^3\ ^1P^\circ$	1	166765.7	
$3p\ ^3S_1$	$2s^2\ 2p(^2P^\circ)3p$	$3p\ ^3S$	1	168893.04	
$3p\ ^3P_0$	$2s^2\ 2p(^2P^\circ)3p$	$3p\ ^3P$	0	170573.38	35.25
$^3P_1$			1	170608.63	58.37
$^3P_2$			2	170667.00	
$3p\ ^1D_2$	$2s^2\ 2p(^2P^\circ)3p$	$3p\ ^1D$	2	174212.93	
$3p\ ^1S_0$	$2s^2\ 2p(^2P^\circ)3p$	$3p\ ^1S$	0	178274.17	
$3d\ ^3F_2$	$2s^2\ 2p(^2P^\circ)3d$	$3d\ ^3F^\circ$	2	186512.38	59.42
$^3F_3$			3	186571.80	81.55
$^3F_4$			4	186653.35	
$3d\ ^1D_2$	$2s^2\ 2p(^2P^\circ)3d$	$3d\ ^1D^\circ$	2	187092.20	
$3d\ ^3D_1$	$2s^2\ 2p(^2P^\circ)3d$	$3d\ ^3D^\circ$	1	187438.34	24.04
$^3D_2$			2	187462.38	30.34
$^3D_3$			3	187492.72	
$3d\ ^3P_2$	$2s^2\ 2p(^2P^\circ)3d$	$3d\ ^3P^\circ$	2	188858.09	−51.80
$^3P_1$			1	188909.89	−28.06
$^3P_0$			0	188937.95	
$3d\ ^1F_3$	$2s^2\ 2p(^2P^\circ)3d$	$3d\ ^1F^\circ$	3	189336.0	
$3d\ ^1P_1$	$2s^2\ 2p(^2P^\circ)3d$	$3d\ ^1P^\circ$	1	190121.15	
$4s\ ^3P_0$	$2s^2\ 2p(^2P^\circ)4s$	$4s\ ^3P^\circ$	0	196541.09	51.79
$^3P_1$			1	196592.88	119.29
$^3P_2$			2	196712.17	
$4s\ ^1P_1$	$2s^2\ 2p(^2P^\circ)4s$	$4s\ ^1P^\circ$	1	197859.28	
$4p\ ^1P_1$	$2s^2\ 2p(^2P^\circ)4p$	$4p\ ^1P$	1	202169.9	
$4p\ ^3D_1$	$2s^2\ 2p(^2P^\circ)4p$	$4p\ ^3D$	1	202714.94	50.92
$^3D_2$			2	202765.86	96.20
$^3D_3$			3	202862.06	
$4p\ ^3P_0$	$2s^2\ 2p(^2P^\circ)4p$	$4p\ ^3P$	0	203164.7	24.1
$^3P_1$			1	203188.8	70.9
$^3P_2$			2	203259.7	

N II

Edlén	Config.	Desig.	J	Level	Interval
$4p\ ^3S_1$	$2s^2\ 2p(^2P^\circ)4p$	$4p\ ^3S$	1	203532.8	
$4p\ ^1D_2$	$2s^2\ 2p(^2P^\circ)4p$	$4p\ ^1D$	2	205350.7	
$3s'\ ^5P_1$	$2s\ 2p^2(^4P)3s$	$3s\ ^5P$	1	205982.1+x	56.0
$^5P_2$			2	206038.1+x	70.6
$^5P_3$			3	206108.7+x	
$4p\ ^1S_0$	$2s^2\ 2p(^2P^\circ)4p$	$4p\ ^1S$	0	206327.5	
$4d\ ^3F_2$	$2s^2\ 2p(^2P^\circ)4d$	$4d\ ^3F^\circ$	2	209675.3	64.2
$^3F_3$			3	209739.5	85.8
$^3F_4$			4	209825.3	
$4d\ ^1D_2$	$2s^2\ 2p(^2P^\circ)4d$	$4d\ ^1D^\circ$	2	209926.92	
$4d\ ^3D_1$	$2s^2\ 2p(^2P^\circ)4d$	$4d\ ^3D^\circ$	1	210239.8	26.5
$^3D_2$			2	210266.3	35.6
$^3D_3$			3	210301.9	
$4d\ ^3P_2$	$2s^2\ 2p(^2P^\circ)4d$	$4d\ ^3P^\circ$	2	210705.4	−46.1
$^3P_1$			1	210751.5	−25.5
$^3P_0$			0	210777.0	
$4f\ ^1F_3$	$2s^2\ 2p(^2P^\circ)4f$	$4f\ ^1F$	3	211030.90	
$4f\ ^3F_2$	$2s^2\ 2p(^2P^\circ)4f$	$4f\ ^3F$	2	211033.71	23.36
$^3F_3$			3	211057.07	3.96
$^3F_4$			4	211061.03	
$4d\ ^1F_3$	$2s^2\ 2p(^2P^\circ)4d$	$4d\ ^1F^\circ$	3	211104.8	
$4f\ ^3G_3$	$2s^2\ 2p(^2P^\circ)4f$	$4f\ ^3G$	3	211288.02	7.63
$^3G_4$			4	211295.65	95.12
$^3G_5$			5	211390.77	
$4d\ ^1P_1$	$2s^2\ 2p(^2P^\circ)4d$	$4d\ ^1P^\circ$	1	211335.5	
$4f\ ^1G_4$	$2s^2\ 2p(^2P^\circ)4f$	$4f\ ^1G$	4	211402.89	
$4f\ ^3D_3$	$2s^2\ 2p(^2P^\circ)4f$	$4f\ ^3D$	3	211411.25	−4.95
$^3D_2$			2	211416.20	−71.08
$^3D_1$			1	211487.28	
$4f\ ^1D_2$	$2s^2\ 2p(^2P^\circ)4f$	$4f\ ^1D$	2	211491.16	
$3s'\ ^3P_0$	$2s\ 2p^2(^4P)3s$	$3s\ ^3P$	0	211750.2	30.4
$^3P_1$			1	211780.6	48.2
$^3P_2$			2	211828.8	
$5s\ ^3P_0$	$2s^2\ 2p(^2P^\circ)5s$	$5s\ ^3P^\circ$	0	214212.4	45.8
$^3P_1$			1	214258.2	127.1
$^3P_3$			2	214385.3	
$5s\ ^1P_1$	$2s^2\ 2p(^2P^\circ)5s$	$5s\ ^1P^\circ$	1	214828.0	
	$2s^2\ 2p(^2P^\circ)5d$	$5d\ ^3D^\circ$	1		
			2		
$5d\ ^3D_3$			3	220717	
$5f\ ^3F_2$	$2s^2\ 2p(^2P^\circ)5f$	$5f\ ^3F$	2		
$^3F_3$			3	221070.2	4.1
$^3F_4$			4	221074.3	
$5d\ ^1F_3$	$2s^2\ 2p(^2P^\circ)5d$	$5d\ ^1F^\circ$	3	221137.6	
$5f\ ^3G_3$	$2s^2\ 2p(^2P^\circ)5f$	$5f\ ^3G$	3	221227.7	5.0
$^3G_4$			4	221232.7	69.5
$^3G_5$			5	221302.2	
$5f\ ^1G_4$	$2s^2\ 2p(^2P^\circ)5f$	$5f\ ^1G$	4	221312.1	
$3p'\ ^5D_0$	$2s\ 2p^2(^4P)3p$	$3p\ ^5D^\circ$	0	224027.1+x	15.8
$^5D_1$			1	224042.9+x	29.4
$^5D_2$			2	224072.3+x	43.1
$^5D_3$			3	224115.4+x	53.9
$^5D_4$			4	224169.3+x	

N II—Continued

Edlén	Config.	Desig.	J	Level	Interval
$3p'\ ^5P_1$	$2s\ 2p^2(^4P)3p$	$3p\ ^5P^\circ$	1	*225987. 1+x*	
$^5P_2$			2	*226011. 2+x*	24. 1
$^5P_3$			3	*226055. 2+x*	44. 0
$3p'\ ^5S_2$	$2s\ 2p^2(^4P)3p$	$3p\ ^5S^\circ$	2	*230223. 0+x*	
	N III ($^2P^\circ_{\frac{1}{2}}$)	*Limit*	------	238846. 7	
$3d'\ ^5F_1$	$2s\ 2p^2(^4P)3d$	$3d\ ^5F$	1	243355. 5+x	
$^5F_2$			2	243371. 2+x	15. 7
$^5F_3$			3	243396. 6+x	25. 4
$^5F_4$			4	243430. 2+x	33. 6
$^5F_5$			5	243470. 8+x	40. 6

N II—Continued

Edlén	Config.	Desig.	J	Level	Interval
$3d'\ ^5P_3$	$2s\ 2p^2(^4P)3d$	$3d\ ^5P$	3	244737. 4+x	
$^5P_2$			2	244775. 9+x	−38. 5
$^5P_1$			1	244802. 0+x	−26. 1
$3d'\ ^5D_0$	$2s\ 2p^2(^4P)3d$	$3d\ ^5D$	0	245319. 8+x	
$^5D_1$			1	245323. 4+x	3. 6
$^5D_2$			2	245331. 3+x	7. 9
$^5D_3$			3	245342. 9+x	11. 6
$^5D_4$			4	245356. 9+x	14. 0

December 1947.

N II Observed g-Values

Desig.	J	Obs. g	Desig.	J	Obs. g	Desig.	J	Obs. g
$3s\ ^3P^\circ$	1	1. 455	$3p\ ^3S$	1	2. 015	$3d\ ^1D^\circ$	2	0. 986
	2	1. 502						
			$3p\ ^3P$	1	1. 530	$3d\ ^3D^\circ$	1	0. 494
$3s\ ^1P^\circ$	1	1. 051		2	1. 497		2	1. 114
							3	1. 329
$3p\ ^1P$	1	1. 005	$3p\ ^1D$	2	1. 002			
						$3d\ ^3P^\circ$	2	1. 504
$3p\ ^3D$	1	0. 494	$3d\ ^3F^\circ$	3	1. 079		1	1. 487
	2	1. 166		4	1. 250			
	3	1. 330				$3d\ ^1P^\circ$	1	1. 026

N II Observed Terms*

Config. $1s^2+$	Observed Terms			
$2s^2\ 2p^2$	$2p^2\ ^1S$; $2p^2\ ^3P$; $2p^2\ ^1D$			
$2s\ 2p^3$	$2p^3\ ^5S^\circ$; $2p^3\ ^3S^\circ$; $2p^3\ ^3P^\circ$; $2p^3\ ^3D^\circ$; $2p^3\ ^1P^\circ$; $2p^3\ ^1D^\circ$			
	ns ($n\geq 3$)	np ($n\geq 3$)	nd ($n\geq 3$)	nf ($n\geq 4$)
$2s^2\ 2p(^2P^\circ)nx$	3–5$s\ ^3P^\circ$ 3–5$s\ ^1P^\circ$	3, 4$p\ ^3S$ 3, 4$p\ ^3P$ 3, 4$p\ ^3D$ 3, 4$p\ ^1S$ 3, 4$p\ ^1P$ 3, 4$p\ ^1D$	3, 4$d\ ^3P^\circ$ 3–5$d\ ^3D^\circ$ 3, 4$d\ ^3F^\circ$ 3, 4$d\ ^1P^\circ$ 3, 4$d\ ^1D^\circ$ 3–5$d\ ^1F^\circ$	4$f\ ^3D$ 4, 5$f\ ^3F$ 4, 5$f\ ^3G$ 4$f\ ^1D$ 4$f\ ^1F$ 4, 5$f\ ^1G$
$2s\ 2p^2(^4P)nx$	$3s\ ^5P$ $3s\ ^3P$	$3p\ ^5S^\circ$ $3p\ ^5P^\circ$ $3p\ ^5D^\circ$	$3d\ ^5P$ $3d\ ^5D$ $3d\ ^5F$	

*For predicted terms in the spectra of the C I isoelectronic sequence, see Introduction.

N III

(B I sequence; 5 electrons) Z=7

Ground state $1s^2\ 2s^2\ 2p\ ^2P^{\circ}_{1/2}$

$2p\ ^2P^{\circ}_{1/2}$ *382625.5* cm^{-1} I. P. 47.426 volts

All of the terms except those with a 4*f*-electron, have been taken from Edlén's Monograph. In 1936 Edlén published a revised and extended list of 4*f*-terms and the corresponding classified lines, including intersystem combinations. The observed correction to his previously published quartet terms $-396.4\ cm^{-1}$, connecting them with the doublet terms has been incorporated into the present list.

REFERENCES

L. J. Freeman, Proc. Roy. Soc. (London) [A] **121,** 318 (1928). (T) (C L)
B. Edlén, Nova Acta Reg. Soc. Sci. Uppsala [IV] **9,** No. 6, 78 (1934). (I P) (T) (C L) (G D)
B. Edlén, Zeit. Phys. **98,** 561 (1936). (T) (C L)

N III

Edlén	Config.	Desig.	J	Level	Interval
$2p\ ^2P_1$	$2s^2(^1S)2p$	$2p\ ^2P^{\circ}$	½	*0.0*	174.5
$^2P_2$			1½	*174.5*	
$2p'\ ^4P_1$	$2s\ 2p^2$	$2p^2\ ^4P$	½	57192.1	59.9
$^4P_2$			1½	57252.0	81.2
$^4P_3$			2½	57333.2	
$2p'\ ^2D_3$	$2s\ 2p^2$	$2p^2\ ^2D$	2½	101023.8	−7.7
$^2D_2$			1½	101031.5	
$2p'\ ^2S_1$	$2s\ 2p^2$	$2p^2\ ^2S$	½	131003.5	
$2p'\ ^2P_1$	$2s\ 2p^2$	$2p^2\ ^2P$	½	145876.1	110.4
$^2P_2$			1½	145986.5	
$2p''\ ^4S_2$	$2p^3$	$2p^3\ ^4S^{\circ}$	1½	*186802.3*	
$2p''\ ^2D_3$	$2p^3$	$2p^3\ ^2D^{\circ}$	2½	*203072.2*	−16.7
$^2D_2$			1½	*203088.9*	
$3s\ ^2S_1$	$2s^2(^1S)3s$	$3s\ ^2S$	½	221302.4	
$2p''\ ^2P_1$	$2p^3$	$2p^3\ ^2P^{\circ}$	½	*230404.5*	4.1
$^2P_2$			1½	*230408.6*	
$3p\ ^2P_1$	$2s^2(^1S)3p$	$3p\ ^2P^{\circ}$	½	*245665.7*	36.0
$^2P_2$			1½	*245701.7*	
$3d\ ^2D_2$	$2s^2(^1S)3d$	$3d\ ^2D$	1½	267238.5	5.9
$^2D_3$			2½	267244.4	

N III

Edlén	Config.	Desig.	J	Level	Interval
$3s'\ ^4P_1$	$2s\ 2p(^3P^{\circ})3s$	$3s\ ^4P^{\circ}$	½	*287535.6*	62.5
$^4P_2$			1½	*287598.1*	115.8
$^4P_3$			2½	*287713.9*	
$3s'\ ^2P_1$	$2s\ 2p(^3P^{\circ})3s$	$3s\ ^2P^{\circ}$	½	*297150.2*	112.9
$^2P_2$			1½	*297263.1*	
$4s\ ^2S_1$	$2s^2(^1S)4s$	$4s\ ^2S$	½	301088.2	
$3p'\ ^2P_1$	$2s\ 2p(^3P^{\circ})3p$	$3p\ ^2P$	½	309132.6	53.2
$^2P_2$			1½	309185.8	
$3p'\ ^4D_1$	$2s\ 2p(^3P^{\circ})3p$	$3p\ ^4D$	½	309662.8	35.5
$^4D_2$			1½	309698.3	62.2
$^4D_3$			2½	309760.5	96.2
$^4D_4$			3½	309856.7	
$4p\ ^2P_1$	$2s^2(^1S)4p$	$4p\ ^2P^{\circ}$	½	*311691.3*	24.8
$^2P_2$			1½	*311716.1*	
$3p'\ ^4S_2$	$2s\ 2p(^3P^{\circ})3p$	$3p\ ^4S$	1½	314224.0	
$3p'\ ^4P_1$	$2s\ 2p(^3P^{\circ})3p$	$3p\ ^4P$	½	317299.9	43.5
$^4P_2$			1½	317343.4	58.9
$^4P_3$			2½	317402.3	
$4d\ ^2D_2$	$2s^2(^1S)4d$	$4d\ ^2D$	1½	317750.8	31.0
$^2D_3$			2½	317781.8	
	$2s^2(^1S)4f$	$4f\ ^2F^{\circ}$	2½		
$4f\ ^2F_4$			3½	*320287.5*	

N III—Continued

Edlén	Config.	Desig.	J	Level	Interval
$3p'\,^2D_2$	$2s\,2p(^3P^\circ)3p$	$3p\,^2D$	1½	320977.4	88.4
$^2D_3$			2½	321065.8	
$3p'\,^2S_1$	$2s\,2p(^3P^\circ)3p$	$3p\,^2S$	½	327056.8	
$3d'\,^4F_2$	$2s\,2p(^3P^\circ)3d$	$3d\,^4F^\circ$	1½	*330238.4*	35.1
$^4F_3$			2½	*330273.5*	51.8
$^4F_4$			3½	*330325.3*	71.4
$^4F_5$			4½	*330396.7*	
$3d'\,^4D_1$	$2s\,2p(^3P^\circ)3d$	$3d\,^4D^\circ$	½	*332796.6*	13.4
$^4D_2$			1½	*332810.0*	22.0
$^4D_3$			2½	*332832.0*	28.3
$^4D_4$			3½	*332860.3*	
$5s\,^2S_1$	$2s^2(^1S)5s$	$5s\,^2S$	½	333713.1	
$3d'\,^2D_2$	$2s\,2p(^3P^\circ)3d$	$3d\,^2D^\circ$	1½	*334542.2*	26.7
$^2D_3$			2½	*334568.9*	
$3d'\,^4P_3$	$2s\,2p(^3P^\circ)3d$	$3d\,^4P^\circ$	2½	*336213.4*	−54.6
$^4P_2$			1½	*336268.0*	−35.1
$^4P_1$			½	*336303.1*	
$3d'\,^2F_3$	$2s\,2p(^3P^\circ)3d$	$3d\,^2F^\circ$	2½	*339744.4*	111.3
$^2F_4$			3½	*339855.7*	
$5d\,^2D_2$	$2s^2(^1S)5d$	$5d\,^2D$	1½	341946.2	1.7
$^2D_3$			2½	341947.9	
$3d'\,^2P_2$	$2s\,2p(^3P^\circ)3d$	$3d\,^2P^\circ$	1½	*342693.0*	−70.7
$^2P_1$			½	*342763.7*	
	$2s^2(^1S)5f$	$5f\,^2F^\circ$	2½		
$5f\,^2F_4$			3½	*342752.0*	
$5g\,^2G$	$2s^2(^1S)5g$	$5g\,^2G$	{3½, 4½}	343116	
	$2s^2(^1S)6d$	$6d\,^2D$	1½		
$6d\,^2D_3$			2½	354517	
	$2s^2(^1S)6f$	$6f\,^2F^\circ$	2½		
$6f\,^2F_4$			3½	*354955.7*	
$6g\,^2G$	$2s^2(^1S)6g$	$6g\,^2G$	{3½, 4½}	355214	
$4s'\,^4P_1$	$2s\,2p(^3P^\circ)4s$	$4s\,^4P^\circ$	½	*368525.6*	62.7
$^4P_2$			1½	*368588.3*	116.5
$^4P_3$			2½	*368704.8*	
$\overline{3p'}\,^2D_2$	$2s\,2p(^1P^\circ)3p$	$3p'\,^2D$	1½	373342	34
$^2D_3$			2½	373376	
$4p'\,^2P_1$	$2s\,2p(^3P^\circ)4p$	$4p\,^2P$	½	374747.4	57.9
$^2P_2$			1½	374805.3	
$4p'\,^4D_1$	$2s\,2p(^3P^\circ)4p$	$4p\,^4D$	½	376756.6	46.7
$^4D_2$			1½	376803.3	60.5
$^4D_3$			2½	376863.8	89.5
$^4D_4$			3½	376953.3	
$\overline{3p'}\,^2P_1$	$2s\,2p(^1P^\circ)3p$	$3p'\,^2P$	½	377591	17
$^2P_2$			1½	377608	

N III—Continued

Edlén	Config.	Desig.	J	Level	Interval
$4p'\,^2D_2$	$2s\,2p(^3P^\circ)4p$	$4p\,^2D$	1½	377883.7	87.1
$^2D_3$			2½	377970.8	
$4p'\,^4S_2$	$2s\,2p(^3P^\circ)4p$	$4p\,^4S$	1½	378440.5	
$4p'\,^4P_1$	$2s\,2p(^3P^\circ)4p$	$4p\,^4P$	½	379307.3	44.8
$^4P_2$			1½	379352.1	52.9
$^4P_3$			2½	379405.0	
	N IV ($^1S_0$)	*Limit*	------	***382625.5***	
	$2s\,2p(^3P^\circ)4d$	$4d\,^4F^\circ$	1½		
$4d'\,^4F_3$			2½	*384016*	49
$^4F_4$			3½	*384065*	74
$^4F_5$			4½	*384139*	
$4d'\,^2D$	$2s\,2p(^3P^\circ)4d$	$4d\,^2D^\circ$	{1½, 2½}	*385126*	
	$2s\,2p(^3P^\circ)4d$	$4d\,^4D^\circ$	½		
$4d'\,^4D_2$			1½	*385296*	27
$^4D_3$			2½	*385323*	29
$^4D_4$			3½	*385352*	
$4d'\,^4P_3$	$2s\,2p(^3P^\circ)4d$	$4d\,^4P^\circ$	2½	*386246*	
			1½		
			½		
$4f'\,^2F_3$	$2s\,2p(^3P^\circ)4f$	$4f\,^2F$	2½	386953.4	21
$^2F_4$			3½	386974	
	$2s\,2p(^3P^\circ)4f$	$4f\,^4F$	1½		
$4f'\,^4F_3$			2½	387000.8	9.5
$^4F_4$			3½	387010.3	32.0
$^4F_5$			4½	387042.3	
$4d'\,^2F_3$	$2s\,2p(^3P^\circ)4d$	$4d\,^2F^\circ$	2½	*387728.7*	82.8
$^2F_4$			3½	*387811.5*	
$4f'\,^4G_3$	$2s\,2p(^3P^\circ)4f$	$4f\,^4G$	2½	388039.2	43.7
$^4G_4$			3½	388082.9	51.9
$^4G_5$			4½	388134.8	63
$^4G_6$			5½	388198	
$4f'\,^2G_4$	$2s\,2p(^3P^\circ)4f$	$4f\,^2G$	3½	388190.3	99.7
$^2G_5$			4½	388290.0	
$4f'\,^4D_4$	$2s\,2p(^3P^\circ)4f$	$4f\,^4D$	3½	388273.4	−37.5
$^4D_3$			2½	388310.9	−48.3
$^4D_2$			1½	388359.2	−27.4
$^4D_1$			½	388386.6	
$4f'\,^2D_3$	$2s\,2p(^3P^\circ)4f$	$4f\,^2D$	2½	388376.9	−65.5
$^2D_2$			1½	388442.4	
$\overline{3d'}\,^2D_2$	$2s\,2p(^1P^\circ)3d$	$3d'\,^2D^\circ$	1½	*396574.9*	9.9
$^2D_3$			2½	*396584.8*	
	$2s\,2p(^3P^\circ)5d$	$5d\,^4D^\circ$	½		
			1½		
			2½		
$5d'\,^4D_4$			3½	*409017*	

June 1946.

N III OBSERVED TERMS*

Config. $1s^2+$	Observed Terms								
$2s^2$ (^{1}S)$2p$	$2p$ ^{2}P°								
$2s$ $2p^2$	$2p^2$ ^{2}S	$2p^2$ ^{4}P $2p^2$ ^{2}P	$2p^2$ ^{2}D						
$2p^3$	$2p^3$ ^{4}S°	$2p^3$ ^{2}P°	$2p^3$ ^{2}D°						
	ns ($n\geq3$)			np ($n\geq3$)			nd ($n\geq3$)		
$2s^2$ (^{1}S)nx	3–5s ^{2}S				3, 4p ^{2}P°			3–6d ^{2}D	
$2s$ $2p$(^{3}P°)nx		3, 4s ^{4}P° 3s ^{2}P°		3, 4p ^{4}S 3p ^{2}S	3, 4p ^{4}P 3, 4p ^{2}P	3, 4p ^{4}D 3, 4p ^{2}D	3, 4d ^{4}P° 3d ^{2}P°	3–5d ^{4}D° 3, 4d ^{2}D°	3, 4d ^{4}F° 3, 4d ^{2}F°
$2s$ $2p$(^{1}P°)nx'					3p' ^{2}P	3p' ^{2}D		3d' ^{2}D°	
	nf ($n\geq4$)			ng ($n\geq5$)					
$2s^2$ (^{1}S)nx		4–6f ^{2}F°			5, 6g ^{2}G				
$2s$ $2p$(^{3}P°)nx	4f ^{4}D 4f ^{2}D	4f ^{4}F 4f ^{2}F	4f ^{4}G 4f ^{2}G						

*For predicted terms in the spectra of the B I isoelectronic sequence, see Introduction.

N IV

(Be I sequence; 4 electrons) $Z=7$

Ground state $1s^2$ $2s^2$ $^1S_0$

$2s^2$ $^1S_0$ **624851** cm^{-1} I. P. 77.450 volts

The terms are from Edlén's papers. The absolute values of the singlet terms are uncertain, since only two members of the ^{1}D-series have been observed. No intersystem combinations have been found. By analogy with N III, Edlén (1936) estimates that $2s^2$ $^1S_0-2p$ $^3P_1^\circ=67200$ cm^{-1}, which gives the absolute value of $2s^2$ $^1S_0$ as 624851 cm^{-1} instead of the earlier value 624499 cm^{-1}. The relative uncertainty x, therefore probably does not exceed ±300 cm^{-1}.

The terms $4p$ ^{3}P°, $4f$ ^{3}F°, $5g$ ^{3}G, and $3d$ ^{3}F° are from the 1936 reference. Edlén obtains the $4f$ ^{3}F° term by assuming that $5g$ ^{3}G is hydrogen-like (absolute value 70500 cm^{-1}) and adopting Freeman's identification of the $4f$ ^{3}F°$-5g$ ^{3}G group of lines. The listed value of $5g$ ^{3}G has been adjusted to fit Edlén's adopted value of $4f$ ^{3}F°.

The estimated value of $3d$ ^{3}F° is included in the table in brackets.

REFERENCES

L. J. Freeman, Proc. Roy. Soc. (London) [A] **127,** 330 (1930). (T) (C L)

B. Edlén, Nova Acta Reg. Soc. Sci. Uppsala [IV] **9,** No. 6, 62 (1934). (T) (C L)

B. Edlén, Zeit. Phys. **98,** 561 (1936). (I P) (C L)

N IV

Edlén	Config.	Desig.	J	Level	Interval
$2s\ ^1S_0$	$2s^2$	$2s^2\ ^1S$	0	0	
$2p\ ^3P_0$	$2s(^2S)2p$	$2p\ ^3P^\circ$	0	67136.4+x	
$^3P_1$			1	67199.6+x	63.2
$^3P_2$			2	67343.8+x	144.2
$2p\ ^1P_1$	$2s(^2S)2p$	$2p\ ^1P^\circ$	1	130695	
$2p'\ ^3P_0$	$2p^2$	$2p^2\ ^3P$	0	175463.5+x	
$^3P_1$			1	175536.7+x	73.2
$^3P_2$			2	175661.5+x	124.8
$2p'\ ^1D_2$	$2p^2$	$2p^2\ ^1D$	2	188885	
$2p'\ ^1S_0$	$2p^2$	$2p^2\ ^1S$	0	235370	
$3s\ ^3S_1$	$2s(^2S)3s$	$3s\ ^3S$	1	377206+x	
$3s\ ^1S_0$	$2s(^2S)3s$	$3s\ ^1S$	0	388858	
$3p\ ^1P_1$	$2s(^2S)3p$	$3p\ ^1P^\circ$	1	404521	
$3p\ ^3P_0$	$2s(^2S)3p$	$3p\ ^3P^\circ$	0	405893.2+x	
$^3P_1$			1	405909.0+x	15.8
$^3P_2$			2	405944.4+x	35.4
$3d\ ^3D_1$	$2s(^2S)3d$	$3d\ ^3D$	1	419967.8+x	
$^3D_2$			2	419971.3+x	3.5
$^3D_3$			3	419979.4+x	8.1
$3d\ ^1D_2$	$2s(^2S)3d$	$3d\ ^1D$	2	429158	
$3s'\ ^3P_0$	$2p(^2P^\circ)3s$	$3s\ ^3P^\circ$	0	465223.0+x	
$^3P_1$			1	465300.6+x	77.6
$^3P_2$			2	465463.4+x	162.8
$3s'\ ^1P_1$	$2p(^2P^\circ)3s$	$3s\ ^1P^\circ$	1	473032	
$3p'\ ^1P_1$	$2p(^2P^\circ)3p$	$3p\ ^1P$	1	480880	
	$2p(^2P^\circ)3p$	$3p\ ^3D$	1		
$3p'\ ^3D_2$			2	484394 +x	
$^3D_3$			3	484525 +x	131
$3p'\ ^3S_1$	$2p(^2P^\circ)3p$	$3p\ ^3S$	1	487542 +x	
	$2p(^2P^\circ)3p$	$3p\ ^3P$	0		
$3p'\ ^3P_1$			1	494240 +x	
$^3P_2$			2	494338 +x	98
$3d'\ ^1D_2$	$2p(^2P^\circ)3d$	$3d\ ^1D^\circ$	2	498315	
$3p'\ ^1D_2$	$2p(^2P^\circ)3p$	$3p\ ^1D$	2	499708	

N IV

Edlén	Config.	Desig.	J	Level	Interval
$3d'\ ^3F$	$2p(^2P^\circ)3d$	$3d\ ^3F^\circ$	2, 3, 4	[499851] +x	
$4p\ ^3P$	$2s(^2S)4p$	$4p\ ^3P^\circ$	0, 1, 2	503625 +x	
$3d'\ ^3D_1$	$2p(^2P^\circ)3d$	$3d\ ^3D^\circ$	1	505487 +x	
$^3D_2$			2	505518 +x	31
$^3D_3$			3	505561 +x	43
$3d'\ ^1F_3$	$2p(^2P^\circ)3d$	$3d\ ^1F^\circ$	3	506292	
$4p\ ^1P_1$	$2s(^2S)4p$	$4p\ ^1P^\circ$	1	507022	
	$2s(^2S)4d$	$4d\ ^3D$	1		
			2		
$4d\ ^3D_3$			3	511384 +x	
$3d'\ ^3P_2$	$2p(^2P^\circ)3d$	$3d\ ^3P^\circ$	2	511440 +x	
$^3P_1$			1	511493 +x	−53
			0		
$4d\ ^1D_2$	$2s(^2S)4d$	$4d\ ^1D$	2	514638	
$4f\ ^3F_2$	$2s(^2S)4f$	$4f\ ^3F^\circ$	2	516631 +x	
$^3F_3$			3	516639 +x	8
$^3F_4$			4	516650 +x	11
$3d'\ ^1P_1$	$2p(^2P^\circ)3d$	$3d\ ^1P^\circ$	1	519414	
$4f\ ^1F_3$	$2s(^2S)4f$	$4f\ ^1F^\circ$	3	521868	
$5p\ ^1P_1$	$2s(^2S)5p$	$5p\ ^1P^\circ$	1	550218	
	$2s(^2S)5d$	$5d\ ^3D$	1		
			2		
$5d\ ^3D_3$			3	552731 +x	
$5g\ ^3G$	$2s(^2S)5g$	$5g\ ^3G$	3, 4, 5	554419 +x	
	$2s(^2S)6d$	$6d\ ^3D$	1		
			2		
$6d\ ^3D_3$			3	574940 +x	
$4p'\ ^1D_2$	$2p(^2P^\circ)4p$	$4p\ ^1D$	2	591043	
$4d'\ ^3D_{1,2}$	$2p(^2P^\circ)4d$	$4d\ ^3D^\circ$	1, 2	593665 +x	
$^3D_3$			3	593704 +x	39
	N v ($^2S_{½}$)	*Limit*	------	624851	
	$2p(^2P^\circ)5d$	$5d\ ^3D^\circ$	1		
			2		
$5d'\ ^3D_3$			3	634198 +x	

May 1946.

N IV OBSERVED TERMS*

Config. $1s^2+$	Observed Terms				
$2s^2$	$2s^2\ ^1S$				
$2s(^2S)2p$	$2p\ ^3P^\circ$ $2p\ ^1P^\circ$				
$2p^2$	$2p^2\ ^3P$ $2p^2\ ^1S$ $2p^2\ ^1D$				
	$ns\ (n\geq3)$	$np\ (n\geq3)$	$nd\ (n\geq3)$	$nf\ (n\geq4)$	$ng\ (n\geq5)$
$2s(^2S)nx$	$3s\ ^3S$ $3s\ ^1S$	$3, 4p\ ^3P^\circ$ $3\text{–}5p\ ^1P^\circ$	$3\text{–}6d\ ^3D$ $3, 4d\ ^1D$	$4f\ ^3F^\circ$ $4f\ ^1F^\circ$	$5g\ ^3G$
$2p(^2P^\circ)nx$	$3s\ ^3P^\circ$ $3s\ ^1P^\circ$	$3p\ ^3S$ $3p\ ^3P$ $3p\ ^3D$ $3p\ ^1P$ $3, 4p\ ^1D$	$3d\ ^3P^\circ$ $3\text{–}5d\ ^3D^\circ$ $3d\ ^1P^\circ$ $3d\ ^1D^\circ$ $3d\ ^1F^\circ$		

*For predicted terms in the spectra of the Be I isoelectronic sequence, see Introduction.

N V

(Li I sequence; 3 electrons) $Z=7$

Ground state $1s^2\ 2s\ ^2S_{1/2}$

$2s\ ^2S_{1/2}$ **789532.9** cm^{-1} I. P. 97.863 volts

Both Edlén and Cady have published analyses of this spectrum. Edlén has recently extended the earlier work and has generously furnished his revised term list in manuscript form. The observed term values in the table are from this unpublished list.

Edlén's extrapolated intervals and the term values for higher series members based on his calculations from the series formula are entered in brackets in the table. These have been taken from his 1933 and 1934 papers.

REFERENCES

W. Cady, Phys. Rev. **44**, 821 (1933). (T) (C L)
B. Edlén, Zeit. Astroph. **7**, 378 (1933). (T) (C L)
B. Edlén, Nova Acta Reg. Soc. Sci. Uppsala [IV] **9**, No. 6, 41 (1934). (T) (C L)
B. Edlén, unpublished material (Sept. 1947). (I P) (T)

N v

Edlén	Config.	Desig.	J	Level	Interval
$2s\ ^2S_1$	$2s$	$2s\ ^2S$	½	0.0	
$2p\ ^2P_1$	$2p$	$2p\ ^2P^\circ$	½	*80464.9*	258.4
$^2P_2$			1½	*80723.3*	
$3s\ ^2S_1$	$3s$	$3s\ ^2S$	½	456134	
$3p\ ^2P_1$	$3p$	$3p\ ^2P^\circ$	½	*477777.2*	74.2
$^3P_2$			1½	*477851.4*	
$3d\ ^2D_2$	$3d$	$3d\ ^2D$	1½	484403	[24]
$^2D_3$			2½	484427	
$4s\ ^2S_1$	$4s$	$4s\ ^2S$	½	606337	
$4p\ ^2P_2$	$4p$	$4p\ ^2P^\circ$	{½, 1½}	*615150*	[32]
$4d\ ^2D_3$	$4d$	$4d\ ^2D$	{1½, 2½}	617905	[10]
	$5s$	$5s\ ^2S$	½	673882	
$5p\ ^2P_2$	$5p$	$5p\ ^2P^\circ$	{½, 1½}	*678297*	[16]
$5d\ ^2D_3$	$5d$	$5d\ ^2D$	{1½, 2½}	679725	[5]
6S	$6s$	$6s\ ^2S$	½	[709947]	
$6p\ ^2P$	$6p$	$6p\ ^2P^\circ$	{½, 1½}	*712464*	
$6d\ ^2D$	$6d$	$6d\ ^2D$	{1½, 2½}	713289	
6F	$6f$	$6f\ ^2F^\circ$	{2½, 3½}	[*713327*]	
6GH	$6g$, $6h$	$6g\ ^2G$, etc.	{3½ to 5½}	[713335]	
7S	$7s$	$7s\ ^2S$	½	[731432]	
7P	$7p$	$7p\ ^2P^\circ$	{½, 1½}	*732993*	
7D	$7d$	$7d\ ^2D$	{1½, 2½}	[733516]	
7F	$7f$	$7f\ ^2F^\circ$	{2½, 3½}	[*733547*]	
7GHI	$7g$, etc.	$7g\ ^2G$, etc.	{3½ to 6½}	[733552]	
8S	$8s$	$8s\ ^2S$	½	[745260]	
8P	$8p$	$8p\ ^2P^\circ$	{½, 1½}	[*746311*]	
8D	$8d$	$8d\ ^2D$	{1½, 2½}	[746649]	
8F	$8f$	$8f\ ^2F^\circ$	{2½, 3½}	[*746670*]	
8GHIK	$8g$, etc.	$8g\ ^2G$, etc.	{3½ to 7½}	[746674]	
	N VI ($^1S_0$)	*Limit*	------	**789532.9**	

September 1947.

N VI

(He I sequence; 2 electrons) $Z=7$

Ground state $1s^2\ ^1S_0$

$1s^2\ ^1S_0$ **4452800± 500cm^{-1}.** I. P. 551.925±0.062 volts

Tyrén has observed the first three members of the singlet series. They are in the region from 23 A to 28 A. He lists also one intersystem combination—a line at 29.084 A classified as $1s^2\ ^1S_0-2p\ ^3P_1^\circ$. His unit, 10^3 cm^{-1}, has here been changed to cm^{-1}.

Edlén has generously furnished his unpublished manuscript containing absolute values of the triplet terms extrapolated along the He I isoelectronic sequence. The relative positions of the singlet and triplet terms thus determined confirm the intersystem combination reported by Tyrén. The $2s\ ^3S-2p\ ^3P^\circ$ combination has apparently not been observed, but Edlén regards the extrapolation from the irregular doublet law as very reliable. Brackets are used in the table to indicate extrapolated values not yet confirmed by observation.

REFERENCES

F. Tyrén, Nova Acta Reg. Soc. Sci Uppsala [IV] **12**, No. 1, 24 (1940). (I P) (T) (C L)
B. Edlén, unpublished material (Sept. 1947). (T)

N VI

Config.	Desig.	J	Level	Interval
$1s^2$	$1s^2\ ^1S$	0	0	
$1s\ 2s$	$2s\ ^3S$	1	[3385890]	
$1s\ 2p$	$2p\ ^3P^\circ$	0 1 2	[*3438270*] *3438280* [*3438570*]	[10] [290]
$1s\ 2p$	$2p\ ^1P^\circ$	1	*3473790*	
$1s\ 3p$	$3p\ ^1P^\circ$	1	*4016390*	
$1s\ 4p$	$4p\ ^1P^\circ$	1	*4206810*	
N VII ($^2S_{1/2}$)	*Limit*	--------	**4452800**	

September 1947.

N VII

(H sequence; 1 electron) $Z=7$

Ground state $1s\ ^2S_{1/2}$

$1s\ ^2S_{1/2}$ **5379860** cm^{-1} I. P. 666.83 volts

The first Lyman line has been observed by Tyrén. J. E. Mack has calculated the terms in the table, "using $R_{N^{14}}=109733.004$ and $\Lambda=0.040$. The series limit of N^{15} is higher by 14.0 cm^{-1} than the value given here."

REFERENCES

F. Tyrén, Nova Acta Reg. Soc. Sci. Uppsala [IV] **12**, No. 1, 24 (1940). (C L)

J. E. Mack, unpublished material (1949). (I P) (T) (C L)

N VII

Config.	Desig.	J	Level	Interval
$1s$	$1s\ ^2S$	½	0	
$2p$ $2s$ $2p$	$2p\ ^2P^\circ$ $2s\ ^2S$ $2p\ ^2P^\circ$	½ ½ 1½	4034535 4034605 4035412	70 876. 9
$3s$, etc.	$3s\ ^2S$, etc.	½, etc.	4782035 to 381	
$4s$, etc.	$4s\ ^2S$, etc.	½, etc.	5043625 to 789	
	∞=*Limit*	--------	**5379860**	

February 1949.

OXYGEN

O I

8 electrons $Z=8$

Ground state $1s^2\,2s^2\,2p^4\;{}^3P_2$

$2p^4\;{}^3P_2$ **109836.7** cm^{-1} I. P. 13.614 volts

Edlén has published a detailed analysis of this spectrum in which he has revised and extended the earlier work by others. The terms have all been taken from his paper. For the higher series members not included in his main term table, $ns\;{}^5S^\circ$ and $ns\;{}^3S^\circ$ (n=8 to 11), and $nd\;{}^5D^\circ$ and $nd\;{}^3D^\circ$ (n=8 to 10) the observed values taken from his discussion of the series formulas (p. 15), in which he compares observed and calculated values, are listed below.

Two terms not derived from observed lines are entered in brackets: $11s\;{}^5S^\circ$, which is calculated from the series formula and $2s\,2p^5\;{}^1P^\circ$, which is extrapolated.

Intersystem combinations connect the terms of the singlet, triplet, and quintet systems.

Kiess and Shortley have observed g values for four levels as follows:

Desig.	Obs. g
$3s\;{}^5S^\circ_2$	1.999
$3p\;{}^5P_1$	2.506
${}^5P_2$	1.836
${}^5P_3$	1.666

REFERENCES

A. Fowler, *Report on Series in Line Spectra* p. 166 (Fleetway Press, London, 1922). (T) (C L)

R. Frerichs, Phys. Rev. **34,** 1239 (1929); **36,** 398 (1930). (T) (C L)

H. E. White, *Introduction to Atomic Spectra* p. 266 (McGraw-Hill Book Co., Inc., New York, N. Y., 1934). (G D)

K. R. More and C. A. Rieke, Phys. Rev. **50,** 1054 (1936). (Standard wavelengths)

B. Edlén, Kungl. Svenska Vetenskapsakad. Handl. [3] **20,** No. 10, 31 pp. (1943). (I P) (T) (C L)

W. F. Meggers, J. Opt. Soc. Am. **36,** 431 (1946). (Summary hfs)

C. C. Kiess and G. Shortley, J. Research Nat. Bur. Std. 42, 190, RP1961 (1949). (Z E)

O I

Config.	Desig.	J	Level	Interval
$2s^2\,2p^4$	$2p^4\;{}^3P$	2	0. 0	−158. 5
		1	158. 5	−68. 0
		0	226. 5	
$2s^2\,2p^4$	$2p^4\;{}^1D$	2	15867. 7	
$2s^2\,2p^4$	$2p^4\;{}^1S$	0	33792. 4	
$2s^2\,2p^3(^4S^\circ)3s$	$3s\;{}^5S^\circ$	2	*73767. 81*	
$2s^2\,2p^3(^4S^\circ)3s$	$3s\;{}^3S^\circ$	1	*76794. 69*	
$2s^2\,2p^3(^4S^\circ)3p$	$3p\;{}^5P$	1	86625. 35	2. 02
		2	86627. 37	3. 67
		3	86631. 04	
$2s^2\,2p^3(^4S^\circ)3p$	$3p\;{}^3P$	2	88630. 84	0. 54
		1	88630. 30	−0. 70
		0	88631. 00	
$2s^2\,2p^3(^4S^\circ)4s$	$4s\;{}^5S^\circ$	2	*95476. 43*	

O I

Config.	Desig.	J	Level	Interval
$2s^2\,2p^3(^4S^\circ)4s$	$4s\;{}^3S^\circ$	1	*96225. 5*	
$2s^2\,2p^3(^4S^\circ)3d$	$3d\;{}^5D^\circ$	4	*97420. 24*	−0. 13
		3, 2	*97420. 37*	−0. 13
		2, 1, 0	*97420. 50*	
$2s^2\,2p^3(^4S^\circ)3d$	$3d\;{}^3D^\circ$	3, 2, 1	*97488. 14*	
$2s^2\,2p^3(^4S^\circ)4p$	$4p\;{}^5P$	1	99092. 64	0. 67
		2	99093. 31	1. 21
		3	99094. 52	
$2s^2\,2p^3(^4S^\circ)4p$	$4p\;{}^3P$	2, 1, 0	99680. 4	
$2s^2\,2p^3(^2D^\circ)3s$	$3s'\;{}^3D^\circ$	3	*101135. 04*	−12. 17
		2	*101147. 21*	−7. 89
		1	*101155. 10*	
$2s^2\,2p^3(^4S^\circ)5s$	$5s\;{}^5S^\circ$	2	*102116. 21*	
$2s^2\,2p^3(^4S^\circ)5s$	$5s\;{}^3S^\circ$	1	*102411. 65*	

O I—Continued

Config.	Desig.	J	Level	Interval
$2s^2\,2p^3(^2D^\circ)3s$	$3s'\ ^1D^\circ$	2	102661.63	
$2s^2\,2p^3(^4S^\circ)4d$	$4d\ ^5D^\circ$	4 3 2 1 0	102865.09	
$2s^2\,2p^3(^4S^\circ)4d$	$4d\ ^3D^\circ$	3, 2, 1	102908.14	
$2s^2\,2p^3(^4S^\circ)5p$	$5p\ ^3P$	2, 1, 0	103869.4	
$2s^2\,2p^3(^4S^\circ)6s$	$6s\ ^5S^\circ$	2	105019.0	
$2s^2\,2p^3(^4S^\circ)6s$	$6s\ ^3S^\circ$	1	105164.90	
$2s^2\,2p^3(^4S^\circ)5d$	$5d\ ^5D^\circ$	4 to 0	105385.3	
$2s^2\,2p^3(^4S^\circ)5d$	$5d\ ^3D^\circ$	3, 2, 1	105408.58	
$2s^2\,2p^3(^4S^\circ)6p$	$6p\ ^3P$	2, 1, 0	105911.3	
$2s^2\,2p^3(^4S^\circ)7s$	$7s\ ^5S^\circ$	2	106545.1	
$2s^2\,2p^3(^4S^\circ)7s$	$7s\ ^3S^\circ$	1	106627.9	
$2s^2\,2p^3(^4S^\circ)6d$	$6d\ ^5D^\circ$	4 to 0	106751.2	
$2s^2\,2p^3(^4S^\circ)6d$	$6d\ ^3D^\circ$	3, 2, 1	106765.8	
$2s^2\,2p^3(^4S^\circ)8s$	$8s\ ^5S^\circ$	2	107445.4	
$2s^2\,2p^3(^4S^\circ)8s$	$8s\ ^3S^\circ$	1	107497.1	
$2s^2\,2p^3(^4S^\circ)7d$	$7d\ ^5D^\circ$	4 to 0	107573.1	
$2s^2\,2p^3(^4S^\circ)7d$	$7d\ ^3D^\circ$	3, 2, 1	107582.7	
$2s^2\,2p^3(^4S^\circ)9s$	$9s\ ^5S^\circ$	2	108021.4	
$2s^2\,2p^3(^4S^\circ)9s$	$9s\ ^3S^\circ$	1	108057.6	
$2s^2\,2p^3(^4S^\circ)8d$	$8d\ ^5D^\circ$	4 to 0	108105.7	
$2s^2\,2p^3(^4S^\circ)8d$	$8d\ ^3D^\circ$	3, 2, 1	108116.6	
$2s^2\,2p^3(^4S^\circ)10s$	$10s\ ^5S^\circ$	2	108412.0	
$2s^2\,2p^3(^4S^\circ)10s$	$10s\ ^3S^\circ$	1	108436.1	
$2s^2\,2p^3(^4S^\circ)9d$	$9d\ ^5D^\circ$	4 to 0	108470.2	
$2s^2\,2p^3(^4S^\circ)9d$	$9d\ ^3D^\circ$	3, 2, 1	108477.8	
$2s^2\,2p^3(^4S^\circ)11s$	$11s\ ^5S^\circ$	2	[108688.4]	
$2s^2\,2p^3(^4S^\circ)11s$	$11s\ ^3S^\circ$	1	108707.3	
$2s^2\,2p^3(^4S^\circ)10d$	$10d\ ^5D^\circ$	4 to 0	108731.5	
$2s^2\,2p^3(^4S^\circ)10d$	$10d\ ^3D^\circ$	3, 2, 1	108734.4	
O II ($^4S^\circ_{1\frac{1}{2}}$)	*Limit*	--------	109836.7	
$2s^2\,2p^3(^2D^\circ)3p$	$3p'\ ^3D$	3 2 1	113294.42 113294.55 113298.01	−0.13 −3.46
$2s^2\,2p^3(^2D^\circ)3p$	$3p'\ ^3F$	4 3 2	113714.06 113721.06 113726.81	−7.00 −5.75
$2s^2\,2p^3(^2P^\circ)3s$	$3s''\ ^3P^\circ$	2 1 0	113910.20 113920.63 113926.80	−10.43 −6.17
$2s^2\,2p^3(^2D^\circ)3p$	$3p'\ ^1F$	3	113995.81	
$2s^2\,2p^3(^2P^\circ)3s$	$3s''\ ^1P^\circ$	1	115918.30	
$2s^2\,2p^3(^2D^\circ)3p$	$3p'\ ^1D$	2	116630.51	
$2s^2\,2p^3(^2D^\circ)4s$	$4s'\ ^1D^\circ$	2	122798.7	
$2s^2\,2p^3(^2D^\circ)3d$	$3d'\ ^3P^\circ$	2 1 0	123296.6 123355.2 123386.9	−58.6 −31.7
$2s^2\,2p^3(^2D^\circ)3d$	$3d'\ ^3F^\circ$	4 3 2	124213.18	
$2s^2\,2p^3(^2D^\circ)3d$	$3d'\ ^1G^\circ$	4	124238.21	
$2s^2\,2p^3(^2D^\circ)3d$	$3d'\ ^3G^\circ$	5 4 3	124239.66 124258.37 124252.52	−18.71 5.85
$2s^2\,2p^3(^2D^\circ)3d$	$3d'\ ^1F^\circ$	3	124326.32	
$2s^2\,2p^3(^2D^\circ)4p$	$4p'\ ^3D$	3 2 1	125774.51 125782.09 125787.14	−7.58 −5.05
$2s\,2p^5$	$2p^5\ ^3P^\circ$	2 1 0	126266.48 126339.92 126383.44	−73.44 −43.52
$2s^2\,2p^3(^2P^\circ)3p$	$3p''\ ^3D$	3 2 1	127281.85 127287.62 127290.93	−5.77 −3.31
$2s^2\,2p^3(^2P^\circ)3p$	$3p''\ ^1P$	1	127667.85	
$2s^2\,2p^3(^2P^\circ)3p$	$3p''\ ^1D$	2	128595.02	
$2s^2\,2p^3(^2D^\circ)5s$	$5s'\ ^1D^\circ$	2	129134 ±	
$2s^2\,2p^3(^2D^\circ)4d$	$4d'\ ^3F^\circ$	4 3 2	129666.55	
$2s^2\,2p^3(^2D^\circ)4d$	$4d'\ ^1G^\circ$	4	129679.49	
$2s^2\,2p^3(^2D^\circ)4d$	$4d'\ ^3G^\circ$	5 4 3	129680.14 129699.16 129693.08	−19.02 6.08
$2s^2\,2p^3(^2D^\circ)4d$	$4d'\ ^1F^\circ$	3	129736.60	
$2s^2\,2p^3(^2D^\circ)4d$	$4d'\ ^3P^\circ$	2 1 0	129969.60 129979.04 129984.15	−9.44 −5.11
$2s^2\,2p^3(^2P^\circ)3p$	$3p''\ ^1S$	0	130943.21	
$2s^2\,2p^3(^2D^\circ)6s$	$6s'\ ^1D^\circ$	2	131927 ±	
$2s^2\,2p^3(^2D^\circ)5d$	$5d'\ ^3F^\circ$	4 3 2	132190.7 ±	
$2s^2\,2p^3(^2D^\circ)5d$	$5d'\ ^1G^\circ$	4	132197.6 ±	
$2s^2\,2p^3(^2D^\circ)5d$	$5d'\ ^3G^\circ$	5 4 3	132198.1 132217.8	−19.7
$2s^2\,2p^3(^2D^\circ)5d$	$5d'\ ^3P^\circ$	2, 1 0	132310 ±	
$2s^2\,2p^3(^2D^\circ)7s$	$7s'\ ^1D^\circ$	2	133413 ±	
$2s^2\,2p^3(^2D^\circ)6d$	$6d'\ ^3P^\circ$	2, 1 0	133618 ±	
$2s\,2p^5$	$2p^5\ ^1P^\circ$	1	[189837]	

August 1947.

O I Observed Terms*

Config. $1s^2+$	Observed Terms		
$2s^2\,2p^4$	$2p^4\;{}^3P$ $2p^4\;{}^1S$ $2p^4\;{}^1D$		
$2s\,2p^5$	$2p^5\;{}^3P^\circ$		
	ns $(n\geq 3)$	np $(n\geq 3)$	nd $(n\geq 3)$
$2s^2\,2p^3(^4S^\circ)nx$	3–10s $^5S^\circ$ 3–11s $^3S^\circ$	3, 4p ^5P 3–6p ^3P	3–10d $^5D^\circ$ 3–10d $^3D^\circ$
$2s^2\,2p^3(^2D^\circ)nx'$	$3s'$ $^3D^\circ$ 3–7s' $^1D^\circ$	3, 4p' ^3D $3p'$ ^3F $3p'$ ^1D $3p'$ ^1F	3–6d' $^3P^\circ$ 3–5d' $^3F^\circ$ 3–5d' $^3G^\circ$ 3, 4d' $^1F^\circ$ 3–5d' $^1G^\circ$
$2s^2\,2p^3(^2P^\circ)nx''$	$3s''$ $^3P^\circ$ $3s''$ $^1P^\circ$	$3p''$ ^3D $3p''$ ^1S $3p''$ ^1P $3p''$ ^1D	

*For predicted terms in the spectra of the O I isoelectronic sequence, see Introduction.

O II

(N I sequence; 7 electrons) $Z=8$

Ground state $1s^2\,2s^2\,2p^3\;{}^4S^\circ_{1\frac{1}{2}}$

$2p^3\;{}^4S^\circ_{1\frac{1}{2}}$ *283550.9* cm^{-1} I. P. 35.146 volts

The terms are from Edlén's publications. He has summarized the earlier work on analysis by others and extended it by his observations in the far ultraviolet.

Edlén states that a number of the $5f$-terms are very uncertain. These are followed by a "?" in the table. His estimated values of three terms from the (^1S) limit in O III are given in brackets.

Mihul lists the observed Zeeman effects for 111 lines, which in general agree well with the theoretical patterns for the adopted classifications. From his data a number of g-values could be calculated, but many of the observed patterns are unresolved.

Although the analysis of O II is fairly complete, the measures by different observers are discordant. The term values could be greatly improved by a set of homogeneous observations. A monograph containing all classified lines of this spectrum is also needed.

The doublet and quartet terms are connected by intersystem combinations, but the sextet terms are not so connected with the rest. The relative uncertainty, x, may be a few hundred cm^{-1}.

REFERENCES

I. S. Bowen, Phys. Rev. **29,** 231 (1927). (T) (C L)
A. Fowler, Proc. Roy. Soc. (London) [A] **110,** 476 (1926). (T) (C L)
C. Mihul, Ann. de Phys. [10] **9,** 294 (1928). (T) (C L) (Z E)
H. N. Russell, Phys. Rev. **31,** 27 (1928). (T) (C L)
B. Edlén, Nova Acta Reg. Soc. Sci. Uppsala [IV] **9,** No. 6, 136 (1934). (I P) (T) (C L) (G D)
B. Edlén, Zeit. Phys. **93,** 728 (1935). (T) (C L)

O II

Edlén	Config.	Desig.	J	Level	Interval
$2p\ {}^4S_2$	$2s^2\ 2p^3$	$2p^3\ {}^4S^\circ$	1½	0.0	
$2p\ {}^2D_3$	$2s^2\ 2p^3$	$2p^3\ {}^2D^\circ$	2½	26808.4	−21.0
${}^2D_2$			1½	26829.4	
$2p\ {}^2P_2$	$2s^2\ 2p^3$	$2p^3\ {}^2P^\circ$	1½	40466.9	−1.5
${}^2P_1$			½	40468.4	
$2p'\ {}^4P_3$	$2s\ 2p^4$	$2p^4\ {}^4P$	2½	119837.7	−163.4
${}^4P_2$			1½	120001.1	−82.4
${}^4P_1$			½	120083.5	
$2p'\ {}^2D_3$	$2s\ 2p^4$	$2p^4\ {}^2D$	2½	165987.7	−8.3
${}^2D_2$			1½	165996.0	
$3s\ {}^4P_1$	$2s^2\ 2p^2(^3P)3s$	$3s\ {}^4P$	½	185235.36	105.32
${}^4P_2$			1½	185340.68	158.52
${}^4P_3$			2½	185499.20	
$3s\ {}^2P_1$	$2s^2\ 2p^2(^3P)3s$	$3s\ {}^2P$	½	188888.38	179.99
${}^2P_2$			1½	189068.37	
$2p'\ {}^2S_1$	$2s\ 2p^4$	$2p^4\ {}^2S$	½	195710.4	
$3p\ {}^2S_1$	$2s^2\ 2p^2(^3P)3p$	$3p\ {}^2S^\circ$	½	203942.21	
$3p\ {}^4D_1$	$2s^2\ 2p^2(^3P)3p$	$3p\ {}^4D^\circ$	½	206730.80	55.54
${}^4D_2$			1½	206786.34	91.56
${}^4D_3$			2½	206877.90	124.62
${}^4D_4$			3½	207002.52	
$\overline{3s}\ {}^2D_3$	$2s^2\ 2p^2(^1D)3s$	$3s'\ {}^2D$	2½	206971.3	−1.0
${}^2D_2$			1½	206972.3	
$3p\ {}^4P_1$	$2s^2\ 2p^2(^3P)3p$	$3p\ {}^4P^\circ$	½	208346.17	46.10
${}^4P_2$			1½	208392.27	91.97
${}^4P_3$			2½	208484.24	
$3p\ {}^2D_2$	$2s^2\ 2p^2(^3P)3p$	$3p\ {}^2D^\circ$	1½	211521.98	190.68
${}^2D_3$			2½	211712.66	
$3p\ {}^4S_2$	$2s^2\ 2p^2(^3P)3p$	$3p\ {}^4S^\circ$	1½	212161.94	
$2p'\ {}^2P_2$	$2s\ 2p^4$	$2p^4\ {}^2P$	1½	212593.2	−169.2
${}^2P_1$			½	212762.4	
$3p\ {}^2P_1$	$2s^2\ 2p^2(^3P)3p$	$3p\ {}^2P^\circ$	½	214169.74	59.74
${}^2P_2$			1½	214229.48	
	$2s^2\ 2p^2(^1S)3s$	$3s''\ {}^2S$	½	[226851]	
$\overline{3p}\ {}^2F_3$	$2s^2\ 2p^2(^1D)3p$	$3p'\ {}^2F^\circ$	2½	228723.3	23.6
${}^2F_4$			3½	228746.9	
$\overline{3p}\ {}^2D_3$	$2s^2\ 2p^2(^1D)3p$	$3p'\ {}^2D^\circ$	2½	229946.6	−21.6
${}^2D_2$			1½	229968.2	
$3d\ {}^4F_2$	$2s^2\ 2p^2(^3P)3d$	$3d\ {}^4F$	1½	231296.05	54.03
${}^4F_3$			2½	231350.08	77.91
${}^4F_4$			3½	231427.99	102.27
${}^4F_5$			4½	231530.26	
$3d\ {}^4P_3$	$2s^2\ 2p^2(^3P)3d$	$3d\ {}^4P$	2½	232462.83	−73.23
${}^4P_2$			1½	232536.06	−66.51
${}^4P_1$			½	232602.57	
$\overline{3p}\ {}^2P_1$	$2s^2\ 2p^2(^1D)3p$	$3p'\ {}^2P^\circ$	½	232480.1	46.6
${}^2P_2$			1½	232526.7	
$3d\ {}^4D_1$	$2s^2\ 2p^2(^3P)3d$	$3d\ {}^4D$	½	232711.70	34.28
${}^4D_2$			1½	232745.98	1.53
${}^4D_3$			2½	232747.51	6.35
${}^4D_4$			3½	232753.86	
$3d\ {}^2F_3$	$2s^2\ 2p^2(^3P)3d$	$3d\ {}^2F$	2½	232796.27	162.99
${}^2F_4$			3½	232959.26	

O II

Edlén	Config.	Desig.	J	Level	Interval
$3d\ {}^2P_2$	$2s^2\ 2p^2(^3P)3d$	$3d\ {}^2P$	1½	233430.10	−113.99
${}^2P_1$			½	233544.09	
$3d\ {}^2D_2$	$2s^2\ 2p^2(^3P)3d$	$3d\ {}^2D$	1½	234402.48	51.97
${}^2D_3$			2½	234454.45	
$4s\ {}^4P_1$	$2s^2\ 2p^2(^3P)4s$	$4s\ {}^4P$	½	238626.32	105.22
${}^4P_2$			1½	238731.54	161.42
${}^4P_3$			2½	238892.96	
$4s\ {}^2P_1$	$2s^2\ 2p^2(^3P)4s$	$4s\ {}^2P$	½	240328.75	187.53
${}^2P_2$			1½	240516.28	
$3s'\ {}^6S_3$	$2s\ 2p^3(^5S^\circ)3s$	$3s'''\ {}^6S^\circ$	2½	245395.5 $+x$	
$4p\ {}^4D_1$	$2s^2\ 2p^2(^3P)4p$	$4p\ {}^4D^\circ$	½	245767.80	48.49
${}^4D_2$			1½	245816.29	86.56
${}^4D_3$			2½	245902.85	126.10
${}^4D_4$			3½	246028.95	
$4p\ {}^2D_2$	$2s^2\ 2p^2(^3P)4p$	$4p\ {}^2D^\circ$	1½	248009.1	176.2
${}^2D_3$			2½	248185.3	
$4p\ {}^2P_1$	$2s^2\ 2p^2(^3P)4p$	$4p\ {}^2P^\circ$	½	248425.35	88.88
${}^2P_2$			1½	248514.23	
	$2s^2\ 2p^2(^1S)3p$	$3p''\ {}^2P^\circ$	{½, 1½}	[250251]	
$\overline{3d}\ {}^2F_4$	$2s^2\ 2p^2(^1D)3d$	$3d'\ {}^2F$	3½	251220.9	−3.2
${}^2F_3$			2½	251224.1	
$\overline{3d}\ {}^2G_5$	$2s^2\ 2p^2(^1D)3d$	$3d'\ {}^2G$	4½	252607.7	−1.2
${}^2G_4$			3½	252608.9	
$\overline{3d}\ {}^2D_2$	$2s^2\ 2p^2(^1D)3d$	$3d'\ {}^2D$	1½	253046.23	2.12
${}^2D_3$			2½	253048.35	
$\overline{3d}\ {}^2P_1$	$2s^2\ 2p^2(^1D)3d$	$3d'\ {}^2P$	½	253789.51	2.36
${}^2P_2$			1½	253791.87	
	$2s^2\ 2p^2(^3P)4d$	$4d\ {}^4F$	1½		
			2½		
$4d\ {}^4F_4$			3½	254481.5	109.2
${}^4F_5$			4½	254590.7	
	$2s^2\ 2p^2(^3P)4d$	$4d\ {}^4D$	½		
$4d\ {}^4D_{2,3}$			{1½, 2½}	254895.2	
			3½		
$3s'\ {}^4S_2$	$2s\ 2p^3(^5S^\circ)3s$	$3s'''\ {}^4S^\circ$	1½	254982.2	
$4d\ {}^4P_3$	$2s^2\ 2p^2(^3P)4d$	$4d\ {}^4P$	2½	255104.6	−36.3
${}^4P_2$			1½	255140.9	−21.7
${}^4P_1$			½	255162.6	
$4d\ {}^2P_2$	$2s^2\ 2p^2(^3P)4d$	$4d\ {}^2P$	1½	255172.5	−108.9
${}^2P_1$			½	255281.4	
$4d\ {}^2F_3$	$2s^2\ 2p^2(^3P)4d$	$4d\ {}^2F$	2½	255301.3	163.9
${}^2F_4$			3½	255465.2	
$\overline{3d}\ {}^2S_1$	$2s^2\ 2p^2(^1D)3d$	$3d'\ {}^2S$	½	255622.4	
$4f\ {}^2D_3$	$2s^2\ 2p^2(^3P)4f$	$4f\ {}^2D^\circ$	2½	255689.6	−122.6
${}^2D_2$			1½	255812.2	
$4f\ {}^4D_4$	$2s^2\ 2p^2(^3P)4f$	$4f\ {}^4D^\circ$	3½	255691.4	−121.7
${}^4D_3$			2½	255813.1	−100
${}^4D_2$			1½	255913 ±	1
${}^4D_1$			½	255912.0	

O II—Continued

Eldén	Config.	Desig.	J	Level	Interval
$4f\,^4G_3$	$2s^2\,2p^2(^3P)4f$	$4f\,^4G^\circ$	2½	*255755.8*	
$^4G_4$			3½	*255759.4*	3.6
$^4G_5$			4½	*255827.6*	68.2
$^4G_6$			5½	*255977.5*	149.9
$4f\,^2G_4$	$2s^2\,2p^2(^3P)4f$	$4f\,^2G^\circ$	3½	*255829.4*	
$^2G_5$			4½	*255983.6*	154.2
$4d\,^2D_2$	$2s^2\,2p^2(^3P)4d$	$4d\,^2D$	1½	255843.1	
$^2D_3$			2½	255897.2	54.1
$4f\,^4F_2$	$2s^2\,2p^2(^3P)4f$	$4f\,^4F^\circ$	1½	*256083.5*	
$^4F_3$			2½	*256087.6*	4.1
$^4F_4$			3½	*256123.1*	35.5
$^4F_5$			4½	*256136.2*	13.1
$4f\,^2F_3$	$2s^2\,2p^2(^3P)4f$	$4f\,^2F^\circ$	2½	*256125.8*	
$^2F_4$			3½	*256143.3*	17.5
$5s\,^4P_1$	$2s^2\,2p^2(^3P)5s$	$5s\,^4P$	½	257693.7	
$^4P_2$			1½	257797.9	104.2
$^4P_3$			2½	257963.8	165.9
$5s\,^2P_1$	$2s^2\,2p^2(^3P)5s$	$5s\,^2P$	½	258408.6	
$^2P_2$			1½	258601.7	193.1
$\overline{4s}\,^2D_3$	$2s^2\,2p^2(^1D)4s$	$4s'\,^2D$	2½	259286.2	
$^2D_2$			1½	259287.0	−0.8
	$2s^2\,2p^2(^3P)5p$	$5p\,^4D^\circ$	½		
$5p\,^4D_2$			1½	*260959*	
$^4D_3$			2½	*261042*	83
$^4D_4$			3½	*261180*	138
	$2s^2\,2p^2(^3P)5p$	$5p\,^4P^\circ$	½		
$5p\,^4P_2$			1½	*261261.7*	
$^4P_3$			2½	*261354.3*	92.6
$5p\,^2D_2$	$2s^2\,2p^2(^3P)5p$	$5p\,^2D^\circ$	1½	*261697.5*	
$^2D_3$			2½	*261869.4*	171.9
	$2s^2\,2p^2(^3P)5d$	$5d\,^4D$	½		
$5d\,^4D_{2,3}$			{1½, 2½}	265220.3	
			3½		
$5d\,^4P_3$	$2s^2\,2p^2(^3P)5d$	$5d\,^4P$	2½	265431.5	
$^4P_{1,2}$			{1½, ½}	265468.2	−36.7
	$2s^2\,2p^2(^3P)5d$	$5d\,^2F$	2½		
$5d\,^2F_4$			3½	265578?	
$5f\,^4D_4$	$2s^2\,2p^2(^3P)5f$	$5f\,^4D^\circ$	3½	*265639*	
$^4D_3$			2½	*265705?*	−66
$^4D_2$			1½	*265762?*	−57
$^4D_1$			½	*265859?*	−97
$5f\,^4G_3$	$2s^2\,2p^2(^3P)5f$	$5f\,^4G^\circ$	2½	*265665?*	
$^4G_4$			3½	*265691*	26
$^4G_5$			4½	*265761*	70
$^4G_6$			5½	*265925*	164

O II—Continued

Eldén	Config.	Desig.	J	Level	Interval
$5f\,^2G_4$	$2s^2\,2p^2(^3P)5f$	$5f\,^2G^\circ$	3½	*265763.0*	
$^2G_5$			4½	*265930.2*	167.2
	$2s^2\,2p^2(^3P)5d$	$5d\,^2D$	1½		
$5d\,^2D_3$			2½	265856	
$5f\,^4F_2$	$2s^2\,2p^2(^3P)5f$	$5f\,^4F^\circ$	1½	*265928?*	
$^4F_3$			2½	*265961?*	33
$^4F_4$			3½	*265985*	24
$^4F_5$			4½	*265999*	14
$5f\,^2F_3$	$2s^2\,2p^2(^3P)5f$	$5f\,^2F^\circ$	2½	*265988?*	
$^2F_4$			3½	*265999?*	11
$3p'\,^6P_2$	$2s\,2p^3(^5S^\circ)3p$	$3p'''\,^6P$	1½	267763.39+x	
$^6P_3$			2½	267770.85+x	7.46
$^6P_4$			3½	267783.40+x	12.55
$\overline{4d}\,^2F_3$	$2s^2\,2p^2(^1D)4d$	$4d'\,^2F$	2½	274739.2	
$^2F_4$			3½	274782.4	43.2
$\overline{4d}\,^2D_{2,3}$	$2s^2\,2p^2(^1D)4d$	$4d'\,^2D$	{1½, 2½}	274920	
$\overline{4d}\,^2P_{1,2}$	$2s^2\,2p^2(^1D)4d$	$4d'\,^2P$	{½, 1½}	275611?	
$\overline{4f}\,^2G$	$2s^2\,2p^2(^1D)4f$	$4f'\,^2G^\circ$	{3½, 4½}	*275841.3*	
$\overline{4f}\,^2F$	$2s^2\,2p^2(^1D)4f$	$4f'\,^2F^\circ$	{2½, 3½}	*275879.6*	
	$2s^2\,2p^2(^1S)3d$	$3d''\,^2D$	{1½, 2½}	[275951]	
$\overline{4d}\,^2S_1$	$2s^2\,2p^2(^1D)4d$	$4d'\,^2S$	½	275997?	
$\overline{4f}\,^2D$	$2s^2\,2p^2(^1D)4f$	$4f'\,^2D^\circ$	{1½, 2½}	*276066.3*	
$\overline{4f}\,^2H$	$2s^2\,2p^2(^1D)4f$	$4f'\,^2H^\circ$	{4½, 5½}	*276109.1*	
$\overline{4f}\,^2P$	$2s^2\,2p^2(^1D)4f$	$4f'\,^2P^\circ$	{½, 1½}	*276263.9?*	
$\overline{5s}\,^2D_{2,3}$	$2s^2\,2p^2(^1D)5s$	$5s'\,^2D$	{1½, 2½}	278140	
	O III ($^3P_0$)	***Limit***	------	**283550.9**	
$3d'\,^6D_5$	$2s\,2p^3(^5S^\circ)3d$	$3d'''\,^6D^\circ$	4½	*291895.90+x*	
$^6D_4$			3½	*291896.78+x*	−0.88
$^6D_3$			2½	*291898.01+x*	−1.23
$^6D_2$			1½	*291899.11+x*	−1.10
$^6D_1$			½	*291899.81+x*	−0.70
$4s'\,^6S_3$	$2s\,2p^3(^5S^\circ)4s$	$4s'''\,^6S^\circ$	2½	*298849.2 +x*	

December 1947.

O II OBSERVED TERMS*

Config. $1s^2+$	Observed Terms				
$2s^2\,2p^3$	$2p^3\ {}^4S^\circ$	$2p^3\ {}^2P^\circ$	$2p^3\ {}^2D^\circ$		
$2s\,2p^4$	$2p^4\ {}^2S$	$2p^4\ {}^4P$ $2p^4\ {}^2P$	$2p^4\ {}^2D$		

Config. $1s^2+$	$ns\ (n\geq 3)$	$np\ (n\geq 3)$
$2s^2\,2p^2(^3P)nx$	$3\text{–}5s\ {}^4P$ $3\text{–}5s\ {}^2P$	$3p\ {}^4S^\circ$ $3,5p\ {}^4P^\circ$ $3\text{–}5p\ {}^4D^\circ$ $3p\ {}^2S^\circ$ $3,4p\ {}^2P^\circ$ $3\text{–}5p\ {}^2D^\circ$
$2s^2\,2p^2(^1D)nx'$	$3\text{–}5s'\ {}^2D$	$3p'\ {}^2P^\circ$ $3p'\ {}^2D^\circ$ $3p'\ {}^2F^\circ$
$2s\,2p^3(^5S^\circ)nx'''$	$3,4s'''\ {}^6S^\circ$ $3s'''\ {}^4S^\circ$	$3p'''\ {}^6P$

Config. $1s^2+$	$nd\ (n\geq 3)$	$nf\ (n\geq 4)$
$2s^2\,2p^2(^3P)nx$	$3\text{–}5d\ {}^4P$ $3\text{–}5d\ {}^4D$ $3,4d\ {}^4F$ $3,4d\ {}^2P$ $3\text{–}5d\ {}^2D$ $3\text{–}5d\ {}^2F$	$4,5f\ {}^4D^\circ$ $4,5f\ {}^4F^\circ$ $4,5f\ {}^4G^\circ$ $4f\ {}^2D^\circ$ $4,5f\ {}^2F^\circ$ $4,5f\ {}^2G^\circ$
$2s^2\,2p^2(^1D)nx'$	$3,4d'\ {}^2S$ $3,4d'\ {}^2P$ $3,4d'\ {}^2D$ $3,4d'\ {}^2F$ $3d'\ {}^2G$	$4f'\ {}^2P^\circ$ $4f'\ {}^2D^\circ$ $4f'\ {}^2F^\circ$ $4f'\ {}^2G^\circ$ $4f'\ {}^2H^\circ$
$2s\,2p^3(^5S^\circ)nx'''$	$3d'''\ {}^6D^\circ$	

*For predicted terms in the spectra of the N I isoelectronic sequence, see Introduction.

O III

(C I sequence; 6 electrons) $Z=8$

Ground state $1s^2\,2s^2\,2p^2\ {}^3P_0$

$2p^2\ {}^3P_0$ **443193.5** cm^{-1} I. P. 54.934 volts

The terms are from the papers by Edlén. The singlet, triplet and quintet terms are connected by intersystem combinations. Edlén has kindly furnished some unpublished results for inclusion here, namely, that intersystem combinations with quintet terms indicate that his published absolute values of these terms should be decreased by 418 cm^{-1}. This correction has been incorporated into the tabular values of the quintet terms.

REFERENCES

C. Mihul, Ann. de Phys. [10] **9**, 326 (1928). (T) (C L) (Z E)
A. Fowler, Proc. Roy. Soc. (London) [A] **117**, 317 (1928). (T) (C L)
B. Edlén, Nova Acta Reg. Soc. Sci Uppsala [IV] **9**, No. 6, 115 (1934). (I P) (T) (C L) (G D)
B. Edlén, Zeit. Phys. **93**, 726 (1935). (T) (C L)
B. Edlén, Naturwiss. **30**, 279 (1942). (T) (C L)
B. Edlén, unpublished material (Dec. 1947). (T)

O III

Edlén	Config.	Desig.	J	Level	Interval
$2p\ ^3P_0$	$2s^2\ 2p^2$	$2p^2\ ^3P$	0	0. 0	113. 4
$^3P_1$			1	113. 4	193. 4
$^3P_2$			2	306. 8	
$2p\ ^1D_2$	$2s^2\ 2p^2$	$2p^2\ ^1D$	2	20271. 0	
$2p\ ^1S_0$	$2s^2\ 2p^2$	$2p^2\ ^1S$	0	43183. 5	
$2p'\ ^5S_2$	$2s\ 2p^3$	$2p^3\ ^5S^\circ$	2	*60312. 1*	
$2p'\ ^3D_3$	$2s\ 2p^3$	$2p^3\ ^3D^\circ$	3	*120025. 4*	−27. 2
$^3D_2$			2	*120052. 6*	−5. 9
$^3D_1$			1	*120058. 5*	
$2p'\ ^3P_2$	$2s\ 2p^3$	$2p^3\ ^3P^\circ$	2	*142381. 7*	−1. 1
$^3P_1$			1	*142382. 8*	−14. 1
$^3P_0$			0	*142396. 9*	
$2p'\ ^1D_2$	$2s\ 2p^3$	$2p^3\ ^1D^\circ$	2	*187049. 4*	
$2p'\ ^3S_1$	$2s\ 2p^3$	$2p^3\ ^3S^\circ$	1	*197086. 7*	
$2p'\ ^1P_1$	$2s\ 2p^3$	$2p^3\ ^1P^\circ$	1	*210458. 5*	
$3s\ ^3P_0$	$2s^2\ 2p(^2P^\circ)3s$	$3s\ ^3P^\circ$	0	*267257. 29*	118. 36
$^3P_1$			1	*267375. 65*	256. 94
$^3P_2$			2	*267632. 59*	
$3s\ ^1P_1$	$2s^2\ 2p(^2P^\circ)3s$	$3s\ ^1P^\circ$	1	*273080. 07*	
$2p''\ ^3P_2$	$2p^4$	$2p^4\ ^3P$	2	283758. 9	−217. 7
$^3P_1$			1	283976. 6	−96. 7
$^3P_0$			0	284073. 3	
$3p\ ^1P_1$	$2s^2\ 2p(^2P^\circ)3p$	$3p\ ^1P$	1	290956. 62	
$3p\ ^3D_1$	$2s^2\ 2p(^2P^\circ)3p$	$3p\ ^3D$	1	293865. 26	136. 34
$^3D_2$			2	294001. 60	220. 05
$^3D_3$			3	294221. 65	
$3p\ ^3S_1$	$2s^2\ 2p(^2P^\circ)3p$	$3p\ ^3S$	1	297557. 50	
$2p''\ ^1D_2$	$2p^4$	$2p^4\ ^1D$	2	298289. 4	
$3p\ ^3P_0$	$2s^2\ 2p(^2P^\circ)3p$	$3p\ ^3P$	0	300228. 21	82. 10
$^3P_1$			1	300310. 31	130. 54
$^3P_2$			2	300440. 85	
$3p\ ^1D_2$	$2s^2\ 2p(^2P^\circ)3p$	$3p\ ^1D$	2	306584. 8	
$3p\ ^1S_0$	$2s^2\ 2p(^2P^\circ)3p$	$3p\ ^1S$	0	313801. 07	
$3d\ ^3F_2$	$2s^2\ 2p(^2P^\circ)3d$	$3d\ ^3F^\circ$	2	*324462. 46*	195. 79
$^3F_3$			3	*324658. 25*	178. 16
$^3F_4$			4	*324836. 41*	
$3d\ ^1D_2$	$2s^2\ 2p(^2P^\circ)3d$	$3d\ ^1D^\circ$	2	*324734. 22*	
$3d\ ^3D_1$	$2s^2\ 2p(^2P^\circ)3d$	$3d\ ^3D^\circ$	1	*327227. 94*	49. 24
$^3D_2$			2	*327277. 18*	73. 72
$^3D_3$			3	*327350. 90*	
$3d\ ^3P_2$	$2s^2\ 2p(^2P^\circ)3d$	$3d\ ^3P^\circ$	2	*329467. 98*	−114. 00
$^3P_1$			1	*329581. 98*	−61. 45
$^3P_0$			0	*329643. 43*	
$3d\ ^1F_3$	$2s^2\ 2p(^2P^\circ)3d$	$3d\ ^1F^\circ$	3	*331820. 2*	
$3d\ ^1P_1$	$2s^2\ 2p(^2P^\circ)3d$	$3d\ ^1P^\circ$	1	*332777. 1*	
$3s'\ ^5P_1$	$2s\ 2p^2(^4P)3s$	$3s\ ^5P$	1	338565. 87	124. 47
$^5P_2$			2	338690. 34	161. 16
$^5P_3$			3	338851. 50	
$2p''\ ^1S_0$	$2p^4$	$2p^4\ ^1S$	0	343302. 6?	

O III

Edlén	Config.	Desig.	J	Level	Interval
$3s'\ ^3P_0$	$2s\ 2p^2(^4P)3s$	$3s\ ^3P$	0	350026. 1	96. 8
$^3P_1$			1	350122. 9	179. 4
$^3P_2$			2	350302. 3	
$4s\ ^3P_0$	$2s^2\ 2p(^2P^\circ)4s$	$4s\ ^3P^\circ$	0	*356732*	106
$^3P_1$			1	*356838*	273
$^3P_2$			2	*357111*	
$4s\ ^1P_1$	$2s^2\ 2p(^2P^\circ)4s$	$4s\ ^1P^\circ$	1	*358667. 4*	
$3p'\ ^3S_1$	$2s\ 2p^2(^4P)3p$	$3p\ ^3S^\circ$	1	*363266. 8*	
$3p'\ ^5D_0$	$2s\ 2p^2(^4P)3p$	$3p\ ^5D^\circ$	0	*365515. 76*	34. 84
$^5D_1$			1	*365550. 60*	68. 52
$^5D_2$			2	*365619. 12*	100. 04
$^5D_3$			3	*365719. 16*	127. 30
$^5D_4$			4	*365846. 46*	
$4p\ ^1P_1$	$2s^2\ 2p(^2P^\circ)4p$	$4p\ ^1P$	1	365723. 9	
$4p\ ^3D_1$	$2s^2\ 2p(^2P^\circ)4p$	$4p\ ^3D$	1	366486. 91	107. 10
$^3D_2$			2	366594. 01	207. 03
$^3D_3$			3	366801. 04	
$4p\ ^3S_1$	$2s^2\ 2p(^2P^\circ)4p$	$4p\ ^3S$	1	367952. 20	
$3p'\ ^5P_1$	$2s\ 2p^2(^4P)3p$	$3p\ ^5P^\circ$	1	*368526. 37*	57. 26
$^5P_2$			2	*368583. 63*	101. 12
$^5P_3$			3	*368684. 75*	
$4p\ ^3P_0$	$2s^2\ 2p(^2P^\circ)4p$	$4p\ ^3P$	0	370326. 7	89. 0
$^3P_1$			1	370415. 7	108. 5
$^3P_2$			2	370524. 2	
$4p\ ^1D_2$	$2s^2\ 2p(^2P^\circ)4p$	$4p\ ^1D$	2	370900. 6	
$4p\ ^1S_0$	$2s^2\ 2p(^2P^\circ)4p$	$4p\ ^1S$	0	373046. 2	
$3p'\ ^3D_1$	$2s\ 2p^2(^4P)3p$	$3p\ ^3D^\circ$	1	*374575*	88
$^3D_2$			2	*374662. 5*	136. 1
$^3D_3$			3	*374798. 6*	
$3p'\ ^5S_2$	$2s\ 2p^2(^4P)3p$	$3p\ ^5S^\circ$	2	*376067. 66*	
$4d\ ^3F_2$	$2s^2\ 2p(^2P^\circ)4d$	$4d\ ^3F^\circ$	2	*377375*	
			3		
			4		
$4d\ ^1D_2$	$2s^2\ 2p(^2P^\circ)4d$	$4d\ ^1D^\circ$	2	*377687*	
$3p'\ ^3P_2$	$2s\ 2p^2(^4P)3p$	$3p\ ^3P^\circ$	2	*378408. 5*	−12. 4
$^3P_1$			1	*378420. 9*	−17. 2
$^3P_0$			0	*378438. 1*	
$4d\ ^3D_1$	$2s^2\ 2p(^2P^\circ)4d$	$4d\ ^3D^\circ$	1	*379232*	61
$^3D_2$			2	*379293*	63
$^3D_3$			3	*379356*	
$4d\ ^3P_2$	$2s^2\ 2p(^2P^\circ)4d$	$4d\ ^3P^\circ$	2	*380706*	
			1		
			0		
$4d\ ^1F_3$	$2s^2\ 2p(^2P^\circ)4d$	$4d\ ^1F^\circ$	3	*380782*	
$4d\ ^1P_1$	$2s^2\ 2p(^2P^\circ)4d$	$4d\ ^1P^\circ$	1	*381086*	
	$2s^2\ 2p(^2P^\circ)5s$	$5s\ ^3P^\circ$	0		
			1		
$5s\ ^3P_2$			2	*392221*	
$5s\ ^1P_1$	$2s^2\ 2p(^2P^\circ)5s$	$5s\ ^1P^\circ$	1	*392778*	
$\overline{3s'}\ ^3D_1$	$2s\ 2p^2(^2D)3s$	$3s'\ ^3D$	1	394090	36
$^3D_2$			2	394126	69
$^3D_3$			3	394195	

O III—Continued

Edlén	Config.	Desig.	J	Level	Interval
$3d'\ {}^5F_1$	$2s\ 2p^2(^4P)3d$	$3d\ {}^5F$	1	394516.45	
${}^5F_2$			2	394555.15	38.70
${}^5F_3$			3	394612.70	57.55
${}^5F_4$			4	394688.44	75.74
${}^5F_5$			5	394780.47	92.03
$3d'\ {}^5D_0$	$2s\ 2p^2(^4P)3d$	$3d\ {}^5D$	0	398135.0	
${}^5D_1$			1	398131.4	−3.6
${}^5D_2$			2	398127.3	−4.1
${}^5D_3$			3	398137.4	10.1
D_4			4	398218.8	81.4
$3d'\ {}^5P_3$	$2s\ 2p^2(^4P)3d$	$3d\ {}^5P$	3	398474.3	
${}^5P_2$			2	398544.3	−70.0
${}^5P_1$			1	398582.8	−38.5
$3d'\ {}^3P_2$	$2s\ 2p^2(^4P)3d$	$3d\ {}^3P$	2	400354.8	
${}^3P_1$			1	400464.7	−109.9
${}^3P_0$			0	400518.4	−53.7
$3d'\ {}^3F_2$	$2s\ 2p^2(^4P)3d$	$3d\ {}^3F$	2	401379	
${}^3F_3$			3	401475.4	96
${}^3F_4$			4	401609.1	133.7
$5d\ {}^3F_2$	$2s^2\ 2p(^2P^\circ)5d$	$5d\ {}^3F^\circ$	2	*401530*	
			3		
			4		
$5d\ {}^1D_2$	$2s^2\ 2p(^2P^\circ)5d$	$5d\ {}^1D^\circ$	2	*401787*	
	$2s^2\ 2p(^2P^\circ)5d$	$5d\ {}^3D^\circ$	1		
			2		
$5d\ {}^3D_3$			3	*402530*	
$5d\ {}^1F_3$	$2s^2\ 2p(^2P^\circ)5d$	$5d\ {}^1F^\circ$	3	*403374*	
$5d\ {}^1P_1$	$2s^2\ 2p(^2P^\circ)5d$	$5d\ {}^1P^\circ$	1	*403526*	
$3d'\ {}^3D_1$	$2s\ 2p^2(^4P)3d$	$3d\ {}^3D$	1	405805.1	
${}^3D_2$			2	405834.1	29.0
${}^3D_3$			3	405883.0	48.9
$6d\ {}^1D_2$	$2s^2\ 2p(^2P^\circ)6d$	$6d\ {}^1D^\circ$	2	*414675*	
	$2s^2\ 2p(^2P^\circ)6d$	$6d\ {}^3D^\circ$	1		
			2		
$6d\ {}^3D_3$			3	*415181*	

O III—Continued

Edlén	Config.	Desig.	J	Level	Interval
$7d\ {}^1F_3$	$2s^2\ 2p(^2P^\circ)7d$	$7d\ {}^1F^\circ$	3	*422977*	
$\overline{3p'}\ {}^1F_3$	$2s\ 2p^2(^2D)3p$	$3p'\ {}^1F^\circ$	3	*424998*	
$\overline{3p'}\ {}^1D_2$	$2s\ 2p^2(^2D)3p$	$3p'\ {}^1D^\circ$	2	*426338*	
$4s'\ {}^5P_1$	$2s\ 2p^2(^4P)4s$	$4s\ {}^5P$	1	428487	
${}^5P_2$			2	428606	119
${}^5P_3$			3	428769	163
$\overline{3p'}\ {}^1P_1$	$2s\ 2p^2(^2D)3p$	$3p'\ {}^1P^\circ$	1	*430025*	
$4p'\ {}^3S_1$	$2s\ 2p^2(^4P)4p$	$4p\ {}^3S^\circ$	1	*437015.0*	
$4p'\ {}^5D_0$	$2s\ 2p^2(^4P)4p$	$4p\ {}^5D^\circ$	0		
${}^5D_1$			1	*438241.0*	
${}^5D_2$			2	*438303.2*	62.2
${}^5D_3$			3	*438395.2*	92.0
${}^5D_4$			4	*438517.5*	122.3
$4p'\ {}^5P_1$	$2s\ 2p^2(^4P)4p$	$4p\ {}^5P^\circ$	1	*439278.1*	
${}^5P_2$			2	*439329.5*	51.4
${}^5P_3$			3	*439427.6*	98.1
	$2s\ 2p^2(^4P)4p$	$4p\ {}^3D^\circ$	1		
			2		
$4p'\ {}^3D_3$			3	*442710*	
	O IV ($^2P^\circ_{1/2}$)	*Limit*	------	**443193.5**	
$4d'\ {}^5P_3$	$2s\ 2p^2(^4P)4d$	$4d\ {}^5P$	3	450167	
${}^5P_2$			2	450237	−70
${}^5P_1$			1	450291	−54
$\overline{3d'}\ {}^3F$	$2s\ 2p^2(^2D)3d$	$3d'\ {}^3F$	2, 3, 4	452855	
$\overline{3d'}\ {}^3D$	$2s\ 2p^2(^2D)3d$	$3d'\ {}^3D$	1, 2, 3	454174	
$\overline{3d'}\ {}^3P$	$2s\ 2p^2(^2D)3d$	$3d'\ {}^3P$	0, 1, 2	457634	
$5d'\ {}^5P_3$	$2s\ 2p^2(^4P)5d$	$5d\ {}^5P$		473750	
			1		

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O III Observed Terms*

Config. $1s^2+$	Observed Terms		
$2s^2\ 2p^2$	$2p^2\ {}^1S$	$2p^2\ {}^3P$	$2p^2\ {}^1D$
$2s\ 2p^3$	$2p^3\ {}^5S^\circ$ $2p^3\ {}^3S^\circ$	$2p^3\ {}^3P^\circ$ $2p^3\ {}^1P^\circ$	$2p^3\ {}^3D^\circ$ $2p^3\ {}^1D^\circ$
$2p^4$	$2p^4\ {}^1S$	$2p^4\ {}^3P$	$2p^4\ {}^1D$
	$ns\ (n\geq3)$	$np\ (n\geq3)$	$nd\ (n\geq3)$
$2s^2\ 2p(^2P^\circ)nx$	$3–5s\ {}^3P^\circ$ $3–5s\ {}^1P^\circ$	$3, 4p\ {}^3S$ $3, 4p\ {}^3P$ $3, 4p\ {}^3D$ $3, 4p\ {}^1S$ $3, 4p\ {}^1P$ $3, 4p\ {}^1D$	$3, 4d\ {}^3P^\circ$ $3–6d\ {}^3D^\circ$ $3–5d\ {}^3F^\circ$ $3–5d\ {}^1P^\circ$ $3–6d\ {}^1D^\circ$ $3–5, 7d\ {}^1F^\circ$
$2s\ 2p^2(^4P)nx$	$3, 4s\ {}^5P$ $3s\ {}^3P$	$3p\ {}^5S^\circ$ $3, 4p\ {}^5P^\circ$ $3, 4p\ {}^5D^\circ$ $3, 4p\ {}^3S^\circ$ $3p\ {}^3P^\circ$ $3, 4p\ {}^3D^\circ$	$3–5d\ {}^5P$ $3d\ {}^5D$ $3d\ {}^5F$ $3d\ {}^3P$ $3d\ {}^3D$ $3d\ {}^3F$
$2s\ 2p^2(^2D)nx'$	$3s'\ {}^3D$	$3p'\ {}^1P^\circ$ $3p'\ {}^1D^\circ$ $3p'\ {}^1F^\circ$	$3d'\ {}^3P$ $3d'\ {}^3D$ $3d'\ {}^3F$

*For predicted terms in the spectra of the C I isoelectronic sequence, see Introduction.

O IV

(B I sequence; 5 electrons) $Z=8$

Ground state $1s^2\,2s^2\,2p\ ^2P^{\circ}_{\frac{1}{2}}$

$2p\ ^2P^{\circ}_{\frac{1}{2}}$ ***624396.5*** cm^{-1} I. P. 77.394 volts

Most of the terms are from Edlén's Monograph, corrected to agree with his 1935 paper, in which he adds several terms from $2p^2(^1D)$ and relabels his $2p^2(^3P)3s\ ^2P$ term as $2p^2(^1D)3s\ ^2D$. He also lists a combination in the visible, $3s'\ ^2P^{\circ}-3p'\ ^2D$, from which a revised value of $3s'\ ^2P^{\circ}$ has been calculated. A few other additions and corrections kindly communicated by Edlén have been incorporated into the table.

The term $6f\ ^2F^{\circ}$ is from the paper by Whitelaw and Mack.

No intercombinations between the doublet and quartet terms have been observed, but the limits adopted by Edlén are based on well-established series, and the relative positions of the two groups of terms differ by probably only a small constant x.

REFERENCES

L. J. Freeman, Proc. Roy. Soc. (London) [A] **127**, 330 (1930). (T) (C L)
B. Edlén, Nova Acta Reg. Soc. Uppsala [IV] **9**, No. 6, 87 (1934). (I P) (T) (C L) (G D)
P. G. Kruger and W. E. Shoupp, Phys. Rev. **44**, 105 (1933). (T) (C L)
E. Edlén, Zeit. Phys. **93**, 726 (1935). (T) (C L)
N. G. Whitelaw and J. E. Mack, Phys. Rev. **47**, 677 (1935). (T)
B. Edlén, unpublished material (Dec. 1947). (T)

O IV

Edlén	Config.	Desig.	J	Level	Interval
$2p\ ^2P_1$ $^2P_2$	$2s^2(^1S)2p$	$2p\ ^2P^{\circ}$	½ 1½	*0.0* *386.5*	386.5
$2p'\ ^4P_1$ $^4P_2$ $^4P_3$	$2s\ 2p^2$	$2p^2\ ^4P$	½ 1½ 2½	71177.0+x 71308.4+x 71492.9+x	131.4 184.5
$2p'\ ^2D_3$ $^2D_2$	$2s\ 2p^2$	$2p^2\ ^2D$	2½ 1½	126936.3 126950.3	−14.0
$2p'\ ^2S_1$	$2s\ 2p^2$	$2p^2\ ^2S$	½	164366.9	
$2p'\ ^2P_1$ $^2P_2$	$2s\ 2p^2$	$2p^2\ ^2P$	½ 1½	180481.3 180724.6	243.3
$2p''\ ^4S_2$	$2p^3$	$2p^3\ ^4S^{\circ}$	1½	*231275.1*+x	
$2p''\ ^2D_3$ $^2D_2$	$2p^3$	$2p^3\ ^2D^{\circ}$	2½ 1½	*255156.7* *255186.0*	−29.3
$2p''\ ^2P_1$ $^2P_2$	$2p^3$	$2p^3\ ^2P^{\circ}$	½ 1½	*289016.1* *289024.0*	7.9
$3s\ ^2S_1$	$2s^2(^1S)3s$	$3s\ ^2S$	½	357614.8	
$3p\ ^2P_1$ $^2P_2$	$2s^2(^1S)3p$	$3p\ ^2P^{\circ}$	½ 1½	*390161.1* *390248.2*	87.1
$3d\ ^2D_2$ $^2D_3$	$2s^2(^1S)3d$	$3d\ ^2D$	1½ 2½	419533.5 419550.2	16.7
$3s'\ ^4P_1$ $^4P_2$ $^4P_3$	$2s\ 2p(^3P^{\circ})3s$	$3s\ ^4P^{\circ}$	½ 1½ 2½	*438588.5*+x *438723.6*+x *438970.5*+x	135.1 246.9

O IV

Edlén	Config.	Desig.	J	Level	Interval
$3s'\ ^2P_1$ $^2P_2$	$2s\ 2p(^3P^{\circ})3s$	$3s\ ^2P^{\circ}$	½ 1½	*452808.0* *453073.0*	265.0
$3p'\ ^2P_1$ $^2P_2$	$2s\ 2p(^3P^{\circ})3p$	$3p\ ^2P$	½ 1½	467231.1 467346.5	115.4
$3p'\ ^4D_1$ $^4D_2$ $^4D_3$ $^4D_4$	$2s\ 2p(^3P^{\circ})3p$	$3p\ ^4D$	½ 1½ 2½ 3½	468075.4+x 468154.2+x 468289.7+x 468499.4+x	78.8 135.5 209.7
$3p'\ ^4S_2$	$2s\ 2p(^3P^{\circ})3p$	$3p\ ^4S$	1½	474217.8+x	
$3p'\ ^4P_1$ $^4P_2$ $^4P_3$	$2s\ 2p(^3P^{\circ})3p$	$3p\ ^4P$	½ 1½ 2½	478587.7+x 478682.2+x 478811.3+x	94.5 129.1
$3p'\ ^2D_2$ $^2D_3$	$2s\ 2p(^3P^{\circ})3p$	$3p\ ^2D$	1½ 2½	482667.5 482923.1	255.6
$4s\ ^2S_1$	$2s^2(^1S)4s$	$4s\ ^2S$	½	485823.1	
$3p'\ ^2S_1$	$2s\ 2p(^3P^{\circ})3p$	$3p\ ^2S$	½	492880	
$3d'\ ^4F_2$ $^4F_3$ $^4F_4$ $^4F_5$	$2s\ 2p(^3P^{\circ})3d$	$3d\ ^4F^{\circ}$	1½ 2½ 3½ 4½	*494907.5*+x *494986.3*+x *495098.7*+x *495252.8*+x	78.8 112.4 154.1
$3d'\ ^4D_1$ $^4D_2$ $^4D_3$ $^4D_4$	$2s\ 2p(^3P^{\circ})3d$	$3d\ ^4D^{\circ}$	½ 1½ 2½ 3½	*499506.4*+x *499535.3*+x *499582.0*+x *499646.6*+x	28.9 46.7 64.6

O IV—Continued

Edlén	Config.	Desig.	J	Level	Interval
$3d'\ ^2D_2$	$2s\,2p(^3P^\circ)3d$	$3d\ ^2D^\circ$	1½	501511.3	55.1
$^2D_3$			2½	501566.4	
$3d'\ ^4P_3$	$2s\,2p(^3P^\circ)3d$	$3d\ ^4P^\circ$	2½	503834.5+x	−113.4
$^4P_2$			1½	503947.9+x	−73.8
$^4P_1$			½	504021.7+x	
$4d\ ^2D_2$	$2s^2(^1S)4d$	$4d\ ^2D$	1½	510560	7
$^2D_3$			2½	510567	
$3d'\ ^2F_3$	$2s\,2p(^3P^\circ)3d$	$3d\ ^2F^\circ$	2½	510746.1	232.4
$^2F_4$			3½	510978.5	
$3d'\ ^2P_2$	$2s\,2p(^3P^\circ)3d$	$3d\ ^2P^\circ$	1½	514217	−151
$^2P_1$			½	514368	
$\overline{3s'}\ ^2P_1$	$2s\,2p(^1P^\circ)3s$	$3s'\ ^2P^\circ$	½	518684	6
$^2P_2$			1½	518690	
$5s\ ^2S_1$	$2s^2(^1S)5s$	$5s\ ^2S$	½	539368	
$\overline{3p'}\ ^2D_2$	$2s\,2p(^1P^\circ)3p$	$3p'\ ^2D$	1½	547311	25
$^2D_3$			2½	547336	
$\overline{3p'}\ ^2P_1$	$2s\,2p(^1P^\circ)3p$	$3p'\ ^2P$	½	549792	63
$^2P_2$			1½	549855	
	$2s^2(^1S)5d$	$5d\ ^2D$	1½		
$5d\ ^2D_3$			2½	552034	
$5f\ ^2F$	$2s^2(^1S)5f$	$5f\ ^2F^\circ$	{2½, 3½}	552490	
$\overline{3p'}\ ^2S_1$	$2s\,2p(^1P^\circ)3p$	$3p'\ ^2S$	½	554461	
$4s'\ ^4P_1$	$2s\,2p(^3P^\circ)4s$	$4s\ ^4P^\circ$	½	568638 +x	135
$^4P_2$			1½	568773 +x	247
$^4P_3$			2½	569020 +x	
	$2s\,2p(^1P^\circ)3d$	$3d'\ ^2F^\circ$	2½		
$\overline{3d'}\ ^2F_4$			3½	570791	
$4s'\ ^2P_1$	$2s\,2p(^3P^\circ)4s$	$4s\ ^2P^\circ$	½	573696	211
$^2P_2$			1½	573907	
	$2s^2(^1S)6d$	$6d\ ^2D$	1½		
$6d\ ^2D_3$			2½	574373	
$4p'\ ^2P_1$	$2s^2\ 2p(^3P^\circ)4p$	$4p\ ^2P$	½	575204	169
$^2P_2$			1½	575373	
$\overline{3d'}\ ^2D_2$	$2s\,2p(^1P^\circ)3d$	$3d'\ ^2D^\circ$	1½	575819	34
$^2D_3$			2½	575853	
$3s''\ ^4P_1$	$2p^2(^3P)3s$	$3s''\ ^4P$	½	576591 +x	144
$^4P_2$			1½	576735 +x	212
$^4P_3$			2½	576947 +x	
$\overline{3d'}\ ^2P_1$	$2s\,2p(^1P^\circ)3d$	$3d'\ ^2P^\circ$	½	581721	22
$^2P_2$			1½	581743	
$4p'\ ^2D_2$	$2s\,2p(^3P^\circ)4p$	$4p\ ^2D$	1½	584552	216
$^2D_3$			2½	584768	
$7f\ ^2F$	$2s^2(^1S)7f$	$7f\ ^2F^\circ$	{2½, 3½}	587850	
$4p'\ ^2S$	$2s\,2p(^3P^\circ)4p$	$4p\ ^2S$	½	590071	
	$2s\,2p(^3P^\circ)4d$	$4d\ ^4D^\circ$	½		
			1½		
			2½		
$4d'\ ^4D_4$			3½	591767 +x	
$4d'\ ^4P_3$	$2s\,2p(^3P^\circ)4d$	$4d\ ^4P^\circ$	2½	592999 +x	
			1½		
			½		

O IV—Continued

Edlén	Config.	Desig.	J	Level	Interval
$4d'\ ^2D_2$	$2s\,2p(^3P^\circ)4d$	$4d\ ^2D^\circ$	1½	593627	81
$^2D_3$			2½	593708	
$4f'\ ^2F_3$	$2s\,2p(^3P^\circ)4f$	$4f\ ^2F$	2½	594007	73
$^2F_4$			3½	594080	
$4f'\ ^2D_2$	$2s\,2p(^3P^\circ)4f$	$4f\ ^2D$	1½	594337	205
$^2D_3$			2½	594542	
$4d'\ ^2F_3$	$2s\,2p(^3P^\circ)4d$	$4d\ ^2F^\circ$	2½	596299	178
$^2F_4$			3½	596477	
$3p''\ ^2S_1$	$2p^2(^3P)3p$	$3p''\ ^2S^\circ$	½	597254	
$8f\ ^2F$	$2s^2(^1S)8f$	$8f\ ^2F^\circ$	{2½, 3½}	597352	
$4d'\ ^2P_2$	$2s\,2p(^3P^\circ)4d$	$4d\ ^2P^\circ$	1½	597726	−137
$^2P_1$			½	597863	
$\overline{3s''}\ ^2D_2$	$2p^2(^1D)3s$	$3s'''\ ^2D$	1½	600092	14
$^2D_3$			2½	600106	
	$2p^2(^3P)3p$	$3p''\ ^4D^\circ$	½		
			1½		
			2½		
$3p''\ ^4D_4$			3½	602977 +x	
	$2p^2(^3P)3p$	$3p''\ ^4P^\circ$	½		
			1½		
$3p''\ ^4P_3$			2½	606434 +x	
$3p''\ ^2D_3$	$2p^2(^3P)3p$	$3p''\ ^2D^\circ$	2½	615431	−29
$^2D_2$			1½	615460	
$3p''\ ^4S_2$	$2p^2(^3P)3p$	$3p''\ ^4S^\circ$	1½	616588 +x	
	O V $(^1S_0)$	*Limit*	------	**624396.5**	
$\overline{3p''}\ ^2F$	$2p^2(^1D)3p$	$3p'''\ ^2F^\circ$	{2½, 3½}	624882	
	$2s\,2p(^3P^\circ)5p$	$5p\ ^2P$	½		
$5p'\ ^2P_2$			1½	628496	
	$2p^2(^3P)3d$	$3d''\ ^2F$	2½		
$3d''\ ^2F_4$			3½	630095	
$5p'\ ^2D_2$	$2s\,2p(^3P^\circ)5p$	$5p\ ^2D$	1½	630703	176
$^2D_3$			2½	630879	
$3d''\ ^2D_3$	$2p^2(^3P)3d$	$3d''\ ^2D$	2½	632426	−168
$^2D_2$			1½	632594	
	$2s\,2p(^3P^\circ)5d$	$5d\ ^4D^\circ$	½		
			1½		
			2½		
$5d'\ ^4D_4$			3½	633896 +x	
$5d'\ ^4P_3$	$2s\,2p(^3P^\circ)5d$	$5d\ ^4P^\circ$	2½	634245.5+x	
			1½		
			½		
$5d'\ ^2F_3$	$2s\,2p(^3P^\circ)5d$	$5d\ ^2F^\circ$	2½	636024	212
$^2F_4$			3½	636236	
$5d'\ ^2P_2$	$2s\,2p(^3P^\circ)5d$	$5d\ ^2P^\circ$	1½	636492?	
			½		
$3d''\ ^4P_3$	$2p^2(^3P)3d$	$3d''\ ^4P$	2½	636851 +x	−99
$^4P_2$			1½	636950 +x	−62
$^4P_1$			½	637012 +x	
$\overline{3d''}\ ^2D$	$2p^2(^1D)3d$	$3d'''\ ^2D$	{1½, 2½}	646859	

O IV—Continued

Edlén	Config.	Desig.	J	Level	Interval
$\overline{3d}''$ $^2F_3$ $^2F_4$	$2p^2(^1D)3d$	$3d'''$ ^2F	$2\frac{1}{2}$ $3\frac{1}{2}$	651098 651117	19
$\overline{3d}''$ $^2P_2$ $^2P_1$	$2p^2(^1D)3d$	$3d'''$ ^2P	$1\frac{1}{2}$ $\frac{1}{2}$	653328 653411	−83
   $6d'$ $^4D_4$	$2s\ 2p(^3P°)6d$	$6d$ $^4D°$	$\frac{1}{2}$ $1\frac{1}{2}$ $2\frac{1}{2}$ $3\frac{1}{2}$	 *656328* $+x$	
 $\overline{4p}'$ $^2D_3$	$2s\ 2p(^1P°)4p$	$4p'$ ^2D	$1\frac{1}{2}$ $2\frac{1}{2}$	 656748	
$\overline{3d}''$ $^2S_1$	$2p^2(^1D)3d$	$3d'''$ ^2S	$\frac{1}{2}$	659998	
 $\overline{4d}'$ $^2D_3$	$2s\ 2p(^1P°)4d$	$4d'$ $^2D°$	$1\frac{1}{2}$ $2\frac{1}{2}$	 *668538*	
   $7d'$ $^4D_4$	$2s\ 2p(^3P°)7d$	$7d$ $^4D°$	$\frac{1}{2}$ $1\frac{1}{2}$ $2\frac{1}{2}$ $3\frac{1}{2}$	 *669705* $+x$	

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O IV Observed Terms*

Config. $1s^2+$	Observed Terms		
$2s^2(^1S)2p$		$2p$ $^2P°$	
$2s\ 2p^2$	$2p^2$ ^2S	$2p^2$ ^4P $2p^2$ ^2P	$2p^2$ ^2D
$2p^3$	$2p^3$ $^4S°$	$2p^3$ $^2P°$	$2p^3$ $^2D°$

Config. $1s^2+$	ns ($n\geq3$)	np ($n\geq3$)	nd ($n\geq3$)	nf ($n\geq4$)
$2s^2(^1S)nx$	3–5s ^2S	$3p$ $^2P°$	3–6d ^2D	5, 7, 8f $^2F°$
$2s\ 2p(^3P°)nx$	3, 4s $^4P°$ 3, 4s $^2P°$	$3p$ ^4S; $3p$ ^4P; $3p$ ^4D 3, 4p ^2S; 3–5p ^2P; 3–5p ^2D	3–5d $^4P°$; 3–7d $^4D°$; $3d$ $^4F°$ 3–5d $^2P°$; 3, 4d $^2D°$; 3–5d $^2F°$	$4f$ ^2D; $4f$ ^2F
$2s\ 2p(^1P°)nx'$	$3s'$ $^2P°$	$3p'$ ^2S; $3p'$ ^2P; 3, 4p' ^2D	$3d'$ $^2P°$; 3, 4d' $^2D°$; $3d'$ $^2F°$	
$2p^2(^3P)nx''$	$3s''$ ^4P	$3p''$ $^4S°$; $3p''$ $^4P°$; $3p''$ $^4D°$ $3p''$ $^2S°$; $3p''$ $^2D°$	$3d''$ ^4P; $3d''$ ^2D; $3d''$ ^2F	
$2p^2(^1D)nx'''$	$3s'''$ ^2D	$3p'''$ $^2F°$	$3d'''$ ^2S; $3d'''$ ^2P; $3d'''$ ^2D; $3d'''$ ^2F	

*For predicted terms in the spectra of the B I isoelectronic sequence, see Introduction.

O V

(Be I sequence; 4 electrons) Z=8

Ground state $1s^2\,2s^2\ ^1S_0$

$2s^2\ ^1S_0$ **918702** cm^{-1} I. P. 113.873 volts

Edlén has revised and extended his published analysis and has generously furnished a manuscript copy of his complete term list in advance of publication, for inclusion here. He states that no intersystem combinations have been observed and that the relative uncertainty x in the position of the triplet terms with respect to the singlets may be $\pm 100\ cm^{-1}$.

In the published papers Edlén has used a prime to designate the terms from the $^2P^\circ$ limit in O VI.

REFERENCES

B. Edlén, Nova Acta Reg. Soc. Sci. Uppsala [IV] **9**, No. 6, 62 (1934). (I P) (T) (C L)
B. Edlén, unpublished material (Dec. 1947). (I P) (T)

O V

Config.	Desig.	J	Level	Interval
$2s^2$	$2s^2\ ^1S$	0	0	
$2s(^2S)2p$	$2p\ ^3P^\circ$	0	*82121. 2+x*	136. 7
		1	*82257. 9+x*	306. 2
		2	*82564. 1+x*	
$2s(^2S)2p$	$2p\ ^1P^\circ$	1	*158798*	
$2p^2$	$2p^2\ ^3P$	0	213641. 7+x	155. 7
		1	213797. 4+x	268. 8
		2	214066. 2+x	
$2p^2$	$2p^2\ ^1D$	2	231722	
$2p^2$	$2p^2\ ^1S$	0	287909	
$2s(^2S)3s$	$3s\ ^3S$	1	547150. 0+x	
$2s(^2S)3s$	$3s\ ^1S$	0	561278	
$2s(^2S)3p$	$3p\ ^1P^\circ$	1	*580826*	
$2s(^2S)3p$	$3p\ ^3P^\circ$	0	*582983. 6+x*	36. 3
		1	*583019. 9+x*	77. 3
		2	*583097. 2+x*	
$2s(^2S)3d$	$3d\ ^3D$	1	600925. 5+x	10. 8
		2	600936. 3+x	19. 8
		3	600956. 1+x	
$2s(^2S)3d$	$3d\ ^1D$	2	612617	
$2p(^2P^\circ)3s$	$3s\ ^3P^\circ$	0	*653099. 7+x*	162. 5
		1	*653262. 2+x*	342. 8
		2	*653605. 0+x*	
$2p(^2P^\circ)3s$	$3s\ ^1P^\circ$	1	*664486*	
$2p(^2P^\circ)3p$	$3p\ ^1P$	1	672695	
$2p(^2P^\circ)3p$	$3p\ ^3D$	1	677333 +x	199
		2	677532 +x	315
		3	677847 +x	

O V

Config.	Desig.	J	Level	Interval
$2p(^2P^\circ)3p$	$3p\ ^3S$	1	684124 +x	
$2p(^2P^\circ)3p$	$3p\ ^3P$	0	689585. 6+x	114. 0
		1	689699. 6+x	190. 7
		2	689890. 3+x	
$2p(^2P^\circ)3d$	$3d\ ^1D^\circ$	2	*694646*	
$2p(^2P^\circ)3p$	$3p\ ^1D$	2	697170	
$2p(^2P^\circ)3d$	$3d\ ^3D^\circ$	1	*704360* +x	64
		2	*704424* +x	103
		3	*704527* +x	
$2p(^2P^\circ)3p$	$3p\ ^1S$	0	707630	
$2p(^2P^\circ)3d$	$3d\ ^3P^\circ$	2	*708154* +x	−142
		1	*708296* +x	−83
		0	*708379* +x	
$2p(^2P^\circ)3d$	$3d\ ^1F^\circ$	3	*712967*	
$2p(^2P^\circ)3d$	$3d\ ^1P^\circ$	1	*719277*	
$2s(^2S)4s$	$4s\ ^3S$	1	722666 +x	
$2s(^2S)4s$	$4s\ ^1S$	0	731667	
$2s(^2S)4p$	$4p\ ^3P^\circ$	0		
		1	*736108* +x	18
		2	*736126* +x	
$2s(^2S)4p$	$4p\ ^1P^\circ$	1	*737883*	
$2s(^2S)4d$	$4d\ ^3D$	1	742401 +x	6
		2	742407 +x	14
		3	742421 +x	
$2s(^2S)4d$	$4d\ ^1D$	2	746280	
$2s(^2S)4f$	$4f\ ^1F^\circ$	3	*749857*	
$2s(^2S)5s$	$5s\ ^3S$	1	796263 +x	

O v—Continued

Config.	Desig.	J	Level	Interval
2s(^{2}S)5p	5p ^{1}P°	1	*802452*	
2s(^{2}S)5d	5d ^{3}D	1 2 3	 806625 +x	
2s(^{2}S)5d	5d ^{1}D	2	808351	
2p(^{2}P°)4s	4s ^{1}P°	1	*824280*	
2p(^{2}P°)4p	4p ^{1}P	1	829588	
2p(^{2}P°)4p	4p ^{3}D	1 2 3	831047 +x 831213 +x 831504 +x	166 291
2p(^{2}P°)4p	4p ^{3}S	1	832251 +x	
2p(^{2}P°)4p	4p ^{3}P	0 1 2	 835151 +x 835321 +x	170
2p(^{2}P°)4d	4d ^{1}D°	2	*837834*	
2p(^{2}P°)4p	4p ^{1}D	2	837864	
2s(^{2}S)6p	6p ^{1}P°	1	*839616*	
2s(^{2}S)6f	6f ^{1}F°	3	*840832*	
2s(^{2}S)6d	6d ^{3}D	1 2 3	 841220 +x	
2p(^{2}P°)4d	4d ^{3}D°	1 2 3	*841280* +x *841374* +x *841497* +x	94 123
2s(^{2}S)6d	6d ^{1}D	2	842105	
2p(^{2}P°)4d	4d ^{3}P°	2 1 0	*843290* +x *843397* +x *843449* +x	−107 −52
2p(^{2}P°)4d	4d ^{1}F°	3	*847129*	
2p(^{2}P°)4d	4d ^{1}P°	1	*847465*	

O v—Continued

Config.	Desig.	J	Level	Interval
2s(^{2}S)7p	7p ^{1}P°	1	*860874*	
2s(^{2}S)7d	7d ^{3}D	1 2 3	 861975 +x	
2s(^{2}S)7d	7d ^{1}D	2	862419	
2s(^{2}S)8p	8p ^{1}P°	1	*874447*	
2s(^{2}S)8d	8d ^{3}D	1 2 3	 875365 +x	
2p(^{2}P°)5p	5p ^{1}P	1	898580	
2p(^{2}P°)5p	5p ^{3}D	1 2 3	 899671 +x	
2p(^{2}P°)5p	5p ^{3}P	0 1 2	 901344 +x	
2p(^{2}P°)5p	5p ^{1}D	2	902442	
2p(^{2}P°)5d	5d ^{1}D°	2	*902592*	
2p(^{2}P°)5d	5d ^{3}D°	1 2 3	 *904497* +x	
2p(^{2}P°)5d	5d ^{1}F°	3	*906404*	
O vi (^{2}S½)	*Limit*	---------	918702	
2p(^{2}P°)6p	6p ^{1}P	1	935093	
2p(^{2}P°)6p	6p ^{3}D	1 2 3	 935945 +x	
2p(^{2}P°)6p	6p ^{3}P	0 1 2	 936805 +x	
2p(^{2}P°)6p	6p ^{1}D	2	937341	

December 1947.

O v Observed Terms*

Config. 1s^2+	Observed Terms			
2s^2	2s^2 ^{1}S			
2s(^{2}S)2p	2p ^{3}P° 2p ^{1}P°			
2p^2	2p^2 ^{3}P 2p^2 ^{1}S 2p^2 ^{1}D			
	ns (n≥3)	np (n≥3)	nd (n≥3)	nf (n≥4)
2s(^{2}S)nx	3–5s ^{3}S 3, 4s ^{1}S	3, 4p ^{3}P° 3–8p ^{1}P°	3–8d ^{3}D 3–7d ^{1}D	4, 6f ^{1}F°
2p(^{2}P°)nx	3s ^{3}P° 3, 4s ^{1}P°	3, 4p ^{3}S 3–6p ^{3}P 3–6p ^{3}D 3p ^{1}S 3–6p ^{1}P 3–6p ^{1}D	3, 4d ^{3}P° 3–5d ^{3}D° 3, 4d ^{1}P° 3–5d ^{1}D° 3–5d ^{1}F°	

*For predicted terms in the spectra of the Be i isoelectronic sequence, see Introduction.

O VI

(Li I sequence; 3 electrons) $Z=8$

Ground state $1s^2\ 2s\ ^2S_{\frac{1}{2}}$

$2s\ ^2S_{\frac{1}{2}}$ **1113999.5 cm⁻¹** I. P. 138.080 volts

This spectrum has been analyzed by Edlén. The observed term values have all been taken from a manuscript generously furnished by him in advance of publication. He remarks that the *np* $^2P°$ and *nd* ^2D series have been observed in the vacuum spark further than given in the table. For series members beyond $n=6$ he states that the term values calculated from a Ritz formula are probably to be preferred.

In the table, extrapolated intervals and calculated term values are entered in brackets. They have been taken from the 1933 and 1934 references below, as have also the entries in column one.

REFERENCES

B. Edlén, Zeit. Astroph. **7,** 378 (1933). (T) (C L)
B. Edlén, Nova Acta Reg. Soc. Sci. Uppsala [IV] **9,** No. 6, 44 (1934). (T) (C L)
F. Tyrén, Nova Acta Reg. Soc. Sci. Uppsala [IV] **12,** No. 1, 24 (1940). (C L)
B. Edlén, unpublished material (Sept. 1947). (T)

O VI

Edlén	Config.	Desig.	*J*	Level	Interval
$2s\ ^2S_1$	$2s$	$2s\ ^2S$	½	0.0	
$2p\ ^2P_1$ $^2P_2$	$2p$	$2p\ ^2P°$	½ 1½	*96375.0* *96907.5*	532.5
$3s\ ^2S_1$	$3s$	$3s\ ^2S$	½	640039.8	
$3p\ ^2P_1$ $^2P_2$	$3p$	$3p\ ^2P°$	½ 1½	*666113.2* *666269.8*	156.6
$3d\ ^2D_2$ $^2D_3$	$3d$	$3d\ ^2D$	1½ 2½	674625.7 674676.8	51.1
$4s\ ^2S_1$	$4s$	$4s\ ^2S$	½	852696	
$4p\ ^2P_1$ $^2P_2$	$4p$	$4p\ ^2P°$	½ 1½	*863333.8* *863397.7*	63.9
$4d\ ^2D_2$ $^2D_3$	$4d$	$4d\ ^2D$	1½ 2½	866880.1 866901.5	21.4
$4f\ ^2F_3$ $^2F_4$	$4f$	$4f\ ^2F°$	2½ 3½	*867077.7* *867087.5*	9.8
	$5s$	$5s\ ^2S$	½	948690	
$5p\ ^2P_2$	$5p$	$5p\ ^2P°$	½ 1½	*954080*	[33]
$5d\ ^2D_3$	$5d$	$5d\ ^2D$	1½ 2½	955856	[11]
6 S	$6s$	$6s\ ^2S$	½	1000080	
6 P	$6p$	$6p\ ^2P°$	½ 1½	*1003130*	
$6d\ ^2D_3$	$6d$	$6d\ ^2D$	1½ 2½	1004178	

O VI

Edlén	Config.	Desig.	*J*	Level	Interval
6 F	$6f$	$6f\ ^2F°$	2½ 3½	*[1004265]*	
6 GH	$6g$, $6h$	$6g\ ^2G$, etc.	3½ to 5½	[1004276]	
7 S	$7s$	$7s\ ^2S$	½	1030780	
7 P	$7p$	$7p\ ^2P°$	½ 1½	*1032630*	
7 D	$7d$	$7d\ ^2D$	1½ 2½	1033324	
7 F	$7f$	$7f\ ^2F°$	2½ 3½	*[1033382]*	
7 GHI	$7g$, etc.	$7g\ ^2G$, etc.	3½ to 6½	[1033389]	
8 S	$8s$	$8s\ ^2S$	½	[1050543]	
8 P	$8p$	$8p\ ^2P°$	½ 1½	*1051724*	
8 F	$8f$	$8f\ ^2F°$	2½ 3½	*[1052280]*	
8 GHIK	$8g$, etc.	$8g\ ^2G$, etc.	3½ to 7½	[1052285]	
8 D	$8d$	$8d\ ^2D$	1½ 2½	1052296	
	O VII ($^1S_0$)	*Limit*	------	**1113999.5**	

September 1947.

O VII

(He I sequence; 2 electrons) $Z=8$

Ground State $1s^2\ ^1S_0$

$1s^2\ ^1S_0$ **5963000±600** cm^{-1} I. P. 739.114 ±0.074 volts

Five singlet lines have been observed by Tyrén in the interval 17 A to 21 A. He has also observed one intersystem combination—a line at 21.804 A classified as $1s^2\ ^1S_0-2p\ ^3P_1^\circ$. His unit 10^3 cm^{-1} has here been changed to cm^{-1}.

The triplet terms are from Edlén, who has kindly furnished them in advance of publication. He remarks that the extrapolated absolute term values of the triplets relative to those of the singlets confirm the intersystem combination reported by Tyrén. The $2s\ ^3S-2p\ ^3P^\circ$ combination has apparently not been observed, but Edlén regards the extrapolation from the irregular doublet law as very reliable. Brackets are used in the table to indicate extrapolated values not yet confirmed by observation.

REFERENCES

F. Tyrén, Nova Acta Reg. Soc. Sci. Uppsala [IV] **12**, No. 1, 25 (1940). (I P) (T) (C L)
B. Edlén, unpublished material (Sept. 1947). (T)

O VII

Config.	Desig.	J	Level	Interval
$1s^2$	$1s^2\ ^1S$	0	0	
1s 2s	$2s\ ^3S$	1	4525340	
1s 2p	$2p\ ^3P^\circ$	0	*[4586170]*	[60]
		1	*4586230*	[550]
		2	*[4586780]*	
1s 2p	$2p\ ^1P^\circ$	1	*4629200*	
1s 3p	$3p\ ^3P^\circ$	0, 1, 2	*5356380*	
1s 3d	$3d\ ^3D$	3, 2, 1	5364990	
1s 3p	$3p\ ^1P^\circ$	1	*5368550*	
1s 4p	$4p\ ^1P^\circ$	1	*5628100*	
1s 5p	$5p\ ^1P^\circ$	1	*5748450*	
1s 6p	$6p\ ^1P^\circ$	1	*5813950*	
O VIII ($^2S_{1/2}$)	*Limit*		**5963000**	

September 1947.

O VIII

(H sequence; 1 electron) $Z=8$

Ground state $1s\ ^2S_{1/2}$

$1s\ ^2S_{1/2}$ **7027970** cm^{-1} I. P. 871.12 volts

Tyrén has observed the first Lyman line. J. E. Mack has calculated the terms in the table, "using $R_{O^{16}}=109733.539$, and $\Lambda=0.040$. The last digit is arbitrary, since the extrapolated 1s-shift is 957 cm^{-1}. The series limits of O^{17} and O^{18} are higher than that for O^{16} by 14.3 and 25.8 cm^{-1}, respectively."

REFERENCES

F. Tyrén, Nova Acta Reg. Soc. Sci. Uppsala [IV] **12**, No. 1, 24 (1940). (C L)
J. E. Mack, unpublished material (1949). (I P) (T) (C L)

O VIII

Config.	Desig.	J	Level	Interval
1s	$1s\ ^2S$	½	0	
2p	$2p\ ^2P^\circ$	½	5270363	120
2s	$2s\ ^2S$	½	5270483	1496
2p	$2p\ ^2P^\circ$	1½	5271859	
3s, etc.	$3s\ ^2S$, etc.	½, etc.	6246978 to 7569	
	∞=*Limit*		**7027970**	

February 1949.

FLUORINE

F I

9 electrons $Z=9$

Ground state $1s^2\ 2s^2\ 2p^5\ ^2P^\circ_{1\frac{1}{2}}$

$2p^5\ ^2P^\circ_{1\frac{1}{2}}$ *140553.5* cm^{-1} I. P. 17.42 volts

This spectrum is incompletely analyzed, but the terms from the ^3P limit in F II are fairly well established. The terms listed have been taken from Edlén's later paper, supplemented by levels from further recent analysis by Lidén. The new levels have been generously furnished in manuscript form by Edlén, for inclusion here.

Intersystem combinations have been observed, connecting the doublet and quartet terms.

Edlén remarks that it is impossible to assign term designations to the levels labeled $3d$ X and $4d$ X, because of the departure from *LS*-coupling. He also states that the terms from ^1D in F II need further confirmation. They are connected with the rest by only two ultraviolet lines, those observed by Bowen at 806.92 A and 809.60 A.

REFERENCES

G. H. Carragan, Astroph. J. **63**, 145 (1926). (Z E)
I. S. Bowen, Phys. Rev. **29**, 231 (1927). (T) (C L)
B. Edlén, Zeit. Phys. **93**, 447 (1935). (C L)
B. Edlén, Zeit. Phys. **98**, 445 (1936). (I P) (T) (C L)
W. F. Meggers, J. Opt. Soc. Am. **36**, 431 (1946). (Summary hfs)
B. Edlén, unpublished material (Dec. 1947). (T)
K. Lidén, Ark. Mat. Astr. Fys. (Stockholm) **35A**, No. 24, p. 5 (1948). (T)

F I

Edlén	Config.	Desig.	J	Level	Interval
$2p\ ^2P_2$	$2s^2\ 2p^5$	$2p^5\ ^2P^\circ$	1½	*0.0*	−404.0
$^2P_1$			½	*404.0*	
$3s\ ^4P_3$	$2s^2\ 2p^4(^3P)3s$	$3s\ ^4P$	2½	102406.50	−274.74
$^4P_2$			1½	102681.24	−159.96
$^4P_1$			½	102841.20	
$3s\ ^2P_2$	$2s^2\ 2p^4(^3P)3s$	$3s\ ^2P$	1½	104731.86	−325.24
$^2P_1$			½	105057.10	
$3p\ ^4P_3$	$2s^2\ 2p^4(^3P)3p$	$3p\ ^4P^\circ$	2½	*115918.70*	−122.99
$^4P_2$			1½	*116041.69*	−102.70
$^4P_1$			½	*116144.39*	
$3p\ ^4D_4$	$2s^2\ 2p^4(^3P)3p$	$3p\ ^4D^\circ$	3½	*116988.21*	−176.62
$^4D_3$			2½	*117164.83*	−144.54
$^4D_2$			1½	*117309.37*	−83.40
$^4D_1$			½	*117392.77*	

F I

Edlén	Config.	Desig.	J	Level	Interval
$3p\ ^2D_3$	$2s\ 2p^4(^3P)3p$	$3p\ ^2D^\circ$	2½	*117623.73*	−250.02
$^2D_2$			1½	*117873.75*	
$3p\ ^2S_1$	$2s^2\ 2p^4(^3P)3p$	$3p\ ^2S^\circ$	½	*118406.09*	
$3p\ ^4S_2$	$2s^2\ 2p^4(^3P)3p$	$3p\ ^4S^\circ$	1½	*118428.62*	
$3p\ ^2P_2$	$2s^2\ 2p^4(^3P)3p$	$3p\ ^2P^\circ$	1½	*118937.61*	−145.02
$^2P_1$			½	*119082.63*	
$\overline{3s}\ ^2D_3$	$2s^2\ 2p^4(^1D)3s$	$3s'\ ^2D$	2½	123925.50	−1.06
$^2D_2$			1½	123926.56	
$3d\ ^4D_4$	$2s^2\ 2p^4(^3P)3d$	$3d\ ^4D$	3½	128064.90	−23.73
$^4D_3$			2½	128088.63	−34.88
$^4D_2$			1½	128123.51	−62.29
$^4D_1$			½	128185.80	

F I—Continued

Edlén	Config.	Desig.	J	Level	Interval
3d X_8	$2s^2\,2p^4(^3P)3d$	3d Z_4		128141.27	
3d $^4F_5$	$2s^2\,2p^4(^3P)3d$	3d ^4F	4½	128219.92	−295.63
$^4F_4$			3½	128515.55	−10.60
$^4F_3$			2½	128526.15	−86.58
$^4F_2$			1½	128612.73	
3d X_7	$2s^2\,2p^4(^3P)3d$	3d Z_2		128220.65	
3d X_6	$2s^2\,2p^4(^3P)3d$	3d Z_3		128221.16	
3d X_5	$2s^2\,2p^4(^3P)3d$	3d Y_3		128339.53	
3d X_4	$2s^2\,2p^4(^3P)3d$	3d Y_2	1½	128524.09	
3d X_3	$2s^2\,2p^4(^3P)3d$	3d Y_1		128606.88	
3d X_2	$2s^2\,2p^4(^3P)3d$	3d X_2		128698.68	
3d X_1	$2s^2\,2p^4(^3P)3d$	3d X_1		128713.12	
	$2s^2\,2p^4(^3P)5s$	5s ^4P	2½	132596.26	−149.51
			1½	132745.77	−264.19
			½	133009.96	
	$2s^2\,2p^4(^3P)5s$	5s ^2P	1½	132999.16	−224.94
			½	133224.10	
	$2s^2\,2p^4(^3P)4d$	4d ^4D	3½	133545.27	−12.87
			2½	133558.14	−20.01
			1½	133578.15	−35.95
			½	133614.10	
	$2s^2\,2p^4(^3P)4d$	4d Z_4		133584.35	

F I—Continued

Edlén	Config.	Desig.	J	Level	Interval
	$2s^2\,2p^4(^3P)4d$	4d ^4F	4½	133606.39	−317.44
			3½	133923.83	−8.73
			2½	133932.56	−39.50
			1½	133972.06	
	$2s^2\,2p^4(^3P)4d$	4d Z_3		133607.33	
	$2s^2\,2p^4(^3P)4d$	4d Z_2		133624.61	
	$2s^2\,2p^4(^3P)4d$	4d Z_1		133644.4	
	$2s^2\,2p^4(^3P)4d$	4d Y_3		133911.08	
	$2s^2\,2p^4(^3P)4d$	4d Y_2		133920.20	
	$2s^2\,2p^4(^3P)4d$	4d Y_1		133966.47	
	$2s^2\,2p^4(^3P)4d$	4d X_2		134085.53	
	$2s^2\,2p^4(^3P)4d$	4d X_1		134092.03	
$\overline{3p}\ ^2F_3$	$2s^2\,2p^4(^1D)3p$	3p′ $^2F^\circ$	2½	*137594.63*	8.81
$^2F_4$			3½	*137603.44*	
$\overline{3p}\ ^2D_2$	$2s^2\,2p^4(^1D)3p$	3p′ $^2D^\circ$	1½	*138700.15*	7.86
$^2D_3$			2½	*138708.01*	
	F II ($^3P_2$)	*Limit*	------	***140553.5***	
2p′ $^2S_1$	$2s\,2p^6$	$2p^6\ ^2S$	½	[168554]	

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F I Observed Terms*

Config. $1s^2+$	Observed Terms		
$2s^2\,2p^5$	$2p^5\ ^2P^\circ$		
	ns ($n \geq 3$)	*np* ($n \geq 3$)	*nd* ($n \geq 3$)
$2s^2\,2p^4(^3P)nx$	3, 5s ^4P 3, 5s ^2P	3p $^4S^\circ$ 3p $^4P^\circ$ 3p $^4D^\circ$ 3p $^2S^\circ$ 3p $^2P^\circ$ 3p $^2D^\circ$	3, 4d ^4D 3, 4d ^4F
$2s^2\,2p^4(^1D)nx'$	3s′ ^2D	3p′ $^2D^\circ$ 3p′ $^2F^\circ$	

*For predicted terms in the spectra of the F I isoelectronic sequence, see Introduction.

F II

(O I sequence; 8 electrons) $Z=9$

Ground state $1s^2\ 2s^2\ 2p^4\ {}^3P_2$

$2p^4\ {}^3P_2$ **282190.2** cm^{-1} I. P. 34.98 volts

Bowen, Dingle, and Edlén have all contributed to the analysis of this spectrum. The singlet and triplet terms are taken from Edlén, who has revised and extended the earlier work. The quintet terms, except $5f\ {}^5F$, are from Dingle's paper. The term $5f\ {}^5F$ derived by Edlén agrees well with the $4f\ {}^5F$ term and Dingle's series limit.

The singlet and triplet terms are connected by intersystem combinations. The relative position of the quintets is determined by the series with the uncertainty x probably not exceeding 200 cm^{-1}.

Edlén lists a number of combinations that probably involve $2s^2\ 2p^3(^2D^\circ)4f$ terms at about 288600±cm^{-1} above the ground state.

In a private communication Edlén has stated that his term published as $\overline{\overline{3d}}\ {}^3D$ should have the designation $\overline{\overline{4s}}\ {}^3P$. He has also revised his published value of $3d'\ {}^1S^\circ$.

REFERENCES

H. Dingle, Proc. Roy. Soc. (London) [A] **128,** 600 (1930). (T) (C L)
I. S. Bowen, Phys. Rev. **45,** 82 (1934). (T) (C L)
B. Edlén, Zeit. Phys. **93,** 433 (1935). (I P) (T) (C L)
B. Edlén, private communication (Dec. 1947). (T)

F II

Edlén	Config.	Desig.	J	Level	Interval
$2p\ {}^3P_2$	$2s^2\ 2p^4$	$2p^4\ {}^3P$	2	0.0	−341.8
${}^3P_1$			1	341.8	−148.8
${}^3P_0$			0	490.6	
$2p\ {}^1D_2$	$2s^2\ 2p^4$	$2p^4\ {}^1D$	2	20873	
$2p\ {}^1S_0$	$2s^2\ 2p^4$	$2p^4\ {}^1S$	0	44919	
$2p'\ {}^3P_2$	$2s\ 2p^5$	$2p^5\ {}^3P^\circ$	2	*164797.7*	−309.4
${}^3P_1$			1	*165107.1*	−173.9
${}^3P_0$			0	*165281.0*	
	$2s^2\ 2p^3(^4S^\circ)3s$	$3s\ {}^5S^\circ$	2	*176654.2* +x	
$3s\ {}^3S_1$	$2s^2\ 2p^3(^4S^\circ)3s$	$3s\ {}^3S^\circ$	1	*182865.2*	
	$2s^2\ 2p^3(^4S^\circ)3p$	$3p\ {}^5P$	1	202609.65+x	11.33
			2	202620.98+x	19.55
			3	202640.53+x	
$3p\ {}^3P_0$	$2s^2\ 2p^3(^4S^\circ)3p$	$3p\ {}^3P$	0	207702.91	−3.00
${}^3P_1$			1	207699.91	4.70
${}^3P_2$			2	207704.61	
$\overline{3s}\ {}^3D_3$	$2s^2\ 2p^3(^2D^\circ)3s$	$3s'\ {}^3D^\circ$	3	*211866.62*	−21.07
${}^3D_2$			2	*211887.69*	−13.03
${}^3D_1$			1	*211900.72*	
$\overline{3s}\ {}^1D_2$	$2s^2\ 2p^3(^2D^\circ)3s$	$3s'\ {}^1D^\circ$	2	*215069.8*	
$\overline{\overline{3s}}\ {}^1P_1$	$2s^2\ 2p^3(^2P^\circ)3s$	$3s''\ {}^1P^\circ$	1	*227228.2*	
$\overline{\overline{3s}}\ {}^3P_2$	$2s^2\ 2p^3(^2P^\circ)3s$	$3s''\ {}^3P^\circ$	2	*229550.83*	−1.61
${}^3P_1$			1	*229552.44*	−2.66
${}^3P_0$			0	*229555.10*	

F II

Edlén	Config.	Desig.	J	Level	Interval
	$2s^2\ 2p^3(^4S^\circ)3d$	$3d\ {}^5D^\circ$	4	*231158.08*+x	−0.91
			3	*231158.99*+x	−1.20
			2	*231160.19*+x	−0.68
			1	*231160.87*+x	−0.52
			0	*231161.39*+x	
$3d\ {}^3D_1$	$2s^2\ 2p^3(^4S^\circ)3d$	$3d\ {}^3D^\circ$	1	*232064.18*	0.80
${}^3D_2$			2	*232064.98*	2.08
${}^3D_3$			3	*232067.06*	
	$2s^2\ 2p^3(^4S^\circ)4s$	$4s\ {}^5S^\circ$	2	*235311.15*+x	
$\overline{3p}\ {}^1P_1$	$2s^2 2p^3(^2D^\circ)3p$	$3p'\ {}^1P$	1	235643.1	
$\overline{3p}\ {}^3D_1$	$2s^2 2p^3(^2D^\circ)3p$	$3p'\ {}^3D$	1	236170.35	2.72
${}^3D_2$			2	236173.07	22.50
${}^3D_3$			3	236195.57	
$4s\ {}^3S_1$	$2s^2\ 2p^3(^4S^\circ)4s$	$4s\ {}^3S^\circ$	1	*236961.63*	
$\overline{3p}\ {}^3F_4$	$2s^2 2p^3(^2D^\circ)3p$	$3p'\ {}^3F$	4	237507.91	−0.81
${}^3F_3$			3	237508.72	−0.65
${}^3F_2$			2	237509.37	
$\overline{3p}\ {}^1F_3$	$2s^2 2p^3(^2D^\circ)3p$	$3p'\ {}^1F$	3	238323.6	
$2p'\ {}^1P_1$	$2s\ 2p^5$	$2p^5\ {}^1P^\circ$	1	*239605.0*	
$\overline{3p}\ {}^3P_2$	$2s^2 2p^3(^2D^\circ)3p$	$3p'\ {}^3P$	2	240093.10	−60.24
${}^3P_1$			1	240153.34	−26.57
${}^3P_0$			0	240179.91	
$\overline{3p}\ {}^1D_2$	$2s^2 2p^3(^2D^\circ)3p$	$3p'\ {}^1D$	2	246283.9	
$4p\ {}^3P_0$	$2s^2\ 2p^3(^4S^\circ)4p$	$4p\ {}^3P$	0	246655.10	7.45
${}^3P_1$			1	246662.55	20.12
${}^3P_2$			2	246682.67	
$\overline{\overline{3p}}\ {}^3S_1$	$2s^2\ 2p^3(^2P^\circ)3p$	$3p''\ {}^3S$	1	253313.2	

F II—Continued

Edlén	Config.	Desig.	*J*	Level	Interval
	$2s^2\,2p^3(^4S^\circ)4d$	$4d\ ^3D^\circ$	1 2		
$4d\ ^3D_3$			3	*254016*	
$4f\ ^3F$	$2s^2\,2p^3(^4S^\circ)4f$	$4f\ ^3F$	4, 3, 2	254547. 3	
$\overline{\overline{3p}}\ ^3D_3$ $^3D_2$ $^3D_1$	$2s^2\,2p^3(^2P^\circ)3p$	$3p''\ ^3D$	3 2 1	254702. 30 254717. 36 254723. 96	−15. 06 −6. 60
	$2s^2\,2p^3(^4S^\circ)4f$	$4f\ ^5F$	5 to 1	254703. 1+x	
$\overline{\overline{3p}}\ ^1P_1$	$2s^2\,2p^3(^2P^\circ)3p$	$3p''\ ^1P$	1	255606. 0	
$\overline{\overline{3p}}\ ^3P_0$ $^3P_1$ $^3P_2$	$2s^2\,2p^3(^2P^\circ)3p$	$3p''\ ^3P$	0 1 2	257253. 9 257268. 8 257292. 7	14. 9 23. 9
$\overline{\overline{3p}}\ ^1D_2$	$2s^2\,2p^3(^2P^\circ)3p$	$3p''\ ^1D$	2	258930. 0	
$5f\ ^5F$	$2s^2\,2p^3(^4S^\circ)5f$	$5f\ ^5F$	5 to 1	264610 +x	
$\overline{3d}\ ^3F_2$ $^3F_3$ $^3F_4$	$2s^2\,2p^3(^2D^\circ)3d$	$3d'\ ^3F^\circ$	2 3 4	*264953. 12* *264958. 63* *264965. 91*	5. 51 7. 28
$\overline{3d}\ ^1S_0$	$2s^2\,2p^3(^2D^\circ)3d$	$3d'\ ^1S^\circ$	0	*264994. 9*	
$\overline{3d}\ ^3G_5$ $^3G_4$ $^3G_3$	$2s^2\,2p^3(^2D^\circ)3d$	$3d'\ ^3G^\circ$	5 4 3	*265255. 8* *265267. 8* *265289. 3*	−12. 0 −21. 5
$\overline{3d}\ ^1G_4$	$2s^2\,2p^3(^2D^\circ)3d$	$3d'\ ^1G^\circ$	4	*265310. 1*	
$\overline{3d}\ ^3D_3$ $^3D_2$ $^3D_1$	$2s^2\,2p^3(^2D^\circ)3d$	$3d'\ ^3D^\circ$	3 2 1	*265472. 70* *265498. 74* *265517. 14*	−26. 04 −18. 40
$\overline{3d}\ ^1D_2$	$2s^2\,2p^3(^2D^\circ)3d$	$3d'\ ^1D^\circ$	2	*266270. 2*	
$\overline{\overline{3p}}\ ^1S_0$	$2s^2\,2p^3(^2P^\circ)3p$	$3p''\ ^1S$	0	266338. 4	
$\overline{3d}\ ^3S_1$	$2s^2\,2p^3(^2D^\circ)3d$	$3d'\ ^3S^\circ$	1	*266360. 69*	
$\overline{3d}\ ^3P_2$ $^3P_1$ $^3P_0$	$2s^2\,2p^3(^2D^\circ)3d$	$3d'\ ^3P^\circ$	2 1 0	*266454. 27* *266499. 12* *266516. 35*	−44. 85 −17. 23
$\overline{3d}\ ^1F_3$	$2s^2\,2p^3(^2D^\circ)3d$	$3d'\ ^1F^\circ$	3	*266548. 7*	
$\overline{3d}\ ^1P_1$	$2s^2\,2p^3(^2D^\circ)3d$	$3d'\ ^1P^\circ$	1	*267400. 3*	
$\overline{4s}\ ^3D_3$ $^3D_2$ $^3D_1$	$2s^2\,2p^3(^2D^\circ)4s$	$4s'\ ^3D^\circ$	3 2 1	*269548. 7* *269564. 2* *269574. 5*	−15. 5 −10. 3
$\overline{4s}\ ^1D_2$	$2s^2\,2p^3(^2D^\circ)4s$	$4s'\ ^1D^\circ$	2	*270508. 4*	
	F III ($^4S^\circ_{1\frac{1}{2}}$)	*Limit*	------	282190. 2	
$\overline{\overline{3d}}\ ^3F_4$ $^3F_3$ $^3F_2$	$2s^2\,2p^3(^2P^\circ)3d$	$3d''\ ^3F^\circ$	4 3 2	*282544. 7* *282569. 7* *282586. 9*	−25. 0 −17. 2
$\overline{\overline{3d}}\ ^1D_2$	$2s^2\,2p^3(^2P^\circ)3d$	$3d''\ ^1D^\circ$	2	*282774. 7*	
$\overline{\overline{3d}}\ ^3P_0$ $^3P_1$ $^3P_2$	$2s^2\,2p^3(^2P^\circ)3d$	$3d''\ ^3P^\circ$	0 1 2	*282897. 0* *282913. 4* *282947. 9*	16. 4 34. 5
$\overline{\overline{3d}}\ ^1F_3$	$2s^2\,2p^3(^2P^\circ)3d$	$3d''\ ^1F^\circ$	3	*283409. 4*	
$\overline{\overline{3d}}\ ^1P_1$	$2s^2\,2p^3(^2P^\circ)3d$	$3d''\ ^1P^\circ$	1	*284224. 8*	
$\overline{\overline{3d}}\ ^3D_3$ $^3D_2$ $^3D_1$	$2s^2\,2p^3(^2P^\circ)4s$	$4s''\ ^3P^\circ$	2 1 0	*286701. 9* *286706. 6* *286707. 3*	−4. 7 −0. 7

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F II Observed Terms*

Config. $1s^2+$	Observed Terms			
$2s^2\,2p^4$	{ $2p^4\ ^1S$ $2p^4\ ^3P$ $2p^4\ ^1D$			
$2s\,2p^5$	{ $2p^5\ ^3P^\circ$ $2p^5\ ^1P^\circ$			
	ns ($n\geq 3$)	*np* ($n\geq 3$)	*nd* ($n\geq 3$)	*nf* ($n\geq 4$)
$2s^2\,2p^3(^4S^\circ)nx$	{3, $4s\ ^5S^\circ$ {3, $4s\ ^3S^\circ$	$3p\ ^5P$ 3, $4p\ ^3P$	$3d\ ^5D^\circ$ 3, $4d\ ^3D^\circ$	4, $5f\ ^5F$ $4f\ ^3F$
$2s^2\,2p^3(^2D^\circ)nx'$	{ 3, $4s'\ ^3D^\circ$ 3, $4s'\ ^1D^\circ$	$3p'\ ^3P$ $3p'\ ^3D$ $3p'\ ^3F$ $3p'\ ^1P$ $3p'\ ^1D$ $3p'\ ^1F$	$3d'\ ^3S^\circ$ $3d'\ ^3P^\circ$ $3d'\ ^3D^\circ$ $3d'\ ^3F^\circ$ $3d'\ ^3G^\circ$ $3d'\ ^1S^\circ$ $3d'\ ^1P^\circ$ $3d'\ ^1D^\circ$ $3d'\ ^1F^\circ$ $3d'\ ^1G^\circ$	
$2s^2\,2p^3(^2P^\circ)nx''$	{ 3, $4s''\ ^3P^\circ$ $3s''\ ^1P^\circ$	$3p''\ ^3S$ $3p''\ ^3P$ $3p''\ ^3D$ $3p''\ ^1S$ $3p''\ ^1P$ $3p''\ ^1D$	$3d''\ ^3P^\circ$ $3d''\ ^3F^\circ$ $3d''\ ^1P^\circ$ $3d''\ ^1D^\circ$ $3d''\ ^1F^\circ$	

*For predicted terms in the spectra of the O I isoelectronic sequence, see Introduction.

F III

(N I sequence; 7 electrons) $Z=9$

Ground state $1s^2\,2s^2\,2p^3\;{}^4S^\circ_{1\frac{1}{2}}$

$2p^3\;{}^4S^\circ_{1\frac{1}{2}}$ ***505410*** cm^{-1} I. P. 62.646 volts

The terms are from the paper by Edlén. With the aid of observations in the extreme ultraviolet he has extended the analysis by Bowen and Dingle and derived improved values of the series limits. He has found the sextet terms and estimated their position relative to the other terms. The value of x is somewhat uncertain. Bowen found 14 intersystem combinations connecting the doublet and quartet terms.

The term $3p''\;{}^2P^\circ$ depends upon the combination with $3s''\;{}^2S$, assigned to a pair of lines at 2920 A. According to Edlén this classification is somewhat uncertain.

REFERENCES

H. Dingle, Proc. Roy. Soc. (London) [A] **122**, 144 (1929). (T) (C L)
I. S. Bowen, Phys. Rev. **45**, 82 (1934). (T) (C L)
B. Edlén, Zeit. Phys. **93**, 433 (1935). (I P) (T) (C L)

F III

Edlén	Config.	Desig.	J	Level	Interval
$2p\;{}^4S_2$	$2s^2\,2p^3$	$2p^3\;{}^4S^\circ$	1½	*0*	
$2p\;{}^2D_3$	$2s^2\,2p^3$	$2p^3\;{}^2D^\circ$	2½	*34084*	−36
${}^2D_2$			1½	*34120*	
$2p\;{}^2P_{12}$	$2s^2\,2p^3$	$2p^3\;{}^2P^\circ$	{1½, ½}	*51558*	
$2p'\;{}^4P_3$	$2s\,2p^4$	$2p^4\;{}^4P$	2½	151897. 9	−337. 4
${}^4P_2$			1½	152235. 3	−174. 7
${}^4P_1$			½	152410. 0	
$2p'\;{}^2D_3$	$2s\,2p^4$	$2p^4\;{}^2D$	2½	210240	−16
${}^2D_2$			1½	210256	
$2p'\;{}^2S_1$	$2s\,2p^4$	$2p^4\;{}^2S$	½	248260	
$2p'\;{}^2P_2$	$2s\,2p^4$	$2p^4\;{}^2P$	1½	266559	−384
${}^2P_1$			½	266943	
$3s\;{}^4P_1$	$2s^2\,2p^2({}^3P)3s$	$3s\;{}^4P$	½	316707. 3	211. 3
${}^4P_2$			1½	316918. 6	318. 9
${}^4P_3$			2½	317237. 5	

F III

Edlén	Config.	Desig.	J	Level	Interval
$3s\;{}^2P_1$	$2s^2\,2p^2({}^3P)3s$	$3s\;{}^2P$	½	324489. 9	384. 5
${}^2P_2$			1½	324874. 4	
$\overline{3s}\;{}^2D_3$	$2s^2\,2p^2({}^1D)3s$	$3s'\;{}^2D$	2½	344016. 2	−3. 3
${}^2D_2$			1½	344019. 5	
$3p\;{}^2S_1$	$2s^2\,2p^2({}^3P)3p$	$3p\;{}^2S^\circ$	½	*344438. 4*	
$3p\;{}^4D_1$	$2s^2\,2p^2({}^3P)3p$	$3p\;{}^4D^\circ$	½	*348700. 5*	114. 9
${}^4D_2$			1½	*348815. 4*	189. 7
${}^4D_3$			2½	*349005. 1*	258. 9
${}^4D_4$			3½	*349264. 0*	
$3p\;{}^4P_1$	$2s^2\,2p^2({}^3P)3p$	$3p\;{}^4P^\circ$	½	*351234. 1*	94. 3
${}^4P_2$			1½	*351328. 4*	188. 7
${}^4P_3$			2½	*351517. 1*	
$3p\;{}^2D_2$	$2s^2\,2p^2({}^3P)3p$	$3p\;{}^2D^\circ$	1½	*355979. 6*	390. 4
${}^2D_3$			2½	*356370. 0*	
$3p\;{}^4S_2$	$2s^2\,2p^2({}^3P)3p$	$3p\;{}^4S^\circ$	1½	*357477. 0*	

F III—Continued

Edlén	Config.	Desig.	J	Level	Interval
$3p\ ^2P_1$	$2s^2\,2p^2(^3P)3p$	$3p\ ^2P^\circ$	½	360346. 2	86. 9
$^2P_2$			1½	360433. 1	
$\overline{\overline{3s}}\ ^2S_1$	$2s^2\,2p^2(^1S)3s$	$3s''\ ^2S$	½	372673. 0	
$\overline{3p}\ ^2F_3$	$2s^2\,2p^2(^1D)3p$	$3p'\ ^2F^\circ$	2½	376806. 2	64. 8
$^2F_4$			3½	376871. 0	
$\overline{3p}\ ^2D_3$	$2s^2\,2p^2(^1D)3p$	$3p'\ ^2D^\circ$	2½	380242. 9	−56. 2
$^2D_2$			1½	380299. 1	
$\overline{3p}\ ^2P_1$	$2s^2\,2p^2(^1D)3p$	$3p'\ ^2P^\circ$	½	384350. 9	134. 3
$^2P_2$			1½	384485. 2	
$3d\ ^4F_2$	$2s^2\,2p^2(^3P)3d$	$3d\ ^4F$	1½	387257. 3	108. 9
$^4F_3$			2½	387366. 2	155. 6
$^4F_4$			3½	387521. 8	203. 7
$^4F_5$			4½	387725. 5	
$3d\ ^2P_2$	$2s^2\,2p^2(^3P)3d$	$3d\ ^2P$	1½	389523. 5	−212. 2
$^2P_1$			½	389735. 7	
$3d\ ^4D_1$	$2s^2\,2p^2(^3P)3d$	$3d\ ^4D$	½	390118. 4	−40. 1
$^4D_2$			1½	390078. 3	−2. 6
$^4D_3$			2½	390075. 7	132. 7
$^4D_4$			3½	390208. 4	
$3d\ ^4P_3$	$2s^2\,2p^2(^3P)3d$	$3d\ ^4P$	2½	390832. 3	−141. 7
$^4P_2$			1½	390974. 0	−71. 2
$^4P_1$			½	391045. 2	
$3d\ ^2F_3$	$2s^2\,2p^2(^3P)3d$	$3d\ ^2F$	2½	391255. 6	369. 9
$^2F_4$			3½	391625. 5	
$3s'\ ^6S_3$	$2s\,2p^3(^5S^\circ)3s$	$3s'''\ ^6S^\circ$	2½	391910. 0 +x	
$3d\ ^2D_2$	$2s^2\,2p^2(^3P)3d$	$3d\ ^2D$	1½	395266. 1	118. 0
$^2D_3$			2½	395384. 1	
$2p''\ ^2P_2$	$2p^5$	$2p^5\ ^2P^\circ$	1½	401203	−518
$^2P_1$			½	401721	
$3s'\ ^4S_2$	$2s\,2p^3(^5S^\circ)3s$	$3s'''\ ^4S^\circ$	1½	404778	
$\overline{\overline{3p}}\ ^2P_1$	$2s^2\,2p^2(^1S)3p$	$3p''\ ^2P^\circ$	½	406899. 2	4. 1
$^2P_2$			1½	406903. 3	
$\overline{3d}\ ^2F_4$	$2s^2\,2p^2(^1D)3d$	$3d'\ ^2F$	3½	413136. 1	−51. 0
$^2F_3$			2½	413187. 1	
$\overline{3d}\ ^2G_5$	$2s^2\,2p^2(^1D)3d$	$3d'\ ^2G$	4½	414887. 0	−3. 1
$^2G_4$			3½	414890. 1	
$4s\ ^4P_1$	$2s^2\,2p^2(^3P)4s$	$4s\ ^4P$	½	415188	
$^4P_2$			1½		
$^4P_3$			2½	415714	
$\overline{3d}\ ^2D_2$	$2s^2\,2p^2(^1D)3d$	$3d'\ ^2D$	1½	416160. 7	17. 4
$^2D_3$			2½	416178. 1	
$4s\ ^2P_1$	$2s^2\,2p^2(^3P)4s$	$4s\ ^2P$	½	417581	387
$^2P_2$			1½	417968	
$\overline{3d}\ ^2P_1$	$2s^2\,2p^2(^1D)3d$	$3d'\ ^2P$	½	418180. 6	60. 3
$^2P_2$			1½	418240. 9	
$\overline{3d}\ ^2S_1$	$2s^2\,2p^2(^1D)3d$	$3d'\ ^2S$	½	420997. 9	
$3p'\ ^6P_2$	$2s\,2p^3(^5S^\circ)3p$	$3p'''\ ^6P$	1½	425239. 6 +x	21. 7
$^6P_3$			2½	425261. 3 +x	36. 1
$^6P_4$			3½	425297. 4 +x	
$4p\ ^2S_1$	$2s^2\,2p^2(^3P)4p$	$4p\ ^2S^\circ$	½	425388. 9	

F III—Continued

Edlén	Config.	Desig.	J	Level	Interval
$4p\ ^4D_1$	$2s^2\,2p^2(^3P)4p$	$4p\ ^4D^\circ$	½	426426. 0	130. 4
$^4D_2$			1½	426556. 4	174. 3
$^4D_3$			2½	426730. 7	256. 8
$^4D_4$			3½	426987. 5	
$4p\ ^4P_1$	$2s^2\,2p^2(^3P)4p$	$4p\ ^4P^\circ$	½	427456. 7	85. 7
$^4P_2$			1½	427542. 4	186. 9
$^4P_3$			2½	427729. 3	
$4p\ ^2D_2$	$2s^2\,2p^2(^3P)4p$	$4p\ ^2D^\circ$	1½	429105. 3	395. 3
$^2D_3$			2½	429500. 6	
$4p\ ^2P_1$	$2s^2\,2p^2(^3P)4p$	$4p\ ^2P^\circ$	½	431057. 1	167. 1
$^2P_2$			1½	431224. 2	
$3p'\ ^4P_3$	$2s\,2p^3(^5S^\circ)3p$	$3p'''\ ^4P$	2½	434546. 3	−20. 7
$^4P_2$			1½	434567. 0	−14. 6
$^4P_1$			½	434581. 6	
$\overline{4s}\ ^2D_{23}$	$2s^2\,2p^2(^1D)4s$	$4s'\ ^2D$	{2½, 1½}	440830	
$4d\ ^2P_2$	$2s^2\,2p^2(^3P)4d$	$4d\ ^2P$	1½	441159	−225
$^2P_1$			½	441384	
$4d\ ^4P_3$	$2s^2\,2p^2(^3P)4d$	$4d\ ^4P$	2½	442153	−147
$^4P_2$			1½	442300	−78
$^4P_1$			½	442378	
$4d\ ^2F_3$	$2s^2\,2p^2(^3P)4d$	$4d\ ^2F$	2½	442280	354
$^2F_4$			3½	442634	
$\overline{\overline{3d}}\ ^2D_{23}$	$2s^2\,2p^2(^1S)3d$	$3d''\ ^2D$	{1½, 2½}	442760	
$4d\ ^2D_2$	$2s^2\,2p^2(^3P)4d$	$4d\ ^2D$	1½	444960	48
$^2D_3$			2½	445008	
$3d'\ ^6D_5$	$2s\,2p^3(^5S^\circ)3d$	$3d'''\ ^6D^\circ$	4½	462930. 1+x	−2. 6
$^6D_4$			3½	462932. 7+x	−3. 8
$^6D_3$			2½	462936. 5+x	−3. 4
$^6D_2$			1½	462939. 9+x	−2. 5
$^6D_1$			½	462942. 4+x	
$5d\ ^4P_3$	$2s^2\,2p^2(^3P)5d$	$5d\ ^4P$	2½	465409	−132
$^4P_{12}$			{1½, ½}	465541	
$5d\ ^2D_{23}$	$2s^2\,2p^2(^3P)5d$	$5d\ ^2D$	{1½, 2½}	466293	
$\overline{4d}\ ^2F_{34}$	$2s^2\,2p^2(^1D)4d$	$4d'\ ^2F$	{3½, 2½}	466810	
$\overline{4d}\ ^2D_{23}$	$2s^2\,2p^2(^1D)4d$	$4d'\ ^2D$	{1½, 2½}	466964	
$\overline{4d}\ ^2P_{12}$	$2s^2\,2p^2(^1D)4d$	$4d'\ ^2P$	{½, 1½}	467798	
$3d'\ ^4D_4$	$2s\,2p^3(^5S^\circ)3d$	$3d'''\ ^4D^\circ$	3½	467868. 9	−0. 4
$^4D_3$			2½	467869. 3	−1. 0
$^4D_{12}$			{1½, ½}	467870. 3	
$\overline{3s'}\ ^2D_3$	$2s\,2p^3(^3D^\circ)3s$	$3s^{IV}\ ^2D^\circ$	2½	474369	−44
$^2D_2$			1½	474413	
$\overline{5d}\ ^2F_{34}$	$2s^2\,2p^2(^1D)5d$	$5d'\ ^2F$	{3½, 2½}	489494	
$\overline{5d}\ ^2D_{23}$	$2s^2\,2p^2(^1D)5d$	$5d'\ ^2D$	{1½, 2½}	490140	
	F IV$(^3P_0)$	Limit	------	505410	

January 1947.

F III Observed Terms*

Config. $1s^2+$	Observed Terms		
$2s^2\ 2p^3$	$2p^3\ ^4S^\circ$ $2p^3\ ^2P^\circ$ $2p^3\ ^2D^\circ$		
$2s\ 2p^4$	$2p^4\ ^4P$ $2p^4\ ^2S$ $2p^4\ ^2P$ $2p^4\ ^2D$		
$2p^5$	$2p^5\ ^2P^\circ$		
	$ns\ (n\geq 3)$	$np\ (n\geq 3)$	$nd\ (n\geq 3)$
$2s^2\ 2p^2(^3P)nx$	$3, 4s\ ^4P$ $3, 4s\ ^2P$	$3p\ ^4S^\circ$ $3, 4p\ ^4P^\circ$ $3, 4p\ ^4D^\circ$ $3, 4p\ ^2S^\circ$ $3, 4p\ ^2P^\circ$ $3, 4p\ ^2D^\circ$	$3–5d\ ^4P$ $3d\ ^4D$ $3d\ ^4F$ $3, 4d\ ^2P$ $3–5d\ ^2D$ $3, 4d\ ^2F$
$2s^2\ 2p^2(^1D)nx'$	$3, 4s'\ ^2D$	$3p'\ ^2P^\circ$ $3p'\ ^2D^\circ$ $3p'\ ^2F^\circ$	$3d'\ ^2S$ $3, 4d'\ ^2P$ $3–5d'\ ^2D$ $3–5d'\ ^2F$ $3d'\ ^2G$
$2s^2\ 2p^2(^1S)nx''$	$3s''\ ^2S$	$3p''\ ^2P^\circ$	$3d''\ ^2D$
$2s\ 2p^3(^5S^\circ)nx'''$	$3s'''\ ^6S^\circ$ $3s'''\ ^4S^\circ$	$3p'''\ ^6P$ $3p'''\ ^4P$	$3d'''\ ^6D^\circ$ $3d'''\ ^4D^\circ$
$2s\ 2p^3(^3D^\circ)nx^{IV}$	$3s^{IV}\ ^2D^\circ$		

*For predicted terms in the spectra of the N I isoelectronic sequence, see Introduction.

F IV

(C I sequence; 6 electrons) $Z=9$

Ground state $1s^2\ 2s^2\ 2p^2\ ^3P_0$

$2p^2\ ^3P_0$ **703766.4** cm^{-1} I. P. 87.23 volts

The first work on this spectrum was by Bowen. Edlén has greatly extended the earlier analysis. About 250 lines in the intervals 140 to 679 A and 2171 to 3176 A are now classified. The terms are from Edlén, who has rejected two terms in his published list, $4d'\ ^3S$ and $\overline{\overline{3s}}'\ ^3S$. Extrapolated values are entered in brackets in the table.

The singlet and triplet terms are connected by intersystem combinations. No such combinations involving quintet terms have been observed. The uncertainty x may reach 50 to 100 cm^{-1}.

REFERENCES

B. Edlén, Zeit. Phys. **92**, 19 (1934). (I P) (T) (C L)
B. Edlén, private communication (Dec. 1947). (T)

Edlén	Config.	Desig.	J	Level	Interval
$2p\ ^3P_0$	$2s^2\ 2p^2$	$2p^2\ ^3P$	0	0.0	225.2
$^3P_1$			1	225.2	388.2
$^3P_2$			2	613.4	
$2p\ ^1D_2$	$2s^2\ 2p^2$	$2p^2\ ^1D$	2	25241	
$2p\ ^1S_0$	$2s^2\ 2p^2$	$2p^2\ ^1S$	0	53544	
$2p'\ ^5S_2$	$2s\ 2p^3$	$2p^3\ ^5S^\circ$	2	*74506* +x	
$2p'\ ^3D_3$	$2s\ 2p^3$	$2p^3\ ^3D^\circ$	3	*147841.8*	−47.1
$^3D_2$			2	*147888.9*	−12.7
$^3D_1$			1	*147901.6*	
$2p'\ ^3P_2$	$2s\ 2p^3$	$2p^3\ ^3P^\circ$	2	*175237.0*	−5.0
$^3P_1$			1	*175242.0*	−22.1
$^3P_0$			0	*175264.1*	
$2p'\ ^1D_2$	$2s\ 2p^3$	$2p^3\ ^1D^\circ$	2	*228908*	
$2p'\ ^3S_1$	$2s\ 2p^3$	$2p^3\ ^3S^\circ$	1	*238297.2*	
$2p'\ ^1P_1$	$2s\ 2p^3$	$2p^3\ ^1P^\circ$	1	*257390*	
$2p''\ ^3P_2$	$2p^4$	$2p^4\ ^3P$	2	348327.0	−443.0
$^3P_1$			1	348770.0	−193.0
$^3P_0$			0	348963.0	
$3s\ ^3P_0$	$2s^2\ 2p(^2P^\circ)3s$	$3s\ ^3P^\circ$	0	*416417.3*	222.5
$^3P_1$			1	*416639.8*	503.6
$^3P_2$			2	*417143.4*	
$3s\ ^1P_1$	$2s^2\ 2p(^2P^\circ)3s$	$3s\ ^1P^\circ$	1	*423606.4*	
$3p\ ^3D_1$	$2s^2\ 2p(^2P^\circ)3p$	$3p\ ^3D$	1	451819.6	261.5
$^3D_2$			2	452081.1	436.0
$^3D_3$			3	452517.1	
$3p\ ^3S_1$	$2s^2\ 2p(^2P^\circ)3p$	$3p\ ^3S$	1	456884.3	
$3p\ ^3P_0$	$2s^2\ 2p(^2P^\circ)3p$	$3p\ ^3P$	0	460215.2	170.6
$^3P_1$			1	460385.8	254.8
$^3P_2$			2	460640.6	
$3p\ ^1D_2$	$2s^2\ 2p(^2P^\circ)3p$	$3p\ ^1D$	2	469644.2	
$3d\ ^3F_2$	$2s^2\ 2p(^2P^\circ)3d$	$3d\ ^3F^\circ$	2	*492395.1*	463.7
$^3F_3$			3	*492858.8*	347.4
$^3F_4$			4	*493206.2*	
$3d\ ^1D_2$	$2s^2\ 2p(^2P^\circ)3d$	$3d\ ^1D^\circ$	2	*492864*	
$3d\ ^3D_1$	$2s^2\ 2p(^2P^\circ)3d$	$3d\ ^3D^\circ$	1	*497481.4*	94.2
$^3D_2$			2	*497575.6*	153.5
$^3D_3$			3	*497729.1*	
$3d\ ^3P_2$	$2s^2\ 2p(^2P^\circ)3d$	$3d\ ^3P^\circ$	2	*500390.1*	−212.0
$^3P_1$			1	*500602.1*	−114.4
$^3P_0$			0	*500716.5*	
$3s'\ ^5P_1$	$2s\ 2p^2(^4P)3s$	$3s\ ^5P$	1	502723.0+x	241.4
$^5P_2$			2	502964.4+x	318.0
$^5P_3$			3	503282.4+x	
$3d\ ^1F_3$	$2s^2\ 2p(^2P^\circ)3d$	$3d\ ^1F^\circ$	3	*505421.4*	
$3d\ ^1P_1$	$2s^2\ 2p(^2P^\circ)3d$	$3d\ ^1P^\circ$	1	*506514*	
$3s'\ ^3P_0$	$2s\ 2p^2(^4P)3s$	$3s\ ^3P$	0	519341	198
$^3P_1$			1	519539	351
$^3P_2$			2	519890	
$3p'\ ^3S_1$	$2s\ 2p^2(^4P)3p$	$3p\ ^3S^\circ$	1	*534686*	
$3p'\ ^5D_0$	$2s\ 2p^2(^4P)3p$	$3p\ ^5D^\circ$	0	[*538507*] +x	[66]
$^5D_1$			1	*538573.3*+x	135.9
$^5D_2$			2	*538709.2*+x	200.6
$^5D_3$			3	*538909.8*+x	256.3
$^5D_4$			4	*539166.1*+x	

Edlén	Config.	Desig.	J	Level	Interval
$3p'\ ^5P_1$	$2s\ 2p^2(^4P)3p$	$3p\ ^5P^\circ$	1	*542578.3*+x	114.9
$^5P_2$			2	*542693.2*+x	202.0
$^5P_3$			3	*542895.2*+x	
$3p'\ ^3D_1$	$2s\ 2p^2(^4P)3p$	$3p\ ^3D^\circ$	1	*550918*	180
$^3D_2$			2	*551098*	268
$^3D_3$			3	*551366*	
	$2s\ 2p^2(^4P)3p$	$3p\ ^3P^\circ$	0		
$3p'\ ^3P_1$			1	*556051*	265
$^3P_2$			2	*556316*	
$4s\ ^3P_0$	$2s^2\ 2p(^2P^\circ)4s$	$4s\ ^3P^\circ$	0	*559747*	134
$^3P_1$			1	*559881*	423
$^3P_2$			2	*560304*	
$4s\ ^1P_1$	$2s^2\ 2p(^2P^\circ)4s$	$4s\ ^1P^\circ$	1	*561267*	
$\overline{3s}'\ ^3D_1$	$2s\ 2p^2(^2D)3s$	$3s'\ ^3D$	1	567900	119
$^3D_2$			2	568019	156
$^3D_3$			3	568175	
$3d'\ ^5F_1$	$2s\ 2p^2(^4P)3d$	$3d\ ^5F$	1	[576581] +x	[75]
$^5F_2$			2	576656.1+x	112.1
$^5F_3$			3	576768.2+x	148.4
$^5F_4$			4	576916.6+x	183.5
$^5F_5$			5	577100.1+x	
$3d'\ ^5D_0$	$2s\ 2p^2(^4P)3d$	$3d\ ^5D$	0	581806.1+x	5.4
$^5D_1$			1	581811.5+x	17.1
$^5D_2$			2	581828.6+x	43.7
$^5D_3$			3	581872.3+x	105.3
$^5D_4$			4	581977.6+x	
$3d'\ ^5P_3$	$2s\ 2p^2(^4P)3d$	$3d\ ^5P$	3	583547 +x	−150
$^5P_2$			2	583697 +x	−101
$^5P_1$			1	583798 +x	
$3d'\ ^3P_2$	$2s\ 2p^2(^4P)3d$	$3d\ ^3P$	2	585201	−224
$^3P_1$			1	585425	−106
$^3P_0$			0	585531	
$\overline{3s}'\ ^1D_2$	$2s\ 2p^2(^2D)3s$	$3s'\ ^1D$	2	586263	
$4d\ ^3F_2$	$2s^2\ 2p(^2P^\circ)4d$	$4d\ ^3F^\circ$	2	*586641*	
			3		
			4		
$4d\ ^1D_2$	$2s^2\ 2p(^2P^\circ)4d$	$4d\ ^1D^\circ$	2	*587130*	
$3d'\ ^3F_2$	$2s\ 2p^2(^4P)3d$	$3d\ ^3F$	2	588021	202
$^3F_3$			3	588223	255
$^3F_4$			4	588478	
$4d\ ^3D_1$	$2s^2\ 2p(^2P^\circ)4d$	$4d\ ^3D^\circ$	1	*589109*	79
$^3D_2$			2	*589188*	218
$^3D_3$			3	*589406*	
$4d\ ^3P_2$	$2s^2\ 2p(^2P^\circ)4d$	$4d\ ^3P^\circ$	2	*590024*	−177
$^3P_1$			1	*590201*	−61
$^3P_0$			0	*590262*	
$4d\ ^1F_3$	$2s^2\ 2p(^2P^\circ)4d$	$4d\ ^1F^\circ$	3	*592240*	
$4d\ ^1P_1$	$2s^2\ 2p(^2P^\circ)4d$	$4d\ ^1P^\circ$	1	*592674*	
$3d'\ ^3D_1$	$2s\ 2p^2(^4P)3d$	$3d\ ^3D$	1	595331	72
$^3D_2$			2	595403	78
$^3D_3$			3	595481	
$\overline{3p}'\ ^1F_3$	$2s\ 2p^2(^2D)3p$	$3p'\ ^1F^\circ$	3	*609811*	
$\overline{3p}'\ ^1D_2$	$2s\ 2p^2(^2D)3p$	$3p'\ ^1D^\circ$	2	*612830*	
$\overline{3p}'\ ^1P_1$	$2s\ 2p^2(^2D)3p$	$3p'\ ^1P^\circ$	1	*618889*	
$5d\ ^3F_2$	$2s^2\ 2p(^2P^\circ)5d$	$5d\ ^3F^\circ$	2	*629547*	
			3		
			4		

F IV—Continued

Edlén	Config.	Desig.	J	Level	Interval
$5d\ ^1D_2$	$2s^2\,2p(^2P^\circ)5d$	$5d\ ^1D^\circ$	2	*630019*	
	$2s^2\,2p(^2P^\circ)5d$	$5d\ ^3D^\circ$	1		
			2		
$5d\ ^3D_3$			3	*631126*	
$5d\ ^3P_2$	$2s^2\,2p(^2P^\circ)5d$	$5d\ ^3P^\circ$	2	[*631426*]	[−120]
$^3P_{01}$			1, 0	*631546*	
$5d\ ^1F_3$	$2s^2\,2p(^2P^\circ)5d$	$5d\ ^1F^\circ$	3	*632730*	
$5d\ ^1P_1$	$2s^2\,2p(^2P^\circ)5d$	$5d\ ^1P^\circ$	1	*632740*	
$\overline{3d'}\ ^3F_{234}$	$2s\,2p^2(^2D)3d$	$3d'\ ^3F$	2, 3, 4	644224	
	$2s\,2p^2(^4P)4s$	$4s\ ^5P$	1		
$4s'\ ^5P_2$			2	645504 $+x$	323
$^5P_3$			3	645827 $+x$	
	$2s\,2p^2(^2D)3d$	$3d'\ ^3P$	0		
			1		
$\overline{3d'}\ ^3P_2$			2	648827	
$\overline{3d'}\ ^3D_{12}$	$2s\,2p^2(^2D)3d$	$3d'\ ^3D$	1, 2	650196	146
$^3D_3$			3	650342	
	$2s^2\,2p(^2P^\circ)6d$	$6d\ ^3D^\circ$	1		
			2		
$6d\ ^3D_3$			3	*653606*	
$6d\ ^3P_2$	$2s^2\,2p(^2P^\circ)6d$	$6d\ ^3P^\circ$	2	*653772*	−61
$^3P_{01}$			1, 0	*653833*	
$6d\ ^1F_3$	$2s^2\,2p(^2P^\circ)6d$	$6d\ ^1F^\circ$	3	*654469*	
$\overline{3d'}\ ^3S_1$	$2s\,2p^2(^2D)3d$	$3d'\ ^3S$	1	654739	

F IV—Continued

Edlén	Config.	Desig.	J	Level	Interval
$\overline{3d'}\ ^1F_3$	$2s\,2p^2(^2D)3d$	$3d'\ ^1F$	3	657546	
$\overline{3d'}\ ^1D_2$	$2s\,2p^2(^2D)3d$	$3d'\ ^1D$	2	657800	
$\overline{3d'}\ ^1P_1$	$2s\,2p^2(^2D)3d$	$3d'\ ^1P$	1	658629	
	$2s\,2p^2(^4P)4p$	$4p\ ^3D^\circ$	1		
			2		
$4p'\ ^3D_3$			3	*662843*	
	$2s\,2p^2(^4P)4p$	$4p\ ^3P^\circ$	0		
			1		
$4p'\ ^3P_2$			2	*665409*	
$4d'\ ^5P_3$	$2s\,2p^2(^4P)4d$	$4d\ ^5P$	3	675110 $+x$	−199
$^5P_{1\,2}$			2, 1	675309 $+x$	
$4d'\ ^3F_2$	$2s\,2p^2(^4P)4d$	$4d\ ^3F$	2	677467	
$^3F_3$			3	677667	200
$^3F_4$			4	677906	239
$4d'\ ^3D_3$	$2s\,2p^2(^4P)4d$	$4d\ ^3D$	1, 2	679798	196
$^3D_{12}$			3	679994	
	F v ($^2P^\circ_{1/2}$)	*Limit*	------	**703766.4**	
	$2s\,2p^2(^4P)5p$	$5p\ ^3D^\circ$	1		
			2		
$5p'\ ^3D_3$			3	*710760*	
$5d'\ ^5P_3$	$2s\,2p^2(^4P)5d$	$5d\ ^5P$	3	716878 $+x$	−202
$^5P_{12}$			2, 1	717080 $+x$	
$\overline{4d'}\ ^3F_{234}$	$2s\,2p^2(^2D)4d$	$4d'\ ^3F$	2, 3, 4	738996	

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F IV Observed Terms*

Config. $1s^2+$	Observed Terms		
$2s^2\,2p^2$	$2p^2\ ^1S$	$2p^2\ ^3P$	$2p^2\ ^1D$
$2s\,2p^3$	$2p^3\ ^5S^\circ$ $2p^3\ ^3S^\circ$	$2p^3\ ^3P^\circ$ $2p^3\ ^1P^\circ$	$2p^3\ ^3D^\circ$ $2p^3\ ^1D^\circ$
$2p^4$		$2p^4\ ^3P$	
	ns ($n\geq 3$)	np ($n\geq 3$)	nd ($n\geq 3$)
$2s^2\,2p(^2P^\circ)nx$	$3,\ 4s\ ^3P^\circ$ $3,\ 4s\ ^1P^\circ$	$3p\ ^3S$ $3p\ ^3P$ $3p\ ^3D$ $3p\ ^1D$	$3–6d\ ^3P^\circ$ $3–6d\ ^3D^\circ$ $3–5d\ ^3F^\circ$ $3–5d\ ^1P^\circ$ $3–5d\ ^1D^\circ$ $3–6d\ ^1F^\circ$
$2s\,2p^2(^4P)nx$	$3,\ 4s\ ^5P$ $3s\ ^3P$	$3p\ ^5P^\circ$ $3p\ ^5D^\circ$ $3p\ ^3S^\circ$ $3,\ 4p\ ^3P^\circ$ $3–5p\ ^3D^\circ$	$3–5d\ ^5P$ $3d\ ^5D$ $3d\ ^5F$ $3d\ ^3P$ $3,\ 4d\ ^3D$ $3,\ 4d\ ^3F$
$2s\,2p^2(^2D)nx'$	$3s'\ ^3D$ $3s'\ ^1D$	$3p'\ ^1P^\circ$ $3p'\ ^1D^\circ$ $3p'\ ^1F^\circ$	$3d'\ ^3S$ $3d'\ ^3P$ $3d'\ ^3D$ $3,\ 4d'\ ^3F$ $3d'\ ^1P$ $3d'\ ^1D$ $3d'\ ^1F$

*For predicted terms in the spectra of the C I isoelectronic sequence, see Introduction.

F V

(B I sequence; 5 electrons) $Z=9$

Ground state $1s^2\,2s^2\,2p\ ^2P^\circ_{\frac{1}{2}}$

$2p\ ^2P^\circ_{\frac{1}{2}}$ ***921450*** cm^{-1} I. P. 114.214 volts

All of the terms are from an unpublished manuscript kindly furnished by Edlén. He has revised and extended his earlier analysis. The notation in the left column is from his published papers.

No intersystem combinations have been observed. The position of the quartet terms relative to the doublets may be in error by ±100 cm^{-1} according to Edlén. This uncertainty is indicated by x in the table.

REFERENCES

B. Edlén, Zeit. Phys. **89**, 597 (1934); **92**, 26 (1934); **94**, 56 (1935). (I P) (T) (C L).

B. Edlén, unpublished material (Dec. 1947). (I P) (T).

F V

Edlén	Config.	Desig.	J	Level	Interval
$2p\ ^2P_1$	$2s^2(^1S)2p$	$2p\ ^2P^\circ$	½	0	746
$^2P_2$			1½	746	
$2p'\ ^4P_1$	$2s\ 2p^2$	$2p^2\ ^4P$	½	86035+x	252
$^4P_2$			1½	86287+x	364
$^4P_3$			2½	86651+x	
$2p'\ ^2D_3$	$2s\ 2p^2$	$2p^2\ ^2D$	2½	152876	−22
$^2D_2$			1½	152898	
$2p'\ ^2S_1$	$2s\ 2p^2$	$2p^2\ ^2S$	½	197565	
$2p'\ ^2P_1$	$2s\ 2p^2$	$2p^2\ ^2P$	½	214881	467
$^2P_2$			1½	215348	
$2p''\ ^4S_2$	$2p^3$	$2p^3\ ^4S^\circ$	1½	276657+x	
$2p''\ ^2D_3$	$2p^3$	$2p^3\ ^2D^\circ$	2½	307226	−47
$^2D_2$			1½	307273	
$2p''\ ^2P_1$	$2p^3$	$2p^3\ ^2P^\circ$	½	347418	20
$^2P_2$			1½	347438	
$3s\ ^2S_1$	$2s^2(^1S)3s$	$3s\ ^2S$	½	524751	
$3p\ ^2P_1$	$2s^2(^1S)3p$	$3p\ ^2P^\circ$	½	565367	177
$^2P_2$			1½	565544	
$3d\ ^2D_2$	$2s^2(^1S)3d$	$3d\ ^2D$	1½	602476	40
$^2D_3$			2½	602516	
$3s'\ ^4P_1$	$2s\ 2p(^3P^\circ)3s$	$3s\ ^4P^\circ$	½	621138+x	257
$^4P_2$			1½	621395+x	468
$^4P_3$			2½	621863+x	
$3s'\ ^2P_1$	$2s\ 2p(^3P^\circ)3s$	$3s\ ^2P^\circ$	½	638856	509
$^2P_2$			1½	639365	
$3p'\ ^2P_1$	$2s\ 2p(^3P^\circ)3p$	$3p\ ^2P$	½	656208	228
$^2P_2$			1½	656436	
$3p'\ ^4D_1$	$2s\ 2p(^3P^\circ)3p$	$3p\ ^4D$	½	657988+x	146
$^4D_2$			1½	658134+x	256
$^4D_3$			2½	658390+x	401
$^4D_4$			3½	658791+x	
$3p'\ ^4S_2$	$2s\ 2p(^3P^\circ)3p$	$3p\ ^4S$	1½	666240+x	
$3p'\ ^2D_2$	$2s\ 2p(^3P^\circ)3p$	$3p\ ^2D$	1½	675932	490
$^2D_3$			2½	676422	
$3p'\ ^2S_1$	$2s\ 2p(^3P^\circ)3p$	$3p\ ^2S$	½	687806	
$3d'\ ^4D_{12}$	$2s\ 2p(^3P^\circ)3d$	$3d\ ^4D^\circ$	{½, 1½}	697817+x	102
$^4D_3$			2½	697919+x	136
$^4D_4$			3½	698055+x	
$3d'\ ^2D_2$	$2s\ 2p(^3P^\circ)3d$	$3d\ ^2D^\circ$	1½	699293	96
$^2D_3$			2½	699389	
$3d'\ ^4P_3$	$2s\ 2p(^3P^\circ)3d$	$3d\ ^4P^\circ$	2½	702908+x	−209
$^4P_2$			1½	703117+x	−142
$^4P_1$			½	703259+x	
$\overline{3s}'\ ^2P_{12}$	$2s\ 2p(^1P^\circ)3s$	$3s'\ ^2P^\circ$	{½, 1½}	712755	

F v—Continued

Edlén	Config.	Desig.	J	Level	Interval
$3d'\ {}^2F_3$ ${}^2F_4$	$2s\ 2p(^3P^\circ)3d$	$3d\ {}^2F^\circ$	2½ 3½	*712840* *713306*	466
$4s\ {}^2S_1$	$2s^2(^1S)4s$	$4s\ {}^2S$	½	712936	
$3d'\ {}^2P_2$ ${}^2P_1$	$2s\ 2p(^3P^\circ)3d$	$3d\ {}^2P^\circ$	1½ ½	*718472* *718691*	−219
$4d\ {}^2D_2$ ${}^2D_3$	$2s^2(^1S)4d$	$4d\ {}^2D$	1½ 2½	744010 744036	26
$\overline{3p}'\ {}^2D_2$ ${}^2D_3$	$2s\ 2p(^1P^\circ)3p$	$3p'\ {}^2D$	1½ 2½	751406 751452	46
$\overline{3p}'\ {}^2P_1$ ${}^2P_2$	$2s\ 2p(^1P^\circ)3p$	$3p'\ {}^2P$	½ 1½	752529 753656	127
$\overline{3p}'\ {}^2S_1$	$2s\ 2p(^1P^\circ)3p$	$3p'\ {}^2S$	½	760342	
$\overline{3d}'\ {}^2F_{34}$	$2s\ 2p(^1P^\circ)3d$	$3d'\ {}^2F^\circ$	{ 2½ 3½ }	*783650*	
$3s''\ {}^4P_1$ ${}^4P_2$ ${}^4P_3$	$2p^2(^3P)3s$	$3s''\ {}^4P$	½ 1½ 2½	784343+x 784604+x 785014+x	261 410
$\overline{3d}'\ {}^2D_2$ ${}^2D_3$	$2s\ 2p(^1P^\circ)3d$	$3d'\ {}^2D^\circ$	1½ 2½	*787725* *787764*	39
$\overline{3d}'\ {}^2P_{12}$	$2s\ 2p(^1P^\circ)3d$	$3d'\ {}^2P^\circ$	{ ½ 1½ }	*793308*	
$3s''\ {}^2P_1$ ${}^2P_2$	$2p^2(^3P)3s$	$3s''\ {}^2P$	½ 1½	797059 797519	460
$5d\ {}^2D_3$	$2s^2(^1S)5d$	$5d\ {}^2D$	1½ 2½	808663 808677	14
$4s'\ {}^4P_3$	$2s\ 2p(^3P^\circ)4s$	$4s\ {}^4P^\circ$	½ 1½ 2½	 *810298+x*	
$\overline{3s}''\ {}^2D$	$2p^2(^1D)3s$	$3s'''\ {}^2D$	{ 1½ 2½ }	811075	
$3p''\ {}^4D_4$	$2p^2(^3P)3p$	$3p''\ {}^4D^\circ$	½ 1½ 2½ 3½	 *816518+x* *816759+x* *817101+x*	241 342
$3p''\ {}^4P_3$	$2p^2(^3P)3p$	$3p''\ {}^4P^\circ$	½ 1½ 2½	 *823375+x* *823625+x*	250
	$2s\ 2p(^3P^\circ)4p$	$4p\ {}^2P$	½ 1½	829436 829707	271
$4p'\ {}^2D_2$ ${}^2D_3$	$2s\ 2p(^3P^\circ)4p$	$4p\ {}^2D$	1½ 2½	833501 833920	419
$3p''\ {}^4S_2$	$2p^2(^3P)3p$	$3p''\ {}^4S^\circ$	1½	*834790+x*	
	$2s\ 2p(^3P^\circ)4p$	$4p\ {}^2S$	½	838036	
$4d'\ {}^4D_4$	$2s\ 2p(^3P^\circ)4d$	$4d\ {}^4D^\circ$	{ ½ 1½ } 2½ 3½	*841037+x* *841095+x* *841305+x*	58 210

F v—Continued

Eglén	Config.	Desig.	J	Level	Interval
	$2s\ 2p(^3P^\circ)4d$	$4d\ {}^2D^\circ$	1½ 2½	*841598* *841695*	97
$4d'\ {}^4P_3$	$2s\ 2p(^3P^\circ)4d$	$4d\ {}^4P^\circ$	2½ 1½ ½	*842452+x*	
	$2s^2(^1S)6d$	$6d\ {}^2D$	1½ 2½	 843497	
$\overline{3p}''\ {}^2F_3$ ${}^2F_4$	$2p^2(^1D)3p$	$3p'''\ {}^2F^\circ$	2½ 3½	*844112* *844266*	154
$4d'\ {}^2F_3$ ${}^2F_4$	$2s\ 2p(^3P^\circ)4d$	$4d\ {}^2F^\circ$	2½ 3½	*847506* *847817*	311
	$2p^2(^3P)3d$	$3d''\ {}^2P$	1½ ½	853035 853442	−407
	$2p^2(^1D)3p$	$3p'''\ {}^2D^\circ$	1½ 2½	 *854971*	
$3d''\ {}^4P_3$ ${}^4P_2$ ${}^4P_1$	$2p^2(^3P)3d$	$3d''\ {}^4P$	2½ 1½ ½	860421+x 860619+x 860725+x	−198 −106
$\overline{3d}''\ {}^2D$	$2p^2(^1D)3d$	$3d'''\ {}^2D$	{ 1½ 2½ }	873904	
$\overline{3d}''\ {}^2F_{34}$	$2p^2(^1D)3d$	$3d'''\ {}^2F$	{ 2½ 3½ }	880312	
$\overline{3d}''\ {}^2P_1$ ${}^2P_2$	$2p^2(^1D)3d$	$3d'''\ {}^2P$	½ 1½	882930 883083	153
	$2s\ 2p(^3P^\circ)5s$	$5s\ {}^4P^\circ$	½ 1½ 2½	 *892180+x*	
	$2s\ 2p(^3P^\circ)5p$	$5p\ {}^2D$	1½ 2½	901487 902012	525
$5d'\ {}^4D$	$2s\ 2p(^3P^\circ)5d$	$5d\ {}^4D^\circ$	½ 1½ 2½ 3½	 *906074+x*	
	$2s\ 2p(^3P^\circ)5d$	$5d\ {}^4P^\circ$	2½ 1½ ½	*906565+x*	
	F VI ($^1S_0$)	***Limit***	------	***921450***	
	$2s\ 2p(^3P^\circ)6d$	$6d\ {}^4D^\circ$	½ 1½ 2½ 3½	 *940921+x*	
	$2s\ 2p(^3P^\circ)6d$	$6d\ {}^4P^\circ$	2½ 1½ ½	*941286+x*	
	$2p^2(^3P)4d$	$4d''\ {}^4P$	2½ 1½ ½	998189+x	

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F v Observed Terms*

Config. $1s^2+$	Observed Terms		
$2s^2(^1S)2p$	$2p\ ^2P^\circ$		
$2s\ 2p^2$	$\{2p^2\ ^2S$; $2p^2\ ^4P$; $2p^2\ ^2P$; $2p^2\ ^2D$		
$2p^3$	$\{2p^3\ ^4S^\circ$; $2p^3\ ^2P^\circ$; $2p^3\ ^2D^\circ$		
	$ns\ (n \geq 3)$	$np\ (n \geq 3)$	$nd\ (n \geq 3)$
$2s^2(^1S)nx$	$3,\ 4s\ ^2S$	$3p\ ^2P^\circ$	$3–6d\ ^2D$
$2s\ 2p(^3P^\circ)nx$	$\{3–5s\ ^4P^\circ$; $3s\ ^2P^\circ$	$3p\ ^4S$; $3p\ ^4D$; $3,\ 4p\ ^2S$; $3,\ 4p\ ^2P$; $3–5p\ ^2D$	$3–6d\ ^4P^\circ$; $3–6d\ ^4D^\circ$; $3d\ ^2P^\circ$; $3,\ 4d\ ^2D^\circ$; $3,\ 4d\ ^2F^\circ$
$2s\ 2p(^1P^\circ)nx'$	$3s'\ ^2P^\circ$	$3p'\ ^2S$; $3p'\ ^2P$; $3p'\ ^2D$	$3d'\ ^2P^\circ$; $3d'\ ^2D^\circ$; $3d'\ ^2F^\circ$
$2p^2(^3P)nx''$	$\{3s''\ ^4P$; $3s''\ ^2P$	$3p''\ ^4S^\circ$; $3p''\ ^4P^\circ$; $3p''\ ^4D^\circ$	$3,\ 4d''\ ^4P$; $3d''\ ^2P$
$2p^2(^1D)nx'''$	$3s'''\ ^2D$	$3p'''\ ^2D^\circ$; $3p'''\ ^2F^\circ$	$3d'''\ ^2P$; $3d'''\ ^2D$; $3d'''\ ^2F$

*For predicted terms in the spectra of the B I isoelectronic sequence, see Introduction.

F VI

(Be I sequence; 4 electrons) $Z=9$

Ground state $1s^2 2s^2\ ^1S_0$

$2s^2\ ^1S_0$ 1267581 cm^{-1} I. P. 157.117 volts

Edlén has revised and extended his published analysis and has generously furnished a manuscript copy of his complete term list in advance of publication, for inclusion here.

In the published papers he has used a prime to designate the terms from the $^2P^\circ$ limit in F VII.

Intersystem combinations connecting the singlet and triplet systems of terms, have been observed.

REFERENCES

B. Edlén, Zeit. Phys. **89,** 179 (1934). (I P) (T) (C L)
B. Edlén, Zeit. Phys. **94,** 56 (1935). (T) (C L)
B. Edlén, unpublished material (Dec. 1947). (I P) (T)

F VI

Config.	Desig.	J	Level	Interval
$2s^2$	$2s^2\ ^1S$	0	0	
$2s(^2S)2p$	$2p\ ^3P^\circ$	0	*96601*	260
		1	*96861*	576
		2	*97437*	
$2s(^2S)2p$	$2p\ ^1P^\circ$	1	*186841*	
$2p^2$	$2p^2\ ^3P$	0	251341	294
		1	251635	510
		2	252145	
$2p^2$	$2p^2\ ^1D$	2	274597	
$2p^2$	$2p^2\ ^1S$	0	340424	
$2s(^2S)3s$	$3s\ ^3S$	1	747298	
$2s(^2S)3s$	$3s\ ^1S$	0	764392	
$2s(^2S)3p$	$3p\ ^1P^\circ$	1	*787833*	
$2s(^2S)3p$	$3p\ ^3P^\circ$	0		
		1	*790326*	148
		2	*790474*	
$2s(^2S)3d$	$3d\ ^3D$	1, 2	812169	39
		3	812208	
$2s(^2S)3d$	$3d\ ^1D$	2	826853	
$2p(^2P^\circ)3s$	$3s\ ^3P^\circ$	0	*871160*	281
		1	*871441*	637
		2	*872078*	
$2p(^2P^\circ)3s$	$3s\ ^1P^\circ$	1	*884290*	
$2p(^2P^\circ)3p$	$3p\ ^1P$	1	895287	
$2p(^2P^\circ)3p$	$3p\ ^3D$	1	900442	343
		2	900785	612
		3	901397	
$2p(^2P^\circ)3p$	$3p\ ^3S$	1	909316	
$2p(^2P^\circ)3p$	$3p\ ^3P$	0	915196	224
		1	915420	350
		2	915770	
$2p(^2P^\circ)3d$	$3d\ ^1D^\circ$	2	*921821*	
$2p(^2P^\circ)3p$	$3p\ ^1D$	2	925393	
$2p(^2P^\circ)3d$	$3d\ ^3D^\circ$	1	*933586*	131
		2	*933717*	203
		3	*933920*	
$2p(^2P^\circ)3p$	$3p\ ^1S$	0	934633	
$2p(^2P^\circ)3d$	$3d\ ^3P^\circ$	2	*938524*	−287
		1	*938811*	−147
		0	*938958*	
$2p(^2P^\circ)3d$	$3d\ ^1F^\circ$	3	*947305*	
$2p(^2P^\circ)3d$	$3d\ ^1P^\circ$	1	*953402*	
$2s(^2S)4s$	$4s\ ^3S$	1	989928	
$2s(^2S)4s$	$4s\ ^1S$	0	997693	
$2s(^2S)4p$	$4p\ ^1P^\circ$	1	*1007852*	
$2s(^2S)4d$	$4d\ ^3D$	1		
		2		
		3	1014439	
$2s(^2S)4d$	$4d\ ^1D$	2	1019363	
$2s(^2S)5s$	$5s\ ^3S$	1	1093463	
$2s(^2S)5p$	$5p\ ^1P^\circ$	1	*1099409*	
$2s(^2S)5d$	$5d\ ^3D$	1		
		2		
		3	1106417	
$2s(^2S)5d$	$5d\ ^1D$	2	1108712	
$2p(^2P^\circ)4s$	$4s\ ^1P^\circ$	1	*1112328*	
$2p(^2P^\circ)4p$	$4p\ ^1P$	1	1115967	
$2p(^2P^\circ)4p$	$4p\ ^3D$	1	1117498	243
		2	1117741	532
		3	1118273	
$2p(^2P^\circ)4p$	$4p\ ^3S$	1	1121377	
$2p(^2P^\circ)4p$	$4p\ ^3P$	0		
		1	1122468	194
		2	1122662	
$2p(^2P^\circ)4p$	$4p\ ^1D$	2	1126152	
$2p(^2P^\circ)4d$	$4d\ ^1D^\circ$	2	*1126168*	
$2p(^2P^\circ)4d$	$4d\ ^3D^\circ$	1		
		2		
		3	*1130339*	
$2p(^2P^\circ)4d$	$4d\ ^3P^\circ$	2	*1131653*	−204
		1	*1131857*	
		0		
$2p(^2P^\circ)4d$	$4d\ ^1F^\circ$	3	*1135953*	
$2p(^2P^\circ)4d$	$4d\ ^1P^\circ$	1	*1137535*	

F VI—Continued

Config.	Desig.	J	Level	Interval
$2s(^2S)6p$	$6p\ ^1P^\circ$	1	*1154428*	
$2s(^2S)6d$	$6d\ ^3D$	1		
		2		
		3	1156097	
$2s(^2S)6d$	$6d\ ^1D$	2	1157385	
$2s(^2S)7p$	$7p\ ^1P^\circ$	1	*1184469*	
$2s(^2S)7d$	$7d\ ^3D$	1		
		2		
		3	1185884	
$3s(^2S)7d$	$7d\ ^1D$	2	1186611	
$2s(^2S)8d$	$8d\ ^3D$	1		
		2		
		3	1205139	
$2p(^2P^\circ)5p$	$5p\ ^3D$	1		
		2		
		3	1215055	
$2p(^3P^\circ)5p$	$5p\ ^3P$	0		
		1		
		2	1216995	
$2p(^2P^\circ)5p$	$5p\ ^1D$	2	1218588	
$2p(^2P^\circ)5d$	$5d\ ^1D^\circ$	2	*1218786*	
$2p(^2P^\circ)5d$	$5d\ ^3D^\circ$	1		
		2		
		3	*1220940*	
$2p(^2P^\circ)5d$	$5d\ ^3P^\circ$	2	*1221541*	
		1		
		0		
$2p(^2P^\circ)5d$	$5d\ ^1F^\circ$	3	*1223598*	
$2p(^2P^\circ)5d$	$5d\ ^1P^\circ$	1	*1224285*	
$2p(^2P^\circ)6p$	$6p\ ^3D$	1		
		2		
		3	1266672	
F VII ($^2S_{1/2}$)	*Limit*	--------	**1267581**	
$2p(^2P^\circ)6p$	$6p\ ^3P$	0		
		1		
		2	1267616	
$2p(^2P^\circ)6p$	$6p\ ^1D$	2	1268554	
$2p(^2P^\circ)6d$	$6d\ ^3D^\circ$	1		
		2		
		3	*1269888*	
$2p(^2P^\circ)6d$	$6d\ ^1F^\circ$	3	*1271437*	
$2p(^2P^\circ)7d$	$7d\ ^3D^\circ$	1		
		2		
		3	*1299418*	

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F VI Observed Terms*

Config. $1s^2+$	Observed Terms		
$2s^2$	$2s^2\ ^1S$		
$2s(^2S)2p$	$2p\ ^3P^\circ$ $2p\ ^1P^\circ$		
$2p^2$	$2p^2\ ^3P$ $2p^2\ ^1S$ $2p^2\ ^1D$		
	$ns\ (n\geq3)$	$np\ (n\geq3)$	$nd\ (n\geq3)$
$2s(^2S)nx$	3–5$s\ ^3S$ 3, 4$s\ ^1S$	$3p\ ^3P^\circ$ 3–7$p\ ^1P^\circ$	3–8$d\ ^3D$ 3–7$d\ ^1D$
$2p(^2P^\circ)nx$	$3s\ ^3P^\circ$ 3, 4$s\ ^1P^\circ$	3, 4$p\ ^3S$ 3–6$p\ ^3P$ 3–6$p\ ^3D$ $3p\ ^1S$ 3, 4$p\ ^1P$ 3–6$p\ ^1D$	3–5$d\ ^3P^\circ$ 3–7$d\ ^3D^\circ$ 3–5$d\ ^1P^\circ$ 3–5$d\ ^1D^\circ$ 3–6$d\ ^1F^\circ$

*For predicted terms in the spectra of the Be I isoelectronic sequence, see Introduction.

F VII

(Li I sequence; 3 electrons) $Z=9$

Ground state $1s^2\ 2s\ ^2S_{\frac{1}{2}}$

$2s\ ^2S_{\frac{1}{2}}$ **1493656** cm^{-1} I. P. 185.139 volts

The analysis is by Edlén, who, in 1934, published a list of nine classified lines in the range between 86 A and 134 A. He has recently extended the analysis and has generously furnished his unpublished term list for use in the present compilation. All terms in the table have been taken from the later list, although the entries in column one are from the earlier paper.

Edlén remarks that the $np\ ^2P^{\circ}$ and $nd\ ^2D$ series have been observed in the vacuum spark further than indicated in the table, but beyond $n=6$ the term values calculated from a Ritz formula are probably to be preferred.

REFERENCES

B. Edlén, Zeit. Phys. **89**, 179 (1934). (T) (C L)

B. Edlén, unpublished material (Sept. 1947). (I P) (T)

F VII

Edlén	Config.	Desig.	J	Level	Interval
$2s\ ^2S$	$2s$	$2s\ ^2S$	½	0	
$2p\ ^2P_1$ $^2P_2$	$2p$	$2p\ ^2P^{\circ}$	½ 1½	*112258* *113235*	977
$3s\ ^2S$	$3s$	$3s\ ^2S$	½	854625	
$3p\ ^2P_1$ $^2P_2$	$3p$	$3p\ ^2P^{\circ}$	½ 1½	*885136* *885418*	282
$3d\ ^2D_2$ $^2D_3$	$3d$	$3d\ ^2D$	1½ 2½	895632 895722	90
$4s\ ^2S$	$4s$	$4s\ ^2S$	½	1140416	
$4p\ ^2P_2$	$4p$	$4p\ ^2P^{\circ}$	{½, 1½}	*1152977*	
$4d\ ^2D_3$	$4d$	$4d\ ^2D$	1½ 2½	1157223 1157255	32
	$5s$	$5s\ ^2S$	½	1269826	
	$5p$	$5p\ ^2P^{\circ}$	{½, 1½}	*1276194*	
$5d\ ^2D_3$	$5d$	$5d\ ^2D$	{1½, 2½}	1278404	

F VII

Edlén	Config.	Desig.	J	Level	Interval
	$6s$	$6s\ ^2S$	½	1339216	
	$6p$	$6p\ ^2P^{\circ}$	{½, 1½}	*1342877*	
	$6d$	$6d\ ^2D$	{1½, 2½}	1344141	
	$7s$	$7s\ ^2S$	½	1380775	
	$7p$	$7p\ ^2P^{\circ}$	{½, 1½}	*1382858*	
	$7d$	$7d\ ^2D$	{1½, 2½}	1383841	
	$8p$	$8p\ ^2P^{\circ}$	{½, 1½}	*1408848*	
	$8d$	$8d\ ^2D$	{1½, 2½}	1409538	
	F VIII ($^1S_0$)	*Limit*	------	**1493656**	

September 1947.

F VIII

(He I sequence; 2 electrons) $Z=9$

Ground state $1s^2\,{}^1S_0$

$1s^2\,{}^1S_0$ 7693400±800 cm^{-1} I. P. 953.60±0.10 volts

Flemberg has classified three lines between 13 A and 16 A as the first three members of the singlet series. Tyrén has also observed the first two members of this series and classified a line at 16.951 A as the intersystem combination $1s^2\,{}^1S_0-2p\,{}^3P^\circ_1$. Tyrén's value of the limit is quoted here. The unit, 10^3 cm^{-1}, has here been changed to cm^{-1}.

Edlén has extended the analysis and has generously furnished his unpublished manuscript containing absolute values of the triplet terms extrapolated along the He I isoelectronic sequence. The relative positions of the singlet and triplet terms thus determined confirm the intersystem combination reported by Tyrén. The $2s\,{}^3S-2p\,{}^3P^\circ$ combination has apparently not been observed, but Edlén regards the extrapolation from the irregular doublet law as very reliable. Brackets are used in the table to denote extrapolated values not yet confirmed by observation.

REFERENCES

F. Tyrén, Nova Acta Reg. Soc. Sci. Uppsala [IV] 12, No. 1, 25 (1940). (I P) (T) (C L)
H. Flemberg, Ark. Mat. Astr. Fys. (Stockholm) 28A, No. 18 p. 34 (1942). (T) (C L)
B. Edlén, unpublished material (Sept. 1947). (T)

F VIII

Config.	Desig.	J	Level	Interval
$1s^2$	$1s^2\,{}^1S$	0	0	
1s 2s	2s ${}^3S$	1	[5829920]	
1s 2p	2p ${}^3P^\circ$	0	*[5899150]*	[160]
		1	*5899310*	[950]
		2	*[5900260]*	
1s 2p	2p ${}^1P^\circ$	1	*5949900*	

F VIII

Config.	Desig.	J	Level	Interval
1s 3d	3d ${}^3D$	3, 2, 1	[6912360]	
1s 3p	3p ${}^1P^\circ$	1	*6916590*	
1s 4p	4p ${}^1P^\circ$	1	*7256680*	
F IX (${}^2S_{1/2}$)	*Limit*	--------	7693400	

September 1947.

NEON

Ne I

10 electrons $Z=10$

Ground state $1s^2\ 2s^2\ 2p^6\ {}^1S_0$

$2p^6\ {}^1S_0$ **173931.7** cm^{-1} I. P. 21.559 volts

The present list has been compiled from an unpublished manuscript kindly furnished by Edlén, who has made a study of the terms of this spectrum and interpreted them with the aid of present atomic theory. His term array is based on that published by Meggers and Humphreys in 1933, although he has revised and extended their list. Three place values are from measures made with the interferometer. His predicted values of five *f*-levels are entered in brackets in the table.

Edlén has determined the new values of the series limits quoted here.

The classical work by Paschen on Ne I forms the basis of all subsequent investigations. His notation has, therefore, been retained in column one of the table, except for his fractional numerical prefixes for levels from an *s*-configuration, $m=1.5$, 2.5, etc., which are listed as 1, 2, etc., in accord with the 1933 term table mentioned above. The letters U, V, X, Y, Z adopted later when configurations involving *f*-electrons were found, are also entered in this column. Eleven levels in the latter group have *J*-values fixed by the observed combinations listed in the 1933 reference below. These *J*-values are entered in italics in the table.

Edlén suggested that a pair-coupling notation be adopted for Ne-like spectra to take into account the departure from *LS*-coupling. According to Shortley, *LS*-designations can be significantly assigned in only a few cases, in particular, for the following groups of levels:

Paschen	Desig.	Paschen	Desig.	Paschen	Desig.
$(n-2)s_5$	$ns\ {}^3P_2^{\circ}$	$2p_{10}$	$3p\ {}^3S_1$	$2p_5$	$3p\ {}^1P_1$
$(n-2)s_4$	$ns\ {}^3P_1^{\circ}$				
$(n-2)s_3$	$ns\ {}^3P_0^{\circ}$	$2p_9$	$3p\ {}^3D_3$	$2p_4$	$3p\ {}^3P_2$
		$2p_8$	$3p\ {}^3D_2$	$2p_3$	$3p\ {}^3P_0$
$(n-2)s_2$	$ns\ {}^1P_1^{\circ}$	$2p_7$	$3p\ {}^3D_1$	$2p_2$	$3p\ {}^3P_1$
		$2p_6$	$3p\ {}^1D_2$	$2p_1$	$3p\ {}^1S_0$

Consequently, the *jl*-coupling notation in the general form suggested by Racah is here introduced. The present arrangement has been suggested by Shortley, who has made a detailed investigation of the theoretical arrangement of the "pairs," to be used as a guide in preparing the present table. Pairs are separated only the case of *np* [½], where the interval is large.

Twenty lines of Ne I in the range between 5852 A and 7032 A have been measured relative to the primary standard, and are regarded as accurate to eight figures. They have been adopted by the International Astronomical Union as secondary standards of wavelength.

Ne I—Continued

REFERENCES

F. Paschen, Ann. der Phys. [4] **60,** 405 (1919). (T) (C L)
W. Grotrian, Phys. Zeit. **21,** 638 (1920). (G D)
F. Paschen, Ann. der Phys. [4] **63,** 201 (1920). (T) (C L)
E. Back, Ann. der Phys. [4] **76,** 330 (1925). (Z E)
N. Ryde, Zeit. Phys. **59,** 836 (1929). (T) (C L)
K. Murakawa and T. Iwama, Sci. Papers Inst. Phys. Chem. Research (Tokyo) **13,** No. 254, 289 (1930). (Z E)
W. F. Meggers and C. J. Humphreys, Bur. Std. J. Research **10,** 429, RP540 (1933). (T) (C L)
J. C. Boyce, Phys. Rev. **46,** 378 (1934). (I P) (T) (C L)
W. F. Meggers, J. Research Nat. Bur. Std. **14,** 490, RP781 (1935). (C L)
Trans. Intern. Astr. Union **5,** 86 (1935).
Y. Ishida and T. Tamura, Sci. Papers Inst. Phys. Chem. Research (Tokyo) **29,** 9 (1936). (T) (C L)
P. Jacquinot, Compt. Rend. **202,** 1578 (1936). (Z E)
R. Ritschl und H. Schober, Phys. Zeit. **38,** 6 (1937). (I S)
C. J. Humphreys, J. Research Nat. Bur. Std. **20,** 24, RP1061 (1938). (T) (C L)
J. B. Green and J. A. Peoples, Jr., Phys. Rev. **54,** 602 (1938). (Z E)
G. Racah, Phys. Rev. **61,** 537 (L) (1942).
B. Edlén, Ark. Mat. Astr. Fys. (Stockholm) **29A,** No. 32, p. 2 (1943). (C L)
J. B. Green, Phys. Rev. **64,** 151 (1943). (Z E)
B. Edlén, unpublished material (March 1948). (I P) (T)
G. Shortley, unpublished material (Aug. 1947).

Ne I

Paschen	Config.	Desig.	J	Level	Obs. g
	$2p^6$	$2p^6\ ^1S$	0	0	
$1s_5$	$2p^5(^2P^\circ_{1\frac12})3s$	$3s\ [1\frac12]^\circ$	2	134043.790	1.503
$1s_4$			1	134461.237	1.464
$1s_3$	$2p^5(^2P^\circ_{\frac12})3s$	$3s'\ [\frac12]^\circ$	0	134820.591	
$1s_2$			1	135890.670	1.034
$2p_{10}$	$2p^5(^2P^\circ_{1\frac12})3p$	$3p\ [\frac12]$	1	148259.746	1.984
$2p_9$	"	$3p\ [2\frac12]$	3	149659.000	1.329
$2p_8$			2	149826.181	1.137
$2p_7$	"	$3p\ [1\frac12]$	1	150123.551	0.669
$2p_6$			2	150317.821	1.229
$2p_3$	"	$3p\ [\frac12]$	0	150919.391	
$2p_5$	$2p^5(^2P^\circ_{\frac12})3p$	$3p'\ [1\frac12]$	1	150774.072	0.999
$2p_4$			2	150860.468	1.301
$2p_2$	"	$3p'\ [\frac12]$	1	151040.413	1.340
$2p_1$			0	152972.697	
$2s_5$	$2p^5(^2P^\circ_{1\frac12})4s$	$4s\ [1\frac12]^\circ$	2	158603.070	
$2s_4$			1	158797.954	
$2s_3$	$2p^5(^2P^\circ_{\frac12})4s$	$4s'\ [\frac12]^\circ$	0	159381.94	
$2s_2$			1	159536.57	
$3d_6$	$2p^5(^2P^\circ_{1\frac12})3d$	$3d\ [\frac12]^\circ$	0	161511.590	
$3d_5$			1	161526.134	1.397
$3d'_4$	"	$3d\ [3\frac12]^\circ$	4	161592.308	1.249
$3d_4$			3	161594.081	1.034
$3d_3$	"	$3d\ [1\frac12]^\circ$	2	161609.222	1.356
$3d_2$			1	161638.581	0.860
$3d''_1$	"	$3d\ [2\frac12]^\circ$	2	161701.623	0.948
$3d'_1$			3	161703.413	1.249

Ne I

Paschen	Config.	Desig.	J	Level	Obs. g
$3s''''_1$	$2p^5(^2P^\circ_{\frac12})3d$	$3d'\ [2\frac12]^\circ$	2	162410.617	0.781
$3s'''_1$			3	162412.138	1.125
$3s''_1$	"	$3d'\ [1\frac12]^\circ$	2	162421.944	1.242
$3s'_1$			1	162437.642	0.752
$3p_{10}$	$2p^5(^2P^\circ_{1\frac12})4p$	$4p\ [\frac12]$	1	162519.850	1.929
$3p_9$	"	$4p\ [2\frac12]$	3	162832.683	1.328
$3p_8$			2	162901.093	1.112
$3p_7$	"	$4p\ [1\frac12]$	1	163014.600	0.974
$3p_6$			2	163040.330	1.360
$3p_3$	"	$4p\ [\frac12]$	0	163403.281	
$3p_5$	$2p^5(^2P^\circ_{\frac12})4p$	$4p'\ [1\frac12]$	1	163659.248	0.685
$3p_4$			2	163710.581	1.184
$3p_2$	"	$4p'\ [\frac12]$	1	163709.699	1.397
$3p_1$			0	164287.864	
$3s_5$	$2p^5(^2P^\circ_{1\frac12})5s$	$5s\ [1\frac12]^\circ$	2	165830.144	1.492
$3s_4$			1	165914.756	1.207
$3s_3$	$2p^5(^2P^\circ_{\frac12})5s'$	$5s'\ [\frac12]^\circ$	0	166608.309	
$3s_2$			1	166658.484	1.295
$4d_6$	$2p^5(^2P^\circ_{1\frac12})4d$	$4d\ [\frac12]^\circ$	0	166969.639	
$4d_5$			1	166977.321	1.391
$4d'_4$	"	$4d\ [3\frac12]^\circ$	4	167002.007	1.251
$4d_4$			3	167003.104	1.040
$4d_3$	"	$4d\ [1\frac12]^\circ$	2	167013.535	1.322
$4d_2$			1	167028.957	0.812
$4d''_1$	"	$4d\ [2\frac12]^\circ$	2	167049.580	0.990
$4d'_1$			3	167050.639	1.248
$4s''''_1$	$2p^5(^2P^\circ_{\frac12})4d$	$4d'\ [2\frac12]^\circ$	2	167796.939	0.783
$4s'''_1$			3	167797.865	1.116

Ne I—Continued

Paschen	Config.	Desig.	J	Level	Obs. g
$4s''_1$	$2p^5(^2P^\circ_{\frac{1}{2}})4d$	$4d'$ [1½]°	2	167798.914	1.230
$4s'_1$			1	167809.722	0.797
4X	$2p^5(^2P^\circ_{1\frac{1}{2}})4f$	$4f$ [1½]	1, 2	167054.59	
4V	"	$4f$ [4½]	4, 5	[167062.5]	
4Y	"	$4f$ [2½]	2, 3	167071.08	
4Z	"	$4f$ [3½]	3, 4	[167079.1]	
4U	$2p^5(^2P^\circ_{\frac{1}{2}})4f$	$4f'$ [2½]	2, 3	167848.67	
$4p_{10}$	$2p^5(^2P^\circ_{1\frac{1}{2}})5p$	$5p$ [½]	1	167451.44	
$4p_9$	"	$5p$ [2½]	3	167561.03	
$4p_8$			2	167593.18	
$4p_7$	"	$5p$ [1½]	1	167641.53	
$4p_6$			2	167650.60	
$4p_3$	"	$5p$ [½]	0	167869.17	
$4p_5$	$2p^5(^2P^\circ_{\frac{1}{2}})5p$	$5p'$ [1½]	1	168357.44	
$4p_4$			2	168380.69	
$4p_2$	"	$5p'$ [½]	1	168360.57	
$4p_1$			0	168588.83	
$4s_5$	$2p^5(^2P^\circ_{1\frac{1}{2}})6s$	$6s$ [1½]°	2	168926.626	1.500
$4s_4$			1	168969.328	1.184
$4s_3$	$2p^5(^2P^\circ_{\frac{1}{2}})6s$	$6s'$ [½]°	0	169707.899	
$4s_2$			1	169729.602	1.313
$5d_6$	$2p^5(^2P^\circ_{1\frac{1}{2}})5d$	$5d$ [½]°	0	169484.98	
$5d_5$			1	169490.414	1.383
$5d'_4$	"	$5d$ [3½]°	4	169503.612	
$5d_4$			3	169504.258	1.093
$5d_3$	"	$5d$ [1½]°	2	169510.540	1.298
$5d_2$			1	169518.977	0.791
$5d''_1$	"	$5d$ [2½]°	2	169528.241	
$5d'_1$			3	169528.862	
$5s''''_1$	$2p^5(^2P^\circ_{\frac{1}{2}})5d$	$5d'$ [2½]°	2	170291.291	
$5s'''_1$			3	170291.650	
$5s''_1$	"	$5d'$ [1½]°	2	170290.934	1.251
$5s'_1$			1	170297.98	0.809
5X	$2p^5(^2P^\circ_{1\frac{1}{2}})5f$	$5f$ [1½]	1, 2	169532.22	
5V	"	$5f$ [4½]	4, 5	[169536.3]	
5Y	"	$5f$ [2½]	2, 3	169540.88	
5Z	"	$5f$ [3½]	3, 4	[169545.0]	
5U	$2p^5(^2P^\circ_{\frac{1}{2}})5f$	$5f'$ [2½]	2, 3	170319.71	
$5p_{10}$	$2p^5(^2P^\circ_{1\frac{1}{2}})6p$	$6p$ [½]	1	169750.11	
$5p_9$	"	$6p$ [2½]	3	169799.15	
$5p_8$			2	169816.60	
$5p_7$	"	$6p$ [1½]	1	169841.45	
$5p_6$			2	169845.79	

Ne I—Continued

Paschen	Config.	Desig.	J	Level	Obs. g
$5p_3$	$2p^5(^2P^\circ_{1\frac{1}{2}})6p$	$6p$ [½]	0	169978.70	
$5p_5$	$2p^5(^2P^\circ_{\frac{1}{2}})6p$	$6p'$ [1½]	1	170586.94	
$5p_4$			2	170599.19	
$5p_2$	"	$6p'$ [½]	1	170580.35	
$5p_1$			0	170691.32	
$5s_5$	$2p^5(^2P^\circ_{1\frac{1}{2}})7s$	$7s$ [1½]°	2	170534.694	
$5s_4$			1	170559.032	
$5s_3$	$2p^5(^2P^\circ_{\frac{1}{2}})7s$	$7s'$ [½]°	0	171314.84	
$5s_2$			1	171325.997	1.315
$6d_6$	$2p^5(^2P^\circ_{1\frac{1}{2}})6d$	$6d$ [½]°	0	170850.252	
$6d_5$			1	170853.315	1.389
$6d'_4$	"	$6d$ [3½]°	4	170860.447	
$6d_4$			3	170860.850	
$6d_3$	"	$6d$ [1½]°	2	170864.959	1.331
$6d_2$			1	170869.927	0.783
$6d''_1$	"	$6d$ [2½]°	2	170874.840	0.971
$6d'_1$			3	170875.216	
$6s''''_1$	$2p^5(^2P^\circ_{\frac{1}{2}})6d$	$6d'$ [2½]°	2	171644.139	
$6s'''_1$			3	171644.434	
$6s''_1$	"	$6d'$ [1½]°	2	171641.951	
$6s'_1$			1	171646.87	0.857
6X	$2p^5(^2P^\circ_{1\frac{1}{2}})6f$	$6f$ [1½]	1, 2	170877.72	
6V	"	$6f$ [4½]	4, 5	170879.95	
6Y	"	$6f$ [2½]	2, 3	170882.65	
6Z	"	$6f$ [3½]	3, 4	170884.95	
6U	$2p^5(^2P^\circ_{\frac{1}{2}})6f$	$6f'$ [3½]	3, 4	171661.87	
	"	$6f'$ [2½]	2, 3	171661.66	
$6p_{10}$	$2p^5(^2P^\circ_{1\frac{1}{2}})7p$	$7p$ [½]	1	171011.31	
$6p_9$	"	$7p$ [2½]	3	171034.80	
$6p_8$			2	171045.65	
$6p_7$	"	$7p$ [1½]	1	171059.96	
$6p_6$			2	171062.18	
$6p_3$	"	$7p$ [½]	0	171150.81	
$6p_5$	$2p^5(^2P^\circ_{\frac{1}{2}})7p$	$7p'$ [1½]	1	171824.2	
$6p_4$			2	171830.0	
$6p_2$	"	$7p'$ [½]	1	171832.7	
$6p_1$			0	171915.46	
$6s_5$	$2p^5(^2P^\circ_{1\frac{1}{2}})8s$	$8s$ [1½]°	2	171475.295	
$6s_4$			1	171491.464	
$6s_3$	$2p^5(^2P^\circ_{\frac{1}{2}})8s$	$8s'$ [½]°	0	172256.31	
$6s_2$			1	172263.720	
$7d_6$	$2p^5(^2P^\circ_{1\frac{1}{2}})7d$	$7d$ [½]°	0	171671.14	
$7d_5$			1	171673.90	
$7d'_4$	"	$7d$ [3½]°	4	171677.455	
$7d_4$			3	171677.714	

Ne I—Continued

Paschen	Config.	Desig.	J	Level	Obs. g
$7d_3$	$2p^5(^2P^\circ_{1\frac{1}{2}})7d$	$7d$ [1½]°	2	171683.331	
$7d_2$			1	171684.902	
$7d_1''$	''	$7d$ [2½]°	2	171687.268	
$7d_1'$			3	171687.518	
$7s_1''''$	$2p^5(^2P^\circ_{\frac{1}{2}})7d$	$7d'$ [2½]°	2	172460.407	
$7s_1'''$			3	172460.602	
$7s_1''$	''	$7d'$ [1½]°	2	172459.85	
$7s_1'$			1	172463.02	
7X	$2p^5(^2P^\circ_{1\frac{1}{2}})7f$	$7f$ [1½]	1, 2	171688.57	
7V	''	$7f$ [4½]	4, 5	171689.95	
7Y	''	$7f$ [2½]	2, 3	171692.07	
7Z	''	$7f$ [3½]	3, 4	171693.32	
7U	$2p^5(^2P^\circ_{\frac{1}{2}})7f$	{ $7f'$ [3½] { $7f'$ [2½]	3, 4 2, 3	}172471.45	
$7p_{10}$	$2p^5(^2P^\circ_{1\frac{1}{2}})8p$	$8p$ [½]	1	171754.2	
$7p_9$	''	$8p$ [2½]	3	171789.0	
$7p_8$			2	171793.7	
$7p_7$	''	$8p$ [1½]	1	171800.3	
$7p_6$			2	171805.1	
$7p_3$	''	$8p$ [½]	0	171833.0	
	$2p^5(^2P^\circ_{\frac{1}{2}})8p$	$8p'$ [1½]	1		
$7p_4$			2	172575.4	
$7p_2$	''	$8p'$ [½]	1	172564.8	
$7p_1$			0	172601.7	
$7s_5$	$2p^5(^2P^\circ_{1\frac{1}{2}})9s$	$9s$ [1½]°	2	172073.375	
$7s_4$			1	172082.895	
$7s_3$	$2p^5(^2P^\circ_{\frac{1}{2}})9s$	$9s'$ [½]°	0	172854.12	
$7s_2$			1	172858.96	
$8d_6$	$2p^5(^2P^\circ_{1\frac{1}{2}})8d$	$8d$ [½]°	0	172202.33	
$8d_5$			1	172203.86	
$8d_4'$	''	$8d$ [3½]°	4	172207.110	
$8d_4$			3	172207.278	
$8d_3$	''	$8d$ [1½]°	2	172208.77	
$8d_2$			1	172211.10	
$8d_1''$	''	$8d$ [2½]°	2	172213.094	
$8d_1'$			3	172213.249	
$8s_1''''$	$2p^5(^2P^\circ_{\frac{1}{2}})8d$	$8d'$ [2½]°	2	172989.185	
$8s_1'''$			3	172989.263	
$8s_1''$	''	$8d'$ [1½]°	2	172989.06	
$8s_1'$			1	172990.96	
8X	$2p^5(^2P^\circ_{1\frac{1}{2}})8f$	$8f$ [1½]	1, 2	172214.66	
8V	''	$8f$ [4½]	4, 5	172215.54?	
8Y	''	$8f$ [2½]	2, 3	[172216.7]	
8Z	''	$8f$ [3½]	3, 4	172217.64	

Ne I—Continued

Paschen	Config.	Desig.	J	Level	Obs. g
8U	$2p^5(^2P^\circ_{\frac{1}{2}})8f$	{ $8f'$ [3½] { $8f'$ [2½]	3, 4 2, 3	}172996.63	
$8p_{10}$	$2p^5(^2P^\circ_{1\frac{1}{2}})9p$	$9p$ [½]	1	172270.4	
$8p_9$	''	$9p$ [2½]	3	172284.2	
$8p_8$			2	172288.8	
$8p_{7,6}$	''	$9p$ [1½]	1, 2	172293.4	
$8p_3$	''	$9p$ [½]	0	172329.3	
	$2p^5(^2P^\circ_{\frac{1}{2}})9p$	$9p'$ [1½]	1		
$8p_4$			2	173067.4	
	''	$9p'$ [½]	1		
$8p_1$			0	173099.3	
$8s_5$	$2p^5(^2P^\circ_{1\frac{1}{2}})10s$	$10s$ [1½]°	2	172477.303	
$8s_4$			1	172483.84	
$8s_3$	$2p^5(^2P^\circ_{\frac{1}{2}})10s$	$10s'$ [½]°	0	173257.24	
$8s_2$			1	173261.41	
$9d_6$	$2p^5(^2P^\circ_{1\frac{1}{2}})9d$	$9d$ [½]°	0	172566.85	
$9d_5$			1	172567.88	
$9d_4'$	''	$9d$ [3½]°	4	172569.840	
$9d_4$			3	172570.064	
$9d_3$	''	$9d$ [1½]°	2	172571.37	
$9d_2$			1	172572.82	
$9d_1''$	''	$9d$ [2½]°	2	172574.12	
$9d_1'$			3	172574.22	
$9s_1''''$	$2p^5(^2P^\circ_{\frac{1}{2}})9d$	$9d'$ [2½]°	2	173351.45	
$9s_1'''$			3	173351.50	
$9s_1''$	''	$9d'$ [1½]°	2	173351.49	
$9s_1'$			1	173352.75	
9V	$2p^5(^2P^\circ_{1\frac{1}{2}})9f$	$9f$ [4½]	4, 5	172575.83	
9Y	''	$9f$ [2½]	2, 3	172576.8	
9Z	''	$9f$ [3½]	3, 4	172577.3	
$9p_{10}$	$2p^5(^2P^\circ_{1\frac{1}{2}})10p$	$10p$ [½]	1	172621.0	
$9p_9$	''	$10p$ [2½]	3	172625.2	
$9p_8$			2		
$9p_{7,6}$	''	$10p$ [1½]	1, 2	172632.2	
$9p_3$	''	$10p$ [½]	0	172667.1	
$9s_5$	$2p^5(^2P^\circ_{1\frac{1}{2}})11s$	$11s$ [1½]°	2	172761.79	
$9s_4$			1	172766.55	
$9s_3$	$2p^5(^2P^\circ_{\frac{1}{2}})11s$	$11s'$ [½]°	0	173542.00	
$9s_2$			1	173545.28	
$10d_6$	$2p^5(^2P^\circ_{1\frac{1}{2}})10d$	$10d$ [½]°	0	172826.54	
$10d_5$			1	172827.42	

Ne I—Continued

Paschen	Config.	Desig.	J	Level	Obs. g
$10d_4'$	$2p^5(^2P^\circ_{1\frac{1}{2}})10d$	$10d\ [3\frac{1}{2}]^\circ$	4	172829. 11	
$10d_4$			3	172829. 20	
$10d_3$	"	$10d\ [1\frac{1}{2}]^\circ$	2	172829. 87	
$10d_2$			1	172831. 28	
$10d_1''$	"	$10d\ [2\frac{1}{2}]^\circ$	2	172832. 20	
$10d_1'$			3	172832. 24	
$10s_1''''$	$2p^5(^2P^\circ_{\frac{1}{2}})10d$	$10d'\ [2\frac{1}{2}]^\circ$	2	173610. 45	
$10s_1'''$			3	173610. 52	
$10s_1''$	"	$10d'\ [1\frac{1}{2}]^\circ$	2	173610. 50	
$10s_1'$			1	173611. 54	
$10p_{7,6}$	$2p^5(^2P^\circ_{1\frac{1}{2}})11p$	$11p\ [1\frac{1}{2}]$	1, 2	172873. 9	
$10s_5$	$2p^5(^2P^\circ_{1\frac{1}{2}})12s$	$12s\ [1\frac{1}{2}]^\circ$	2	172970. 51	
$10s_4$			1	172974. 34	
$11d_6$	$2p^5(^2P^\circ_{1\frac{1}{2}})11d$	$11d\ [\frac{1}{2}]^\circ$	0	173019. 37	
$11d_5$			1	173019. 86	
$11d_4'$	"	$11d\ [3\frac{1}{2}]^\circ$	4	173020. 86	
$11d_4$			3	173020. 82	
$11d_3$	"	$11d\ [1\frac{1}{2}]^\circ$	2	173022. 02	
			1		
$11d_1''$	"	$11d\ [2\frac{1}{2}]^\circ$	2	173022. 95	
$11d_1'$			3	173023. 27	

Ne I—Continued

Paschen	Config.	Desig.	J	Level	Obs. g
$11s_1''''$	$2p^5(^2P^\circ_{\frac{1}{2}})11d$	$11d'\ [2\frac{1}{2}]^\circ$	2	173802. 27	
$11s_1'''$			3	173802. 33	
	"	$11d'\ [1\frac{1}{2}]^\circ$	2		
$11s_1'$			1	173802. 75	
$11s_5$	$2p^5(^2P^\circ_{1\frac{1}{2}})13s$	$13s\ [1\frac{1}{2}]^\circ$	2	173128. 02	
$11s_4$			1	173130. 76	
	$2p^5(^2P^\circ_{1\frac{1}{2}})12d$	$12d\ [\frac{1}{2}]^\circ$	0		
$12d_5$			1	173165. 56	
$12d_4'$	"	$12d\ [3\frac{1}{2}]^\circ$	4	173166. 46	
$12d_4$			3	173166. 43	
$12d_3$	"	$12d\ [1\frac{1}{2}]^\circ$	2	173167. 03	
			1		
$12d_1''$	"	$12d\ [2\frac{1}{2}]^\circ$	2	173168. 14	
$12d_1'$			3	173168. 43	
	$2p^5(^2P^\circ_{1\frac{1}{2}})13d$	$13d\ [\frac{1}{2}]^\circ$	0		
$13d_5$			1	173279. 46	
$13d_4'$	"	$13d\ [3\frac{1}{2}]^\circ$	4	173280. 05	
$13d_4$			3	173280. 12	
	Ne II ($^2P^\circ_{1\frac{1}{2}}$)	*Limit*	------	**173931.7**	
	Ne II ($^2P^\circ_{\frac{1}{2}}$)	*Limit*	------	174712. 2	

March 1948.

Ne I Observed Levels*

<table>
<tr><td>Config.
$1s^2\ 2s^2+$</td><td colspan="4">Observed Terms</td></tr>
<tr><td>$2p^6$</td><td colspan="4">$2p^6\ ^1S$</td></tr>
<tr><td></td><td>$ns\ (n\geq3)$</td><td colspan="3">$np\ (n\geq3)$</td></tr>
<tr><td>$2p^5(^2P^\circ)nx$</td><td>{3–13s $^3P^\circ$
{3–11s $^1P^\circ$</td><td>$3p\ ^3S$
$3p\ ^1S$</td><td>$3p\ ^3P$
$3p\ ^1P$</td><td>$3p\ ^3D$
$3p\ ^1D$</td></tr>
<tr><td colspan="5">jl-Coupling Notation</td></tr>
<tr><td></td><td colspan="4">Observed Pairs</td></tr>
<tr><td></td><td>$ns\ (n\geq3)$</td><td>$np\ (n\geq3)$</td><td>$nd\ (n\geq3)$</td><td>$nf\ (n\geq4)$</td></tr>
<tr><td>$2p^5(^2P^\circ_{1\frac{1}{2}})nx$</td><td>3–13s [1½]°</td><td>3–10p [½]
3–10p [2½]
3–11p [1½]</td><td>3–13d [½]°
3–13d [3½]°
3–12d [1½]°
3–12d [2½]°</td><td>4– 8f [1½]
6– 9f [4½]
4–7, 9f [2½]
6– 9f [3½]</td></tr>
<tr><td>$2p^5(^2P^\circ_{\frac{1}{2}})nx'$</td><td>3–11s′[½]°</td><td>3– 9p′[1½]
3– 9p′[½]</td><td>3–11d′[2½]°
3–11d′[1½]°</td><td>6– 8f′[3½]
4– 8f′[2½]</td></tr>
</table>

*For predicted levels in the spectra of the Ne I isoelectronic sequence, see Introduction.

Ne II

(F I sequence; 9 electrons) $Z=10$

Ground state $1s^2 2s^2 2p^5\ ^2P^{\circ}_{1\frac{1}{2}}$

$2p^5\ ^2P^{\circ}_{1\frac{1}{2}}$ ***331350*** cm^{-1} I. P. 41.07 volts

The terms are from Boyce, who has extended the analysis by further observations in the ultraviolet, and improved the earlier term values. The series limit is estimated from series of two members, the $3s$ and $4s$ terms.

Intersystem combinations connecting the doublet and quartet terms have been observed.

The values of the $3d'\ ^2G$ and $3d'\ ^2S$ terms have been corrected to agree with the observed combinations.

REFERENCES

K. T. Compton and J. C. Boyce, J. Franklin Inst. **205,** 511 (1928). (T) (C L) (G D)
T. L. de Bruin and C. J. Bakker, Zeit. Phys. **69,** 19 (1931). (T) (C L) (Z E)
J. C. Boyce, Phys. Rev. **46,** 378 (1934). (I P) (T) (C L)

Ne II

Config.	Desig.	J	Level	Interval	Obs. g
$2s^2 2p^5$	$2p^5\ ^2P^{\circ}$	1½	*0*	−782	
		½	*782*		
$2s\ 2p^6$	$2p^6\ ^2S$	½	217050		
$2s^2 2p^4(^3P)3s$	$3s\ ^4P$	2½	219133. 0	−517. 8	1. 60
		1½	219650. 8	−299. 1	1. 73
		½	219949. 9		2. 67
$2s^2 2p^4(^3P)3s$	$3s\ ^2P$	1½	224089. 3	−612. 5	1. 33
		½	224701. 8		0. 67
$2s^2 2p^4(^3P)3p$	$3p\ ^4P^{\circ}$	2½	*246194. 8*	−222. 6	1. 60
		1½	*246417. 4*	−182. 5	1. 73
		½	*246599. 9*		2. 67
$2s^2 2p^4(^1D)3s$	$3s'\ ^2D$	2½	246396. 5	−3. 5	1. 20
		1½	246400. 0		0. 80
$2s^2 2p^4(^3P)3p$	$3p\ ^4D^{\circ}$	3½	*249110. 8*	−337. 2	1. 43
		2½	*249448. 0*	−249. 7	1. 37
		1½	*249697. 7*	−144. 1	1. 20
		½	*249841. 8*		0. 00
$2s^2 2p^4(^3P)3p$	$3p\ ^2D^{\circ}$	2½	*251013. 3*	−511. 4	1. 20
		1½	*251524. 7*		0. 80
$2s^2 2p^4(^3P)3p$	$3p\ ^2S^{\circ}$	½	*252800. 8*		1. 96
$2s^2 2p^4(^3P)3p$	$3p\ ^4S^{\circ}$	1½	*252956. 0*		
$2s^2 2p^4(^3P)3p$	$3p\ ^2P^{\circ}$	1½	*254167. 0*	−127. 0	1. 33
		½	*254294. 0*		0. 71
$2s^2 2p^4(^1D)3p$	$3p'\ ^2F^{\circ}$	2½	*274366. 9*	44. 4	0. 86
		3½	*274411. 3*		1. 14
$2s^2 2p^4(^1D)3p$	$3p'\ ^2P^{\circ}$	1½	*276278. 6*	−235. 5	1. 33
		½	*276514. 1*		0. 67
$2s^2 2p^4(^1S)3s$	$3s''\ ^2S$	½	276678. 0		2. 00
$2s^2 2p^4(^1D)3p$	$3p'\ ^2D^{\circ}$	1½	*277327. 6*	18. 5	0. 80
		2½	*277346. 1*		1. 20

Ne II

Config.	Desig.	J	Level	Interval	Obs. g
$2s^2 2p^4(^3P)3d$	$3d\ ^4D$	3½	279139. 1	−81. 5	
		2½	279220. 6	−106. 2	
		1½	279326. 8	−98. 3	
		½	279425. 1		
$2s^2 2p^4(^3P)3d$	$3d\ ^4F$	4½	280174. 4	−528. 1	
		3½	280702. 5	−325. 6	
		2½	281028. 1	78. 5	
		1½	280949. 6		
$2s^2 2p^4(^3P)3d$	$3d\ ^2F$	3½	280264. 0	−535. 3	
		2½	280799. 3		
$2s^2 2p^4(^3P)3d$	$3d\ ^2D$	2½	280271. 0	−204. 6	
		1½	280475. 6		
$2s^2 2p^4(^3P)3d$	$3d\ ^4P$	½	280770. 2	221. 5	
		1½	280991. 7	181. 8	
		2½	281173. 5		
$2s^2 2p^4(^3P)3d$	$3d\ ^2P$	½	281334. 5	387. 8	0. 70
		1½	281722. 3		1. 25
$2s^2 2p^4(^3P)4s$	$4s\ ^4P$	2½	282000. 0	−376. 7	
		1½	282376. 7	−305. 5	
		½	282682. 2		
$2s^2 2p^4(^3P)4s$	$4s\ ^2P$	1½	283323. 7	−572. 8	
		½	283896. 5		
$2s^2 2p^4(^3P)4d$	$4d\ ^2D$	2½	302321?	−131	
		1½	302452?		
$2s^2 2p^4(^3P)4f$	$4f\ ^4D^{\circ}$	3½	*302830. 6*	−14. 9	
		2½	*302845. 5*	−59. 7	
		1½	*302905. 2*	−86. 0	
		½	*302991. 2*		
$2s^2 2p^4(^3P)4d$	$4d\ ^2P$	{1½, ½}	302884?		
$2s^2 2p^4(^3P)4f$	$4f\ ^4F^{\circ}$	4½	*302905. 8*	−625. 0	
		3½	*303530. 8*	−295. 8	
		2½	*303826. 6*	315. 0	
		1½	*303511. 6*		

Ne II—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$2s^2 2p^4(^3P)4f$	$4f\ ^4G^\circ$	5½ 4½ 3½ 2½	*303475.7* *303465.1* *303701.1* *303602.3*	10.6 −236.0 98.8	
$2s^2 2p^4(^3P)4f$	$4f\ ^2D^\circ$	1½ 2½	*303465.4* *303882.3*	416.9	
$2s^2 2p^4(^1D)3d$	$3d'\ ^2G$	4½ 3½	305366.2 305367.2	−1.0	
$2s^2 2p^4(^1S)3p$	$3p''\ ^2P^\circ$	1½ ½	*305399.2* *305409.3*	−10.1	1.33 0.67
$2s^2 2p^4(^1D)3d$	$3d'\ ^2P$	1½ ½	305568.9 305584.2	−15.3	
$2s^2 2p^4(^1D)4s$	$4s'\ ^2D$	{ 2½ { 1½	} 306018?		
$2s^2 2p^4(^1D)3d$	$3d'\ ^2D$	1½ 2½	306244.8 306689.8	445.0	
$2s^2 2p^4(^1D)3d$	$3d'\ ^2F$	3½ 2½	307992.2 308103.3	−111.1	
$2s^2 2p^4(^1D)3d$	$3d'\ ^2S$	½	309049.7		
$2s^2 2p^4(^1S)3d$	$3d''\ ^2D$	2½ 1½	327954.7 327968.2	−13.5	
Ne III ($^3P_2$)	*Limit*	------	*331350*		

March 1947.

Ne II Observed Terms*

Config. $1s^2+$	Observed Terms	
$2s^2 2p^5$	$2p^5\ ^2P^\circ$	
$2s\ 2p^6$	$2p^6\ ^2S$	
	$ns\ (n\geq 3)$	$np\ (n\geq 3)$
$2s^2 2p^4(^3P)nx$	{ $3, 4s\ ^4P$ { $3, 4s\ ^2P$	$3p\ ^4S^\circ$ $3p\ ^4P^\circ$ $3p\ ^4D^\circ$ $3p\ ^2S^\circ$ $3p\ ^2P^\circ$ $3p\ ^2D^\circ$
$2s^2 2p^4(^1D)nx'$	$3, 4s'\ ^2D$	$3p'\ ^2P^\circ$ $3p'\ ^2D^\circ$ $3p'\ ^2F^\circ$
$2s^2 2p^4(^1S)nx''$	$3s''\ ^2S$	$3p''\ ^2P^\circ$
	$nd\ (n\geq 3)$	$nf\ (n\geq 4)$
$2s^2 2p^4(^3P)nx$	{ $3d\ ^4P$ $3d\ ^4D$ $3d\ ^4F$ { $3, 4d\ ^2P$ $3, 4d\ ^2D$ $3d\ ^2F$	$4f\ ^4D^\circ$ $4f\ ^4F^\circ$ $4f\ ^4G^\circ$ $4f\ ^2D^\circ$
$2s^2 2p^4(^1D)nx'$	$3d'\ ^2S$ $3d'\ ^2P$ $3d'\ ^2D$ $3d'\ ^2F$ $3d'\ ^2G$	
$2s^2 2p^4(^1S)nx''$	$3d''\ ^2D$	

*For predicted terms in the spectra of the F I isoelectronic sequence, see Introduction.

Ne III

(O I sequence; 8 electrons) $Z=10$

Ground state $1s^2\,2s^2\,2p^4\ ^3P_2$

$2p^4\ ^3P_2$ **514148** cm^{-1} I. P. 64 ± 1 volts

This spectrum is incompletely analyzed. The terms have been taken from two references: triplet and quintet terms, de Bruin (1935); and singlet terms, Boyce (1934). The latter are located with respect to the ground state by means of the nebular lines at 3343 A, 3868.74 A, and 3967.51 A. The relative positions of the quintet terms and the ionization potential are estimated, and the uncertainty, x, may be considerable.

REFERENCES

T. L. de Bruin, Zeit. Phys. **77,** 505 (1932). (T) (C L)
V. v. Keussler, Zeit. Phys. **85,** 1 (1933). (C L)
J. C. Boyce, Phys. Rev. **46,** 378 (1934). (I P) (T) (C L)
T. L. de Bruin, *Zeeman Verhandelingen* p. 413 (Martinus Nÿhoff, The Hague, 1935). (I P) (T)
J. C. Boyce, Mon. Not. Roy. Astr. Soc. **96,** 690 (1936). (C L)

Ne III

Config.	Desig.	J	Level	Interval
$2s^2\,2p^4$	$2p^4\ ^3P$	2	0	−650
		1	650	−277
		0	927	
$2s^2\,2p^4$	$2p^4\ ^1D$	2	25841	
$2s^2\,2p^4$	$2p^4\ ^1S$	0	55747	
$2s\ 2p^5$	$2p^5\ ^3P^\circ$	2	*204292*	−587
		1	*204879*	−325
		0	*205204*	
$2s\ 2p^5$	$2p^5\ ^1P^\circ$	1	*289479*	
$2s^2\,2p^3(^4S^\circ)3s$	$3s\ ^5S^\circ$	2	*314148* $+x$	
$2s^2\,2p^3(^4S^\circ)3s$	$3s\ ^3S^\circ$	1	*319444. 90*	
$2s^2\,2p^3(^4S^\circ)3p$	$3p\ ^5P$	1	352662. 05$+x$	30. 88
		2	352692. 93$+x$	52. 98
		3	352745. 91$+x$	
$2s^2\,2p^3(^2D^\circ)3s$	$3s'\ ^3D^\circ$	3	*353148. 00*	−29. 16
		2	*353177. 16*	−20. 24
		1	*353197. 40*	
$2s^2\,2p^3(^4S^\circ)3p$	$3p\ ^3P$	2	356776. 52	10. 32
		1	356766. 20	−10. 32
		0	356776. 52	
$2s^2\,2p^3(^2D^\circ)3s$	$3s'\ ^1D^\circ$	2	*357930*	
$2s^2\,2p^3(^2P^\circ)3s$	$3s''\ ^3P^\circ$	2	*374434. 00*	−26. 75
		1	*374460. 75*	−16. 91
		0	*374477. 66*	
$2s^2\,2p^3(^2P^\circ)3s$	$3s''\ ^1P^\circ$	1	*379834*	
$2s^2\,2p^3(^2D^\circ)3p$	$3p'\ ^3D$	1	389058. 24	11. 13
		2	389069. 37	69. 68
		3	389139. 05	
$2s^2\,2p^3(^2D^\circ)3p$	$3p'\ ^3F$	2	391414. 02	15. 92
		3	391429. 94	20. 37
		4	391450. 31	

Ne III

Config.	Desig.	J	Level	Interval
$2s^2\,2p^3(^4S^\circ)3d$	$3d\ ^3D^\circ$	1	*398192. 70*	4. 13
		2	*398196. 83*	13. 91
		3	*398210. 74*	
$2s^2\,2p^3(^4S^\circ)3d$	$3d\ ^5D^\circ$	4	*398946. 98*$+x$	−1. 53
		3	*398948. 51*$+x$	−3. 83
		2	*398952. 34*$+x$	−3. 41
		1	*398955. 75*$+x$	
		0		
$2s^2\,2p^3(^2D^\circ)3p$	$3p'\ ^3P$	2	398986. 64	−95. 93
		1	399082. 57	−42. 55
		0	399125. 12	
$2s^2\,2p^3(^2P^\circ)3p$	$3p''\ ^3D$	3	409847. 53	2. 45
		2	409845. 08	−10. 15
		1	409855. 23	
$2s^2\,2p^3(^2P^\circ)3p$	$3p''\ ^3S$	1	410134. 72	
$2s^2\,2p^3(^2P^\circ)3p$	$3p''\ ^3P$	0	412293. 59	19. 52
		1	412313. 11	7. 10
		2	412320. 21	
$2s^2\,2p^3(^2D^\circ)3d$	$3d'\ ^3F^\circ$	2	*435527. 90*	40. 10
		3	*435568. 00*	52. 80
		4	*435620. 80*	
$2s^2\,2p^3(^2D^\circ)3d$	$3d'\ ^3G^\circ$	5	*436561. 35*	−26. 99
		4	*436588. 34*	−23. 22
		3	*436611. 56*	
$2s^2\,2p^3(^2D^\circ)3d$	$3d'\ ^3D^\circ$	3	*436844. 63*	−69. 76
		2	*436914. 39*	−45. 10
		1	*436959. 49*	
$2s^2\,2p^3(^2D^\circ)3d$	$3d'\ ^3P^\circ$	2	*439586. 00*	−121. 81
		1	*439707. 81*	−52. 54
		0	*439760. 35*	
$2s^2\,2p^3(^2D^\circ)3d$	$3d'\ ^3S^\circ$	1	*440064. 90*	
Ne IV ($^4S^\circ_{1\frac{1}{2}}$)	*Limit*	-------	514148	

February 1947.

Ne III Observed Terms*

Config. $1s^2+$	Observed Terms	
$2s^2\,2p^4$	$2p^4\ ^1S$ $\quad 2p^4\ ^3P$ $\quad 2p^4\ ^1D$	
$2s\ 2p^5$	$2p^5\ ^3P^\circ$ $\quad 2p^5\ ^1P^\circ$	
	$ns\ (n \geq 3)$	$np\ (n \geq 3)$
$2s^2\,2p^3(^4S^\circ)nx$	$3s\ ^5S^\circ$ $\quad 3s\ ^3S^\circ$	$3p\ ^5P$ $\quad 3p\ ^3P$
$2s^2\,2p^3(^2D^\circ)nx'$	$3s'\ ^3D^\circ$ $\quad 3s'\ ^1D^\circ$	$3p'\ ^3P$ $\quad 3p'\ ^3D$ $\quad 3p'\ ^3F$
$2s^2\,2p^3(^2P^\circ)nx''$	$3s''\ ^3P^\circ$ $\quad 3s''\ ^1P^\circ$	$3p''\ ^3S$ $\quad 3p''\ ^3P$ $\quad 3p''\ ^3D$
	$nd\ (n \geq 3)$	
$2s^2\,2p^3(^4S^\circ)nx$	$3d\ ^5D^\circ$ $\quad 3d\ ^3D^\circ$	
$2s^2\,2p^3(^2D^\circ)nx'$	$3d'\ ^3S^\circ$ $\quad 3d'\ ^3P^\circ$ $\quad 3d'\ ^3D^\circ$ $\quad 3d'\ ^3F^\circ$ $\quad 3d'\ ^3G^\circ$	

*For predicted terms in the spectra of the O I isoelectronic sequence, see Introduction.

Ne IV

(N I sequence; 7 electrons) $Z=10$

Ground state $1s^2\,2s^2\,2p^3\ ^4S^\circ_{1\frac{1}{2}}$

$2p^3\ ^4S^\circ_{1\frac{1}{2}}$ *783880* cm^{-1} I. P. 97.16 volts

The analysis is by Paul and Polster, who have extended the earlier work by Boyce and published 111 classified lines in the interval from 140 A to 786 A. From series they derive the limit 781714 cm^{-1} and place the level $2p^3\ ^2D^\circ_2$ at 38540 cm^{-1} above the ground state zero. No intersystem combinations have been observed.

On the basis of later analyses of the spectra in this sequence a slight adjustment in these values has been made by Robinson. The doublet terms have been increased by 2410 cm^{-1} and the limit by 2166 cm^{-1} to fit the isoelectronic sequence data. The later values have been adopted in the table. The uncertainty x, may be considerable.

REFERENCES

F. W. Paul and H. D. Polster, Phys. Rev. **59**, 426 (1941). (I P) (T) (C L)
H. A. Robinson, unpublished material (March 1948). (I P) (T)

Ne IV

Config.	Desig.	J	Level	Interval
$2s^2\,2p^3$	$2p^3\ {}^4S^\circ$	1½	0	
$2s^2\,2p^3$	$2p^3\ {}^2D^\circ$	2½ 1½	40950+x 40975+x	−25
$2s^2\,2p^3$	$2p^3\ {}^2P^\circ$	½ 1½	62157+x 62167+x	10
$2s\,2p^4$	$2p^4\ {}^4P$	2½ 1½ ½	183860 184477 184799	−617 −322
$2s\,2p^4$	$2p^4\ {}^2D$	2½ 1½	253807+x 253823+x	−16
$2s\,2p^4$	$2p^4\ {}^2S$	½	299351+x	
$2s\,2p^4$	$2p^4\ {}^2P$	1½ ½	319751+x 320452+x	−701
$2s^2\,2p^2(^3P)3s$	$3s\ {}^4P$	½ 1½ 2½	478701 479079 479651	378 572
$2p^5$	$2p^5\ {}^2P^\circ$	1½ ½	484623+x 485585+x	−962
$2s^2\,2p^2(^3P)3s$	$3s\ {}^2P$	½ 1½	488215+x 488917+x	702
$2s^2\,2p^2(^1D)3s$	$3s'\ {}^2D$	{ 2½ 1½ }	511411+x	
$2s^2\,2p^2(^3P)3p$	$3p\ {}^4P^\circ$	½ 1½ 2½	524391 524676 525017	285 341
$2s^2\,2p^2(^3P)3p$	$3p\ {}^4S^\circ$	1½	532978	
$2s^2\,2p^2(^1S)3s$	$3s''\ {}^2S$	½	551712+x	
$2s^2\,2p^2(^3P)3d$	$3d\ {}^2P$	1½ ½	575968+x 576353+x	−385
$2s^2\,2p^2(^1S)3d$	$3d''\ {}^2D$	{ 1½ 2½ }	576915+x	
$2s^2\,2p^2(^3P)3d$	$3d\ {}^4P$	2½ 1½ ½	579307 579626 579737	−319 −111
$2s^2\,2p^2(^3P)3d$	$3d\ {}^2F$	2½ 3½	579375+x 580095+x	720
$2s^2\,2p^2(^3P)3d$	$3d\ {}^2D$	1½ 2½	586685+x 586918+x	233
$2s\,2p^3(^5S^\circ)3s$	$3s'''\ {}^4S^\circ$	1½	588021	
$2s^2\,2p^2(^1D)3d$	$3d'\ {}^2F$	{ 2½ 3½ }	605417+x	
$2s^2\,2p^2(^1D)3d$	$3d'\ {}^2D$	{ 1½ 2½ }	609118+x	
$2s^2\,2p^2(^1D)3d$	$3d'\ {}^2P$	½ 1½	612668+x 612781+x	113

Ne IV

Config.	Desig.	J	Level	Interval
$2s^2\,2p^2(^1D)3d$	$3d'\ {}^2S$	½	616482+x	
$2s^2\,2p^2(^3P)4s$	$4s\ {}^4P$	½ 1½ 2½	633465 633790 634413	325 623
$2s^2\,2p^2(^3P)4s$	$4s\ {}^2P$	½ 1½	635866+x 636475+x	609
$2s^2\,2p^2(^3P)4p$	$4p\ {}^4D^\circ$	½ 1½ 2½ 3½	641908 642184 642472 642934	276 288 462
$2s^2\,2p^2(^3P)4p$	$4p\ {}^4P^\circ$	½ 1½ 2½	643239 643672 643975	433 303
$2s^2\,2p^2(^3P)4p$	$4p\ {}^4S^\circ$	1½	648060	
$2s^2\,2p^2(^1D)4s$	$4s'\ {}^2D$	{ 2½ 1½ }	664124+x	
$2s^2\,2p^2(^3P)4d$	$4d\ {}^2F$	2½ 3½	670595+x 671252+x	657
$2s^2\,2p^2(^3P)4d$	$4d\ {}^4P$	2½ 1½ ½	671402 672102 672676	−700 −574
$2s\,2p^3(^5S^\circ)3d$	$3d'''\ {}^4D^\circ$	{ ½ to 3½ }	672799	
$2s^2\,2p^2(^3P)4d$	$4d\ {}^2D$	1½ 2½	673427+x 673587+x	160
$2s^2\,2p^2(^3P)5s$	$5s\ {}^4P$	½ 1½ 2½	693106 693717 694353	611 636
$2s^2\,2p^2(^1D)4d$	$4d'\ {}^2F$	{ 2½ 3½ }	697855+x	
$2s^2\,2p^2(^1D)4d$	$4d'\ {}^2D$	{ 1½ 2½ }	699622+x	
$2s^2\,2p^2(^1D)4d$	$4d'\ {}^2P$	{ ½ 1½ }	701223+x	
$2s^2\,2p^2(^1S)4d$	$4d''\ {}^2D$	{ 1½ 2½ }	709460+x	
$2s^2\,2p^2(^1D)5s$	$5s'\ {}^2D$	{ 1½ 2½ }	724690+x	
$2s^2\,2p^2(^1D)5d$	$5d'\ {}^2F$	{ 2½ 3½ }	740607+x	
$2s^2\,2p^2(^1D)6s$	$6s'\ {}^2D$	{ 1½ 2½ }	754597+x	
Ne V ($^3P_0$)	*Limit*	-------	783880	

March 1948.

Ne IV Observed Terms*

Config. $1s^2+$	Observed Terms		
$2s^2\,2p^3$	$2p^3\ ^4S^\circ$	$2p^3\ ^2P^\circ$	$2p^3\ ^2D^\circ$
$2s\ 2p^4$	$2p^4\ ^2S$	$2p^4\ ^4P$ $2p^4\ ^2P$	$2p^4\ ^2D$
$2p^5$		$2p^5\ ^2P^\circ$	
	$ns\ (n\geq 3)$	$np\ (n\geq 3)$	$nd\ (n\geq 3)$
$2s^2\,2p^2(^3P)nx$	$3\text{–}5s\ ^4P$ $3,\ 4s\ ^2P$	$3,\ 4p\ ^4S^\circ$ $3,\ 4p\ ^4P^\circ$ $4p\ ^4D^\circ$	$3,\ 4d\ ^4P$ $3d\ ^2P$ $3,\ 4d\ ^2D$ $3,\ 4d\ ^2F$
$2s^2\,2p^2(^1D)nx'$	$3\text{–}6s'\ ^2D$		$3d'\ ^2S$ $3,\ 4d'\ ^2P$ $3,\ 4d'\ ^2D$ $3\text{–}5d'\ ^2F$
$2s^2\,2p^2(^1S)nx''$	$3s''\ ^2S$		$3,\ 4d''\ ^2D$
$2s\ 2p^3(^5S^\circ)nx'''$	$3s'''\ ^4S^\circ$		$3d'''\ ^4D^\circ$

*For predicted terms in the spectra of the N I isoelectronic sequence, see Introduction.

Ne V

(C I sequence; 6 electrons) $Z=10$

Ground state $1s^2\,2s^2\,2p^2\ ^3P_0$

$2p^2\ ^3P_0$ **1019950** cm^{-1} I. P. 126.4 volts

Paul and Polster have classified a total of 56 lines of Ne V in the range 118 A to 572 A, as transitions among 47 energy levels. The absolute value of $2p^2\ ^3P_0$ is calculated from the $nd\ ^3P^\circ$ and $nd\ ^3D^\circ$ series, in each of which two members have been observed.

The singlet and triplet terms are connected by the intersystem lines $2p^2\ ^3P_{2,1}-2p^2\ ^1D_2$ observed in the spectra of gaseous nebula, as given by Bowen.

No intersystem combinations connecting the quintet terms with the rest have been observed, as indicated by the uncertainty x in the table. Paul and Polster estimate from isoelectronic sequence data that the term $2p^3\ ^5S_2^\circ$ is 86700 ± 300 cm^{-1} above the ground state. From later data on this sequence Robinson places the value at 88842 cm^{-1}. The later value is entered in brackets and has been used in the present compilation for all quintet terms.

REFERENCES

I. S. Bowen, Rev. Mod. Phys. **8**, 68 (1936). (C L)
F. W. Paul and H. D. Polster, Phys. Rev. **59**, 428 (1941). (I P) (T) (C L)
H. A. Robinson, unpublished material (March 1948). (T)

Ne V

Config.	Desig.	J	Level	Interval
$2s^2\,2p^2$	$2p^2\ ^3P$	0	0	
		1	414	414
		2	1112	698
$2s^2\,2p^2$	$2p^2\ ^1D$	2	30294	
$2s^2\,2p^2$	$2p^2\ ^1S$	0	63900	
$2s\ 2p^3$	$2p^3\ ^5S^\circ$	2	[88842]+x	
$2s\ 2p^3$	$2p^3\ ^3D^\circ$	3	175834	
		2	175905	−71
		1	175927	−22
$2s\ 2p^3$	$2p^3\ ^3P^\circ$	2, 1	208157	
		0	208193	−36
$2s\ 2p^3$	$2p^3\ ^1D^\circ$	2	270564	
$2s\ 2p^3$	$2p^3\ ^3S^\circ$	1	279365	
$2s\ 2p^3$	$2p^3\ ^1P^\circ$	1	303812	
$2p^4$	$2p^4\ ^3P$	2	412681	
		1	413466	−785
		0	413803	−337
$2s^2\,2p(^2P^\circ)3s$	$3s\ ^3P^\circ$	0	596230	
		1	596626	396
		2	597492	866
$2s^2\,2p(^2P^\circ)3s$	$3s\ ^1P^\circ$	1	605231	
$2s^2\,2p(^2P^\circ)3d$	$3d\ ^1D^\circ$	2	690691	
$2s\ 2p^2(^4P)3s$	$3s\ ^5P$	1	697507+x	
		2	698059+x	552
		3	698512+x	453
$2s^2\,2p(^2P^\circ)3d$	$3d\ ^3D^\circ$	1	698231	
		2	698382	151
		3	698735	353
$2s^2\,2p(^2P^\circ)3d$	$3d\ ^3P^\circ$	2	701765	
		1	702074	−309
		0	702459	−385
$2s^2\,2p(^2P^\circ)3d$	$3d\ ^1P^\circ$	1	702412	
$2s^2\,2p(^2P^\circ)3d$	$3d\ ^1F^\circ$	3	709956	
$2s\ 2p^2(^4P)3s$	$3s\ ^3P$	0	719350	
		1	719527	177
		2	720011	484
$2s^2\,2p(^2P^\circ)4s$	$4s\ ^3P^\circ$	0, 1, 2	795279	
$2s\ 2p^2(^4P)3d$	$3d\ ^5P$	3	799115+x	
		2	799286+x	−171
		1	799493+x	−207
$2s^2\,2p(^2P^\circ)4s$	$4s\ ^1P^\circ$	1	805284	
$2s\ 2p^2(^4P)4s$	$4s\ ^5P$	1, 2, 3	822976+x	
$2s^2\,2p(^2P^\circ)4d$	$4d\ ^1D^\circ$	2	838623	
$2s^2\,2p(^2P^\circ)4d$	$4d\ ^3D^\circ$	1, 2, 3	842020	
$2s^2\,2p(^2P^\circ)4d$	$4d\ ^3P^\circ$	2, 1, 0	842914	
$2s^2\,2p(^2P^\circ)4d$	$4d\ ^1F^\circ$	3	847207?	
$2s\ 2p^2(^4P)4d$	$4d\ ^5P$	3, 2, 1	865282+x	
Ne VI ($^2P^\circ_{1/2}$)	*Limit*	-------	1019950	

March 1948.

Ne V Observed Terms*

Config. $1s^2+$	Observed Terms		
$2s^2\,2p^2$	$2p^2\ ^1S$	$2p^2\ ^3P$	$2p^2\ ^1D$
$2s\ 2p^3$	$2p^3\ ^5S^\circ$ $2p^3\ ^3S^\circ$	$2p^3\ ^3P^\circ$ $2p^3\ ^1P^\circ$	$2p^3\ ^3D^\circ$ $2p^3\ ^1D^\circ$
$2p^4$		$2p^4\ ^3P$	
	ns ($n \geq 3$)	*nd* ($n \geq 3$)	
$2s^2\,2p(^2P^\circ)nx$	3, 4s $^3P^\circ$ 3, 4s $^1P^\circ$	3, 4d $^3P^\circ$ 3, 4d $^3D^\circ$ 3d $^1P^\circ$ 3, 4d $^1D^\circ$	3, 4d $^1F^\circ$
$2s\,2p^2(^4P)nx$	3, 4s ^5P 3s ^3P	3, 4d ^5P	

*For predicted terms in the spectra of the C I isoelectronic sequence, see Introduction.

Ne VI

(B I sequence; 5 electrons) $Z=10$

Ground state $1s^2\, 2s^2\, 2p\ ^2P^{\circ}_{1/2}$

$2p\ ^2P^{\circ}_{1/2}$ ***1274000±1000*** cm^{-1} I. P. 157.91±0.12 volts

This spectrum is incompletely analyzed. Paul and Polster have classified 23 lines in the range from 110 A to 562 A. They have estimated the limit and ionization potential from isoelectronic data. No intersystem combinations have been observed but the uncertainty x is approximately known from their estimated value of $2p^2\ ^4P$ (entered in brackets in the table).

REFERENCE

F. W. Paul and H. D. Polster, Phys. Rev. **59**, 429 (1941). (I P) (T) (C L)

Ne VI

Config.	Desig.	*J*	Level	Interval
$2s^2(^1S)2p$	$2p\ ^2P^{\circ}$	½ 1½	*0* *1316*	1316
$2s\ 2p^2$	$2p^2\ ^4P$	½ to 2½	[99300]+x	
$2s\ 2p^2$	$2p^2\ ^2D$	2½ 1½	178998 179020	−22
$2s\ 2p^2$	$2p^2\ ^2S$	½	232587	
$2s\ 2p^2$	$2p^2\ ^2P$	½ 1½	249292 250112	820
$2s^2(^1S)3s$	$3s\ ^2S$	½	722610	
$2s^2(^1S)3p$	$3p\ ^2P^{\circ}$	½ 1½	*763096* *763385*	289
$2s^2(^1S)3d$	$3d\ ^2D$	1½ 2½	816405	
$2s\ 2p(^3P^{\circ})3s$	$3s\ ^4P^{\circ}$	½ to 2½	*834113+x*	
$2s\ 2p(^3P^{\circ})3p$	$3p\ ^2P$	½ 1½	878852	
$2s\ 2p(^3P^{\circ})3p$	$3p\ ^2S$	½	900408	
$2s\ 2p(^3P^{\circ})3p$	$3p\ ^2D$	1½ 2½	906373	
$2s\ 2p(^3P^{\circ})3d$	$3d\ ^4D^{\circ}$	½ to 3½	*924791+x*	
Ne VII ($^1S_0$)	*Limit*	-------	***1274000***	

October 1946

SODIUM

Na I

11 electrons $Z=11$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s\ ^2S_{1/2}$

$3s\ ^2S_{1/2}$ **41449.65** cm^{-1} I. P. 5.138 volts

Thackeray has observed the $^2P°$ series in absorption to $n=73$. His values are used for this series for $n=4$ to 59,* and for the ^2D series for $n=8$ to 13.

Meissner and Luft have observed selected lines with an interferometer. Their results, including observed intervals of the 3–6$d\ ^2D$ terms (the four-place entries in the table) and improved absolute values of the 3–7$s\ ^2S$, $3p\ ^2P°$ and 3–7$d\ ^2D$ terms, have been used.

From infrared observations Rood and Sawyer have extended the $nf\ ^2F°$ series from $n=5$ to $n=11$, except for $n=8$. Their values have been used, a calculated value of $8f\ ^2F°$ being entered in brackets in the table.

The rest of the terms are from Fowler and Paschen-Götze, who published detailed analyses. By analogy with other spectra the designations $5g\ ^2G$ and $6h\ ^2H°$ have been assigned to the terms calculated from Fowler's combinations labeled "3φ–4φ" and "4φ–5φ", respectively.

REFERENCES

A. Fowler, *Report on Series in Line Spectra* p. 99 (Fleetway Press, London, 1922). (I P) (T) (C L)
F. Paschen und R. Götze, *Seriengesetze der Linienspektren* p. 56 (Springer, Berlin, 1922). (I P) (T) (C L)
W. F. Meggers, Bur. Std. J. Research **10**, 673, RP558 (1933). (C L)
H. E. White, *Introduction to Atomic Spectra* p. 77 (McGraw-Hill Book Co., Inc., New York, 1934). (G D)
W. F. Meggers, J. Research Nat. Bur. Std. **14**, 487, RP781 (1935). (C L)
K. W. Meissner und K. F. Luft, Ann. der Phys. [5] **29**, 698 (1937). (I P) (T) (C L)
P. Rood and R. A. Sawyer, Astroph. J. **87**, 70 (1938). (T) (C L)
W. F. Meggers, J. Opt. Soc. Am. **36**, 431 (1946). (Summary hfs)
E. R. Thackeray, Phys. Rev. (1949). (In press). (I P) (T) (C L)

Na I

Config.	Desig.	J	Level	Interval
3s	$3s\ ^2S$	½	0. 000	
3p	$3p\ ^2P°$	½	*16956. 183*	17. 1963
		1½	*16973. 379*	
4s	$4s\ ^2S$	½	25739. 86	
3d	$3d\ ^2D$	2½	29172. 855	−0. 0494
		1½	29172. 904	
4p	$4p\ ^2P°$	½	*30266. 88*	5. 63
		1½	*30272. 51*	
5s	$5s\ ^2S$	½	33200. 696	
4d	$4d\ ^2D$	2½	34548. 754	−0. 0346
		1½	34548. 789	
4f	$4f\ ^2F°$	{2½, 3½}	*34588. 6*	

Na I

Config.	Desig.	J	Level	Interval
5p	$5p\ ^2P°$	½	*35040. 27*	2. 52
		1½	*35042. 79*	
6s	$6s\ ^2S$	½	36372. 647	
5d	$5d\ ^2D$	2½	37036. 781	−0. 0230
		1½	37036. 805	
5f	$5f\ ^2F°$	{2½, 3½}	*37057. 6*	
5g	$5g\ ^2G$	{3½, 4½}	37060. 2	
6p	$6p\ ^2P°$	½	*37296. 51*	1. 25
		1½	*37297. 76*	
7s	$7s\ ^2S$	½	38012. 074	
6d	$6d\ ^2D$	2½	38387. 287	=0. 0124
		1½	38387. 300	

*The last 14 members are not included because page proof had been prepared when the data were received.

Na I—Continued

Config.	Desig.	*J*	Level	Interval
6*f*	6*f* ²F°	{ 2½ 3½ }	*38400. 1*	
6*h*	6*h* ²H°	{ 4½ 5½ }	*38403. 4*	
7*p*	7*p* ²P°	½ 1½	*38540. 40* *38541. 14*	0. 74
8*s*	8*s* ²S	½	38968. 35	
7*d*	7*d* ²D	2½ 1½	39200. 962 39200. 963	−0. 001
7*f*	7*f* ²F°	{ 2½ 3½ }	*39209. 2*	
8*p*	8*p* ²P°	½ 1½	*39298. 54* *39299. 01*	0. 47
9*s*	9*s* ²S	½	39574. 51	
8*d*	8*d* ²D	{ 2½ 1½ }	39729. 00	
8*f*	8*f* ²F°	{ 2½ 3½ }	[*39734. 0*]	
9*p*	9*p* ²P°	½ 1½	*39794. 53* *39795. 00*	0. 47
10*s*	10*s* ²S	½	39983. 0	
9*d*	9*d* ²D	{ 2½ 1½ }	40090. 57	
9*f*	9*f* ²F°	{ 2½ 3½ }	*40093. 2*	
10*p*	10*p* ²P°	{ ½ 1½ }	*40137. 23*	
11*s*	11*s* ²S	½	40273. 5	
10*d*	10*d* ²D	{ 2½ 1½ }	40349. 17	
10*f*	10*f* ²F°	{ 2½ 3½ }	*40350. 9*	
11*p*	11*p* ²P°	{ ½ 1½ }	*40383. 16*	
12*s*	12*s* ²S	½	40482. 9	
11*f*	11*f* ²F°	{ 2½ 3½ }	*40539*	
11*d*	11*d* ²D	{ 2½ 1½ }	40540. 35	
12*p*	12*p* ²P°	{ ½ 1½ }	*40566. 03*	
13*s*	13*s* ²S	½	40644. 6	
12*d*	12*d* ²D	{ 2½ 1½ }	40685. 8	
13*p*	13*p* ²P°	{ ½ 1½ }	*40705. 68*	
14*s*	14*s* ²S	½	40769. 5	
13*d*	13*d* ²D	{ 2½ 1½ }	40798. 8	

Na I—Continued

Config.	Desig.	*J*	Level	Interval
14*p*	14*p* ²P°	{ ½ 1½ }	*40814. 47*	
14*d*	14*d* ²D	{ 2½ 1½ }	40890. 0	
15*p*	15*p* ²P°	{ ½ 1½ }	*40901. 11*	
15*d*	15*d* ²D	{ 2½ 1½ }	40958	
16*p*	16*p* ²P°	{ ½ 1½ }	*40971. 16*	
17*p*	17*p* ²P°	{ ½ 1½ }	*41028. 68*	
18*p*	18*p* ²P°	{ ½ 1½ }	*41076. 37*	
19*p*	19*p* ²P°	{ ½ 1½ }	*41116. 28*	
20*p*	20*p* ²P°	{ ½ 1½ }	*41150. 39*	
21*p*	21*p* ²P°	{ ½ 1½ }	*41179. 22*	
22*p*	22*p* ²P°	{ ½ 1½ }	*41204. 28*	
23*p*	23*p* ²P°	{ ½ 1½ }	*41225. 88*	
24*p*	24*p* ²P°	{ ½ 1½ }	*41244. 77*	
25*p*	25*p* ²P°	{ ½ 1½ }	*41261. 42*	
26*p*	26*p* ²P°	{ ½ 1½ }	*41276. 11*	
27*p*	27*p* ²P°	{ ½ 1½ }	*41289. 16*	
28*p*	28*p* ²P°	{ ½ 1½ }	*41300. 74*	
29*p*	29*p* ²P°	{ ½ 1½ }	*41311. 09*	
30*p*	30*p* ²P°	{ ½ 1½ }	*41320. 34*	
31*p*	31*p* ²P°	{ ½ 1½ }	*41328. 87*	
32*p*	32*p* ²P°	{ ½ 1½ }	*41336. 50*	
33*p*	33*p* ²P°	{ ½ 1½ }	*41343. 49*	
34*p*	34*p* ²P°	{ ½ 1½ }	*41349. 70*	
35*p*	35*p* ²P°	{ ½ 1½ }	*41355. 50*	
36*p*	36*p* ²P°	{ ½ 1½ }	*41360. 82*	

Na I—Continued

Config.	Desig.	J	Level	Interval
37*p*	37*p* $^2P^\circ$	{ ½, 1½ }	*41365. 66*	
38*p*	38*p* $^2P^\circ$	{ ½, 1½ }	*41370. 11*	
39*p*	39*p* $^2P^\circ$	{ ½, 1½ }	*41374. 27*	
40*p*	40*p* $^2P^\circ$	{ ½, 1½ }	*41378. 04*	
41*p*	41*p* $^2P^\circ$	{ ½, 1½ }	*41381. 55*	
42*p*	42*p* $^2P^\circ$	{ ½, 1½ }	*41384. 84*	
43*p*	43*p* $^2P^\circ$	{ ½, 1½ }	*41387. 91*	
44*p*	44*p* $^2P^\circ$	{ ½, 1½ }	*41390. 73*	
45*p*	45*p* $^2P^\circ$	{ ½, 1½ }	*41393. 34*	
46*p*	46*p* $^2P^\circ$	{ ½, 1½ }	*41395. 77*	
47*p*	47*p* $^2P^\circ$	{ ½, 1½ }	*41398. 10*	
48*p*	48*p* $^2P^\circ$	{ ½, 1½ }	*41400. 28*	

Na I—Continued

Config.	Desig.	J	Level	Interval
49*p*	49*p* $^2P^\circ$	{ ½, 1½ }	*41402. 25*	
50*p*	50*p* $^2P^\circ$	{ ½, 1½ }	*41404. 18*	
51*p*	51*p* $^2P^\circ$	{ ½, 1½ }	*41406. 03*	
52*p*	52*p* $^2P^\circ$	{ ½, 1½ }	*41407. 69*	
53*p*	53*p* $^2P^\circ$	{ ½, 1½ }	*41409. 30*	
54*p*	54*p* $^2P^\circ$	{ ½, 1½ }	*41410. 81*	
55*p*	55*p* $^2P^\circ$	{ ½, 1½ }	*41412. 20*	
56*p*	56*p* $^2P^\circ$	{ ½, 1½ }	*41413. 59*	
57*p*	57*p* $^2P^\circ$	{ ½, 1½ }	*41414. 89*	
58*p*	58*p* $^2P^\circ$	{ ½, 1½ }	*41416. 06*	
59*p*	59*p* $^2P^\circ$	{ ½, 1½ }	*41417. 18*	
Na II ($^1S_0$)	*Limit*	-------	**41449.65**	

January 1949.

Na II

(Ne I sequence; 10 electrons) $Z=11$

Ground state $1s^2\ 2s^2\ 2p^6\ {}^1S_0$

$2p^6\ {}^1S_0$ **381528** cm^{-1} I. P. 47.29 volts

The analysis has been taken from Söderqvist's Monograph except for the 5*s*- and 6*s*-levels, which are quoted from Vance's paper.

The term designations assigned by Söderqvist on the assumption of *LS*-coupling are listed under the heading "Author," with corresponding assignments added for the 5*s*- and 6*s*-levels.

As for Ne I, the *jl*-coupling notation in the general form suggested by Racah is adopted. Shortley has, however, pointed out that the configurations $2p^5\ 3s$, $2p^5\ 3p$, and $2p^5\ 3d$ are much closer to *LS*-coupling than they are to *jl*-coupling.

REFERENCES

I. S. Bowen, Phys. Rev. **31,** 967 (1928). (T) (C L)
S. Frisch, Zeit. Phys. **70,** 498 (1931). (T) (C L)
B. B. Vance, Phys. Rev. **41,** 480 (1932). (T) (C L)
J. Söderqvist, Nova Acta Reg. Soc. Sci. Uppsala [IV] **9,** No. 7, 22 (1934). (I P) (T) (C L) (G D)
G. Racah, Phys. Rev. **61,** 537 (L) (1942).
G. Shortley, unpublished material (1948).

Author	Config.	Desig.	J	Level
$2p\ ^1S_0$	$2p^6$	$2p^6\ ^1S$	0	0.00
$3s_5\ ^3P_2$	$2p^5(^2P^\circ_{1½})3s$	3s [1½]°	2	264928.00
$3s_4\ ^3P_1$			1	265693.29
$3s_3\ ^3P_0$	$2p^5(^2P^\circ_{½})3s$	3s′ [½]°	0	266285.36
$3s_2\ ^1P_1$			1	268766.67
$3p_{10}\ ^3S_1$	$2p^5(^2P^\circ_{1½})3p$	3p [½]	1	293224.12
$3p_9\ ^3D_3$	"	3p [2½]	3	297252.52
$3p_8\ ^3D_2$			2	297639.34
$3p_7\ ^3D_1$	"	3p [1½]	1	298169.14
$3p_6\ ^1D_2$			2	299193.75
$3p_3\ ^3P_0$	"	3p [½]	0	300391.59
$3p_5\ ^1P_1$	$2p^5(^2P^\circ_{½})3p$	3p′ [1½]	1	299889.16
$3p_4\ ^3P_2$			2	300107.71
$3p_2\ ^3P_1$	"	3p′ [½]	1	300510.92
$3p_1\ ^1S_0$			0	308864.54
$3d\ ^3P_0$	$2p^5(^2P^\circ_{1½})3d$	3d [½]°	0	330553.18
$^3P_1$			1	330640.60
$3d\ ^3P_2$	"	3d [1½]°	2	330792.85
$3d\ ^3F_4$	"	3d [3½]°	4	331126.76
$^3F_3$			3	331190.49
$3d\ ^3F_2$	"	3d [2½]°	2	331669.40
$^1F_3$			3	331711.75

Author	Config.	Desig.	J	Level
$3d\ ^1P_1$	$2p^5(^2P^\circ_{1½})3d$	3d [1½]°	1	331748.77
$3d\ ^1D_2$	$2p^5(^2P^\circ_{½})3d$	3d′ [2½]°	2	332806.06
$^3D_3$			3	332845.80
$3d\ ^3D_2$	"	3d′ [1½]°	2	332966.42
$^3D_1$			1	333166.70
$4s_5\ ^3P_2$	$2p^5(^2P^\circ_{1½})4s$	4s [1½]°	2	331500.29
$4s_4\ ^3P_1$			1	331877.67
$4s_3\ ^3P_0$	$2p^5(^2P^\circ_{½})4s$	4s′ [½]°	0	332713.96
$4s_2\ ^1P_1$			1	333111.60
	$2p^5(^2P^\circ_{1½})5s$	5s [1½]°	2	
$5s_4\ ^3P_1$			1	353260
	$2p^5(^2P^\circ_{½})5s$	5s′ [½]°	0	
$5s_2\ ^1P_1$			1	354850
$4d\ ^1P_1$	$2p^5(^2P^\circ_{1½})4d$	4d [1½]°	1	353573
	$2p^5(^2P^\circ_{1½})6s$	6s [1½]°	2	
$6s_4\ ^3P_1$			1	363500
	$2p^5(^2P^\circ_{½})6s$	6s′ [½]°	0	
$6s_2\ ^1P_1$			1	364960
	Na III $(^2P^\circ_{1½})$	Limit	-------	381528
	Na III $(^2P^\circ_{½})$	Limit	-------	382892

August 1947.

Na II Observed Levels*

Config. $1s^2\ 2s^2+$	Observed Terms		
$2p^6$	$2p^6\ ^1S$		
	$ns\ (n\geq 3)$	$np\ (n\geq 3)$	$nd\ (n\geq 3)$
$2p^5(^2P^\circ)nx$	{ 3–6s $^3P^\circ$ 3–6s $^1P^\circ$	3p ^3S 3p ^3P 3p ^3D 3p ^1S 3p ^1P 3p ^1D	3d $^3P^\circ$ 3d $^3D^\circ$ 3d $^3F^\circ$ 3, 4d $^1P^\circ$ 3d $^1D^\circ$ 3d $^1F^\circ$
	jl-Coupling Notation		
	Observed Pairs		
	$ns\ (n\geq 3)$	$np\ (n\geq 3)$	$nd\ (n\geq 3)$
$2p^5(^2P^\circ_{1½})nx$	3–6s [1½]°	3p [½] 3p [2½] 3p [1½]	3d [½]° 3d [3½]° 3, 4d [1½]° 3d [2½]°
$2p^5(^2P^\circ_{½})nx'$	3–6s′ [½]°	3p′ [1½] 3p′ [½]	3d′ [2½]° 3d′ [1½]°

*For predicted levels in the spectra of the Ne I isoelectronic sequence, see Introduction.

Na III

(F I sequence; 9 electrons) $Z=11$

Ground state is $1s^2\,2s^2\,2p^5\ {}^2P^\circ_{1\frac{1}{2}}$

$2p^5\ {}^2P^\circ_{1\frac{1}{2}}$ *578033* cm^{-1} I. P. 71.65 volts

The terms are taken from the paper by Tomboulian, who has revised and extended the analysis by Söderqvist, but adopts the limit estimated by Söderqvist. The $^2P^\circ$ term from the ^1S limit in Na IV has not been located to confirm Söderqvist's ^2S and ^2D terms from this limit.

Intersystem combinations have been observed, connecting the doublet and quartet terms.

REFERENCES

J. Söderqvist, Nova Acta Reg. Soc. Sci. Uppsala [IV] **9**, No. 7, 39 (1934). (T) (C L) (G D)
D. H. Tomboulian, Phys. Rev. **54**, 347 (1938). (I P) (T) (C L)

Na III

Config.	Desig.	J	Level	Interval
$2s^2\,2p^5$	$2p^5\ {}^2P^\circ$	1½ ½	*0* *1364*	−1364
$2s\ 2p^6$	$2p^6\ {}^2S$	½	264449	
$2s^2\,2p^4(^3P)3s$	$3s\ {}^4P$	2½ 1½ ½	366165.3 367052.3 367561.9	−887.0 −509.6
$2s^2\,2p^4(^3P)3s$	$3s\ {}^2P$	1½ ½	373633.0 374681.4	−1048.4
$2s^2\,2p^4(^1D)3s$	$3s'\ {}^2D$	2½ 1½	399179.4 399182.7	−3.3
$2s^2\,2p^4(^3P)3p$	$3p\ {}^4P^\circ$	2½ 1½ ½	*406200.9* *406562.0* *406876.0*	−361.1 −314.0
$2s^2\,2p^4(^3P)3p$	$3p\ {}^4D^\circ$	3½ 2½ 1½ ½	*410987.9* *411548.2* *411963.9* *412201.5*	−560.3 −415.7 −237.6
$2s^2\,2p^4(^3P)3p$	$3p\ {}^2D^\circ$	2½ 1½	*414281.0* *415173.2*	−892.2
$2s^2\,2p^4(^3P)3p$	$3p\ {}^2S^\circ$	½	*416910.2*	

Na III

Config.	Desig.	J	Level	Interval
$2s^2\,2p^4(^3P)3p$	$3p\ {}^4S^\circ$	1½	*417415.5*	
$2s^2\,2p^4(^3P)3p$	$3p\ {}^2P^\circ$	1½ ½	*418418.1* *418556.9*	−138.8
$2s^2\,2p^4(^1S)3s$	$3s''\ {}^2S$	½	435031	
$2s^2\,2p^4(^1D)3p$	$3p'\ {}^2F^\circ$	2½ 3½	*440472.0* *440552.4*	80.4
$2s^2\,2p^4(^1D)3p$	$3p'\ {}^2P^\circ$	1½ ½	*442710.5* *443261.6*	−551.1
$2s^2\,2p^4(^1D)3p$	$3p'\ {}^2D^\circ$	1½ 2½	*444748.1* *444825.0*	76.9
$2s^2\,2p^4(^3P)3d$	$3d\ {}^4D$	3½ 2½ 1½ ½	460267.8 460421.0 460605.6 460759.3	−153.2 −184.6 −153.7
$2s^2\,2p^4(^3P)3d$	$3d\ {}^4F$	4½ 3½ 2½ 1½	461877.4? 463112.8 463628.1 463462.2	−1235.4 −515.3 165.9
$2s^2\,2p^4(^3P)3d$	$3d\ {}^4P$	½ 1½ 2½	462391.2 462963.6 463257.4	572.4 293.8

Na III—Continued

Config.	Desig.	J	Level	Interval
$2s^2 2p^4(^3P)3d$	$3d\ ^2F$	3½ 2½	463968. 8 465768. 8	−1800. 0
$2s^2 2p^4(^3P)3d$	$3d\ ^2D$	2½ 1½	464392. 1 465027. 9	−635. 8
$2s^2 2p^4(^3P)3d$	$3d\ ^2P$	½ 1½	465988. 0 466773. 0	785. 0
$2s^2 2p^4(^3P)4s$	$4s\ ^4P$	2½ 1½ ½	467773. 8 468528. 5 468949. 5	−754. 7 −421. 0
$2s^2 2p^4(^3P)4s$	$4s\ ^2P$	1½ ½	471446. 6 472250. 6	−804. 0
$2s^2 2p^4(^1D)3d$	$3d'\ ^2G$	4½ 3½	491928. 2	
$2s^2 2p^4(^1D)3d$	$3d'\ ^2P$	½ 1½	493191. 3 493289. 3	98. 0
$2s^2 2p^4(^1D)3d$	$3d'\ ^2D$	1½ 2½	493853. 2 494599. 0	745. 8
$2s^2 2p^4(^1D)3d$	$3d'\ ^2F$	3½ 2½	495446. 8 495668. 6	−221. 8

Na III—Continued

Config.	Desig.	J	Level	Interval
$2s^2 2p^4(^1D)3d$	$3d'\ ^2S$	½	497751. 2	
$2s^2 2p^4(^1D)4s$	$4s'\ ^2D$	2½ 1½	511410	
$2s^2 2p^4(^3P)4d$	$4d\ ^2D$	2½ 1½	514652	
$2s^2 2p^4(^3P)4d$	$4d\ ^2P$	½ 1½	515023 515379	356
$2s^2 2p^4(^1S)3d$	$3d''\ ^2D$	2½ 1½	529465 529498	−33
$2s^2 2p^4(^1D)4d$	$4d'\ ^2P$	{ ½ 1½ }	544227	
$2s^2 2p^4(^1D)4d$	$4d'\ ^2D$	1½ 2½	544736	
Na IV ($^3P_2$)	*Limit*	-------	*578033*	

March 1947.

Na III Observed Terms*

Config. $1s^2+$	Observed Terms		
$2s^2 2p^5$	$2p^5\ ^2P°$		
$2s\ 2p^6$	$2p^6\ ^2S$		
	ns ($n\geq 3$)	np ($n\geq 3$)	nd ($n\geq 3$)
$2s^2 2p^4(^3P)nx$	{ 3, 4s ^4P 3, 4s ^2P	$3p\ ^4S°$ $3p\ ^4P°$ $3p\ ^4D°$ $3p\ ^2S°$ $3p\ ^2P°$ $3p\ ^2D°$	$3d\ ^4P$ $3d\ ^4D$ $3d\ ^4F$ 3, 4d ^2P 3, 4d ^2D $3d\ ^2F$
$2s^2 2p^4(^1D)nx'$	3, 4s' ^2D	$3p'\ ^2P°$ $3p'\ ^2D°$ $3p'\ ^2F°$	$3d'\ ^2S$ 3, 4d' ^2P 3, 4d' ^2D $3d'\ ^2F$ $3d'\ ^2G$
$2s^2 2p^4(^1S)nx''$	$3s''\ ^2S$		$3d''\ ^2D$

*For predicted terms in the spectra of the F I isoelectronic sequence, see Introduction.

Na IV

(O I sequence; 8 electrons) $Z=11$

Ground state $1s^2\,2s^2\,2p^4\ {}^3P_2$

$2p^4\ {}^3P_2$ **797741** cm^{-1} I. P. 98.88 volts

The terms are from Söderqvist who has extended Vance's early work on this spectrum. In the 1946 reference Söderqvist states that the absolute values of the singlets as published in his Monograph should be decreased by 1000 cm^{-1}. This correction has been applied in the present list. The analysis is incomplete but 74 lines have been classified in the range 129 A to 412 A, and 40 terms found. No intersystem combinations have been observed and the uncertainty, x, may be considerable. The term $3d'''\ {}^3D$ has been calculated from its combination with $2p^5\ {}^3P°$ and added to the published list.

REFERENCES

J. Söderqvist, Nova Acta Reg. Soc. Sci. Uppsala [IV] **9,** No. 7, 51 (1934). (I P) (T) (C L) (G D)
J. Söderqvist, Ark. Mat. Astr. Fys. (Stockholm) **32A,** No. 19 p. 4 (1946). (C L)

Na IV

Config.	Desig.	J	Level	Interval
$2s^2\,2p^4$	$2p^4\ {}^3P$	2 1 0	0 1106 1576	−1106 −470
$2s^2\,2p^4$	$2p^4\ {}^1D$	2	31118+x	
$2s^2\,2p^4$	$2p^4\ {}^1S$	0	66780+x	
$2s\ 2p^5$	$2p^5\ {}^3P°$	2 1 0	*243682* *244688* *245238*	−1006 −550
$2s\ 2p^5$	$2p^5\ {}^1P°$	1	*343972*+x	
$2s^2\,2p^3(^4S°)3s$	$3s\ {}^3S°$	1	*486648*	
$2s^2\,2p^3(^2D°)3s$	$3s'\ {}^3D°$	3 2 1	*525100* *525119* *525136*	−19 −17
$2s^2\,2p^3(^2D°)3s$	$3s'\ {}^1D°$	2	*531696*+x	
$2s^2\,2p^3(^2P°)3s$	$3s''\ {}^3P°$	2, 1, 0	*550176*	
$2s^2\,2p^3(^2P°)3s$	$3s''\ {}^1P°$	1	*557081*+x	
$2s^2\,2p^3(^4S°)3d$	$3d\ {}^3D°$	1 2 3	*594893* *594898* *594941*	5 43
$2s^2\,2p^3(^2D°)3d$	$3d'\ {}^3D°$	3 2 1	*638831* *638942* *638977*	−111 −35
$2s^2\,2p^3(^2D°)3d$	$3d'\ {}^1P°$	1	*641468*+x	
$2s^2\,2p^3(^2D°)3d$	$3d'\ {}^3P°$	2 1 0	*643029* *643304* (*643396*)	−275 (−92)
$2s^2\,2p^3(^2D°)3d$	$3d'\ {}^1D°$	2	*643912*+x	
$2s^2\,2p^3(^2D°)3d$	$3d'\ {}^3S°$	1	*644140*	
$2s^2\,2p^3(^4S°)4s$	$4s\ {}^3S°$	1	*644792*	
$2s^2\,2p^3(^2D°)3d$	$3d'\ {}^1F°$	3	*646711*+x	

Na IV

Config.	Desig.	J	Level	Interval
$2s^2\,2p^3(^2P°)3d$	$3d''\ {}^3P°$	2, 1, 0	*663592*	
$2s^2\,2p^3(^2P°)3d$	$3d''\ {}^1D°$	2	*664904*+x	
$2s^2\,2p^3(^2P°)3d$	$3d''\ {}^3D°$	3, 2, 1	*665362*	
$2s^2\,2p^3(^2P°)3d$	$3d''\ {}^1P°$	1	*665640*+x	
$2s^2\,2p^3(^2P°)3d$	$3d''\ {}^1F°$	3	*667696*+x	
$2s^2\,2p^3(^4S°)4d$	$4d\ {}^3D°$	3, 2, 1	*684649*	
$2s^2\,2p^3(^2D°)4s$	$4s'\ {}^3D°$	3, 2, 1	*689755*	
$2s^2\,2p^3(^2D°)4s$	$4s'\ {}^1D°$	2	*692043*+x	
$2s^2\,2p^3(^2P°)4s$	$4s''\ {}^3P°$	2, 1, 0	*714937*	
$2s^2\,2p^3(^2P°)4s$	$4s''\ {}^1P°$	1	*716773*+x	
$2s^2\,2p^3(^2D°)4d$	$4d'\ {}^3D°$	3, 2, 1	*730712*	
$2s^2\,2p^3(^2D°)4d$	$4d'\ {}^1P°$	1	*731948*+x	
$2s^2\,2p^3(^2D°)4d$	$4d'\ {}^3P°$	2, 1, 0	*732355*	
$2s^2\,2p^3(^2D°)4d$	$4d'\ {}^3S°$	1	*732940*	
$2s^2\,2p^3(^2D°)4d$	$4d'\ {}^1D°$	2	*733548*+x	
$2s^2\,2p^3(^2D°)4d$	$4d'\ {}^1F°$	3	*734195*+x	
$2s^2\,2p^3(^2D°)5s$	$5s'\ {}^3D°$	3, 2, 1	*753352*	
$2s^2\,2p^3(^2P°)4d$	$4d''\ {}^1D°$	2	*756045*+x	
$2s^2\,2p^3(^2P°)4d$	$4d''\ {}^3D°$	3, 2, 1	*756367*	
$2s^2\,2p^3(^2P°)4d$	$4d''\ {}^1F°$	3	*757261*+x	
$2s^2\,2p^3(^2D°)5d$	$5d'\ {}^3D°$	3, 2, 1	*772415*	
Na V ($^4S°_{1\frac{1}{2}}$)	*Limit*		**797741**	
$2s\ 2p^4(^4P)3d$	$3d'''\ {}^3D$	3, 2, 1	813538	

February 1947.

Na IV OBSERVED TERMS*

Config. $1s^2+$	Observed Terms	
$2s^2\ 2p^4$	$2p^4\ ^1S$; $2p^4\ ^3P$; $2p^4\ ^1D$	
$2s\ 2p^5$	$2p^5\ ^3P^\circ$; $2p^5\ ^1P^\circ$	
	$ns\ (n \geq 3)$	$nd\ (n \geq 3)$
$2s^2\ 2p^3(^4S^\circ)nx$	3, $4s\ ^3S^\circ$	3, $4d\ ^3D^\circ$
$2s^2\ 2p^3(^2D^\circ)nx'$	3–$5s'\ ^3D^\circ$; 3, $4s'\ ^1D^\circ$	3, $4d'\ ^3S^\circ$; 3, $4d'\ ^3P^\circ$; 3, $4d'\ ^1P^\circ$; 3–$5d'\ ^3D^\circ$; 3, $4d'\ ^1D^\circ$; 3, $4d'\ ^1F^\circ$
$2s^2\ 2p^3(^2P^\circ)nx''$	3, $4s''\ ^3P^\circ$; 3, $4s''\ ^1P^\circ$	$3d''\ ^3P^\circ$; $3d''\ ^1P^\circ$; 3, $4d''\ ^3D^\circ$; 3, $4d''\ ^1D^\circ$; 3, $4d''\ ^1F^\circ$
$2s\ 2p^4(^4P)nx'''$		$3d'''\ ^3D$

*For predicted terms in the spectra of the O I isoelectronic sequence, see Introduction.

Na V

(N I sequence; 7 electrons) $Z=11$

Ground state $1s^2\ 2s^2\ 2p^3\ ^4S^\circ_{1\frac{1}{2}}$

$2p^3\ ^4S^\circ_{1\frac{1}{2}}$ ***1118170*** cm^{-1} I. P. 138.60 volts

Söderqvist has found 45 terms in this spectrum and classified 203 lines in the interval between 100 A and 514 A. No intersystem combinations have been observed. The series are short and the uncertainty, x, may be considerable.

REFERENCES

J. Söderqvist, Nova Acta Reg. Soc. Sci. Uppsala [IV] **9**, No. 7, 75 (1934). (T) (C L) (G D)
J. Söderqvist, Ark. Mat. Astr. Fys. (Stockholm) **32A**, No. 19 p. 4 (1946). (I P) (T) (C L)

Na V

Author	Config.	Desig.	J	Level	Interval
$2p\ {}^4S_2$	$2s^2\ 2p^3$	$2p^3\ {}^4S^\circ$	1½	*0*	
$2p\ {}^2D_3$ ${}^2D_2$	$2s^2\ 2p^3$	$2p^3\ {}^2D^\circ$	2½ 1½	*47570+x* *47595+x*	−25
$2p\ {}^2P_1$ ${}^2P_2$	$2s^2\ 2p^3$	$2p^3\ {}^2P^\circ$	½ 1½	*72454+x* *72493+x*	39
$2p'\ {}^4P_3$ ${}^4P_2$ ${}^4P_1$	$2s\ 2p^4$	$2p^4\ {}^4P$	2½ 1½ ½	215860 216896 217440	−1036 −544
$2p'\ {}^2D_3$ ${}^2D_2$	$2s\ 2p^4$	$2p^4\ {}^2D$	2½ 1½	297116+x 297150+x	−34
$2p'\ {}^2S_1$	$2s\ 2p^4$	$2p^4\ {}^2S$	½	349987+x	
$2p'\ {}^2P_2$ ${}^2P_1$	$2s\ 2p^4$	$2p^4\ {}^2P$	1½ ½	371967+x 373167+x	−1200
$2p''\ {}^2P_2$ ${}^2P_1$	$2p^5$	$2p^5\ {}^2P^\circ$	1½ ½	*567583+x* *569211+x*	−1628
$3s\ {}^4P_1$ ${}^4P_2$ ${}^4P_3$	$2s^2\ 2p^2(^3P)3s$	$3s\ {}^4P$	½ 1½ 2½	671136 671790 672757	654 967
$3s\ {}^2P_1$ ${}^2P_2$	$2s^2\ 2p^2(^3P)3s$	$3s\ {}^2P$	½ 1½	682470+x 683673+x	1203
$\overline{3s}\ {}^2D$	$2s^2\ 2p^2(^1D)3s$	$3s'\ {}^2D$	{2½ 1½}	709277+x	
$\overline{\overline{3s}}\ {}^2S_1$	$2s^2\ 2p^2(^1S)3s$	$3s''\ {}^2S$	½	748640+x	
$3d\ {}^2P_2$ ${}^2P_1$	$2s^2\ 2p^2(^3P)3d$	$3d\ {}^2P$	1½ ½	792337+x 792849+x	−512
$3d\ {}^4D_{23}$ ${}^4D_1$	$2s^2\ 2p^2(^3P)3d$	$3d\ {}^4D$	3½ {2½ 1½} ½	797060 797270	−210
$3d\ {}^2F_3$ ${}^2F_4$	$2s^2\ 2p^2(^3P)3d$	$3d\ {}^2F$	2½ 3½	797288+x 798535+x	1247
$3d\ {}^4P_3$ ${}^4P_2$ ${}^4P_1$	$2s^2\ 2p^2(^3P)3d$	$3d\ {}^4P$	2½ 1½ ½	798174 798620 798862	−446 −242
$3s'\ {}^4S_2$	$2s\ 2p^3(^5S^\circ)3s$	$3s'''\ {}^4S^\circ$	1½	*801950*	
$3d\ {}^2D_2$ ${}^2D_3$	$2s^2\ 2p^2(^3P)3d$	$3d\ {}^2D$	1½ 2½	808546+x 808920+x	374
$\overline{3d}\ {}^2F_4$ ${}^2F_3$	$2s^2\ 2p^2(^1D)3d$	$3d'\ {}^2F$	3½ 2½	828509+x 828692+x	−183
$\overline{3d}\ {}^2D_2$ ${}^2D_3$	$2s^2\ 2p^2(^1D)3d$	$3d'\ {}^2D$	1½ 2½	832075+x 832228+x	153
$\overline{3d}\ {}^2P_1$ ${}^2P_2$	$2s^2\ 2p^2(^1D)3d$	$3d'\ {}^2P$	½ 1½	837431+x 837723+x	292
$\overline{3d}\ {}^2S_1$	$2s^2\ 2p^2(^1D)3d$	$3d'\ {}^2S$	½	842067+x	
$3p'\ {}^4P$	$2s\ 2p^3(^5S^\circ)3p$	$3p'''\ {}^4P$	{½ to 2½}	847539	
$\overline{\overline{3d}}\ {}^2D$	$2s^2\ 2p^2(^1S)3d$	$3d''\ {}^2D$	{1½ to 2½}	866780+x	

Na V

Author	Config.	Desig.	J	Level	Interval
$\overline{3s'}\ {}^4D$	$2s\ 2p^3(^3D^\circ)3s$	$3s^{IV}\ {}^4D^\circ$	{½ to 3½}	*878288*	
$4s\ {}^4P_1$ ${}^4P_2$ ${}^4P_3$	$2s^2\ 2p^2(^3P)4s$	$4s\ {}^4P$	½ 1½ 2½	892244 892885 893822	641 937
$\overline{3s'}\ {}^2D$	$2s\ 2p^3(^3D^\circ)3s$	$3s^{IV}\ {}^2D^\circ$	{1½ 2½}	*894095+x*	
$4s\ {}^2P_1$ ${}^2P_2$	$2s^2\ 2p^2(^3P)4s$	$4s\ {}^2P$	½ 1½	895944+x 897147+x	1203
$3d'\ {}^4D$	$2s\ 2p^3(^5S^\circ)3d$	$3d'''\ {}^4D^\circ$	{½ to 3½}	*908717*	
$\overline{\overline{3s'}}\ {}^4P$	$2s\ 2p^3(^3P^\circ)3s$	$3s^{V}\ {}^4P^\circ$	{½ to 2½}	*919070*	
$\overline{4s}\ {}^2D$	$2s^2\ 2p^2(^1D)4s$	$4s'\ {}^2D$	{2½ 1½}	928053+x	
$4d\ {}^2P_2$	$2s^2\ 2p^2(^3P)4d$	$4d\ {}^2P$	1½ ½	937669+x	
$4d\ {}^4D_{23}$ ${}^4D_1$	$2s^2\ 2p^2(^3P)4d$	$4d\ {}^4D$	3½ {2½ 1½} ½	939055 939858	−803
$4d\ {}^2F_3$ ${}^2F_4$	$2s^2\ 2p^2(^3P)4d$	$4d\ {}^2F$	2½ 3½	940380+x 941392+x	1012
$4d\ {}^4P_3$ ${}^4P_2$	$2s^2\ 2p^2(^3P)4d$	$4d\ {}^4P$	2½ 1½ ½	940716 940929	−213
$4d\ {}^2D_2$ ${}^2D_3$	$2s^2\ 2p^2(^3P)4d$	$4d\ {}^2D$	1½ 2½	944022+x 944334+x	312
$\overline{3p'}\ {}^2F_4$ ${}^2F_3$	$2s\ 2p^3(^3D^\circ)3p$	$3p^{IV}\ {}^2F$	3½ 2½	949462+x 949984+x	−522
$\overline{4d}\ {}^2F$	$2s^2\ 2p^2(^1D)4d$	$4d'\ {}^2F$	{3½ 2½}	973350+x	
$\overline{4d}\ {}^2D$	$2s^2\ 2p^2(^1D)4d$	$4d'\ {}^2D$	{1½ 2½}	974048+x	
$\overline{3d'}\ {}^4P_3$ ${}^4P_2$ ${}^4P_1$	$2s\ 2p^3(^3D^\circ)3d$	$3d^{IV}\ {}^4P^\circ$	2½ 1½ ½	*1004404* *1004626* *1004794*	−222 −168
$\overline{3d'}\ {}^4D$	$2s\ 2p^3(^3D^\circ)3d$	$3d^{IV}\ {}^4D^\circ$	{½ to 3½}	*1008214*	
$\overline{3d'}\ {}^4S_2$	$2s\ 2p^3(^3D^\circ)3d$	$3d^{IV}\ {}^4S^\circ$	1½	*1008941*	
$\overline{3d'}\ {}^2F_4$ ${}^2F_3$	$2s\ 2p^3(^3D^\circ)3d$	$3d^{IV}\ {}^2F^\circ$	3½ 2½	*1010088+x* *1010565+x*	−477
$\overline{5d}\ {}^2F$	$2s^2\ 2p^2(^1D)5d$	$5d'\ {}^2F$	{3½ 2½}	1038208+x	
$\overline{5d}\ {}^2D$	$2s^2\ 2p^2(^1D)5d$	$5d'\ {}^2D$	{1½ 2½}	1038845+x	
	Na VI ($^3P_0$)	*Limit*	------	***1118170***	

January 1947.

Na v Observed Terms*

Config. $1s^2+$	Observed Terms		
$2s^2\ 2p^3$	$2p^3\ {}^4S^\circ$	$2p^3\ {}^2P^\circ$	$2p^3\ {}^2D^\circ$
$2s\ 2p^4$	$2p^4\ {}^2S$	$2p^4\ {}^4P$ $2p^4\ {}^2P$	$2p^4\ {}^2D$
$2p^5$		$2p^5\ {}^2P^\circ$	
	$ns\ (n\geq 3)$	$np\ (n\geq 3)$	$nd\ (n\geq 3)$
$2s^2\ 2p^2(^3P)nx$	$3,\ 4s\ {}^4P$ $3,\ 4s\ {}^2P$		$3,\ 4d\ {}^4P$ $3,\ 4d\ {}^4D$ $3,\ 4d\ {}^2P$ $3,\ 4d\ {}^2D$ $3,\ 4d\ {}^2F$
$2s^2\ 2p^2(^1D)nx'$	$3,\ 4s'\ {}^2D$		$3d'\ {}^2S$ $3d'\ {}^2P$ $3\text{–}5d'\ {}^2D$ $3\text{–}5d'\ {}^2F$
$2s^2\ 2p^2(^1S)nx''$	$3s''\ {}^2S$		$3d''\ {}^2D$
$2s\ 2p^3(^5S^\circ)nx'''$	$3s'''\ {}^4S^\circ$	$3p'''\ {}^4P$	$3d'''\ {}^4D^\circ$
$2s\ 2p^3(^3D^\circ)nx^{IV}$	$3s^{IV}\ {}^4D^\circ$ $3s^{IV}\ {}^2D^\circ$	$3p^{IV}\ {}^2F$	$3d^{IV}\ {}^4S^\circ$ $3d^{IV}\ {}^4P^\circ$ $3d^{IV}\ {}^4D^\circ$ $3d^{IV}\ {}^2F^\circ$
$2s\ 2p^3(^3P^\circ)nx^V$	$3s^V\ {}^4P^\circ$		

*For predicted terms in the spectra of the N I isoelectronic sequence, see Introduction.

Na VI

(C I sequence; 6 electrons) $Z=11$

Ground state $1s^2\,2s^2\,2p^2\ {}^3P_0$

$2p^2\ {}^3P_0$ **1390558** cm^{-1} I. P. 172.36 volts

The analysis is by Söderqvist, who has found 63 terms and classified 134 lines in the range between 80 A and 638 A. He determines the relative values of terms of different multiplicity from the series limits, although he lists a few observed singlet-triplet combinations. His term $2p^4\ {}^1D$ has been corrected to agree with the two observed combinations.

Söderqvist gives the quintet term $2p^3\ {}^5S^\circ_2$ at 103187 cm^{-1} above the ground state zero. From isoelectronic sequence data Robinson estimates this value as 103508 cm^{-1}. The later value has been used in the table and all quintet terms adjusted accordingly. The uncertainty, x, may be a few hundred cm^{-1}.

REFERENCES

J. Söderqvist, Ark, Mat. Astr. Fys. (Stockholm) **32A,** No. 19 p. 4 (1946). (I P) (T) (C L)
H. A. Robinson, unpublished material (March 1948). (T)

Na VI

Author	Config.	Desig.	J	Level	Interval
$2p\ {}^3P_0$ ${}^3P_1$ ${}^3P_2$	$2s^2\,2p^2$	$2p^2\ {}^3P$	0 1 2	0 698 1858	698 1160
$2p\ {}^1D_2$	$2s^2\,2p^2$	$2p^2\ {}^1D$	2	35358	
$2p\ {}^1S_0$	$2s^2\,2p^2$	$2p^2\ {}^1S$	0	74274	
$2p'\ {}^5S_2$	$2s\ 2p^3$	$2p^3\ {}^5S^\circ$	2	*103508+x*	
$2p'\ {}^3D_3$ ${}^3D_2$ ${}^3D_1$	$2s\ 2p^3$	$2p^3\ {}^3D^\circ$	3 2 1	*204131* *204222* *204260*	−91 −38
$2p'\ {}^3P$	$2s\ 2p^3$	$2p^3\ {}^3P^\circ$	2, 1, 0	*241341*	
$2p'\ {}^1D_2$	$2s\ 2p^3$	$2p^3\ {}^1D^\circ$	2	*312175*	
$2p'\ {}^3S_1$	$2s\ 2p^3$	$2p^3\ {}^3S^\circ$	1	*320589*	
$2p'\ {}^1P_1$	$2s\ 2p^3$	$2p^3\ {}^1P^\circ$	1	*350179*	
$2p''\ {}^3P_2$ ${}^3P_1$ ${}^3P_0$	$2p^4$	$2p^4\ {}^3P$	2 1 0	477277 478597 479156	−1320 −559
$2p''\ {}^1D_2$	$2p^4$	$2p^4\ {}^1D$	2	539310	
 $3s\ {}^3P_1$ ${}^3P_2$	$2s^2\,2p(^2P^\circ)3s$	$3s\ {}^3P^\circ$	0 1 2	 *807324* *808795*	1471
$3s\ {}^1P_1$	$2s^2\,2p(^2P^\circ)3s$	$3s\ {}^1P^\circ$	1	*817598*	
 $3p\ {}^3P_1$ ${}^3P_2$	$2s^2\,2p(^2P^\circ)3p$	$3p\ {}^3P$	0 1 2	 872577 873287	710
$3d\ {}^3F_2$	$2s^2\,2p(^2P^\circ)3d$	$3d\ {}^3F^\circ$	2 3 4	*919476*	
$3d\ {}^1D_2$	$2s^2\,2p(^2P^\circ)3d$	$3d\ {}^1D^\circ$	2	*920706*	
$3s'\ {}^5P_1$ ${}^5P_2$ ${}^5P_3$	$2s\ 2p^2(^4P)3s$	$3s\ {}^5P$	1 2 3	923059+x 923765+x 924708+x	706 943
$3d\ {}^3D_1$ ${}^3D_2$ ${}^3D_3$	$2s^2\,2p(^2P^\circ)3d$	$3d\ {}^3D^\circ$	1 2 3	*929774* *929999* *930510*	225 511
$3d\ {}^3P_2$ ${}^3P_1$ ${}^3P_0$	$2s^2\,2p(^2P^\circ)3d$	$3d\ {}^3P^\circ$	2 1 0	*933915* *934463* *934745*	−548 −282
$3d\ {}^1F_3$	$2s^2\,2p(^2P^\circ)3d$	$3d\ {}^1F^\circ$	3	*945309*	
$3d\ {}^1P_1$	$2s^2\,2p(^2P^\circ)3d$	$3d\ {}^1P^\circ$	1	*946392*	
$3s'\ {}^3P_0$ ${}^3P_1$ ${}^3P_2$	$2s\ 2p^2(^4P)3s$	$3s\ {}^3P$	0 1 2	949778 950367 951389	589 1022
$3p'\ {}^3S_1$	$2s\ 2p^2(^4P)3p$	$3p\ {}^3S^\circ$	1	*970835*	
 $3p'\ {}^3D_2$ ${}^3D_3$	$2s\ 2p^2(^4P)3p$	$3p\ {}^3D^\circ$	1 2 3	 *996011* *996734*	723
 $3p'\ {}^3P_1$ ${}^3P_2$	$2s\ 2p^2(^4P)3p$	$3p\ {}^3P^\circ$	0 1 2	 *1005068* *1005713*	645
$\overline{3s}'\ {}^3D$	$2s\ 2p^2(^2D)3s$	$3s'\ {}^3D$	1, 2, 3	1016274	
$\overline{3s}'\ {}^1D_2$	$2s\ 2p^2(^2D)3s$	$3s'\ {}^1D$	2	1033221	

Author	Config.	Desig.	J	Level	Interval
$3p'\ {}^3D$	$2s\ 2p^2(^2D)3p$	$3p'\ {}^3D^\circ$	1, 2, 3	*1040223*	
$3d'\ {}^5D_{23}$	$2s\ 2p^2(^4P)3d$	$3d\ {}^5D$	0 1 { 2 3 } 4	1041771+x	
$3d'\ {}^5P_3$ ${}^5P_2$ ${}^5P_1$	$2s\ 2p^2(^4P)3d$	$3d\ {}^5P$	3 2 1	1045793+x 1046220+x 1046548+x	−427 −328
$3d'\ {}^3P_2$ ${}^3P_1$	$2s\ 2p^2(^4P)3d$	$3d\ {}^3P$	2 1 0	1047408 1048104	−696
$3d'\ {}^3F_2$ ${}^3F_3$ ${}^3F_4$	$2s\ 2p^2(^4P)3d$	$3d\ {}^3F$	2 3 4	1053885 1054497 1055260	612 763
$3d'\ {}^3D_1$ ${}^3D_2$ ${}^3D_3$	$2s\ 2p^2(^4P)3d$	$3d\ {}^3D$	1 2 3	1067760 1067971 1068258	211 287
$\overline{3p}'\ {}^1F_3$	$2s\ 2p^2(^2D)3p$	$3p'\ {}^1F^\circ$	3	*1071896*	
$\overline{3p}'\ {}^1D_2$	$2s\ 2p^2(^2D)3p$	$3p'\ {}^1D^\circ$	2	*1077752*	
  $4s\ {}^3P_2$	$2s^2\,2p(^2P^\circ)4s$	$4s\ {}^3P^\circ$	0 1 2	 *1090756*	
$\overline{3d}'\ {}^3F$	$2s\ 2p^2(^2D)3d$	$3d'\ {}^3F$	2, 3, 4	1125323	
$4d\ {}^3F_2$	$2s^2\,2p(^2P^\circ)4d$	$4d\ {}^3F^\circ$	2 3 4	*1128693*	
$\overline{3d}'\ {}^3P$	$2s\ 2p^2(^2D)3d$	$3d'\ {}^3P$	0, 1, 2	1130631	
$4d\ {}^1D_2$	$2s^2\,2p(^2P^\circ)4d$	$4d\ {}^1D^\circ$	2	*1131032*	
$4d\ {}^3D_1$ ${}^3D_2$ ${}^3D_3$	$2s^2\,2p(^2P^\circ)4d$	$4d\ {}^3D^\circ$	1 2 3	*1133491* *1133871* *1134746*	380 875
$\overline{3d}'\ {}^3D$	$2s\ 2p^2(^2D)3d$	$3d'\ {}^3D$	1, 2, 3	1134094	
  $4d\ {}^3P_2$	$2s^2\,2p(^2P^\circ)4d$	$4d\ {}^3P^\circ$	0 1 2	 *1136378*	
$4d\ {}^1F_3$	$2s^2\,2p(^2P^\circ)4d$	$4d\ {}^1F^\circ$	3	*1140721*	
$\overline{3d}'\ {}^3S_1$	$2s\ 2p^2(^2D)3d$	$3d'\ {}^3S$	1	1144276	
$\overline{3d}'\ {}^1F_3$	$2s\ 2p^2(^2D)3d$	$3d'\ {}^1F$	3	1147708	
$\overline{3d}'\ {}^1D_2$	$2s\ 2p^2(^2D)3d$	$3d'\ {}^1D$	2	1147735	
$\overline{3d}'\ {}^1P_1$	$2s\ 2p^2(^2D)3d$	$3d'\ {}^1P$	1	1151140	
  $4s'\ {}^5P_3$	$2s\ 2p^2(^4P)4s$	$4s\ {}^5P$	1 2 3	 1205485+x	
  $4s'\ {}^3P_2$	$2s\ 2p^2(^4P)4s$	$4s\ {}^3P$	0 1 2	 1214191	
  $5d\ {}^3D_3$	$2s^2\,2p(^2P^\circ)5d$	$5d\ {}^3D^\circ$	1 2 3	 *1228205*	
  $5d\ {}^3P_2$	$2s^2\,2p(^2P^\circ)5d$	$5d\ {}^3P^\circ$	0 1 2	 *1228882*	

Na VI—Continued

Author	Config.	Desig.	J	Level	Interval
$5d\ ^1F_3$	$2s^2\,2p(^2P^\circ)5d$	$5d\ ^1F^\circ$	3	*1230972*	
	$2s\ 2p^2(^4P)4d$	$4d\ ^5P$	1		
			2		
$4d'\ ^5P_3$			3	1250152+x	
$4d'\ ^3F_2$	$2s\ 2p^2(^4P)4d$	$4d\ ^3F$	2	1253369	578
$^3F_3$			3	1253947	803
$^3F_4$			4	1254750	
$4d'\ ^3D$	$2s\ 2p^2(^4P)4d$	$4d\ ^3D$	1, 2, 3	1258613	
$3p''\ ^3P$	$1s^2\,2p^3(^4S^\circ)3p$	$3p^{IV}\ ^3P$	0, 1, 2	1265583	
$6d\ ^1F_3$	$2s^2\,2p(^2P^\circ)6d$	$6d\ ^1F^\circ$	3	*1279991*	
$\overline{4d'}\ ^3F$	$2s\ 2p^2(^2D)4d$	$4d'\ ^3F$	2, 3, 4	1334585	
$\overline{4d'}\ ^3P$	$2s\ 2p^2(^2D)4d$	$4d'\ ^3P$	0, 1, 2	1335519	
$\overline{4d'}\ ^3D$	$2s\ 2p^2(^2D)4d$	$4d'\ ^3D$	1, 2, 3	1337017	
	$2s\ 2p^2(^4P)5d$	$5d\ ^5P$	1		
			2		
$5d'\ ^5P_3$			3	1343510+x	
	Na VII ($^2P^\circ_{1/2}$)	*Limit*	------	1390558	
$\overline{5d'}\ ^3F$	$2s\ 2p^2(^2D)5d$	$5d'\ ^3F$	2, 3, 4	1429862	

March 1948.

Na VI Observed Terms*

Config. $1s^2+$	Observed Terms		
$2s^2\,2p^2$	$2p^2\ ^1S$; $2p^2\ ^3P$; $2p^2\ ^1D$		
$2s\ 2p^3$	$2p^3\ ^5S^\circ$; $2p^3\ ^3S^\circ$; $2p^3\ ^3P^\circ$; $2p^3\ ^1P^\circ$; $2p^3\ ^3D^\circ$; $2p^3\ ^1D^\circ$		
$2p^4$	$2p^4\ ^3P$; $2p^4\ ^1D$		
	$ns\ (n\geq 3)$	$np\ (n\geq 3)$	$nd\ (n\geq 3)$
$2s^2\,2p(^2P^\circ)nx$	3, 4$s\ ^3P^\circ$; 3$s\ ^1P^\circ$	$3p\ ^3P$	3–5$d\ ^3P^\circ$; 3$d\ ^1P^\circ$; 3–5$d\ ^3D^\circ$; 3, 4$d\ ^1D^\circ$; 3, 4$d\ ^3F^\circ$; 3–6$d\ ^1F^\circ$
$2s\ 2p^2(^4P)nx$	3, 4$s\ ^5P$; 3, 4$s\ ^3P$	$3p\ ^3S^\circ$; $3p\ ^3P^\circ$; $3p\ ^3D^\circ$	3–5$d\ ^5P$; 3$d\ ^3P$; 3$d\ ^5D$; 3, 4$d\ ^3D$; 3, 4$d\ ^3F$
$2s\ 2p^2(^2D)nx'$	$3s'\ ^3D$; $3s'\ ^1D$	$3p'\ ^3D^\circ$; $3p'\ ^1D^\circ$; $3p'\ ^1F^\circ$	$3d'\ ^3S$; 3, 4$d'\ ^3P$; 3$d'\ ^1P$; 3, 4$d'\ ^3D$; 3$d'\ ^1D$; 3–5$d'\ ^3F$; 3$d'\ ^1F$
$2p^3(^4S^\circ)nx^{IV}$		$3p^{IV}\ ^3P$	

*For predicted terms in the spectra of the C I isoelectronic sequence, see Introduction.

Na VII

(B I sequence; 5 electrons) $Z=11$

Ground state $1s^2\,2s^2\,2p\ ^2P^\circ_{1/2}$

$2p\ ^2P^\circ_{1/2}$ ***1681679*** cm^{-1} I. P. 208.444 volts

All of the terms are taken from Söderqvist's later publication. The Grotrian diagram in the earlier paper should be extended to include the more complete analysis of 1944. He has classified 158 lines in the region between 62 A and 491 A.

The absolute values of the doublet terms are well determined. Those of the quartets are derived from the $nd\ ^4D^\circ$ ($n=3$, 4, 5) series; and the relative uncertainty x, may be a few hundred cm^{-1}. No intersystem combinations have been observed.

Na VII—Continued

REFERENCES

J. Söderqvist, Nova Acta Reg. Soc. Sci. Uppsala [IV] **9**, No. 7, 93 (1934). (T) (C L) (G D)

J. Söderqvist, Ark. Mat. Astr. Fys. (Stockholm) **30A**, No. 11 p. 9 (1944). (I P) (T) (C L)

Na VII

Author	Config.	Desig.	J	Level	Interval
$2p\ ^2P_1$ $^2P_2$	$2s^2(^1S)2p$	$2p\ ^2P^\circ$	½ 1½	*0* *2139*	2139
$2p'\ ^4P_1$ $^4P_2$ $^4P_3$	$2s\ 2p^2$	$2p^2\ ^4P$	½ 1½ 2½	115187+x 115920+x 116987+x	733 1067
$2p'\ ^2D_3$ $^2D_2$	$2s\ 2p^2$	$2p^2\ ^2D$	2½ 1½	205412 205448	−36
$2p'\ ^2S_1$	$2s\ 2p^2$	$2p^2\ ^2S$	½	264400	
$2p'\ ^2P_1$ $^2P_2$	$2s\ 2p^2$	$2p^2\ ^2P$	½ 1½	283869 285189	1320
$2p''\ ^4S_2$	$2p^3$	$2p^3\ ^4S^\circ$	1½	*367481+x*	
$2p''\ ^2D_3$ $^2D_2$	$2p^3$	$2p^3\ ^2D^\circ$	2½ 1½	*412311* *412395*	−84
$2p''\ ^2P_1$ $^2P_2$	$2p^3$	$2p^3\ ^2P^\circ$	½ 1½	*465017* *465111*	94
$3s\ ^2S_1$	$2s^2(^1S)3s$	$3s\ ^2S$	½	951347	
 $3p\ ^2P_2$	$2s^2(^1S)3p$	$3p\ ^2P^\circ$	½ 1½	 *1008418*	
$3d\ ^2D_2$ $^2D_3$	$2s^2(^1S)3d$	$3d\ ^2D$	1½ 2½	1060580 1060699	119
$3s'\ ^4P_1$ $^4P_2$ $^4P_3$	$2s\ 2p(^3P^\circ)3s$	$3s\ ^4P^\circ$	½ 1½ 2½	*1077458+x* *1078190+x* *1079520+x*	732 1330
$3s'\ ^2P_1$ $^2P_2$	$2s\ 2p(^3P^\circ)3s$	$3s\ ^2P^\circ$	½ 1½	*1103222* *1104620*	1398
$3p'\ ^2P_1$ $^2P_2$	$2s\ 2p(^3P^\circ)3p$	$3p\ ^2P$	½ 1½	1126810 1127431	621
$3p'\ ^2D_2$ $^2D_3$	$2s\ 2p(^3P^\circ)3p$	$3p\ ^2D$	1½ 2½	1154779 1156180	1401
$3p'\ ^2S_1$	$2s\ 2p(^3P^\circ)3p$	$3p\ ^2S$	½	1172339	
 $3d'\ ^4D_2$ $^4D_3$ $^4D_4$	$2s\ 2p(^3P^\circ)3d$	$3d\ ^4D^\circ$	½ 1½ 2½ 3½	 *1185931+x* *1186190+x* *1186666+x*	259 476
$3d'\ ^2D_2$ $^2D_3$	$2s\ 2p(^3P^\circ)3d$	$3d\ ^2D^\circ$	1½ 2½	*1186628* *1187885*	1257
$3d'\ ^4P_3$ $^4P_2$ $^4P_1$	$2s\ 2p(^3P^\circ)3d$	$3d\ ^4P^\circ$	2½ 1½ ½	*1192538+x* *1193059+x* *1193402+x*	−521 −343
$\overline{3s'}\ ^2P$	$2s\ 2p(^1P^\circ)3s$	$3s'\ ^2P^\circ$	{ ½ 1½ }	*1198287*	
$3d'\ ^2F_3$ $^2F_4$	$2s\ 2p(^3P^\circ)3d$	$3d\ ^2F^\circ$	2½ 3½	*1209908* *1211236*	1328
$3d'\ ^2P_2$ $^2P_1$	$2s\ 2p(^3P^\circ)3d$	$3d\ ^2P^\circ$	1½ ½	*1217189* *1217955*	−766

Na VII

Author	Config.	Desig.	J	Level	Interval
$\overline{3p'}\ ^2D_2$ $^2D_3$	$2s\ 2p(^1P^\circ)3p$	$3p'\ ^2D$	1½ 2½	1251674 1252014	340
$\overline{3p'}\ ^2P_1$ $^2P_2$	$2s\ 2p(^1P^\circ)3p$	$3p'\ ^2P$	½ 1½	1253353 1253779	426
$\overline{3p'}\ ^2S_1$	$2s\ 2p(^1P^\circ)3p$	$3p'\ ^2S$	½	1258878	
 $3s''\ ^4P_2$ $^4P_3$	$2p^2(^3P)3s$	$3s''\ ^4P$	½ 1½ 2½	 1290221+x 1291755+x	1534
$\overline{3d'}\ ^2F$	$2s\ 2p(^1P^\circ)3d$	$3d'\ ^2F^\circ$	{ 2½ 3½ }	*1292333*	
$4s\ ^2S_1$	$2s^2(^1S)4s$	$4s\ ^2S$	½	1294914	
$\overline{3d'}\ ^2D_2$ $^2D_3$	$2s\ 2p(^1P^\circ)3d$	$3d'\ ^2D^\circ$	1½ 2½	*1303445* *1303643*	198
$\overline{3d'}\ ^2P$	$2s\ 2p(^1P^\circ)3d$	$3d'\ ^2P^\circ$	{ ½ 1½ }	*1306468*	
$\overline{3s''}\ ^2D_2$ $^2D_3$	$2p^2(^1D)3s$	$3s'''\ ^2D$	1½ 2½	1331137 1331974	837
$4d\ ^2D_2$ $^2D_3$	$2s^2(^1S)4d$	$4d\ ^2D$	1½ 2½	1335809 1335889	80
   $3p''\ ^4D_4$	$2p^2(^3P)3p$	$3p''\ ^4D^\circ$	½ 1½ 2½ 3½	 *1338659+x*	
  $3p''\ ^4P_3$	$2p^2(^3P)3p$	$3p''\ ^4P^\circ$	½ 1½ 2½	 *1345036+x*	
$3p''\ ^2D$	$2p^2(^3P)3p$	$3p''\ ^2D^\circ$	{ 1½ 2½ }	*1348721*	
$3p''\ ^4S_2$	$2p^2(^3P)3p$	$3p''\ ^4S^\circ$	1½	*1363160+x*	
$\overline{3p''}\ ^2F_3$ $^2F_4$	$2p^2(^1D)3p$	$3p'''\ ^2F^\circ$	2½ 3½	*1377822* *1378295*	473
$3d''\ ^2F_3$ $^2F_4$	$2p^2(^3P)3d$	$3d''\ ^2F$	2½ 3½	1388500? 1388969?	469
$3d''\ ^2D$	$2p^2(^3P)3d$	$3d''\ ^2D$	{ 1½ 2½ }	1390448?	
$\overline{3p''}\ ^2D$	$2p^2(^1D)3p$	$3p'''\ ^2D^\circ$	{ 1½ 2½ }	*1392764*	
$3d''\ ^4P_3$ $^4P_2$ $^4P_1$	$2p^2(^3P)3d$	$3d''\ ^4P$	2½ 1½ ½	1399238+x 1399771+x 1400059+x	−533 −288
$\overline{3d''}\ ^2D$	$2p^2(^1D)3d$	$3d'''\ ^2D$	{ 1½ 2½ }	1415636	
  $4s'\ ^4P_3$	$2s\ 2p(^3P^\circ)4s$	$4s\ ^4P^\circ$	½ 1½ 2½	 *1423050+x*	

Na VII—Continued

Author	Config.	Desig.	J	Level	Interval
$\overline{3d''}$ $^2F_3$ $^2F_4$	$2p^2(^1D)3d$	$3d'''\,^2F$	$2\frac{1}{2}$ $3\frac{1}{2}$	1428717 1428798	81
$\overline{3d''}$ $^2P_1$ $^2P_2$	$2p^2(^1D)3d$	$3d'''\,^2P$	$\frac{1}{2}$ $1\frac{1}{2}$	1432135 1432606	471
$4s'$ $^2P_2$	$2s\ 2p(^3P^\circ)4s$	$4s$ $^2P^\circ$	$\frac{1}{2}$ $1\frac{1}{2}$	*1432595*	
$4p'$ $^2P_1$ $^2P_2$	$2s\ 2p(^3P^\circ)4p$	$4p$ ^2P	$\frac{1}{2}$ $1\frac{1}{2}$	1442711 1443165	454
$4p'$ $^2D_2$ $^2D_3$	$2s\ 2p(^3P^\circ)4p$	$4p$ ^2D	$1\frac{1}{2}$ $2\frac{1}{2}$	1452095 1453349	1254
$5d$ $^2D_2$ $^2D_3$	$2s^2(^1S)5d$	$5d$ ^2D	$1\frac{1}{2}$ $2\frac{1}{2}$	1461518 1461588	70
$4d'$ $^4D_2$ $^4D_3$ $^4D_4$	$2s\ 2p(^3P^\circ)4d$	$4d$ $^4D^\circ$	$\frac{1}{2}$ $1\frac{1}{2}$ $2\frac{1}{2}$ $3\frac{1}{2}$	*1462587+x* *1462631+x* *1463462+x*	44 831
$4d'$ $^2D_3$	$2s\ 2p(^3P^\circ)4d$	$4d$ $^2D^\circ$	$1\frac{1}{2}$ $2\frac{1}{2}$	*1464051*	
$4d'$ $^4P_3$	$2s\ 2p(^3P^\circ)4d$	$4d$ $^4P^\circ$	$2\frac{1}{2}$ $1\frac{1}{2}$ $\frac{1}{2}$	*1465059+x*	
$4d'$ $^2F_3$ $^2F_4$	$2s\ 2p(^3P^\circ)4d$	$4d$ $^2F^\circ$	$2\frac{1}{2}$ $3\frac{1}{2}$	*1471559* *1472727*	1168
$4d'$ $^2P_2$ $^2P_1$	$2s\ 2p(^3P^\circ)4d$	$4d$ $^2P^\circ$	$1\frac{1}{2}$ $\frac{1}{2}$	*1473809* *1474526*	−717
$6d$ ^2D	$2s^2(^1S)6d$	$6d$ ^2D	{ $1\frac{1}{2}$ $2\frac{1}{2}$ }	1529463	
$\overline{4s'}$ ^2P	$2s\ 2p(^1P^\circ)4s$	$4s'$ $^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	*1538951*	

Na VII—Continued

Author	Config.	Desig.	J	Level	Interval
$4p'$ ^2D	$2s\ 2p(^1P^\circ)4p$	$4p'$ ^2D	{ $1\frac{1}{2}$ $2\frac{1}{2}$ }	1561885	
$7d$ ^2D	$2s^2(^1S)7d$	$7d$ ^2D	{ $1\frac{1}{2}$ $2\frac{1}{2}$ }	1570078	
$\overline{4d'}$ ^2F	$2s\ 2p(^1P^\circ)4d$	$4d'$ $^2F^\circ$	{ $2\frac{1}{2}$ $3\frac{1}{2}$ }	*1577813?*	
$5p'$ ^2P	$2s\ 2p(^3P^\circ)5p$	$5p$ ^2P	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	1578354	
$5p'$ ^2D	$2s\ 2p(^3P^\circ)5p$	$5p$ ^2D	{ $1\frac{1}{2}$ $2\frac{1}{2}$ }	1583742	
$5d'$ ^4D	$2s\ 2p(^3P^\circ)5d$	$5d$ $^4D^\circ$	{ $\frac{1}{2}$ to $3\frac{1}{2}$ }	*1589481+x*	
$5d'$ ^4P	$2s\ 2p(^3P^\circ)5d$	$5d$ $^4P^\circ$	{ $\frac{1}{2}$ to $2\frac{1}{2}$ }	*1590240+x*	
$5d'$ $^2F_3$ $^2F_4$	$2s\ 2p(^3P^\circ)5d$	$5d$ $^2F^\circ$	$2\frac{1}{2}$ $3\frac{1}{2}$	*1592815* *1593915*	11
$8d$ ^2D	$2s^2(^1S)8d$	$8d$ ^2D	{ $1\frac{1}{2}$ $2\frac{1}{2}$ }	1596400	
$4p''$ ^4D	$2p^2(^3P)4p$	$4p''$ $^4D^\circ$	{ $\frac{1}{2}$ to $3\frac{1}{2}$ }	*1646320+x*	
$6d'$ ^4P $6d'$ ^4D	$2s\ 2p(^3P^\circ)6d$	$6d$ $^4P^\circ$ $6d$ $^4D^\circ$	{ $\frac{1}{2}$ to $3\frac{1}{2}$ }	*1657724+x*	
$4d''$ $^4P_3$ $^4P_2$	$2p^2(^3P)4d$	$4d''$ ^4P	$2\frac{1}{2}$ $1\frac{1}{2}$ $\frac{1}{2}$	1668514+x 1668855+x	−341
	Na VIII ($^1S^\circ$)	*Limit*	------	*1681679*	

October 1946.

Na VII Observed Terms*

Config. $1s^2+$	Observed Terms		
$2s^2(^1S)2p$	$2p$ $^2P^\circ$		
$2s\ 2p^2$	{ $2p^2$ ^4P $2p^2$ ^2S $2p^2$ ^2P $2p^2$ ^2D		
$2p^3$	{ $2p^3$ $^4S^\circ$ $2p^3$ $^2P^\circ$ $2p^3$ $^2D^\circ$		
	ns ($n\geq 3$)	np ($n\geq 3$)	nd ($n\geq 3$)
$2s^2(^1S)nx$	3, $4s$ ^2S	$3p$ $^2P^\circ$	3–$8d$ ^2D
$2s\ 2p(^3P^\circ)nx$	{ 3, $4s$ $^4P^\circ$ 3, $4s$ $^2P^\circ$	$3p$ ^2S 3–$5p$ ^2P 3–$5p$ ^2D	3–$6d$ $^4P^\circ$ 3–$6d$ $^4D^\circ$ 3, $4d$ $^2P^\circ$ 3, $4d$ $^2D^\circ$ 3–$5d$ $^2F^\circ$
$2s\ 2p(^1P^\circ)nx'$	3, $4s'$ $^2P^\circ$	$3p'$ ^2S $3p'$ ^2P 3, $4p'$ ^2D	$3d'$ $^2P^\circ$ $3d'$ $^2D^\circ$ 3, $4d'$ $^2F^\circ$
$2p^2(^3P)nx''$	{ $3s''\,^4P$	$3p''$ $^4S^\circ$ $3p''$ $^4P^\circ$ 3, $4p''$ $^4D^\circ$ $3p''$ $^2D^\circ$	3, $4d''$ ^4P $3d''$ ^2D $3d''$ ^2F
$2p^2(^1D)nx'''$	$3s'''$ ^2D	$3p'''$ $^2D^\circ$ $3p'''$ $^2F^\circ$	$3d'''$ ^2P $3d'''$ ^2D $3d'''$ ^2F

*For predicted terms in the spectra of the B I isoelectronic sequence, see Introduction.

Na VIII

(Be I sequence; 4 electrons) $Z=11$

Ground state $1s^2\,2s^2\ ^1S_0$

$2s^2\ ^1S_0$ **2131139** cm^{-1} I. P. 264.155 volts

Eighty-six lines have been classified by Söderqvist, all but three of which are in the region between 51 A and 117 A. No intersystem combinations are known, but the absolute term values are well determined by the series, the relative uncertainty x being probably a few hundred cm^{-1}.

REFERENCE

J. Söderqvist, Ark. Mat. Astr. Fys. (Stockholm) **30A**, No. 11, p. 7 (1944). (I P) (T) (C L)

Na VIII

Author	Config.	Desig.	J	Level	Interval
$2s\ ^1S_0$	$2s^2$	$2s^2\ ^1S$	0	0	
$2p\ ^3P_0$	$2s(^2S)2p$	$2p\ ^3P^\circ$	0	*126053+x*	730
$^3P_1$			1	*126783+x*	1604
$^3P_2$			2	*128387+x*	
$2p\ ^1P_1$	$2s(^2S)2p$	$2p\ ^1P^\circ$	1	*243223*	
$2p'\ ^3P_0$	$2p^2$	$2p^2\ ^3P$	0	327667+x	827
$^3P_1$			1	328494+x	1405
$^3P_2$			2	329899+x	
$2p'\ ^1D_2$	$2p^2$	$2p^2\ ^1D$	2	361046	
$2p'\ ^1S_0$	$2p^2$	$2p^2\ ^1S$	0	446099	
$3s\ ^3S_1$	$2s(^2S)3s$	$3s\ ^3S$	1	1240255+x	
$3s\ ^1S_0$	$2s(^2S)3s$	$3s\ ^1S$	0	1262799	
$3p\ ^1P_1$	$2s(^2S)3p$	$3p\ ^1P^\circ$	1	*1294214*	
$3d\ ^3D_1$	$2s(^2S)3d$	$3d\ ^3D$	1	1327399+x	37
$^3D_2$			2	1327436+x	121
$^3D_3$			3	1327557+x	
$3d\ ^1D_2$	$2s(^2S)3d$	$3d\ ^1D$	2	1347756	
$3s'\ ^3P_0$	$2p(^2P^\circ)3s$	$3s\ ^3P^\circ$	0	*1399858+x*	805
$^3P_1$			1	*1400663+x*	1714
$^3P_2$			2	*1402377+x*	
$3s'\ ^1P_1$	$2p(^2P^\circ)3s$	$3s\ ^1P^\circ$	1	*1426049*	

Na VIII

Author	Config.	Desig.	J	Level	Interval
$3p'\ ^1P_1$	$2p(^2P^\circ)3p$	$3p\ ^1P$	1	1432991	
$3p'\ ^3D_1$	$2p(^2P^\circ)3p$	$3p\ ^3D$	1	1439584+x	846
$^3D_2$			2	1440430+x	1620
$^3D_3$			3	1442050+x	
$3p'\ ^3S_1$	$2p(^2P^\circ)3p$	$3p\ ^3S$	1	1452568+x	
	$2p(^2P^\circ)3p$	$3p\ ^3P$	0		
$3p'\ ^3P_1$			1	1460244+x	884
$^3P_2$			2	1461128+x	
$3d'\ ^1D_2$	$2p(^2P^\circ)3d$	$3d\ ^1D^\circ$	2	*1469055*	
$3p'\ ^1D_2$	$2p(^2P^\circ)3p$	$3p\ ^1D$	2	1474598	
$3p'\ ^1S_0$	$2p(^2P^\circ)3p$	$3p\ ^1S$	0	1481521	
$3d'\ ^3D_1$	$2p(^2P^\circ)3d$	$3d\ ^3D^\circ$	1	*1485329+x*	292
$^3D_2$			2	*1485621+x*	628
$^3D_3$			3	*1486249+x*	
$3d'\ ^3P_2$	$2p(^2P^\circ)3d$	$3d\ ^3P^\circ$	2	*1492167+x*	−642
$^3P_1$			1	*1492809+x*	−358
$^3P_0$			0	*1493167+x*	
$3d'\ ^1F_3$	$2p(^2P^\circ)3d$	$3d\ ^1F^\circ$	3	*1507690*	
$3d'\ ^1P_1$	$2p(^2P^\circ)3d$	$3d\ ^1P^\circ$	1	*1513677*	
$4s\ ^3S_1$	$2s(^2S)4s$	$4s\ ^3S$	1	1649682+x	
$4s\ ^1S_0$	$2s(^2S)4s$	$4s\ ^1S$	0	1656830	
$4p\ ^1P_1$	$2s(^2S)4p$	$4p\ ^1P^\circ$	1	*1673388*	

Na VIII—Continued

Author	Config.	Desig.	J	Level	Interval
$4d\ ^3D$	$2s(^2S)4d$	$4d\ ^3D$	1, 2, 3	1683549+x	
$4d\ ^1D_2$	$2s(^2S)4d$	$4d\ ^1D$	2	1689982	
$4p'\ ^1P_1$	$2p(^2P^\circ)4p$	$4p\ ^1P$	1	1813205	
	$2p(^2P^\circ)4p$	$4p\ ^3D$	1		
$4p'\ ^3D_2$			2	1816179+x	1283
$^3D_3$			3	1817462+x	
	$2p(^2P^\circ)4p$	$4p\ ^3P$	0		
			1		
$4p'\ ^3P_2$			2	1823044+x	
$4d'\ ^1D_2$	$2p(^2P^\circ)4d$	$4d\ ^1D^\circ$	2	*1827472*	
$4p'\ ^1D_2$	$2p(^2P^\circ)4p$	$4p\ ^1D$	2	1827658	
	$2p(^2P^\circ)4d$	$4d\ ^3D^\circ$	1		
			2		
$4d'\ ^3D_3$			3	*1833704*+x	
$4d'\ ^3P_2$	$2p(^2P^\circ)4d$	$4d\ ^3P^\circ$	2	*1835175*+x	
			1		
			0		
$4d'\ ^1F_3$	$2p(^2P^\circ)4d$	$4d\ ^1F^\circ$	3	*1838762*	
$5p\ ^1P_1$	$2s(^2S)5p$	$5p\ ^1P^\circ$	1	*1838911*	
$4d'\ ^1P_1$	$2p(^2P^\circ)4d$	$4d\ ^1P^\circ$	1	*1843384*	
$5d\ ^3D$	$2s(^2S)5d$	$5d\ ^3D$	1, 2, 3	1848841+x	

Na VIII—Continued

Author	Config.	Desig.	J	Level	Interval
$5d\ ^1D_2$	$2s(^2S)5d$	$5d\ ^1D$	2	1848978	
$6p\ ^1P_1$	$2s(^2S)6p$	$6p\ ^1P^\circ$	1	*1930912*	
$6d\ ^3D$	$2s(^2S)6d$	$6d\ ^3D$	1, 2, 3	1933601+x	
$6d\ ^1D_2$	$2s(^2S)6d$	$6d\ ^1D$	2	1935242	
$5p'\ ^3P$	$2p(^2P^\circ)5p$	$5p\ ^3P$	0, 1, 2	1988852+x	
$5p'\ ^1D_2$	$2p(^2P^\circ)5p$	$5p\ ^1D$	2	1990558	
$5d'\ ^1D_2$	$2p(^2P^\circ)5d$	$5d\ ^1D^\circ$	2	*1991118*	
$5d'\ ^3D$	$2p(^2P^\circ)5d$	$5d\ ^3D^\circ$	1, 2, 3	*1994540*+x	
$5d'\ ^3P$	$2p(^2P^\circ)5d$	$5d\ ^3P^\circ$	2, 1, 0	*1995095*+x	
$5d'\ ^1F_3$	$2p(^2P^\circ)5d$	$5d\ ^1F^\circ$	3	*1998029*	
$6p'\ ^3D$	$2p(^2P^\circ)6p$	$6p\ ^3D$	1, 2, 3	2077097+x	
$6d'\ ^3D$	$2p(^2P^\circ)6d$	$6d\ ^3D^\circ$	1, 2, 3	*2080630*+x	
$6d'\ ^3P$	$2p(^2P^\circ)6d$	$6d\ ^3P^\circ$	2, 1, 0	*2081335*+x	
$6d'\ ^1F_3$	$2p(^2P^\circ)6d$	$6d\ ^1F^\circ$	3	*2083106*	
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	Na IX ($^2S_{1/2}$)	*Limit*	------	**2131139**	

May 1946.

Na VIII Observed Terms*

Config. $1s^2+$	Observed Terms		
$2s^2$	$2s^2\ ^1S$		
$2s(^2S)2p$	$2p\ ^3P^\circ$ $2p\ ^1P^\circ$		
$2p^2$	$2p^2\ ^3P$ $2p^2\ ^1S$ $2p^2\ ^1D$		
	ns ($n \geq 3$)	np ($n \geq 3$)	nd ($n \geq 3$)
$2s(^2S)nx$	3, $4s\ ^3S$ 3, $4s\ ^1S$	3–$6p\ ^1P^\circ$	3–$6d\ ^3D$ 3–$6d\ ^1D$
$2p(^2P^\circ)nx$	$3s\ ^3P^\circ$ $3s\ ^1P^\circ$	$3p\ ^3S$ 3–$5p\ ^3P$ 3, 4, $6p\ ^3D$ $3p\ ^1S$ 3, $4p\ ^1P$ 3–$5p\ ^1D$	3–$6d\ ^3P^\circ$ 3–$6d\ ^3D^\circ$ 3, $4d\ ^1P^\circ$ 3–$5d\ ^1D^\circ$ 3–$6d\ ^1F^\circ$

*For predicted terms in the spectra of the Be I isoelectronic sequence, see Introduction.

Na IX

(Li I sequence; 3 electrons) $Z=11$

Ground state $1s^2\,2s\ ^2S_{1/2}$

$2s\ ^2S_{1/2}$ **2418520** cm^{-1} I. P. 299.78 volts

The analysis is by Söderqvist, who has classified 22 lines in this spectrum. They occur in the region 81 A to 44 A, with the exception of one line at 681 A.

Some of the relative levels have been connected by a study of the Rydberg denominators in the isoelectronic sequence rather than by the Ritz combination principle.

REFERENCE

J. Söderqvist, Ark. Mat. Astr. Fys. (Stockholm) **30A,** No. 11, p. 1 (1944). (I P) (T) (C L)

Na IX

Author	Config.	Desig.	J	Level	Interval
$2s\ ^2S_1$	$2s$	$2s\ ^2S$	½	0	
$2p\ ^2P_1$ $^2P_2$	$2p$	$2p\ ^2P^\circ$	½ 1½	*144038* *146688*	2650
$3s\ ^2S_1$	$3s$	$3s\ ^2S$	½	1375944	
$3p\ ^2P_1$ $^2P_2$	$3p$	$3p\ ^2P^\circ$	½ 1½	*1415368* *1416130*	762
$3d\ ^2D_2$ $^2D_3$	$3d$	$3d\ ^2D$	1½ 2½	1429980 1430204	224
$4s\ ^2S_1$	$4s$	$4s\ ^2S$	½	1840336	
$4p\ ^2P_{2\,1}$	$4p$	$4p\ ^2P^\circ$	{½ 1½}	*1856665*	
$4d\ ^2D_2$ $^2D_3$	$4d$	$4d\ ^2D$	1½ 2½	1862222 1862572	350
$5s\ ^2S_1$	$5s$	$5s\ ^2S$	½	2051922?	
$5p\ ^2P_{2\,1}$	$5p$	$5p\ ^2P^\circ$	{½ 1½}	*2059605*	
$5d\ ^2D_2$ $^2D_3$	$5d$	$5d\ ^2D$	1½ 2½	2062835 2062911	76
$6p\ ^2P_{2\,1}$	$6p$	$6p\ ^2P^\circ$	{½ 1½}	*2169668*	
$6d\ ^2D_2$ $^2D_3$	$6d$	$6d\ ^2D$	1½ 2½	2171366 2171553	187
$7p\ ^2P_{2\,1}$	$7p$	$7p\ ^2P^\circ$	{½ 1½}	*2235886*	
$7d\ ^2D_2$ $^2D_3$	$7d$	$7d\ ^2D$	1½ 2½	2237139 2237165	26
	Na X ($^1S_0$)	*Limit*	------	**2418520**	

May 1946.

MAGNESIUM

Mg I

12 electrons $Z=12$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\;{}^1S_0$

$3s^2\;{}^1S_0$ **61669.14** cm^{-1} I. P. 7.644 volts

The most complete term array is given in Paschen's 1931 paper, which has been extensively used in the present compilation.

Paschen lists the combinations $3d\;{}^3D-nf\;{}^3F^\circ$ (n=4,5) and $3d\;{}^1D-nf\;{}^1F^\circ$ (n=4–9), deriving from his infrared observations practically coincident values for the terms $nf\;{}^3F^\circ$ and $nf\;{}^1F^\circ$ for n=4 and n=5. Assuming that the two F-series were coincident throughout, Russell, Babcock, and the writer extended both series by the identification of Paschen's lines in the Infrared Solar Spectrum and by the discovery of the constant solar wave-number separation $3d\;{}^3D-3d\;{}^1D$ for predicted successive series members. The constancy of this separation and the behavior of the solar lines in the disk and spot spectra leave no doubt as to the correctness of the identifications, although laboratory observations are lacking for confirmation of many of the lines. The term values in the table for the F-series ($nf\;{}^1F^\circ$ to n=14 and $nf\;{}^3F^\circ$ to n=12) have been calculated from solar data, with a slight adjustment to Paschen's absolute values of $3d\;{}^3D$ and $3d\;{}^1D$, as indicated in the 1945 reference below.

The three-decimal values listed for the terms $3p\;{}^3P^\circ$ and $3d\;{}^3D$ are from Meissner's paper.

Sawyer suggests that Paschen's $6d\;{}^1D$ term (58023.27 cm^{-1} in the table) may have the designation $3p^2\;{}^1D$, in which case the n-values of the higher series members should be decreased by one unit. In accordance with the observations of Shenstone and Russell on related series, the $nd\;{}^1D$ series may well have absorbed the $3p^2\;{}^1D$ term. The present analysis indicates that throughout the D-series the singlets are lower than the corresponding triplet terms.

The singlet and triplet terms are well connected by intersystem combinations.

REFERENCES

F. Paschen, Sitz. Preuss. Akad. Wiss. **32**, 709 (1931). (I P) (T) (C L)

F. Paschen, Ann. der Phys. [5] **12**, 511 (1932). (T) (C L)

A. G. Shenstone and H. N. Russell, Phys. Rev. **39**, 431 (1932).

H. E. White, *Introduction to Atomic Spectra* p. 179 (McGraw-Hill Book Co., Inc., New York, N. Y., 1934). (G D)

K. W. Meissner, Ann. der Phys. [5] **31**, 518 (1938). (T) (C L)

L. G. Mundie and K. W. Meissner, Phys. Rev. **65**, 265 (1944). (I S)

H. D. Babock and C. E. Moore, Astroph. J. **101**, 374 (1945). (T) (C L)

Mg I

Config.	Desig.	J	Level	Interval
$3s^2$	$3s^2\ ^1S$	0	0.00	
$3s(^2S)3p$	$3p\ ^3P^\circ$	0 1 2	*21850.368* *21870.426* *21911.140*	20.058 40.714
$3s(^2S)3p$	$3p\ ^1P^\circ$	1	*35051.36*	
$3s(^2S)4s$	$4s\ ^3S$	1	41197.37	
$3s(^2S)4s$	$4s\ ^1S$	0	43503.0	
$3s(^2S)3d$	$3d\ ^1D$	2	46403.14	
$3s(^2S)4p$	$4p\ ^3P^\circ$	0, 1 2	*47847.7* *47851.8*	4.1
$3s(^2S)3d$	$3d\ ^3D$	3 2 1	47957.035 47957.018 47957.047	0.017 −0.029
$3s(^2S)4p$	$4p\ ^1P^\circ$	1	*49346.6*	
$3s(^2S)5s$	$5s\ ^3S$	1	51872.36	
$3s(^2S)5s$	$5s\ ^1S$	0	52556.37	
$3s(^2S)4d$	$4d\ ^1D$	2	53134.70	
$3s(^2S)4d$	$4d\ ^3D$	3, 2, 1	54192.16	
$3s(^2S)5p$	$5p\ ^3P^\circ$	0 1 2	 *54252.6*	
$3s(^2S)4f$	$4f\ ^3F^\circ$	2, 3, 4	*54676.38*	
$3s(^2S)4f$	$4f\ ^1F^\circ$	3	*54676.38*	
$3s(^2S)5p$	$5p\ ^1P^\circ$	1	*54699.4*	
$3s(^2S)6s$	$6s\ ^3S$	1	55891.83	
$3s(^2S)6s$	$6s\ ^1S$	0	56187.03	
$3s(^2S)5d$	$5d\ ^1D$	2	56308.43	
$3s(^2S)5d$	$5d\ ^3D$	3, 2, 1	56968.31	
$3s(^2S)6p$	$6p\ ^3P^\circ$	0, 1 2	*57018.8* *57020.1*	1.3
$3s(^2S)5f$	$5f\ ^3F^\circ$	2, 3, 4	*57204.22*	
$3s(^2S)5f$	$5f\ ^1F^\circ$	3	*57204.22*	
$3p^2$	$3p^2\ ^3P$	0 1 2	57812.72 57833.28 57873.89	20.56 40.61
$3s(^2S)7s$	$7s\ ^3S$	1	57853.5	
$3s(^2S)7s$	$7s\ ^1S$	0	58009.46	
$3s(^2S)6d$	$6d\ ^1D$	2	58023.27	
$3s(^2S)6d$	$6d\ ^3D$	3, 2, 1	58442.62	
$3s(^2S)7p$	$7p\ ^3P^\circ$	0, 1, 2	*58478.4*	
$3s(^2S)6f$	$6f\ ^3F^\circ$	2, 3, 4	*58575.54*	
$3s(^2S)6f$	$6f\ ^1F^\circ$	3	*58575.54*	
$3s(^2S)8s$	$8s\ ^3S$	1	58962.49	
$3s(^2S)7d$	$7d\ ^1D$	2	59041.09	

July 1947.

Mg I

Config.	Desig.	J	Level	Interval
$3s(^2S)7d$	$7d\ ^3D$	3, 2, 1	59317.4	
$3s(^2S)7f$	$7f\ ^3F^\circ$	2, 3, 4	*59400.77*	
$3s(^2S)7f$	$7f\ ^1F^\circ$	3	*59400.77*	
$3s(^2S)9s$	$9s\ ^3S$	1	59648.2	
$3s(^2S)8d$	$8d\ ^1D$	2	59690.02	
$3s(^2S)8d$	$8d\ ^3D$	3, 2, 1	59880.3	
$3s(^2S)8f$	$8f\ ^3F^\circ$	2, 3, 4	*59935.38*	
$3s(^2S)8f$	$8f\ ^1F^\circ$	3	*59935.38*	
$3s(^2S)10s$	$10s\ ^3S$	1	60103.5	
$3s(^2S)9d$	$9d\ ^1D$	2	60127.31	
$3s(^2S)9d$	$9d\ ^3D$	3, 2, 1	60263.0	
$3s(^2S)9f$	$9f\ ^3F^\circ$	2, 3, 4	*60301.30*	
$3s(^2S)9f$	$9f\ ^1F^\circ$	3	*60301.30*	
$3s(^2S)11s$	$11s\ ^3S$	1	60420.2	
$3s(^2S)10d$	$10d\ ^1D$	2	60435.15	
$3s(^2S)10d$	$10d\ ^3D$	3, 2, 1	60534.5	
$3s(^2S)10f$	$10f\ ^3F^\circ$	2, 3, 4	*60562.64*	
$3s(^2S)10f$	$10f\ ^1F^\circ$	3	*60562.64*	
$3s(^2S)12s$	$12s\ ^3S$	1	60649.2	
$3s(^2S)11d$	$11d\ ^1D$	2	60658.37	
$3s(^2S)11d$	$11d\ ^3D$	3, 2, 1	60734.0	
$3s(^2S)11f$	$11f\ ^3F^\circ$	2, 3, 4	*60755.78*	
$3s(^2S)11f$	$11f\ ^1F^\circ$	3	*60755.78*	
$3s(^2S)13s$	$13s\ ^3S$	1	60820.9	
$3s(^2S)12d$	$12d\ ^1D$	2	60826.6	
$3s(^2S)12d$	$12d\ ^3D$	3, 2, 1	60884.8	
$3s(^2S)12f$	$12f\ ^3F^\circ$	2, 3, 4	*60902.53*	
$3s(^2S)12f$	$12f\ ^1F^\circ$	3	*60902.53*	
$3s(^2S)14s$	$14s\ ^3S$	1	60952.0	
$3s(^2S)13d$	$13d\ ^1D$	2	60955.8	
$3s(^2S)13d$	$13d\ ^3D$	3, 2, 1	61002.2	
$3s(^2S)13f$	$13f\ ^1F^\circ$	3	*61016.42*	
$3s(^2S)14d$	$14d\ ^3D$	3, 2, 1	61094.6	
$3s(^2S)14f$	$14f\ ^1F^\circ$	3	*61106.98*	
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Mg II $(^2S_{1/2})$	***Limit***	----------	**61669.14**	
$3p(^2P^\circ)3d$	$3d\ ^1F^\circ$	3	*80693.2*	
$3p(^2P^\circ)3d$	$3d\ ^3D^\circ$	1 2 3	*83510.73* *83519.98* *83536.22*	9.25 16.24

Mg I OBSERVED TERMS*

Config. $1s^2\,2s^2\,2p^6+$	Observed Terms			
$3s^2$	$3s^2\ ^1S$			
$3s(^2S)3p$	$3p\ ^3P°$ $3p\ ^1P°$			
$3p^2$	$3p^2\ ^3P$			
	$ns\ (n\geq4)$	$np\ (n\geq4)$	$nd\ (n\geq3)$	$nf\ (n\geq4)$
$3s(^2S)nx$	4–14s ^3S 4– 7s ^1S	4–7p $^3P°$ 4, 5p $^1P°$	3–14d ^3D 3–13d ^1D	4–12f $^3F°$ 4–14f $^1F°$
$3p(^2P°)nx$			$3d\ ^3D°$ $3d\ ^1F°$	

*For predicted terms in the spectra of the Mg I isoelectronic sequence, see Introduction.

Mg II

(Na I sequence; 11 electrons) $Z=12$

Ground state $1s^2\,2s^2\,2p^6\,3s\ ^2S_{1/2}$

$3s\ ^2S_{1/2}$ **121267.41** cm^{-1} I. P. 15.03 volts

The analysis is from Fowler and Paschen-Götze. Mundie and Meissner calculate the separation of $3d\ ^2D$ to be 1.000 ± 0.002 cm^{-1} (entered in brackets in the table). In 1913 A. S. King observed the line at 4481 A ($3d\ ^2D-4f\ ^2F°$) as double, the violet component being about twice as strong as the red, thus indicating that the term $3d\ ^2D$ is inverted.

REFERENCES

A. S. King, Astroph. J. **38**, 327 (1913).

F. Paschen und R. Götze, *Seriengesetze der Linienspektren*, p. 103 (Julius Springer, Berlin, 1922). (T) (C L)

A. Fowler, *Report on Series in Line Spectra*, p. 118 (Fleetway Press, London, 1922). (I P) (T) (C L)

R. F. Bacher and S. Goudsmit, *Atomic Energy States*, p. 273 (McGraw-Hill Book Co., Inc., New York and London, 1932). (T)

H. E. White, *Introduction to Atomic Spectra*, p. 98 (McGraw-Hill Book Co., Inc., New York, N. Y., 1934). (G D)

L. G. Mundie and K. W. Meissner, Phys. Rev. **65**, 272 (1944). (I S)

Mg II

Config.	Desig.	*J*	Level	Interval
3*s*	3*s* ^{2}S	½	0.00	
3*p*	3*p* ^{2}P°	½ 1½	*35669.42* *35760.97*	91.55
4*s*	4*s* ^{2}S	½	69805.19	
3*d*	3*d* ^{2}D	2½ 1½	71490.41 71491.32	[−1.000]
4*p*	4*p* ^{2}P°	½ 1½	*80620.8* *80651.3*	30.5
5*s*	5*s* ^{2}S	½	92786.2	
4*d*	4*d* ^{2}D	{ 1½ 2½	} 93312.1	
4*f*	4*f* ^{2}F°	{ 2½ 3½	} *93800.0*	
5*p*	5*p* ^{2}P°	½ 1½	*97454.9* *97469.0*	14.1
6*s*	6*s* ^{2}S	½	103198.1	
5*d*	5*d* ^{2}D	{ 1½ 2½	} 103421.1	
5*f*	5*f* ^{2}F°	{ 2½ 3½	} *103690.2*	
6*p*	6*p* ^{2}P°	½ 1½	*105623.1* *105630.7*	7.6
7*s*	7*s* ^{2}S	½	108784.7	
6*d*	6*d* ^{2}D	{ 1½ 2½	} 108900.9	
6*f*	6*f* ^{2}F°	{ 2½ 3½	} *109062.6*	
6*g*	6*g* ^{2}G	{ 3½ 4½	} 109073.2	
8*s*	8*s* ^{2}S	½	112129.8	

Mg II

Config.	Desig.	*J*	Level	Interval
7*d*	7*d* ^{2}D	{ 1½ 2½	} 112198.0	
7*f*	7*f* ^{2}F°	{ 2½ 3½	} *112301.8*	
7*g*	7*g* ^{2}G	{ 3½ 4½	} 112310.2	
9*s*	9*s* ^{2}S	½	114292.2	
8*d*	8*d* ^{2}D	{ 1½ 2½	} 114335.7	
8*f*	8*f* ^{2}F°	{ 2½ 3½	} *114403.6*	
8*g*	8*g* ^{2}G	{ 3½ 4½	} 114408.6	
9*f*	9*f* ^{2}F°	{ 2½ 3½	} *115845.1*	
9*g*	9*g* ^{2}G	{ 3½ 4½	} 115848.6	
10*f*	10*f* ^{2}F°	{ 2½ 3½	} *116875.7*	
10*g*	10*g* ^{2}G	{ 3½ 4½	} 116878.2	
11*f*	11*f* ^{2}F°	{ 2½ 3½	} *117638.3*	
11*g*	11*g* ^{2}G	{ 3½ 4½	} 117640.6	
12*f*	12*f* ^{2}F°	{ 2½ 3½	} *118218.5*	
12*g*	12*g* ^{2}G	{ 3½ 4½	} 118220.2	
Mg III (^{1}S$_0$)	*Limit*	---------	121267.41	

May 1947.

Mg III

(Ne I sequence; 10 electrons) $Z=12$

Ground state $1s^2\ 2s^2\ 2p^6\ ^1S_0$

$2p^6\ ^1S_0$ **646364** cm^{-1} I. P. 80.12 volts

The analysis has been taken from Söderqvist's Monograph. The term designations he assigns on the assumption of *LS*-coupling are given with his notation under the heading "Author" in the table.

As for Ne I, the *jl*-coupling notation is introduced in the general form suggested by Racah. Shortley has, however, pointed out that the configurations $2p^5\ 3s$, $2p^5\ 3p$, and $2p^5\ 3d$ are much closer to *LS*-coupling than to *jl*-coupling.

REFERENCES

J. Söderqvist, Nova Acta Reg. Soc. Sci. Uppsala [IV] **9,** No. 7, 22 (1934). (I P) (T) (C L) (G D).
G. Racah, Phys. Rev. **61,** 537 (L) (1942).
G. Shortley, unpublished material (1948).

Mg III

Author	Config.	Desig.	*J*	Level
$2p\ ^1S_0$	$2p^6$	$2p^6\ ^1S$	0	0.0
$3s\ ^3P_2$	$2p^5(^2P^\circ_{1\frac{1}{2}})3s$	$3s\ [1\frac{1}{2}]^\circ$	2	*425649.1*
$^3P_1$			1	*426877.0*
$3s\ ^3P_0$	$2p^5(^2P^\circ_{\frac{1}{2}})3s$	$3s'[\ \frac{1}{2}]^\circ$	0	*427861.1*
$^1P_1$			1	*431539.0*
$3p_{10}\ ^3S_1$	$2p^5(^2P^\circ_{1\frac{1}{2}})3p$	$3p\ [\ \frac{1}{2}]$	1	467387.3
$3p_9\ ^3D_3$	"	$3p\ [2\frac{1}{2}]$	3	474062.6
$3p_8\ ^3D_2$			2	474663.6
$3p_7\ ^3D_1$	"	$3p\ [1\frac{1}{2}]$	1	475511.4
$3p_6\ ^1D_2$			2	477444.9
$3p_3\ ^3P_0$	"	$3p\ [\ \frac{1}{2}]$	0	479275.3
$3p_5\ ^1P_1$	$2p^5(^2P^\circ_{\frac{1}{2}})3p$	$3p'[1\frac{1}{2}]$	1	478383.8
$3p_4\ ^3P_2$			2	478855.5
$3p_2\ ^3P_1$	"	$3p'[\ \frac{1}{2}]$	1	479465.4
$3p_1\ ^1S_0$			0	484439.3
$3d\ ^3P_0$	$2p^5(^2P^\circ_{1\frac{1}{2}})3d$	$3d\ [\ \frac{1}{2}]^\circ$	0	*530186.4*
$^3P_1$			1	*530429.5*
$3d\ ^3P_2$	"	$3d\ [1\frac{1}{2}]^\circ$	2	*530972.0*
$3d\ ^3F_4$	"	$3d\ [3\frac{1}{2}]^\circ$	4	*531569.9*
$^3F_3$			3	*531838.5*
$3d\ ^3F_2$	"	$3d\ [2\frac{1}{2}]^\circ$	2	*532731.8*
$^1F_3$			3	*532978.0*
$3d\ ^1P_1$	"	$3d\ [1\frac{1}{2}]^\circ$	1	*534204.1*
$3d\ ^1D_2$	$2p^5(^2P^\circ_{\frac{1}{2}})3d$	$3d'[2\frac{1}{2}]^\circ$	2	*534782.2*
$^3D_3$			3	*534931.0*
$3d\ ^3D_2$	"	$3d'[1\frac{1}{2}]^\circ$	2	*535185.9*
$^3D_1$			1	*536156.7*
	$2p^5(^2P^\circ_{1\frac{1}{2}})4s$	$4s\ [1\frac{1}{2}]^\circ$	2	
$4s\ ^3P_1$			1	*546529*
	$2p^5(^2P^\circ_{\frac{1}{2}})4s$	$4s'[\ \frac{1}{2}]^\circ$	0	
$4s\ ^1P_1$			1	*548727*

Mg III

Author	Config.	Desig.	*J*	Level
	$2p^5(^2P^\circ_{1\frac{1}{2}})4d$	$4d\ [\ \frac{1}{2}]^\circ$	0	
$4d\ ^3P_1$			1	*581747*
$4d\ ^1P_1$	"	$4d\ [1\frac{1}{2}]^\circ$	1	*583448*
	$2p^5(^2P^\circ_{\frac{1}{2}})4d$	$4d'[1\frac{1}{2}]^\circ$	2	
$4d\ ^3D_1$			1	*585473*
	$2p^5(^2P^\circ_{1\frac{1}{2}})5s$	$5s\ [1\frac{1}{2}]^\circ$	2	
$5s\ ^3P_1$			1	*589116*
	$2p^5(^2P^\circ_{\frac{1}{2}})5s$	$5s'[\ \frac{1}{2}]^\circ$	0	
$5s\ ^1P_1$			1	*591191*
	$2p^5(^2P^\circ_{1\frac{1}{2}})5d$	$5d\ [\ \frac{1}{2}]^\circ$	0	
$5d\ ^3P_1$			1	*605345*
$5d\ ^1P_1$	"	$5d\ [1\frac{1}{2}]^\circ$	1	*606230*
	$2p^5(^2P^\circ_{\frac{1}{2}})5d$	$5d'[1\frac{1}{2}]^\circ$	2	
$5d\ ^3D_1$			1	*608332*
	$2p^5(^2P^\circ_{1\frac{1}{2}})6s$	$6s\ [1\frac{1}{2}]^\circ$	2	
$6s\ ^3P_1$			1	*609166*
	$2p^5(^2P^\circ_{\frac{1}{2}})6s$	$6s'[\ \frac{1}{2}]^\circ$	0	
$6s\ ^1P_1$			1	*611299*
$6d\ ^1P_1$	$2p^5(^2P^\circ_{1\frac{1}{2}})6d$	$6d\ [1\frac{1}{2}]^\circ$	1	*618483*
	$2p^5(^2P^\circ_{\frac{1}{2}})6d$	$6d'[1\frac{1}{2}]^\circ$	2	
$6d\ ^3D_1$			1	*620598*
$7d\ ^1P_1$	$2p^5(^2P^\circ_{1\frac{1}{2}})7d$	$7d\ [1\frac{1}{2}]^\circ$	1	*625958*
	$2p^5(^2P^\circ_{\frac{1}{2}})7d$	$7d'[1\frac{1}{2}]^\circ$	2	
$7d\ ^3D_1$			1	*628105*
$8d\ ^1P_1$	$2p^5(^2P^\circ_{1\frac{1}{2}})8d$	$8d\ [1\frac{1}{2}]^\circ$	1	*630795*
	Mg IV $(^2P^\circ_{1\frac{1}{2}})$	***Limit***	-------	**646364**
	Mg IV $(^2P^\circ_{\frac{1}{2}})$	*Limit*	-------	648590

July 1947.

Mg III OBSERVED LEVELS*

Config. $1s^2\ 2s^2+$	Observed Terms		
$2p^6$	$2p^6\ ^1S$		
	$ns\ (n\geq3)$	$np\ (n\geq3)$	$nd\ (n\geq3)$
$2p^5(^2P^\circ)nx$	3–6s $^3P^\circ$ 3–6s $^1P^\circ$	$3p\ ^3S$ $3p\ ^3P$ $3p\ ^3D$ $3p\ ^1S$ $3p\ ^1P$ $3p\ ^1D$	3–5$d\ ^3P^\circ$ 3–7$d\ ^3D^\circ$ $3d\ ^3F^\circ$ 3–8$d\ ^1P^\circ$ $3d\ ^1D^\circ$ $3d\ ^1F^\circ$
jl-Coupling Notation			
	Observed Pairs		
	$ns\ (n\geq3)$	$np\ (n\geq3)$	$nd\ (n\geq3)$
$2p^5(^2P^\circ_{1\frac{1}{2}})nx$	3–6s $[1\frac{1}{2}]^\circ$	$3p\ [\frac{1}{2}]$ $3p\ [2\frac{1}{2}]$ $3p\ [1\frac{1}{2}]$	3–5$d\ [\frac{1}{2}]^\circ$ $3d\ [3\frac{1}{2}]^\circ$ 3–8$d\ [1\frac{1}{2}]^\circ$ $3d\ [2\frac{1}{2}]^\circ$
$2p^5(^2P^\circ_{\frac{1}{2}})nx'$	3–6s' $[\frac{1}{2}]^\circ$	$3p'\ [1\frac{1}{2}]$ $3p'\ [\frac{1}{2}]$	$3d'\ [2\frac{1}{2}]^\circ$ 3–7$d'\ [1\frac{1}{2}]^\circ$

*For predicted levels in the spectra of the Ne I isoelectronic sequence, see Introduction.

Mg IV

(F I sequence; 9 electrons) $Z=12$

Ground state $1s^2\ 2s^2\ 2p^5\ ^2P^\circ_{1\frac{1}{2}}$

$2p^5\ ^2P^\circ_{1\frac{1}{2}}$ *881759* cm^{-1} I. P. 109.29 volts

The analysis is by Söderqvist, who has classified more than 70 lines, 13 in the interval 1459 A to 1956 A, and the rest between 123 A and 323 A.

From later isoelectronic sequence data Robinson has revised Söderqvist's $3d'\ ^2S$ and $4d\ ^2D$ terms, rejected his $3d\ ^4D$ term, and added $3d\ ^2F$; 3, $4d\ ^4P$; $3d\ ^4F$, and $3d'\ ^2F$. These revisions have been incorporated into the table.

Intersystem combinations connecting the doublet and quartet systems of terms, have been observed.

REFERENCES

J. Söderqvist, Nova Acta Reg. Soc. Sci. Uppsala [IV] **9**, No. 7, 39 (1934). (I P) (T) (C L)

H. A. Robinson, unpublished material (March 1948). (T) (C L)

Config.	Desig.	J	Level	Interval
$2s^2\,2p^5$	$2p^5\ ^2P^\circ$	1½ ½	*0* *2226*	−2226
$2s\,2p^6$	$2p^6\ ^2S$	½	311527	
$2s^2\,2p^4(^3P)3s$	$3s\ ^4P$	2½ 1½ ½	543727.0 545143.5 545962.1	−1416.5 −818.6
$2s^2\,2p^4(^3P)3s$	$3s\ ^2P$	1½ ½	553659 555338	−1679
$2s^2\,2p^4(^1D)3s$	$3s'\ ^2D$	2½ 1½	582571 582589	−18
$2s^2\,2p^4(^3P)3p$	$3p\ ^4P^\circ$	2½ 1½ ½	*596527.3* *597071.9* *597589.9*	−544.6 −518.0
$2s^2\,2p^4(^3P)3p$	$3p\ ^4D^\circ$	3½ 2½ 1½ ½	*603143.3* *604007.4* *604666.6*	−864.1 −659.2
$2s^2\,2p^4(^3P)3p$	$3p\ ^4S^\circ$	1½	*612240.3*	
$2s^2\,2p^4(^1S)3s$	$3s''\ ^2S$	½	624102	
$2s^2\,2p^4(^3P)3d$	$3d\ ^4P$	2½ 1½ ½	676837 677805	−968
$2s^2\,2p^4(^3P)3d$	$3d\ ^4F$	4½ 3½ 2½ 1½	 677355	
$2s^2\,2p^4(^3P)3d$	$3d\ ^2D$	2½ 1½	678403 680030	−1627
$2s^2\,2p^4(^3P)3d$	$3d\ ^2F$	3½ 2½	 680510	
$2s^2\,2p^4(^3P)3d$	$3d\ ^2P$	½ 1½	681024 682471	1447

Config.	Desig.	J	Level	Interval
$2s^2\,2p^4(^1D)3d$	$3d'\ ^2P$	½ 1½	711622 711865	243
$2s^2\,2p^4(^1D)3d$	$3d'\ ^2D$	1½ 2½	712120 713389	1269
$2s^2\,2p^4(^1D)3d$	$3d'\ ^2F$	3½ 2½	 713660	
$2s^2\,2p^4(^1D)3d$	$3d'\ ^2S$	½	714330	
$2s^2\,2p^4(^3P)4s$	$4s\ ^2P$	1½ ½	723254 724809	−1555
$2s^2\,2p^4(^1S)3d$	$3d''\ ^2D$	2½ 1½	752927 752965	−38
$2s^2\,2p^4(^3P)4d$	$4d\ ^2D$	2½ 1½	767454 770799	−3345
$2s^2\,2p^4(^3P)4d$	$4d\ ^4P$	½ 1½ 2½	 767769 768728	959
$2s^2\,2p^4(^3P)4d$	$4d\ ^2P$	½ 1½	769397 770056	659
$2s^2\,2p^4(^1S)4s$	$4s''\ ^2S$	½	797062	
$2s^2\,2p^4(^1D)4d$	$4d'\ ^2P$	{ ½ 1½ }	802272	
$2s^2\,2p^4(^1D)4d$	$4d'\ ^2D$	{ 1½ 2½ }	803023	
$2s^2\,2p^4(^1D)4d$	$4d'\ ^2S$	½	803769	
$2s^2\,2p^4(^3P)5d$	$5d\ ^2D$	2½ 1½	809677 811362	−1685
$2s^2\,2p^4(^3P)5d$	$5d\ ^2P$	{ ½ 1½ }	810543	
Mg V $(^3P_2)$	*Limit*	-------	*881759*	

March 1948.

Mg IV Observed Terms*

Config. $1s^2+$	Observed Terms		
$2s^2\,2p^5$	$2p^5\ ^2P^\circ$		
$2s\,2p^6$	$2p^6\ ^2S$		
	$ns\ (n\geq3)$	$np\ (n\geq3)$	$nd\ (n\geq3)$
$2s^2\,2p^4(^3P)nx$	{ $3s\ ^4P$ $3, 4s\ ^2P$	$3p\ ^4S^\circ$ $3p\ ^4P^\circ$ $3p\ ^4D^\circ$	$3, 4d\ ^4P$ $3d\ ^4F$ $3\text{–}5d\ ^2P$ $3\text{–}5d\ ^2D$ $3d\ ^2F$
$2s^2\,2p^4(^1D)nx'$	$3s'\ ^2D$		$3, 4d'\ ^2S$ $3, 4d'\ ^2P$ $3, 4d'\ ^2D$ $3d'\ ^2F$
$2s^2\,2p^4(^1S)nx''$	$3, 4s''\ ^2S$		$3d''\ ^2D$

*For predicted terms in the spectra of the F I isoelectronic sequence, see Introduction.

Mg V

(O I sequence; 8 electrons) $Z=12$

Ground state $1s^2\,2s^2\,2p^4\;{}^3P_2$

$2p^4\;{}^3P_2$ **1139421** cm^{-1} I. P. 141.23 volts

Söderqvist has found 53 terms and classified 113 lines in this spectrum in the interval between 92 A and 355 A. No intersystem combinations have been observed and the uncertainty, x, may be considerable.

REFERENCE

J. Söderqvist, Ark. Mat. Astr. Fys. (Stockholm) **32A**, No. 19 p. 4 (1946). (I P) (T) (C L)

Mg V

Author	Config.	Desig.	J	Level	Interval
$2p$ $^3P_2$ $^3P_1$ $^3P_0$	$2s^2\,2p^4$	$2p^4\;{}^3P$	2 1 0	0 1780 2519	−1780 −739
$2p$ $^1D_2$	$2s^2\,2p^4$	$2p^4\;{}^1D$	2	36348+x	
$2p$ $^1S_0$	$2s^2\,2p^4$	$2p^4\;{}^1S$	0	77712+x	
$2p'$ $^3P_2$ $^3P_1$ $^3P_0$	$2s\;2p^5$	$2p^5\;{}^3P^\circ$	2 1 0	283211 284827 285708	−1616 −881
$2p'$ $^1P_1$	$2s\;2p^5$	$2p^5\;{}^1P^\circ$	1	397906+x	
$3s$ $^3S_1$	$2s^2\,2p^3(^4S^\circ)3s$	$3s\;{}^3S^\circ$	1	684544	
$\overline{3s}$ $^3D_3$ $^3D_2$ $^3D_1$	$2s^2\,2p^3(^2D^\circ)3s$	$3s'\;{}^3D^\circ$	3 2 1	727718 727763 727787	−45 −24
$\overline{3s}$ $^1D_2$	$2s^2\,2p^3(^2D^\circ)3s$	$3s'\;{}^1D^\circ$	2	735976+x	
 $\overline{\overline{3s}}$ $^3P_1$ $^3P_2$	$2s^2\,2p^3(^2P^\circ)3s$	$3s''\;{}^3P^\circ$	0 1 2	 756536 756589	53
$\overline{\overline{3s}}$ $^1P_1$	$2s^2\,2p^3(^2P^\circ)3s$	$3s''\;{}^1P^\circ$	1	765049+x	
$3d$ $^3D_1$ $^3D_2$ $^3D_3$	$2s^2\,2p^3(^4S^\circ)3d$	$3d\;{}^3D^\circ$	1 2 3	821963 821977 822071	14 94
$\overline{3d}$ ^3D	$2s^2\,2p^3(^2D^\circ)3d$	$3d'\;{}^3D^\circ$	1, 2, 3	871221	
$\overline{3d}$ $^1P_1$	$2s^2\,2p^3(^2D^\circ)3d$	$3d'\;{}^1P^\circ$	1	873862+x	
$\overline{3d}$ $^3P_2$ $^3P_1$ $^3P_0$	$2s^2\,2p^3(^2D^\circ)3d$	$3d'\;{}^3P^\circ$	2 1 0	876762 877244 877444	−482 −200
$\overline{3d}$ $^1D_2$	$2s^2\,2p^3(^2D^\circ)3d$	$3d'\;{}^1D^\circ$	2	878028+x	
$\overline{3d}$ $^3S_1$	$2s^2\,2p^3(^2D^\circ)3d$	$3d'\;{}^3S^\circ$	1	879485	
$\overline{3d}$ $^1F_3$	$2s^2\,2p^3(^2D^\circ)3d$	$3d'\;{}^1F^\circ$	3	883210+x	
$\overline{\overline{3d}}$ $^3P_0$ $^3P_1$ $^3P_2$	$2s^2\,2p^3(^2P^\circ)3d$	$3d''\;{}^3P^\circ$	0 1 2	898673 898904 899291	231 387
$\overline{\overline{3d}}$ $^1D_2$	$2s^2\,2p^3(^2P^\circ)3d$	$3d''\;{}^1D^\circ$	2	901872+x	

Mg V

Author	Config.	Desig.	J	Level	Interval
$\overline{\overline{3d}}$ $^3D_3$ $^3D_2$ $^3D_1$	$2s^2\,2p^3(^2P^\circ)3d$	$3d''\;{}^3D^\circ$	3 2 1	902047 902441 902682	−394 −241
$\overline{\overline{3d}}$ $^1P_1$	$2s^2\,2p^3(^2P^\circ)3d$	$3d''\;{}^1P^\circ$	1	902907+x	
$\overline{\overline{3d}}$ $^1F_3$	$2s^2\,2p^3(^2P^\circ)3d$	$3d''\;{}^1F^\circ$	3	905211+x	
$4s$ $^3S_1$	$2s^2\,2p^3(^4S^\circ)4s$	$4s\;{}^3S^\circ$	1	910639	
$3s'$ $^3P_2$ $^3P_1$	$2s\;2p^4(^4P)3s$	$3s'''\;{}^3P$	2 1 0	940455 941048	−593
$\overline{4s}$ ^3D	$2s^2\,2p^3(^2D^\circ)4s$	$4s'\;{}^3D^\circ$	3, 2, 1	962027	
$4d$ $^3D_1$ $^3D_2$ $^3D_3$	$2s^2\,2p^3(^4S^\circ)4d$	$4d\;{}^3D^\circ$	1 2 3	962378 962395 962427	17 32
$\overline{4s}$ $^1D_2$	$2s^2\,2p^3(^2D^\circ)4s$	$4s'\;{}^1D^\circ$	2	965189+x	
$\overline{\overline{4s}}$ ^3P	$2s^2\,2p^3(^2P^\circ)4s$	$4s''\;{}^3P^\circ$	0, 1, 2	990599	
$\overline{\overline{4s}}$ $^1P_1$	$2s^2\,2p^3(^2P^\circ)4s$	$4s''\;{}^1P^\circ$	1	993795+x	
$5s$ $^3S_1$	$2s^2\,2p^3(^4S^\circ)5s$	$5s\;{}^3S^\circ$	1	1002125	
$\overline{4d}$ ^3D	$2s^2\,2p^3(^2D^\circ)4d$	$4d'\;{}^3D^\circ$	1, 2, 3	1013878	
$\overline{4d}$ $^1P_1$	$2s^2\,2p^3(^2D^\circ)4d$	$4d'\;{}^1P^\circ$	1	1015981+x	
$\overline{4d}$ $^3P_2$ $^3P_1$	$2s^2\,2p^3(^2D^\circ)4d$	$4d'\;{}^3P^\circ$	2 1 0	1017590 1017972	−382
$\overline{4d}$ $^1D_2$	$2s^2\,2p^3(^2D^\circ)4d$	$4d'\;{}^1D^\circ$	2	1018840+x	
$\overline{4d}$ $^1F_3$	$2s^2\,2p^3(^2D^\circ)4d$	$4d'\;{}^1F^\circ$	3	1019913+x	
$\overline{3s'}$ $^3D_1$ $^3D_2$ $^3D_3$	$2s\;2p^4(^2D)3s$	$3s^{IV}\;{}^3D$	1 2 3	1020311 1020375 1020468	64 93
$3p'$ ^3D	$2s\;2p^4(^4P)3p$	$3p'''\;{}^3D^\circ$	1, 2, 3	1026283	
$5d$ ^3D	$2s^2\,2p^3(^4S^\circ)5d$	$5d\;{}^3D^\circ$	1, 2, 3	1026774	
 $\overline{\overline{4d}}$ $^3P_1$ $^3P_2$	$2s^2\,2p^3(^2P^\circ)4d$	$4d''\;{}^3P^\circ$	0 1 2	 1042481 1042681	200

Mg V—Continued

Author	Config.	Desig.	J	Level	Interval
$\overline{4d}$ ^3D	$2s^2\,2p^3(^2P^\circ)4d$	$4d''$ $^3D^\circ$	1, 2, 3	*1043818*	
$\overline{\overline{4d}}$ $^1D_2$	$2s^2\,2p^3(^2P^\circ)4d$	$4d''$ $^1D^\circ$	2	*1045766+x*	
$\overline{\overline{4d}}$ $^1P_1$	$2s^2\,2p^3(^2P^\circ)4d$	$4d''$ $^1P^\circ$	1	*1046201+x*	
$\overline{\overline{4d}}$ $^1F_3$	$2s^2\,2p^3(^2P^\circ)4d$	$4d''$ $^1F^\circ$	3	*1046625+x*	
$\overline{5s}$ ^3D	$2s^2\,2p^3(^2D^\circ)5s$	$5s'$ $^3D^\circ$	3, 2, 1	*1054921*	
$3d'$ ^3D	$2s\ 2p^4(^4P)3d$	$3d'''$ ^3D	1, 2, 3	1075102	
$\overline{5d}$ ^3D	$2s^2\,2p^3(^2D^\circ)5d$	$5d'$ $^3D^\circ$	1, 2, 3	*1079431*	
$\overline{5d}$ $^3P_2$	$2s^2\,2p^3(^2D^\circ)5d$	$5d'$ $^3P^\circ$	2	*1081883*	
$^3P_1$			1	*1082146*	−263
			0		

Mg V—Continued

Author	Config.	Desig.	J	Level	Interval
$\overline{5d}$ $^1D_2$	$2s^2\,2p^2(^2D^\circ)5d$	$5d'$ $'D^\circ$	2	*1082461+x*	
$\overline{5d}$ $^1F_3$	$2s^2\,2p^3(^2D^\circ)5d$	$5d'$ $^1F^\circ$	3	*1082855+x*	
$\overline{\overline{5d}}$ $^1D_2$	$2s^2\,2p^3(^2P^\circ)5d$	$5d''$ $^1D^\circ$	2	*1110358+x*	
	Mg VI ($^4S^\circ_{1\frac{1}{2}}$)	***Limit***	------	**1139421**	
$4s'$ $^3P_2$	$2s\ 2p^4(^4P)4s$	$4s'''$ ^3P	2	1161768	
			1		
			0		
$\overline{3d'}$ $^3D_3$	$2s\ 2p^4(^2D)3d$	$3d^{IV}$ ^3D	3	1166471	
$^3D_2$			2	1166552	−81
$^3D_1$			1	1166626	−74
$5s'$ $^3P_2$	$2s\ 2p^4(^4P)5s$	$5s'''$ ^3P	2	1250956	
			1		
			0		

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Mg v Observed Terms*

Config. $1s^2+$	Observed Terms		
$2s^2\,2p^4$	$2p^4$ ^1S; $2p^4$ ^3P; $2p^4$ ^1D		
$2s\ 2p^5$	$2p^5$ $^3P^\circ$; $2p^5$ $^1P^\circ$		
	$ns\ (n\geq 3)$	$np\ (n\geq 3)$	$nd\ (n\geq 3)$
$2s^2\,2p^3(^4S^\circ)nx$	3–5s $^3S^\circ$		3–5d $^3D^\circ$
$2s^2\,2p^3(^2D^\circ)nx'$	3–5s' $^3D^\circ$; 3, 4s' $^1D^\circ$		$3d'$ $^3S^\circ$; 3–5d' $^3P^\circ$; 3, 4d' $^1P^\circ$; 3–5d' $^3D^\circ$; 3–5d' $^1D^\circ$; 3–5d' $^1F^\circ$
$2s^2\,2p^3(^2P^\circ)nx''$	3, 4s'' $^3P^\circ$; 3, 4s'' $^1P^\circ$		3, 4d'' $^3P^\circ$; 3, 4d'' $^1P^\circ$; 3, 4d'' $^3D^\circ$; 3–5d'' $^1D^\circ$; 3, 4d'' $^1F^\circ$
$2s\ 2p^4(^4P)nx'''$	3–5s''' ^3P	$3p'''$ $^3D^\circ$	$3d'''$ ^3D
$2s\ 2p^4(^2D)nx^{IV}$	$3s^{IV}$ ^3D		$3d^{IV}$ ^3D

*For predicted terms in the spectra of the O I isoelectronic sequence, see Introduction.

Mg VI

(N I sequence; 7 electrons) $Z=12$

Ground state $1s^2\,2s^2\,2p^3\ ^4S^\circ_{1\frac{1}{2}}$

$2p^3\ ^4S^\circ_{1\frac{1}{2}}$ ***1507520*** cm^{-1} I. P. 186.86 volts

The analysis is by Söderqvist, who has found 56 terms and classified 124 lines in the range 72 A to 403 A. No intersystem combinations have been observed. The observations indicate an evident typographical error in the published absolute value of $2p^4$ ^2P, which has been corrected. The series are short and the uncertainty, x, may be considerable.

REFERENCE

J. Söderqvist, Ark. Mat. Astr. Fys. (Stockholm) **32A,** No. 19 p. 4 (1946). (I P) (T) (C L)

Mg VI

Author	Config.	Desig.	J	Level	Interval
$2p\ ^4S_2$	$2s^2\,2p^3$	$2p^3\ ^4S^\circ$	1½	*0*	
$2p\ ^2D_3$ $^2D_2$	$2s^2\,2p^3$	$2p^3\ ^2D^\circ$	2½ 1½	*54150+x* *54171+x*	−21
$2p\ ^2P_1$ $^2P_2$	$2s^2\,2p^3$	$2p^3\ ^2P^\circ$	½ 1½	*82710+x* *82832+x*	122
$2p'\ ^4P_3$ $^4P_2$ $^4P_1$	$2s\ 2p^4$	$2p^4\ ^4P$	2½ 1½ ½	247945 249578 250445	−1633 −867
$2p'\ ^2D_3$ $^2D_2$	$2s\ 2p^4$	$2p^4\ ^2D$	2½ 1½	340551+x 340584+x	−33
$2p'\ ^2S_1$	$2s\ 2p^4$	$2p^4\ ^2S$	½	400619+x	
$2p'\ ^2P_2$ $^2P_1$	$2s\ 2p^4$	$2p^4\ ^2P$	1½ ½	423981+x 425938+x	−1957
$3s\ ^4P_1$ $^4P_2$ $^4P_3$	$2s^2\,2p^2(^3P)3s$	$3s\ ^4P$	½ 1½ 2½	893943 894887 896443	944 1556
$3s\ ^2P_1$ $^2P_2$	$2s^2\,2p^2(^3P)3s$	$3s\ ^2P$	½ 1½	907202+x 909096+x	1894
$\overline{3s}\ ^2D$	$2s^2\,2p^2(^1D)3s$	$3s'\ ^2D$	{1½ 2½}	937628+x	
$\overline{\overline{3s}}\ ^2S_1$	$2s^2\,2p^2(^1S)3s$	$3s''\ ^2S$	½	982218+x	
$3d\ ^2P_2$ $^2P_1$	$2s^2\,2p^2(^3P)3d$	$3d\ ^2P$	1½ ½	1038855+x 1039472+x	−617
  $3d\ ^4D_{23}$ $^4D_1$	$2s^2\,2p^2(^3P)3d$	$3d\ ^4D$	3½ 2½ } 1½ } ½	 1045205 1045620	−415
$3d\ ^2F_3$ $^2F_4$	$2s^2\,2p^2(^3P)3d$	$3d\ ^2F$	2½ 3½	1045212+x 1047179+x	1967
$3s'\ ^4S_2$	$2s\ 2p^3(^5S^\circ)3s$	$3s'''\ ^4S^\circ$	1½	*1046634*	
$3d\ ^4P_3$ $^4P_2$ $^4P_1$	$2s^2\,2p^2(^3P)3d$	$3d\ ^4P$	2½ 1½ ½	1047307 1047987 1048383	−680 −396
$3d\ ^2D_2$ $^2D_3$	$2s^2\,2p^2(^3P)3d$	$3d\ ^2D$	1½ 2½	1060848+x 1061411+x	563
$\overline{3d}\ ^2F_4$ $^2F_3$	$2s^2\,2p^2(^1D)3d$	$3d'\ ^2F$	3½ 2½	1082132+x 1082438+x	−306
$\overline{3d}\ ^2D_2$ $^2D_3$	$2s^2\,2p^2(^1D)3d$	$3d'\ ^2D$	1½ 2½	1085361+x 1085718+x	357
$\overline{3d}\ ^2P_1$ $^2P_2$	$2s^2\,2p^2(^1D)3d$	$3d'\ ^2P$	½ 1½	1092558+x 1093046+x	488

Mg VI

Author	Config.	Desig.	J	Level	Interval
$\overline{3d}\ ^2S_1$	$2s^2\,2p^2(^1D)3d$	$3d'\ ^2S$	½	1097978+x	
$3p'\ ^4P$	$2s\ 2p^3(^5S^\circ)3p$	$3p'''\ ^4P$	{½ to 2½}	1100146	
$\overline{3s'}\ ^4D$	$2s\ 2p^3(^3D^\circ)3s$	$3s^{IV}\ ^4D^\circ$	{½ to 3½}	*1122023*	
$\overline{\overline{3d}}\ ^2D$	$2s^2\,2p^2(^1S)3d$	$3d''\ ^2D$	{1½ 2½}	1123683+x	
$\overline{3s'}\ ^2D$	$2s\ 2p^3(^3D^\circ)3s$	$3s^{IV}\ ^2D^\circ$	{1½ 2½}	*1149638+x*	
$\overline{\overline{3s'}}\ ^4P$	$2s\ 2p^3(^3P^\circ)3s$	$3s^{V}\ ^4P^\circ$	{½ to 2½}	*1172608*	
$3d'\ ^4D$	$2s\ 2p^3(^5S^\circ)3d$	$3d'''\ ^4D^\circ$	{½ to 3½}	*1175396*	
$\overline{\overline{3s'}}\ ^2P_1$ $^2P_2$	$2s\ 2p^3(^3P^\circ)3s$	$3s^{V}\ ^2P^\circ$	½ 1½	*1191126+x* *1191432+x*	306
  $4s\ ^4P_3$	$2s^2\,2p^2(^3P)4s$	$4s\ ^4P$	½ 1½ 2½	 1196740	
 $4s\ ^2P_2$	$2s^2\,2p^2(^3P)4s$	$4s\ ^2P$	½ 1½	 1198265+x	
$\overline{3p'}\ ^2F_4$ $^2F_3$	$2s\ 2p^3(^3D^\circ)3p$	$3p^{IV}\ ^2F$	3½ 2½	1222074+x 1222709+x	−635
$\overline{4s}\ ^2D$	$2s^2\,2p^2(^1D)4s$	$4s'\ ^2D$	{1½ 2½}	1234487+x	
 $4d\ ^4D_{23}$ $^4D_1$	$2s^2\,2p^2(^3P)4d$	$4d\ ^4D$	3½ {2½ 1½} ½	 1248829 1249500	−671
$4d\ ^2F_3$ $^2F_4$	$2s^2\,2p^2(^3P)4d$	$4d\ ^2F$	2½ 3½	1251503+x 1253148+x	1645
$4d\ ^4P_3$ $^4P_2$ $^4P_1$	$2s^2\,2p^2(^3P)4d$	$4d\ ^4P$	2½ 1½ ½	1252238 1252662 1252866	−424 −204
 $4d\ ^2D_3$	$2s^2\,2p^2(^3P)4d$	$4d\ ^2D$	1½ 2½	 1257189+x	
$\overline{3d'}\ ^4P_3$ $^4P_2$ $^4P_1$	$2s\ 2p^3(^3D^\circ)3d$	$3d^{IV}\ ^4P^\circ$	2½ 1½ ½	*1282028* *1282398* *1282668*	−370 −270

Mg VI—Continued

Mg VI—Continued

Author	Config.	Desig.	J	Level	Interval
$\overline{3d}'$ ^{4}D	$2s\ 2p^3(^3D^\circ)3d$	$3d^{IV}$ $^4D^\circ$	½ to 3½	*1287044*	
$\overline{4d}$ ^{2}F	$2s^2\ 2p^2(^1D)4d$	$4d'$ ^2F	3½, 2½	1287104+x	
$\overline{3d}'$ $^4S_2$	$2s\ 2p^3(^3D^\circ)3d$	$3d^{IV}$ $^4S^\circ$	1½	*1287889*	
$\overline{3d}'$ $^2F_4$, $^2F_3$	$2s\ 2p^3(^3D^\circ)3d$	$3d^{IV}$ $^2F^\circ$	3½, 2½	*1288400*+x, *1289261*+x	−861
$\overline{4d}$ ^{2}D	$2s2p^2(^1D)4d$	$4d'$ ^2D	1½, 2½	1289787+x	
$\overline{4d}$ ^{2}P	$2s^2\ 2p^2(^1D)4d$	$4d'$ ^2P	½, 1½	1292939+x	
$\overline{4d}$ $^2S_1$	$2s^2\ 2p^2(^1D)4d$	$4d'$ ^2S	½	1295321+x	
$5s$ $^4P_2$, $^4P_3$	$2s^2\ 2p^2(^3P)5s$	$5s$ ^4P	½, 1½, 2½	1317697, 1318670	973
$4s'$ $^4S_2$	$2s\ 2p^3(^5S^\circ)4s$	$4s'''$ $^4S^\circ$	1½	*1323609*	
$\overline{\overline{4d}}$ ^{2}D	$2s^2\ 2p^2(^1S)4d$	$4d''$ ^2D	1½, 2½	1332285+x	
$4p'$ ^{4}P	$2s\ 2p^3(^5S^\circ)4p$	$4p'''$ ^4P	½ to 2½	1340950	
$5d$ $^4D_{23}$	$2s^2\ 2p^2(^3P)5d$	$5d$ ^4D	3½, 2½, 1½, ½	1342985	
$5d$ $^2F_3$, $^2F_4$	$2s^2\ 2p^2(^3P)5d$	$5d$ ^2F	2½, 3½	1344310+x, 1346056+x	1746
$5d$ $^4P_3$	$2s^2\ 2p^2(^3P)5d$	$5d$ ^4P	2½, 1½, ½	1345550	
$4d'$ ^{4}D	$2s\ 2p^3(^5S^\circ)4d$	$4d'''$ $^4D^\circ$	½ to 3½	*1373760*	
$6s$ $^4P_3$	$2s^2\ 2p^2(^3P)6s$	$6s$ ^4P	½, 1½, 2½	1380643	
$\overline{5d}$ ^{2}F	$2s^2\ 2p^2(^1D)5d$	$5d'$ ^2F	3½, 2½	1381572+x	
$\overline{5d}$ ^{2}D	$2s^2\ 2p^2(^1D)5d$	$5d'$ ^2D	1½, 2½	1383088+x	
$5d'$ ^{4}D	$2s\ 2p^3(^5S^\circ)5d$	$5d'''$ $^4D^\circ$	½ to 3½	*1463928*	
	Mg VII ($^3P_0$)	*Limit*	------	*1507520*	

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Mg VI Observed Terms*

Config. $1s^2+$	Observed Terms		
$2s^2\ 2p^3$	$2p^3$ $^4S^\circ$; $2p^3$ $^2P^\circ$; $2p^3$ $^2D^\circ$		
$2s\ 2p^4$	$2p^4$ ^4P; $2p^4$ ^2S; $2p^4$ ^2P; $2p^4$ ^2D		
	ns ($n\geq3$)	np ($n\geq3$)	nd ($n\geq3$)
$2s^2\ 2p^2(^3P)nx$	3–6s ^4P; 3, 4s ^2P		3–5d ^4P; 3d ^2P; 3–5d ^4D; 3, 4d ^2D; 3–5d ^2F
$2s^2\ 2p^2(^1D)nx'$	3, 4s' ^2D		3, 4d' ^2S; 3, 4d' ^2P; 3–5d' ^2D; 3–5d' ^2F
$2s^2\ 2p^2(^1S)nx''$	3s'' ^2S		3, 4d'' ^2D
$2s\ 2p^3(^5S^\circ)nx'''$	3, 4s''' $^4S^\circ$	3, 4p''' ^4P	3–5d''' $^4D^\circ$
$2s\ 2p^3(^3D^\circ)nx^{IV}$	$3s^{IV}$ $^4D^\circ$; $3s^{IV}$ $^2D^\circ$	$3p^{IV}$ ^2F	$3d^{IV}$ $^4S^\circ$; $3d^{IV}$ $^4P^\circ$; $3d^{IV}$ $^4D^\circ$; $3d^{IV}$ $^2F^\circ$
$2s\ 2p^3(^3P^\circ)nx^{V}$	$3s^{V}$ $^4P^\circ$; $3s^{V}$ $^2P^\circ$		

*For predicted terms in the spectra of the N I isoelectronic sequence, see Introduction.

Mg VII

(C I sequence; 6 electrons) $Z=12$

Ground state $1s^2\,2s^2\,2p^2\ ^3P_0$

$2p^2\ ^3P_0$ **1817734** cm^{-1} I. P. 225.31 volts

Söderqvist has found 56 terms and classified 114 lines in this spectrum in the range 58 A to 434 A. He determines the relative values of the singlet, triplet, and quintet systems of terms from the series limits.

Söderqvist gives the quintet term $2p^3\ ^5S^{\circ}_2$ at 118134 cm^{-1} above the ground state zero. From isoelectronic sequence data Robinson estimates this value as 118620 cm^{-1}. The later value has been used in the table and all quintet terms adjusted accordingly.

The uncertainties x and y may be considerable.

REFERENCES

J. Söderqvist, Ark. Mat. Astr. Fys. (Stockholm) **32A**, No. 19 p. 4 (1946). (I P) (T) (C L)
H. A. Robinson, unpublished material (March 1948). (T)

Mg VII

Author	Config.	Desig.	J	Level	Interval
$2p\ ^3P_0$ $^3P_1$ $^3P_2$	$2s^2\,2p^2$	$2p^2\ ^3P$	0 1 2	0 1127 2939	1127 1812
$2p\ ^1D_2$	$2s^2\,2p^2$	$2p^2\ ^1D$	2	41459+x	
$2p\ ^1S_0$	$2s^2\,2p^2$	$2p^2\ ^1S$	0	85647+x	
$2p'\ ^5S_2$	$2s\ 2p^3$	$2p^3\ ^5S^{\circ}$	2	*118620*+y	
$2p'\ ^3D_3$ $^3D_2$ $^3D_1$	$2s\ 2p^3$	$2p\ ^3D^{\circ}$	3 2 1	*232865* *232975* *233027*	−110 −52
$2p'\ ^3P$	$2s\ 2p^3$	$2p^3\ ^3P^{\circ}$	2, 1, 0	*274922*	
$2p'\ ^1D_2$	$2s\ 2p^3$	$2p^3\ ^1D^{\circ}$	2	*354923*+x	
$2p'\ ^3S_1$	$2s\ 2p^3$	$2p^3\ ^3S^{\circ}$	1	*362128*	
$2p'\ ^1P_1$	$2s\ 2p^3$	$2p^3\ ^1P^{\circ}$	1	*397655*+x	
$3s\ ^3P_0$ $^3P_1$ $^3P_2$	$2s^2\,2p(^2P^{\circ})3s$	$3s\ ^3P^{\circ}$	0 1 2	*1047624* *1048385* *1050906*	761 2521
$3s\ ^1P_1$	$2s^2\,2p(^2P^{\circ})3s$	$3s\ ^1P^{\circ}$	1	*1061534*+x	
$3p\ ^3P_0$ $^3P_1$ $^3P_2$	$2s^2\,2p(^2P^{\circ})3p$	$3p\ ^3P$	0 1 2	1123745 1124937 1125850	1192 913
$3d\ ^3F_2$	$2s^2\,2p(^2P^{\circ})3d$	$3d\ ^3F^{\circ}$	2 3 4	*1178758*+x	
$3s'\ ^5P_1$ $^5P_2$ $^5P_3$	$2s\ 2p^2(^4P)3s$	$3s\ ^5P$	1 2 3	1179696+y 1180484+y 1181963+y	788 1479
$3d\ ^1D_2$	$2s^2\,2p(^2P^{\circ})3d$	$3d\ ^1D^{\circ}$	2	*1181424*+x	

Mg VII

Author	Config.	Desig.	J	Level	Interval
$3d\ ^3D_1$ $^3D_2$ $^3D_3$	$2s^2\,2p(^2P^{\circ})3d$	$3d\ ^3D^{\circ}$	1 2 3	*1191753* *1192185* *1193061*	432 876
$3d\ ^3P_2$ $^3P_1$ $^3P_0$	$2s^2\,2p(^2P^{\circ})3d$	$3d\ ^3P^{\circ}$	2 1 0	*1196770* *1197469* *1197872*	−699 −403
$3s'\ ^3P_0$ $^3P_1$ $^3P_2$	$2s\ 2p^2(^4P)3s$	$3s\ ^3P$	0 1 2	1211173 1212055 1213679	882 1624
$3d\ ^1F_3$	$2s^2\,2p(^2P^{\circ})3d$	$3d\ ^1F^{\circ}$	3	*1212323*+x	
$3d\ ^1P_1$	$2s^2\,2p(^2P^{\circ})3d$	$3d\ ^1P^{\circ}$	1	*1213297*+x	
$3p'\ ^3S_1$	$2s\ 2p^2(^4P)3p$	$3p\ ^3S^{\circ}$	1	*1235329*	
 $3p'\ ^3D_2$ $^3D_3$	$2s\ 2p^2(^4P)3p$	$3p\ ^3D^{\circ}$	1 2 3	 *1264827* *1266076*	1249
$3p'\ ^3P$	$2s\ 2p^2(^4P)3p$	$3p\ ^3P^{\circ}$	0, 1, 2	*1276520*	
$\overline{3s'}\ ^3D$	$2s\ 2p^2(^2D)3s$	$3s'\ ^3D$	1, 2, 3	1285196	
$\overline{3p'}\ ^3D$	$2s\ 2p^2(^2D)3p$	$3p'\ ^3D^{\circ}$	1, 2, 3	*1299244*	
$\overline{3s'}\ ^1D_2$	$2s\ 2p^2(^2D)3s$	$3s'\ ^1D$	2	1305806+x	
$3d'\ ^5D_{23}$	$2s\ 2p^2(^4P)3d$	$3d\ ^5D$	0 1 2 3 4	 }1317618+y (2, 3)	
$3d'\ ^5P_3$ $^5P_2$ $^5P_1$	$2s\ 2p^2(^4P)3d$	$3d\ ^5P$	3 2 1	1323222+y 1323889+y 1324311+y	−667 −422

Mg VII—Continued

Author	Config.	Desig.	J	Level	Interval
$3d'$ ^{3}P$_2$	2s 2p^2(^{4}P)3d	3d ^{3}P	2	1324975	
^{3}P$_1$			1	1326033	−1058
^{3}P$_0$			0	1326568	−535
$3d'$ ^{3}F$_2$	2s 2p^2(^{4}P)3d	3d ^{3}F	2	1333173	
^{3}F$_3$			3	1334115	942
^{3}F$_4$			4	1335328	1213
$\overline{3p'}$ ^{1}F$_3$	2s 2p^2(^{2}D)3p	3p′ ^{1}F°	3	*1350497+x*	
$3d'$ ^{3}D$_1$	2s 2p^2(^{4}P)3d	3d ^{3}D	1	1350626	
^{3}D$_2$			2	1350948	322
^{3}D$_3$			3	1351359	411
$\overline{3p'}$ ^{1}D$_2$	2s 2p^2(^{2}D)3p	3p′ ^{1}D°	2	*1357681+x*	
$\overline{3d'}$ ^{3}F	2s 2p^2(^{2}D)3d	3d′ ^{3}F	2, 3, 4	1414307	
$\overline{3d'}$ ^{3}P	2s 2p^2(^{2}D)3d	3d′ ^{3}P	0, 1, 2	1420669	
	2s 2p^2(^{2}D)3d	3d′ ^{3}D	1		
$\overline{3d'}$ ^{3}D$_2$			2	1422040	
^{3}D$_3$			3	1422614	574
$\overline{3d'}$ ^{3}S$_1$	2s 2p^2(^{2}D)3d	3d′ ^{3}S	1	1435724	
$\overline{3d'}$ ^{1}F$_3$	2s 2p^2(^{2}D)3d	3d′ ^{1}F	3	1438863+x	
$\overline{3d'}$ ^{1}D$_2$	2s 2p^2(^{2}D)3d	3d′ ^{1}D	2	1439116+x	
4d ^{1}D$_2$	2s^2 2p(^{2}P°)4d	4d ^{1}D°	2	*1466102+x*	
	2s^2 2p(^{2}P°)4d	4d ^{3}D°	1		
4d ^{3}D$_2$			2	*1469556*	
^{3}D$_3$			3	*1470420*	864
	2s^2 2p(^{2}P°)4d	4d ^{3}P°	0		
			1		
4d ^{3}P$_2$			2	*1472144*	
4d ^{1}F$_3$	2s^2 2p(^{2}P°)4d	4d ^{1}F°	3	*1477931+x*	
4d ^{1}P$_1$	2s^2 2p(^{2}P°)4d	4d ^{1}P°	1	*1478676+x*	

Mg VII—Continued

Author	Config.	Desig.	J	Level	Interval
	2s 2p^2(^{4}P)4s	4s ^{5}P	1		
			2		
4s′ ^{5}P$_3$			3	1549235+y	
	2s 2p^2(^{4}P)4p	4p ^{3}D°	1		
			2		
4p′ ^{3}D$_3$			3	*1579211*	
5d ^{3}P	2s^2 2p(^{2}P°)5d	5d ^{3}P°	0, 1, 2	*1597937*	
4d′ ^{5}P$_3$	2s 2p^2(^{4}P)4d	4d ^{5}P	3	1600167+y	
^{5}P$_2$			2	1600760+y	−593
^{5}P$_1$			1	1601134+y	−374
5d ^{1}F$_3$	2s^2 2p(^{2}P°)5d	5d ^{1}F°	3	*1600986+x*	
4d′ ^{3}F$_2$	2s 2p^2(^{4}P)4d	4d ^{3}F	2	1604844	
^{3}F$_3$			3	1605621	777
^{3}F$_4$			4	1606747	1126
6d ^{3}P	2s^2 2p(^{2}P°)6d	6d ^{3}P°	0, 1, 2	*1665781*	
$\overline{4d'}$ ^{3}F	2s 2p^2(^{2}D)4d	4d′ ^{3}F	2, 3, 4	1695880	
	2s 2p^2(^{4}P)5p	5p ^{3}D°	1		
			2		
5p′ ^{3}D$_3$			3	*1717734*	
	2s 2p^2(^{4}P)5d	5d ^{5}P	1		
			2		
5d′ ^{5}P$_3$			3	1727216+y	
	2s 2p^2(^{4}P)5d	5d ^{3}F	2		
			3		
5d′ ^{3}F$_4$			4	1730140	
	2s 2p^2(^{4}P)6d	6d ^{5}P	1		
			2		
6d′ ^{5}P$_3$			3	1795347+y	
	Mg VIII (^{2}P°$_{½}$)	*Limit*	------	1817734	

March 1948.

Mg VII Observed Terms*

Config. 1s^2+	Observed Terms		
2s^2 2p^2	2p^2 ^{3}P; 2p^2 ^{1}S; 2p^2 ^{1}D		
2s 2p^3	2p^3 ^{5}S°; 2p^3 ^{3}S°; 2p^3 ^{3}P°; 2p^3 ^{3}D°; 2p^3 ^{1}P°; 2p^3 ^{1}D°		
	ns (n≥3)	np (n≥3)	nd (n≥3)
2s^2 2p(^{2}P°)nx	3s ^{3}P° 3s ^{1}P°	3p ^{3}P	3–6d ^{3}P°; 3, 4d ^{3}D°; 3d ^{3}F° 3, 4d ^{1}P°; 3, 4d ^{1}D°; 3–5d ^{1}F°
2s 2p^2(^{4}P)nx	3, 4s ^{5}P 3s ^{3}P	3p ^{3}S°; 3p ^{3}P°; 3–5p ^{3}D°	3–6d ^{5}P; 3d ^{5}D 3d ^{3}P; 3d ^{3}D; 3–5d ^{3}F
2s 2p^2(^{2}D)nx′	3s′ ^{3}D 3s′ ^{1}D	3p′ ^{3}D° 3p′ ^{1}D°; 3p′ ^{1}F°	3d′ ^{3}S; 3d′ ^{3}P; 3d′ ^{3}D; 3, 4d′ ^{3}F 3d′ ^{1}D; 3d′ ^{1}F

*For predicted terms in the spectra of the C I isoelectronic sequence, see Introduction.

Mg VIII

(B I sequence; 5 electrons) $Z=12$

Ground state $1s^2\,2s^2\,2p\ ^2P^\circ_{1/2}$

$2p\ ^2P^\circ_{1/2}$ ***2145679*** cm^{-1} I. P. 265.957 volts

The analysis is by Söderqvist, who has classified 118 lines, all but 9 of which lie between 52A and 97 A. He remarks that the term values of $2p^3\ ^2P^\circ$ and $2p^3\ ^2D^\circ$ need further confirmation, since no combination of these terms with the doublets of the $2p^2$ configuration have been observed. These two terms and those calculated from combinations with them may require a slight adjustment but they are not seriously in error, as compared with the errors of measurement. Apparently the values extrapolated from the law of irregular doublets and those obtained from observed combinations confirm the terms fairly well.

The absolute values of the doublet terms are well determined from the $nd\ ^2D$ series and $nd\ ^2F^\circ$ series, both of which extend to $n=5$.

The absolute values of the quartet terms are obtained from the $nd\ ^4D^\circ$ series ($n=3, 4, 5$). No intersystem combinations have been observed, and a small correction x may be needed to connect the doublet and quartet terms.

REFERENCE

J. Söderqvist, Ark. Mat. Astr. Fys. (Stockholm) **30A**, No. 11, p. 13 (1944). (I P) (T) (C L)

Mg VIII

Author	Config.	Desig.	J	Level	Interval
$2p\ ^2P_1$ $^2P_2$	$2s^2(^1S)2p$	$2p\ ^2P^\circ$	½ 1½	*0* *3304*	3304
$2p'\ ^4P_1$ $^4P_2$ $^4P_3$	$2s\ 2p^2$	$2p^2\ ^4P$	½ 1½ 2½	130598+x 131763+x 133481+x	1165 1718
$2p'\ ^2D_3$ $^2D_2$	$2s\ 2p^2$	$2p^2\ ^2D$	2½ 1½	232281 232304	−23
$2p'\ ^2S_1$	$2s\ 2p^2$	$2p^2\ ^2S$	½	298283	
$2p'\ ^2P_1$ $^2P_2$	$2s\ 2p^2$	$2p^2\ ^2P$	½ 1½	318747 320742	1995
$2p''\ ^4S_2$	$2p^3$	$2p^3\ ^4S^\circ$	1½	*414380*+x	
$2p''\ ^2D_3$ $^2D_2$	$2p^3$	$2p^3\ ^2D^\circ$	2½ 1½	*465598* *465738*	−140
$2p''\ ^2P_1$ $^2P_2$	$2p^3$	$2p^3\ ^2P^\circ$	½ 1½	*524339* *524486*	147
$3s\ ^2S_1$	$2s^2(^1S)3s$	$3s\ ^2S$	½	1210689	
$3d\ ^2D_2$ $^2D_3$	$2s^2(^1S)3d$	$3d\ ^2D$	1½ 2½	1335863 1336033	170
$3s'\ ^4P_1$ $^4P_2$ $^4P_3$	$2s\ 2p(^3P^\circ)3s$	$3s\ ^4P^\circ$	½ 1½ 2½	*1352123*+x *1353279*+x *1355296*+x	1156 2017
$3s'\ ^2P_1$ $^2P_2$	$2s\ 2p(^3P^\circ)3s$	$3s\ ^2P^\circ$	½ 1½	*1381466* *1383731*	2265
$3p'\ ^2P_1$ $^2P_2$	$2s\ 2p(^3P^\circ)3p$	$3p\ ^2P$	½ 1½	1408371 1409401	1030
$3p'\ ^2D_2$ $^2D_3$	$2s\ 2p(^3P^\circ)3p$	$3p\ ^2D$	1½ 2½	1440561 1442836	2275

Mg VIII

Author	Config.	Desig.	J	Level	Interval
$3p'\ ^2S_1$	$2s\ 2p(^3P^\circ)3p$	$3p\ ^2S$	½	1460911	
	$2s\ 2p(^3P^\circ)3d$	$3d\ ^4D^\circ$	½		
$3d'\ ^4D_2$ $^4D_3$ $^4D_4$			1½ 2½ 3½	*1476964*+x *1477341*+x *1478182*+x	377 841
$3d'\ ^2D_2$ $^2D_3$	$2s\ 2p(^3P^\circ)3d$	$3d\ ^2D^\circ$	1½ 2½	*1478358* *1478706*	348
$3d'\ ^4P_3$ $^4P_2$ $^4P_1$	$2s\ 2p(^3P^\circ)3d$	$3d\ ^4P^\circ$	2½ 1½ ½	*1484449*+x *1485153*+x *1485639*+x	−704 −486
$\overline{3s'}\ ^2P$	$2s\ 2p(^1P^\circ)3s$	$3s'\ ^2P^\circ$	{½ {1½	}*1486995*	
$3d'\ ^2F_3$ $^2F_4$	$2s\ 2p(^3P^\circ)3d$	$3d\ ^2F^\circ$	2½ 3½	*1504992* *1507043*	2051
$3d'\ ^2P_2$ $^2P_1$	$2s\ 2p(^3P^\circ)3d$	$3d\ ^2P^\circ$	1½ ½	*1513099* *1514266*	−1167
$\overline{3p'}\ ^2D_2$ $^2D_3$	$2s\ 2p(^1P^\circ)3p$	$3p'\ ^2D$	1½ 2½	1548027 1548851	824
$\overline{3p'}\ ^2P_1$ $^2P_2$	$2s\ 2p(^1P^\circ)3p$	$3p'\ ^2P$	½ 1½	1549955 1550564	609
$\overline{3p'}\ ^2S_1$	$2s\ 2p(^1P^\circ)3p$	$3p'\ ^2S$	½	1556517	
$3s''\ ^4P_1$ $^4P_2$ $^4P_3$	$2p^2(^3P)3s$	$3s''\ ^4P$	½ 1½ 2½	1588737+x 1589965+x 1591973+x	1228 2008
$\overline{3d'}\ ^2F$	$2s\ 2p(^1P^\circ)3d$	$3d'\ ^2F^\circ$	{2½ {3½	}*1597469*	
$\overline{3d'}\ ^2D_2$ $^2D_3$	$2s\ 2p(^1P^\circ)3d$	$3d'\ ^2D^\circ$	1½ 2½	*1607872* *1608224*	

Author	Config.	Desig.	J	Level	Interval
$\overline{3d'}\ ^2P$	$2s\ 2p(^1P^\circ)3d$	$3d'\ ^2P^\circ$	$\{ \frac{1}{2}, 1\frac{1}{2}$	$\}$*1610669*	
$\overline{3s''}\ ^2D$	$2p^2(^1D)3s$	$3s'''\ ^2D$	$\{ 1\frac{1}{2}, 2\frac{1}{2}$	$\}$1638646	
   $3p''\ ^4D_4$	$2p^2(^3P)3p$	$3p''\ ^4D^\circ$	$\frac{1}{2}$ $1\frac{1}{2}$ $2\frac{1}{2}$ $3\frac{1}{2}$	 *1647050+x*	
$4s\ ^2S_1$	$2s^2(^1S)4s$	$4s\ ^2S$	$\frac{1}{2}$	1647879	
  $3p''\ ^4P_3$	$2p^2(^3P)3p$	$3p''\ ^4P^\circ$	$\frac{1}{2}$ $1\frac{1}{2}$ $2\frac{1}{2}$	 *1653061+x*	
$3p''\ ^4S_2$	$2p^2(^3P)3p$	$3p''\ ^4S^\circ$	$1\frac{1}{2}$	*1674774+x*	
$\overline{3p''}\ ^2F$	$2p^2(^1D)3p$	$3p'''\ ^2F^\circ$	$\{ 2\frac{1}{2}, 3\frac{1}{2}$	$\}$*1691070*	
$4d\ ^2D_2$ $^2D_3$	$2s^2(^1S)4d$	$4d\ ^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	1693824 1693835	11
 $3d''\ ^2F_4$	$2p^2(^3P)3d$	$3d''\ ^2F$	$2\frac{1}{2}$ $3\frac{1}{2}$	 1701860	
$3d''\ ^2D$	$2p^2(^3P)3d$	$3d''\ ^2D$	$\{ 1\frac{1}{2}, 2\frac{1}{2}$	$\}$1703243?	
$\overline{3p''}\ ^2D$	$2p^2(^1D)3p$	$3p'''\ ^2D^\circ$	$\{ 1\frac{1}{2}, 2\frac{1}{2}$	$\}$*1708860*	
$3d''\ ^4P_3$ $^4P_2$ $^4P_1$	$2p^2(^3P)3d$	$3d''\ ^4P$	$2\frac{1}{2}$ $1\frac{1}{2}$ $\frac{1}{2}$	1716667+x 1717481+x 1717923+x	−814 −442
$\overline{3d''}\ ^2D$	$2p^2(^1D)3d$	$3d'''\ ^2D$	$\{ 1\frac{1}{2}, 2\frac{1}{2}$	$\}$1733744	
$\overline{3d''}\ ^2F$	$2p^2(^1D)3d$	$3d'''\ ^2F$	$\{ 2\frac{1}{2}, 3\frac{1}{2}$	$\}$1751987	
$\overline{3d''}\ ^2P_1$ $^2P_2$	$2p^2(^1D)3d$	$3d'''\ ^2P$	$\frac{1}{2}$ $1\frac{1}{2}$	1754593 1755558	965

Author	Config.	Desig.	J	Level	Interval
  $4s'\ ^4P_3$	$2s\ 2p(^3P^\circ)4s$	$4s\ ^4P^\circ$	$\frac{1}{2}$ $1\frac{1}{2}$ $2\frac{1}{2}$	 *1769549+x*	
 $4p'\ ^2P_2$	$2s\ 2p(^3P^\circ)4p$	$4p\ ^2P$	$\frac{1}{2}$ $1\frac{1}{2}$	 1814176	
 $4p'\ ^2D_3$	$2s\ 2p(^3P^\circ)4p$	$4p\ ^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	 1825262	
$4d'\ ^2D$	$2s\ 2p(^3P^\circ)4d$	$4d\ ^2D^\circ$	$\{ 1\frac{1}{2}, 2\frac{1}{2}$	$\}$*1837649*	
$4d'\ ^4D$	$2s\ 2p(^3P^\circ)4d$	$4d\ ^4D^\circ$	$\{ \frac{1}{2}$ to $3\frac{1}{2}$	$\}$*1838017+x*	
$4d'\ ^4P$	$2s\ 2p(^3P^\circ)4d$	$4d\ ^4P^\circ$	$\{ \frac{1}{2}$ to $2\frac{1}{2}$	$\}$*1840084+x*	
$4d'\ ^2F_3$ $^2F_4$	$2s\ 2p(^3P^\circ)4d$	$4d\ ^2F^\circ$	$2\frac{1}{2}$ $3\frac{1}{2}$	*1846146* *1848025*	1879
$5d\ ^2D_2$ $^2D_3$	$2s^2(^1S)5d$	$5d\ ^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	1858322 1858419	97
$\overline{4d'}\ ^2F$	$2s\ 2p(^1P^\circ)4d$	$4d'\ ^2F^\circ$	$\{ 2\frac{1}{2}, 3\frac{1}{2}$	$\}$*1964303?*	
$\overline{4d'}\ ^2D$	$2s\ 2p(^1P^\circ)4d$	$4d'\ ^2D^\circ$	$\{ 1\frac{1}{2}, 2\frac{1}{2}$	$\}$*1968694?*	
$5d'\ ^4D$	$2s\ 2p(^3P^\circ)5d$	$5d\ ^4D^\circ$	$\{ \frac{1}{2}$ to $3\frac{1}{2}$	$\}$*2002221+x*	
$5d'\ ^2F_3$ $^2F_4$	$2s\ 2p(^3P^\circ)5d$	$5d\ ^2F^\circ$	$2\frac{1}{2}$ $3\frac{1}{2}$	*2005261* *2006652*	1391
   $4p''\ ^4D_4$	$2p^2(^3P)4p$	$4p''\ ^4D^\circ$	$\frac{1}{2}$ $1\frac{1}{2}$ $2\frac{1}{2}$ $3\frac{1}{2}$	 *2042060+x*	
	Mg IX ($^1S_0$)	*Limit*	------	*2145679*	

October 1946.

Mg VIII Observed Terms*

Config. $1s^2+$	Observed Terms		
$2s^2(^1S)2p$	$2p\ ^2P^\circ$		
$2s\ 2p^2$	$\{ 2p^2\ ^2S$ $\quad 2p^2\ ^4P$, $2p^2\ ^2P$ $\quad 2p^2\ ^2D$		
$2p^3$	$\{ 2p^3\ ^4S^\circ$ $\quad 2p^3\ ^2P^\circ$ $\quad 2p^3\ ^2D^\circ$		
	$ns\ (n\geq 3)$	$np\ (n\geq 3)$	$nd\ (n\geq 3)$
$2s^2(^1S)nx$	3, $4s\ ^2S$		3–$5d\ ^2D$
$2s\ 2p(^3P^\circ)nx$	$\{$ 3, $4s\ ^4P^\circ$ $3s\ ^2P^\circ$	$3p\ ^2S$ 3, $4p\ ^2P$ 3, $4p\ ^2D$	3, $4d\ ^4P^\circ$ 3–$5d\ ^4D^\circ$ $3d\ ^2P^\circ$ 3, $4d\ ^2D^\circ$ 3–$5d\ ^2F^\circ$
$2s\ 2p(^1P^\circ)nx'$	$3s'\ ^2P^\circ$	$3p'\ ^2S$ $\quad 3p'\ ^2P$ $\quad 3p'\ ^2D$	$3d'\ ^2P^\circ$ 3, $4d'\ ^2D^\circ$ 3, $4d'\ ^2F^\circ$
$2p^2(^3P)nx''$	$\{ 3s''\ ^4P$	$3p''\ ^4S^\circ$ $\quad 3p''\ ^4P^\circ$ 3, $4p''\ ^4D^\circ$	$3d''\ ^4P$ $\quad 3d''\ ^2D$ $\quad 3d''\ ^2F$
$2p^2(^1D)nx'''$	$3s'''\ ^2D$	$3p'''\ ^2D^\circ$ $\quad 3p'''\ ^2F^\circ$	$3d'''\ ^2P$ $\quad 3d'''\ ^2D$ $\quad 3d'''\ ^2F$

*For predicted terms in the spectra of the B I isoelectronic sequence, see Introduction.

Mg IX

(Be I sequence; 4 electrons) $Z=12$

Ground state $1s^2\ 2s^2\ ^1S_0$

$2s^2\ ^1S_0$ **2645444** cm^{-1} I. P. 327.90 volts

Sixty-five lines have been classified by Söderqvist. All but three lie in the range between 46 A and 91 A. No intersystem combinations are known, but the absolute term values are determined from series that are fairly well established. The relative uncertainty, x, is probably a few hundred cm^{-1}.

REFERENCE

J. Söderqvist, Ark. Mat. Astr. Fys. (Stockholm) **30A**, No. 11 p. 8 (1944). (I P) (T) (C L)

Mg IX

Author	Config.	Desig.	J	Level	Interval
$2s\ ^1S_0$	$2s^2$	$2s^2\ ^1S$	0	0	
$2p\ ^3P_0$ $^3P_1$ $^3P_2$	$2s(^2S)2p$	$2p\ ^3P°$	0 1 2	*140786+x* *141948+x* *144420+x*	1162 2472
$2p\ ^1P_1$	$2s(^2S)2p$	$2p\ ^1P°$	1	*271687*	
$2p'\ ^3P_0$ $^3P_1$ $^3P_2$	$2p^2$	$2p^2\ ^3P$	0 1 2	366194+x 367493+x 369650+x	1299 2157
$2p'\ ^1D_2$	$2p^2$	$2p^2\ ^1D$	2	404744	
$2p'\ ^1S_0$	$2p^2$	$2p^2\ ^1S$	0	499444	
$3s\ ^3S_1$	$2s(^2S)3s$	$3s\ ^3S$	1	1532749+x	
$3s\ ^1S_0$	$2s(^2S)3s$	$3s\ ^1S$	0	1558076	
$3p\ ^1P_1$	$2s(^2S)3p$	$3p\ ^1P°$	1	*1593600*	
$3d\ ^3D_1$ $^3D_2$ $^3D_3$	$2s(^2S)3d$	$3d\ ^3D$	1 2 3	1631321+x 1631484+x 1631652+x	163 168
$3d\ ^1D_2$	$2s(^2S)3d$	$3d\ ^1D$	2	1654583	
$3s'\ ^3P_0$ $^3P_1$ $^3P_2$	$2p(^2P°)3s$	$3s\ ^3P°$	0 1 2	*1710478+x* *1711572+x* *1714105+x*	1094 2533
$3s'\ ^1P_1$	$2p(^2P°)3s$	$3s\ ^1P°$	1	*1742772*	
$3p'\ ^1P_1$	$2p(^2P°)3p$	$3p\ ^1P$	1	1748116	
$3p'\ ^3D_1$ $^3D_2$ $^3D_3$	$2p(^2P°)3p$	$3p\ ^3D$	1 2 3	1755785+x 1756803+x 1759303+x	1018 2500
$3p'\ ^3S_1$	$2p(^2P°)3p$	$3p\ ^3S$	1	1770688+x	
$3p'\ ^3P_0$ $^3P_1$ $^3P_2$	$2p(^2P°)3p$	$3p\ ^3P$	0 1 2	1777886+x 1779003+x 1780315+x	1117 1312
$3d'\ ^1D_2$	$2p(^2P°)3d$	$3d\ ^1D°$	2	*1789287*	
$3p'\ ^1D_2$	$2p(^2P°)3p$	$3p\ ^1D$	2	1795868	
$3d'\ ^3D_1$ $^3D_2$ $^3D_3$	$2p(^2P°)3d$	$3d\ ^3D°$	1 2 3	*1807694+x* *1808187+x* *1809182+x*	493 995

Mg IX

Author	Config.	Desig.	J	Level	Interval
$3d'\ ^3P_2$ $^3P_1$ $^3P_0$	$2p(^2P°)3d$	$3d\ ^3P°$	2 1 0	*1815552+x* *1816534+x* *1817062+x*	−982 −528
$3d'\ ^1F_3$	$2p(^2P°)3d$	$3d\ ^1F°$	3	*1834337*	
$3d'\ ^1P_1$	$2p(^2P°)3d$	$3d\ ^1P°$	1	*1841286*	
$4p\ ^1P_1$	$2s(^2S)4p$	$4p\ ^1P°$	1	*2068680*	
$4d\ ^3D_1$ $^3D_2$ $^3D_3$	$2s(^2S)4d$	$4d\ ^3D$	1 2 3	2080274+x 2080328+x 2080378+x	54 50
$4d\ ^1D_2$	$2s(^2S)4d$	$4d\ ^1D$	2	2087888	
  $4p'\ ^3D_3$	$2p(^2P°)4p$	$4p\ ^3D$	1 2 3	 2230056+x	
  $4p'\ ^3P_2$	$2p(^2P°)4p$	$4p\ ^3P$	0 1 2	 2235683	
$4d'\ ^1D_2$	$2p(^2P°)4d$	$4d\ ^1D°$	2	*2240853*	
$4p'\ ^1D_2$	$2p(^2P°)4p$	$4p\ ^1D$	2	2241083	
  $4d'\ ^3D_3$	$2p(^2P°)4d$	$4d\ ^3D°$	1 2 3	 *2248572+x*	
$4d'\ ^3P_2$	$2p(^2P°)4d$	$4d\ ^3P°$	2 1 0	*2249773+x*	
$4d'\ ^1F_3$	$2p(^2P°)4d$	$4d\ ^1F°$	3	*2256219*	
$4d'\ ^1P_1$	$2p(^2P°)4d$	$4d\ ^1P°$	1	*2258119*	
$5d\ ^3D$	$2s(^2S)5d$	$5d\ ^3D$	1, 2, 3	2285243+x	
$5d\ ^1D_2$	$2s(^2S)5d$	$5d\ ^1D$	2	2288385	
$5d'\ ^3D,\ ^3P$	$2p(^2P°)5d$	$5d\ ^3P°, ^3D°$	0 to 3	*2451942+x*	
$5d'\ ^1F_3$	$2p(^2P°)5d$	$5d\ ^1F°$	3	*2454176*	
	Mg X ($^2S_{½}$)	*Limit*	------	2645444	

May 1946.

Mg IX Observed Terms*

Config. $1s^2+$	Observed Terms							
$2s^2$	$2s^2\ ^1S$							
$2s(^2S)2p$	$2p\ ^3P^\circ$ $2p\ ^1P^\circ$							
$2p^2$	$2p^2\ ^1S$	$2p^2\ ^3P$	$2p^2\ ^1D$					
	$ns\ (n \geq 3)$		$np\ (n \geq 3)$			$nd\ (n \geq 3)$		
$2s(^2S)nx$	$3s\ ^3S$ $3s\ ^1S$			$3, 4p\ ^1P^\circ$			$3\text{–}5d\ ^3D$ $3\text{–}5d\ ^1D$	
$2p(^2P^\circ)nx$	$3s\ ^3P^\circ$ $3s\ ^1P^\circ$		$3p\ ^3S$	$3, 4p\ ^3P$ $3p\ ^1P$	$3, 4p\ ^3D$ $3, 4p\ ^1D$	$3\text{–}5d\ ^3P^\circ$ $3, 4d\ ^1P^\circ$	$3\text{–}5d\ ^3D^\circ$ $3, 4d\ ^1D^\circ$	$3\text{–}5d\ ^1F^\circ$

*For predicted terms in the spectra of the Be I isoelectronic sequence, see Introduction.

Mg x

(Li I sequence; 3 electrons) $Z=12$

Ground state $1s^2\ 2s\ ^2S_{1/2}$

$2s\ ^2S_{1/2}$ **2963810** cm^{-1} I. P. 367.36 volts

The present analysis results from the classification of nine lines in the region 65 A to 44 A. The transition $2s\ ^2S—2p\ ^2P^\circ$ has not been reported. The predicted positions of these lines are at 625 A and 609 A.

Some of the relative levels have been connected by a study of the Rydberg denominators in the isoelectronic sequence rather than by the Ritz combination principle.

REFERENCE

J. Söderqvist, Ark. Mat. Astr. Fys. (Stockholm) **30A,** No. 11, p. 3 (1944). (I P) (T) (C L)

Mg x

Author	Config.	Desig.	J	Level	Interval
$2s\ ^2S_1$	$2s$	$2s\ ^2S$	½	0	
$2p\ ^2P_1$ $^2P_2$	$2p$	$2p\ ^2P°$	½ 1½	*159929* *163976*	4047
$3s\ ^2S_1$	$3s$	$3s\ ^2S$	½	1682648	
$3p\ ^2P_1$ $^2P_2$	$3p$	$3p\ ^2P°$	½ 1½	*1726519* *1727832*	1313
$3d\ ^2D_2$ $^2D_3$	$3d$	$3d\ ^2D$	1½ 2½	1743410 1743880	470
$4p\ ^2P_{2,1}$	$4p$	$4p\ ^2P°$	{ ½ 1½ }	*2270148*	
$4d\ ^2D_2$ $^2D_3$	$4d$	$4d\ ^2D$	1½ 2½	2277182 2277694	512
	----------	--------	----	----------	
	Mg xi ($^1S_0$)	*Limit*	------	**2963810**	

May 1946.

Mg xi

(He i sequence; 2 electrons) $Z=12$

Ground state $1s^2\ ^1S_0$

$1s^2\ ^1S_0$ **14209200±2500** cm^{-1} I. P. 1761.23±0.31 volts

Flemberg has observed the four leading lines in this spectrum; they lie between 7 A and 9 A. He has calculated absolute term values on the assumption that the P-terms can be represented by a Ritz formula. The fourth line appeared on only one plate and was not used in the calculation of the limit.

The unit adopted by Flemberg, 10^3 cm^{-1}, has here been changed to cm^{-1}.

REFERENCE

H. Flemberg, Ark. Mat. Astr. Fys. (Stockholm) **28A,** No. 18, p. 34 (1942). (I P) (T) (C L)

Mg xi

Config.	Desig.	J	Level
$1s^2$	$1s^2\ ^1S$	0	0
$1s\ 2p$	$2p\ ^1P°$	1	*10907300*
$1s\ 3p$	$3p\ ^1P°$	1	*12738400*
$1s\ 4p$	$4p\ ^1P°$	1	*13381100*
$1s\ 5p$	$5p\ ^1P°$	1	*13680600*
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Mg xii ($^2S_{½}$)	*Limit*	---	**14209200**

October 1946.

ALUMINUM

Al I

13 electrons $Z=13$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p\ ^2\mathrm{P}^\circ_{1/2}$

$3p\ ^2\mathrm{P}^\circ_{1/2}$ ***48279.16*** cm^{-1} I. P. 5.984 volts

The earlier analysis has been extended by Paschen and Ritschl, who have derived improved term values and extended the observations in the infrared and ultraviolet.

The terms $3p^2\ ^2\mathrm{P}$ and $3p^2\ ^2\mathrm{S}$ have been suggested by Bowen and Millikan and by Selwyn, respectively. The only combinations are with $3p\ ^2\mathrm{P}^\circ$.

Paschen discusses the possibility that the term here called $3d\ ^2\mathrm{D}$ may be $3p^2\ ^2\mathrm{D}$, in which case all subsequent members of the $^2\mathrm{D}$ series must have n decreased by one unit.

Intersystem combinations connecting the doublet and quartet terms have been observed.

REFERENCES

A. Fowler, *Report on Series in Line Spectra*, p. 156 (Fleetway Press, London, 1922). (T) (C L)
I. S. Bowen and R. A. Millikan, Phys. Rev. **26**, 160 (1925). (C L)
E. W. H. Selwyn, Proc. Phys. Soc. (London) **41**, Part 4, No. 229, 402 (1929). (C L)
F. Paschen, Ann. der Phys. [5] **12**, 516 (1932). (T) (C L)
F. Paschen und R. Ritschl, Ann. der Phys. [5] **18**, 886 (1933). (I P) (T) (C L)
W. F. Meggers, J. Opt. Soc. Am. **36**, 431 (1946). (Summary hfs)

Al I

Config.	Desig.	J	Level	Interval
$3s^2(^1\mathrm{S})3p$	$3p\ ^2\mathrm{P}^\circ$	½ 1½	*0. 00* *112. 04*	112. 04
$3s^2(^1\mathrm{S})4s$	$4s\ ^2\mathrm{S}$	½	25347. 69	
$3s\ 3p^2$	$3p^2\ ^4\mathrm{P}$	½ 1½ 2½	29020. 32 29066. 90 29142. 68	46. 58 75. 78
$3s^2(^1\mathrm{S})3d$	$3d\ ^2\mathrm{D}$	1½ 2½	32435. 45 32436. 79	1. 34
$3s^2(^1\mathrm{S})4p$	$4p\ ^2\mathrm{P}^\circ$	½ 1½	*32949. 84* *32965. 67*	15. 83
$3s^2(^1\mathrm{S})5s$	$5s\ ^2\mathrm{S}$	½	37689. 32	

Al I

Config.	Desig.	J	Level	Interval
$3s^2(^1\mathrm{S})4d$	$4d\ ^2\mathrm{D}$	1½ 2½	38929. 42 38933. 96	4. 54
$3s^2(^1\mathrm{S})5p$	$5p\ ^2\mathrm{P}^\circ$	½ 1½	*40271. 98* *40277. 92*	5. 94
$3s^2(^1\mathrm{S})4f$	$4f\ ^2\mathrm{F}^\circ$	{ 2½ 3½ }	*41318. 74*	
$3s^2(^1\mathrm{S})6s$	$6s\ ^2\mathrm{S}$	½	42144. 84	
$3s^2(^1\mathrm{S})5d$	$5d\ ^2\mathrm{D}$	1½ 2½	42233. 72 42237. 71	3. 99
$3s^2(^1\mathrm{S})6p$	$6p\ ^2\mathrm{P}^\circ$	½ 1½	*43334. 95* *43337. 77*	2. 82

Al I—Continued

Config.	Desig.	J	Level	Interval
$3s^2(^1S)5f$	$5f\ ^2F°$	{ $2\frac{1}{2}$ $3\frac{1}{2}$ }	*43831. 08*	
$3s^2(^1S)6d$	$6d\ ^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	44166. 48 44168. 88	2. 40
$3s^2(^1S)7s$	$7s\ ^2S$	$\frac{1}{2}$	44273. 16	
$3s^2(^1S)7p$	$7p\ ^2P°$	$\frac{1}{2}$ $1\frac{1}{2}$	*44928. 4* *44930. 4*	2. 0
$3s^2(^1S)6f$	$6f\ ^2F°$	{ $2\frac{1}{2}$ $3\frac{1}{2}$ }	*45194. 65*	
$3s^2(^1S)7d$	$7d\ ^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	45344. 16 45345. 60	1. 44
$3s^2(^1S)8s$	$8s\ ^2S$	$\frac{1}{2}$	45457. 27	
$3s^2(^1S)7f$	$7f\ ^2F°$	{ $2\frac{1}{2}$ $3\frac{1}{2}$ }	*46015. 73*	
$3s^2(^1S)8d$	$8d\ ^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	46093. 9 46094. 27	0. 4
$3s^2(^1S)9s$	$9s\ ^2S$	$\frac{1}{2}$	46184. 5	
$3s^2(^1S)9d$	$9d\ ^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	46593. 28 46593. 83	0. 55
$3s^2(^1S)10s$	$10s\ ^2S$	$\frac{1}{2}$	46665. 7	
$3s^2(^1S)10d$	$10d\ ^2D$	{ $1\frac{1}{2}$ $2\frac{1}{2}$ }	46942. 3	
$3s^2(^1S)11d$	$11d\ ^2D$	{ $1\frac{1}{2}$ $2\frac{1}{2}$ }	47192. 0	
Al II ($^1S_0$)	*Limit*	---------	***48279. 16***	

Al I—Continued

Config.	Desig.	J	Level	Interval
$3s\ 3p^2$	$3p^2\ ^2S$	$\frac{1}{2}$	51753. 0?	
$3s\ 3p^2$	$3p^2\ ^2P$	$\frac{1}{2}$ $1\frac{1}{2}$	56643. 0? 56727. 3?	84. 3
$3s\ 3p(^3P°)4s$	$4s\ ^4P°$	$\frac{1}{2}$ $1\frac{1}{2}$ $2\frac{1}{2}$	*61691. 29* *61747. 38* *61843. 41*	56. 09 96. 03
$3s\ 3p(^3P°)3d$	$3d\ ^2D°$	$1\frac{1}{2}$ $2\frac{1}{2}$	*67635. 3* *67663. 2*	27. 9
$3s\ 3p(^3P°)3d$	$3d\ ^2P°$	$1\frac{1}{2}$ $\frac{1}{2}$	*71184. 7?* *71260. 7*	−76. 0
$3s\ 3p(^3P°)3d$	$3d\ ^4D°$	$\frac{1}{2}$ $1\frac{1}{2}$ $2\frac{1}{2}$ $3\frac{1}{2}$	*71235. 63* *71244. 38* *71260. 78* *71286. 27*	8. 75 16. 40 25. 49
$3s\ 3p(^3P°)3d$	$3d\ ^4P°$	$2\frac{1}{2}$ $1\frac{1}{2}$ $\frac{1}{2}$	*72203. 77* *72250. 29* *72277. 68*	−46. 52 −27. 39
$3s\ 3p(^3P°)5s$	$5s\ ^2P°$	$\frac{1}{2}$ $1\frac{1}{2}$	*72979. 0* *73077. 9*	98. 9
$3s\ 3p(^3P°)4d$	$4d\ ^2P°$	$\frac{1}{2}$ $1\frac{1}{2}$	*76521. 8* *76553. 7*	31. 9
$3s\ 3p(^3P°)6s$	$6s\ ^2P°$	$\frac{1}{2}$ $1\frac{1}{2}$	*78612. 5* *78710. 5*	98. 0
$3s\ 3p(^3P°)5d$	$5d\ ^2F°$	$2\frac{1}{2}$ $3\frac{1}{2}$	*80158. 0* *80191. 9*	33. 9

August 1947.

Al I Observed Terms*

Config. $1s^2\ 2s^2\ 2p^6+$	Observed Terms			
$3s^2(^1S)3p$	$3p\ ^2P°$			
$3s\ 3p^2$	{ $3p^2\ ^2S?$ $3p^2\ ^4P$ $3p^2\ ^2P?$			
	ns ($n\geq 4$)	*np* ($n\geq 4$)	*nd* ($n\geq 3$)	*nf* ($n\geq 4$)
$3s^2(^1S)nx$	4–10$s\ ^2S$	4–7$p\ ^2P°$	3–11$d\ ^2D$	4–7$f\ ^2F°$
$3s\ 3p(^3P°)nx$	{ $4s\ ^4P°$ 5, $6s\ ^2P°$		$3d\ ^4P°$ $3d\ ^4D°$ 3, $4d\ ^2P°$ $3d\ ^2D°$ $5d\ ^2F°$	

*For predicted terms in the spectra of the Al I isoelectronic sequence, see Introduction.

Al II

(Mg I sequence; 12 electrons) $Z=13$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ ^1S_0$

$3s^2\ ^1S_0$ **151860.4±0.5** cm^{-1} I. P. 18.823 volts

Sawyer and Paschen published a detailed analysis in 1927, from which most of the terms have been taken. Since then some revisions and extensions have been made, especially regarding the terms from the $^2P°$ limit in Al III. The spectrum of Al II furnishes an excellent illustration of perturbed series and consequently is discussed in a number of theoretical papers on this subject. For example, Shenstone and Russell remark that one of the two lowest ^1D terms should be $3p^2\ ^1D$. In accordance with their suggestions the terms labeled by Sawyer and Paschen 3 ^1D, 7 ^3F, and 12 ^1P are here designated $3p^2\ ^1D$, $3d\ ^3F°$, and $4s\ ^1P°$?, respectively. These changes cause a decrease of one unit in the published values of n for all following series members in each of the three series.

In the 1927 paper the higher series members of the ^3P and ^3D series are assigned the J-values of the leading components (2 and 3, respectively). As the term intervals are known to be small, all three J-values for each term are entered in the table on the assumption that the terms are unresolved.

In 1933 Paschen and Ritschl published the detailed hyperfine structure separations they observed for a number of the components of triplet terms. From this paper the three new H-terms have been taken, and also slightly improved values of the terms $4s\ ^1S$, $6s\ ^3S$, $8p\ ^3P°$, $5f\ ^1F°$, and $5g\ ^{1,3}G$. It has been assumed that the singlet and triplet G-terms and also the singlet and triplet H-terms are coincident, since no multiplicities are assigned to them. Van Vleck and Whitelaw give the theoretical explanation of this for the G–terms.

Intersystem combinations connecting the singlet and triplet systems of terms have been observed.

REFERENCES

R. A. Sawyer und F. Paschen, Ann. der Phys. [4] **84**, 1 (1927). (I P) (T) (C L)
F. Paschen, Ann. der Phys. [5] **12**, 509 (1932). (T) (C L)
A. G. Shenstone and H. N. Russell, Phys. Rev. **39**, 427 (1932). (T)
F. Paschen und R. Ritschl, Ann. der Phys. [5] **18**, 872 (1933). (T) (C L) (hfs)
J. H. Van Vleck and N. G. Whitelaw, Phys. Rev. **44**, 551 (1933).
W. F. Meggers, J. Opt. Soc. Am. **36**, 431 (1946). (Summary hfs)

Al II

Config.	Desig.	J	Level	Interval
$3s^2$	$3s^2\ ^1S$	0	0.0	
$3s(^2S)3p$	$3p\ ^3P°$	0	*37392.0*	61.8
		1	*37453.8*	125.5
		2	*37579.3*	
$3s(^2S)3p$	$3p\ ^1P°$	1	*59849.7*	
$3p^2$	$3p^2\ ^1D$	2	85479.0	
$3s(^2S)4s$	$4s\ ^3S$	1	91271.2	
$3p^2$	$3p^2\ ^3P$	0	94084.5	62.3
		1	94146.8	120.9
		2	94267.7	
$3s(^2S)4s$	$4s\ ^1S$	0	95348.2	
$3s(^2S)3d$	$3d\ ^3D$	3	95546.8	−1.1
		2	95547.9	−0.9
		1	95548.8	

Al II

Config.	Desig.	J	Level	Interval
$3s(^2S)4p$	$4p\ ^3P°$	0	*105424.3*	14.1
		1	*105438.4*	29.3
		2	*105467.7*	
$3s(^2S)4p$	$4p\ ^1P°$	1	*106918.2*	
$3s(^2S)3d$	$3d\ ^1D$	2	110087.5	
$3s(^2S)5s$	$5s\ ^3S$	1	120089.8	
$3s(^2S)5s$	$5s\ ^1S$	0	121365.2	
$3s(^2S)4d$	$4d\ ^3D$	3	121480.3	−0.6
		2	121480.9	−0.3
		1	121481.2	
$3s(^2S)4f$	$4f\ ^3F°$	2	*123415.9*	2.1
		3	*123418.0*	2.8
		4	*123420.8*	
$3s(^2S)4f$	$4f\ ^1F°$	3	*123468.1*	

Al II—Continued

Config.	Desig.	*J*	Level	Interval
3*s*(^{2}S)4*d*	4*d* ^{1}D	2	124792. 0	
3*s*(^{2}S)5*p*	5*p* ^{3}P°	0	*125700. 5*	
		1	*125706. 2*	5. 7
		2	*125719. 0*	12. 8
3*s*(^{2}S)5*p*	5*p* ^{1}P°	1	*125866. 7*	
3*s*(^{2}S)6*s*	6*s* ^{3}S	1	132213. 2	
3*s*(^{2}S)6*s*	6*s* ^{1}S	0	132776. 4	
3*s*(^{2}S)5*d*	5*d* ^{3}D	3	132819. 7	
		2, 1	132819. 9	−0. 2
3*s*(^{2}S)5*f*	5*f* ^{3}F°	2	*133435. 0*	
		3	*133440. 4*	5. 4
		4	*133447. 3*	6. 9
3*s*(^{2}S)5*f*	5*f* ^{1}F°	3	*133679. 3*	
3*s*(^{2}S)5*d*	5*d* ^{1}D	2	133914. 1	
3*s*(^{2}S)5*g*	5*g* ^{3}G	3, 4, 5	134181. 2	
3*s*(^{2}S)5*g*	5*g* ^{1}G	4	134181. 2	
3*s*(^{2}S)6*p*	6*p* ^{1}P°	1	*134917. 3*	
3*s*(^{2}S)6*p*	6*p* ^{3}P°	0	*135009. 0*	
		1	*135012. 1*	3. 1
		2	*135018. 9*	6. 8
3*s*(^{2}S)7*s*	7*s* ^{3}S	1	138496. 7	
3*s*(^{2}S)6*f*	6*f* ^{3}F°	2	*138518. 7*	
		3	*138536. 4*	17. 7
		4	*138559. 2*	22. 8
3*s*(^{2}S)7*s*	7*s* ^{1}S	0	138799. 3	
3*s*(^{2}S)6*d*	6*d* ^{3}D	3, 2, 1	138811. 9	
3*s*(^{2}S)6*f*	6*f* ^{1}F°	3	*139242. 9*	
3*s*(^{2}S)6*d*	6*d* ^{1}D	2	139286. 8	
3*s*(^{2}S)6*g*	6*g* ^{3}G	3, 4, 5	139588. 7	
3*s*(^{2}S)6*g*	6*g* ^{1}G	4	139588. 7	
3*s*(^{2}S)7*p*	7*p* ^{1}P°	1	*139916. 7*	
3*s*(^{2}S)7*p*	7*p* ^{3}P°	0, 1, 2	*140091. 2*	
3*p*(^{2}P°)3*d*	3*d* ^{3}F°	2	*141082. 4*	
		3	*141107. 5*	25. 1
		4	*141140. 5*	33. 0
3*s*(^{2}S)8*s*	8*s* ^{3}S	1	142179. 8	
3*s*(^{2}S)8*s*	8*s* ^{1}S	0	142360. 8	
3*s*(^{2}S)7*d*	7*d* ^{3}D	3, 2, 1	142362. 8	
3*s*(^{2}S)7*f*	7*f* ^{1}F°	3	*142601. 6*	
3*s*(^{2}S)7*d*	7*d* ^{1}D	2	142607. 0	
3*s*(^{2}S)7*g*	7*g* ^{3}G	3, 4, 5	142849. 2	
3*s*(^{2}S)7*g*	7*g* ^{1}G	4	142849. 2	
3*s*(^{2}S)8*p*	8*p* ^{1}P°	1	*142958. 9*	
3*s*(^{2}S)8*p*	8*p* ^{3}P°	0, 1, 2	*143170. 0*	
3*s*(^{2}S)7*f*	7*f*^{3} F°	2	*143262. 7*	
		3	*143269. 8*	7. 1
		4	*143280. 6*	10. 8

Al II—Continued

Config.	Desig.	*J*	Level	Interval
3*s*(^{2}S)9*s*	9*s* ^{3}S	1	*144524. 3*	
3*s*(^{2}S)8*d*	8*d* ^{3}D	3, 2, 1	144638. 9	
3*s*(^{2}S)9*s*	9*s* ^{1}S	0	144641. 9	
3*s*(^{2}S)8*d*	8*d* ^{1}D	2	144780. 2	
3*s*(^{2}S)8*f*	8*f* ^{1}F°	3	*144781. 9*	
3*s*(^{2}S)9*p*	9*p* ^{1}P°	1	*144939. 1*	
3*s*(^{2}S)8*g*	8*g* ^{3}G	3, 4, 5	144964. 7	
3*s*(^{2}S)8*g*	8*g* ^{1}G	4	144964. 7	
3*s*(^{2}S)8*h*	8*h* ^{3}H°	4, 5, 6	*144990. 0*	
3*s*(^{2}S)8*h*	8*h* ^{1}H°	5	*144990. 0*	
3*s*(^{2}S)8*f*	8*f* ^{3}F°	2	*145126. 5*	
		3	*145128. 9*	2. 4
		4	*145132. 1*	3. 2
3*p*(^{2}P°)3*d*	3*d* ^{3}D°	1, 2	*145148*	
		3	*145152*	4
3*s*(^{2}S)9*p*	9*p* ^{3}P°	0, 1, 2	*145185?*	
3*p*(^{2}P°)4*s*	4*s* ^{3}P°	0	*145773. 9*	
		1	*145832. 6*	58. 7
		2	*145959. 4*	126. 8
3*s*(^{2}S)10*s*	10*s* ^{3}S	1	146108. 8	
3*s*(^{2}S)9*d*	9*d* ^{3}D	3, 2, 1	146185. 0	
3*s*(^{2}S)10*s*	10*s* ^{1}S	0	146190. 1	
3*s*(^{2}S)9*d*	9*d* ^{1}D	2	146274. 4	
3*s*(^{2}S)9*f*	9*f* ^{1}F°	3	*146276. 5*	
3*s*(^{2}S)10*p*	10*p* ^{1}P°	1	*146297. 5*	
3*s*(^{2}S)9*g*	9*g* ^{3}G	3, 4, 5	146414. 5	
3*s*(^{2}S)9*g*	9*g* ^{1}G	4	146414. 5	
3*s*(^{2}S)9*h*	9*h* ^{3}H°	4, 5, 6	*146432. 8*	
3*s*(^{2}S)9*h*	9*h* ^{1}H°	5	*146432. 8*	
3*s*(^{2}S)9*f*	9*f* ^{3}F°	2	*146496. 7*	
		3	*146497. 8*	1. 1
		4	*146499. 2*	1. 4
3*s*(^{2}S)10*p*	10*p* ^{3}P°	0, 1, 2	*146577?*	
3*p*(^{2}P°)3*d*	3*d* ^{3}P°	0	*146595. 0?*	
		1	*146596. 9*	1. 9
		2	*146599. 3*	2. 4
3*s*(^{2}S)11*s*	11*s* ^{3}S	1	147229. 0	
3*s*(^{2}S)11*p*	11*p* ^{1}P°	1	*147268. 8*	
3*s*(^{2}S)10*d*	10*d* ^{3}D	3, 2, 1	147282. 8	
3*s*(^{2}S)11*s*	11*s* ^{1}S	0	147288. 8	
3*s*(^{2}S)10*d*	10*d* ^{1}D	2	147343. 2	
3*s*(^{2}S)10*f*	10*f* ^{1}F°	3	*147344. 2*	
3*s*(^{2}S)10*g*	10*g* ^{3}G	3, 4, 5	147451. 0	
3*s*(^{2}S)10*g*	10*g* ^{1}G	4	147451. 0	
3*s*(^{2}S)10*h*	10*h* ^{3}H°	4, 5, 6	*147464. 7*	

Al II—Continued

Config.	Desig.	*J*	Level	Interval
3*s*(^{2}S)10*h*	10*h* ^{1}H°	5	147464. 7	
3*s*(^{2}S)10*f*	10*f* ^{3}F°	2	147499. 8	0. 4
		3	147500. 2	0. 6
		4	147500. 8	
3*s*(^{2}S)11*p*	11*p* ^{3}P°	0, 1, 2	147572?	
3*p*(^{2}P°)4*s*?	4*s* ^{1}P°	1	148002. 0	
3*s*(^{2}S)12*s*	12*s* ^{3}S	1	148052. 5	
3*s*(^{2}S)11*d*	11*d* ^{3}D	3, 2, 1	148090. 0	
3*s*(^{2}S)12*s*	12*s* ^{1}S	0	148097. 1	
3*s*(^{2}S)11*f*	11*f* ^{1}F°	3	148132. 6	
3*s*(^{2}S)11*d*	11*d* ^{1}D	2	148132. 7	
3*s*(^{2}S)11*g*	11*g* ^{3}G	3, 4, 5	148217. 6	
3*s*(^{2}S)11*g*	11*g* ^{1}G	4	148217. 6	
3*s*(^{2}S)11*f*	11*f* ^{3}F°	2	148248. 7	0. 4
		3	148249. 1	0. 5
		4	148249. 6	
3*s*(^{2}S)12*p*	12*p* ^{1}P°	1	148579. 4	
3*s*(^{2}S)13*s*	13*s* ^{3}S	1	148673. 7	
3*s*(^{2}S)13*s*	13*s* ^{1}S	0	148706. 9	
3*s*(^{2}S)12*f*	12*f* ^{1}F°	3	148731. 6	
3*s*(^{2}S)12*g*	12*g* ^{3}G	3, 4, 5	148800. 4	
3*s*(^{2}S)12*g*	12*g* ^{1}G	4	148800. 4	
3*s*(^{2}S)12*f*	12*f* ^{3}F°	2, 3, 4	148822. 5	
3*s*(^{2}S)13*p*	13*p* ^{1}P°	1	149051. 9	
3*s*(^{2}S)14*s*	14*s* ^{1}S	0	149179. 8	

Al II—Continued

Config.	Desig.	*J*	Level	Interval
3*s*(^{2}S)13*f*	13*f* ^{1}F°	3	149199. 2	
3*s*(^{2}S)13*g*	13*g* ^{3}G	3, 4, 5	149252. 9	
3*s*(^{2}S)13*g*	13*g* ^{1}G	4	149252. 9	
3*s*(^{2}S)13*f*	13*f* ^{3}F°	2, 3, 4	149269. 5	
3*s*(^{2}S)14*p*	14*p* ^{1}P°	1	149434. 8	
3*s*(^{2}S)15*s*	15*s* ^{1}S	0	149554. 7	
3*s*(^{2}S)14*f*	14*f* ^{1}F°	3	149568. 6	
3*s*(^{2}S)14*f*	14*f* ^{3}F°	2, 3, 4	149625. 5	
3*s*(^{2}S)15*p*	15*p* ^{1}P°	1	149748. 0	
3*s*(^{2}S)16*s*	16*s* ^{1}S	0	149856. 6	
3*s*(^{2}S)15*f*	15*f* ^{1}F°	3	149866. 2	
3*s*(^{2}S)15*f*	15*f* ^{3}F°	2, 3, 4	149913. 2	
3*s*(^{2}S)16*p*	16*p* ^{1}P°	1	150007. 6	
3*s*(^{2}S)16*f*	16*f* ^{1}F°	3	150109. 7	
3*s*(^{2}S)16*f*	16*f* ^{3}F°	2, 3, 4	150148. 4	
3*s*(^{2}S)17*f*	17*f* ^{1}F°	3	150311. 1	
3*s*(^{2}S)17*f*	17*f* ^{3}F°	2, 3, 4	150343. 5	
3*s*(^{2}S)18*f*	18*f* ^{1}F°	3	150479. 7	
3*s*(^{2}S)19*f*	19*f* ^{1}F°	3	150622. 2	
3*s*(^{2}S)20*f*	20*f* ^{1}F°	3	150744. 1	
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Al III (^{2}S$_{½}$)	*Limit*	--------	**151860. 4**	

July 1947.

Al II Observed Terms*

Config. 1*s*^{2} 2*s*^{2} 2*p*^{6}+	Observed Terms		
3*s*^{2}	3*s*^{2} ^{1}S		
3*s*(^{2}S)3*p*	3*p* ^{3}P° 3*p* ^{1}P°		
3*p*^{2}	3*p*^{2} ^{3}P 3*p*^{2} ^{1}D		
	ns (*n*≥4)	*np* (*n*≥4)	*nd* (*n*≥3)
3*s*(^{2}S)*nx*	4–13*s* ^{3}S 4–16*s* ^{1}S	4–11*p* ^{3}P° 4–16*p* ^{1}P°	3–11*d* ^{3}D 3–11*d* ^{1}D
3*p*(^{2}P°)*nx*	4*s* ^{3}P° 4*s* ^{1}P°?		3*d* ^{3}P° 3*d* ^{3}D° 3*d* ^{3}F°
	nf (*n*≥4)	*ng* (*n*≥5)	*nh* (*n*≥6)
3*s*(^{2}S)*nx*	4–17*f* ^{3}F° 4–20*f* ^{1}F°	5–13*g* ^{3}G 5–13*g* ^{1}G	8–10*h* ^{3}H° 8–10*h* ^{1}H°

*For predicted terms in the spectra of the Mg I isoelectronic sequence, see Introduction.

Al III

(Na I sequence; 11 electrons) Z=13

Ground state $1s^2\ 2s^2\ 2p^6\ 3s\ ^2S_{1/2}$

$3s\ ^2S_{1/2}$ **229453.99** cm^{-1} I. P. 28.44 volts

The analysis is by Paschen. Three terms, $6s\ ^2S$, $7s\ ^2S$ and $7p\ ^2P°$ are from the paper by Ekefors, who extended the observations in the ultra-violet to 486 A.

REFERENCES

F. Paschen, Ann. der Phys. [5] **71**, 148 (1923) and unpublished material. (I P) (T) (C L)
E. Ekefors, Zeit. Phys. **51**, 471 (1928). (T) (C L)

Al III

Config.	Desig.	J	Level	Interval
3s	3s ²S	½	0.00	
3p	3p ²P°	½ 1½	*53684.1* *53916.6*	232.5
3d	3d ²D	2½ 1½	115955.03 115957.31	−2.28
4s	4s ²S	½	126162.58	
4p	4p ²P°	½ 1½	*143632.25* *143712.38*	80.13
4d	4d ²D	2½ 1½	165785.26 165786.54	−1.28
4f	4f ²F°	2½ 3½	*167612.05* *167612.43*	0.38
5s	5s ²S	½	170636.38	
5p	5p ²P°	½ 1½	*178430.49* *178469.64*	39.15
5d	5d ²D	{2½, 1½}	188875.52	
5f	5f ²F°	2½ 3½	*189875.34* *189875.46*	0.12
5g	5g ²G	{3½, 4½}	189927.76	
6s	6s ²S	½	191478.5	
6p	6p ²P°	½ 1½	*195620.94* *195641.53*	20.59
6d	6d ²D	{2½, 1½}	201374.37	
6f	6f ²F°	{2½, 3½}	*201969.52*	

Al III

Config.	Desig.	J	Level	Interval
6g	6g ²G	{3½, 4½}	202001.32	
6h	6h ²H°	{4½, 5½}	*202007.32*	
7s	7s ²S	½	202904.8	
7p	7p ²P°	{½, 1½}	*205360*	
7d	7d ²D	{2½, 1½}	208880.37	
7f	7f ²F°	{2½, 3½}	*209260.98*	
7g	7g ²G	{3½, 4½}	209282.17	
7h	7h ²H°	{4½, 5½}	*209287.52*	
8d	8d ²D	{2½, 1½}	213741.42	
8f	8f ²F°	{2½, 3½}	*213992.12*	
8g	8g ²G	{3½, 4½}	214010.67	
8h	8h ²H°	{4½, 5½}	*214015.8*	
9h	9h ²H°	{4½, 5½}	*217255.2*	
Al IV (¹S₀)	*Limit*	-------	**229453.99**	

May 1947.

Al IV

(Ne I sequence; 10 electrons) $Z=13$

Ground state $1s^2\,2s^2\,2p^6\ ^1S_0$

$2p^6\ ^1S_0$ **967783** cm^{-1} I. P. 119.96 volts

The analysis has been taken from Söderqvist's Monograph. The term designations he assigns on the assumption of LS-coupling are given with his notation under the heading "Author" in the table.

As for Ne I, the jl-coupling notation in the general form suggested by Racah is introduced. Shortley has, however, pointed out that the configurations $2p^5\,3s$, $2p^5\,3p$, and $2p^5\,3d$ are much closer to LS-coupling than to jl-coupling.

REFERENCES

J. Söderqvist, Nova Acta Reg. Soc. Sci. Uppsala [IV] **9**, No. 7, 34 (1934). (I P) (T) (C L).
G. Racah, Phys. Rev. **61**, 537 (L) (1942).
G. Shortley, unpublished material (1948).

Al IV

Author	Config.	Desig.	J	Level
$2p\ ^1S_0$	$2p^6$	$2p^6\ ^1S$	0	0
$3s\ ^3P_2$	$2p^5(^2P^\circ_{1\frac{1}{2}})3s$	$3s\ [1\frac{1}{2}]^\circ$	2	*616646.7*
$^3P_1$			1	*618477.5*
$3s\ ^3P_0$	$2p^5(^2P^\circ_{\frac{1}{2}})3s$	$3s'\ [\frac{1}{2}]^\circ$	0	*619947.7*
$^1P_1$			1	*624720.5*
$3p_{10}\ ^3S_1$	$2p^5(^2P^\circ_{1\frac{1}{2}})3p$	$3p\ [\frac{1}{2}]$	1	671635.5
$3p_9\ ^3D_3$	"	$3p\ [2\frac{1}{2}]$	3	680862.9
$3p_8\ ^3D_2$			2	681686.7
$3p_7\ ^3D_1$	"	$3p\ [1\frac{1}{2}]$	1	682869.3
$3p_6\ ^1D_2$			2	685732.8
$3p_3\ ^3P_0$	"	$3p\ [\frac{1}{2}]$	0	688313.3
$3p_5\ ^1P_1$	$2p^5(^2P^\circ_{\frac{1}{2}})3p$	$3p'\ [1\frac{1}{2}]$	1	687456.8
$3p_4\ ^3P_2$			2	687834.7
$3p_2\ ^3P_1$	"	$3p'\ [\frac{1}{2}]$	1	688653.0
$3p_1\ ^1S_0$			0	690244.9
$3d\ ^3P_0$	$2p^5(^2P^\circ_{1\frac{1}{2}})3d$	$3d\ [\frac{1}{2}]^\circ$	0	*759197.4*
$^3P_1$			1	*759600.9*
$3d\ ^3P_2$	"	$3d\ [1\frac{1}{2}]^\circ$	2	*761015.4*
$3d\ ^3F_4$	"	$3d\ [3\frac{1}{2}]^\circ$	4	*761694.5*
$^3F_3$			3	*762277.1*
$3d\ ^3F_2$	"	$3d\ [2\frac{1}{2}]^\circ$	2	*763502.8*
$^1F_3$			3	*764304.3*
$3d\ ^1P_1$	"	$3d\ [1\frac{1}{2}]^\circ$	1	*767040.6*
$3d\ ^3D_3$	$2p^5(^2P^\circ_{\frac{1}{2}})3d$	$3d'\ [2\frac{1}{2}]^\circ$	3	*767351.9*
$^1D_2$			2	*767536.2?*
$3d\ ^3D_2$	"	$3d'\ [1\frac{1}{2}]^\circ$	2	*767756.1*
$^3D_1$			1	*770836.1*

Al IV

Author	Config.	Desig.	J	Level
	$2p^5(^2P^\circ_{1\frac{1}{2}})4s$	$4s\ [1\frac{1}{2}]^\circ$	2	
$4s\ ^3P_1$			1	*802936*
	$2p^5(^2P^\circ_{\frac{1}{2}})4s$	$4s'\ [\frac{1}{2}]^\circ$	0	
$4s\ ^1P_1$			1	*806231*
	$2p^5(^2P^\circ_{1\frac{1}{2}})4d$	$4d\ [\frac{1}{2}]^\circ$	0	
$4d\ ^3P_1$			1	*851956*
$4d\ ^1P_1$	"	$4d\ [1\frac{1}{2}]^\circ$	1	*855286*
	$2p^5(^2P^\circ_{\frac{1}{2}})4d$	$4d'\ [1\frac{1}{2}]^\circ$	2	
$4d\ ^3D_1$			1	*858671*
	$2p^5(^2P^\circ_{1\frac{1}{2}})5s$	$5s\ [1\frac{1}{2}]^\circ$	2	
$5s\ ^3P_1$			1	*871391*
	$2p^5(^2P^\circ_{\frac{1}{2}})5s$	$5s'\ [\frac{1}{2}]^\circ$	0	
$5s\ ^1P_1$			1	*874669*
	$2p^5(^2P^\circ_{1\frac{1}{2}})5d$	$5d\ [\frac{1}{2}]^\circ$	0	
$5d\ ^3P_1$			1	*894614*
$5d\ ^1P_1$	"	$5d\ [1\frac{1}{2}]^\circ$	1	*896138*
	$2p^5(^2P^\circ_{\frac{1}{2}})5d$	$5d'\ [1\frac{1}{2}]^\circ$	2	
$5d\ ^3D_1$			1	*899281*
$6d\ ^1P_1$	$2p^5(^2P^\circ_{1\frac{1}{2}})6d$	$6d\ [1\frac{1}{2}]^\circ$	1	*918215*
	$2p^5(^2P^\circ_{\frac{1}{2}})6d$	$6d'\ [1\frac{1}{2}]^\circ$	2	
$6d\ ^3D_1$			1	*921362*
	Al V $(^2P^\circ_{1\frac{1}{2}})$	*Limit*	-------	**967783**
	Al V $(^2P^\circ_{\frac{1}{2}})$	*Limit*	-------	971223

April 1947.

Al IV Observed Levels*

Config. $1s^2\,2s^2+$	Observed Terms		
$2p^6$	$2p^6$ ^1S		
	ns ($n\geq 3$)	*np* ($n\geq 3$)	*nd* ($n\geq 3$)
$2p^5(^2P^\circ)nx$	3–5*s* $^3P^\circ$ 3–5*s* $^1P^\circ$	3*p* ^3S 3*p* ^3P 3*p* ^3D 3*p* ^1S 3*p* ^1P 3*p* ^1D	3–5*d* $^3P^\circ$ 3–6*d* $^3D^\circ$ 3*d* $^3F^\circ$ 3–6*d* $^1P^\circ$ 3*d* $^1D^\circ$ 3*d* $^1F^\circ$
jl-Coupling Notation			
	Observed Pairs		
	ns ($n\geq 3$)	*np* ($n\geq 3$)	*nd* ($n\geq 3$)
$2p^5(^2P^\circ_{1\frac{1}{2}})nx$	3–5*s* [1½]°	3*p* [½] 3*p* [2½] 3*p* [1½]	3–5*d* [½]° 3*d* [3½]° 3–6*d* [1½]° 3*d* [2½]°
$2p^5(^2P^\circ_{\frac{1}{2}})nx'$	3–5*s*′ [½]°	3*p*′ [1½] 3*p*′ [½]	3*d*′ [2½]° 3–6*d*′ [1½]°

*For predicted levels in the spectra of the Ne I isoelectronic sequence, see Introduction.

Al V

(F I sequence; 9 electrons) $Z=13$

Ground state $1s^2\,2s^2\,2p^5\;^2P^\circ_{1\frac{1}{2}}$

$2p^5\;^2P^\circ_{1\frac{1}{2}}$ ***1240600*** cm^{-1} I. P. 153.77 volts

The analysis published by Söderqvist in 1934 has been extended by Ferner to include 78 classified lines in the region between 85 A and 281 A. The present list has been compiled from unpublished material kindly furnished by Ferner.

Intersystem combinations connecting the doublet and quartet terms have been observed. All but one of the observed combinations are with the ground term.

Ferner's unit, 10^3 cm^{-1}, has here been changed to cm^{-1}.

By analogy with related spectra in the isoelectronic sequence Robinson has suggested the following changes in Ferner's term assignments:

Ferner	Robinson	Ferner	Robinson
3*d* $^4P_{2\frac{1}{2}}$	3*d* $^2D_{2\frac{1}{2}}$	3*d*′ $^2S_{\frac{1}{2}}$	3*d*′ $^2P_{1\frac{1}{2}}$
3*d* $^4D_{1\frac{1}{2}}$ $^4D_{2\frac{1}{2}}$	3*d* $^4F_{1\frac{1}{2}}$ 3*d* $^4P_{2\frac{1}{2}}$	3*d*′ $^2P_{1\frac{1}{2}}$	3*d*′ $^2D_{1\frac{1}{2}}$
3*d* $^2D_{2\frac{1}{2}}$	3*d* $^2F_{2\frac{1}{2}}$	3*d*′ $^2D_{1\frac{1}{2}}$	3*d*′ $^2S_{\frac{1}{2}}$
4*d* $^4D_{1\frac{1}{2}}$ $^4D_{2\frac{1}{2}}$	4*d* $^4P_{1\frac{1}{2}}$ 4*d* $^2D_{2\frac{1}{2}}$	3*d*′ $^2D_{2\frac{1}{2}}$ 4*d*′ $^2S_{\frac{1}{2}}$	3*d*′ $^2D_{2\frac{1}{2}}$ $^2F_{2\frac{1}{2}}$ 4*d*′ $^2P_{1\frac{1}{2}}$
4*d* $^2D_{1\frac{1}{2}}$ $^2D_{2\frac{1}{2}}$	4*d* $^2P_{1\frac{1}{2}}$ 4*d* $^2D_{1\frac{1}{2}}$	4*d*′ $^2P_{1\frac{1}{2}}$ 4*d*′ $^2P_{\frac{1}{2}}$ $^2S_{\frac{1}{2}}$*	4*d*′ ^2D

*1100620.

He has also suggested a correction of $+1000$ cm^{-1} to Ferner's absolute term values. This correction has been made in the limit quoted here.

Al v—Continued

REFERENCES

J. Söderqvist, Nova Acta Reg. Soc. Sci. Uppsala [IV] **9**, No. 7, 39 (1934). (T) (C L)
E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **36A**, No. 1, p. 57 (1948). (I P) (T) (C L)
H. A. Robinson, unpublished material (March 1948). (T) (C L)

Al v

Author	Config.	Desig.	J	Level	Interval
$2p\ ^2P_2$ $^2P_1$	$2s^2\ 2p^5$	$2p^5\ ^2P°$	1½ ½	*0* *3440*	−3440
$2p'\ ^2S_1$	$2s\ 2p^6$	$2p^6\ ^2S$	½	358810	
$3s\ ^4P_3$ $^4P_2$ $^4P_1$	$2s^2\ 2p^4(^3P)3s$	$3s\ ^4P$	2½ 1½ ½	751810 753960 755250	−2150 −1290
$3s\ ^2P_2$ $^2P_1$	$2s^2\ 2p^4(^3P)3s$	$3s\ ^2P$	1½ ½	764240 766790	−2550
$\overline{3s}\ ^2D_3$ $^2D_2$	$2s^2\ 2p^4(^1D)3s$	$3s'\ ^2D$	2½ 1½	796650 796680	−30
$\overline{\overline{3s}}\ ^2S_1$	$2s^2\ 2p^4(^1S)3s$	$3s''\ ^2S$	½	843880	
$3d\ ^4D_3$ $^4D_2$	$2s^2\ 2p^4(^3P)3d$	$3d\ ^4D$	3½ 2½ 1½ ½	 919900 920680	−780
$3d\ ^4P_1$ $^4P_2$ $^4P_3$	$2s^2\ 2p^4(^3P)3d$	$3d\ ^4P$	½ 1½ 2½	921440 922120 922640	680 520
$3d\ ^2F_3$	$2s^2\ 2p^4(^3P)3d$	$3d\ ^2F$	3½ 2½	 923230	
$3d\ ^2D_2$ $^2D_3$	$2s^2\ 2p^4(^3P)3d$	$3d\ ^2D$	1½ 2½	925430 926400	970
$3d\ ^2P_1$ $^2P_2$	$2s^2\ 2p^4(^3P)3d$	$3d\ ^2P$	½ 1½	925900 928410	2510
$\overline{3d}\ ^2P_1$ $^2P_2$	$2s^2\ 2p^4(^1D)3d$	$3d'\ ^2P$	½ 1½	960420 961630	1210
$\overline{3d}\ ^2S_1$	$2s^2\ 2p^4(^1D)3d$	$3d'\ ^2S$	½	960860	
$\overline{3d}\ ^2D_3$ $^2D_2$	$2s^2\ 2p^4(^1D)3d$	$3d'\ ^2D$	2½ 1½	962640 963330	−690
$4s\ ^2P_2$ $^2P_1$	$2s^2\ 2p^4(^3P)4s$	$4s\ ^2P$	1½ ½	1005760 1008040	−2280
$\overline{\overline{3d}}\ ^2D_3$ $^2D_2$	$2s^2\ 2p^4(^1S)3d$	$3d''\ ^2D$	2½ 1½	1007150 1007290	−140
$\overline{4s}\ ^2D_3$ $^2D_2$	$2s^2\ 2p^4(^1D)4s$	$4s'\ ^2D$	2½ 1½	1043430 1043480	−50
$4d\ ^4D_3$ $^4D_2$	$2s^2\ 2p^4(^3P)4d$	$4d\ ^4D$	3½ 2½ 1½ ½	 1062510 1062820	−310
$4d\ ^4P_2$ $^4P_3$	$2s^2\ 2p^4(^3P)4d$	$4d\ ^4P$	½ 1½ 2½	 1063650 1064050	400
$4d\ ^2P_1$ $^2P_2$	$2s^2\ 2p^4(^3P)4d$	$4d\ ^2P$	½ 1½	1065170 1067770	2600
$4d\ ^2D_2$ $^2D_3$	$2s^2\ 2p^4(^3P)4d$	$4d\ ^2D$	1½ 2½	1065460 1066610	1150
$\overline{\overline{4s}}\ ^2S_1$	$2s^2\ 2p^4(^1S)4s$	$4s''\ ^2S$	½	1089930	
$3s'\ ^2P_2$ $^2P_1$	$2s\ 2p^5(^3P°)3s$	$3s'''\ ^2P°$	1½ ½	*1096180* *1098350*	−2170
$\overline{4d}\ ^2P_1$ $^2P_2$	$2s^2\ 2p^4(^1D)4d$	$4d'\ ^2P$	½ 1½	1101400 1103380	1980
$\overline{4d}\ ^2S_1$	$2s^2\ 2p^4(^1D)4d$	$4d'\ ^2S$	½	1102540	
$\overline{4d}\ ^2D_3$	$2s^2\ 2p^4(^1D)4d$	$4d'\ ^2D$	2½ 1½	1103190	
$5d\ ^4D_3$ $^4D_2$	$2s^2\ 2p^4(^3P)5d$	$5d\ ^4D$	3½ 2½ 1½ ½	 1127550 1127730	−180
$5d\ ^2D_2$ $^2D_3$	$2s^2\ 2p^4(^3P)5d$	$5d\ ^2D$	1½ 2½	1129350 1130900	1550
$5d\ ^2P_1$ $^2P_2$	$2s^2\ 2p^4(^3P)5d$	$5d\ ^2P$	½ 1½	1129350 1131650	2300
$\overline{\overline{4d}}\ ^2D_3$ $^2D_2$	$2s^2\ 2p^4(^1S)4d$	$4d''\ ^2D$	2½ 1½	1149160 1149260	−100
$6d\ ^2D_2$ $^2D_3$	$2s^2\ 2p^4(^3P)6d$	$6d\ ^2D$	1½ 2½	1163850 1165450	1600
$\overline{5d}\ ^2S_1$	$2s^2\ 2p^4(^1D)5d$	$5d'\ ^2S$	½	1167380	
$\overline{5d}\ ^2P_2$	$2s^2\ 2p^4(^1D)5d$	$5d'\ ^2P$	½ 1½	 1168060	
	Al vi $(^3P_2)$	***Limit***	------	***1240600***	

March 1948.

Al v Observed Terms*

Config. $1s^2+$	Observed Terms					
$2s^2\,2p^5$		$2p^5\ {}^2P^\circ$				
$2s\ 2p^6$	$2p^6\ {}^2S$					
	ns $(n\geq 3)$		*nd* $(n\geq 3)$			
$2s^2\,2p^4(^3P)nx$		$3s\ {}^4P$ $3, 4s\ {}^2P$		$3, 4d\ {}^4P$ $3\text{–}5d\ {}^2P$	$3\text{–}5d\ {}^4D$ $3\text{–}6d\ {}^2D$	$3d\ {}^2F$
$2s^2\,2p^4(^1D)nx'$		$3, 4s'\ {}^2D$	$3\text{–}5d'\ {}^2S$	$3\text{–}5d'\ {}^2P$	$3, 4d'\ {}^2D$	
$2s^2\,2p^4(^1S)nx''$	$3, 4s''\ {}^2S$				$3, 4d''\ {}^2D$	
$2s\ 2p^5(^3P^\circ)nx'''$		$3s'''\ {}^2P^\circ$				

*For predicted terms in the spectra of the F I isoelectronic sequence, see Introduction.

Al VI

(O I sequence; 8 electrons) $Z=13$

Ground state $1s^2\,2s^2\,2p^4\ {}^3P_2$

$2p^4\ {}^3P_2$ **1536300 cm^{-1}** I. P. 190.42 volts

The analysis is by Ferner, who has extended the earlier work by Söderqvist. He has listed 45 terms and 89 classified lines. The later observations are in the region between 68 A and 113 A. Two intersystem combinations have been observed.

Ferner expresses all level values in units of 10^3 cm^{-1} but for uniformity all values listed below are given in cm^{-1}.

REFERENCES

J. Söderqvist, Nova Acta Reg. Soc. Sci. Uppsala [IV] **9**, No. 7, 51 (1934). (T) (C L)

E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **36A**, No. 1, p. 48 (1948). (I P) (T) (C L)

Al VI

Config.	Desig.	J	Level	Interval
$2s^2\,2p^4$	$2p^4\ {}^3P$	2 1 0	0 2736 3831	−2736 −1095
$2s^2\,2p^4$	$2p^4\ {}^1D$	2	41600	
$2s^2\,2p^4$	$2p^4\ {}^1S$	0	88670	
$2s\ 2p^5$	$2p^5\ {}^3P^\circ$	2 1 0	*323002* *325470* *326822*	−2468 −1352
$2s\ 2p^5$	$2p^5\ {}^1P^\circ$	1	*451840*	
$2s^2\,2p^3(^4S^\circ)3s$	$3s\ {}^3S^\circ$	1	*913130*	
$2s^2\,2p^3(^2D^\circ)3s$	$3s'\ {}^3D^\circ$	3, 2, 1	*961100*	
$2s^2\,2p^3(^2D^\circ)3s$	$3s'\ {}^1D^\circ$	2	*970790*	
$2s^2\,2p^3(^2P^\circ)3s$	$3s''\ {}^3P^\circ$	0 1 2	 *993660* *993880*	 220
$2s^2\,2p^3(^2P^\circ)3s$	$3s''\ {}^1P^\circ$	1	*1003700*	
$2s^2\,2p^3(^4S^\circ)3d$	$3d\ {}^3D^\circ$	1 2 3	*1079460* *1079490* *1079610*	30 120
$2s^2\,2p^3(^2D^\circ)3d$	$3d'\ {}^3F^\circ$	4 3 2	 *1132180*	
$2s^2\,2p^3(^2D^\circ)3d$	$3d'\ {}^3D^\circ$	3, 2, 1	*1134170*	
$2s^2\,2p^3(^2D^\circ)3d$	$3d'\ {}^1P^\circ$	1	*1136500*	

Al VI—Continued

Config.	Desig.	J	Level	Interval
$2s^2\,2p^3(^2D^\circ)3d$	$3d'\ ^3P^\circ$	2 1 0	*1140840* *1141670* *1141910*	−830 −240
$2s^2\,2p^3(^2D^\circ)3d$	$3d'\ ^1D^\circ$	2	*1142220*	
$2s^2\,2p^3(^2D^\circ)3d$	$3d'\ ^3S^\circ$	1	*1145020*	
$2s^2\,2p^3(^2D^\circ)3d$	$3d'\ ^1F^\circ$	3	*1150250*	
$2s^2\,2p^3(^2P^\circ)3d$	$3d''\ ^3P^\circ$	0 1 2	*1164220* *1164620* *1165260*	400 640
$2s^2\,2p^3(^2P^\circ)3d$	$3d''\ ^3F^\circ$	4 3 2	 *1166530* *1168690*	−2160
$2s^2\,2p^3(^2P^\circ)3d$	$3d''\ ^1D^\circ$	2	*1169150*	
$2s^2\,2p^3(^2P^\circ)3d$	$3d''\ ^3D^\circ$	3 2 1	*1169390* *1170650*	−1260
$2s^2\,2p^3(^2P^\circ)3d$	$3d''\ ^1P^\circ$	1	*1171050*	
$2s^2\,2p^3(^2P^\circ)3d$	$3d''\ ^1F^\circ$	3	*1174450*	
$2s\ 2p^4(^4P)3s$	$3s'''\ ^3P$	2 1 0	1204550 1205500	−950
$2s^2\,2p^3(^4S^\circ)4s$	$4s\ ^3S^\circ$	1	*1218290*	
$2s^2\,2p^3(^2D^\circ)4s$	$4s'\ ^3D^\circ$	3, 2, 1	*1274550*	
$2s^2\,2p^3(^2D^\circ)4s$	$4s'\ ^1D^\circ$	2	*1279680*	
$2s^2\,2p^3(^4S^\circ)4d$	$4d\ ^3D^\circ$	1, 2, 3	*1282960*	
$2s\ 2p^4(^2D)3s$	$3s^{IV}\ ^3D$	3, 2, 1	1293290	

Al VI—Continued

Config.	Desig.	J	Level	Interval
$2s^2\,2p^3(^2P^\circ)4s$	$4s''\ ^1P^\circ$	1	*1312070*	
$2s^2\,2p^3(^2D^\circ)4d$	$4d'\ ^3D^\circ$	3, 2, 1	*1339480*	
$2s^2\,2p^3(^2D^\circ)4d$	$4d'\ ^1P^\circ$	1	*1341090*	
$2s^2\,2p^3(^2D^\circ)4d$	$4d'\ ^3P^\circ$	2 1 0	*1343320*	
$2s^2\,2p^3(^2D^\circ)4d$	$4d'\ ^3S^\circ$	1	*1345030*	
$2s^2\,2p^3(^2D^\circ)4d$	$4d'\ ^1D^\circ$	2	*1345430*	
$2s^2\,2p^3(^2D^\circ)4d$	$4d'\ ^1F^\circ$	3	*1346780*	
$2s\ 2p^4(^2S)3s$	$3s^{V}\ ^3S$	1	1359890	
$2s^2\,2p^3(^2P^\circ)4d$	$4d''\ ^3P^\circ$	0 1 2	 *1371220*	
$2s^2\,2p^3(^2P^\circ)4d$	$4d''\ ^3D^\circ$	3 2 1	*1373440* *1375140*	−1700
$2s^2\,2p^3(^4S^\circ)5d$	$5d\ ^3D^\circ$	1, 2, 3	*1375250*	
$2s^2\,2p^3(^2P^\circ)4d$	$4d''\ ^1F^\circ$	3	*1376860*	
$2s^2\,2p^3(^2D^\circ)5s$	$5s'\ ^1D^\circ$	2	*1405220*	
$2s^2\,2p^3(^2P^\circ)5d$	$5d''\ ^3P^\circ$	0 1 2	 *1465780*	
$2s^2\,2p^3(^2P^\circ)5d$	$5d''\ ^3D^\circ$	3 2 1	*1466990*	
Al VII ($^4S^\circ_{1\frac{1}{2}}$)	*Limit*	-------	**1536300**	

February 1947.

Al VI Observed Terms*

Config. $1s^2+$	Observed Terms	
$2s^2\,2p^4$	$2p^4\ ^3P$ $2p^4\ ^1S$ $2p^4\ ^1D$	
$2s\ 2p^5$	$2p^5\ ^3P^\circ$ $2p^5\ ^1P^\circ$	
	ns ($n \geq 3$)	*nd* ($n \geq 3$)
$2s^2\,2p^3(^4S^\circ)nx$	3, 4s $^3S^\circ$	3–5d $^3D^\circ$
$2s^2\,2p^3(^2D^\circ)nx'$	3, 4s′ $^3D^\circ$ 3–5s′ $^1D^\circ$	3, 4d′ $^3S^\circ$ 3, 4d′ $^3P^\circ$ 3, 4d′ $^3D^\circ$ 3d′ $^3F^\circ$ 3, 4d′ $^1P^\circ$ 3, 4d′ $^1D^\circ$ 3, 4d′ $^1F^\circ$
$2s^2\,2p^3(^2P^\circ)nx''$	3s″ $^3P^\circ$ 3, 4s″ $^1P^\circ$	3–5d″ $^3P^\circ$ 3–5d″ $^3D^\circ$ 3d″ $^3F^\circ$ 3d″ $^1P^\circ$ 3d″ $^1D^\circ$ 3, 4d″ $^1F^\circ$
$2s\ 2p^4(^4P)nx'''$	3s‴ ^3P	
$2s\ 2p^4(^2D)nx^{IV}$	$3s^{IV}\ ^3D$	
$2s\ 2p^4(^2S)nx^{V}$	$3s^{V}\ ^3S$	

*For predicted terms in the spectra of the O I isoelectronic sequence, see Introduction.

Al VII

(N I sequence; 7 electrons) $Z=13$

Ground state $1s^2\,2s^2\,2p^3\ ^4S^{\circ}_{1\frac{1}{2}}$

$2p^3\ ^4S^{\circ}_{1\frac{1}{2}}$ ***1951830*** cm^{-1} I. P. 241.93 volts

The analysis is from Ferner who kindly furnished his manuscript in advance of publication. He has extended the earlier work by Söderqvist to include 76 classified lines between 58 A and 96 A. One intersystem combination has been observed, but the relative positions of the doublet and quartet terms are determined from the series.

The unit used by Ferner, $10^3\ cm^{-1}$, has here been changed to cm^{-1}.

REFERENCES

J. Söderqvist, Nova Acta Reg. Soc. Sci. Uppsala [IV] **9,** No. 7, 64 (1934). (T) (C L)

E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **36A,** No. 1, p. 42 (1948). (I P) (T) (C L)

Al VII

Author	Config.	Desig.	J	Level	Interval
$2p\ ^4S_2$	$2s^2\,2p^3$	$2p^3\ ^4S^{\circ}$	1½	*0*	
$2p\ ^2D_2$ $^2D_3$	$2s^2\,2p^3$	$2p^3\ ^2D^{\circ}$	1½ 2½	*60700* *60760*	60
$2p\ ^2P_1$ $^2P_2$	$2s^2\,2p^3$	$2p^3\ ^2P^{\circ}$	½ 1½	*93000* *93270*	270
$2p'\ ^4P_3$ $^4P_2$ $^4P_1$	$2s\ 2p^4$	$2p^4\ ^4P$	2½ 1½ ½	280200 282660 283960	−2460 −1300
$2p'\ ^2D_3$ $^2D_2$	$2s\ 2p^4$	$2p^4\ ^2D$	2½ 1½	384260 384310	−50
$2p'\ ^2S_1$	$2s\ 2p^4$	$2p^4\ ^2S$	½	451360	
$2p'\ ^2P_2$ $^2P_1$	$2s\ 2p^4$	$2p^4\ ^2P$	1½ ½	476090 479050	−2960
$3s\ ^4P_1$ $^4P_2$ $^4P_3$	$2s^2\,2p^2(^3P)3s$	$3s\ ^4P$	½ 1½ 2½	1147100 1148630 1150920	1530 2290
$3s\ ^2P_1$ $^2P_2$	$2s^2\,2p^2(^3P)3s$	$3s\ ^2P$	½ 1½	1162360 1165130	2770
$\overline{3s}\ ^2D$	$2s^2\,2p^2(^1D)3s$	$3s'\ ^2D$	{1½ 2½}	1196680	
$\overline{\overline{3s}}\ ^2S_1$	$2s^2\,2p^2(^1S)3s$	$3s''\ ^2S$	½	1246840	
$3d\ ^2P_2$ $^2P_1$	$2s^2\,2p^2(^3P)3d$	$3d\ ^2P$	1½ ½	1315640 1316420	−780
$3s'\ ^4S_2$	$2s\ 2p^3(^5S^{\circ})3s$	$3s'''\ ^4S^{\circ}$	1½	*1322180*	
$3d\ ^2F_3$ $^2F_4$	$2s^2\,2p^2(^3P)3d$	$3d\ ^2F$	2½ 3½	1323370 1326390	3020
$3d\ ^4D_{32}$ $^4D_1$	$2s^2\,2p^2(^3P)3d$	$3d\ ^4D$	3½ 2½ 1½} ½	1323940 1324710	−770
$3d\ ^4P_3$ $^4P_2$ $^4P_1$	$2s^2\,2p^2(^3P)3d$	$3d\ ^4P$	2½ 1½ ½	1326960 1327990 1328550	−1030 −560

Al VII

Author	Config.	Desig.	J	Level	Interval
$3d\ ^2D_2$ $^2D_3$	$2s^2\,2p^2(^3P)3d$	$3d\ ^2D$	1½ 2½	1343710 1344530	820
$\overline{3d}\ ^2F_4$ $^2F_3$	$2s^2\,2p^2(^1D)3d$	$3d'\ ^2F$	3½ 2½	1366720 1367160	−440
$\overline{3d}\ ^2D_2$ $^2D_3$	$2s^2\,2p^2(^1D)3d$	$3d'\ ^2D$	1½ 2½	1369270 1369960	690
$\overline{3d}\ ^2P_1$ $^2P_2$	$2s^2\,2p^2(^1D)3d$	$3d'\ ^2P$	½ 1½	1378290 1379130	840
$3p'\ ^4P$	$2s\ 2p^3(^5S^{\circ})3p$	$3p'''\ ^4P$	{½ to 2½}	1383700	
$\overline{3d}\ ^2S_1$	$2s^2\,2p^2(^1D)3d$	$3d'\ ^2S$	½	1384370	
$\overline{\overline{3d}}\ ^2D$	$2s^2\,2p^2(^1S)3d$	$3d''\ ^2D$	{1½ 2½}	1410380	
$3d'\ ^4D$	$2s\ 2p^3(^5S^{\circ})3d$	$3d'''\ ^4D^{\circ}$	{½ to 3½}	*1473060*	
$4s\ ^4P_2$ $^4P_3$	$2s^2\,2p^2(^3P)4s$	$4s\ ^4P$	½ 1½ 2½	1540740 1542850	2110
$4s\ ^2P_2$	$2s^2\,2p^2(^3P)4s$	$4s\ ^2P$	½ 1½	1540820	
$\overline{3d'}\ ^4P_3$ $^4P_2$ $^4P_1$	$2s\ 2p^3(^3D^{\circ})3d$	$3d^{IV}\ ^4P^{\circ}$	2½ 1½ ½	*1591560* *1592170* *1592550*	−610 −380
$\overline{3d'}\ ^4D$	$2s\ 2p^3(^3D^{\circ})3d$	$3d^{IV}\ ^4D^{\circ}$	{½ to 3½}	*1598270*	
$4d\ ^2P_2$	$2s^2\,2p^2(^3P)4d$	$4d\ ^2P$	1½ ½	1598890	
$\overline{3d'}\ ^4S_2$	$2s\ 2p^3(^3D^{\circ})3d$	$3d^{IV}\ ^4S^{\circ}$	1½	*1599300*	
$4d\ ^4D_{32}$ $^4D_1$	$2s^2\,2p^2(^3P)4d$	$4d\ ^4D$	3½ {2½ 1½} ½	1600670 1601740	−1070

Al VII—Continued

Author	Config.	Desig.	*J*	Level	Interval
$4d\ ^2F_3$	$2s^2\,2p^2(^3P)4d$	$4d\ ^2F$	2½	1603550	2710
$^2F_4$			3½	1606260	
$4d\ ^4P_3$	$2s^2\,2p^2(^3P)4d$	$4d\ ^4P$	2½	1605240	
			1½		
			½		
$4d\ ^2D_2$	$2s^2\,2p^2(^3P)4d$	$4d\ ^2D$	1½	1610820	740
$^2D_3$			2½	1611560	
$\overline{4d}\ ^2D_2$	$2s^2\,2p^2(^1D)4d$	$4d'\ ^2D$	1½	1646820	1060
$^2D_3$			2½	1647880	
$\overline{4d}\ ^2F_{34}$	$2s^2\,2p^2(^1D)4d$	$4d'\ ^2F$	{2½ 3½}	1647430	
$\overline{4d}\ ^2S_1$	$2s^2\,2p^2(^1D)4d$	$4d'\ ^2S$	½	1654160	

Al VII—Continued

Author	Config.	Desig.	*J*	Level	Interval
	$2s^2\,2p^2(^3P)5s$	$5s\ ^4P$	½		
			1½		
$5s\ ^4P_3$			2½	1702070	
$5d\ ^2F_3$	$2s^2\,2p^2(^3P)5d$	$5d\ ^2F$	2½	1729840	2570
$^2F_4$			3½	1732410	
$4d'\ ^4D_4$	$2s\ 2p^3(^5S^\circ)4d$	$4d'''\ ^4D^\circ$	3½	*1739390*	−210
$^4D_3$			2½	*1739600*	−370
$^4D_{21}$			{1½ ½}	*1739970*	
$\overline{5d}\ ^2F_{43}$	$2s^2\,2p^2(^1D)5d$	$5d'\ ^2F$	{3½ 2½}	1773560	
	Al VIII ($^3P_0$)	*Limit*		***1951830***	

March 1947.

Al VII OBSERVED TERMS*

Config. $1s^2+$	Observed Terms		
$2s^2\,2p^3$	$2p^3\ ^4S^\circ$ $2p^3\ ^2P^\circ$ $2p^3\ ^2D^\circ$		
$2s\ 2p^4$	$2p^4\ ^4P$ $2p^4\ ^2S$ $2p^4\ ^2P$ $2p^4\ ^2D$		
	ns ($n\geq 3$)	*np* ($n\geq 3$)	*nd* ($n\geq 3$)
$2s^2\,2p^2(^3P)nx$	3–5$s\ ^4P$; 3, 4$s\ ^2P$		3, 4$d\ ^4P$ 3, 4$d\ ^4D$; 3, 4$d\ ^2P$ 3, 4$d\ ^2D$ 3–5$d\ ^2F$
$2s^2\,2p^2(^1D)nx'$	$3s'\ ^2D$		3, 4$d'\ ^2S$ $3d'\ ^2P$ 3, 4$d'\ ^2D$ 3–5$d'\ ^2F$
$2s^2\,2p^2(^1S)nx''$	$3s''\ ^2S$		$3d''\ ^2D$
$2s\ 2p^3(^5S^\circ)nx'''$	$3s'''\ ^4S^\circ$	$3p'''\ ^4P$	3, 4$d'''\ ^4D^\circ$
$2s\ 2p^3(^3D^\circ)nx^{IV}$			$3d^{IV}\ ^4S^\circ$ $3d^{IV}\ ^4P^\circ$ $3d^{IV}\ ^4D^\circ$

*For predicted terms in the spectra of the N I isoelectronic sequence, see Introduction.

Al VIII

(C I sequence; 6 electrons) $Z=13$

Ground state $1s^2\,2s^2\,2p^2\ ^3P_0$

$2p^2\ ^3P_0$ **2300390** cm^{-1} I. P. 285.13 volts

The analysis is by Ferner, who has generously furnished his manuscript in advance of publication. He has extended the earlier work by Söderqvist to include 77 classified lines in the region between 53 A and 91 A. The relative values of the singlet, triplet, and quintet systems of terms are determined from the series limits.

Ferner's unit, 10^3 cm^{-1}, has here been converted to cm^{-1}.

REFERENCES

J. Söderqvist, Nova Acta Reg. Soc. Sci. Uppsala [IV], **9,** No. 7, 77 (1934). (T) (C L)
E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **36A,** No. 1, p. 37 (1948). (I P) (T) (C L)

Al VIII

Author	Config.	Desig.	J	Level	Interval
2p $^3P_0$	$2s^2\,2p^2$	$2p^2$ ^3P	0	0	1740
$^3P_1$			1	1740	2700
$^3P_2$			2	4440	
2p $^1D_2$	$2s^2\,2p^2$	$2p^2$ ^1D	2	46690+x	
2p $^1S_0$	$2s^2\,2p^2$	$2p^2$ ^1S	0	96170+x	
2p′ $^5S_2$	$2s\ 2p^3$	$2p^3$ $^5S°$	2	*133510+y*	
2p′ $^3D_3$	$2s\ 2p^3$	$2p^3$ $^3D°$	3	*262190*	−130
$^3D_2$			2	*262320*	−70
$^3D_1$			1	*262390*	
2p′ ^3P	$2s\ 2p^3$	$2p^3$ $^3P°$	0, 1, 2	*309130*	
2p′ $^1D_2$	$2s\ 2p^3$	$2p^3$ $^1D°$	2	*396990+x*	
2p′ $^3S_1$	$2s\ 2p^3$	$2p^3$ $^3S°$	1	*404220*	
2p′ $^1P_1$	$2s\ 2p^3$	$2p^3$ $^1P°$	1	*444550+x*	
3s $^3P_0$	$2s^2\,2p(^2P°)3s$	3s $^3P°$	0	*1319280*	1170
$^3P_1$			1	*1320450*	3630
$^3P_2$			2	*1324080*	
3s $^1P_1$	$2s^2\,2p(^2P°)3s$	3s $^1P°$	1	*1335270+x*	
3p $^3S_1$	$2s^2\,2p(^2P°)3p$	3p ^3S	1	1402180	
3s′ $^5P_1$	$2s\ 2p^2(^4P)3s$	3s ^5P	1	1465810+y	1660
$^5P_2$			2	1467470+y	2210
$^5P_3$			3	1469680+y	
3d $^3F_2$	$2s^2\,2p(^2P°)3d$	3d $^3F°$	2	*1468700+x*	
			3		
			4		
3d $^1D_2$	$2s^2\,2p(^2P°)3d$	3d $^1D°$	2	*1471980+x*	
3d $^3D_1$	$2s^2\,2p(^2P°)3d$	3d $^3D°$	1	*1484560*	680
$^3D_2$			2	*1485240*	1470
$^3D_3$			3	*1486710*	
3d $^3P_2$	$2s^2\,2p(^2P°)3d$	3d $^3P°$	2	*1490590*	−980
$^3P_1$			1	*1491570*	−570
$^3P_0$			0	*1492140*	
	$2s\ 2p^2(^4P)3s$	3s ^3P	0		
3s′ $^3P_1$			1	1504810	2410
$^3P_2$			2	1507220	
3d $^1F_3$	$2s^2\,2p(^2P°)3d$	3d $^1F°$	3	*1509210+x*	
3d $^1P_1$	$2s^2\,2p(^2P°)3d$	3d $^1P°$	1	*1510060+x*	
3p′ $^3S_1$	$2s\ 2p^2(^4P)3p$	3p $^3S°$	1	*1531270*	
3p′ $^3D_1$	$2s\ 2p^2(^4P)3p$	3p $^3D°$	1	*1564140*	700
$^3D_2$			2	*1564840*	2000
$^3D_3$			3	*1566840*	
	$2s\ 2p^2(^4P)3p$	3p $^3P°$	0		
			1		
3p′ $^3P_2$			2	*1577760*	
$\overline{3s}'$ ^3D	$2s\ 2p^2(^2D)3s$	3s′ ^3D	1, 2, 3	1585400	
$\overline{3s}'$ $^1D_2$	$2s\ 2p^2(^2D)3s$	3s′ ^1D	2	1608440+x	

Author	Config.	Desig.	J	Level	Interval
3d′ $^5P_3$	$2s\ 2p^2(^4P)3d$	3d ^5P	3	1631170+y	−890
$^5P_2$			2	1632060+y	−610
$^5P_1$			1	1632670+y	
3d′ $^3P_2$	$2s\ 2p^2(^4P)3d$	3d ^3P	2	1633840	−1600
$^3P_1$			1	1635440	
			0		
3d′ $^3F_2$	$2s\ 2p^2(^4P)3d$	3d ^3F	2	1643590	1400
$^3F_3$			3	1644990	1800
$^3F_4$			4	1646790	
$\overline{3p}'$ $^1F_3$	$2s\ 2p^2(^2D)3p$	3p′ $^1F°$	3	*1659180+x*	
$\overline{\overline{3s}}'$ $^3S_1$	$2s\ 2p^2(^2S)3s$	3s″ ^3S	1	1662740	
3d′ $^3D_1$	$2s\ 2p^2(^4P)3d$	3d ^3D	1	1664880	500
$^3D_2$			2	1665380	550
$^3D_3$			3	1665930	
$\overline{3p}'$ $^1D_2$	$2s\ 2p^2(^2D)3p$	3p′ $^1D°$	2	*1667490+x*	
	$2s\ 2p^2(^2P)3s$	3s‴ ^3P	0		
			1		
$\equiv$ 3s′ $^3P_2$			2	1682590	
$\overline{3d}'$ ^3F	$2s\ 2p^2(^2D)3d$	3d′ ^3F	2, 3, 4	1733950	
$\overline{3d}'$ ^3D	$2s\ 2p^2(^2D)3d$	3d′ ^3D	1, 2, 3	1742250	
$\overline{3d}'$ $^3P_2$	$2s\ 2p^2(^2D)3d$	3d′ ^3P	2	1745690	−1250
$^3P_1$			1	1747940	−1700
$^3P_0$			0	1749640	
$\overline{3d}'$ $^3S_1$	$2s\ 2p^2(^2D)3d$	3d′ ^3S	1	1762090	
	$2s^2\,2p(^2P°)4s$	4s $^3P°$	0		
			1		
4s $^3P_2$			2	*1785380*	
	$2s\ 2p^2(^2S)3d$	3d″ ^3D	1		
$\overline{\overline{3d}}'$ $^3D_2$			2	1815990	960
$^3D_3$			3	1816950	
$\equiv$ 3d′ ^3F	$2s\ 2p^2(^2P)3d$	3d‴ ^3F	2, 3, 4	1831700	
$\equiv$ 3d′ ^3D	$2s\ 2p^2(^2P)3d$	3d‴ ^3D	1, 2, 3	1840570	
	$2s\ 2p^2(^2P)3d$	3d‴ ^3P	0		
			1		
$\equiv$ 3d′ $^3P_2$			2	1844390	
	$2s^2\,2p(^2P°)4d$	4d $^3D°$	1		
4d $^3D_2$			2	*1846180*	1310
$^3D_3$			3	*1847490*	
4d $^1P_1$	$2s^2\,2p(^2P°)4d$	4d $^1P°$	1	*1853670+x*	
4d′ $^5P_3$	$2s\ 2p^2(^4P)4d$	4d ^5P	3	1991450+y	−800
$^5P_2$			2	1992250+y	−510
$^5P_1$			1	1992760+y	
	$2s\ 2p^2(^4P)4d$	4d ^3F	2		
4d′ $^3F_3$			3	1997710	2000
$^3F_4$			4	1999710	
	Al IX ($^2P^{\circ}_{1/2}$)	*Limit*		**2300390**	

March 1948.

Al VIII Observed Terms*

Config. $1s^2+$	Observed Terms		
$2s^2\ 2p^2$	$2p^2\ ^1S$ $2p^2\ ^3P$ $2p^2\ ^1D$		
$2s\ 2p^3$	$2p^3\ ^5S^\circ$ $2p^3\ ^3S^\circ$ $2p^3\ ^3P^\circ$ $2p^3\ ^1P^\circ$ $2p^3\ ^3D^\circ$ $2p^3\ ^1D^\circ$		
	$ns\ (n \geq 3)$	$np\ (n \geq 3)$	$nd\ (n \geq 3)$
$2s^2\ 2p(^2P^\circ)nx$	$3, 4s\ ^3P^\circ$ $3s\ ^1P^\circ$	$3p\ ^3S$	$3d\ ^3P^\circ$ $3, 4d\ ^3D^\circ$ $3d\ ^3F^\circ$ $3, 4d\ ^1P^\circ$ $3d\ ^1D^\circ$ $3d\ ^1F^\circ$
$2s\ 2p^2(^4P)nx$	$3s\ ^5P$ $3s\ ^3P$	$3p\ ^3S^\circ$ $3p\ ^3P^\circ$ $3p\ ^3D^\circ$	$3, 4d\ ^5P$ $3d\ ^3P$ $3d\ ^3D$ $3, 4d\ ^3F$
$2s\ 2p^2(^2D)nx'$	$3s'\ ^3D$ $3s'\ ^1D$	$3p'\ ^1D^\circ$ $3p'\ ^1F^\circ$	$3d'\ ^3S$ $3d'\ ^3P$ $3d'\ ^3D$ $3d'\ ^3F$
$2s\ 2p^2(^2S)nx''$	$3s''\ ^3S$		$3d''\ ^3D$
$2s\ 2p^2(^2P)nx'''$	$3s'''\ ^3P$		$3d'''\ ^3P$ $3d'''\ ^3D$ $3d'''\ ^3F$

*For predicted terms in the spectra of the C I isoelectronic sequence, see Introduction.

Al IX

(B I sequence; 5 electrons) $Z=13$

Ground state $1s^2\ 2s^2\ 2p\ ^2P^\circ_{1/2}$

$2p\ ^2P^\circ_{1/2}$ ***2663340*** cm^{-1} I. P. 330.1 volts

Ferner has extended the preliminary analysis by Söderqvist and now has 74 classified lines in the range between 43 A and 77 A. He kindly furnished his manuscript in advance of publication.

No intersystem combinations have been observed, as indicated by x in the table, but the absolute values of the doublet and quartet terms are determined from series. The quartet terms are not all connected by observed combinations.

Ferner's unit, 10^3 cm^{-1}, has here been changed to cm^{-1}.

REFERENCE

J. Söderqvist, Nova Acta Reg. Soc. Sci. Uppsala [IV] **9,** No. 7, 90 (1934). (C L)
E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **36A,** No. 1, p. 30 (1948). (I P) (T) (C L)

Al IX

Author	Config.	Desig.	J	Level	Interval
$2p$ $^2P_1$ $^2P_2$	$2s^2(^1S)2p$	$2p$ $^2P°$	½ 1½	*0* *4890*	4890
$2p'$ $^4P_1$ $^4P_2$ $^4P_3$	$2s\,2p^2$	$2p^2$ ^4P	½ 1½ 2½	146310+x 148000+x 150490+x	1690 2490
$2p'$ ^2D	$2s\,2p^2$	$2p^2$ ^2D	{ 1½ 2½ }	259720	
$2p'$ $^2S_1$	$2s\,2p^2$	$2p^2$ ^2S	½	332650	
$2p'$ $^2P_1$ $^2P_2$	$2s\,2p^2$	$2p^2$ ^2P	½ 1½	353960 356950	2990
$2p''$ $^4S_2$	$2p^3$	$2p^3$ $^4S°$	1½	*461910+x*	
$2p''$ $^2D_3$ $^2D_2$	$2p^3$	$2p^3$ $^2D°$	2½ 1½	*519560* *519740*	−180
$2p''$ $^2P_1$ $^2P_2$	$2p^3$	$2p^3$ $^2P°$	½ 1½	*584150* *584390*	240
$3s$ $^2S_1$	$2s^2(^1S)3s$	$3s$ ^2S	½	1501020	
$3d$ $^2D_2$ $^2D_3$	$2s^2(^1S)3d$	$3d$ ^2D	1½ 2½	1642140 1642380	240
$3s'$ $^4P_1$ $^4P_2$ $^4P_3$	$2s\,2p(^3P°)3s$	$3s$ $^4P°$	½ 1½ 2½	*1657690+x* *1659350+x* *1662340+x*	1660 2990
$3s'$ $^2P_1$ $^2P_2$	$2s\,2p(^3P°)3s$	$3s$ $^2P°$	½ 1½	*1690880* *1694110*	3230
$3p'$ $^2P_1$ $^2P_2$	$2s\,2p(^3P°)3p$	$3p$ ^2P	½ 1½	1720900 1722400	1500
$3p'$ $^2D_2$ $^2D_3$	$2s\,2p(^3P°)3p$	$3p$ ^2D	1½ 2½	1757500 1760970	3470
$3p'$ $^2S_1$	$2s\,2p(^3P°)3p$	$3p$ ^2S	½	1780950	
$3d'$ $^4D_{12}$ $^4D_3$ $^4D_4$	$2s\,2p(^3P°)3d$	$3d$ $^4D°$	{ ½ 1½ } 2½ 3½	*1799090+x* *1799490+x* *1800980+x*	400 1490
$3d'$ $^2D_2$ $^2D_3$	$2s\,2p(^3P°)3d$	$3d$ $^2D°$	1½ 2½	*1800460* *1800910*	450
$\overline{3s'}$ ^2P	$2s\,2p(^1P°)3s$	$3s'$ $^2P°$	{ ½ 1½ }	*1807020*	
$3d'$ $^4P_3$ $^4P_2$ $^4P_1$	$2s\,2p(^3P°)3d$	$3d$ $^4P°$	2½ 1½ ½	*1807490+x* *1808530+x* *1809210+x*	−1040 −680
$3d'$ $^2F_3$ $^2F_4$	$2s\,2p(^3P°)3d$	$3d$ $^2F°$	2½ 3½	*1831260* *1834300*	3040
$3d'$ $^2P_2$ $^2P_1$	$2s\,2p(^3P°)3d$	$3d$ $^2P°$	1½ ½	*1840470* *1842220*	−1750

Al IX

Author	Config.	Desig.	J	Level	Interval
$\overline{3p'}$ $^2D_2$ $^2D_3$	$2s\,2p(^1P°)3p$	$3p'$ ^2D	1½ 2½	1875340 1876710	1370
$\overline{3p'}$ ^2P	$2s\,2p(^1P°)3p$	$3p'$ ^2P	{ ½ 1½ }	1878390	
$3s''$ $^4P_1$ $^4P_2$ $^4P_3$	$2p^2(^3P)3s$	$3s''$ ^4P	½ 1½ 2½	1917920+x 1918850+x 1921100+x	930 2250
$\overline{3d'}$ ^2F	$2s\,2p(^1P°)3d$	$3d'$ $^2F°$	{ 2½ 3½ }	*1933050*	
$\overline{3d'}$ $^2D_2$ $^2D_3$	$2s\,2p(^1P°)3d$	$3d'$ $^2D°$	1½ 2½	*1943380* *1943980*	600
$\overline{3d'}$ ^2P	$2s\,2p(^1P°)3d$	$3d'$ $^2P°$	{ ½ 1½ }	*1954710*	
   $3p''$ $^4D_4$	$2p^2(^3P)3p$	$3p''$ $^4D°$	½ 1½ 2½ 3½	 *1986800+x*	
  $3p''$ $^4P_3$	$2p^2(^3P)3p$	$3p''$ $^4P°$	½ 1½ 2½	 *1991700+x*	
$3p''$ $^4S_2$	$2p^2(^3P)3p$	$3p''$ $^4S°$	1½	*2017670+x*	
$\overline{3p''}$ ^2D	$2p^2(^1D)3p$	$3p'''$ $^2D°$	{ 1½ 2½ }	*2056120*	
$3d''$ ^4P	$2p^2(^3P)3d$	$3d''$ ^4P	2½ 1½ ½	2065270+x 2066350+x 2067100+x	−1080 −750
$4d$ $^2D_2$ $^2D_3$	$2s^2(^1S)4d$	$4d$ ^2D	1½ 2½	2094020 2094490	470
   $4d'$ $^4D_4$	$2s\,2p(^3P°)4d$	$4d$ $^4D°$	½ 1½ 2½ 3½	 *2254250+x*	
$4d'$ $^4P_3$	$2s\,2p(^3P°)4d$	$4d$ $^4P°$	2½ 1½ ½	*2256240+x*	
 $4d'$ $^2F_4$	$2s\,2p(^3P°)4d$	$4d$ $^2F°$	2½ 3½	 *2265580*	
 $5d$ $^2D_3$	$2s^2(^1S)5d$	$5d$ ^2D	1½ 2½	 2301150	
 $\overline{4d'}$ $^2D_3$	$2s\,2p(^1P°)4d$	$4d'$ $^2D°$	1½ 2½	 *2393860*	
	Al X ($^1S_0$)	*Limit*	-------	*2663340*	

August 1947.

Al IX Observed Terms*

Config. $1s^2+$	Observed Terms
$2s^2(^1S)2p$	$2p\ ^2P^\circ$
$2s\ 2p^2$	$2p^2\ ^4P$; $2p^2\ ^2S$, $2p^2\ ^2P$, $2p^2\ ^2D$
$2p^3$	$2p^3\ ^4S^\circ$; $2p^3\ ^2P^\circ$, $2p^3\ ^2D^\circ$

Config. $1s^2+$	ns ($n\geq 3$)	np ($n\geq 3$)	nd ($n\geq 3$)
$2s^2(^1S)nx$	$3s\ ^2S$		$3\text{–}5d\ ^2D$
$2s\ 2p(^3P^\circ)nx$	$3s\ ^4P^\circ$; $3s\ ^2P^\circ$	$3p\ ^2S$, $3p\ ^2P$, $3p\ ^2D$	$3, 4d\ ^4P^\circ$, $3, 4d\ ^4D^\circ$; $3d\ ^2P^\circ$, $3d\ ^2D^\circ$, $3, 4d\ ^2F^\circ$
$2s\ 2p(^1P^\circ)nx'$	$3s'\ ^2P^\circ$	$3p'\ ^2P$, $3p'\ ^2D$	$3d'\ ^2P^\circ$, $3, 4d'\ ^2D^\circ$, $3d'\ ^2F^\circ$
$2p^2(^3P)nx''$	$3s''\ ^4P$	$3p''\ ^4S^\circ$, $3p''\ ^4P^\circ$, $3p''\ ^4D^\circ$	$3d''\ ^4P$
$2p^2(^1D)nx'''$		$3p'''\ ^2D^\circ$	

*For predicted terms in the spectra of the B I isoelectronic sequence, see Introduction.

Al X

(Be I sequence; 4 electrons) $Z=13$

Ground state $1s^2\,2s^2\ ^1S_0$

$2s^2\ ^1S_0$ **3215340** cm^{-1} I. P. 398.5 volts

Ferner has extended the preliminary analysis by Söderqvist and has classified 30 lines in the region between 44 A and 63 A. He has kindly furnished his manuscript in advance of publication.

No intersystem combinations have been observed, as indicated by x in the table, but absolute values of the singlet and triplet terms are known from the series.

Ferner's unit, $10^3\ cm^{-1}$, has here been changed to cm^{-1}.

REFERENCES

J. Söderqvist, Nova Acta Reg. Soc. Sci Uppsala [IV] **9**, No. 7, 94 (1934). (T) (C L)
E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **36A**, No. 1, p. 27 (1948). (I P) (T) (C L)

Al X

Author	Config.	Desig.	J	Level	Interval
$2s\ ^1S_0$	$2s^2$	$2s^2\ ^1S$	0	0	
$2p\ ^3P_0$	$2s(^2S)2p$	$2p\ ^3P^\circ$	0	*154850+x*	
$^3P_1$			1	*156540+x*	1690
$^3P_2$			2	*160200+x*	3660
$2p\ ^1P_1$	$2s(^2S)2p$	$2p\ ^1P^\circ$	1	*300400*	
$2p'\ ^3P$	$2p^2$	$2p^2\ ^3P$	0	404300+x	
			1	406270+x	1970
			2	409460+x	3190
$2p'\ ^1D_2$	$2p^2$	$2p^2\ ^1D$	2	448840	
$2p'\ ^1S_0$	$2p^2$	$2p^2\ ^1S$	0	553270	
$3s\ ^3S_1$	$2s(^2S)3s$	$3s\ ^3S$	1	1855510+x	
$3s\ ^1S_0$	$2s(^2S)3s$	$3s\ ^1S$	0	1884330	
$3p\ ^1P_1$	$2s(^2S)3p$	$3p\ ^1P^\circ$	1	*1923850*	
$3d\ ^3D_1$	$2s(^2S)3d$	$3d\ ^3D$	1	1965560+x	
$^3D_2$			2	1965770+x	210
$^3D_3$			3	1966050+x	280
$3d\ ^1D_2$	$2s(^2S)3d$	$3d\ ^1D$	2	1992250	
	$2p(^2P^\circ)3s$	$3s\ ^3P^\circ$	0		
			1		
$3s'\ ^3P_2$			2	*2056910+x*	
$3s'\ ^1P_1$	$2p(^2P^\circ)3s$	$3s\ ^1P^\circ$	1	*2090980*	

Al X

Author	Config.	Desig.	J	Level	Interval
$3p'\ ^1P_1$	$2p(^2P^\circ)3p$	$3p\ ^1P$	1	2094730	
$3p'\ ^3D_1$	$2p(^2P^\circ)3p$	$3p\ ^3D$	1	2101950+x	
$^3D_2$			2	2103560+x	1610
$^3D_3$			3	2107290+x	3730
$3p'\ ^3S_1$	$2p(^2P^\circ)3p$	$3p\ ^3S$	1	2119440+x	
	$2p(^2P^\circ)3p$	$3p\ ^3P$	0		
$3p'\ ^3P_1$			1	2128300+x	
$^3P_2$			2	2130180+x	1880
$3d'\ ^1D_2$	$2p(^2P^\circ)3d$	$3d\ ^1D^\circ$	2	*2140690*	
$3p'\ ^1D_2$	$2p(^2P^\circ)3p$	$3p\ ^1D$	2	2148320	
	$2p(^2P^\circ)3d$	$3d\ ^3D^\circ$	1		
$3d'\ ^3D_2$			2	*2161630+x*	
$^3D_3$			3	*2163110+x*	1480
$3d'\ ^3P_2$	$2p(^2P^\circ)3d$	$3d\ ^3P^\circ$	2	*2169960+x*	
$^3P_1$			1	*2171350+x*	−1390
			0		
$3d'\ ^1F_3$	$2p(^2P^\circ)3d$	$3d\ ^1F^\circ$	3	*2192060*	
$4d\ ^1D_2$	$2s(^2S)4d$	$4d\ ^1D$	2	2527470	
$4d'\ ^1F_3$	$2p(^2P^\circ)4d$	$4d\ ^1F^\circ$	3	*2714560*	
	Al XI ($^2S_{1/2}$)		*Limit*	3215340	

August 1947.

Al X Observed Terms*

Config. $1s^2+$	Observed Terms		
$2s^2$	$2s^2\ ^1S$		
$2s(^2S)2p$	$2p\ ^3P^\circ$ $2p\ ^1P^\circ$		
$2p^2$	$2p^2\ ^3P$ $2p^2\ ^1S$ $2p^2\ ^1D$		
	ns ($n\geq 3$)	np ($n\geq 3$)	nd ($n\geq 3$)
$2s(^2S)nx$	$3s\ ^3S$ $3s\ ^1S$	$3p\ ^1P^\circ$	$3d\ ^3D$ 3, $4d\ ^1D$
$2p(^2P^\circ)nx$	$3s\ ^3P^\circ$ $3s\ ^1P^\circ$	$3p\ ^3S$ $3p\ ^3P$ $3p\ ^3D$ $3p\ ^1P$ $3p\ ^1D$	$3d\ ^3P^\circ$ $3d\ ^3D^\circ$ $3d\ ^1D^\circ$ 3, $4d\ ^1F^\circ$

*For predicted terms in the spectra of the Be I isoelectronic sequence, see Introduction.

Al XI

(Li I sequence; 3 electrons) Z=13

Ground state $1s^2\ 2s\ ^2S_{1/2}$

$2s\ ^2S_{1/2}$ **3564900** cm^{-1} I. P. 441.9 volts

The analysis is by Ferner, who kindly furnished his manuscript in advance of publication. Seven lines have been classified between 39 A and 54 A. Observations of the resonance lines have not been reported. Some of the relative levels have been connected by a study of the behavior of the Rydberg denominators rather than by the Ritz combination principle.

Ferner's unit, 10^3 cm^{-1}, has here been changed to cm^{-1}.

REFERENCE

E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **36A**, No. 1, p. 25 (1948). (I P) (T) (C L)

Al XI

Config.	Desig.	J	Level	Interval
$2s$	$2s\ ^2S$	½	0	
$2p$	$2p\ ^2P°$	½ 1½	*175900* *181820*	5920
$3s$	$3s\ ^2S$	½	2020460	
$3p$	$3p\ ^2P°$	½ 1½	*2068770* *2070520*	1750
$3d$	$3d\ ^2D$	1½ 2½	2087980 2088540	560
$4d$	$4d\ ^2D$	1½ 2½	 2734140	
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Al XII ($^1S_0$)	*Limit*	---	3564900	

August 1947.

Al XII

(He I sequence; 2 electrons) $Z=13$

Ground state $1s^2\ ^1S_0$

$1s^2\ ^1S_0$ **16825000±3000** cm^{-1} I. P. 2085.46±0.37 volts

Flemberg has observed the first three members of the singlet series; the lines are in the region between 6 A and 7 A. He has calculated absolute term values on the assumption that the P-terms can be represented by a Ritz formula.

The unit adopted by Flemberg, 10^3 cm^{-1}, has here been changed to cm^{-1}.

REFERENCE

H. Flemberg, Ark. Mat. Astr. Fys. (Stockholm) **28A,** No. 18 p. 34 (1942). (I P) (T) (C L)

Al XII

Config.	Desig.	J	Level
$1s^2$	$1s^2\ ^1S$	0	0
$1s\ 2p$	$2p\ ^1P^\circ$	1	*12891900*
$1s\ 3p$	$3p\ ^1P^\circ$	1	*15072700*
$1s\ 4p$	$4p\ ^1P^\circ$	1	*15838600*
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Al XIII ($^2S_{1/2}$)	*Limit*	---	**16825000**

October 1946.

SILICON

Si I

14 electrons $Z=14$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^2\,{}^3P_0$

$3p^2\,{}^3P_0$ **65743.00** cm^{-1} I. P. 8.149 volts

The terms are from Kiess, who has revised and extended the earlier work on analysis. He has published a complete list of classified lines extending from 1565 A to 12270 A. His notation has been adopted throughout, except for the following entries, which have been changed for uniformity:

Kiess	Desig.	Kiess	Desig.
$3p\ {}^3P$	$3p^2\ {}^3P$	$3p'\ {}^3D^\circ$	$3p^3\ {}^3D^\circ$
$3p\ {}^1D$	$3p^2\ {}^1D$	x'	1°
$3p\ {}^1S$	$3p^2\ {}^1S$	x''	2°

The singlet and triplet terms are connected by numerous intersystem combinations. No quintet terms have been found.

The Si I sequence invites further study from the theoretical point of view. In Si I the $3d\ {}^3D^\circ$ term is lower than the $3p^3\ {}^3D^\circ$ term. In later members of the sequence the corresponding terms appear in the reverse order.

The extension by Kiess of the laboratory analysis to cover the infrared region has been of special astrophysical importance. The leading lines of Si I are strong in the solar spectrum. Conversely, the solar wave-number separations within the multiplets afford a valuable check on the accuracy of infrared solar wavelengths, provided the Si lines are unblended in the sun. The satisfactory internal agreement within the "solar" Si multiplets has also justified the use of this method to identify solar lines by prediction as unquestionably due to Si, although they have not yet been observed in the laboratory.

REFERENCES

H. D. Babcock, C. E. Moore and W. P. Hoge, Mt. Wilson Contr. No. 534; Astroph. J. **83,** 118 (1936).
C. C. Kiess, J. Research Nat. Bur. Std. **21,** 85, RP1124 (1938). (I P) (T) (C L) (E D)

Si I

Config.	Desig.	J	Level	Interval
$3s^2\,3p^2$	$3p^2\ {}^3P$	0	0. 00	77. 15
		1	77. 15	146. 16
		2	223. 31	
$3s^2\,3p^2$	$3p^2\ {}^1D$	2	6298. 81	
$3s^2\,3p^2$	$3p^2\ {}^1S$	0	15394. 24	
$3s^2\,3p(^2P^\circ)4s$	$4s\ {}^3P^\circ$	0	*39683. 10*	77. 10
		1	*39760. 20*	194. 92
		2	*39955. 12*	
$3s^2\,3p(^2P^\circ)4s$	$4s\ {}^1P^\circ$	1	*40991. 74*	
$3s^2\,3p(^2P^\circ)3d$	$3d\ {}^3D^\circ$	1	*45276. 20*	17. 40
		2	*45293. 60*	28. 26
		3	*45321. 86*	
$3s^2\,3p(^2P^\circ)4p$	$4p\ {}^1P$	1	47284. 20	
$3s^2\,3p(^2P^\circ)3d$	$3d\ {}^1D^\circ$	2	*47351. 50*	
$3s^2\,3p(^2P^\circ)4p$	$4p\ {}^3D$	1	48020. 00	82. 38
		2	48102. 38	161. 97
		3	48264. 35	
$3s\ 3p^3$	$3p^3\ {}^3D^\circ$	1	*48399. 15*	178. 45
		2	*48577. 60*	296. 36
		3	*48873. 96*	
$3s^2\,3p(^2P^\circ)4p$	$4p\ {}^3P$	0	49028. 17	32. 38
		1	49060. 55	128. 06
		2	49188. 61	
$3s^2\,3p(^2P^\circ)4p$	$4p\ {}^3S$	1	49399. 66	
$3s^2\,3p(^2P^\circ)3d$	$3d\ {}^3F^\circ$	2	*49850. 93*	83. 19
		3	*49934. 12*	137. 76
		4	*50071. 88*	
$3s^2\,3p(^2P^\circ)4p$	$4p\ {}^1D$	2	50189. 43	
$3s^2\,3p(^2P^\circ)3d$	$3d\ {}^3P^\circ$	2	*50499. 44*	−66. 51
		1	*50565. 95*	−36. 20
		0	*50602. 15*	
$3s^2\,3p(^2P^\circ)4p$	$4p\ {}^1S$	0	51611. 77	
$3s^2\,3p(^2P^\circ)3d$	$3d\ {}^1F^\circ$	3	*53362. 41*	
$3s^2\,3p(^2P^\circ)3d$	$3d\ {}^1P^\circ$	1	*53387. 17*	
$3s^2\,3p(^2P^\circ)4d$	$4d\ {}^3D^\circ$	1	*54184. 97*	20. 15
		2	*54205. 12*	52. 28
		3	*54257. 40*	
$3s^2\,3p(^2P^\circ)5s$	$5s\ {}^3P^\circ$	0	*54244. 58*	69. 32
		1	*54313. 90*	213. 98
		2	*54527. 88*	
$3s^2\,3p(^2P^\circ)5s$	$5s\ {}^1P^\circ$	1	*54870. 99*	
$3s^2\,3p(^2P^\circ)5p$	$5p\ {}^1P$	1	56425. 1	
$3s^2\,3p(^2P^\circ)4d$	$4d\ {}^1D^\circ$	2	*56503. 00*	
$3s^2\,3p(^2P^\circ)4d$	$4d\ {}^3P^\circ$	2	*56690. 94*	−9. 90
		1	*56700. 84*	−32. 40
		0	*56733. 24*	

Si I

Config.	Desig.	J	Level	Interval
$3s^2\,3p(^2P^\circ)5p$	$5p\ {}^3D$	1	56978. 00	39. 26
		2	57017. 26	180. 68
		3	57197. 94	
$3s^2\,3p(^2P^\circ)5p$	$5p\ {}^3P$	0	57295. 76	32. 88
		1	57328. 64	139. 54
		2	57468. 18	
$3s^2\,3p(^2P^\circ)4d$	$4d\ {}^3F^\circ$	2	*57372. 44*	78. 26
		3	*57450. 70*	133. 15
		4	*57583. 85*	
$3s^2\,3p(^2P^\circ)5p$	$5p\ {}^3S$	1	57541. 86	
$3s^2\,3p(^2P^\circ)5p$	$5p\ {}^1D$	2	57797. 82	
$3s^2\,3p(^2P^\circ)5p$	$5p\ {}^1S$	0	58311. 19	
$3s^2\,3p(^2P^\circ)4f$	$4f\ {}^1F$	3	58774. 18	
$3s^2\,3p(^2P^\circ)4f$	$4f\ {}^3F$	2	58775. 44	11. 36
		3	58786. 80	2. 20
		4	58789. 00	
$3s^2\,3p(^2P^\circ)4d$	$4d\ {}^1P^\circ$	1	*58802. 00*	
$3s^2\,3p(^2P^\circ)4d$	$4d\ {}^1F^\circ$	3	*58893. 28*	
$3s^2\,3p(^2P^\circ)4f$	$4f\ {}^3G$	3	59035. 15	1. 85
		4	59037. 00	16. 84
		5	59053. 84	
$3s^2\,3p(^2P^\circ)5d$	$5d\ {}^3D^\circ$	1	*59056. 70*	−24. 28
		2	*59032. 42*	86. 09
		3	*59118. 51*	
$3s^2\,3p(^2P^\circ)4f$	$4f\ {}^3D$	3	59109. 75	−81. 09
		2	59190. 84	0. 44
		1	59190. 40	
	1°	?	*59109. 9*	
$3s^2\,3p(^2P^\circ)4f$	$4f\ {}^1D$	2	59110. 91	
	2°	?	*59132. 5*	
$3s^2\,3p(^2P^\circ)6s$	$6s\ {}^3P^\circ$	0	*59220. 76*	52. 52
		1	*59273. 28*	232. 89
		2	*59506. 17*	
$3s^2\,3p(^2P^\circ)6s$	$6s\ {}^1P^\circ$	1	*59636. 34*	
$3s^2\,3p(^2P^\circ)5d$	$5d\ {}^3P^\circ$	2	*59917. 35*	−92. 75
		1	*60010. 10*	−32. 38
		0	*60042. 48*	
$3s^2\,3p(^2P^\circ)5d$	$5d\ {}^1D^\circ$	2	*60299. 92*	
$3s^2\,3p(^2P^\circ)5d$	$5d\ {}^3F^\circ$	2	*60645. 49*	60. 41
		3	*60705. 90*	143. 23
		4	*60849. 13*	
$3s^2\,3p(^2P^\circ)5f$	$5f\ {}^1D$	2	61303. 28	
$3s^2\,3p(^2P^\circ)5f$	$5f\ {}^3F$	2	61304. 50	0. 36
		3	61304. 86	1. 71
		4	61306. 57	

Si I—Continued

Config.	Desig.	J	Level	Interval
$3s^2\,3p(^2P^\circ)5d$	$5d\ ^1P^\circ$	1	*61308.32*	
$3s^2\,3p(^2P^\circ)6d$	$6d\ ^3D^\circ$	1	*61510.71*	−86.78
		2	*61423.93*	151.87
		3	*61575.80*	
$3s^2\,3p(^2P^\circ)5d$	$5d\ ^1F^\circ$	3	*61424.00*	
$3s^2\,3p(^2P^\circ)7s$	$7s\ ^3P^\circ$	0	*61540.00*	54.80
		1	*61594.80*	228.64
		2	*61823.44*	
$3s^2\,3p(^2P^\circ)5f$	$5f\ ^3G$	3	61562.37	1.38
		4	61563.75	
		5		
$3s^2\,3p(^2P^\circ)5f$	$5f\ ^3D$	3	61597.12	−0.78
		2	61597.90	−0.70
		1	61598.60	
$3s^2\,3p(^2P^\circ)6d$	$6d\ ^3P^\circ$	2	*61845.96*	−90.90
		1	*61936.86*	−33.42
		0	*61970.28*	
$3s^2\,3p(^2P^\circ)7s$	$7s\ ^1P^\circ$	1	*61881.50*	
$3s^2\,3p(^2P^\circ)6d$	$6d\ ^1D^\circ$	2	*62155.20*	
$3s^2\,3p(^2P^\circ)6d$	$6d\ ^3F^\circ$	2	*62349.27*	27.41
		3	*62376.68*	157.78
		4	*62534.46*	

Si I—Continued

Config.	Desig.	J	Level	Interval
$3s^2\,3p(^2P^\circ)6f$	$6f\ ^3F$	2	62668.50	
		3		
		4		
$3s^2\,3p(^2P^\circ)8s$	$8s\ ^3P^\circ$	0	*62753.05*	55.90
		1	*62808.95*	114.80
		2	*62923.75*	
$3s^2\,3p(^2P^\circ)6d$	$6d\ ^1F^\circ$	3	*62802.00*	
$3s^2\,3p(^2P^\circ)7d$	$7d\ ^3D^\circ$	1	*62873.90*	1.28
		2	*62875.18*	61.12
		3	*62936.30*	
$3s^2\,3p(^2P^\circ)8s$	$8s\ ^1P^\circ$	1	*63130.60*	
$3s^2\,3p(^2P^\circ)7d$	$7d\ ^3F^\circ$	2	*63257.61*	96.09
		3	*63353.70*	26.93
		4	*63580.63*	
$3s^2\,3p(^2P^\circ)7d$	$7d\ ^1F^\circ$	3	*63642.55*	
$3s^2\,3p(^2P^\circ)8d$	$8d\ ^3D^\circ$	1		
		2		
		3	*63758.35*	
$3s^2\,3p(^2P^\circ)9s$	$9s\ ^1P^\circ$	1	*63884.95*	
Si II ($^2P^\circ_{1/2}$)	*Limit*	-------	**65743.00**	

October 1947.

Si I Observed Terms*

Config. $1s^2\,2s^2\,2p^6+$	Observed Terms		
$3s^2\,3p^2$	$3p^2\ ^1S$ $3p^2\ ^3P$ $3p^2\ ^1D$		
$3s\ 3p^3$	$3p^3\ ^3D^\circ$		
	ns $(n\geq 4)$	np $(n\geq 4)$	
$3s^2\,3p(^2P^\circ)nx$	4–8s $^3P^\circ$ 4–9s $^1P^\circ$	4, 5p ^3S 4, 5p ^3P 4, 5p ^3D 4, 5p ^1S 4, 5p ^1P 4, 5p ^1D	
	nd $(n\geq 3)$	nf $(n\geq 4)$	
$3s^2\,3p(^2P^\circ)nx$	3–6d $^3P^\circ$ 3–8d $^3D^\circ$ 3–7d $^3F^\circ$ 3–5d $^1P^\circ$ 3–6d $^1D^\circ$ 3–7d $^1F^\circ$	4, 5f ^3D 4–6f ^3F 4, 5g ^3G 4, 5f ^1D 4f ^1F	

*For predicted terms in the spectra of the Si I isoelectronic sequence, see Introduction.

Si II

(Al I sequence; 13 electrons) $Z=14$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p\ ^2P^\circ_{1/2}$

$3p\ ^2P^\circ_{1/2}$ ***131818*** cm⁻¹ I. P. 16.34 volts

The doublet terms from the ^1S limit in Si III are from Fowler. His values of $nf\ ^2F^\circ$, $n=7$ to 9, are from his series formula and are indicated by brackets in the table, although they appear to be confirmed by observed combinations with $3p^2\ ^2D$.

The $3p^2\ ^2P$ term has been calculated from the data given by Bowen and Millikan in 1925.

The remaining terms are from Bowen, who pointed out in his 1928 paper that Fowler's term called "x" is $3p^2\ ^2D$; and listed the two lines classified as $3p\ ^2P^\circ - 3p^2\ ^2S$. This combination has been used to calculate $3p^2\ ^2S$.

The quartet terms are from Bowen's 1932 paper. No intersystem combinations have been observed and the uncertainty, x, may be considerable. Bowen remarks that the relative positions of the doublet and quartet terms are only approximately determined by assuming that the difference between the terms $4s\ ^2S$ and $4s\ ^4P^\circ$ is equal to that between the terms $3s^2\ ^1S$ and $3p\ ^3P^\circ$ in Si III.

REFERENCES

A. Fowler, Phil. Trans. Roy. Soc. London [A] **225**, 20 (1925). (I P) (T) (C L)
I. S. Bowen and R. A. Millikan, Phys. Rev. **26**, 160 (1925). (T) (C L)
I. S. Bowen, Phys. Rev. **31**, 37 (1928). (C L)
I. S. Bowen, Phys. Rev. **39**, 13 (1932). (T) (C L)
C. C. Kiess, J. Research Nat. Bur. Std. **21**, 205, RP1124 (1938). (C L)

Si II

Config.	Desig.	J	Level	Interval
$3s^2(^1S)3p$	$3p\ ^2P^\circ$	½ 1½	*0* *287*	287
$3s\,3p^2$	$3p^2\ ^4P$	½ 1½ 2½	44080. 3+x 44190. 9+x 44364. 4+x	110. 6 173. 5
$3s\,3p^2$	$3p^2\ ^2D$	1½ 2½	55303. 93 55319. 84	15. 91
$3s^2(^1S)4s$	$4s\ ^2S$	½	65495. 08	
$3s\,3p^2$	$3p^2\ ^2S$	½	76663. 9	
$3s^2(^1S)3d$	$3d\ ^2D$	1½ 2½	79334. 89 79351. 49	16. 60
$3s^2(^1S)4p$	$4p\ ^2P^\circ$	½ 1½	*81185. 98* *81245. 98*	60. 00
$3s\,3p^2$	$3p^2\ ^2P$	½ 1½	83800 84004	204
$3s^2(^1S)5s$	$5s\ ^2S$	½	97966. 60	
$3s^2(^1S)4d$	$4d\ ^2D$	1½ 2½	101017. 58 101018. 88	1. 30
$3s^2(^1S)4f$	$4f\ ^2F^\circ$	{ 2½ 3½ }	*103552. 58*	
$3s^2(^1S)5p$	$5p\ ^2P^\circ$	½ 1½	*103855. 29* *103879. 60*	24. 31
$3s^2(^1S)6s$	$6s\ ^2S$	½	111178. 95	
$3s^2(^1S)5d$	$5d\ ^2D$	{ 1½ 2½ }	112389. 2	

Si II

Config.	Desig.	J	Level	Interval
$3s^2(^1S)5f$	$5f\ ^2F^\circ$	{ 2½ 3½ }	*113756. 60*	
$3s^2(^1S)6p$	$6p\ ^2P^\circ$	½ 1½	*114048. 7* *114057. 8*	9. 1
$3s^2(^1S)7s$	$7s\ ^2S$	½	117908. 93	
$3s\,3p(^3P^\circ)4s$	$4s\ ^4P^\circ$	½ 1½ 2½	*118118. 0*+x *118234. 0*+x *118433. 9*+x	116. 0 199. 9
$3s^2(^1S)6d$	$6d\ ^2D$	{ 1½ 2½ }	118516. 6	
$3s^2(^1S)6f$	$6f\ ^2F^\circ$	{ 2½ 3½ }	*119307. 57*	
$3s^2(^1S)7f$	$7f\ ^2F^\circ$	{ 2½ 3½ }	[*122649*]	
$3p^3$	$3p^3\ ^4S^\circ$	1½	*124291. 2*+x	
$3s^2(^1S)8f$	$8f\ ^2F^\circ$	{ 2½ 3½ }	[*124814*]	
$3s^2(^1S)9f$	$9f\ ^2F^\circ$	{ 2½ 3½ }	[*126294*]	
Si III ($^1S_0$)	***Limit***	---------	***131818***	
$3s\,3p(^3P^\circ)4p$	$4p\ ^4P$	½ 1½ 2½	135272. 4+x 135334. 6+x 135469. 4+x	62. 2 134. 8
$3s\,3p(^3P^\circ)4p$	$4p\ ^4S$	1½	136161. 1+x	

September 1947.

Si II Observed Terms*

Config. $1s^2\ 2s^2\ 2p^6+$	Observed Terms			
$3s^2(^1S)3p$	$3p\ ^2P^\circ$			
$3s\ 3p^2$	$3p^2\ ^4P$; $3p^2\ ^2S$ $3p^2\ ^2P$ $3p^2\ ^2D$			
$3p^3$	$3p^3\ ^4S^\circ$			
	$ns\ (n \geq 4)$	$np\ (n \geq 4)$	$nd\ (n \geq 3)$	$nf\ (n \geq 4)$
$3s^2(^1S)nx$	$4\text{–}7s\ ^2S$	$4\text{–}6p\ ^2P^\circ$	$3\text{–}6d\ ^2D$	$4\text{–}6f\ ^2F^\circ$
$3s\ 3p(^3P^\circ)nx$	$4s\ ^4P^\circ$	$4p\ ^4S$ $4p\ ^4P$		

*For predicted terms in the spectra of the Al I isoelectronic sequence, see Introduction.

Si III

(Mg I sequence; 12 electrons) $Z=14$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ ^1S_0$

$3s^2\ ^1S_0$ **269940.6** cm^{-1} I. P. 33.46 volts

The analysis is from Bowen, who has extended the earlier work of Fowler, by observations in the ultraviolet. Ninety-six lines have been classified in the interval 566 A to 5739 A. One intersystem combination, $3s^2\ ^1S—3p\ ^3P_1^\circ$, is given, but Bowen states that the identification of this line is dubious. He remarks further that "the term values of the singlets and triplets can be independently determined with an accuracy that precludes any large shift in the relative position of the two systems, regardless of this identification." The irregular doublet law for the isoelectronic sequence through P IV confirms this classification, as has been pointed out by Robinson.

Van Vleck and Whitelaw, by analogy with Al II, using a rigorous series formula, have recalculated the absolute value of $5g\ ^3G$ as equal to 39831 cm^{-1} as compared with Fowler's value 39741 cm^{-1} and Bowen's value 39734.0 cm^{-1}.

REFERENCES

R. A. Sawyer und F. Paschen, Ann. der Phys. [IV] **84**,, 8 (1927). (T)
I. S. Bowen, Phys. Rev. **39**, 8 (1932). (I P) (T) (C L)
H. A. Robinson, Phys. Rev. **51**, 731 (1937).
J. H. Van Vleck and N. G. Whitelaw, Phys. Rev. **44**, 560 (1933). (T)

Si III

Config.	Desig.	*J*	Level	Interval
$3s^2$	$3s^2\ {}^1S$	0	0.0	
$3s(^2S)3p$	$3p\ {}^3P^\circ$	0	*52630*	
		1	*52758*	128
		2	*53019*	261
$3s(^2S)3p$	$3p\ {}^1P^\circ$	1	*82883.0*	
$3p^2$	$3p^2\ {}^1D$	2	121946	
$3s(^2S)3d$	$3d\ {}^1D$	2	122213.0	
$3p^2$	$3p^2\ {}^3P$	0	129615	
		1	129747	132
		2	130006	259
$3s(^2S)3d$	$3d\ {}^3D$	3	142847.6	
		2	142849.7	−2.1
		1	142851.7	−2.0
$3s(^2S)4s$	$4s\ {}^3S$	1	153281.0	
$3p^2$	$3p^2\ {}^1S$	0	153443.0	
$3s(^2S)4s$	$4s\ {}^1S$	0	159068.4	
$3s(^2S)4p$	$4p\ {}^3P^\circ$	0	*175134.0*	
		1	*175167.0*	33.0
		2	*175240.2*	73.2
$3s(^2S)4p$	$4p\ {}^1P^\circ$	1	*176485.9*	
$3s(^2S)4d$	$4d\ {}^3D$	3, 2, 1	201502.5	
$3s(^2S)4d$	$4d\ {}^1D$	2	204329.6	
$3s(^2S)5s$	$5s\ {}^3S$	1	206079.6	
$3s(^2S)5s$	$5s\ {}^1S$	0	207872.5	
$3s(^2S)4f$	$4f\ {}^3F^\circ$	2	*209436.7*	
		3	*209464.3*	27.6
		4	*209503.8*	39.5
$3p(^2P^\circ)3d$	$3d\ {}^3P^\circ$	2	*216095*	
		1	*216193*	−98
		0	*216255*	−62
$3p(^2P^\circ)3d$	$3d\ {}^3D^\circ$	1	*217290*	
		2	*217344*	54
		3	*217395*	51
$3p(^2P^\circ)4s$	$4s\ {}^3P^\circ$	0	*226305*	
		1	*226432*	127
		2	*226727*	295
$3s(^2S)5g$	$5g\ {}^3G$	3, 4, 5	230206.6	
$3s(^2S)6g$	$6g\ {}^3G$	3, 4, 5	242379.0	
$3p(^2P^\circ)4p$	$4p\ {}^3P$	0	247776	
		1	247859	83
		2	248073	214
Si IV ($^2S_{1/2}$)	*Limit*	----------	269940.6	

July 1947.

Si III Observed Terms*

Config. $1s^2\ 2s^2\ 2p^6$	Observed Terms				
$3s^2$	$3s^2\ {}^1S$				
$3s(^2S)3p$	$3p\ {}^3P^\circ$; $3p\ {}^1P^\circ$				
$3p^2$	$3p^2\ {}^3P$; $3p^2\ {}^1S$; $3p^2\ {}^1D$				
	ns ($n \geq 4$)	*np* ($n \geq 4$)	*nd* ($n \geq 3$)	*nf* ($n \geq 4$)	*ng* ($n \geq 5$)
$3s(^2S)nx$	4, 5s ^3S; 4, 5s ^1S	$4p\ {}^3P^\circ$; $4p\ {}^1P^\circ$	3, 4d ^3D; 3, 4d ^1D	$4f\ {}^3F^\circ$	5, 6g ^3G
$3p(^2P^\circ)np$	$4s\ {}^3P^\circ$	$4p\ {}^3P$	$3d\ {}^3P^\circ$; $3d\ {}^3D^\circ$		

*For predicted terms in the spectra of the Mg I isoelectronic sequence, see Introduction.

Si IV

(Na I sequence; 11 electrons) $Z=14$

Ground state $1s^2\,2s^2\,2p^6\,3s\;^2S_{1/2}$

$3s\;^2S_{1/2}$ **364097.7** cm^{-1} I. P. 45.13 volts

The first detailed analysis by Fowler was extended and improved by Edlén and Söderqvist, who observed the spectrum from 815 A to 4328 A. The terms have been taken from their paper, extrapolated values being entered in brackets. They estimate the accuracy of the limit as probably within 2 or 3 cm^{-1}. One additional term, $8f\;^2F^\circ$, has been taken from Fowler's paper and corrected slightly to agree with the rest.

The observations by McLennan and Shaver extend to the violet limit 458 A and those by Millikan and Bowen extend to 361 A.

REFERENCES

R. A. Millikan and I. S. Bowen, Phys. Rev. **23**, 1 (1924). (C L)

J. C. McLennan and W. W. Shaver, Trans. Roy Soc. Canada [3] **18**, Sec III p. 14 (1924). (C L)

A. Fowler, Phil. Trans. Roy. Soc. (London) [A] **225**, 38 (1925). (T) (C L)

B. Edlén and J. Söderqvist, Zeit. Phys. **87**, 217 (1933). (I P) (T) (C L)

Si IV

Config.	Desig.	J	Level	Interval
3s	3s ²S	½	0.0	
3p	3p ²P°	½ 1½	*71289.6* *71749.9*	460.3
3d	3d ²D	1½ 2½	160376.8	
4s	4s ²S	½	193981.5	
4p	4p ²P°	½ 1½	*218269.5* *218431.3*	161.8
4d	4d ²D	1½ 2½	250010.6	
4f	4f ²F°	2½ 3½	*254129.4* *254130.7*	1.3
5s	5s ²S	½	265420.4	
5p	5p ²P°	½ 1½	*276506.5* *276581.8*	75.3
5d	5d ²D	1½ 2½	291499.2	
5f	5f ²F°	2½ 3½	*293721.0*	
5g	5g ²G	{3½ 4½}	293839.7	
6s	6s ²S	½	299679.6	
6p	6p ²P°	½ 1½	*305645* *305687.6*	43

Si IV

Config.	Desig.	J	Level	Interval
6d	6d ²D	1½ 2½	313923.4	
6f	6f ²F°	2½ 3½	*315231.6*	
6g	6g ²G	{3½ 4½}	315306.8	
6h	6h ²H°	{4½ 5½}	*315320.0*	
7s	7s ²S	½	318744.5	
7p	7p ²P°	½ 1½	[*322347*]	
7d	7d ²D	1½ 2½	[327369]	
7f	7f ²F°	2½ 3½	*328201.5*	
7g	7g ²G	{3½ 4½}	328251.7	
7h	7h ²H°	{4½ 5½}	*328262*	
8f	8f ²F°	{2½ 3½}	[*336619*]	
Si V (¹S₀)	*Limit*	---------	**364097.7**	

June 1947.

Si V

(Ne I sequence; 10 electrons) $Z=14$

Ground state $1s^2\ 2s^2\ 2p^6\ {}^1S_0$

$2p^6\ {}^1S_0$ **1345100** cm^{-1} I. P. 166.73 volts

The analysis is by Ferner, who has extended the early work by Söderqvist. Thirteen lines have been classified in the region 78 A to 118 A, as combinations with the ground term.

Ferner's term designations assigned on the assumption of *LS*-coupling are given under the heading "Author" in the table.

As for Ne I, the *jl*-coupling notation in the general form suggested by Racah is introduced.

The unit used by Ferner, $10^3\ cm^{-1}$, has here been changed to cm^{-1}.

REFERENCES

E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **28A**, No. 4 p. 4 (1941). (I P) (T) (C L).

G. Racah, Phys. Rev. **61**, 537 (L) (1942).

Si V

Author	Config.	Desig.	J	Level
$2p\ {}^1S$	$2p^6$	$2p^6\ {}^1S$	0	0
	$2p^5(^2P^\circ_{1\frac{1}{2}})3s$	$3s\ [1\frac{1}{2}]^\circ$	2	
$3s\ {}^3P_1$			1	*840560*
	$2p^5(^2P^\circ_{\frac{1}{2}})3s$	$3s'[\ \frac{1}{2}]^\circ$	0	
$3s\ {}^1P_1$			1	*848460*
	$2p^5(^2P^\circ_{1\frac{1}{2}})3d$	$3d\ [\ \frac{1}{2}]^\circ$	0	
$3d\ {}^3P_1$			1	*1018240*
$3d\ {}^1P_1$	"	$3d\ [1\frac{1}{2}]^\circ$	1	*1029410*
$3d\ {}^3D_1$	$2p^5(^2P^\circ_{\frac{1}{2}})3d$	$3d'[1\frac{1}{2}]^\circ$	1	*1036930*
	$2p^5(^2P^\circ_{1\frac{1}{2}})4s$	$4s\ [1\frac{1}{2}]^\circ$	2	
$4s\ {}^3P_1$			1	*1100690*
	$2p^5(^2P^\circ_{\frac{1}{2}})4s$	$4s'[\ \frac{1}{2}]^\circ$	0	
$4s\ {}^1P_1$			1	*1105550*

Si V

Author	Config.	Desig.	J	Level
$4d\ {}^1P_1$	$2p^5(^2P^\circ_{1\frac{1}{2}})4d$	$4d\ [1\frac{1}{2}]^\circ$	1	*1168550*
$4d\ {}^3D_1$	$2p^5(^2P^\circ_{\frac{1}{2}})4d$	$4d'[1\frac{1}{2}]^\circ$	1	*1174050*
$5d\ {}^1P_1$	$2p^5(^2P^\circ_{1\frac{1}{2}})5d$	$5d\ [1\frac{1}{2}]^\circ$	1	*1232850*
$5d\ {}^3D_1$	$2p^5(^2P^\circ_{\frac{1}{2}})5d$	$5d'[1\frac{1}{2}]^\circ$	1	*1237520*
$6d\ {}^1P_1$	$2p^5(^2P^\circ_{1\frac{1}{2}})6d$	$6d\ [1\frac{1}{2}]^\circ$	1	*1267380*
$6d\ {}^3D_1$	$2p^5(^2P^\circ_{\frac{1}{2}})6d$	$6d'[1\frac{1}{2}]^\circ$	1	*1272090*
	Si VI $(^2P^\circ_{1\frac{1}{2}})$	*Limit*	-------	**1345100**
	Si VI $(^2P^\circ_{\frac{1}{2}})$	*Limit*	-------	1350200

April 1947.

Si v Observed Levels*

Config. $1s^2\ 2s^2+$	Observed Terms	
$2p^6$	$2p^6\ ^1S$	
	$ns\ (n \geq 3)$	$nd\ (n \geq 3)$
$2p^5(^2P^\circ)nx$	{ 3, 4s $^3P^\circ$ 3, 4s $^1P^\circ$	3d $^3P^\circ$ 3–6d $^3D^\circ$ 3–6d $^1P^\circ$
jl-Coupling Notation		
	Observed Pairs	
	$ns\ (n \geq 3)$	$nd\ (n \geq 3)$
$2p^5(^2P^\circ_{1\frac{1}{2}})nx$	3, 4s $[1\frac{1}{2}]^\circ$	3d $[\frac{1}{2}]^\circ$ 3–6d $[1\frac{1}{2}]^\circ$
$2p^5(^2P^\circ_{\frac{1}{2}})nx'$	3, 4s' $[\frac{1}{2}]^\circ$	3–6d' $[1\frac{1}{2}]^\circ$

*For predicted levels in the spectra of the Ne i isoelectronic sequence, see Introduction.

Si vi

(F i sequence; 9 electrons) $Z=14$

Ground state $1s^2\ 2s^2\ 2p^5\ ^2P^\circ_{1\frac{1}{2}}$

$2p^5\ ^2P^\circ_{1\frac{1}{2}}$ ***1654800*** cm^{-1} I. P. 205.11 volts

The terms are from Ferner's paper. He has extended the earlier analysis by Söderqvist to include 63 classified lines in the range between 65 A and 249 A. All but two of the observed combinations are with the ground term. According to Ferner some of the term assignments are somewhat uncertain. The unit adopted by Ferner, 10^3 cm^{-1}, has here been changed to cm^{-1}.

By analogy with related spectra in the isoelectronic sequence Robinson has suggested the following changes in Ferner's term assignments:

Ferner	Robinson	Ferner	Robinson
$3d\ ^4F_{2\frac{1}{2}}$	$3d\ ^4P_{2\frac{1}{2}}$	$3d'\ ^2S_{\frac{1}{2}}$	$3d'\ ^2P_{1\frac{1}{2}}$
$3d\ ^4P_{2\frac{1}{2}}$	$3d\ ^2D_{2\frac{1}{2}}$	$3d'\ ^2P_{1\frac{1}{2}}$	$3d'\ ^2D_{1\frac{1}{2}}$
$3d\ ^2D_{2\frac{1}{2}}$	$3d\ ^2F_{2\frac{1}{2}}$	$3d'\ ^2D_{2\frac{1}{2}}$ $^2D_{1\frac{1}{2}}$	$3d'\ ^2F_{2\frac{1}{2}}$ $3d'\ ^2S_{\frac{1}{2}}$
$4d\ ^4F_{2\frac{1}{2}}$	$4d\ ^2D_{2\frac{1}{2}}$		
		$3d'\ ^2F_{2\frac{1}{2}}$	$3d'\ ^2D_{2\frac{1}{2}}$
	$4d\ ^4P_{2\frac{1}{2}}$*		
			$4d'\ ^2S_{\frac{1}{2}}$**
$4d\ ^2D_{2\frac{1}{2}}$ $^2D_{1\frac{1}{2}}$	$4d\ ^2D_{1\frac{1}{2}}$ $4d\ ^2P_{1\frac{1}{2}}$	$4d'\ ^2S_{\frac{1}{2}}$	$4d'\ ^2P_{1\frac{1}{2}}$
		$4d'\ ^2D_{2\frac{1}{2}}$ $^2D_{1\frac{1}{2}}$	$4d'\ ^2D$ $4d'\ ^2P_{\frac{1}{2}}$***

*1401250. **1446330. ***1445500.

REFERENCES

E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **28A**, No. 4, p. 5 (1941). (I P) (T) (C L)
H. A. Robinson, unpublished material (March 1948). (T) (C L)

Si VI

Config.	Desig.	J	Level	Interval
$2s^2 2p^5$	$2p^5\ ^2P^\circ$	1½ ½	*0* *5100*	−5100
$2s\ 2p^6$	$2p^6\ ^2S$	½	406500	
$2s^2 2p^4(^3P)3s$	$3s\ ^4P$	2½ 1½ ½	990460 993640	−3180
$2s^2 2p^4(^3P)3s$	$3s\ ^2P$	1½ ½	1005440 1009140	−3700
$2s^2 2p^4(^1D)3s$	$3s'\ ^2D$	2½ 1½	1041450 1041500	−50
$2s^2 2p^4(^1S)3s$	$3s''\ ^2S$	½	1094460	
$2s^2 2p^4(^3P)3d$	$3d\ ^4F$	4½ 3½ 2½ 1½	 1193290 1194330	−1040
$2s^2 2p^4(^3P)3d$	$3d\ ^4P$	½ 1½ 2½	1194970 1196040 1197230	1070 1190
$2s^2 2p^4(^3P)3d$	$3d\ ^2P$	½ 1½	1200720 1204740	4020
$2s^2 2p^4(^3P)3d$	$3d\ ^2D$	1½ 2½	1201100 1202960	1860
$2s^2 2p^4(^1D)3d$	$3d'\ ^2P$	½ 1½	1239200 1242390	3190
$2s^2 2p^4(^1D)3d$	$3d'\ ^2S$	½	1241060	
$2s^2 2p^4(^1D)3d$	$3d'\ ^2D$	2½ 1½	1242220 1243860	−1640
$2s^2 2p^4(^1D)3d$	$3d'\ ^2F$	3½ 2½	 1243020	
$2s^2 2p^4(^1S)3d$	$3d''\ ^2D$	2½ 1½	1291510 1291800	−290
$2s^2 2p^4(^3P)4s$	$4s\ ^4P$	2½ 1½ ½	 1322980 	

Si VI

Config.	Desig.	J	Level	Interval
$2s^2 2p^4(^3P)4s$	$4s\ ^2P$	1½ ½	1329900	
$2s^2 2p^4(^1D)4s$	$4s'\ ^2D$	{2½ 1½}	1371820	
$2s\ 2p^5(^3P^\circ)3s$	$3s'''\ ^2P^\circ$	1½ ½	*1375840* *1378830*	−2990
$2s^2 2p^4(^3P)4d$	$4d\ ^4F$	4½ 3½ 2½ 1½	 1399110 1399450	−340
$2s^2 2p^4(^3P)4d$	$4d\ ^4P$	½ 1½ 2½	 1400880 1401740	860
$2s^2 2p^4(^3P)4d$	$4d\ ^2P$	½ 1½	1402510 1406330	3820
$2s^2 2p^4(^3P)4d$	$4d\ ^2D$	1½ 2½	1403050 1404870	1820
$2s^2 2p^4(^1D)4d$	$4d'\ ^2S$	½	1444340	
$2s^2 2p^4(^1D)4d$	$4d'\ ^2D$	2½ 1½	1445000 1445590	−590
$2s^2 2p^4(^1D)4d$	$4d'\ ^2P$	½ 1½	 1445030	
$2s^2 2p^4(^1S)4d$	$4d''\ ^2D$	2½ 1½	1497100 	
$2s^2 2p^4(^3P)5d$	$5d\ ^2D$	1½ 2½	 1497630	
$2s^2 2p^4(^1D)5d$	$5d'\ ^2S$	½	1538370	
$2s^2 2p(^1D)5d$	$5d'\ ^2P$	½ 1½	 1538580	
Si VII ($^3P_2$)	*Limit*	---------	***1654800***	

March 1948.

Si VI Observed Terms*

Config. $1s^2+$	Observed Terms				
$2s^2 2p^5$	$2p^5\ ^2P^\circ$				
$2s\ 2p^6$	$2p^6\ ^2S$				
	ns ($n \geq 3$)	nd ($n \geq 3$)			
$2s^2 2p^4(^3P)nx$	{3, 4s ^4P 3, 4s ^2P		3, 4d ^4P 3, 4d ^2P	 3–5d ^2D	3, 4d ^4F
$2s^2 2p^4(^1D)nx'$	3, 4s′ ^2D	3–5d′ ^2S	3–5d′ ^2P	3, 4d′ ^2D	3d′ ^2F
$2s^2 2p^4(^1S)nx''$	3s″ ^2S			3, 4d″ ^2D	
$2s\ 2p^5(^3P^\circ)nx'''$	3s‴ $^2P^\circ$				

*For predicted terms in the spectra of the F I isoelectronic sequence, see Introduction.

Si VII

(O I sequence; 8 electrons) $Z=14$

Ground state $1s^2\,2s^2\,2p^4\;{}^3P_2$

$2p^4\;{}^3P_2$ **1988000** cm^{-1} I. P. 246.41 volts

In 1941 Ferner published an analysis of this spectrum including 71 classified lines—64 in the region between 54 A and 85 A and 7 between 217 A and 278 A. The present term list is, however, based on later work kindly furnished by him in manuscript form.

Two intersystem combinations have been observed, connecting the triplet and singlet terms.

Ferner's unit, 10^3 cm^{-1}, has here been changed to cm^{-1}.

REFERENCES

E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **28A,** No. 4 p. 3 (1941). (T) (C L)
E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **36A,** No. 1, p. 48 (1948). (I P) (T) (C L)

Si VII

Config.	Desig.	J.	Level	Interval
$2s^2\,2p^4$	$2p^4\;{}^3P$	2	0	−4030
		1	4030	−1540
		0	5570	
$2s^2\,2p^4$	$2p^4\;{}^1D$	2	47000	
$2s^2\,2p^4$	$2p^4\;{}^1S$	0	99780	
$2s\;2p^5$	$2p^5\;{}^3P^\circ$	2	36 170	−3610
		1	366780	−1980
		0	368760	
$2s^2\,2p^5$	$2p^5\;{}^1P^\circ$	1	506080	
$2s^2\,2p^3(^4S^\circ)3s$	$3s\;{}^3S^\circ$	1	1172470	
$2s^2\,2p^3(^2D^\circ)3s$	$3s'\;{}^3D^\circ$	1, 2, 3	1225150	
$2s^2\,2p^3(^2D^\circ)3s$	$3s'\;{}^1D^\circ$	2	1236320	
$2s^2\,2p^3(^2P^\circ)3s$	$3s''\;{}^3P^\circ$	0		
		1	1261610	430
		2	1262040	
$2s^2\,2p^3(^2P^\circ)3s$	$3s''\;{}^1P^\circ$	1	1273170	
$2s^2\,2p^3(^4S^\circ)3d$	$3d\;{}^3D^\circ$	1, 2	1367360	200
		2, 3	1367560	
$2s^2\,2p^3(^2D^\circ)3d$	$3d'\;{}^3F^\circ$	4		
		3	1426050	
		2		

Si VII

Config.	Desig.	J.	Level	Interval
$2s^2\,2p^3(^2D^\circ)3d$	$3d'\;{}^3D^\circ$	3	1428020	−70
		2	1428090	
		1		
$2s^2\,2p^3(^2D^\circ)3d$	$3d'\;{}^1P^\circ$	1	1429680	
$2s^2\,2p^3(^2D^\circ)3d$	$3d'\;{}^3P^\circ$	2	1435460	−1290
		1	1436750	−340
		0	1437090	
$2s^2\,2p^3(^2D^\circ)3d$	$3d'\;{}^1D^\circ$	2	1436760	
$2s^2\,2p^3(^2D^\circ)3d$	$3d'\;{}^3S^\circ$	1	1441230	
$2s^2\,2p^3(^2D^\circ)3d$	$3d'\;{}^1F^\circ$	3	1447870	
$2s^2\,2p^3(^2P^\circ)3d$	$3d''\;{}^3P^\circ$	0	1460290	570
		1	1460860	1000
		2	1461860	
$2s^2\,2p^3(^2P^\circ)3d$	$3d''\;{}^3F^\circ$	4		
		3	1463270	−3220
		2	1466490	
$2s^2\,2p^3(^2P^\circ)3d$	$3d''\;{}^1D^\circ$	2	1466910	
$2s^2\,2p^3(^2P^\circ)3d$	$3d''\;{}^3D^\circ$	3	1467390	−2660
		2	1470050	
		1		
$2s^2\,2p^3(^2P^\circ)3d$	$3d''\;{}^1P^\circ$	1	1470490	
$2s^2\,2p^3(^2P^\circ)3d$	$3d''\;{}^1F^\circ$	3	1474100	

Si VII—Continued

Config.	Desig.	*J.*	Level	Interval
$2s\ 2p^4(^4P)3s$	$3s'''\ ^3P$	2 1 0	1499430	
$2s\ 2p^4(^2D)3s$	$3s^{IV}\ ^3D$	3 2 1	1590930	
$2s^2\ 2p^3(^2D°)4s$	$4s'\ ^3D°$	1, 2, 3	*1631160*	
$2s^2\ 2p^3(^2D°)4s$	$4s'\ ^1D°$	2	*1635820*	
$2s^2\ 2p^3(^4S°)4d$	$4d\ ^3D°$	1 2, 3	 *1643740*	
$2s^2\ 2p^3(^2P°)4s$	$4s''\ ^3P°$	0 1 2	 *1669900*	
$2s^2\ 2p^3(^2D°)4d$	$4d'\ ^3D°$	3, 2 1	*1707070*	
$2s^2\ 2p^3(^2D°)4d$	$4d'\ ^1P°$	1	*1707550*	
$2s^2\ 2p^3(^2D°)4d$	$4d'\ ^3P°$	2 1 0	*1711010*	
$2s^2\ 2p^3(^2D°)4d$	$4d'\ ^3S°$	1	*1712680*	

Si VII—Continued

Config.	Desig.	*J.*	Level	Interval
$2s^2\ 2p^3(^2D°)4d$	$4d'\ ^1F°$	3	*1714610*	
$2s^2\ 2p^3(^2P°)4d$	$4d''\ ^3P°$	0 1 2	 *1741130*	
$2s^2\ 2p^3(^2P°)4d$	$4d''\ ^3D°$	3 2 1	*1744440*	
$2s^2\ 2p^3(^2P°)4d$	$4d''\ ^1F°$	3	*1748200*	
$2s^2\ 2p^3(^4S°)5d$	$5d\ ^3D°$	1 2, 3	 *1769040*	
$2s^2\ 2p^3(^2D°)5d$	$5d'\ ^3D°$	3, 2 1	*1834120*	
$2s^2\ 2p^3(^2D°)5d$	$5d'\ ^3P°$	2 1 0	*1836140*	
$2s\ 2p^4(^4P)4s$	$4s'''\ ^3P$	2 1 0	1887680	
Si VIII ($^4S°_{1\frac{1}{2}}$)	*Limit*	---------	**1988000**	

February 1947.

Si VII Observed Terms*

Config. $1s^2+$	Observed Terms	
$2s^2\ 2p^4$	$2p^4\ ^3P$ $2p^4\ ^1S$ $2p^4\ ^1D$	
$2s\ 2p^5$	$2p^5\ ^3P°$ $2p^5\ ^1P°$	
	ns ($n \geq 3$)	*nd* ($n \geq 3$)
$2s^2\ 2p^3(^4S°)nx$	$3s\ ^3S°$	$3–5d\ ^3D°$
$2s^2\ 2p^3(^2D°)nx'$	$3, 4s'\ ^3D°$ $3, 4s'\ ^1D°$	$3, 4d'\ ^3S°$ $3–5d'\ ^3P°$ $3–5d'\ ^3D°$ $3d'\ ^3F°$ $3, 4d'\ ^1P°$ $3d'\ ^1D°$ $3, 4d'\ ^1F°$
$2s^2\ 2p^3(^2P°)nx''$	$3, 4s''\ ^3P°$ $3s''\ ^1P°$	$3, 4d''\ ^3P°$ $3, 4d''\ ^3D°$ $3d''\ ^3F°$ $3d''\ ^1P°$ $3d''\ ^1D°$ $3, 4d''\ ^1F°$
$2s\ 2p^4(^4P)nx'''$	$3, 4s'''\ ^3P$	
$2s\ 2p^4(^2D)nx^{IV}$	$3s^{IV}\ ^3D$	

*For predicted terms in the spectra of the O I isoelectronic sequence, see Introduction.

Si VIII

(N I sequence; 7 electrons) $Z=14$

Ground state $1s^2\ 2s^2\ 2p^3\ ^4S^\circ_{1\frac{1}{2}}$

$2p^3\ ^4S^\circ_{1\frac{1}{2}}$ *2451570* cm^{-1} I. P. 303.87 volts

The terms published by Ferner in 1941 have been corrected as indicated in his 1948 paper. The absolute values of the quartet terms have been decreased by 250 cm^{-1}; those of the doublet terms increased by 250 cm^{-1} as compared with the values he published in 1941.

Fifty-nine lines have been classified, all but 13 of which are in the region between 49 A and 76 A. No intersystem combinations have been published and the uncertainty, x, may be considerable.

The unit adopted by Ferner, 10^3 cm^{-1}, has here been changed to cm^{-1}.

REFERENCES

J. Söderqvist, Nova Acta Reg. Soc. Sci. Uppsala [IV] 9, No. 7, 64 (1934). (T) (C L)

E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) 28A, No. 4, p. 6 (1941). (I P) (T) (C L)

E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) 36A, No. 1, p. 42 (1948).

Si VIII

Author	Config.	Desig.	J	Level	Interval
$2p\ ^4S_2$	$2s^2\ 2p^3$	$2p^3\ ^4S^\circ$	1½	*0*	
$2p\ ^2D_2$ $^2D_3$	$2s^2\ 2p^3$	$2p^3\ ^2D^\circ$	1½ 2½	*67140*+x *67420*+x	280
$2p\ ^2P_1$ $^2P_2$	$2s^2\ 2p^3$	$2p^3\ ^2P^\circ$	½ 1½	*103320*+x *103900*+x	580
$2p'\ ^4P_3$ $^4P_2$ $^4P_1$	$2s\ 2p^4$	$2p^4\ ^4P$	2½ 1½ ½	312670 316260 318160	−3590 −1900
$2p'\ ^2D_3$ $^2D_2$	$2s\ 2p^4$	$2p^4\ ^2D$	2½ 1½	428300+x 428360+x	−60
$2p'\ ^2S_1$	$2s\ 2p^4$	$2p^4\ ^2S$	½	502360+x	
$2p'\ ^2P_2$ $^2P_1$	$2s\ 2p^4$	$2p^4\ ^2P$	1½ ½	528420+x 532790+x	−4370
$3s\ ^4P_1$ $^4P_2$ $^4P_3$	$2s^2\ 2p^2(^3P)3s$	$3s\ ^4P$	½ 1½ 2½	1430510 1432870 1436120	2360 3250
$3s\ ^2P_1$ $^2P_2$	$2s\ 2p^2(^3P)3s$	$3s\ ^2P$	½ 1½	1447950+x 1451900+x	3950
$\overline{3s}\ ^2D_2$ $^2D_3$	$2s^2\ 2p^2(^1D)3s$	$3s'\ ^2D$	1½ 2½	1486120+x 1486710+x	590
$3d\ ^2P_2$	$2s^2\ 2p^2(^3P)3d$	$3d\ ^2P$	1½ ½	1622900+x	
$3s'\ ^4S_2$	$2s\ 2p^3(^5S^\circ)3s$	$3s'''\ ^4S^\circ$	1½	*1628660*	
$3d\ ^2F_3$ $^2F_4$	$2s^2\ 2p^2(^3P)3d$	$3d\ ^2F$	2½ 3½	1632010+x 1636490+x	4480
$3d\ ^4D_{32}$	$2s^2\ 2p^2(^3P)3d$	$3d\ ^4D$	3½ { 2½ 1½ } ½	}1633370	
$3d\ ^4P_3$ $^4P_2$ $^4P_1$	$2s^2\ 2p^2(^3P)3d$	$3d\ ^4P$	2½ 1½ ½	1637470 1638830 1639640	−1360 −810

Author	Config.	Desig.	J	Level	Interval
$3d\ ^2D_2$ $^2D_3$	$2s^2\ 2p^2(^3P)3d$	$3d\ ^2D$	1½ 2½	1657290+x 1658460+x	1170
$\overline{3d}\ ^2F_4$ $^2F_3$	$2s^2\ 2p^2(^1D)3d$	$3d'\ ^2F$	3½ 2½	1682560+x 1682780+x	−220
$\overline{3d}\ ^2D_2$ $^2D_3$	$2s^2\ 2p^2(^1D)3d$	$3d'\ ^2D$	1½ 2½	1683930+x 1685560+x	1630
$\overline{3d}\ ^2P_1$ $^2P_2$	$2s^2\ 2p^2(^1D)3d$	$3d'\ ^2P$	½ 1½	1694560+x 1696140+x	1580
$3p'\ ^4P$	$2s\ 2p^3(^5S^\circ)3p$	$3p'''\ ^4P$	{ ½ to 2½ }	}1698230	
$\overline{3d}\ ^2S_1$	$2s^2\ 2p^2(^1D)3d$	$3d'\ ^2S$	½	1701700+x	
$3d'\ ^4D$	$2s\ 2p^3(^5S^\circ)3d$	$3d'''\ ^4D^\circ$	{ ½ to 3½ }	}*1801710*	
$4s\ ^2P_2$	$2s^2\ 2p^2(^3P)4s$	$4s\ ^2P$	½ 1½	 1927190+x	
$4d\ ^2F_3$ $^2F_4$	$2s^2\ 2p^2(^3P)4d$	$4d\ ^2F$	2½ 3½	1996930+x 2000980+x	4050
$4d\ ^4P_3$ $^4P_2$	$2s^2\ 2p^2(^3P)4d$	$4d\ ^4P$	2½ 1½ ½	1999240 2000520	−1280
$4d\ ^2D_3$	$2s^2\ 2p^2(^3P)4d$	$4d\ ^2D$	1½ 2½	 2006710+x	
$\overline{4d}\ ^2D_3$	$2s^2\ 2p^2(^1D)4d$	$4d'\ ^2D$	1½ 2½	 2046680+x	
	Si IX ($^3P_0$)	*Limit*	------	***2451570***	

July 1948.

Si VIII Observed Terms*

Config. $1s^2+$	Observed Terms		
$2s^2\ 2p^3$	$2p^3\ ^4S°$ $2p^3\ ^2P°$ $2p^3\ ^2D°$		
$2s\ 2p^4$	$2p^4\ ^4P$ $2p^4\ ^2S$ $2p^4\ ^2P$ $2p^4\ ^2D$		
	ns ($n\geq 3$)	*np* ($n\geq 3$)	*nd* ($n\geq 3$)
$2s^2\ 2p^2(^3P)nx$	$3s\ ^4P$ $3, 4s\ ^2P$		$3, 4d\ ^4P$ $3d\ ^4D$ $3d\ ^2P$ $3, 4d\ ^2D$ $3, 4d\ ^2F$
$2s^2\ 2p^2(^1D)nx'$	$3s'\ ^2D$		$3d'\ ^2S$ $3d'\ ^2P$ $3, 4d'\ ^2D$ $3d'\ ^2F$
$2s\ 2p^3(^5S°)nx'''$	$3s'''\ ^4S°$	$3p'''\ ^4P$	$3d'''\ ^4D°$

*For predicted terms in the spectra of the N I isoelectronic sequence, see Introduction.

Si IX

(C I sequence; 6 electrons) $Z=14$

Ground state $1s^2\ 2s^2\ 2p^2\ ^3P_0$

$2p^2\ ^3P_0$ **2838460** cm^{-1} I. P. 351.83 volts

The terms have been taken from a manuscript by Ferner who generously submitted his revised analysis in advance of publication. A total of 42 lines have been classified, all but two of which are in the region between 44 A and 65 A. No combinations involving the terms $2p^3\ ^1D°$ and $2p^3\ ^1P°$ are listed.

The systems of terms of different multiplicity are not connected by intersystem combinations. Their relative positions are estimated by extrapolation along the isoelectronic sequence. The uncertainties, x and y, may be considerable.

Ferner's unit, 10^3 cm^{-1}, has here been converted to cm^{-1}.

REFERENCES

E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **28A,** No. 4 p. 6 (1941). (T) (C L)
E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **36A,** No. 1, p. 37 (1948). (I P) (T) (C L)

Si IX

Author	Config.	Desig.	J	Level	Interval
$2p\ ^3P_0$	$2s^2\,2p^2$	$2p^2\ ^3P$	0	0	2590
$^3P_1$			1	2590	3870
$^3P_2$			2	6460	
$2p\ ^1D_2$	$2s^2\,2p^2$	$2p^2\ ^1D$	2	52960+x	
$2p\ ^1S_0$	$2s^2\,2p^2$	$2p^2\ ^1S$	0	107780+x	
$2p'\ ^5S_2$	$2s\ 2p^3$	$2p^3\ ^5S°$	2	*150010+y*	
$2p'\ ^3D_3$	$2s\ 2p^3$	$2p^3\ ^3D°$	3	*292210*	−150
$^3D_2$			2	*292360*	−80
$^3D_1$			1	*292440*	
$2p'\ ^3P$	$2s\ 2p^3$	$2p^3\ ^3P°$	2, 1, 0	*344080*	
$2p'\ ^1D_2$	$2s\ 2p^3$	$2p^3\ ^1D°$	2	*440410+x*	
$2p'\ ^3S_1$	$2s\ 2p^3$	$2p^3\ ^3S°$	1	*446980*	
$2p'\ ^1P_1$	$2s\ 2p^3$	$2p^3\ ^1P°$	1	*492820+x*	
	$2s^2\,2p(^2P°)3s$	$3s\ ^3P°$	0		
$3s\ ^3P_1$			1	*1623380*	5170
$^3P_2$			2	*1628550*	
$3s\ ^1P_1$	$2s^2\,2p(^2P°)3s$	$3s\ ^1P°$	1	*1640920+x*	
$3s'\ ^5P_1$	$2s\ 2p^2(^4P)3s$	$3s\ ^5P$	1	1784260+y	2170
$^5P_2$			2	1786430+y	3220
$^5P_3$			3	1789650+y	
$3d\ ^3F_2$	$2s^2\,2p(^3P°)3d$	$3d\ ^3F°$	2	*1789400+x*	
			3		
			4		
$3d\ ^1D_2$	$2s^2\,2p(^2P°)3d$	$3d\ ^1D°$	2	*1794090+x*	
$3d\ ^3D_1$	$2s^2\,2p(^2P°)3d$	$3d\ ^3D°$	1	*1808160*	920
$^3D_2$			2	*1809080*	2400
$^3D_3$			3	*1811480*	
$3d\ ^3P_2$	$2s^2\,2p(^2P°)3d$	$3d\ ^3P°$	2	*1815690*	−1250
$^3P_1$			1	*1816940*	−730
$^3P_0$			0	*1817670*	

Si IX

Author	Config.	Desig.	J	Level	Interval
$3d\ ^1F_3$	$2s^2\,2p(^2P°)3d$	$3d\ ^1F°$	3	*1837810+x*	
$3d\ ^1P_1$	$2s^2\,2p(^2P°)3d$	$3d\ ^1P°$	1	*1838540+x*	
$3p'\ ^3S_1$	$2s\ 2p^2(^4P)3p$	$3p\ ^3S°$	1	*1858590*	
	$2s\ 2p^2(^4P)3p$	$3p\ ^3D°$	1		
$3p'\ ^3D_2$			2	*1896170*	2870
$^3D_3$			3	*1899040*	
$\overline{3s}'\ ^3D$	$2s\ 2p^2(^2D)3s$	$3s'\ ^3D$	1, 2, 3	1917080	
$3d'\ ^5P_3$	$2s\ 2p^2(^4P)3d$	$3d\ ^5P$	3	1971270+y	−1230
$^5P_2$			2	1972500+y	−960
$^5P_1$			1	1973460+y	
$3d'\ ^3P_2$	$2s\ 2p^2(^4P)3d$	$3d\ ^3P$	2	1973940	
			1		
			0		
$3d'\ ^3F_2$	$2s\ 2p^2(^4P)3d$	$3d\ ^3F$	2	1985150	2010
$^3F_3$			3	1987160	2670
$^3F_4$			4	1989830	
$\overline{3p}'\ ^1F_3$	$2s\ 2p^2(^2D)3p$	$3p'\ ^1F°$	3	*1999930+x*	
$\overline{3p}'\ ^1D_2$	$2s\ 2p^2(^2D)3p$	$3p'\ ^1D°$	2	*2009410+x*	
	$2s\ 2p^2(^4P)3d$	$3d\ ^3D$	1		
$3d'\ ^3D_{32}$			2, 3	2011690	
$\overline{3d}'\ ^3F$	$2s\ 2p^2(^2D)3d$	$3d'\ ^3F$	2, 3, 4	2084940	
$\overline{3d}'\ ^3D$	$2s\ 2p^2(^2D)3d$	$3d'\ ^3D$	1, 2, 3	2093650	
$\overline{\overline{3d}}'\ ^3F$	$2s\ 2p^2(^2P)3d$	$3d'''\ ^3F$	2, 3, 4	2190790	
	$2s^2\,2p(^2P°)4d$	$4d\ ^3D°$	1		
$4d\ ^3D_2$			2	*2264270*	2130
$^3D_3$			3	*2266400*	
	Si x ($^2P°_{1/2}$)	*Limit*	------	2838460	

March 1948.

Si IX Observed Terms*

Config. $1s^2+$	Observed Terms		
$2s^2\,2p^2$	$2p^2\ ^1S$; $2p^2\ ^3P$; $2p^2\ ^1D$		
$2s\ 2p^3$	$2p^3\ ^5S°$; $2p^3\ ^3S°$; $2p^3\ ^3P°$; $2p^3\ ^1P°$; $2p^3\ ^3D°$; $2p^3\ ^1D°$		
	ns ($n \geq 3$)	np ($n \geq 3$)	nd ($n \geq 3$)
$2s^2\,2p(^2P°)nx$	$3s\ ^3P°$ $3s\ ^1P°$		$3d\ ^3P°$ 3, $4d\ ^3D°$ $3d\ ^3F°$ $3d\ ^1P°$ $3d\ ^1D°$ $3d\ ^1F°$
$2s\ 2p^2(^4P)nx$	$3s\ ^5P$	$3p\ ^3S°$ $3p\ ^3D°$	$3d\ ^5P$ $3d\ ^3P$ $3d\ ^3D$ $3d\ ^3F$
$2s\ 2p^2(^2D)nx'$	$3s'\ ^3D$	$3p'\ ^1D°$ $3p'\ ^1F°$	$3d'\ ^3D$ $3d'\ ^3F$
$2s\ 2p^2(^2P)nx'''$			$3d'''\ ^3F$

*For predicted terms in the spectra of the C I isoelectronic sequence, see Introduction.

Si x

(B I sequence; 5 electrons) $Z=14$

Ground state $1s^2\,2s^2\,2p\ ^2P^\circ_{1/2}$

$2p\ ^2P^\circ_{1/2}$ ***3237400*** cm^{-1} I. P. 401.3 volts

Ferner has classified 29 lines in the range between 47 A and 57 A. He has kindly furnished his unpublished manuscript extending the analysis he published in 1941.

No intersystem combinations have been observed, as indicated by x in the table, but the absolute values of the doublet and quartet terms are determined from series. Extrapolated values are in brackets in the table.

The quartet terms are not all connected by observed combinations.

Ferner's unit, 10^3 cm^{-1}, has here been changed to cm^{-1}.

REFERENCES

E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **28A**, No. 4, p. 18 (1941). (T) (C L)

E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **36A**, No. 1, p. 30 (1948). (I P) (T) (C L)

Si x

Author	Config.	Desig.	J	Level	Interval
$2p\ ^2P_1$ $^2P_2$	$2s^2(^1S)2p$	$2p\ ^2P^\circ$	½ 1½	*0* *6990*	6990
$2p'\ ^4P_1$ $^4P_2$ $^4P_3$	$2s\ 2p^2$	$2p^2\ ^4P$	½ 1½ 2½	162060+x 164500+x 168090+x	2440 3590
$2p'\ ^2D$	$2s\ 2p^2$	$2p^2\ ^2D$	{ 1½ 2½ }	287830	
$2p'\ ^2S_1$	$2s\ 2p^2$	$2p^2\ ^2S$	½	367650	
$2p'\ ^2P_1$ $^2P_2$	$2s\ 2p^2$	$2p^2\ ^2P$	½ 1½	389740 394000	4260
$2p''\ ^4S_2$	$2p^3$	$2p^3\ ^4S^\circ$	1½	*510190+x*	
$2p''\ ^2D_3$ $^2D_2$	$2p^3$	$2p^3\ ^2D^\circ$	2½ 1½	*574360* *574600*	−240
$2p''\ ^2P_1$ $^2P_2$	$2p^3$	$2p^3\ ^2P^\circ$	½ 1½	*[644560]* *[644940]*	380
$3d\ ^2D_2$ $^2D_3$	$2s^2(^1S)3d$	$3d\ ^2D$	1½ 2½	1979260 1979730	470
$3s'\ ^4P_1$ $^4P_2$ $^4P_3$	$2s\ 2p(^3P^\circ)3s$	$3s\ ^4P^\circ$	½ 1½ 2½	*1993860+x* *1996180+x* *2000570+x*	2320 4390
$3s'\ ^2P_2$	$2s\ 2p(^3P^\circ)3s$	$3s\ ^2P^\circ$	½ 1½	*2035810*	
$3p'\ ^2P_2$	$2s\ 2p(^3P^\circ)3p$	$3p\ ^2P$	½ 1½	2066600	

Si x

Author	Config.	Desig.	J	Level	Interval
$3p'\ ^2D_3$	$2s\ 2p(^3P^\circ)3p$	$3p\ ^2D$	1½ 2½	2110260	
$3d'\ ^4D_{12}$ $^4D_3$ $^4D_4$	$2s\ 2p(^3P^\circ)3d$	$3d\ ^4D^\circ$	{ ½ 1½ } 2½ 3½	*2151950+x* *2152370+x* *2154860+x*	420 2490
$3d'\ ^2D_2$ $^2D_3$	$2s\ 2p(^3P^\circ)3d$	$3d\ ^2D^\circ$	1½ 2½	*2153680* *2154440*	760
$\overline{3s}'\ ^2P$	$2s\ 2p(^1P^\circ)3s$	$3s'\ ^2P^\circ$	{ ½ 1½ }	*2158290*	
$3d'\ ^4P_3$	$2s\ 2p(^3P^\circ)3d$	$3d\ ^4P^\circ$	2½ 1½ ½	*2161950+x*	
$3d'\ ^2F_3$ $^2F_4$	$2s\ 2p(^3P^\circ)3d$	$3d\ ^2F^\circ$	2½ 3½	*2188570* *2193140*	4570
$3d'\ ^2P_2$ $^2P_1$	$2s\ 2p(^3P^\circ)3d$	$3d\ ^2P^\circ$	1½ ½	*2199190* *2201770*	−2580
$\overline{3d}'\ ^2F$	$2s\ 2p(^1P^\circ)3d$	$3d'\ ^2F^\circ$	{ 2½ 3½ }	*2299860*	
$\overline{3d}'\ ^2D_2$ $^2D_3$	$2s\ 2p(^1P^\circ)3d$	$3d'\ ^2D^\circ$	1½ 2½	*2310230* *2311360*	1130
$3d''\ ^4P_3$ $^4P_2$	$2p^2(^3P)3d$	$3d''\ ^4P$	2½ 1½ ½	2445320+x 2446860+x	−1540
	Si XI ($^1S_0$)	*Limit*	------	***3237400***	

August 1947.

Si x Observed Terms*

Config. $1s^2+$	Observed Terms						
$2s^2(^1S)2p$		$2p\ ^2P°$					
$2s\,2p^2$	$2p^2\ ^2S$	$2p^2\ ^4P$ $2p^2\ ^2P$	$2p^2\ ^2D$				
$2p^3$	$2p^3\ ^4S°$	$2p^3\ ^2P°$	$2p^3\ ^2D°$				
	$ns\ (n \geq 3)$		$np\ (n \geq 3)$		$nd\ (n \geq 3)$		
$2s^2(^1S)nx$						$3d\ ^2D$	
$2s\,2p(^3P°)nx$		$3s\ ^4P°$ $3s\ ^2P°$	$3p\ ^2P$	$3p\ ^2D$	$3d\ ^4P°$ $3d\ ^2P°$	$3d\ ^4D°$ $3d\ ^2D°$	$3d\ ^2F°$
$2s\,2p(^1P°)nx'$		$3s'\ ^2P°$				$3d'\ ^2D°$	$3d'\ ^2F°$
$2p^2(^3P)nx''$						$3d''\ ^4P$	

*For predicted terms in the spectra of the B I isoelectronic sequence, see Introduction.

Si XI

(Be I sequence; 4 electrons) $Z=14$

Ground state $1s^2\ 2s^2\ ^1S_0$

$2s^2\ ^1S_0$ **3840470** cm^{-1} I. P. 476.0 volts

Ferner has published a preliminary analysis giving the classifications of 12 lines in the region between 43 A and 49 A. He has recently extended the earlier work and generously furnished his revised term list in advance of publication, to be used in compiling the list below.

No intersystem combinations have been observed, as indicated by *x* in the table.

The unit adopted by Ferner, 10^3 cm^{-1}, has here been changed to cm^{-1}.

REFERENCES

E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **28A**, No. 4 p. 20 (1941). (T) (C L)
E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **36A**, No. 1, p. 27 (1948). (I P) (T)

Si XI

Author	Config.	Desig.	*J*	Level	Interval
$2s\ ^1S_0$	$2s^2$	$2s^2\ ^1S$	0	0	
$2p\ ^3P_0$	$2s(^2S)2p$	$2p\ ^3P^\circ$	0	*169140+x*	
$^3P_1$			1	*171560+x*	2420
$^3P_2$			2	*176810+x*	5250
$2p\ ^1P_1$	$2s(^2S)2p$	$2p\ ^1P^\circ$	1	*329400*	
$2p'\ ^3P_0$	$2p^2$	$2p^2\ ^3P$	0	443020+x	
$^3P_1$			1	445910+x	2890
$^3P_2$			2	450470+x	4560
$2p'\ ^1D_2$	$2p^2$	$2p^2\ ^1D$	2	493400	
$2p'\ ^1S_0$	$2p^2$	$2p^2\ ^1S$	0	607630	
$3s\ ^1S_0$	$2s(^2S)3s$	$3s\ ^1S$	0	2241480	
$3p\ ^1P_1$	$2s(^2S)3p$	$3p\ ^1P^\circ$	1	*2285040*	
	$2s(^2S)3d$	$3d\ ^3D$	1		
$3d\ ^3D_2$			2	2331390+x	550
$^3D_3$			3	2331940+x	

Si XI

Author	Config.	Desig.	*J*	Level	Interval
$3d\ ^1D_2$	$2s(^2S)3d$	$3d\ ^1D$	2	2361010	
	$2p(^2P^\circ)3p$	$3p\ ^3D$	1		
			2		
$3p'\ ^3D_3$			3	2486810+x	
$3d'\ ^1D_2$	$2p(^2P^\circ)3d$	$3d\ ^1D^\circ$	2	*2523240*	
$3p'\ ^1D_2$	$2p(^2P^\circ)3p$	$3p\ ^1D$	2	2532140	
	$2p(^2P^\circ)3d$	$3d\ ^3D^\circ$	1		
$3d'\ ^3D_2$			2	*2546810+x*	2160
$^3D_3$			3	*2548970+x*	
$3d'\ ^3P_2$	$2p(^2P^\circ)3d$	$3d\ ^3P^\circ$	2	*2556220+x*	
			1		
			0		
$3d'\ ^1F_3$	$2p(^2P^\circ)3d$	$3d\ ^1F^\circ$	3	*2581130*	
	Si XII ($^2S_{1/2}$)	*Limit*	------	3840470	

August 1947.

Si XI Observed Terms*

Config. $1s^2+$	Observed Terms		
$2s^2$	$2s^2\ ^1S$		
$2s(^2S)2p$		$2p\ ^3P^\circ$ $2p\ ^1P^\circ$	
$2p^2$	$2p^2\ ^1S$	$2p^2\ ^3P$	$2p^2\ ^1D$
	ns ($n \geq 3$)	*np* ($n \geq 3$)	*nd* (≥ 3)
$2s(^2S)nx$	$3s\ ^1S$	$3p\ ^1P^\circ$	$3d\ ^3D$ $3d\ ^1D$
$2p(^2P^\circ)nx$		$3p\ ^3D$ $3p\ ^1D$	$3d\ ^3P^\circ$ $3d\ ^3D^\circ$ $3d\ ^1D^\circ$ $3d\ ^1F^\circ$

*For predicted terms in the spectra of the Be I isoelectronic sequence, see Introduction.

Si XII

(Li I sequence; 3 electrons) $Z=14$

Ground state $1s^2\,2s\;^2S_{1/2}$

$2s\;^2S_{1/2}$ **4221460** cm^{-1} I. P. 523.2 volts

The classifications of three lines in the region 44 A to 45 A were published by Ferner in 1941, but no terms were given. His absolute term values based on later work, and kindly furnished in advance of publication, have been used in compiling the present list. Observations of the resonance lines have not been reported.

Ferner's unit, 10^3 cm^{-1}, has here been changed to cm^{-1}.

REFERENCES

E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **28A,** No. 4 p. 21 (1941). (C L)
E. Ferner, Ark Mat. Astr. Fys. (Stockholm) **36A,** No. 1, p. 25 (1948). (I P) (T)

Si XII

Config.	Desig.	*J*	Level	Interval
2*s*	2*s* ²S	½	0	
2*p*	2*p* ²P°	½	*191900*	8390
		1½	*200290*	
3*s*	3*s* ²S	½	2390580	
3*d*	3*d* ²D	1½	2463540	990
		2½	2464530	
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Si XIII (¹S₀)	*Limit*	---	4221460	

August 1947.

PHOSPHORUS

P I

15 electrons $Z=15$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^3\ ^4S^\circ_{1\frac{1}{2}}$

$3p^3\ ^4S^\circ_{1\frac{1}{2}}$ ***88560*** cm⁻¹ I. P. 11.0 volts

Eleven terms have been found by Kiess, who extended earlier work on this spectrum by making the important observations in the infrared to 10813 A. Robinson observed the ultraviolet region as far as 1323 A and was able to extend the analysis.

The present list is taken from Robinson's paper, except for the term $4p\ ^2P^\circ$, which has been adjusted to fit the observations by Kiess.

Intersystem combinations connecting the doublet and quartet terms have been observed.

There is not complete agreement about the configuration assignments of $3d\ ^2P$ and $3p^4\ ^2P$, and those entered in the table are tentative.

REFERENCES

C. C. Kiess, Bur. Std. J. Research **8,** 393, RP425 (1932). (I P) (T) (C L)

H. A. Robinson, Phys. Rev. **49,** 297 (1936). (I P) (T) (C L)

W. F. Meggers, J. Opt. Soc. Am. **36,** 431 (1946). (Summary hfs)

P I

Config.	Desig.	J	Level	Interval
$3s^2\,3p^3$	$3p^3\ ^4S^\circ$	1½	*0.0*	
$3s^2\,3p^3$	$3p^3\ ^2D^\circ$	1½ 2½	*11361.7* *11376.5*	14.8
$3s^2\,3p^3$	$3p^3\ ^2P^\circ$	½ 1½	*18722.4* *18748.1*	25.7
$3s^2\,3p^2(^3P)4s$	$4s\ ^4P$	½ 1½ 2½	55939.23 56090.59 56339.68	151.36 249.09
$3s^2\,3p^2(^3P)4s$	$4s\ ^2P$	½ 1½	57876.8 58174.4	297.6
$3s\ 3p^4$	$3p^4\ ^4P$	2½ 1½ ½	59533.4 59713.6 59818.6	−180.2 −105.0
$3s^2\,3p^2(^1D)4s$	$4s'\ ^2D$	{ 1½ 2½ }	65156.6	
$3s^2\,3p^2(^3P)4p$	$4p\ ^4D^\circ$	½ 1½ 2½ 3½	*65373.6* *65450.2* *65585.1* *65787.3*	76.6 134.9 202.2
$3s^2\,3p^2(^3P)4p$	$4p\ ^4P^\circ$	½ 1½ 2½	*66343.4* *66360.2* *66544.1*	16.8 183.9
$3s^2\,3p^2(^3P)4p$	$4p\ ^2D^\circ$	1½ 2½	*66813.1* *66870.2?*	57.1
$3s^2\,3p^2(^3P)4p$	$4p\ ^4S^\circ$	1½	*66834.5*	
$3s\ 3p^4$	$3p^4\ ^2P$	1½ ½	67908.6 68126.2	−217.6

P I

Config.	Desig.	J	Level	Interval
$3s^2\,3p^2(^3P)4p$	$4p\ ^2P^\circ$	½ 1½	*67971.1* *68088.3*	117.2
$3s^2\,3p^2(^3P)4p$	$4p\ ^2S^\circ$	½	*68473.2*	
$3s^2\,3p^2(^3P)3d$	$3d\ ^2F$	2½ 3½	70391.3 70690.0	298.7
$3s^2\,3p^2(^3P)3d$	$3d\ ^4D$	½ 1½ 2½ 3½	 70637.5 70778.6 	141.1
$3s\ 3p^4$	$3p^4\ ^2D$	2½ 1½	71168.3 71202.6	−34.3
$3s^2\,3p^2(^3P)3d$	$3d\ ^4P$	2½ 1½ ½	72386.6 72494.6 72571.4	−108.0 −76.8
$3s^2\,3p^2(^3P)3d$	$3d\ ^2P$	½ 1½	72741.9 72883.5	141.6
$3s\ 3p^4$	$3p^4\ ^2S$	½	72943.3	
$3s^2\,3p^2(^3P)3d$	$3d\ ^2D?$	1½ 2½	 73248.1	
$3s^2\,3p^2(^3P)5s$	$5s\ ^4P$	½ 1½ 2½	75064.6? 75211.3? 75533.4?	146.7 322.1
P II ($^3P_0$)	***Limit***	---------	***88560***	

November 1947.

P I Observed Terms*

Config. $1s^2\ 2s^2\ 2p^6+$	Observed Terms		
$3s^2\ 3p^3$	$3p^3\ {}^4S^\circ$	$3p^3\ {}^2P^\circ$	$3p^3\ {}^2D^\circ$
$3s\ 3p^4$	$3p^4\ {}^2S$	$3p^4\ {}^4P$ $3p^4\ {}^2P$	$3p^4\ {}^2D$
	$ns\ (n\geq 4)$	$np\ (n\geq 4)$	$nd\ (n\geq 3)$
$3s^2\ 3p^2(^3P)nx$	$4, 5s\ {}^4P$ $4s\ {}^2P$	$4p\ {}^4S^\circ$ $4p\ {}^4P^\circ$ $4p\ {}^4D^\circ$ $4p\ {}^2S^\circ$ $4p\ {}^2P^\circ$ $4p\ {}^2D^\circ$	$3d\ {}^4P$ $3d\ {}^4D$ $3d\ {}^2P$ $3d\ {}^2D?$ $3d\ {}^2F$
$3s^2\ 3p^2(^1D)nx'$	$4s'\ {}^2D$		

*For predicted terms in the spectra of the P I isoelectronic sequence, see Introduction.

P II

(Si I sequence; 14 electrons) $Z=15$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^2\ {}^3P_0$

$3p^2\ {}^3P_0$ **158550.0** cm^{-1} I. P. 19.65 volts

The terms are mostly from the 1936 paper by Robinson, who has revised and extended the earlier analysis by Bowen. The singlet and triplet terms are well connected by intersystem combinations.

In his later paper Robinson adds two quintet terms, and makes a few corrections to his earlier list which have been incorporated here. The quintet terms are not connected by observation with the rest, as indicated by the uncertainty x and brackets denoting that the relative position of $3p^3\ {}^5S^\circ$ is estimated.

REFERENCES

I. S. Bowen, Phys. Rev. **29**, 510 (1927). (T) (C L)
S. Tolansky, Zeit. Pkys. **74**, 336 (1932). (hfs)
H. A. Robinson, Phys. Rev. **49**, 297 (1936). (I P) (T) (C L)
H. A. Robinson, Phys. Rev. **51**, 726 (1937). (T)

P II

Config.	Desig.	J	Level	Interval
$3s^2\,3p^2$	$3p^2\ ^3P$	0 1 2	0. 0 166. 6 470. 3	166. 6 303. 7
$3s^2\,3p^2$	$3p^2\ ^1D$	2	8882. 6	
$3s^2\,3p^2$	$3p^2\ ^1S$	0	21576. 4	
$3s\ \ 3p^3$	$3p^3\ ^5S^\circ$	2	[*52450. 0*]$+x$	
$3s\ \ 3p^3$	$3p^3\ ^3D^\circ$	1 2 3	*65251. 8* *65272. 9* *65307. 7*	21. 1 34. 8
$3s\ \ 3p^3$	$3p^3\ ^3P^\circ$	2 1 0	*76764. 9* *76813. 2* *76824. 4*	−48. 3 −11. 2
$3s\ \ 3p^3$	$3p^3\ ^1D^\circ$	2	*77710. 8*	
$3s^2\,3p(^2P^\circ)4s$	$4s\ \ ^3P^\circ$	0 1 2	*86599. 0* *86745. 1* *87126. 1*	146. 1 381. 0
$3s^2\,3p(^2P^\circ)4s$	$4s\ \ ^1P^\circ$	1	*88893. 5*	
$3s\ \ 3p^3$	$3p^3\ ^1P^\circ$	1	*102798. 4*	
$3s^2\,3p(^2P^\circ)4p$	$4p\ \ ^3D$	1 2 3	103166. 7 103340. 2 103668. 9	173. 5 328. 7
$3s^2\,3p(^2P^\circ)3d$	$3d\ \ ^3P^\circ$	2 1 0	*103632. 3* *103755. 4* *104219*?	−123. 1 −464
$3s^2\,3p(^2P^\circ)3d$	$3d\ \ ^3D^\circ$	1 2 3	*103935. 8* *104053. 2* *104101. 4*	117. 4 48. 2
$3s^2\,3p(^2P^\circ)4p$	$4p\ \ ^3P$	0 1 2	105225. 5 105303. 6 105550. 9	78. 1 247. 3
$3s^2\,3p(^2P^\circ)3d$	$3d\ \ ^1D^\circ$	2	*105963. 1*	
$3s^2\,3p(^2P^\circ)4p$	$4p\ \ ^3S$	1	106002. 5	
$3s^2\,3p(^2P^\circ)4p$	$4p\ \ ^1D$	2	107924. 2	
$3s^2\,3p(^2P^\circ)3d$	$3d\ \ ^1P^\circ$	1	*108371. 8*	
$3s^2\,3p(^2P^\circ)4p$	$4p\ \ ^1P$	1	108417. 4	
$3s\ \ 3p^3$	$3p^3\ ^3S^\circ$	1	*110254. 9*	
	2°	2, 3	*110456. 9*?	
$3s^2\,3p(^2P^\circ)4p$	$4p\ \ ^1S$	0	111114. 8	
$3s^2\,3p(^2P^\circ)5s$	$5s\ \ ^3P^\circ$	0 1 2	*123345. 4* *123456. 7* *123892. 0*	111. 3 435. 3
$3s^2\,3p(^2P^\circ)5s$	$5s\ \ ^1P^\circ$	1	*124433. 8*	
$3s^2\,3p(^2P^\circ)4d$	$4d\ \ ^3F^\circ$	2 3 4	*124955. 9* *125130. 6* *125392. 7*	174. 7 262. 1

P II

Config.	Desig.	J	Level	Interval
$3s^2\,3p(^2P^\circ)4d$	$4d\ ^3D^\circ$	3 2 1	*127333. 6* *127890. 2* *127935. 7*	−556. 6 −45. 5
$3s^2\,3p(^2P^\circ)4d$	$4d\ ^3P^\circ$	0 1 2	*127368. 7* *127601. 2* *127951. 1*	232. 5 349. 9
$3s^2\,3p(^2P^\circ)4d$	$4d\ ^1D^\circ$	2	*129612. 0*	
$3s^2\,3p(^2P^\circ)5p$	1 ($5p\ ^3S$?)	1	129625. 5?	
	2	2	130239. 6	
	3	1, 2	130826. 2	
$3s^2\,3p(^2P^\circ)5p$	4 ($5p\ ^1D$?)	2	130913. 9	
	5	2	130949. 6	
$3s^2\,3p(^2P^\circ)5p$	6 ($5p\ ^1P$?)	1	130970. 0	
	7	2	131320. 5	
	8	1, 2	131601. 9	
	9	2	131633. 1	
	10	?	131652. 1?	
$3s^2\,3p(^2P^\circ)4d$	$4d\ ^1P^\circ$	1	*131729. 1*	
$3s^2\,3p(^2P^\circ)4d$	$4d\ ^1F^\circ$	3	*131764. 4*	
$3s^2\,3p(^2P^\circ)4f$	11 ($4f\ ^1D$?)	2	132082. 4	
	12	2, 3	132134. 1	
	13	2	132163. 6	
	14	2	132206. 9	
$3s^2\,3p(^2P^\circ)4f$	15 ($4f\ ^1F$?)	3	132236. 0	
	16	2, 3	132354. 7	
	17	1	132371. 2	
	18	2	132397. 0	
$3s^2\,3p(^2P^\circ)5p$	19 ($5p\ ^1S$?)	0, 1	132641. 5?	
	20	1	133418. 8?	
$3s^2\,3p(^2P^\circ)6s$	$6s\ ^3P^\circ$	0 1 2	*137433* *137486* *138000*	53 514
$3s^2\,3p(^2P^\circ)6s$	$6s\ ^1P^\circ$	1	*138058. 4*	
$3s^2\,3p(^2P^\circ)5d$	$5d\ ^3P^\circ$	0 1 2	 *139091. 9*	
$3s^2\,3p(^2P^\circ)6d$	$6d\ ^3P^\circ$	0 1 2	 *145519. 8*	
P III ($^2P^\circ_{1/2}$)	*Limit*	-------	**158550. 0**	
$3s\ 3p^2(^4P)3d$	$3d\ ^5P$	3 2 1	160018. 2$+x$ 160144. 7$+x$ 160235. 2$+x$	−126. 5 −90. 5

October 1947.

P II OBSERVED TERMS*

Config. $1s^2\ 2s^2\ 2p^6+$	Observed Terms								
$3s^2\ 3p^2$	$3p^2\ ^1S$	$3p^2\ ^3P$	$3p^2\ ^1D$						
$3s\ 3p^3$	$3p^3\ ^5S°$ $3p^3\ ^3S°$	$3p^3\ ^3P°$ $3p^3\ ^1P°$	$3p^3\ ^3D°$ $3p^3\ ^1D°$						
	ns $(n \geq 4)$			np $(n \geq 4)$			nd $(n \geq 3)$		
$3s^2\ 3p(^2P°)nx$	4–6s $^3P°$ 4–6s $^1P°$			$4p\ ^3S$ $4p\ ^1S$	$4p\ ^3P$ $4p\ ^1P$	$4p\ ^3D$ $4p\ ^1D$	3–6d $^3P°$ 3, 4d $^1P°$	3, 4d $^3D°$ 3, 4d $^1D°$	4d $^3F°$ 4d $^1F°$
$3s\ 3p^2(^4P)nx$							3d ^5P		

*For predicted terms in the spectra of the Si I isoelectronic sequence, see Introduction.

P III

(Al I sequence; 13 electrons) $Z=15$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p\ ^2P^\circ_{1/2}$

$3p\ ^2P^\circ_{1/2}$ *243290.0* cm^{-1} I. P. 30.156±0.003 volts

The terms have been taken from Robinson, who has revised and extended the earlier work on analysis. An evident misprint has been corrected here, i. e., the absolute term values of $4f\ ^4D$ should have been printed as negative.

Robinson has classified two lines as the intersystem combination $3p\ ^2P°-3p^2\ ^4P$. He remarks that these must be considered as tentative classifications, but that they are consistent with the analagous transition in Al I.

REFERENCES

R. A. Millikan and I. S. Bowen, Phys. Rev. **25**, 600 (1925). (T) (C L)
I. S. Bowen, Phys. Rev. **39**, 13 (1932). (T) (C L)
H. A. Robinson, Phys. Rev. **51**, 726 (1937). (I P) (T) (C L)

P III

Config.	Desig.	J	Level	Interval
$3s^2(^1S)3p$	$3p\ ^2P^\circ$	½ 1½	*0.0* *559.6*	559.6
$3s\ 3p^2$	$3p^2\ ^4P$	½ 1½ 2½	56919.3 57125.8 57454.5	206.5 328.7
$3s\ 3p^2$	$3p^2\ ^2D$	1½ 2½	74915.1 74944.6	29.5
$3s\ 3p^2$	$3p^2\ ^2S$	½	100201.2	
$3s\ 3p^2$	$3p^2\ ^2P$	½ 1½	109035.7 109409.7	374.0
$3s^2(^1S)3d$	$3d\ ^2D$	1½ 2½	116873.6 116884.9	11.3
$3s^2(^1S)4s$	$4s\ ^2S$	½	117834.5	
$3s^2(^1S)4p$	$4p\ ^2P^\circ$	½ 1½	*141375.7* *141512.8*	137.1
$3p^3$	$3p^3\ ^2D^\circ$	1½ 2½	*147322.4* *147384.3*	61.9
$3p^3$	$3p^3\ ^4S^\circ$	1½	*159714.6*	
$3p^3$	$3p^3\ ^2P^\circ$	1½ ½	*170107.2* *170167.0*	−59.8
$3s^2(^1S)4d$	$4d\ ^2D$	{1½, 2½}	172429.2	
$3s\ 3p(^3P^\circ)3d$	$3d\ ^4P^\circ$	2½ 1½ ½	*173813.4* *173988.4* *174106.2*	−175.0 −117.8
$3s\ 3p(^3P^\circ)3d$	$3d\ ^4D^\circ$	½ 1½ 2½ 3½	*175260.8* *175314.1* *175376.6* *175427.2*	53.3 62.5 50.6
$3s^2(^1S)5s$	$5s\ ^2S$	½	176041.0	
$3s^2(^1S)4f$	$4f\ ^2F^\circ$	{2½, 3½}	*178653.2*	
$3s\ 3p(^3P^\circ)4s$	$4s\ ^4P^\circ$	½ 1½ 2½	*184453.4* *184639.3* *185045.2*	185.9 405.9
$3s\ 3p(^3P^\circ)3d$	$^21^\circ$	1½	*184854.1*	
$3s\ 3p(^3P^\circ)4s$	$4s\ ^2P^\circ$	½ 1½	 *186920.7*	
$3s^2(^1S)5p$	$5p\ ^2P^\circ$	½ 1½	 *191639.5*	
$3s^2(^1S)5d$	$5d\ ^2D$	{1½, 2½}	200442.8	
$3s^2(^1S)6s$	$6s\ ^2S$	½	201103.4	
$3s^2(^1S)5f$	$5f\ ^2F^\circ$	{2½, 3½}	*202906.4*	
$3s^2(^1S)5g$	$5g\ ^2G$	{3½, 4½}	203782.7	
$3s\ 3p(^3P^\circ)4p$	$4p\ ^4P$	½ 1½ 2½	209938.9 210055.8 210306.1	116.9 250.3
$3s\ 3p(^3P^\circ)4p$	$4p\ ^4S$	1½	211339.4	
$3s^2(^1S)6d$	$6d\ ^2D$	{1½, 2½}	213982.8	
$3s^2(^1S)6f$	$6f\ ^2F^\circ$	{2½, 3½}	*215402.0*	
$3s^2(^1S)6g$	$6g\ ^2G$	{3½, 4½}	215863.2	
$3s^2(^1S)7g$	$7g\ ^2G$	{3½, 4½}	223131.0	
P IV ($^1S_0$)	*Limit*	---------	***243290.0***	
$3s\ 3p(^3P^\circ)4f$	$4f\ ^4D$	3½ 2½ 1½ ½	248168.4 248199.4 248228.4 248265.5	−31.0 −29.0 −37.1

September 1947.

P III Observed Terms*

Config. $1s^2\ 2s^2\ 2p^6+$	Observed Terms				
$3s^2(^1S)3p$	$3p\ ^2P^\circ$				
$3s\ 3p^2$	{ $3p^2\ ^4P$; $3p^2\ ^2S$ $3p^2\ ^2P$ $3p^2\ ^2D$				
$3p^3$	{ $3p^3\ ^4S^\circ$; $3p^3\ ^2P^\circ$ $3p^3\ ^2D^\circ$				
	ns ($n \geq 4$)	*np* ($n \geq 4$)	*nd* ($n \geq 3$)	*nf* ($n \geq 4$)	*ng* ($n \geq 5$)
$3s^2(^1S)nx$	4–6s ^2S	4–5p $^2P^\circ$	3–6d ^2D	4–6f $^2F^\circ$	5–7g ^2G
$3s\ 3p(^3P^\circ)nx$	{ $4s\ ^4P^\circ$; $4s\ ^2P^\circ$	$4p\ ^4S$ $4p\ ^4P$	$3d\ ^4P^\circ$ $3d\ ^4D^\circ$	$4f\ ^4D^\circ$	

*For predicted terms in the spectra of the Al I isoelectronic sequence, see Introduction.

P IV

(Mg I sequence; 12 electrons) $Z=16$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\ {}^1S_0$

$3s^2\ {}^1S_0$ **414312.4** cm^{-1} I. P. 51.354 ±0.013 volts

The analysis published by Bowen in 1932 has been extended by Robinson to include a total of 105 classified lines in the range from 283 A to 4291 A.

Intersystem combinations connecting the singlet and triplet terms have been observed. Robinson remarks that the observed combination $3s^2\ {}^1S_0 - 3p\ {}^3P^\circ_1$ obeys the irregular doublet law very well.

REFERENCES

I. S. Bowen, Phys. Rev. **39**, **10** (1932). (T) (C L)

H. A. Robinson, Phys. Rev. **51**, **727** (1937). (I P) (T) (C L)

P IV

Config.	Desig.	J	Level	Interval
$3s^2$	$3s^2\ {}^1S$	0	0.0	
$3s(^2S)3p$	$3p\ {}^3P^\circ$	0 1 2	*67911.6* *68139.0* *68607.4*	227.4 468.4
$3s(^2S)3p$	$3p\ {}^1P^\circ$	1	*105189.9*	
$3s(^2S)3d$	$3d\ {}^1D$	2	158138.2	
$3p^2$	$3p^2\ {}^3P$	0 1 2	164935 165178 165646	243 468
$3p^2$	$3p^2\ {}^1D$	2	166144	
$3s(^2S)3d$	$3d\ {}^3D$	3, 2, 1	189389.0	
$3p^2$	$3p^2\ {}^1S$	0	194588.5	
$3s(^2S)4s$	$4s\ {}^3S$	1	226888.6	
$3s(^2S)4s$	$4s\ {}^1S$	0	233995.0	
$3s(^2S)4p$	$4p\ {}^3P^\circ$	0 1 2	*256544.1* *256602.7* *256751.3*	58.6 148.6
$3s(^2S)4p$	$4p\ {}^1P^\circ$	1	*257520.2*	
$3p(^2P^\circ)3d$	$3d\ {}^1F^\circ$	3	*276270?*	
$3p(^2P^\circ)3d$	$3d\ {}^1D^\circ$	2	*276325?*	
$3p(^2P^\circ)3d$	$3d\ {}^3P^\circ$	2 1 0	*281011* *281251* *281391*	−240 −140
$3p(^2P^\circ)3d$	$3d\ {}^3D^\circ$	1 2 3	*283142* *283239* *283321*	97 82
$3s(^2S)4d$	$4d\ {}^3D$	1 2 3	293233.5 293238.9 293246.6	5.4 7.7
$3s(^2S)4d$	$4d\ {}^1D$	2	296757.8	
$3p(^2P^\circ)3d$	$3d\ {}^1P^\circ$	1	*298327*	
$3s(^2S)4f$	$4f\ {}^3F^\circ$	2 3 4	*303115* *303350* *303659*	235 309
$3s(^2S)5s$	$5s\ {}^3S$	1	309102.4	
$3p(^2P^\circ)4s$	$4s\ {}^1P^\circ$	1	*313078*	
$3s(^2S)5s$	$5s\ {}^1S$	0	316627.0	
$3p(^2P^\circ)4s$	$4s\ {}^3P^\circ$	0 1 2	*317662* *317948* *318353*	286 405
$3s(^2S)5p$	$5p\ {}^3P^\circ$	0 1 2	 *320053* *320126*	73
$3s(^2S)5p$	$5p\ {}^1P^\circ$	1	*320063.5*	
$3s(^2S)5d$	$5d\ {}^3D$	3 2 1	339635.5 339639.3 339642.1	−3.8 −2.8
$3s(^2S)5d$	$5d\ {}^1D$	2	341004.8?	
$3s(^2S)5f$	$5f\ {}^3F^\circ$	2 3 4	 *343309* *343590*	281
$3s(^2S)5g$	$5g\ {}^3G$	3, 4, 5	343688	
$3s(^2S)6s$	$6s\ {}^3S$	1	346672	
$3s(^2S)6p$	$6p\ {}^1P^\circ$	1	*352125?*	
P V $(^2S_{1/2})$	*Limit*	---------	**414312.4**	

July 1947.

P IV Observed Terms*

Config. $1s^2\,2s^2\,2p^6+$	Observed Terms				
$3s^2$	$3s^2\ {}^1S$				
$3s(^2S)3p$	$3p\ {}^3P°$ $3p\ {}^1P°$				
$3p^2$	$3p^2\ {}^3P$ $3p^2\ {}^1S$ $3p^2\ {}^1D$				
	$ns\ (n\geq 4)$	$np\ (n\geq 4)$	$nd\ (n\geq 3)$	$nf\ (n\geq 4)$	$ng\ (n\geq 5)$
$3s(^2S)nx$	4–6s ^3S 4, 5s ^1S	4, 5p $^3P°$ 4–6p $^1P°$	3–5d ^3D 3–5d ^1D	4, 5f $^3F°$	5g ^3G
$3p(^2P°)nx$	4s $^3P°$ 4s $^1P°$		3d $^3P°$ 3d $^3D°$ 3d $^1P°$ 3d $^1D°$ 3d $^1F°$		

* For predicted terms in the spectra of the Mg I isoelectronic sequence, see Introduction.

P V

(Na I sequence; 11 electrons) $Z=15$

Ground state $1s^2\,2s^2\,2p^6\,3s\ {}^2S_{1/2}$

$3s\ {}^2S_{1/2}$ **524462.9 cm⁻¹** I. P. 65.007±0.003 volts

The analysis is from Robinson who has extended the earlier work by Bowen and Millikan. The total number of classified lines is 38, of which 31 are in the range between 210 A and 1610 A. The absolute value of $6h\ {}^2H°$ was extrapolated along the Na I isoelectronic sequence.

REFERENCE

H. A. Robinson, Phys. Rev. **51**, 732 (1937). (I P) (T) (C L)

P V

Config.	Desig.	J	Level	Interval
3s	3s ^2S	½	0.0	
3p	3p $^2P°$	½ 1½	*88651.7* *89446.3*	794.6
3d	3d ^2D	1½ 2½	204197.1 204208.3	11.2
4s	4s ^2S	½	272961.1	
4p	4p $^2P°$	½ 1½	*304161.3* *304445.3*	284.0
4d	4d ^2D	1½ 2½	345398.4 345403.3	4.9
4f	4f $^2F°$	{2½, 3½}	*352595.3*	
5s	5s ^2S	½	376639.2	
5p	5p $^2P°$	½ 1½	*391101.7* *391242.4*	140.7
5d	5d ^2D	{1½, 2½}	410631.1	
5f	5f $^2F°$	{2½, 3½}	*414458.7*	
5g	5g ^2G	{3½, 4½}	414684.4	
6s	6s ^2S	½	427157	
6p	6p $^2P°$	½ 1½	 *435100.4*	
6d	6d ^2D	{1½, 2½}	445814	
6f	6f $^2F°$	{2½, 3½}	*448061.7*	
6g	6g ^2G	{3½, 4½}	448216.8	
6h	6h $^2H°$	{4½, 5½}	*448247.4*	
7s	7s ^2S	½	455573	
7p	7p $^2P°$	{½, 1½}	*460363*	
7d	7d ^2D	{1½, 2½}	466893	
7f	7f $^2F°$	{2½, 3½}	*468530*	
8p	8p $^2P°$	{½, 1½}	*476181*	
P VI ($^1S_0$)	*Limit*	----------	524462.9	

June 1947.

P VI

(Ne I sequence; 10 electrons) $Z=15$

Ground state $1s^2\ 2s^2\ 2p^6\ ^1S_0$

$2p^6\ ^1S_0$ **1778250** cm^{-1} I. P. 220.414 volts

The analysis is by Robinson who has generously furnished his manuscript in advance of publication. He has classified 23 lines in the range 57 A to 91 A, as combinations with the ground term. The term designations he assigns on the assumption of *LS*-coupling are given in the table under the heading "Author".

As for Ne I, the *jl*-coupling notation in the general form suggested by Racah is introduced. A predicted value of $7d\ [1\frac{1}{2}]^\circ_1$ is entered in brackets in the table, since the observed combination is a blend.

REFERENCES

G. Racah, Phys. Rev. **61,** 537 (L) (1942).

H. A. Robinson, unpublished material (June 1947). (I P) (T) (C L)

P VI

Author	Config.	Desig.	J	Level
$2p\ ^1S_0$	$2p^6$	$2p^6\ ^1S$	0	0
	$2p^5(^2P^\circ_{1\frac{1}{2}})3s$	$3s\ [1\frac{1}{2}]^\circ$	2	
$3s\ ^3P_1$			1	*1093240*
	$2p^5(^2P^\circ_{\frac{1}{2}})3s$	$3s'[\ \frac{1}{2}]^\circ$	0	
$3s\ ^1P_1$			1	*1103180*
	$2p^5(^2P^\circ_{1\frac{1}{2}})3d$	$3d\ [\ \frac{1}{2}]^\circ$	0	
$3d\ ^3P_1$			1	*1306610*
$3d\ ^1P_1$	"	$3d\ [1\frac{1}{2}]^\circ$	1	*1321910*
$3d\ ^3D_1$	$2p^5(^2P^\circ_{\frac{1}{2}})3d$	$3d'[1\frac{1}{2}]^\circ$	1	*1334210*
	$2p^5(^2P^\circ_{1\frac{1}{2}})4s$	$4s\ [1\frac{1}{2}]^\circ$	2	
$4s\ ^3P_1$			1	*1439840*
	$2p^5(^2P^\circ_{\frac{1}{2}})4s$	$4s'[\ \frac{1}{2}]^\circ$	0	
$4s\ ^1P_1$			1	*1446740*
	$2p^5(^2P^\circ_{1\frac{1}{2}})4d$	$4d\ [\ \frac{1}{2}]^\circ$	0	
$4d\ ^3P_1$			1	*1516530*
$4d\ ^1P_1$	"	$4d\ [1\frac{1}{2}]^\circ$	1	*1523460*
$4d\ ^3D_1$	$2p^5(^2P^\circ_{\frac{1}{2}})4d$	$4d'[1\frac{1}{2}]^\circ$	1	*1531210*
	$2p^5(^2P^\circ_{1\frac{1}{2}})5s$	$5s\ [1\frac{1}{2}]^\circ$	2	
$5s\ ^3P_1$			1	*1576040*
	$2p^5(^2P^\circ_{\frac{1}{2}})5s$	$5s'[\ \frac{1}{2}]^\circ$	0	
$5s\ ^1P_1$			1	*1582860*
	$2p^5(^2P^\circ_{1\frac{1}{2}})5d$	$5d\ [\ \frac{1}{2}]^\circ$	0	
$5d\ ^3P_1$			1	*1613680*
$5d\ ^1P_1$	"	$5d\ [1\frac{1}{2}]^\circ$	1	*1616320*
$5d\ ^3D_1$	$2p^5(^2P^\circ_{\frac{1}{2}})5d$	$5d'[1\frac{1}{2}]^\circ$	1	*1622800*
	$2p^5(^2P^\circ_{\frac{1}{2}})6s$	$6s'[\ \frac{1}{2}]^\circ$	0	
$6s\ ^1P_1$			1	*1650930*
$6d\ ^1P_1$	$2p^5(^2P^\circ_{1\frac{1}{2}})6d$	$6d\ [1\frac{1}{2}]^\circ$	1	*1666220*
$6d\ ^3D_1$	$2p^5(^2P^\circ_{\frac{1}{2}})6d$	$6d'[1\frac{1}{2}]^\circ$	1	*1672940*
$7d\ ^1P_1$	$2p^5(^2P^\circ_{1\frac{1}{2}})7d$	$7d\ [1\frac{1}{2}]^\circ$	1	[*1696180*]
$7d\ ^3D_1$	$2p^5(^2P^\circ_{\frac{1}{2}})7d$	$7d'[1\frac{1}{2}]^\circ$	1	*1702790*
$8d\ ^1P_1$	$2p^5(^2P^\circ_{1\frac{1}{2}})8d$	$8d\ [1\frac{1}{2}]^\circ$	1	*1715440*
$9d\ ^1P_1$	$2p^5(^2P^\circ_{1\frac{1}{2}})9d$	$9d\ [1\frac{1}{2}]^\circ$	1	*1726160*
	P VII $(^2P^\circ_{1\frac{1}{2}})$	*Limit*	-------	**1778250**
	P VII $(^2P^\circ_{\frac{1}{2}})$	*Limit*	-------	1785518

June 1947.

P VI Observed Levels*

<table>
<tr><th>Config.
$1s^2\ 2s^2+$</th><th colspan="2">Observed Terms</th></tr>
<tr><td rowspan="2">$2p^6$</td><td colspan="2">$2p^6\ {}^1S$</td></tr>
<tr><td>$ns\ (n\geq 3)$</td><td>$nd\ (n\geq 3)$</td></tr>
<tr><td>$2p^5(^2P^\circ)nx$</td><td>{ 3–5s ³P°
3–6s ¹P°</td><td>3–5d ³P° 3–7d ³D°
3–9d ¹P°</td></tr>
<tr><td colspan="3">jl-Coupling Notation</td></tr>
<tr><td rowspan="2"></td><td colspan="2">Observed Pairs</td></tr>
<tr><td>$ns\ (n\geq 3)$</td><td>$nd\ (n\geq 3)$</td></tr>
<tr><td>$2p^5(^2P^\circ_{1\frac{1}{2}})nx$</td><td>3–5s [1½]°</td><td>3–5d [½]°
3–9d [1½]°</td></tr>
<tr><td>$2p^5(^2P^\circ_{\frac{1}{2}})nx'$</td><td>3–6s′ [½]°</td><td>3–7d′ [1½]°</td></tr>
</table>

*For predicted levels in the spectra of the Ne I isoelectronic sequence, see Introduction.

P VII

(F I sequence; 9 electrons) $Z=15$

Ground state $1s^2\ 2s^2\ 2p^5\ {}^2P^\circ_{1\frac{1}{2}}$

$2p^5\ {}^2P^\circ_{1\frac{1}{2}}$ ***2124300*** cm^{-1} I. P. 263.31 volts

The analysis is by Robinson, who has generously furnished his manuscript in advance of publication. He has classified more than 70 lines in the region between 49 A and 223 A.

Intersystem combinations connecting the doublet and quartet terms have been observed.

REFERENCE

H. A. Robinson, unpublished material (March 1948). (I P) (T) (C L)

Config.	Desig.	J	Level	Interval
$2s^2\,2p^5$	$2p^5\ ^2P^\circ$	1½	0	−7268
		½	*7268*	
$2s\ 2p^6$	$2p^6\ ^2S$	½	454732	
$2s^2\,2p^4(^3P)3s$	$3s\ ^4P$	2½	1259730	−4440
		1½	1264170	−1830
		½	1266000?	
$2s^2\,2p^4(^3P)3s$	$3s\ ^2P$	1½	1277380	−5170
		½	1282550	
$2s^2\,2p^4(^1D)3s$	$3s'\ ^2D$	2½	1317110	
		1½		
$2s^2\,2p^4(^1S)3s$	$3s''\ ^2S$	½	1375810	
$2s^2\,2p^4(^3P)3d$	$3d\ ^4P$	2½	1496890	−3150
		1½	1500040	
		½		
$2s^2\,2p^4(^3P)3d$	$3d\ ^4F$	4½		
		3½		
		2½		
		1½	1498400	
$2s^2\,2p^4(^3P)3d$	$3d\ ^2D$	2½	1502040	−4690
		1½	1506730	
$2s^2\,2p^4(^3P)3d$	$3d\ ^2P$	½	1505300	6010
		1½	1511310	
$2s^2\,2p^4(^3P)3d$	$3d\ ^2F$	3½		
		2½	1510050	
$2s^2\,2p^4(^1D)3d$	$3d'\ ^2P$	½	1548480	3690
		1½	1552170	
$2s^2\,2p^4(^1D)3d$	$3d'\ ^2F$	3½		
		2½	1552120	
$2s^2\,2p^4(^1D)3d$	$3d'\ ^2D$	2½	1553740	−680
		1½	1554420	
$2s^2\,2p^4(^1D)3d$	$3d'\ ^2S$	½	1555560	
$2s^2\,2p^4(^1S)3d$	$3d''\ ^2D$	2½	1606550	−330
		1½	1606880	
$2s\ 2p^5(^3P^\circ)3s$	$3s'''\ ^2P^\circ$	1½	*1692160*	−4700
		½	*1696860*	
$2s^2\,2p^4(^3P)4s$	$4s\ ^2P$	1½	1695720	−5660
		½	1701380	
$2s^2\,2p^4(^1D)4s$	$4s'\ ^2D$	{2½, 1½}	1741710	
$2s^2\,2p^4(^3P)4d$	$4d\ ^2D$	2½	1775510	−8520
		1½	1784030	
$2s^2\,2p^4(^3P)4d$	$4d\ ^4P$	½		
		{1½, 2½}	1778690	
$2s^2\,2p^4(^3P)4d$	$4d\ ^2P$	½	1780190	2070
		1½	1782260	
$2s^2\,2p^4(^1S)4s$	$4s''\ ^2S$	½	1801570	
$2s^2\,2p^4(^1D)4d$	$4d'\ ^2P$	1½	1827890	−1300
		½	1829190	
$2s^2\,2p^4(^1D)4d$	$4d'\ ^2D$	{2½, 1½}	1828630	
$2s^2\,2p^4(^1D)4d$	$4d'\ ^2S$	½	1830190	
$2s^2\,2p^4(^3P)5s$	$5s\ ^2P$	1½	1865680	
		½		
$2s^2\,2p^4(^1S)4d$	$4d''\ ^2D$	{2½, 1½}	1885000	
$2s^2\,2p^4(^1S)5s$	$5s''\ ^2S$	½	1913620	
$2s\ 2p^5(^3P^\circ)3d$	$3d'''\ 1^\circ$		*1919310?*	
$2s\ 2p^5(^3P^\circ)3d$	$3d'''\ 2^\circ$		*1921010?*	
$2s\ 2p^5(^3P^\circ)3d$	$3d'''\ 3^\circ$		*1922150?*	
$2s\ 2p^5(^3P^\circ)3d$	$3d'''\ 4^\circ$		*1925560?*	
$2s\ 2p^5(^3P^\circ)3d$	$3d'''\ 5^\circ$		*1931070?*	
$2s^2\,2p^4(^1S)5d$	$5d''\ ^2D$	{2½, 1½}	2013690	
P VIII $(^3P_2)$	***Limit***	---------	***2124300***	

March 1948.

P VII Observed Terms*

Config. $1s^2+$	Observed Terms	
$2s^2\,2p^5$	$2p^5\ ^2P^\circ$	
$2s\ 2p^6$	$2p^6\ ^2S$	
	$ns\ (n\geq 3)$	$nd\ (n\geq 3)$
$2s^2\,2p^4(^3P)nx$	$3s\ ^4P$; $3–5s\ ^2P$	$3, 4d\ ^4P$; $3, 4d\ ^2P$; $3, 4d\ ^2D$; $3d\ ^4F$; $3d\ ^2F$
$2s^2\,2p^4(^1D)nx'$	$3, 4s'\ ^2D$	$3, 4d'\ ^2S$; $3, 4d'\ ^2P$; $3, 4d'\ ^2D$; $3d'\ ^2F$
$2s^2\,2p^4(^1S)nx''$	$3–5s''\ ^2S$	$3–5d''\ ^2D$
$2s\ 2p^5(^3P^\circ)nx'''$	$3s'''\ ^2P^\circ$	

*For predicted terms in the spectra of the F I isoelectronic sequence, see Introduction.

P VIII

(O I sequence; 8 electrons) $Z=15$

Ground state $1s^2\,2s^2\,2p^4\ ^3P_2$

$2p^4\ ^3P_2$ **2495000** cm^{-1} I. P. 309.26 volts

The terms are from an unpublished manuscript kindly furnished by Robinson. No intersystem combinations have been observed and the uncertainty, x, may be considerable.

The unit adopted by Robinson, 10^3 cm^{-1}, has here been changed to cm^{-1}.

REFERENCE

H A. Robinson, unpublished material (March 1948). (I P) (T)

P VIII

Config.	Desig.	J	Level	Interval
$2s^2\,2p^4$	$2p^4\ ^3P$	2	0	
		1	5757	−5757
		0	7826	−2069
$2s^2\,2p^4$	$2p^4\ ^1D$	2	52450+x	
$2s^2\,2p^4$	$2p^4\ ^1S$	0	110970+x	
$2s\ 2p^5$	$2p^5\ ^3P^\circ$	2	*403806*	
		1	*408913*	−5107
		0	*411736*	−2823
$2s\ 2p^5$	$2p^5\ ^1P^\circ$	1	560680+x	
$2s^2\,2p^3(^4S^\circ)3s$	$3s\ ^3S^\circ$	1	*1462340*	
$2s^2\,2p^3(^2D^\circ)3s$	$3s'\ ^3D^\circ$	1, 2	*1519740*	
		3	*1520030*	290
$2s^2\,2p^3(^2D^\circ)3s$	$3s'\ ^1D^\circ$	2	*1532020*+x	
$2s^2\,2p^3(^2P^\circ)3s$	$3s''\ ^3P^\circ$	0	*1559500*	
		1	*1560070*	570
		2	*1561260*	1190
$2s^2\,2p^3(^2P^\circ)3s$	$3s''\ ^1P^\circ$	1	*1573270*+x	
$2s^2\,2p^3(^4S^\circ)3d$	$3d\ ^3D^\circ$	1, 2	*1685980*	
		3	*1686280*	300
$2s^2\,2p^3(^2D^\circ)3d$	$3d'\ ^3F^\circ$	4, 3, 2	*1749870*	
$2s^2\,2p^3(^2D^\circ)3d$	$3d'\ ^3D^\circ$	3, 2, 1	1753090	
$2s^2\,2p^3(^2D^\circ)3d$	$3d'\ ^1P^\circ$	1	*1753830*+x	
$2s^2\,2p^3(^2D^\circ)3d$	$3d'\ ^3P^\circ$	2	*1760530*	
		1	*1762400*	−1870
		0		
$2s^2\,2p^3(^2D^\circ)3d$	$3d'\ ^1D^\circ$	2	*1761680*+x	
$2s^2\,2p^3(^2D^\circ)3d$	$3d'\ ^3S^\circ$	1	*1767880*	
$2s^2\,2p^3(^2D^\circ)3d$	$3d'\ ^1F^\circ$	3	*1776050*+x	
$2s^2\,2p^3(^2P^\circ)3d$	$3d''\ ^3P^\circ$	0	*1787090*	
		1	*1788090*	1000
		2	*1789690*	1600

P VIII

Config.	Desig.	J	Level	Interval
$2s^2\,2p^3(^2P^\circ)3d$	$3d''\ ^3F^\circ$	4		
		3	*1790480*	
		2	*1795030*	−45[illegible]0
$2s^2\,2p^3(^2P^\circ)3d$	$3d''\ ^1D^\circ$	2	*1795430*+x	
$2s^2\,2p^3(^2P^\circ)3d$	$3d''\ ^3D^\circ$	3	*1796240*	
		2	*1800770*	−4530
		1		
$2s^2\,2p^3(^2P^\circ)3d$	$3d''\ ^1P^\circ$	1	*1800760*+x	
$2s^2\,2p^3(^2P^\circ)3d$	$3d''\ ^1F^\circ$	3	*1804930*+x	
$2s^2\,2p^3(^4S^\circ)4s$	$4s\ ^3S^\circ$	1	*1958370*	
$2s^2\,2p^3(^2D^\circ)4s$	$4s'\ ^3D^\circ$	1		
		2		
		3	*2029470*	
$2s^2\,2p^3(^2D^\circ)4s$	$4s'\ ^1D^\circ$	2	*2033320*+x	
$2s^2\,2p^3(^4S^\circ)4d$	$4d\ ^3D^\circ$	1		
		2		
		3	*2046710*	
$2s^2\,2p^3(^2P^\circ)4s$	$4s''\ ^1P^\circ$	1	*2073760*+x	
$2s^2\,2p^3(^2D^\circ)4d$	$4d'\ ^3D^\circ$	3, 2, 1	*2115510*	
$2s^2\,2p^3(^2D^\circ)4d$	$4d'\ ^3P^\circ$	2	*2119360*	
		1		
		0		
$2s^2\,2p^3(^2D^\circ)4d$	$4d'\ ^3S^\circ$	1	*2122020*	
$2s^2\,2p^3(^2D^\circ)4d$	$4d'\ ^1F^\circ$	3	*2123570*+x	
$2s^2\,2p^3(^4S^\circ)5d$	$5d\ ^3D^\circ$	1		
		2		
		3	*2210630*	
$2s^2\,2p^3(^2D^\circ)5s$	$5s'\ ^1D^\circ$	1	*2240920*+x	
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P IX ($^4S^\circ_{1\frac{1}{2}}$)	*Limit*	----------	**2495000**	

March 1948.

P VIII OBSERVED TERMS*

Config. $1s^2+$	Observed Terms	
$2s^2\,2p^4$	$2p^4\ ^3P$ $2p^4\ ^1S$ $2p^4\ ^1D$	
$2s\ 2p^5$	$2p^5\ ^3P^\circ$ $2p^5\ ^1P^\circ$	
	$ns\ (n\geq 3)$	$nd\ (n\geq 3)$
$2s^2\,2p^3(^4S^\circ)nx$	3, 4s $^3S^\circ$	3–5d $^3D^\circ$
$2s^2\,2p^3(^2D^\circ)nx'$	3, 4s′ $^3D^\circ$ 3–5s′ $^1D^\circ$	3, 4d′ $^3S^\circ$ 3, 4d′ $^3P^\circ$ 3, 4d′ $^3D^\circ$ 3d′ $^3F^\circ$ 3d′ $^1P^\circ$ 3d′ $^1D^\circ$ 3, 4d′ $^1F^\circ$
$2s^2\,2p^3(^2P^\circ)nx''$	3s″ $^3P^\circ$ 3, 4s″ $^1P^\circ$	3d″ $^3P^\circ$ 3d″ $^3D^\circ$ 3d″ $^3F^\circ$ 3d″ $^1P^\circ$ 3d″ $^1D^\circ$ 3d″ $^1F^\circ$

*For predicted terms in the spectra of the O I isoelectronic sequence, see Introduction.

P IX

(N I sequence; 7 electrons) $Z=15$

Ground state $1s^2\,2s^2\,2p^3\ ^4S^\circ_{1\frac{1}{2}}$

$2p^3\ ^4S^\circ_{1\frac{1}{2}}$ ***3006200*** cm^{-1} I. P. 372.62 volts

The analysis is by Robinson, who has kindly furnished a manuscript copy in advance of publication. He has found 35 terms, and classified more than 100 lines in the region between 40 A and 314 A. Intersystem combinations connecting the doublet and quartet systems of terms have been observed.

REFERENCE

H. A. Robinson, unpublished material (March 1948). (I P) (T) (C L)

P IX

Config.	Desig.	J	Level	Interval
$2s^2\,2p^3$	$2p^3\ ^4S^\circ$	1½	*0*	
$2s^2\,2p^3$	$2p^3\ ^2D^\circ$	1½ 2½	*73167* *73730*	563
$2s^2\,2p^3$	$2p^3\ ^2P^\circ$	½ 1½	*113457* *114430*	973
$2s\ 2p^4$	$2p^4\ ^4P$	2½ 1½ ½	345390 350440 353050	−5050 −2610
$2s\ 2p^4$	$2p^4\ ^2D$	2½ 1½	472580 473090	−510
$2s\ 2p^4$	$2p^4\ ^2S$	½	552540	
$2s\ 2p^4$	$2p^4\ ^2P$	1½ ½	580710 587010	−6300

P IX

Config.	Desig.	J	Level	Interval
$2p^5$	$2p^5\ ^2P^\circ$	1½ ½	*898220* *904700*	−6480
$2s^2\,2p^2(^3P)3s$	3s ^4P	½ 1½ 2½	1744000 1746250 1751850	2250 5600
$2s^2\,2p^2(^3P)3s$	3s ^2P	½ 1½	1764370 1768970	4600
$2s^2\,2p^2(^1D)3s$	3s′ ^2D	1½ 2½	1805940 1807340	1400
$2s^2\,2p^2(^3P)3d$	3d ^2P	1½ ½	1962630 1963830	−1200
$2s\ 2p^3(^5S^\circ)3s$	3s‴ $^4S^\circ$	1½	*1965970*	
$2s^2\,2p^2(^3P)3d$	3d ^2F	2½ 3½	1970380 1976610	6230

P IX—Continued

Config.	Desig.	*J*	Level	Interval
$2s^2 2p^2(^3P)3d$	$3d\ ^4D$	½		
		1½	1973870	2100
		2½	1975970	
		3½		
$2s^2 2p^2(^3P)3d$	$3d\ ^4P$	2½	1977830	−1920
		1½	1979750	−1120
		½	1980870	
$2s^2 2p^2(^3P)3d$	$3d\ ^2D$	1½	2000360	1600
		2½	2001960	
$2s^2 2p^2(^1D)3d$	$3d'\ ^2F$	2½		
		3½	2028530	
$2s^2 2p^2(^1D)3d$	$3d'\ ^2D$	1½		
		2½	2031610	
$2s^2 2p^2(^1D)3d$	$3d'\ ^2P$	½	2038670	3800
		1½	2042470	
$2s\ 2p^3(^5S^\circ)3p$	$3p'''\ ^4P$	½ to 2½	2043950	
$2s^2 2p^2(^1D)3d$	$3d'\ ^2S$	½	2049150	
$2s^2 2p^2(^1S)3d$	$3d''\ ^2D$	1½, 2½	2079720	
$2s\ 2p^3(^3D^\circ)3s$	$3s^{IV}\ ^2D^\circ$	1½, 2½	*2103110*	
$2s\ 2p^3(^5S^\circ)3d$	$3d'''\ ^4D^\circ$	½ to 3½	*2161390*	

P IX—Continued

Config.	Desig.	*J*	Level	Interval
$2s\ 2p^3(^3D^\circ)3p$	$3p^{IV}\ ^2F$	2½		
		3½	2224980	
$2s\ 2p^3(^3D^\circ)3d$	$3d^{IV}\ ^2F^\circ$	3½	*2309530*	−3000
		2½	*2312530*	
$2s^2 2p^2(^3P)4s$	$4s\ ^4P$	½		
		1½		
		2½	2354100	
$2s^2 2p^2(^3P)4s$	$4s\ ^2P$	½	2354120	5400
		1½	2359520	
$2s^2 2p^2(^3P)4d$	$4d\ ^2F$	2½	2430900	5500
		3½	2436400	
$2s^2 2p^2(^3P)4d$	$4d\ ^4P$	½ to 2½	2435220	
$2s^2 2p^2(^3P)4d$	$4d\ ^2D$	1½, 2½	2441100	
$2s^2 2p^2(^1D)4d$	$4d'\ ^2F$	2½		
		3½	2480120	
$2s^2 2p^2(^1D)4d$	$4d'\ ^2D$	1½, 2½	2487270	
$2s^2 2p^2(^1S)4d$	$4d''\ ^2D$	1½, 2½	2547080	
P x $(^3P_0)$	*Limit*	---------	***3006200***	

March 1948.

P IX Observed Terms*

Config. $1s^2+$	Observed Terms		
$2s^2 2p^3$	$\{2p^3\ ^4S^\circ$ $2p^3\ ^2P^\circ$ $2p^3\ ^2D^\circ$		
$2s\ 2p^4$	$\{2p^4\ ^2S$ $2p^4\ ^4P$ $2p^4\ ^2P$ $2p^4\ ^2D$		
$2p^5$	$2p^5\ ^2P^\circ$		
	ns ($n \geq 3$)	*np* ($n \geq 3$)	*nd* ($n \geq 3$)
$2s^2 2p^2(^3P)nx$	$\{3, 4s\ ^4P$; $3, 4s\ ^2P$		$3, 4d\ ^4P$; $3d\ ^2P$; $3d\ ^4D$; $3, 4d\ ^2D$; $3, 4d\ ^2F$
$2s^2 2p^2(^1D)nx'$	$3s'\ ^2D$		$3d'\ ^2S$; $3d'\ ^2P$; $3, 4d'\ ^2D$; $3, 4d'\ ^2F$
$2s^2 2p^2(^1S)nx''$			$3, 4d''\ ^2D$
$2s\ 2p^3(^5S^\circ)nx'''$	$3s'''\ ^4S^\circ$	$3p'''\ ^4P$	$3d'''\ ^4D^\circ$
$2s\ 2p^3(^3D^\circ)nx^{IV}$	$3s^{IV}\ ^2D^\circ$	$3p^{IV}\ ^2F$	$3d^{IV}\ ^2F^\circ$

*For predicted terms in the spectra of the N I isoelectronic sequence, see Introduction.

P x

(C I sequence; 6 electrons) $Z=15$

Ground state $1s^2\,2s^2\,2p^2\;{}^3P_0$

$2p^2\;{}^3P_0$ **3432500** cm^{-1} I. P. 425.46 volts

The analysis is from unpublished material kindly furnished by Robinson. He has found 36 terms and classified more than 70 lines in the region between 43 A and 318 A.

The singlet and triplet terms are connected by intersystem combinations. The connection of the quintet terms with the rest is based on Robinson's extrapolation of isoelectronic sequence data, as indicated by the uncertainty, x, and brackets in the table. The position of the level $2p^3\;{}^3D^\circ_2$ is also extrapolated and entered in brackets.

REFERENCE

H. A. Robinson, unpublished material (March 1948). (I P) (T) (C L)

P x

Config.	Desig.	J	Level	Interval
$2s^2\,2p^2$	$2p^2\;{}^3P$	0 1 2	0 3390 8580	3390 5190
$2s^2\,2p^2$	$2p^2\;{}^1D$	2	59330	
$2s^2\,2p^2$	$2p^2\;{}^1S$	0	119430	
$2s\;2p^3$	$2p^3\;{}^5S^\circ$	2	[166580]+x	
$2s\;2p^3$	$2p^3\;{}^3D^\circ$	3 2 1	322790 [323010] 323160	[−220] −150
$2s\;2p^3$	$2p^3\;{}^3P^\circ$	2 1 0	379660	
$2s\;2p^3$	$2p^3\;{}^1D^\circ$	2	484377	
$2s\;2p^3$	$2p^3\;{}^3S^\circ$	1	490100	
$2s\;2p^3$	$2p^3\;{}^1P^\circ$	1	541090	
$2s^2\,2p(^2P^\circ)3s$	$3s\;{}^3P^\circ$	0 1 2	1954140 1955980 1963430	1840 7450
$2s^2\,2p(^2P^\circ)3s$	$3s\;{}^1P^\circ$	1	1976578	
$2s\;2p^2(^4P)3s$	$3s\;{}^5P$	1 2 3	2132450 +x 2135050 +x 2139320 +x	2600 4270
$2s^2\,2p(^2P^\circ)3d$	$3d\;{}^3F^\circ$	2 3 4	2140410	
$2s^2\,2p(^2P^\circ)3d$	$3d\;{}^1D^\circ$	2	2147190	
$2s^2\,2p(^2P^\circ)3d$	$3d\;{}^3D^\circ$	1 2 3	2162410 2163500 2166800	1090 3300

P x

Config.	Desig.	J	Level	Interval
$2s^2\,2p(^2P^\circ)3d$	$3d\;{}^3P^\circ$	2 1 0	2171630 2173040 2173990	−1410 −950
$2s\;2p^2(^4P)3s$	$3s\;{}^3P$	0 1 2	2178420 2182320 2188220	3900 5900
$2s^2\,2p(^2P^\circ)3d$	$3d\;{}^1P^\circ$	1	2197500	
$2s^2\,2p(^2P^\circ)3d$	$3d\;{}^1F^\circ$	3	2197500	
$2s\;2p^2(^4P)3p$	$3p\;{}^3S^\circ$	1	2216880	
$2s\;2p^2(^4P)3p$	$3p\;{}^3D^\circ$	3 2 1	2262660 2267280 2269510	−4620 −2230
$2s\;2p^2(^4P)3p$	$3p\;{}^3P^\circ$	2 1 0	2275380 2281140 2286080?	−5760 −4940
$2s\;2p^2(^2D)3s$	$3s'\;{}^3D$	1, 2, 3	2281000	
$2s\;2p^2(^1D)3s$	$3s'\;{}^1D$	2	2307970	
$2s\;2p^2(^4P)3d$	$3d\;{}^5D$	0 1 2} 3} 4	 2331040+x	
$2s\;2p^2(^4P)3d$	$3d\;{}^5P$	3 2 1	2342240+x 2343760+x 2344970+x	−1520 −1210
$2s\;2p^2(^4P)3d$	$3d\;{}^3P$	2 1 0	2345800 2351740 2354640	−5940 −2900
$2s\;2p^2(^4P)3d$	$3d\;{}^3F$	2 3 4	2355750 2358400 2362900	2650 4500

P X—Continued

Config.	Desig.	J	Level	Interval
$2s\ 2p^2(^2D)3p$	$3p'\ ^1F^\circ$	3	*2371790*	
$2s\ 2p^2(^2D)3p$	$3p'\ ^1D^\circ$	2	*2382480*	
$2s\ 2p^2(^4P)3d$	$3d\ ^3D$	1 2 3	2385080 2387080 2388630	2000 1550
$2s\ 2p^2(^2D)3d$	$3d'\ ^3F$	2, 3, 4	2467290	
$2s\ 2p^2(^2D)3d$	$3d'\ ^3D$	1, 2, 3	2476100	

P X—Continued

Config.	Desig.	J	Level	Interval
$2s\ 2p^2(^2D)3d$	$3d'\ ^1D$	2	2499250?	
$2s\ 2p^2(^2D)3d$	$3d'\ ^1F$	3	2499250?	
$2s\ 2p^2(^2D)3d$	$3d'\ ^3S$	1	2509590?	
P XI ($^2P^\circ_{1/2}$)	*Limit*	---------	**3432500**	

March 1948.

P X OBSERVED TERMS*

Config. $1s^2+$	Observed Terms		
$2s^2\ 2p^2$	$2p^2\ ^1S$ $2p^2\ ^3P$ $2p^2\ ^1D$		
$2s\ 2p^3$	$2p^3\ ^5S^\circ$ $2p^3\ ^3S^\circ$ $2p^3\ ^3P^\circ$ $2p^3\ ^3D^\circ$ $2p^3\ ^1P^\circ$ $2p^3\ ^1D^\circ$		
	$ns\ (n\geq 3)$	$np\ (n\geq 3)$	$nd\ (n\geq 3)$
$2s^2\ 2p(^2P^\circ)nx$	$3s\ ^3P^\circ$ $3s\ ^1P^\circ$		$3d\ ^3P^\circ$ $3d\ ^3D^\circ$ $3d\ ^3F^\circ$ $3d\ ^1P^\circ$ $3d\ ^1D^\circ$ $3d\ ^1F^\circ$
$2s\ 2p^2(^4P)nx$	$3s\ ^5P$ $3s\ ^3P$	$3p\ ^3S^\circ$ $3p\ ^3P^\circ$ $3p\ ^3D^\circ$	$3d\ ^5P$ $3d\ ^5D$ $3d\ ^3P$ $3d\ ^3D$ $3d\ ^3F$
$2s\ 2p^2(^2D)nx'$	$3s'\ ^3D$ $3s'\ ^1D$	$3p'\ ^1D^\circ$ $3p'\ ^1F^\circ$	$3d'\ ^3S$ $3d'\ ^3D$ $3d'\ ^3F$ $3d'\ ^1D$ $3d'\ ^1F$

*For predicted terms in the spectra of the C I isoelectronic sequence, see Introduction.

P XI

(B I sequence; 5 electrons) $Z=15$

Ground state $1s^2\ 2s^2\ 2p\ ^2P^\circ_{1/2}$

$2p\ ^2P^\circ_{1/2}$ ***3867500*** cm^{-1} I. P. 479.4 volts

The analysis is by Robinson, who has generously furnished his manuscript in advance of publication. He has classified 31 lines in the range from 42 A to 325 A. Some of the relative levels have been connected by a study of the behavior of the Rydberg denominators, rather than by the Ritz combination principle.

No intersystem combinations, connecting the doublet and quartet terms, have been observed, as indicated by x in the table. Robinson's extrapolated value of $2p^2\ ^4P_{1/2}$ is entered in brackets.

REFERENCE

H. A. Robinson, unpublished material (Feb. 1948). (I P) (T) (C L)

P XI

Config.	Desig.	*J*	Level	Interval
$2s^2(^1S)2p$	$2p\ ^2P^\circ$	½	*0*	9700
		1½	*9700*	
$2s\ 2p^2$	$2p^2\ ^4P$	½	[177900]+x	3400
		1½	181300 +x	5100
		2½	186400 +x	
$2s\ 2p^2$	$2p^2\ ^2D$	{1½, 2½}	317190	
$2s\ 2p^2$	$2p^2\ ^2S$	½	403330	
$2s\ 2p^2$	$2p^2\ ^2P$	½	425820	5830
		1½	431650	
$2p^3$	$2p^3\ ^4S^\circ$	1½	*559500* +x	
$2s^2(^1S)3s$	$3s\ ^2S$	½	2174060	
$2s^2(^1S)3d$	$3d\ ^2D$	1½	2347470	660
		2½	2348130	
$2s\ 2p(^3P^\circ)3s$	$3s\ ^4P^\circ$	2½	*2369930* +x	−6200
		1½	*2376130* +x	−3600
		½	*2379730* +x	
$2s\ 2p(^3P^\circ)3s$	$3s\ ^2P^\circ$	{½, 1½}	*2410070*	
$2s\ 2p(^3P^\circ)3d$	$3d\ ^4D^\circ$	½		
		1½		
		2½	*2536000* +x	4500
		3½	*2540500* +x	

P XI

Config.	Desig.	*J*	Level	Interval
$2s\ 2p(^3P^\circ)3d$	$3d\ ^2D^\circ$	1½	*2539140*	910
		2½	*2540050*	
$2s\ 2p(^1P^\circ)3s$	$3s'\ ^2P^\circ$	{½, 1½}	*2541040*	
$2s\ 2p(^3P^\circ)3d$	$3d\ ^4P^\circ$	½		
		1½		
		2½	*2547290* +x	
$2s\ 2p(^3P^\circ)3d$	$3d\ ^2F^\circ$	2½	*2578000*	6000
		3½	*2584000*	
$2s\ 2p(^3P^\circ)3d$	$3d\ ^2P^\circ$	1½	*2589460*	−3630
		½	*2593090*	
$2s\ 2p(^1P^\circ)3d$	$3d'\ ^2F^\circ$	{2½, 3½}	*2697820*	
$2s\ 2p(^1P^\circ)3d$	$3d'\ ^2D^\circ$	1½	*2707510*	1890
		2½	*2709400*	
$2p^2(^3P)3d$	$3d''\ ^4P$	2½	2856820 +x	−2150
		1½	2858970 +x	
		½		
P XII ($^1S_0$)	*Limit*		3867500	

February 1948.

P XI Observed Terms*

Config. $1s^2+$	Observed Terms	
$2s^2(^1S)2p$	$2p\ ^2P^\circ$	
$2s\ 2p^2$	$2p^2\ ^4P$; $2p^2\ ^2S$ $2p^2\ ^2P$ $2p^2\ ^2D$	
$2p^3$	$2p^3\ ^4S^\circ$	
	ns ($n \geq 3$)	*nd* ($n \geq 3$)
$2s^2(^1S)nx$	$3s\ ^2S$	$3d\ ^2D$
$2s\ 2p(^3P^\circ)nx$	$3s\ ^4P^\circ$; $3s\ ^2P^\circ$	$3d\ ^4P^\circ$ $3d\ ^4D^\circ$; $3d\ ^2P^\circ$ $3d\ ^2D^\circ$ $3d\ ^2F^\circ$
$2s\ 2p(^1P^\circ)nx'$	$3s'\ ^2P^\circ$	$3d'\ ^2D^\circ$ $3d'\ ^2F^\circ$
$2p^2(^3P)nx''$		$3d''\ ^4P$

*For predicted terms in the spectra of the B I isoelectronic sequence, see Introduction.

P XII

(Be I sequence; 4 electrons) Z=15

Ground state $1s^2\ 2s^2\ {}^1S_0$

$2s^2\ {}^1S_0$ **4520500** cm^{-1} I. P. 560.3 volts

The analysis is by Robinson, who has kindly furnished his manuscript on this spectrum in advance of publication. He has found 18 terms and classified 15 lines between 36 A and 44 A. Some of the relative terms have been connected by a study of the Rydberg denominators rather than by the Ritz combination principle.

No intersystem combinations have been observed, as indicated by the uncertainty x in the table. Robinson's extrapolated value of $2p\ {}^3P^{\circ}_0$ is entered in brackets.

REFERENCE

H. A. Robinson, unpublished material (Feb. 1948). (I P) (T) (C L)

P XII

Config.	Desig.	J	Level	Interval
$2s^2$	$2s^2\ {}^1S$	0	0	
$2s(^2S)2p$	$2p\ {}^3P^{\circ}$	0	*[183190]*+x	
		1	*186390* +x	3200
		2	*192990* +x	6600
$2s(^2S)2p$	$2p\ {}^1P^{\circ}$	1	*358840*	
$2p^2$	$2p^2\ {}^3P$	0		
		1		
		2	490990 +x	
$2p^2$	$2p^2\ {}^1D$	2	538190	
$2s(^2S)3s$	$3s\ {}^3S$	1	2594640 +x	
$2s(^2S)3s$	$3s\ {}^1S$	0	2629250	
$2s(^2S)3p$	$3p\ {}^1P^{\circ}$	1	*2677740*	
$2s(^2S)3d$	$3d\ {}^3D$	1	2726690 +x	
		2	2727190 +x	500
		3	2727840 +x	650

P XII

Config.	Desig.	J	Level	Interval
$2s(^2S)3d$	$3d\ {}^1D$	2	2760490	
$2p(^2P^{\circ})3s$	$3s\ {}^1P^{\circ}$	1	*2876720*	
$2p(^2P^{\circ})3p$	$3p\ {}^1P$	1	2888690?	
$2p(^2P^{\circ})3p$	$3p\ {}^3D$	1		
		2		
		3	2897300 +x	
$2p(^2P^{\circ})3d$	$3d\ {}^1D^{\circ}$	2	*2936160*	
$2p(^2P^{\circ})3p$	$3p\ {}^1D$	2	2947770	
$2p(^2P^{\circ})3d$	$3d\ {}^3D^{\circ}$	1, 2, 3	*2964340* +x	
$2p(^2P^{\circ})3d$	$3d\ {}^1F^{\circ}$	3	*3000210*	
$2p(^2P^{\circ})3d$	$3d\ {}^1P^{\circ}$	1	*3011540*	
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P XIII ($^2S_{1/2}$)	*Limit*	----------	**4520500**	

February 1948.

P XII Observed Terms*

Config. $1s^2+$	Observed Terms		
$2s^2$	$2s^2\ ^1S$		
$2s(^2S)2p$	$2p\ ^3P^\circ$ $2p\ ^1P^\circ$		
$2p^2$	$2p^2\ ^3P$ $2p^2\ ^1D$		
	ns ($n \geq 3$)	*np* ($n \geq 3$)	*nd* ($n \geq 3$)
$2s(^2S)nx$	$3s\ ^3S$ $3s\ ^1S$	$3p\ ^1P^\circ$	$3d\ ^3D$ $3d\ ^1D$
$2p(^2P^\circ)nx$	$3s\ ^1P^\circ$	$3p\ ^1P$ $3p\ ^3D$ $3p\ ^1D$	$3d\ ^1P^\circ$ $3d\ ^3D^\circ$ $3d\ ^1D^\circ$ $3d\ ^1F^\circ$

*For predicted terms in the spectra of the Be I isoelectronic sequence, see Introduction.

P XIII

(Li I sequence; 3 electrons) $Z=15$

Ground state $1s^2\,2s\ ^2S_{1/2}$

$2s\ ^2S_{1/2}$ **4933060 cm^{-1}** I. P. 611.45 volts

This spectrum is incompletely analyzed. Robinson has kindly furnished his unpublished manuscript giving seven classified lines; one at 110 A and six between 35 A and 38 A. The resonance lines have not been observed. The absolute value of the ground term has been extrapolated from isoelectronic sequence data. Similarly, other relative levels have been connected by a study of the Rydberg denominators in the isoelectronic sequence rather than by the Ritz combination principle.

REFERENCE

H. A. Robinson, unpublished material (Feb. 1948). (I P) (T) (C L)

P XIII

Config.	Desig.	*J*	Level	Interval
$2s$	$2s\ ^2S$	½	0	
$2p$	$2p\ ^2P^\circ$	½ 1½	*207720* *219250*	11530
$3s$	$3s\ ^2S$	½	2794900	
$3p$	$3p\ ^2P^\circ$	½ 1½	*2844390* *2850150*	5760
$3d$	$3d\ ^2D$	1½ 2½	2870260 2871620	1360
$4f$	$4f\ ^2F^\circ$	2½ 3½	*3772770?*	
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P XIV ($^1S_0$)	*Limit*	------	4933060	

February 1948.

SULFUR

S I

16 electrons $Z=16$

Ground state $1s^2 2s^2 2p^6 3s^2 3p^4\ ^3P_2$

$3p^4\ ^3P_2$ **83559.3** cm^{-1} I. P. 10.357 volts

Edlén has revised and extended the earlier analyses and has generously furnished his manuscript term list in advance of publication, for inclusion here. Brackets denote values calculated from the series. For two such terms, however, $4f$ and $8f\ ^5F$, combinations with $3d\ ^5D°$ have been observed.

Intersystem combinations connecting terms of all three multiplicities, have been observed.

REFERENCES

R. Frerichs, Zeit. Phys. **80,** 150 (1933). (I P) (T) (C L)
K. W. Meissner, O. Bartelt und L. Eckstein, Zeit. Phys. **86,** 54 (1933). (I P) (T) (C L)
J. E. Ruedy, Phys. Rev. **44,** 757 (1933). (I P) (T) (C L)
B. Edlén, Phys. Rev. **62,** 434 (1942). (T)
W. F. Meggers, J. Opt. Soc. Am. **36,** 431 (1946). (Summary hfs)
B. Edlén, unpublished material (Nov. 1946). (I P) (T)

S I

Config.	Desig.	J	Level	Interval
$3s^2 3p^4$	$3p^4\ ^3P$	2	0.0	−396.8
		1	396.8	−176.8
		0	573.6	
$3s^2 3p^4$	$3p^4\ ^1D$	2	9239.0	
$3s^2 3p^4$	$3p^4\ ^1S$	0	22181.4	
$3s^2 3p^3(^4S°)4s$	$4s\ ^5S°$	2	*52623.88*	
$3s^2 3p^3(^4S°)4s$	$4s\ ^3S°$	1	*55331.15*	
$3s^2 3p^3(^4S°)4p$	$4p\ ^5P$	1	63446.36	10.97
		2	63457.33	17.93
		3	63475.26	
$3s^2 3p^3(^4S°)4p$	$4p\ ^3P$	0	64891.71	−2.48
		1	64889.23	3.66
		2	64892.89	
$3s^2 3p^3(^2D°)4s$	$4s'\ ^3D°$	1	*67816.87*	8.85
		2	*67825.72*	17.66
		3	*67843.38*	
$3p^3(^4S°)3d$	$3d\ ^5D°$	4	*67878.03*	−12.42
		3	*67890.45*	2.20
		2	*67888.25*	2.28
		1	*67885.97*	1.30
		0	*67884.67*	

S I

Config.	Desig.	J	Level	Interval
$3s^2 3p^3(^2D°)4s$	$4s'\ ^1D°$	2	*69238.7*	
$3s^2 3p^3(^4S°)3d$	$3d\ ^3D°$	1	*70165.9*	0.9
		2	*70166.8*	3.9
		3	*70170.7*	
$3s^2 3p^3(^4S°)5s$	$5s\ ^5S°$	2	[*70706*]	
$3s^2 3p^3(^4S°)5s$	$5s\ ^3S°$	1	*71352.5*	
$3s\ 3p^5$	$3p^5\ ^3P°$	2	*72025.5*	−357.0
		1	*72382.5*	−189.9
		0	*72572.4*	
$3s^2 3p^3(^4S°)5p$	$5p\ ^5P$	1	73911.53	3.63
		2	73915.16	5.98
		3	73921.14	
$3s^2 3p^3(^4S°)5p$	$5p\ ^3P$	2	74269.20	−1.08
		1	74270.28	−2.04
		0	74272.32	
$3s^2 3p^3(^4S°)4d$	$4d\ ^5D°$	4	*74973.35*	−0.95
		3	*74974.30*	−1.13
		2	*74975.43*	−0.88
		1	*74976.31*	−0.59
		0	*74976.90*	

S I—Continued

Config.	Desig.	J	Level	Interval
$3s^2 3p^3(^4S^\circ)4d$	$4d\ ^3D^\circ$	1	75952.16	
		2	75952.67	0.51
		3	75956.80	4.13
$3s^2 3p^3(^4S^\circ)6s$	$6s\ ^5S^\circ$	2	76464.26	
$3s^2 3p^3(^4S^\circ)4f$	$4f\ ^5F$	5 to 1	[76653]	
$3s^2 3p^3(^4S^\circ)4f$	$4f\ ^3F$	4, 3, 2	[76655]	
$3s^2 3p^3(^4S^\circ)6s$	$6s\ ^3S^\circ$	1	76720.90	
$3s^2 3p^3(^2P^\circ)4s$	$4s''\ ^3P^\circ$	0	77136.10	
		1	77150.59	14.49
		2	77181.41	30.82
$3s^2 3p^3(^4S^\circ)6p$	$6p\ ^5P$	1	77851.21	
		2		5.28
		3	77856.49	
$3s^2 3p^3(^4S^\circ)6p$	$6p\ ^3P$	2	77891.10	
		1		
		0		
$3s^2 3p^3(^2D^\circ)4p$	$4p'\ ^3D$	1	78152.45	
		2	78152.00	−0.45
		3	78203.38	51.38
$3s^2 3p^3(^4S^\circ)5d$	$5d\ ^5D^\circ$	4	78270.30	
		3, 2	78270.72	−0.42
		2, 1, 0	78271.19	−0.47
$3s^2 3p^3(^2P^\circ)4s$	$4s''\ ^1P^\circ$	1	78290.4	
$3s^2 3p^3(^2D^\circ)4p$	$4p'\ ^3F$	2	78410.37	
		3	78436.30	25.93
		4	78463.55	27.25
$3s^2 3p^3(^2D^\circ)4p$	$4p'\ ^1F$	3	78638.2	
$3s^2 3p^3(^4S^\circ)5d$	$5d\ ^3D^\circ$	3	78692.24	
		2	78691.78	0.46
		1	78692.99	−1.21
$3s^2 3p^3(^4S^\circ)7s$	$7s\ ^5S^\circ$	2	79058.24	
$3s^2 3p^3(^4S^\circ)5f$	$5f\ ^5F$	5 to 1	79143.18	
$3s^2 3p^3(^4S^\circ)5f$	$5f\ ^3F$	4, 3, 2	79144.45	
$3s^2 3p^3(^4S^\circ)7s$	$7s\ ^3S^\circ$	1	79185.74	
$3s^2 3p^3(^2D^\circ)4p$	$4p'\ ^3P$	2	79376.34	
		1	79405.74	−29.40
		0	79418.45	−12.71
$3s^2 3p^3(^4S^\circ)7p$	$7p\ ^5P$	1		
		2		
		3	79785.72	
$3s^2 3p^3(^4S^\circ)6d$	$6d\ ^5D^\circ$	4	79992.36	
		3		
		2		
		1		
		0		

S I—Continued

Config.	Desig.	J	Level	Interval
$3s^2 3p^3(^4S^\circ)7p$	$7p\ ^3P$	2	80113.23	
		1	80120.51	−7.28
		0	80124.16	−3.65
$3s^2 3p^3(^4S^\circ)6d$	$6d\ ^3D^\circ$	3	80182.54	
		2	80183.93	−1.39
		1	80185.78	−1.85
$2s^2 3p^3(^4S^\circ)8s$	$8s\ ^5S^\circ$	2	80449.30	
$3s^2 3p^3(^4S^\circ)6f$	$6f\ ^5F$	5 to 1	80494.73	
$3s^2 3p^3(^4S^\circ)6f$	$6f\ ^3F$	4, 3, 2	80495.76	
$3s^2 3p^3(^4S^\circ)8s$	$8s\ ^3S^\circ$	1	80521.99	
$3s^2 3p^3(^4S^\circ)7d$	$7d\ ^5D^\circ$	4	80995.48	
		3		
		2		
		1		
		0		
$3s^2 3p^3(^4S^\circ)8p$	$8p\ ^3P$	0, 1	80995.90	
		2	80996.33	0.43
$3s^2 3p^3(^4S^\circ)7d$	$7d\ ^3D^\circ$	3	81080.52	
		2	81082.83	−2.31
		1	81084.83	−2.00
$3s^2 3p^3(^4S^\circ)9s$	$9s\ ^5S^\circ$	2	81281.76	
$3s^2 3p^3(^4S^\circ)7f$	$7f\ ^5F$	5 to 1	81309.23	
$3s^2 3p^3(^4S^\circ)7f$	$7f\ ^3F$	4, 3, 2	81310.08	
$3s^2 3p^3(^4S^\circ)9s$	$9s\ ^3S^\circ$	1	[81327.3]	
$3s^2 3p^3(^4S^\circ)8d$	$8d\ ^5D^\circ$	4	81628.90	
		3		
		2		
		1		
		0		
$3s^2 3p^3(^4S^\circ)8d$	$8d\ ^3D^\circ$	3	81663.4	
		2	81666	−3
		1	81668	−2
$3s^2 3p^3(^4S^\circ)10s$	$10s\ ^5S^\circ$	2	81819.40	
$3s^2 3p^3(^4S^\circ)8f$	$8f\ ^5F$	5 to 1	[81837.3]	
$3s^2 3p^3(^4S^\circ)8f$	$8f\ ^3F$	4, 3, 2	[81837.9]	
$3s^2 3p^3(^4S^\circ)9d$	$9d\ ^5D^\circ$	4	82053.94	
		3		
		2		
		1		
		0		
$3s^2 3p^3(^4S^\circ)10d$	$10d\ ^5D^\circ$	4	82353.3	
		3		
		2		
		1		
		0		
S II ($^4S^\circ_{1\frac{1}{2}}$)	*Limit*	---------	83559.3	

December 1947.

S I Observed Terms*

Config. $1s^2\ 2s^2\ 2p^6+$	Observed Terms			
$3s^2\ 3p^4$	$3p^4\ {}^3P$ $3p^4\ {}^1S$ $3p^4\ {}^1D$			
$3s\ 3p^5$	$3p^5\ {}^3P^\circ$			
	ns ($n \geq 4$)	*np* ($n \geq 4$)	*nd* ($n \geq 3$)	*nf* ($n \geq 4$)
$3s^2\ 3p^3(^4S^\circ)nx$	4, 6–10s $^5S^\circ$ 4– 8s $^3S^\circ$	4–7p ^5P 4–8p ^3P	3–10d $^5D^\circ$ 3– 8d $^3D^\circ$	4–8f ^5F 5–7f ^3F
$3s^2\ 3p^3(^2D^\circ)nx'$	$4s'$ $^3D^\circ$ $4s'$ $^1D^\circ$	$4p'$ ^3P $4p'$ ^3D $4p'$ ^3F $4p'$ ^1F		
$3s^2\ 3p^3(^2P^\circ)nx''$	$4s''$ $^3P^\circ$ $4s''$ $^1P^\circ$			

*For predicted terms in the spectra of the S I isoelectronic sequence, see Introduction.

S II

(P I sequence; 15 electrons) $Z=16$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3\ {}^4S^\circ_{1\frac{1}{2}}$

$3p^3\ {}^4S^\circ_{1\frac{1}{2}}$ *188824.5* cm^{-1} I. P. 23.4±0.1 volts

The terms are from the paper by Hunter. He has revised and extended the earlier analyses of this spectrum.

The level labeled "x" in his list is here designated "1". The configuration assignments for this level and for the term called "(^{2}P)" in the table are unknown. The latter is attributed by Robinson to $3s^2\ 3p^2$ (^{3}P) $3d$ instead of the term at 118146.50 cm^{-1}.

Intersystem combinations, connecting the doublet and quartet systems of terms, have been established by L. and E. Bloch and confirmed by Hunter. They indicate a correction of +317.17 cm^{-1} to the absolute values of the doublet terms published by Ingram.

REFERENCES

S. B. Ingram, Phys. Rev. **32,** 172 (1928). (I P) (T) (C L)
L. et E. Bloch, Ann. de Phys. [10] **12,** 5 (1929). (T) (C L)
M. Gilles, Ann. de Phys. [10] **15,** 301 (1931). (I P) (T) (C L) (Z E)
O. Bartelt und L. Eckstein, Zeit. Phys. **86,** 77 (1933). (T) (C L)
A. Hunter, Phil. Trans. Roy. Soc. London [A] **233,** 303 (1934). (I P) (T) (C L)
H. A. Robinson, Phys. Rev. **49,** 297 (1936).

S II

Config.	Desig.	J	Level	Interval
$3s^2\,3p^3$	$3p^3\ ^4S^{\circ}$	1½	*0.0*	
$3s^2\,3p^3$	$3p^3\ ^2D^{\circ}$	1½ 2½	*14851.9* *14883.4*	31.5
$3s^2\,3p^3$	$3p^3\ ^2P^{\circ}$	½ 1½	*24524.2* *24572.8*	48.6
$3s\ 3p^4$	$3p^4\ ^4P$	2½ 1½ ½	79394.8 79757.9 79968.0	−363.1 −210.1
$3s\ 3p^4$	$3p^4\ ^2P$	1½ ½	105599.02 106044.16	−445.14
$3s^2\,3p^2(^3P)4s$	$4s\ ^4P$	½ 1½ 2½	109560.50 109831.28 110268.33	270.78 437.05
$3s^2\,3p^2(^3P)3d$	$3d\ ^4F$	1½ 2½ 3½ 4½	110176.83 110313.13 110508.48 110766.31	136.30 195.35 257.83
$3s^2\,3p^2(^3P)4s$	$4s\ ^2P$	½ 1½	112937.33 113461.22	523.89
$3s^2\,3p^2(^3P)3d$	$3d\ ^4D$	½ 1½ 2½ 3½	114162.20 114200.45 114230.75 114279.11	38.25 30.30 48.36
$3s^2\,3p^2(^3P)3d$	$3d\ ^2F$	2½ 3½	114804.11 115285.31	481.20
$3s^2\,3p^2(^3P)3d$	$3d\ ^4P$	2½ 1½ ½	115817.0 115870.4 115892.3	−53.4 −21.9
$3s^2\,3p^2(^3P)3d$	$3d\ ^2P$	½ 1½	 118146.50	
$3s^2\,3p^2(^3P)3d$	$3d\ ^2D$	1½ 2½	119242.13 119294.70	52.57
$3s^2\,3p^2(^1D)4s$	$4s'\ ^2D$	1½ 2½	121528.20 121529.49	1.29
$3s^2\,3p^2(^3P)4p$	$4p\ ^2S^{\circ}$	½	*125485.32*	
$3s^2\,3p^2(^3P)4p$	$4p\ ^4D^{\circ}$	½ 1½ 2½ 3½	*127824.93* *127976.21* *128233.07* *128599.11*	151.28 256.86 366.04
$3s^2\,3p^2(^3P)4p$	$4p\ ^4P^{\circ}$	½ 1½ 2½	*129787.71* *129858.07* *130134.08*	70.36 276.01
$3s^2\,3p^2(^3P)4p$	$4p\ ^2D^{\circ}$	1½ 2½	*130641.00* *131186.86*	545.86
$3s^2\,3p^2(^3P)4p$	$4p\ ^4S^{\circ}$	1½	*131028.76*	

S II

Config.	Desig.	J	Level	Interval
$3s^2\,3p^2(^3P)4p$	$4p\ ^2P^{\circ}$	½ 1½	*133268.53* *133399.82*	131.29
	1	½?	133359.4	
	2 (^2P) 3	½ 1½	139845.6 140015.7	170.1
$3s^2\,3p^2(^1D)4p$	$4p'\ ^2F^{\circ}$	2½ 3½	*140229.78* *140318.80*	89.02
$3s^2\,3p^2(^1D)4p$	$4p'\ ^2D^{\circ}$	2½ 1½	*140708.51* *140750.00*	−41.49
$3s^2\,3p^2(^1D)4p$	$4p'\ ^2P^{\circ}$	½ 1½	*143488.61* *143623.03*	134.42
$3s^2\,3p^2(^3P)5s$	$5s\ ^4P$	½ 1½ 2½	150258.20 150531.12 150996.27	272.92 465.15
$3s^2\,3p^2(^3P)5s$	$5s\ ^2P$	½ 1½	151383.83 151910.67	526.84
$3s^2\,3p^2(^3P)4d$	$4d\ ^4F$	1½ 2½ 3½ 4½	151959.41 152094.34 152304.71 152615.25	134.93 210.37 310.54
$3s^2\,3p^2(^3P)4d$	$4d\ ^4D$	½ 1½ 2½ 3½	153153.66 153201.72 153282.80 153413.52	48.06 81.08 130.72
$3s^2\,3p^2(^3P)4d$	$4d\ ^4P$	2½ 1½ ½	155818.37 156029.28 156148.19	−210.91 −118.91
$3s^2\,3p^2(^3P)4d$	$4d\ ^2F$	2½ 3½	156121.33 156603.67	482.34
$3s^2\,3p^2(^3P)4d$	$4d\ ^2D$	1½ 2½	158666.45 158826.87	160.42
$3s^2\,3p^2(^3P)5p$	$5p\ ^4D^{\circ}$	½ 1½ 2½ 3½	*164118.6* *164252.0* *164447.3* *164772.7*	133.4 195.3 325.4
$3s^2\,3p^2(^1D)4d$	$4d'\ ^2F$	3½ 2½	164180.63 164231.78	−51.15
$3s^2\,3p^2(^3P)5p$	$5p\ ^4P^{\circ}$	½ 1½ 2½	*164279.3* *164317.4* *164459.5*	38.1 142.1
$3s^2\,3p^2(^1D)4d$	$4d'\ ^2G$	4½ 3½	164334.94 164336.71	−1.77
$3s^2\,3p^2(^3P)5p$	$5p\ ^4S^{\circ}$	1½	*165002.45*	
S III $(^3P_0)$	*Limit*	---------	*188824.5*	

October 1947.

S II OBSERVED TERMS*

Config. $1s^2\,2s^2\,2p^6+$	Observed Terms		
$3s^2\,3p^3$	$3p^3\ ^4S^\circ$; $3p^3\ ^2P^\circ$ $3p^3\ ^2D^\circ$		
$3s\ 3p^4$	$3p^4\ ^4P$; $3p^4\ ^2P$		
	$ns\ (n\geq 4)$	$np\ (n\geq 4)$	$nd\ (n\geq 3)$
$3s^2\,3p^2(^3P)nx$	$4, 5s\ ^4P$; $4, 5s\ ^2P$	$4, 5p\ ^4S^\circ$ $4, 5p\ ^4P^\circ$ $4, 5p\ ^4D^\circ$; $4p\ ^2S^\circ$ $4p\ ^2P^\circ$ $4p\ ^2D^\circ$	$3, 4d\ ^4P$ $3, 4d\ ^4D$ $3, 4d\ ^4F$; $3d\ ^2P$ $3, 4d\ ^2D$ $3, 4d\ ^2F$
$3s^2\,3p^2(^1P)nx'$	$4s'\ ^2D$	$4p'\ ^2P^\circ$ $4p'\ ^2D^\circ$ $4p'\ ^2F^\circ$	$4d'\ ^2F$ $4d'\ ^2G$

*For predicted terms in the spectra of the P I isoelectronic sequence, see Introduction.

S III

(Si I sequence; 14 electrons) $Z=16$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^2\ ^3P_0$

$3p^2\ ^3P_0$ **282752** cm^{-1} I. P. 35.0 ± 0.4 volts

The present term list has been compiled from those published by Hunter and by Robinson, although Ingram, Gilles, and others have contributed to the analysis.

Intersystem combinations connecting the singlet and triplet terms have been observed. Robinson derives from his measures a correction of -6 cm^{-1} to be applied to all terms higher than 140000 cm^{-1}. This correction has been introduced here. An estimated value of the interval of $3p^3\ ^3P^\circ_{1,0}$ is entered in brackets in the table.

The quintet terms suggested by Gilles have been omitted, awaiting further confirmation.

REFERENCES

S. B. Ingram, Phys. Rev. **33**, 907 (1929). (I P) (T) (C L)
M. Gilles, Ann. de Phys. [10] **15**, 322 (1931). (I P) (T) (C L) (Z E)
A. Hunter, Phil. Trans. Roy. Soc. London [A] **233**, 309 (1934). (I P) (T) (C L)
L. et E. Bloch, J. Phys. Rad. [7] **6**, No. 11, 441 (1935). (C L)
H. A. Robinson, Phys. Rev. **52**, 724 (1937). (T) (C L)

S III

Config.	Desig.	*J*	Level	Interval
$3s^2 3p^2$	$3p^2\ ^3P$	0	0.0	297.2
		1	297.2	535.3
		2	832.5	
$3s^2 3p^2$	$3p^2\ ^1D$	2	11320	
$3s^2 3p^2$	$3p^2\ ^1S$	0	27163	
$3s\ 3p^3$	$3p^3\ ^3D^\circ$	1	*84018.9*	27.5
		2	*84046.4*	53.1
		3	*84099.5*	
$3s\ 3p^3$	$3p^3\ ^3P^\circ$	2	*98743.0*	−22.6
		1	*98765.6*	[−6]
		0		
$3s\ 3p^3$	$3p^3\ ^1D^\circ$	2	*104159?*	
$3s\ 3p^3$	$3p^3\ ^1P^\circ$	1	*136839*	
$3s\ 3p^3$	$3p^3\ ^3S^\circ$	1	*138061.4*	
$3s^2 3p(^2P^\circ)3d$	$3d\ ^3P^\circ$	0	*143095.91*	20.28
		1	*143116.19*	7.74
		2	*143123.93*	
$3s^2 3p(^2P^\circ)4s$	$4s\ ^3P^\circ$	0	*146696.19*	40.35
		1	*146736.54*	409.46
		2	*147146.00*	
$3s^2 3p(^2P^\circ)3d$	$3d\ ^3D^\circ$	1	*147550.32*	140.67
		2	*147690.99*	53.55
		3	*147744.54*	
$3s^2 3p(^2P^\circ)4s$	$4s\ ^1P^\circ$	1	*148397.8*	
$3s^2 3p(^2P^\circ)4p$	$4p\ ^3D$	1	169770.04	297.27
		2	170067.31	581.63
		3	170648.94	
$3s^2 3p(^2P^\circ)4p$	$4p\ ^3P$	0	172631.27	154.50
		1	172785.77	405.96
		2	173191.73	
$3s^2 3p(^2P^\circ)4p$	$4p\ ^3S$	1	174036.19	
$3s^2 3p(^2P^\circ)4d$	$4d\ ^3F^\circ$	2	*204578.89*	491.86
		3	*205070.75*	489.92
		4	*205560.67*	
$3s^2 3p(^2P^\circ)4d$	$4d\ ^3D^\circ$	1	*206538.87*	132.74
		2	*206671.61*	239.36
		3	*206910.97*	
$3s^2 3p(^2P^\circ)5s$	$5s\ ^3P^\circ$	0	*209773.4*	152.7
		1	*209926.1*	771.5
		2	*210697.6*	
$3s^2 3p(^2P^\circ)5s$	$5s\ ^1P^\circ$	1	*211326.8*	
S IV ($^2P^\circ_{1/2}$)	*Limit*	---------	282752	

October 1947.

S III Observed Terms*

Config. $1s^2 2s^2 2p^6+$	Observed Terms							
$3s^2 3p^2$	$3p^2\ ^1S$	$3p^2\ ^3P$	$3p^2\ ^1D$					
$3s\ 3p^3$	$3p^3\ ^3S^\circ$	$3p^3\ ^3P^\circ$, $3p^3\ ^1P^\circ$	$3p^3\ ^3D^\circ$, $3p^3\ ^1D^\circ$					
	ns ($n \geq 4$)	*np* ($n \geq 4$)			*nd* ($n \geq 3$)			
$3s^2 3p(^2P^\circ)nx$	4, 5s $^3P^\circ$ 4, 5s $^1P^\circ$	$4p\ ^3S$	$4p\ ^3P$	$4p\ ^3D$	$3d\ ^3P^\circ$	3, $4d\ ^3D^\circ$	$4d\ ^3F^\circ$	

*For predicted terms in the spectra of the Si I isoelectronic sequence, see Introduction.

S IV

(Al I sequence; 13 electrons) $Z=16$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p\ {}^2P^\circ_{1/2}$

$3p\ {}^2P^\circ_{1/2}$ *381541.4* cm^{-1} I. P. 47.29 volts

This spectrum is incompletely analyzed but 53 lines have been classified in the range from 519 A to 3118 A. For the doublet terms the authors' notation is entered in the first column of the table. The configurations are as given in Bacher and Goudsmit.

The quartet terms are from Bowen's 1932 paper. No intersystem combinations have been observed, as indicated by the uncertainty x. Bowen remarks that the relative positions of the doublet and quartet terms are only approximately determined, by assuming that the difference between the terms $4s\ {}^2S$ and $4s\ {}^4P^\circ$ is equal to that between the terms $3s^2\ {}^1S$ and $3p\ {}^3P^\circ$ in S V.

REFERENCES

R. A. Millikan and I. S. Bowen, Phys. Rev. **25,** 600 (1925). (I P) (T) (C L)

I. S. Bowen, Phys. Rev. **31,** 37 (1928). (T) (C L)

R. F. Bacher and S. Goudsmit, *Atomic Energy States* p. 404 (McGraw-Hill Book Co. Inc., New York, N. Y., and London, 1932). (T)

I. S. Bowen, Phys. Rev. **39,** 13 (1932). (T) (C L)

L. Bloch et E. Bloch, J. Phys. Rad. [7] **6,** No. 11, 441 (1935). (C L)

S IV

Authors	Config.	Desig.	J	Level	Interval	Authors	Config.	Desig.	J	Level	Interval
$3p_2$ $3p_1$	$3s^2(^1S)3p$	$3p\ {}^2P^\circ$	½ 1½	*0.0* *950.2*	950.2	$4p_2$ $4p_1$	$3s^2(^1S)4p$	$4p\ {}^2P^\circ$	½ 1½	*213507.4* *213717.4*	210.0
	$3s\,3p^2$	$3p^2\ {}^4P$	½ 1½ 2½	71840 +x 72184 +x 72731 +x	344 547		$3s\,3p(^3P^\circ)3d$	$3d\ {}^4P^\circ$	2½ 1½ ½	*222854* +x *223143* +x	−289
bD_2 bD_3	$3s\,3p^2$	$3p^2\ {}^2D$	1½ 2½	94101.9 94148.1	46.2		$3s\,3p(^3P^\circ)3d$	$3d\ {}^4D^\circ$	½ 1½ 2½ 3½	*224991* +x *225094* +x *225194* +x *225274* +x	103 100 80
bS	$3s\,3p^2$	$3p^2\ {}^2S$	½	123503.9							
bP_1 bP_2	$3s\,3p^2$	$3p^2\ {}^2P$	½ 1½	133617.9 134243.9	626.0	$4d$	$3s^2(^1S)4d$	$4d\ {}^2D$	{1½ 2½	}255389.8	
$3d_2$ $3d_1$	$3s^2(^1S)3d$	$3d\ {}^2D$	1½ 2½	152127.1 152141.4	14.3		$3s\,3p(^3P^\circ)4s$	$4s\ {}^4P^\circ$	½ 1½ 2½	*263759* +x *264105* +x *264741* +x	346 636
$4s$	$3s^2(^1S)4s$	$4s\ {}^2S$	½	181432.2		$5s$	$3s^2(^1S)5s$	$5s\ {}^2S$	½	271010.4	
	$3p^3$	$3p^3\ {}^4S^\circ$	1½	*197110* +x							
cP	$3p^3$	$3p^3\ {}^2P^\circ$	{1½ ½	}*211368*			S V ($^1S_0$)	*Limit*	------	*381541.4*	

September 1947.

S IV OBSERVED TERMS*

Config. $1s^2\ 2s^2\ 2p^6+$	Observed Terms		
$3s^2(^1S)3p$	$3p\ ^2P^\circ$		
$3s\ 3p^2$	$3p^2\ ^2S$ $3p^2\ ^4P$ $3p^2\ ^2P$ $3p^2\ ^2D$		
$3p^3$	$3p^3\ ^4S^\circ$ $3p^3\ ^2P^\circ$		
	$ns\ (n\geq 4)$	$np\ (n\geq 4)$	$nd\ (n\geq 3)$
$3s^2(^1S)nx$	4, 5s ^2S	$4p\ ^2P^\circ$	3, 4d ^2D
$3s\ 3p(^3P^\circ)nx$	$4s\ ^4P^\circ$		$3d\ ^4P^\circ$ $3d\ ^4D^\circ$

*For predicted terms in the spectra of the Al I isoelectronic sequence, see Introduction.

S V

(Mg I sequence; 12 electrons) $Z=16$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ ^1S_0$

$3s^2\ ^1S_0$ **584700** cm^{-1} I. P. 72.5± volts

This spectrum is incompletely analyzed, but Bowen has classified 30 lines in the range between 437 A and 905 A. He gives absolute values for only the triplet terms, but lists the singlet combination $3s^2\ ^1S_0-3p\ ^1P_1^\circ$, which has been used to calculate $3p\ ^1P_1^\circ$ in the table.

By extrapolation along the isoelectronic sequence the writer has estimated the limit $3s^2\ ^1S_0$ as approximately 584700 cm^{-1}, which places $3p\ ^3P_0^\circ$ at 83071 cm^{-1} above the ground state zero. These estimated values are entered in brackets in the table. The uncertainty, x, may be several hundred cm^{-1}. Bowen has estimated the error of the limit as probably not greater than ±1000 cm^{-1}.

REFERENCES

I. S. Bowen, Phys. Rev. **39**, 8 (1932). (T) (C L)
I. S. Bowen, letter (Sept. 1947). (T)

S V

Config.	Desig.	J	Level	Interval
$3s^2$	$3s^2\ ^1S$	0	0	
$3s(^2S)3p$	$3p\ ^3P^\circ$	0	*[83071]+x*	
		1	*83433 +x*	362
		2	*84200 +x*	767
$3s(^2S)3p$	$3p\ ^1P^\circ$	1	*127149*	
$3p^2$	$3p^2\ ^3P$	0	200000 +x	
		1	200417 +x	417
		2	201186 +x	769
$3s(^2S)3d$	$3d\ ^3D$	1, 2, 3	234987 +x	

S V

Config.	Desig.	J	Level	Interval
$3s(^2S)4s$	$4s\ ^3S$	1	311670 +x	
$3p(^2P^\circ)3d$	$3d\ ^3P^\circ$	2	*345376 +x*	
		1	*345750 +x*	−374
		0	*345987 +x*	−237
$3p(^2P^\circ)3d$	$3d\ ^3D^\circ$	1	*347883 +x*	
		2	*348051 +x*	168
		3	*348168 +x*	117
S VI ($^2S_{1/2}$)	*Limit*	---------	[584700]	

September 1947.

S v Observed Terms*

Config. $1s^2\,2s^2\,2p^6+$	Observed Terms	
$3s^2$	$3s^2\ ^1S$	
$3s(^2S)3p$	{ $3p\ ^3P^\circ$ $3p\ ^1P^\circ$	
$3p^2$	$3p^2\ ^3P$	
	ns ($n\geq 4$)	*nd* ($n\geq 3$)
$3s(^2S)nx$	$4s\ ^3S$	$3d\ ^3D$
$3p(^2P^\circ)nx$		$3d\ ^3P^\circ$ $3d\ ^3D^\circ$

*For predicted terms in the spectra of the Mg I isoelectronic sequence, see Introduction.

S VI

(Na I sequence; 11 electrons) **Z=16**

Ground state $1s^2\,2s^2\,2p^6\,3s\ ^2S_{1/2}$

$3s\ ^2S_{1/2}$ **710194** cm^{-1} I. P. 88.029±0.003 volts

The terms are from Robinson, who has extended the earlier analysis by Bowen and Millikan. There are 29 classified lines, all but 2 of which are in the region between 171 A and 1117A. The absolute value of the ground state was extrapolated along the isoelectronic sequence.

REFERENCES

I. S. Bowen and R. A. Millikan, Phys. Rev. **25**, 295 (1925). (T) (C L)
H. A. Robinson, Phys. Rev. **52**, 724 (1937). (I P) (T) (C L)

S VI

Config.	Desig.	*J*	Level	Interval
3*s*	$3s\ ^2S$	½	0	
3*p*	$3p\ ^2P^\circ$	½ 1½	*105874* *107137*	1263
3*d*	$3d\ ^2D$	1½ 2½	247420 247452	32
4*s*	$4s\ ^2S$	½	362983	
4*p*	$4p\ ^2P^\circ$	½ 1½	*401164* *401621*	457
4*d*	$4d\ ^2D$	1½ 2½	451785 451808	23
4*f*	$4f\ ^2F^\circ$	{2½, 3½}	*462653*	
5*s*	$5s\ ^2S$	½	504112	
5*p*	$5p\ ^2P^\circ$	½ 1½	*522030* *522248*	218
5*d*	$5d\ ^2D$	1½ 2½	546021 546032	11

S VI

Config.	Desig.	*J*	Level	Interval
5*f*	$5f\ ^2F^\circ$	{2½, 3½}	*551848*	
5*g*	$5g\ ^2G$	{3½, 4½}	552106	
6*s*	$6s\ ^2S$	½	573823	
6*p*	$6p\ ^2P^\circ$	½ 1½	 *583679*	
6*d*	$6d\ ^2D$	{1½, 2½}	596877	
6*f*	$6f\ ^2F^\circ$	{2½, 3½}	*600170*	
7*d*	$7d\ ^2D$	{1½, 2½}	627231	
7*f*	$7f\ ^2F^\circ$	{2½, 3½}	*629395*	
S VII ($^1S_0$)	*Limit*	---------	**710194**	

June 1947.

S VII

(Ne I sequence; 10 electrons) $Z=16$

Ground state $1s^2\,2s^2\,2p^6\ {}^1S_0$

$2p^6\ {}^1S_0$ **2266990** cm^{-1} I. P. 280.99 volts

Ferner has classified 16 lines between 46 A and 72 A as combinations with the ground term, and generously furnished his analysis in advance of publication. The term designations he assigns on the assumption of *LS*-coupling are given in the table under the heading "Author."

As for Ne I, the *jl*-coupling notation in the general form suggested by Racah is introduced.

Ferner's unit, 10^3 cm^{-1}, has here been changed to cm^{-1}.

REFERENCES

G. Racah, Phys. Rev. **61,** 537 (L) (1942).

E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **36A,** No. 1, p. 62 (1948). (I P) (T) (C L)

S VII

Author	Config.	Desig.	*J*	Level
$2p\ {}^1S_0$	$2p^6$	$2p^6\ {}^1S$	0	0
	$2p^5(^2P^\circ_{1\frac{1}{2}})3s$	$3s\ [1\frac{1}{2}]^\circ$	2	
$3s\ {}^3P_1$			1	*1376220*
	$2p^5(^2P^\circ_{\frac{1}{2}})3s$	$3s'\ [\frac{1}{2}]^\circ$	0	
$3s\ {}^1P_1$			1	*1388330*
	$2p^5(^2P^\circ_{1\frac{1}{2}})3d$	$3d\ [\frac{1}{2}]^\circ$	0	
$3d\ {}^3P_1$			1	*1624770*
$3d\ {}^1P_1$	"	$3d\ [1\frac{1}{2}]^\circ$	1	*1644630*
$3d\ {}^3D_1$	$2p^5(^2P^\circ_{\frac{1}{2}})3d$	$3d'\ [1\frac{1}{2}]^\circ$	1	*1662210*
	$2p^5(^2P^\circ_{1\frac{1}{2}})4s$	$4s\ [1\frac{1}{2}]^\circ$	2	
$4s\ {}^3P_1$			1	*1820230*
	$2p^5(^2P^\circ_{\frac{1}{2}})4s$	$4s'\ [\frac{1}{2}]^\circ$	0	
$4s\ {}^1P_1$			1	*1829760*
$4d\ {}^1P_1$	$2p^5(^2P^\circ_{1\frac{1}{2}})4d$	$4d\ [1\frac{1}{2}]^\circ$	1	*1919500*
$4d\ {}^3D_1$	$2p^5(^2P^\circ_{\frac{1}{2}})4d$	$4d'\ [1\frac{1}{2}]^\circ$	1	*1930240*

S VII

Author	Config.	Desig.	*J*	Level
	$2p^5(^2P^\circ_{1\frac{1}{2}})5s$	$5s\ [1\frac{1}{2}]^\circ$	2	
$5s\ {}^3P_1$			1	*1998920*
$3p'\left\{\begin{matrix}{}^3P_1\\{}^1P_1\end{matrix}\right\}$	$2s\ 2p^6(^2S)3p$	$3p\ \left\{\begin{matrix}{}^3P^\circ\\{}^1P^\circ\end{matrix}\right\}$	1	*2000400*
$5d\ {}^1P_1$	$2p^5(P^\circ_{1\frac{1}{2}})5d$	$5d\ [1\frac{1}{2}]^\circ$	1	*2046080*
$5d\ {}^3D_1$	$2p^5(^2P^\circ_{\frac{1}{2}})5d$	$5d'\ [1\frac{1}{2}]^\circ$	1	*2055630*
$6d\ {}^1P_1$	$2p^5(^2P^\circ_{1\frac{1}{2}})6d$	$6d\ [1\frac{1}{2}]^\circ$	1	*2113850*
$6d\ {}^3D_1$	$2p^5(^2P^\circ_{\frac{1}{2}})6d$	$6d'\ [1\frac{1}{2}]^\circ$	1	*2123230*
$7d\ {}^3D_1$	$2p^5(^2P^\circ_{\frac{1}{2}})7d$	$7d'\ [1\frac{1}{2}]^\circ$	1	*2163940*
	S VIII $(^2P^\circ_{1\frac{1}{2}})$	*Limit*	-------	2266990
	S VIII $(^2P_{\frac{1}{2}})$	*Limit*	-------	2277120

August 1947.

S VII OBSERVED LEVELS*

Config. $1s^2\,2s^2+$	Observed Terms		
$2p^6$	$2p^6\ ^1S$		
	ns ($n\geq 3$)	nd ($n\geq 3$)	np ($n\geq 3$)
$2p^5(^2P^\circ)nx$	{ 3–5s $^3P^\circ$ 3–4s $^1P^\circ$	3d $^3P^\circ$ 3–7d $^3D^\circ$ 3–6d $^1P^\circ$	
$2p^6(^2S)nx$			3p { $^3P^\circ$ $^1P^\circ$
jl-Coupling Notation			
	Observed Pairs		
	ns ($n\geq 3$)	nd ($n\geq 3$)	
$2p^5(^2P^\circ_{1\frac{1}{2}})nx$	3–5s [1½]°	3d [½]° 3–6d [1½]°	
$2p^5(^2P^\circ_{\frac{1}{2}})nx'$	3–4s' [½]°	3–7d' [1½]°	

*For predicted levels in the spectra of the Ne I isoelectronic sequence, see Introduction.

S VIII

(F I sequence; 9 electrons) $Z=16$

Ground state $1s^2\,2s^2\,2p^5\ ^2P^\circ_{1\frac{1}{2}}$

$2p^5\ ^2P^\circ_{1\frac{1}{2}}$ *2652720* cm^{-1} I. P. 328.80 volts

The analysis was furnished by Ferner in advance of publication. He has classified 44 lines in the interval between 44 A and 65 A. All but one of the observed combinations are with the ground term. In addition, Robinson has classified a pair of lines at 202.605 A and 198.550 A as $2p^5\ ^2P^\circ-2p^6\ ^2S$.

Ferner's unit, 10^3 cm^{-1}, has here been changed to cm^{-1}.

REFERENCES

H. A. Robinson, Phys. Rev. **52**, 724 (1937). (C L)
E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **36A**, No. 1, p. 57 (1948). (I P) (T) (C L)

S VIII

Author	Config.	Desig.	J	Level	Interval
$2p$ $^2P_2$	$2s^2\ 2p^5$	$2p^5$ $^2P^\circ$	1½	*0*	−10130
$^2P_1$			½	*10130*	
$2p'$ $^2S_1$	$2s\ 2p^6$	$2p^6$ ^2S	½	503590	
$3s$ $^4P_3$	$2s^2\ 2p^4(^3P)3s$	$3s$ ^4P	2½	1559580	−5670
$^4P_2$			1½	1565250	−4040
$^4P_1$			½	1569290	
$3s$ $^2P_2$	$2s^2\ 2p^4(^3P)3s$	$3s$ ^2P	1½	1579700	−6950
$^2P_1$			½	1586650	
$\overline{3s}$ $^2D_3$	$2s^2\ 2p^4(^1D)3s$	$3s'$ ^2D	2½	1623380	−230
$^2D_2$			1½	1623610	
$\overline{\overline{3s}}$ $^2S_1$	$2s^2\ 2p^4(^1S)3s$	$3s''$ ^2S	½	1688170	
	$2s^2\ 2p^4(^3P)3d$	$3d$ ^4D	3½		
$3d$ $^4D_3$			2½	1831370	
			1½	1822510	
			½		
	$2s^2\ 2p^4(^3P)3d$	$3d$ ^4P	½		
$3d$ $^4P_2$			1½	1834830	3910
$^4P_3$			2½	1838740	
$3d$ $^2P_1$	$2s^2\ 2p^4(^3P)3d$	$3d$ ^2P	½	1839250	8300
$^2P_2$			1½	1847550	
$3d$ $^2D_2$	$2s^2\ 2p^4(^3P)3d$	$3d$ ^2D	1½	1842770	5040
$^2D_3$			2½	1847810	
$\overline{3d}$ $^2P_1$	$2s^2\ 2p^4(^1D)3d$	$3d'$ ^2P	½	1888460	9000
$^2P_2$			1½	1897460	
$\overline{3d}$ $^2D_3$	$2s^2\ 2p^4(^1D)3d$	$3d'$ ^2D	2½	1892000	−6220
$^2D_2$			1½	1898220	
$\overline{3d}$ $^2S_1$	$2s^2\ 2p^4(^1D)3d$	$3d'$ ^2S	½	1894330	
	$2s^2\ 2p^4(^1D)3d$	$3d'$ ^2F	3½		
$\overline{3d}$ $^2F_3$			2½	1895520	
$\overline{\overline{3d}}$ $^2D_3$	$2s^2\ 2p^4(^1S)3d$	$3d''$ ^2D	2½	1952100	−910
$^2D_2$			1½	1953010	
$3s'$ $^2P_2$	$2s\ 2p^5(^3P^\circ)3s$	$3s'''$ $^2P^\circ$	1½	*2038530*	−6510
$^2P_1$			½	*2045040*	
$4s$ $^2P_2$	$2s^2\ 2p^4(^3P)4s$	$4s$ ^2P	1½	2102340	−8900
$^2P_1$			½	2111240	
	$2s^2\ 2p^4(^3P)4d$	$4d$ ^4P	½		
			1½		
$4d$ $^4P_3$			2½	2199830	
$4d$ $^2D_2$	$2s^2\ 2p^4(^3P)4d$	$4d$ ^2D	1½	2204100	4430
$^2D_3$			2½	2208530	
	$2s^2\ 2p^4(^3P)4d$	$4d$ ^2P	½		
$4d$ $^2P_2$			1½	2207770	
$\overline{4d}$ $^2S_1$	$2s^2\ 2p^4(^1D)4d$	$4d'$ ^2S	½	2253570	
	$2s^2\ 2p^4(^1D)4d$	$4d'$ ^2F	3½		
$\overline{4d}$ $^2F_3$			2½	2254790	
	S IX ($^3P_2$)	*Limit*	------	*2652720*	

August 1947.

S VIII Observed Terms*

Config. $1s^2+$	Observed Terms					
$2s^2\ 2p^5$		$2p^5$ $^2P^\circ$				
$2s\ 2p^6$	$2p^6$ ^2S					
	ns ($n\geq 3$)		nd ($n\geq 3$)			
$2s^2\ 2p^4(^3P)nx$	$3s$ ^4P $3, 4s$ ^2P			$3, 4d$ ^4P $3, 4d$ ^2P	$3d$ ^4D $3, 4d$ ^2D	
$2s^2\ 2p^4(^1D)nx'$		$3s'$ ^2D	$3, 4d'$ ^2S	$3d'$ ^2P	$3d'$ ^2D	$3, 4d'$ ^2F
$2s^2\ 2p^4(^1S)nx''$	$3s''$ ^2S				$3d''$ ^2D	
$2s\ 2p^5(^3P^\circ)nx'''$		$3s'''$ $^2P^\circ$				

*For predicted terms in the spectra of the F I isoelectronic sequence, see Introduction.

S IX

(O I sequence; 8 electrons) $Z=16$

Ground state $1s^2\,2s^2\,2p^4\;{}^3P_2$

$2p^4\;{}^3P_2$ **3057300** cm^{-1} I. P. 378.95 volts

Ferner has found 17 terms and classified 21 lines in this spectrum in the range from 46 A to 56 A. No intersystem combinations have been observed and the uncertainty, x, may be large. The unit adopted by Ferner, $10^3\ cm^{-1}$, has here been changed to cm^{-1}.

REFERENCE

E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **36A**, No. 1, p. 48 (1948). (I P) (T) (C L)

S IX

Config.	Desig.	J	Level	Interval
$2s^2\,2p^4$	$2p^4\;{}^3P$	2 1 0	0 7970 10630	−7970 −2660
$2s^2\,2p^4$	$2p^4\;{}^1D$	2	58000+x	
$2s^2\,2p^4$	$2p^4\;{}^1S$	0	122300+x	
$2s^2\,2p^3(^4S^\circ)3s$	$3s\;{}^3S^\circ$	1	*1783150*	
$2s^2\,2p^3(^2D^\circ)3s$	$3s'\;{}^3D^\circ$	3 2 1	*1845770* *1846340*	−570
$2s^2\,2p^3(^2D^\circ)3s$	$3s'\;{}^1D^\circ$	2	*1858500*+x	
$2s^2\,2p^3(^2P^\circ)3s$	$3s''\;{}^1P^\circ$	1	*1904040*+x	
$2s^2\,2p^3(^4S^\circ)3d$	$3d\;{}^3D^\circ$	1, 2 3	*2035220* *2035870*	650
$2s^2\,2p^3(^2D^\circ)3d$	$3d'\;{}^3D^\circ$	3, 2, 1	*2108190*	
$2s^2\,2p^3(^2D^\circ)3d$	$3d'\;{}^3P^\circ$	2 1 0	*2116450* *2119180*	−2730
$2s^2\,2p^3(^2D^\circ)3d$	$3d'\;{}^1D^\circ$	2	*2117140*+x	
$2s^2\,2p^3(^2D^\circ)3d$	$3d'\;{}^3S^\circ$	1	*2125310*	
$2s^2\,2p^3(^2D^\circ)3d$	$3d'\;{}^1F^\circ$	3	*2134410*+x	
$2s^2\,2p^3(^2P^\circ)3d$	$3d''\;{}^3P^\circ$	0 1 2	 *2144820* *2146610*	1790
$2s^2\,2p^3(^2P^\circ)3d$	$3d''\;{}^3F^\circ$	4 3 2	 *2154570*	
$2s^2\,2p^3(^2P^\circ)3d$	$3d''\;{}^3D^\circ$	3 2 1	*2156430*	
$2s^2\,2p^3(^2P^\circ)3d$	$3d''\;{}^1P^\circ$	1	*2162470*+x	
S x ($^4S^\circ_{1\frac{1}{2}}$)	*Limit*		**3057300**	

August 1947.

S IX OBSERVED TERMS*

Config. $1s^2+$	Observed Terms	
$2s^2\,2p^4$	$2p^4\;{}^3P$; $2p^4\;{}^1S$; $2p^4\;{}^1D$	
	ns ($n\geq 3$)	nd ($n\geq 3$)
$2s^2\,2p^3(^4S^\circ)nx$	$3s\;{}^3S^\circ$	$3d\;{}^3D^\circ$
$2s^2\,2p^3(^2D^\circ)nx'$	$3s'\;{}^3D^\circ$ $3s'\;{}^1D^\circ$	$3d'\;{}^3S^\circ$ $3d'\;{}^3P^\circ$ $3d'\;{}^3D^\circ$ $3d'\;{}^1D^\circ$ $3d'\;{}^1F^\circ$
$2s^2\,2p^3(^2P^\circ)nx''$	$3s''\;{}^1P^\circ$	$3d''\;{}^3P^\circ$ $3d''\;{}^1P^\circ$ $3d''\;{}^3D^\circ$ $3d''\;{}^3F^\circ$

*For predicted terms in the spectra of the O I isoelectronic sequence, see Introduction.

S x

(N i sequence; 7 electrons) $Z=16$

Ground state $1s^2\,2s^2\,2p^3\ {}^4S^\circ_{1\frac{1}{2}}$

$2p^3\ {}^4S^\circ_{1\frac{1}{2}}$ ***3615900*** cm^{-1} I. P. 448.2 volts

The spectrum is very incompletely analyzed. Ferner has classified 4 lines between 44 A and 47 A and has generously furnished these classifications in advance of publication. The terms in the table have been derived from Ferner's data, adjusted by Robinson to fit the isoelectronic sequence data. All entries in brackets have been extrapolated along the isoelectronic sequence by Robinson. No intersystem combinations have been observed and the uncertainty, x, probably exceeds ± 1000 cm^{-1}.

Ferner's unit, 10^3 cm^{-1}, has been changed to cm^{-1} in deriving the term values.

REFERENCES

E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **36A**, No. 1, p. 42 (1948). (C L)
H. A. Robinson, unpublished material (March 1948). (I P) (T)

S x

Config.	Desig.	J	Level	Interval
$2s^2\,2p^3$	$2p^3\ {}^4S^\circ$	1½	*0*	
$2s^2\,2p^3$	$2p^3\ {}^2P^\circ$	½	[*122230*]+x	[1500]
		1½	[*123730*]+x	
$2s^2\,2p^2(^3P)3s$	$3s\ \ {}^4P$	½		
		1½	2092360	6100
		2½	2098460	
$2s^2\,2p^2(^3P)3d$	$3d\ \ {}^2D$	1½	2375140 +x	2160
		2½	2377300 +x	
------------	------	---	---------	
S xi ($^3P_0$)	*Limit*	---	[***3615900***]	

March 1948.

S xii

(B i sequence; 5 electrons) $Z=16$

Ground state $1s^2\,2s^2\,2p\ {}^2P^\circ_{\frac{1}{2}}$

$2p\ {}^2P^\circ_{\frac{1}{2}}$ cm^{-1} I. P. volts

By extrapolation along the B i isoelectronic sequence, Edlén estimates that the separation of the lowest term, $2p\ {}^2P^\circ_{\frac{1}{2}}-2p\ {}^2P^\circ_{1\frac{1}{2}}$, is 13266 cm^{-1} (7536 A).

REFERENCE

B. Edlén, Zeit. Astroph. **22**, 58 (1942). (T)

July 1948.

CHLORINE

Cl I

17 electrons $Z=17$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^5\ {}^2P^{\circ}_{1\frac{1}{2}}$

$3p^5\ {}^2P^{\circ}_{1\frac{1}{2}}$ ***104991*** cm⁻¹ I. P. 13.01 volts

Most of the terms are from the analysis by Kiess, who has revised and extended the earlier work on this spectrum. Green and Lynn have observed the Zeeman effect and, with the aid of *g*-values, added a few terms to the list by Kiess. They list 11 unclassified lines for which both *g*-values are known.

Their miscellaneous levels are labeled in the table with numbers assigned by the writer, followed by their tentative designations entered in parentheses.

Intersystem combinations, connecting the doublet and quartet terms, have been observed

REFERENCES

L. A. Turner, Phys. Rev. **27**, 401 (1926). (C L)
O. Laporte, Nature **121**, 1021 (1928). (C L)
C. C. Kiess, Bur. Std. J. Research **10**, 827, RP570 (1933). (I P) (T) (C L)
B. Edlén, Zeit, Phys. **104**, 413 (1937). (I P) (C L)
W. F. Meggers, J. Opt. Soc. Am. **36**, 431 (1946). (Summary hfs)
J. B. Green and J. T. Lynn, Phys. Rev. **69**, 165 (1946). (T) (C L) (Z E)
L. Davis, Jr., B. T. Feld, C. W. Zabel, and J. R. Zacharias, Phys. Rev. **73**, 525 (L) (1948). (hfs)

Cl I

Config.	Desig.	*J*	Level	Interval	Obs. *g*
$3s^2\,3p^5$	$3p^5\ {}^2P^{\circ}$	1½ ½	*0* *881*	−881	
$3s^2\,3p^4(^3P)4s$	$4s\ {}^4P$	2½ 1½ ½	71954. 00 72484. 20 72822. 64	−530. 20 −338. 44	1. 599 1. 722 2. 652
$3s^2\,3p^4(^3P)4s$	$4s\ {}^2P$	1½ ½	74221. 44 74861. 24	−639. 80	1. 340 0. 663
$3s^2\,3p^4(^3P)4p$	$4p\ {}^4P^{\circ}$	2½ 1½ ½	*82914. 54* *83126. 59* *83360. 55*	−212. 05 −233. 96	1. 591 1. 723 2. 617
$3s^2\,3p^4(^3P)4p$	$4p\ {}^4D^{\circ}$	3½ 2½ 1½ ½	*83889. 64* *84127. 90* *84480. 91* *84684. 27*	−238. 26 −353. 01 −203. 36	1. 422 1. 308 1. 163 0. 059
$3s^2\,3p^4(^1D)4s$	$4s'\ {}^2D$	2½ 1½	84115. 68 84117. 38	−1. 70	
$3s^2\,3p^4(^3P)4p$	$4p\ {}^2D^{\circ}$	2½ 1½	*84643. 69* *84984. 04*	−340. 35	1. 269 0. 986

Cl I

Config.	Desig.	*J*	Level	Interval	Obs. *g*
$3s^2\,3p^4(^3P)4p$	$4p\ {}^2S^{\circ}$	½	*85239. 98*		1. 280
$3s^2\,3p^4(^3P)4p$	$4p\ {}^2P^{\circ}$	1½ ½	*85438. 04* *85913. 44*	−475. 40	1. 327 1. 379
$3s^2\,3p^4(^3P)4p$	$4p\ {}^4S^{\circ}$	1½	*85730. 68*		1. 877
$3s^2\,3p^4(^1D)4p$	$4p'\ {}^2P^{\circ}$	1½ ½	*94309. 67* *94464. 50*	−154. 83	1. 328 0. 872
$3s^2\,3p^4(^3P)5p$	$5p\ {}^4P^{\circ}$	2½ 1½ ½	*94477. 93* *94659. 28* *94969. 43*	−181. 35 −310. 15	1. 559 1. 722 2. 309
$3s^2\,3p^4(^3P)5p$	$5p\ {}^4D^{\circ}$	3½ 2½ 1½ ½	*94727. 91* *94822. 75* *95309. 43* *95530. 51*	−94. 84 −486. 68 −221. 08	1. 420 1. 247 1. 147 1. 409
$3s^2\,3p^4(^1D)4p$	$4p'\ {}^2F^{\circ}$	2½ 3½	*95140. 05* *95176. 00*	35. 95	
$3s^2\,3p^4(^3P)5p$	$5p\ {}^2D^{\circ}$	2½ 1½	*95396. 31* *95702. 01*	−305. 70	1. 352 1. 321

Cl I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$3s^2\,3p^4(^3P)5p$	$5p\ ^2S°$	½	*95593.28*		0.699
$3s^2\,3p^4(^3P)5p$	$5p\ ^4S°$	1½	*95608.30*		1.531
$3s^2\,3p^4(^3P)4d$	$4d\ ^4D$	3½	95696.49	−85.92	
		2½	95782.41	−110.75	1.367
		1½	95893.16	−98.02	1.209
		½	95991.18		0.00
$3s^2\,3p^4(^3P)5p$	$5p\ ^2P°$	1½	*96308.84*	−280.80	1.286
		½	*96589.64*		0.712
$3s^2\,3p^4(^1D)4p$	$4p'\ ^2D°$	2½	*96478.38*	−3.32	
		1½	*96481.70*		0.867
$3s^2\,3p^4(^3P)4d$	$4d\ ^4F$	4½	96490.40	−236.41	
		3½	96726.81	−214.49	
		2½	96941.30	−314.25	1.097
		1½	97255.55		0.967
$3s^2\,3p^4(^3P)4d$	$4d\ ^2F$	3½	96829.85	−350.09	
		2½	97179.94		
$3s^2\,3p^4(^3P)6s$	$6s\ ^4P$	2½	97233.37	−242.83	1.500
		1½	97476.20	−619.76	1.393
		½	98095.96		1.962
$3s^2\,3p^4(^3P)4d$	$4d\ ^4P$	2½	97334.60	−706.20	1.241
		1½	98040.80	−600.42	1.620
		½	98641.22		
$3s^2\,3p^4(^3P)4d$	$4d\ ^2D$	2½	97529.85	−273.61	1.355
		1½	97803.46		
$3s^2\,3p^4(^3P)6p$	$6p\ ^4P°$	2½			
		1½			
		½	*98911.6*		1.91
$3s^2\,3p^4(^3P)6p$	$6p\ ^4D°$	3½			
		2½			
		1½	*99015.1*		1.32
		½			
$3s^2\,3p^4(^3P)5d$	$5d\ ^4D$	3½	99196.02	−68.69	1.392
		2½	99264.71	−85.51	1.358
		1½	99350.22	−53.39	
		½	99403.61		0.363

Cl I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$3s^2\,3p^4(^3P)5d$	$5d\ ^4F$	4½	99513.68	−150.47	1.310
		3½	99664.15	−97.37	1.181
		2½	99761.52	−183.90	1.149
		1½	99945.42		1.240
$3s^2\,3p^4(^3P)4d$	$4d\ ^2P$	1½	99530.10	−176.90	1.306
		½	99707.00		1.289
$3s^2\,3p^4(^3P)6p$	1° (^2D?)	1½	*99564.7*		1.32
$3s^2\,3p^4(^3P)6p$	2° ($^4D°$?)	½	*99582.7*		0.49
$3s^2\,3p^4(^3P)7s$?	1 (^4P?)	1½	99677.1		1.73
$3s^2\,3p^4(^3P)6p$	$6p\ ^2P°$	1½	*99819.8*	−79.4	1.28
		½	*99899.2*		0.81
$3s^2\,3p^4(^3P)7s$?	2 (^2P?)	½	99968.1		1.21
$3s^2\,3p^4(^3P)5d$	$5d\ ^4P$	2½	99984.30	−248.70	1.589
		1½	100233.00	65.88	
		½	100167.12		1.470
$3s^2\,3p^4(^3P)7s$?	3 (^2P?)	1½	100046.5		1.42
$3s^2\,3p^4(^3P)5d$	$5d\ ^2F$	3½	100142.41	−442.87	1.210
		2½	100585.28		1.069
$3s^2\,3p^4(^3P)5d$	$5d\ ^2D$	2½	100245.32	−97.66	
		1½	100342.98		
$3s^2\,3p^4(^3P)5d$	$5d\ ^2P$	1½	100700.3	−33.1	1.65
		½	100733.4		1.59
$3s^2\,3p^4(^3P)6d$	$6d\ ^4D$	½	100941.9	99.7	1.010
		1½	101041.6	6.9	1.168
		2½	101048.47	−62.87	1.364
		3½	100985.60		1.377
$3s^2\,3p^4(^3P)6d$	4 (^4F?)	1½?	101219.0		1.20
$3s^2\,3p^4(^3P)6d$	5 (^4P?)	2½	101422.4		1.60
$3s^2\,3p^4(^3P)6d$	6	½	101587.4		0.69
$3s^2\,3p^4(^3P)6d$	7 (^2F?)	2½	101855.0		1.45
Cl II ($^3P_2$)	*Limit*	------	***104991***		

January 1948.

Cl I Observed Terms*

Config. $1s^2\,2s^2\,2p^6+$	Observed Terms		
$3s^2\,3p^5$	$3p^5\ ^2P°$		
	$ns\ (n\geq 4)$	$np\ (n\geq 4)$	$nd\ (n\geq 3)$
$3s^2\,3p^4(^3P)nx$	{ 4, 6s ^4P 4s ^2P	4, 5p $^4S°$ 4–6p $^4P°$ 4–6p $^4D°$ 4, 5p $^2S°$ 4–6p $^2P°$ 4, 5p $^2D°$	4, 5d ^4P 4–6d ^4D 4, 5d ^4F 4, 5d ^2P 4, 5d ^2D 4, 5d ^2F
$3s^2\,3p^4(^1D)nx'$	4s′ ^2D	4p′ $^2P°$ 4p′ $^2D°$ 4p′ $^2F°$	

*For predicted terms in the spectra of the Cl I isoelectronic sequence, see Introduction.

Cl II

(S I sequence; 16 electrons) $Z=17$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^4\ {}^3P_2$

$3p^4\ {}^3P_2$ **192000** cm^{-1} I. P. 23.80 volts

The terms are from the paper by Kiess and de Bruin, who have summarized, revised, and extended the earlier analysis by Murakawa and others. They give a complete list of classified lines; it extends from 558 A to 9483 A. Intersystem combinations connecting all three systems of terms, have been observed.

The two unclassified levels designated by them as x' and x'' are here labeled 1 and 2, respectively. The term they list as $4s'\ {}^3P$ is entered as "${}^3P$" since its configuration is not definitely known.

The estimated position of $3p^4\ {}^1S$ given by Edlén, is entered in brackets in the table.

REFERENCES

C. C. Kiess and T. L. de Bruin, J. Research Nat. Bur. Std. **23**, 443, RP1244 (1939). (I P) (T) (C L) (G D)
B. Edlén, Phys. Rev. **62**, 434 (1942). (T)
S. Tolansky, Zeit. Phys. **74**, 336 (1932). (hfs)
S. Tolansky, Zeit. Phys. **73**, 470 (1931). (I S)

Cl II

Config.	Desig.	J	Level	Interval
$3s^2\,3p^4$	$3p^4\ {}^3P$	2	0	−697
		1	697	−299
		0	996	
$3s^2\,3p^4$	$3p^4\ {}^1D$	2	11652	
$3s^2\,3p^4$	$3p^4\ {}^1S$	0	[27900]	
$3s\ 3p^5$	$3p^5\ {}^3P^\circ$	2	*93366. 6*	−632. 1
		1	*93998. 7*	−334. 1
		0	*94332. 8*	
$3s^2\,3p^3(^4S^\circ)4s$	$4s\ {}^5S^\circ$	2	*107878. 5*	
$3s^2\,3p^3(^4S^\circ)3d$	$3d\ {}^5D^\circ$	4	*110295. 8*	−1. 0
		3	*110296. 8*	−2. 7
		2	*110299. 5*	−2. 5
		1	*110302. 0*	−1. 5
		0	*110303. 5*	
$3s^2\,3p^3(^4S^\circ)4s$	$4s\ {}^3S^\circ$	1	*112608. 0*	
$3s\ 3p^5$	$3p^5\ {}^1P^\circ$	1	*115656. 4*	
$3s^2\,3p^3(^4S^\circ)3d$	$3d\ {}^3D^\circ$	3	*119809. 9*	10. 9
		2	*119799. 0*	−43. 1
		1	*119842. 1*	
$3s^2\,3p^3(^2D^\circ)3d$	$3d'\ {}^1D^\circ$	2	*121498. 6*	
$3s^2\,3p^3(^2D^\circ)3d$	$3d'\ {}^1F^\circ$	3	*121635. 1*	
$3s^2\,3p^3(^2D^\circ)3d$	$3d'\ {}^3F^\circ$	2	*126031. 8*	187. 3
		3	*126219. 1*	237. 5
		4	*126456. 6*	
$3s^2\,3p^3(^2D^\circ)4s$	$4s'\ {}^3D^\circ$	1	*126725. 1*	18. 2
		2	*126743. 3*	39. 5
		3	*126782. 8*	

Cl II

Config.	Desig.	J	Level	Interval
$3s^2\,3p^3(^2D^\circ)3d$	$3d'\ {}^1P^\circ$	1	*127726. 9*	
$3s^2\,3p^3(^4S^\circ)4p$	$4p\ {}^5P$	1	128621. 9	40. 6
		2	128662. 5	67. 3
		3	128729. 8	
$3s^2\,3p^3(^2D^\circ)4s$	$4s'\ {}^1D^\circ$	2	*129065. 4*	
$3s^2\,3p^3(^4S^\circ)4p$	$4p\ {}^3P$	2	131767. 4	12. 6
		1	131754. 8	−13. 2
		0	131768. 0	
$3s^2\,3p^3(^2D^\circ)3d$	$3d'\ {}^3G^\circ$	3	*132162. 1*	11. 3
		4	*132173. 4*	17. 9
		5	*132191. 3*	
$3s^2\,3p^3(^2P^\circ)4s$	$4s''\ {}^3P^\circ$	0	*137770. 1*	34. 3
		1	*137804. 4*	73. 2
		2	*137877. 6*	
$3s^2\,3p^3(^2P^\circ)4s$	$4s''\ {}^1P^\circ$	1	*138623. 0*	
$3s^2\,3p^3(^2P^\circ)3d$	$3d''\ {}^1P^\circ$	1	*139350. 0*	
$3s^2\,3p^3(^2P^\circ)3d$	$3d''\ {}^1D^\circ$	2	*140259. 1*	
$3s^2\,3p^3(^2P^\circ)3d$	$3d''\ {}^3D^\circ$	1	*140740. 0*	270. 0
		2	*141010. 0*	339. 6
		3	*141349. 6*	
$3s^2\,3p^3(^2P^\circ)3d$	$3d''\ {}^3F^\circ$	4	*143996. 3*	−178. 2
		3	*144174. 5*	−169. 1
		2	*144343. 6*	
$3s^2\,3p^3(^2D^\circ)4p$	$4p'\ {}^1P$	1	145468. 5	
$3s^2\,3p^3(^2P^\circ)3d$	$3d''\ {}^3P^\circ$	0		
		1		
		2	*146012. 9*	

Cl II—Continued

Config.	Desig.	J	Level	Interval
$3s^2\,3p^3(^2D^\circ)4p$	$4p'\ ^3D$	1	146330.0	3.8
		2	146333.8	135.2
		3	146469.0	
$3s^2\,3p^3(^2D^\circ)4p$	$4p'\ ^3F$	2	147053.7	72.0
		3	147125.7	72.7
		4	147198.4	
$3s^2\,3p^3(^2D^\circ)4p$	$4p'\ ^1F$	3	147605.7	
$3s^2\,3p^3(^2D^\circ)4p$	$4p'\ ^3P$	2	149798.3	−154.1
		1	149952.4	−66.6
		0	150019.0	
$3s^2\,3p^3(^2D^\circ)3d$	$3d'\ ^3P^\circ$	2	*150681.4*	−131.3
		1	*150812.7*	
		0		
$3s^2\,3p^3(^2D^\circ)3d$	$3d'\ ^3D^\circ$	3	*151092.7*	74.1
		2	*151018.6*	−115.2
		1	*151133.8*	
$3s^2\,3p^3(^4S^\circ)5s$	$5s\ ^5S^\circ$	2	*152233.1*	
$3s^2\,3p^3(^2D^\circ)4p$	$4p'\ ^1D$	2	153257.0	
$3s^2\,3p^3(^2D^\circ)3d$	$3d'\ ^3S^\circ$	1	*153571.2*	
$3s^2\,3p^3(^4S^\circ)5s$	$5s\ ^3S^\circ$	1	*153633.1*	
$3s^2\,3p^3(^4S^\circ)4d$	$4d\ ^5D^\circ$	0	*154616.7*	1.1
		1	*154617.8*	1.8
		2	*154619.6*	3.0
		3	*154622.6*	1.2
		4	*154623.8*	
$3p^5\,(^2P^\circ)4s$	$4s^{VII}\,^3P^\circ$	2	*157076.6*	−590.2
		1	*157666.8*	−290.0
		0	*157956.8*	
$3s^2\,3p^3(^2P^\circ)4p$	$4p''\ ^3S$	1	158177.1	
$3s^2\,3p^3(^2P^\circ)4p$	$4p''\ ^3D$	1	158723.7	44.9
		2	158768.6	17.8
		3	158786.4	
$3s^2\,3p^3(^2P^\circ)4p$	$4p''\ ^1D$	2	159574.2	
$3s\ 3p^4(?)4s$	^3P	0	159840.3	159.3
		1	159999.6	143.8
		2	160143.4	
$3s^2\,3p^3(^2P^\circ)4p$	$4p''\ ^1P$	1	161348.4	
$3s^2\,3p^3(^2P^\circ)4p$	$4p''\ ^3P$	2	161634.9	−19.9
		1	161654.8	−16.2
		0	161671.0	
$3s^2\,3p^3(^4S^\circ)4d$	$4d\ ^3D^\circ$	3	*161796.5*	−111.2
		2	*161907.7*	−82.1
		1	*161989.8*	
	1	2	164210.7	
$3s^2\,3p^3(^2P^\circ)4p$	$4p''\ ^1S$	0	165362.1	
$3s^2\,3p^3(^4S^\circ)6s$	$6s\ ^5S^\circ$	2	*168673.6*	
$3s^2\,3p^3(^4S^\circ)6s$	$6s\ ^3S^\circ$	1	*169246.6*	

Cl II—Continued

Config.	Desig.	J	Level	Interval
$3s^2\,3p^3(^4S^\circ)5d$	$5d\ ^5D^\circ$	0		
		1		
		2	*169799.1*	0.5
		3	*169799.6*	0.6
		4	*169800.2*	
$3s^2\,3p^3(^2D^\circ)5s$	$5s'\ ^3D^\circ$	1	*170514.7*	20.4
		2	*170535.1*	40.4
		3	*170575.5*	
$3s^2\,3p^3(^4S^\circ)5d$	$5d\ ^3D^\circ$	3	*170973.6*	−32.2
		2	*171005.8*	−45.7
		1	*171051.5*	
$3s^2\,3p^3(^2D^\circ)5s$	$5s'\ ^1D^\circ$	2	*171209.2*	
$3s^2\,3p^3(^2D^\circ)4d$	$4d'\ ^3F^\circ$	2	*172572.6*	77.7
		3	*172650.3*	90.6
		4	*172740.9*	
$3s^2\,3p^3(^2D^\circ)4d$	$4d'\ ^3G^\circ$	3	*173222.7*	21.2
		4	*173243.9*	33.6
		5	*173277.5*	
$3s^2\,3p^3(^2D^\circ)4d$	$4d'\ ^1F^\circ$	3	*174045.0*	
	2	2	174256.3	
$3s^2\,3p^3(^2D^\circ)4d$	$4d'\ ^3D^\circ$	1	*174785.7*	34.9
		2	*174820.6*	32.0
		3	*174852.6*	
$3s^2\,3p^3(^2D^\circ)4d$	$4d'\ ^3S^\circ$	1	*177423.1*	
$3s^2\,3p^3(^2D^\circ)4d$	$4d'\ ^3P^\circ$	0	*177693.6*	60.6
		1	*177754.2*	62.7
		2	*177816.9*	
$3s^2\,3p^3(^2D^\circ)4d$	$4d'\ ^1D^\circ$	2	*178539.1*	
$3s^2\,3p^3(^2D^\circ)4d$	$4d'\ ^1P^\circ$	1	*179867.0*	
$3s^2\,3p^3(^2P^\circ)5s$	$5s''\ ^3P^\circ$	0	*182337.9*	34.4
		1	*182372.3*	76.4
		2	*182448.7*	
$3s^2\,3p^3(^2P^\circ)4d$	$4d''\ ^3F^\circ$	4	*184628.1*	−27.1
		3	*184655.2*	−3.2
		2	*184658.4*	
$3s^2\,3p^3(^2P^\circ)4d$	$4d''\ ^3P^\circ$	2	*185765.0*	−140.4
		1	*185905.4*	
		0		
$3s^2\,3p^3(^2P^\circ)4d$	$4d''\ ^3D^\circ$	1		
		2		
		3	*185865.2*	
$3s^2\,3p^3(^2D^\circ)6s$	$6s'\ ^3D^\circ$	1	*186844.3*	16.7
		2	*186861.0*	37.3
		3	*186898.3*	
$3s^2\,3p^3(^2D^\circ)6s$	$6s'\ ^1D^\circ$	2	*187141.4*	
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Cl III ($^4S^\circ_{1\frac{1}{2}}$)	*Limit*	---------	192000	

January 1948.

Cl II Observed Terms*

Config. $1s^2\ 2s^2\ 2p^6+$	Observed Terms	
$3s^2\ 3p^4$	$3p^4\ {}^3P$ $3p^4\ {}^1D$	
$3s\ 3p^5$	$3p^5\ {}^3P^\circ$ $3p^5\ {}^1P^\circ$	
	$ns\ (n\geq 4)$	$np\ (n\geq 4)$
$3s^2\ 3p^3(^4S^\circ)nx$	$4\text{–}6s\ {}^5S^\circ$ $4\text{–}6s\ {}^3S^\circ$	$4p\ {}^5P$ $4p\ {}^3P$
$3s^2\ 3p^3(^2D^\circ)nx'$	$4\text{–}6s'\ {}^3D^\circ$ $4\text{–}6s'\ {}^1D^\circ$	$4p'\ {}^3P$ $4p'\ {}^3D$ $4p'\ {}^3F$ $4p'\ {}^1P$ $4p'\ {}^1D$ $4p'\ {}^1F$
$3s^2\ 3p^3(^2P^\circ)nx''$	$4, 5s''\ {}^3P^\circ$ $4s''\ {}^1P^\circ$	$4p''\ {}^3S$ $4p''\ {}^3P$ $4p''\ {}^3D$ $4p''\ {}^1S$ $4p''\ {}^1P$ $4p''\ {}^1D$
$3p^5(^2P^\circ)nx^{VII}$	$4s^{VII}\ {}^3P^\circ$	
	$nd\ (n\geq 3)$	
$3s^2\ 3p^3(^4S^\circ)nx$	$3\text{–}5d\ {}^5D^\circ$ $3\text{–}5d\ {}^3D^\circ$	
$3s^2\ 3p^3(^2D^\circ)nx'$	$3, 4d'\ {}^3S^\circ$ $3, 4d'\ {}^3P^\circ$ $3, 4d'\ {}^3D^\circ$ $3, 4d'\ {}^3F^\circ$ $3, 4d'\ {}^3G^\circ$ $3, 4d'\ {}^1P^\circ$ $3, 4d'\ {}^1D^\circ$ $3, 4d'\ {}^1F^\circ$	
$3s^2\ 3p^3(^2P^\circ)nx''$	$3, 4d''\ {}^3P^\circ$ $3, 4d''\ {}^3D^\circ$ $3, 4d''\ {}^3F^\circ$ $3d''\ {}^1P^\circ$ $3d''\ {}^1D^\circ$	

*For predicted terms in the spectra of the S I isoelectronic sequence, see Introduction.

Cl III

(P I sequence; 15 electrons) $Z=17$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3\ {}^4S^\circ_{1\frac{1}{2}}$

$3p^3\ {}^4S^\circ_{1\frac{1}{2}}$ ***321936*** cm^{-1} I. P. 39.90 volts

The terms are from Bowen, who has greatly extended the early work on this spectrum. About 300 lines have been classified, and the observations range from 406 A to 4971 A. Intersystem combinations connecting the doublet and quartet terms have been observed.

Bowen remarks that because of perturbations the designations of the doublet levels of the 3*d* configuration are somewhat uncertain.

REFERENCES

I. S. Bowen, Phys. Rev. **31,** 35 (1928). (I P) (T) (C L)

I. S. Bowen, Phys. Rev. **45,** 401 (1934). (I P) (T) (C L)

Cl III

Config.	Desig.	J	Level	Interval
$3s^2\,3p^3$	$3p^3\ ^4S^\circ$	1½	0.0	
$3s^2\,3p^3$	$3p^3\ ^2D^\circ$	1½	18053	67
		2½	18120	
$3s^2\,3p^3$	$3p^3\ ^2P^\circ$	½	29812	95
		1½	29907	
$3s\ 3p^4$	$3p^4\ ^4P$	2½	98520	−610
		1½	99130	−345
		½	99475	
$3s^2\,3p^2(^3P)3d$	$3d\ ^4F$	1½	146525.6	224.3
		2½	146749.9	323.1
		3½	147073.0	424.9
		4½	147497.9	
$3s^2\,3p^2(^3P)3d$	$3d\ ^4D$	½	151946.4	−66.5
		1½	151879.9	−31.3
		2½	151848.6	104.9
		3½	151953.5	
$3s^2\,3p^2(^3P)4s$	$4s\ ^4P$	½	173736.0	357.8
		1½	174093.8	520.1
		2½	174613.9	
$3s^2\,3p^2(^3P)4s$	$4s\ ^2P$	½	178369.7	706.4
		1½	179076.1	
$3s^2\,3p^2(^3P)3d$	$3d\ ^4P$	2½	179495.2	−168.3
		1½	179663.5	−117.5
		½	179781.0	
$3s^2\,3p^2(^3P)3d$	$3d\ ^2D$	1½	182076.3	966.4
		2½	183042.7	
$3s^2\,3p^2(^3P)3d$	$3d\ ^2P$	1½	185838.3	−382.1
		½	186220.4	
$3s^2\,3p^2(^1D)4s$	$4s'\ ^2D$	2½	188390.1	−58.0
		1½	188448.1	
$3s^2\,3p^2(^1D)3d$	$3d'\ ^2D$	2½	194959.5	−308.7
		1½	195268.2	
$3s^2\,3p^2(^1D)3d$	$3d'\ ^2F$	2½	196137.9	17.9
		3½	196155.8	
$3s^2\,3p^2(^1D)3d$	$3d'\ ^2P$	½	198835.5	148.4
		1½	198983.9	
$3s^2\,3p^2(^3P)4p$	$4p\ ^4D^\circ$	½	201073.4	258.6
		1½	201332.0	433.1
		2½	201765.1	602.5
		3½	202367.6	

Cl III

Config.	Desig.	J	Level	Interval
$3s^2\,3p^2(^3P)4p$	$4p\ ^4P^\circ$	½	204021.6	102.4
		1½	204124.0	417.2
		2½	204541.2	
$3s^2\,3p^2(^3P)4p$	$4p\ ^2D^\circ$	1½	205037.3	909.6
		2½	205946.9	
$3s^2\,3p^2(^3P)4p$	$4p\ ^4S^\circ$	1½	205938.5	
$3s^2\,3p^2(^3P)4p$	$4p\ ^2P^\circ$	½	209042.1	140.7
		1½	209182.8	
$3s^2\,3p^2(^1D)4p$	$4p'\ ^2F^\circ$	2½	216524.6	185.8
		3½	216710.4	
$3s^2\,3p^2(^1D)4p$	$4p'\ ^2D^\circ$	2½	217850.2	−62.9
		1½	217913.1	
$3s^2\,3p^2(^1D)4p$	$4p'\ ^2P^\circ$	½	221862.9	237.8
		1½	222100.7	
$3s^2\,3p^2(^3P)4d$	$4d\ ^4F$	1½	239506.3	223.6
		2½	239729.9	345.3
		3½	240075.2	493.2
		4½	240568.4	
$3s^2\,3p^2(^3P)4d$	$4d\ ^4D$	½	241559.4	13.0
		1½	241572.4	112.7
		2½	241685.1	361.1
		3½	242046.2	
$3s^2\,3p^2(^3P)4d$	$4d\ ^4P$	2½	242822.8	−257.9
		1½	243080.7	−126.5
		½	243207.2	
$3s^2\,3p^2(^3P)4d$	$4d\ ^2F$	2½	243828.4	856.5
		3½	244684.9	
$3s^2\,3p^2(^3P)5s$	$5s\ ^4P$	½	244951.5	440.9
		1½	245392.4	744.8
		2½	246137.2	
$3s^2\,3p^2(^3P)4d$	$4d\ ^2D$	1½	248528.2	129.5
		2½	248657.7	
$3s^2\,3p^2(^1D)4d$	$4d'\ ^2D$	1½	254612.7?	70.7
		2½	254683.4?	
$3s^2\,3p^2(^1D)4d$	$4d'\ ^2F$	3½	255086.3	−54.1
		2½	255140.4	
$3s^2\,3p^2(^1D)5s$	$5s'\ ^2D$	2½	258885.8	−5.0
		1½	258890.8	
Cl IV $(^3P_0)$	*Limit*	---------	321936	

November 1947.

Cl III Observed Terms*

Config. $1s^2\,2s^2\,2p^6+$	Observed Terms		
$3s^2\,3p^3$	$3p^3\ ^4S^\circ$; $3p^3\ ^2P^\circ$ $3p^3\ ^2D^\circ$		
$3s\ 3p^4$	$3p^4\ ^4P$		
	$ns\ (n\geq 4)$	$np\ (n\geq 4)$	$nd\ (n\geq 3)$
$3s^2\,3p^2(^3P)nx$	4, $5s\ ^4P$; $4s\ ^2P$	$4p\ ^4S^\circ$ $4p\ ^4P^\circ$ $4p\ ^4D^\circ$; $4p\ ^2P^\circ$ $4p\ ^2D^\circ$	3, $4d\ ^4P$ 3, $4d\ ^4D$ 3, $4d\ ^4F$; $3d\ ^2P$ 3, $4d\ ^2D$ $4d\ ^2F$
$3s^2\,3p^2(^1D)nx'$	4, $5s'\ ^2D$	$4p'\ ^2P^\circ$ $4p'\ ^2D^\circ$ $4p'\ ^2F^\circ$	$3d'\ ^2P$ 3, $4d'\ ^2D$ 3, $4d'\ ^2F$

*For predicted terms in the spectra of the P I isoelectronic sequence, see Introduction.

Cl IV

(Si I sequence; 14 electrons) **Z=17**

Ground state $1s^2 2s^2 2p^6 3s^2 3p^2\ {}^3P_0$

$3p^2\ {}^3P_0$ **431226** cm^{-1} **I. P. 53.5 volts**

The analysis is by Bowen, who has classified 84 lines in the range between 318 A and 3167 A. The singlet and triplet terms are connected by intersystem combinations. Bowen classifies three lines (437 A–440 A) as $3p^3\ {}^5S^\circ - 4s\ {}^5P$, but lists no quintet terms.

REFERENCES

I. S. Bowen, Phys. Rev. **31,** 36 (1928). (C L)
S. C. Deb, Acad. Sci. Allahabad Bul. **2,** 49 (1932). (I P) (T) (C L)
I. S. Bowen, Phys. Rev. **45,** 401 (1934). (I P) (T) (C L)
I. S. Bowen, Phys. Rev. **46,** 377 (1934). (T) (C L)

Cl IV

Config.	Desig.	J	Level	Interval
$3s^2 3p^2$	$3p^2\ {}^3P$	0	0	
		1	491	491
		2	1341	850
$3s^2 3p^2$	$3p^2\ {}^1D$	2	13766	
$3s^2 3p^2$	$3p^2\ {}^1S$	0	32550	
$3s\ 3p^3$	$3p^3\ {}^3D^\circ$	1	*102752*	
		2	*102787*	35
		3	*102869*	82
$3s\ 3p^3$	$3p^3\ {}^3P^\circ$	2	*120256*	
		1	*120274*	−18
		0	*120300*	−26
$3s\ 3p^3$	$3p^3\ {}^3S^\circ$	1	*164721*	
$3s\ 3p^3$	$3p^3\ {}^1P^\circ$	1	*166742*	
$3s^2 3p(^2P^\circ)3d$	$3d\ {}^3P^\circ$	2	*181643*	
		1	*182073*	−430
		0	*182300*	−227
$3s^2 3p(^2P^\circ)3d$	$3d\ {}^3D^\circ$	1	*187008*	
		2	*187174*	166
		3	*187346*	172
$3s^2 3p(^2P^\circ)4s$	$4s\ {}^3P^\circ$	0	*215026.0*	
		1	*215389.3*	363.3
		2	*216468.1*	1078.8
$3s^2 3p(^2P^\circ)4s$	$4s\ {}^1P^\circ$	1	*219454*	
$3s^2 3p(^2P^\circ)4p$	$4p\ {}^3D$	1	247575.1?	
		2	248026.1	451.0
		3	248961.2	935.1
$3s^2 3p(^2P^\circ)4p$	$4p\ {}^3P$	0	251471.4	
		1	251725.8	254.4
		2	252396.7	670.9
$3s^2 3p(^2P^\circ)5s$	$5s\ {}^3P^\circ$	0	*312747*	
		1	*312991*	244
		2	*314225*	1234
$3s^2 3p(^2P^\circ)5s$	$5s\ {}^1P^\circ$	1	*315121*	
Cl V ($^2P^\circ_{1/2}$)	*Limit*		**431226**	

October 1947.

Cl IV Observed Terms*

Config. $1s^2\,2s^2\,2p^6+$	Observed Terms		
$3s^2\,3p^2$	$3p^2\ ^1S$ $3p^2\ ^3P$ $3p^2\ ^1D$		
$3s\ 3p^3$	$3p^3\ ^3S^\circ$ $3p^3\ ^3P^\circ$ $3p^3\ ^1P^\circ$ $3p^3\ ^3D^\circ$		
	$ns\ (n\geq 4)$	$np\ (n\geq 4)$	$nd\ (n\geq 3)$
$3s^2\,3p(^2P^\circ)nx$	$4, 5s\ ^3P^\circ$ $4, 5s\ ^1P^\circ$	$4p\ ^3P$ $4p\ ^3D$	$3d\ ^3P^\circ$ $3d\ ^3D^\circ$

*For predicted terms in the spectra of the Si I isoelectronic sequence, see Introduction.

Cl V

(Al I sequence; 13 electrons) $Z=17$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p\ ^2P^\circ_{1/2}$

$3p\ ^2P^\circ_{1/2}$ *547000* cm^{-1} I. P. 67.80 volts

The analysis is by Bowen except for the revision of $3d\ ^4P^\circ$ and the addition of $5d\ ^2D$ suggested by Phillips and Parker. Forty-two lines have been classified in the interval between 236 A and 894 A.

No intersystem combinations connecting the doublet and quartet systems of terms have been observed, as indicated by x in the table.

REFERENCES

I. S. Bowen, Phys. Rev. **31**, 37 (1928). (C L)

S. C. Deb, Acad. Sci. Allahabad Bull. **2**, 43 (1932). (T) (C L)

I. S. Bowen, Phys. Rev. **45**, 401 (1934). (I P) (T) (C L)

L. W. Phillips and W. L. Parker, Phys. Rev. **60**, 306 (1941). (T) (C L)

Cl v

Config.	Desig.	J	Level	Interval
$3s^2(^1S)3p$	$3p\ ^2P^\circ$	½ 1½	*0* *1492*	1492
$3s\ 3p^2$	$3p^2\ ^4P$	½ 1½ 2½	86000+x 86538+x 87381+x	538 843
$3s\ 3p^2$	$3p^2\ ^2D$	1½ 2½	113234 113306	72
$3s\ 3p^2$	$3p^2\ ^2S$	½	146644	
$3s\ 3p^2$	$3p^2\ ^2P$	½ 1½	157931 158892	961
$3s^2(^1S)3d$	$3d\ ^2D$	1½ 2½	185861 185893	32
$3p^3$	$3p^3\ ^4S^\circ$	1½	*233757+x*	
$3s^2(^1S)4s$	$4s\ ^2S$	½	256313	

Cl v

Config.	Desig.	J	Level	Interval
$3s\ 3p(^3P^\circ)3d$	$3d\ ^4P^\circ$	2½ 1½ ½	*269986+x* *270423+x* *270745+x*	−437 −322
$3s\ 3p(^3P^\circ)3d$	$3d\ ^4D^\circ$	½ 1½ 2½ 3½	*272596+x* *272757+x* *272919+x* *273020+x*	161 162 101
$3s^2(^1S)4d$	$4d\ ^2D$	{1½ 2½}	349511	
$3s\ 3p(^3P^\circ)4s$	$4s\ ^4P^\circ$	½ 1½ 2½	*353445+x* *353978+x* *354925+x*	533 947
$3s^2(^1S)5d$	$5d\ ^2D$	1½ 2½	422949 423022	73
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Cl VI ($^1S_0$)	*Limit*	---------	547000	

September 1947.

Cl v Observed Terms*

Config. $1s^2\ 2s^2\ 2p^6+$	Observed Terms	
$3s^2(^1S)3p$	$3p\ ^2P^\circ$	
$3s\ 3p^2$	$3p^2\ ^4P$; {$3p^2\ ^2S$, $3p^2\ ^2P$, $3p^2\ ^2D$	
$3p^3$	$3p^3\ ^4S^\circ$	
	$ns\ (n\geq 4)$	$nd\ (n\geq 3)$
$3s^2(^1S)nx$	$4s\ ^2S$	$3\text{–}5d\ ^2D$
$3s\ 3p(^3P^\circ)nx$	$4s\ ^4P^\circ$	$3d\ ^4P^\circ$ $3d\ ^4D^\circ$

*For predicted terms in the spectra of the Al I isoelectronic sequence, see Introduction.

Cl VI

(Mg I sequence; 12 electrons) $Z=17$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ {}^1S_0$

$3s^2\ {}^1S_0$ **780000**± cm^{-1} I. P. 96.7± volts

The analysis is incomplete. One singlet combination has been given by Bowen and Millikan, a line at 671.37 A classified as $3s^2\ {}^1S_0 - 3p\ {}^1P^{\circ}_1$. The triplet terms are from Phillips and Parker, who have classified 34 lines in the range 194 A to 736 A.

From isoelectronic sequence data the writer has estimated the approximate value of the limit, and of $3p\ {}^3P^{\circ}_1$ above the ground state zero. All triplet terms have, consequently, been increased by 98147 cm^{-1}. The estimated values are entered in brackets in the table. The uncertainty, x, may be several hundred cm^{-1}.

REFERENCES

I. S. Bowen and R. A. Millikan, Phys. Rev. **25**, 597 (1925). (C L)

W. L. Parker and L. W. Phillips, Phys. Rev. **57**, 140 (1940). (T) (C L)

L. W. Phillips and W. L. Parker, Phys. Rev. **60**, 306 (1941). (T) (C L)

Cl VI

Config.	Desig.	J	Level	Interval
$3s^2$	$3s^2\ {}^1S$	0	0	
$3s(^2S)3p$	$3p\ {}^3P^{\circ}$	0	*[98147]*$+x$	
				553
		1	*98700* $+x$	
				1165
		2	*99865* $+x$	
$3s(^2S)3p$	$3p\ {}^1P^{\circ}$	1	*148949*	
$3p^2$	$3p^2\ {}^3P$	0	234960 $+x$	
				636
		1	235596 $+x$	
				1201
		2	236797 $+x$	
$3s(^2S)3d$	$3d\ {}^3D$	1	279845 $+x$	
				15
		2	279860 $+x$	
				28
		3	279888 $+x$	
$3s(^2S)4s$	$4s\ {}^3S$	1	407404 $+x$	
$3p(^2P^{\circ})3d$	$3d\ {}^3P^{\circ}$	2	*409079* $+x$	
				−896
		1	*409975* $+x$	
				−787
		0	*410762* $+x$	

Cl VI

Config.	Desig.	J	Level	Interval
$3p(^2P^{\circ})3d$	$3d\ {}^3D^{\circ}$	1	*411802* $+x$	
				273
		2	*412075* $+x$	
				153
		3	*412228* $+x$	
$3s(^2S)4d$	$4d\ {}^3D$	1	509868 $+x$	
				28
		2	509896 $+x$	
				51
		3	509947 $+x$	
$3s(^2S)4f$	$4f\ {}^3F^{\circ}$	2, 3, 4	*529889* $+x$	
$3s(^2S)5d$	$5d\ {}^3D$	1		
		2	612058 $+x$	
				31
		3	612089 $+x$	
Cl VII ($^2S_{1/2}$)	*Limit*		*[780000]*	

July 1947.

Cl VI Observed Terms*

Config. $1s^2\,2s^2\,2p^6+$	Observed Terms		
$3s^2$	$3s^2\ ^1S$		
$3s(^2S)3p$	{ $3p\ ^3P^\circ$ $3p\ ^1P^\circ$		
$3p^2$	$3p^2\ ^3P$		
	ns ($n\geq 4$)	nd ($n\geq 3$)	nf ($n\geq 4$)
$3s(^2S)nx$	$4s\ ^3S$	3–$5d\ ^3D$	$4f\ ^3F^\circ$
$3p(^2P^\circ)nx$		$3d\ ^3P^\circ$ $3d\ ^3D^\circ$	

*For predicted terms in the spectra of the Mg I isoelectronic sequence, see Introduction.

Cl VII

(Na I sequence; 11 electrons) **Z=17**

Ground state $1s^2\,2s^2\,2p^6\,3s\ ^2S_{1/2}$

$3s\ ^2S_{1/2}$ **921902** cm^{-1} I. P. 114.27 volts

The resonance lines were observed by Bowen and Millikan. The analysis was extended by Phillips to include 22 classified lines in the interval between 174 A and 813 A. Absolute term values were derived from the $3d$-nf series.

REFERENCES

I. S. Bowen and R. A. Millikan, Phys. Rev. **25**, 295 (1925). (C L)
L. W. Phillips, Phys. Rev. **53**, 248 (1938). (I P) (T) (C L)

Cl VII

Config.	Desig.	J	Level	Interval
3s	$3s\ ^2S$	½	0	
3p	$3p\ ^2P^\circ$	½ 1½	*123001* *124891*	1890
3d	$3d\ ^2D$	1½ 2½	290166 290239	73
4s	$4s\ ^2S$	½	464003	
4p	$4p\ ^2P^\circ$	½ 1½	*509197* *509885*	688
4d	$4d\ ^2D$	1½ 2½	569142 569182	40

Cl VII

Config.	Desig.	J	Level	Interval
4f	$4f\ ^2F^\circ$	2½ 3½	*584086* *584099*	13
5s	$5s\ ^2S$	½	647677	
5d	$5d\ ^2D$	1½ 2½	697598 697619	21
5f	$5f\ ^2F^\circ$	2½ 3½	*705398* *705409*	11
6f	$6f\ ^2F^\circ$	{2½, 3½}	*771549*	
Cl VIII ($^1S_0$)	*Limit*	---------	921902	

June 1947.

Cl VIII

(Ne I sequence; 10 electrons) $Z=17$

Ground state $1s^2\,2s^2\,2p^6\ {}^1S_0$

$2p^6\ {}^1S_0$ **2810000 ± 500** cm^{-1} I. P. 348.3 ± 0.1 volts

Edlén has classified 13 lines in the region between 39A and 59A, as combinations with the ground term. The terms from the (^2S) limit in Cl IX need further confirmation.

As for Ne I the *jl*-coupling notation in the general form suggested by Racah is introduced.

The unit 10^3 cm^{-1} used by Edlén has here been converted to cm^{-1}.

REFERENCES

B. Edlén, Zeit. Phys. **100**, 726 (1936). (I P) (T) (C L)
G. Racah, Phys. Rev. **61**, 537 (L) (1942).

Cl VIII

Edlén	Config.	Desig.	J	Level
$2p\ {}^1S_0$	$2s^2\,2p^6$	$2p^6\ {}^1S$	0	0
	$2s^2\,2p^5(^2P^\circ_{1\frac{1}{2}})3s$	$3s\ [1\frac{1}{2}]^\circ$	2	
$3s\ {}^3P_1$			1	*1689450*
	$2s^2\,2p^5(^2P^\circ_{\frac{1}{2}})3s$	$3s'[\ \frac{1}{2}]^\circ$	0	
$3s\ {}^1P_1$			1	*1704360*
	$2s^2\,2p^5(^2P^\circ_{1\frac{1}{2}})3d$	$3d\ [\ \frac{1}{2}]^\circ$	0	
$3d\ {}^3P_1$			1	*1972390*
$3d\ {}^1P_1$	"	$3d\ [1\frac{1}{2}]^\circ$	1	*1997040*
$3d\ {}^3D_1$	$2s^2\,2p^5(^2P^\circ_{\frac{1}{2}})3d$	$3d'[1\frac{1}{2}]^\circ$	1	*2020730*
	$2s^2\,2p^5(^2P^\circ_{1\frac{1}{2}})4s$	$4s\ [1\frac{1}{2}]^\circ$	2	
$4s\ {}^3P_1$			1	*2242000*
	$2s^2\,2p^5(^2P^\circ_{\frac{1}{2}})4s$	$4s'[\ \frac{1}{2}]^\circ$	0	
$4s\ {}^1P_1$			1	*2254200*

Cl VIII

Edlén	Config.	Desig.	J	Level
$4d\ {}^1P_1$	$2s^2\,2p^5(^2P^\circ_{1\frac{1}{2}})4d$	$4d\ [1\frac{1}{2}]^\circ$	1	*2356820*
$4d\ {}^3D_1$	$2s^2\,2p^5(^2P^\circ_{\frac{1}{2}})4d$	$4d'[1\frac{1}{2}]^\circ$	1	*2368550*
	$2s\ \ 2p^6(^2S)3p$	$3p\ {}^3P^\circ$	2	
$3p'\ {}^3P_1$			1	*2371580?*
			0	
$3p'\ {}^1P_1$	$2s\ \ 2p^6(^2S)3p$	$3p\ {}^1P^\circ$	1	*2401770?*
$5d\ {}^1P_1$	$2s^2\,2p^5(^2P^\circ_{1\frac{1}{2}})5d$	$5d\ [1\frac{1}{2}]^\circ$	1	*2521750*
$5d\ {}^3D_1$	$2s^2\,2p^5(^2P^\circ_{\frac{1}{2}})5d$	$5d'[1\frac{1}{2}]^\circ$	1	*2534080*
	Cl IX ($^2P^\circ_{1\frac{1}{2}}$)	*Limit*	-------	**2810000**
	Cl IX ($^2P^\circ_{\frac{1}{2}}$)	*Limit*	-------	2823600

April 1947.

Cl VIII Observed Levels*

Config. $1s^2+$	Observed Terms		
$2s^2\,2p^6$	$2p^6\ ^1S$		
	$ns\ (n\geq 3)$	$np\ (n\geq 3)$	$nd\ (n\geq 3)$
$2s^2\,2p^5(^2P^\circ)nx$	3, 4s $^3P^\circ$ 3, 4s $^1P^\circ$		3d $^3P^\circ$ 3–5d $^3D^\circ$ 3–5d $^1P^\circ$
$2s\ 2p^6(^2S)nx$		3p $^3P^\circ$ 3p $^1P^\circ$	
jl-Coupling Notation			
	Observed Pairs		
	$ns\ (n\geq 3)$		$nd\ (n\geq 3)$
$2s^2\,2p^5(^2P^\circ_{1\frac{1}{2}})nx$	3, 4s [1½]°		3d [½]° 3–5d [1½]°
$2s^2\,2p^5(^2P^\circ_{\frac{1}{2}})nx'$	3, 4s' [½]°		3–5d' [1½]°

*For predicted levels in the spectra of the Ne I isoelectronic sequence, see Introduction.

Cl IX

(F I sequence; 9 electrons) $Z=17$

Ground state $1s^2\ 2s^2\ 2p^5\ ^2P^\circ_{1\frac{1}{2}}$

$2p^5\ ^2P^\circ_{1\frac{1}{2}}$ ***3233000*** cm^{-1} **I. P.** 400.7 volts

Edlén has classified 34 lines in this spectrum in the interval 42 A to 53 A. The absolute value of the ground state has been extrapolated. Since no combinations between the two lowest terms have been observed, relative values have been extrapolated from the irregular doublet law for the three terms entered in brackets in the table. The uncertainty in the relative values may be large.

Levels from the 3d configurations with limits ^3P and ^1D in Cl x are labeled X since Edlén has been unable to assign term designations to them.

The unit used by Edlén, 10^3 cm^{-1}, has here been converted to cm^{-1}.

REFERENCE

B. Edlén, Zeit. Phys. **100**, 726 (1936). (I P) (T) (C L)

Cl IX

Edlén	Config.	Desig.	J	Level	Interval
$2p\ ^2P_2$ $\ ^2P_1$	$2s^2\ 2p^5$	$2p^5\ ^2P^\circ$	1½ ½	*0* *13600*	−13600
$2p'\ ^2S_1$	$2s\ 2p^6$	$2p^6\ ^2S$	½	[553400]	
$3s\ ^4P_3$ $\ ^4P_2$ $\ ^4P_1$	$2s^2\ 2p^4(^3P)3s$	$3s\ ^4P$	2½ 1½ ½	1888970 1896600 1901850	−7630 −5250
$3s\ ^2P_2$ $\ ^2P_1$	$2s^2\ 2p^4(^3P)3s$	$3s\ ^2P$	1½ ½	1911950 1921050	−9100
$\overline{3s}\ ^2D_3$ $\ ^2D_2$	$2s^2\ 2p^4(^1D)3s$	$3s'\ ^2D$	2½ 1½	1959790 1959960	−170
$\overline{\overline{3s}}\ ^2S_1$	$2s^2\ 2p^4(^1S)3s$	$3s''\ ^2S$	½	2031080	
$3d\ X_6$	$2s^2\ 2p^4(^3P)3d$	$3d\ X_6$		2196890	
$3d\ X_5$	$2s^2\ 2p^4(^3P)3d$	$3d\ X_5$		2199540	
$3d\ X_4$	$2s^2\ 2p^4(^3P)3d$	$3d\ X_4$		2203850	
$3d\ X_3$	$2s^2\ 2p^4(^3P)3d$	$3d\ X_3$		2205950	

Cl IX

Edlén	Config.	Desig.	J	Level	Interval
$3d\ X_2$	$2s^2\ 2p^4(^3P)3d$	$3d\ X_2$		2209470	
$3d\ X_1$	$2s^2\ 2p^4(^3P)3d$	$3d\ X_1$		2216710	
$\overline{3d}\ X_5$	$2s^2\ 2p^4(^1D)3d$	$3d'\ X_5$		2259280	
$\overline{3d}\ X_4$	$2s^2\ 2p^4(^1D)3d$	$3d'\ X_4$		2263310	
$\overline{3d}\ X_{2,3}$	$2s^2\ 2p^4(^1D)3d$	$3d'\ X_{2,3}$		2268000	
$\overline{3d}\ X_1$	$2s^2\ 2p^4(^1D)3d$	$3d'\ X_1$		2272570	
$\overline{\overline{3d}}\ ^2D_3$ $\ ^2D_2$	$2s^2\ 2p^4(^1S)3d$	$3d''\ ^2D$	2½ 1½	2328830 2330130	−1300
$3s'\ ^2P_2$ $\ ^2P_1$	$2s\ 2p^5(^3P^\circ)3s$	$3s'''\ ^2P^\circ$	1½ ½	[*2415740*] [*2424380*]	−8640
$3d'\ ^2P_1$ $\ ^2P_2$	$2s\ 2p^5(^3P^\circ)3d$	$3d'''\ ^2P^\circ$	½ 1½	[*2715940*] [*2722690*]	6750
	Cl X ($^3P_2$)	*Limit*	------	[3233000]	

March 1947.

Cl IX Observed Terms*

Config. $1s^2+$	Observed Terms	
$2s^2\ 2p^5$	$2p^5\ ^2P^\circ$	
$2s\ 2p^6$	$2p^6\ ^2S$	
	$ns\ (n\geq 3)$	$nd\ (n\geq 3)$
$2s^2\ 2p^4(^3P)nx$	{ $3s\ ^4P$ $3s\ ^2P$	
$2s^2\ 2p^4(^1D)nx'$	$3s'\ ^2D$	
$2s^2\ 2p^4(^1S)nx''$	$3s''\ ^2S$	$3d''\ ^2D$
$2s\ 2p^5(^3P^\circ)nx'''$	$3s'''\ ^2P^\circ$	$3d'''\ ^2P^\circ$

*For predicted terms in the spectra of the F I isoelectronic sequence, see Introduction.

Cl X

(O I sequence; 8 electrons) $Z=17$

Ground state $1s^2\ 2s^2\ 2p^4\ {}^3P_2$

$2p^4\ {}^3P_2$ **3673000** cm^{-1} I. P. 455.3 volts

Edlén has classified 15 lines between 39 A and 47 A. The absolute value of the ground term has been extrapolated from the isoelectronic sequence. Similarly, the singlet and triplet terms are connected only through the extrapolated value of $2p^4\ {}^3P_2 - 2p^4\ {}^1D_2$, and the uncertainty, x, may be large. The estimated value of $2p^5\ {}^3P^\circ_2$ is given in brackets.

Edlén's term values expressed in units of 10^3 cm^{-1} are here changed to cm^{-1}.

REFERENCE

B. Edlén, Zeit, Phys. **100**, 732 (1936). (I P) (T) (C L).

Cl X

Edlén	Config.	Desig.	J	Level	Interval
$2p\ {}^3P_2$	$2s^2\ 2p^4$	$2p^4\ {}^3P$	2	0	−10880
${}^3P_1$			1	10880	
			0		
$2p\ {}^1D$	$2s^2\ 2p^4$	$2p^4\ {}^1D$	2	61000 $+x$	
$2p\ {}^1S$	$2s^2\ 2p^4$	$2p^4\ {}^1S$	0	130310 $+x$	
$2p'\ {}^3P$	$2s\ 2p^5$	$2p^5\ {}^3P^\circ$	2	*[487000]*	
			1		
			0		
$3s\ {}^3S_1$	$2s^2\ 2p^3({}^4S^\circ)3s$	$3s\ {}^3S^\circ$	1	*2134700*	
$\overline{3s}\ {}^3D$	$2s^2\ 2p^3({}^2D^\circ)3s$	$3s'\ {}^3D^\circ$	3, 2, 1	*2202610*	
$\overline{3s}\ {}^1D$	$2s^2\ 2p^3({}^2D^\circ)3s$	$3s'\ {}^1D^\circ$	2	*2212650* $+x$	

Cl X

Edlén	Config.	Desig.	J	Level	Interval
$\overline{\overline{3s}}\ {}^1P_1$	$2s^2\ 2p^3({}^2P^\circ)3s$	$3s''\ {}^1P^\circ$	1	*2262140* $+x$	
	$2s^2\ 2p^3({}^4S^\circ)3d$	$3d\ {}^3D^\circ$	1		
$3d\ {}^3D_2$			2	*2415360*	680
${}^3D_3$			3	*2416040*	
$\overline{3d}\ {}^3D$	$2s^2\ 2p^3({}^2D^\circ)3d$	$3d'\ {}^3D^\circ$	3, 2, 1	*2494700*	
$\overline{3d}\ {}^1D_2$	$2s^2\ 2p^3({}^2D^\circ)3d$	$3d'\ {}^1D^\circ$	2	*2500380* $+x$	
$\overline{3d}\ {}^3P$	$2s^2\ 2p^3({}^2D^\circ)3d$	$3d'\ {}^3P^\circ$	2, 1, 0	*2502750*	
$\overline{3d}\ {}^1F_3$	$2s^2\ 2p^3({}^2D^\circ)3d$	$3d'\ {}^1F^\circ$	3	*2520420* $+x$	
$\overline{\overline{3d}}\ {}^3D$	$2s^2\ 2p^3({}^2P^\circ)3d$	$3d''\ {}^3D^\circ$	3, 2, 1	*2547580*	
	Cl XI (${}^4S^\circ_{1\frac{1}{2}}$)	*Limit*	-------	**3673000**	

March 1947.

Cl X OBSERVED TERMS*

Config. $1s^2+$	Observed Terms			
$2s^2\ 2p^4$	$2p^4\ {}^1S$ $2p^4\ {}^3P$ $2p^4\ {}^1D$			
	ns ($n \geq 3$)	*nd* ($n \geq 3$)		
$2s^2\ 2p^3({}^4S^\circ)nx$	$3s\ {}^3S^\circ$		$3d\ {}^3D^\circ$	
$2s^2\ 2p^3({}^2D^\circ)nx'$	$3s'\ {}^3D^\circ$ $3s'\ {}^1D^\circ$	$3d'\ {}^3P^\circ$	$3d'\ {}^3D^\circ$ $3d'\ {}^1D^\circ$	$3d'\ {}^1F^\circ$
$2s^2\ 2p^3({}^2P^\circ)nx''$	$3s''\ {}^1P^\circ$		$3d''\ {}^3D^\circ$	

*For predicted terms in the spectra of the O I isoelectronic sequence, see Introduction.

Cl XI

(N I sequence; 7 electrons) $Z=17$

Ground state $1s^2\ 2s^2\ 2p^3\ {}^4S^{\circ}_{1\frac{1}{2}}$

$2p^3\ {}^4S^{\circ}_{1\frac{1}{2}}$ cm^{-1} I. P. volts

This spectrum has not been analyzed, but Edlén has classified two lines as due to Cl XI:

A	Int.	Wave No.	Desig.
40. 787	0	2451760	$2p^3\ {}^2D^{\circ} - 3s'\ {}^2D$
40. 392	0	2475740	$2p^3\ {}^4S^{\circ}_{1\frac{1}{2}} - 3s\ \ {}^4P_{2\frac{1}{2}}$

By extrapolation along the isoelectronic sequence, he lists combinations giving the relative positions of two other levels (entered in brackets in the table). From these data preliminary term values have been calculated and entered below. The uncertainty x is probably large.

The unit used by Edlén, 10^3 cm^{-1}, has here been changed to cm^{-1}.

REFERENCE

B. Edlén, Zeit. Phys. **100**, 728 (1936). (C L)

Cl XI

Edlén	Config.	Desig.	J	Level
$2p\ {}^4S_2$	$2s^2\ 2p^3$	$2p^3\ {}^4S^{\circ}$	1½	*0*
	$2s^2\ 2p^3$	$2p^3\ {}^2D^{\circ}$	1½	
$2p\ {}^2D_3$			2½	[*94000*]$+x$
	$2s^2\ 2p^3$	$2p^3\ {}^2P^{\circ}$	½	
$2p\ {}^2P_2$			1½	[*143000*]$+x$
	$2s^2\ 2p^2({}^3P)3s$	$3s\ \ {}^4P$	½	
			1½	
$3s\ {}^4P_3$			2½	2475740
$\overline{3s}\ {}^2D$	$2s^2\ 2p^2({}^1D)3s$	$3s'\ {}^2D$	{ 1½ 2½ }	2545760?$+x$

February 1947.

ARGON

18 electrons $Z=18$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ ^1S_0$

$3p^6\ ^1S_0$ **127109.9** cm^{-1} I. P. 15.755 volts

The present list has been compiled from an unpublished manuscript kindly furnished by Edlén, who has made a study of this spectrum and interpreted it with the aid of present atomic theory. His term array is based on those published by Humphreys (1938) and by Meggers and Humphreys (1933), although he has revised and extended their lists. Three place entries are from interferometer measurements. The values of $4f[4\frac{1}{2}]$, $4f[3\frac{1}{2}]$, and $4f'[3\frac{1}{2}]$ are from unpublished data by Humphreys based on observations by Sittner.

The terms $ns'[\frac{1}{2}]^\circ$ ($n=11$ to 16) and $nd'[1\frac{1}{2}]^\circ$ ($n=9$ to 14) have been calculated by the writer from the absorption series observed by Beutler in the region between 871 and 876 A, and added to Edlén's list. Beutler lists these terms as blended.

Edlén has determined the new values of the series limits quoted here.

The Paschen notation used by Meissner, Rasmussen, Meggers, Humphreys, and others is entered in column one of the table in the same form as for Ne I. The letters U, V, W, X, Y, Z, adopted when configurations involving *f* electrons were found, are also entered in this column. Twenty-seven of these levels have *J*-values fixed by the observed combinations. These *J*-values are given in italics in the table.

Edlén suggested that a pair-coupling notation be adopted for Ne-like spectra to take into account the departure from *LS*-coupling. According to Shortley, *LS*-designations can be significantly assigned in only a few cases, in particular, for the following groups of levels:

Paschen	Desig.	Paschen	Desig.	Paschen	Desig.	Paschen	Desig.	Paschen	Desig.
$(n-3)s_5$	$ns\ ^3P^\circ_2$	$2p_{10}$	$4p\ ^3S_1$	$2p_5$	$4p\ ^3P_0$	$4d_6$	$4d\ ^3P^\circ_0$	$4d''_1$	$4d\ ^3F^\circ_2$
$(n-3)s_4$	$ns\ ^3P^\circ_1$	$2p_9$	$4p\ ^3D_3$	$2p_4$	$4p\ ^1P_1$	$4d_5$	$4d\ ^3P^\circ_1$	$4d'_1$	$4d\ ^1F^\circ_3$
$(n-3)s_3$	$ns\ ^3P^\circ_0$	$2p_8$	$4p\ ^3D_2$	$2p_3$	$4p\ ^3P_2$	$4d'_4$	$4d\ ^3F^\circ_4$	$4s''''_1$	$4d\ ^1D^\circ_2$
$(n-3)s_2$	$ns\ ^1P^\circ_1$	$2p_7$	$4p\ ^3D_1$	$2p_2$	$4p\ ^3P_1$	$4d_4$	$4d\ ^3F^\circ_3$	$4s'''_1$	$4d\ ^3D^\circ_3$
		$2p_6$	$4p\ ^1D_2$	$2p_1$	$4p\ ^1S_0$	$4d_3$	$4d\ ^3P^\circ_2$	$4s''_1$	$4d\ ^3D^\circ_2$
						$4d_2$	$4d\ ^1P^\circ_1$	$4s'_1$	$4d\ ^3D^\circ_1$

Consequently, the *jl*-coupling notation in the general form suggested by Racah is here introduced. The present arrangement has been suggested by Shortley, who has made a detailed investigation of the theoretical arrangement of the "pairs", to be used as a guide in preparing the present table. The pairs $nd\ [3\frac{1}{2}]^\circ$ and $nd[1\frac{1}{2}]^\circ$ are partially inverted as compared with Ne I.

No Grotrian diagram appears to have been published for this spectrum.

A I—Continued

REFERENCES

K. W. Meissner, Zeit. Phys. **39,** 172 (1926); **40,** 839 (1927). (I P) (T) (C L)

E. Rasmussen, *Serier i de Aedle Luftarters Spektre med Saerligt Henblik paa Radiumemanation* p. 22 (Danske Ervhervs Annoncebureau's Forlag, Kobenhavn, 1932) Dissertation, Copenhagen. (T) (C L)

E. Rasmussen, Zeit. Phys. **75,** 695 (1932). (T) (C L)

W. F. Meggers and C. J. Humphreys, Bur. Std. J. Research **10,** 437, RP540 (1933). (T) (C L)

R. M. Woods and B. J. Spence, Phys. Rev. **45,** 669 (1934). (C L)

J. C. Boyce, Phys. Rev. **48,** 396 (1935). (I P) (T) (C L)

H. Beutler, Zeit. Phys. **93,** 177 (1935). (I P) (T) (C L)

H. Kopfermann und H. Krüger, Zeit. Phys. **105,** 389 (1937). (I S)

J. B. Green, Phys. Rev. **52,** 736 (1937). (Z E)

J. B. Green and B. Fried, Phys. Rev. **54,** 876 (1938). (Z E)

P. Jacquinot, Compt. Rend. **206,** 1635 (1938). (Z E)

C. J. Humphreys, J. Research Nat. Bur. Std. **20,** 26, RP1061 (1938) and unpublished data. (T) (C L)

G. Racah, Phys. Rev. **61,** 537 (L) (1942).

B. Edlén, Ark. Mat. Astr. Fys. (Stockholm) **29A,** No. 32 (1943). (C L)

J. B. Green, Phys. Rev. **64,** 151 (1943). (Z E)

G. Shortley, unpublished material (Aug. 1947).

B. Edlén, unpublished material (April 1948). (I P) (T) (C L)

W. R. Sittner, unpublished material (1949).

A I

Authors	Config.	Desig.	J	Level	Obs. g
$1p_0$	$3p^6$	$3p^6\ ^1S$	0	0.0	
$1s_5$	$3p^5(^2P^\circ_{1\frac{1}{2}})4s$	$4s$ [1½]°	2	*93143.800*	1.506
$1s_4$			1	*93750.639*	1.404
$1s_3$	$3p^5(^2P^\circ_{\frac{1}{2}})4s$	$4s'$ [½]°	0	*94553.707*	
$1s_2$			1	*95399.870*	1.102
$2p_{10}$	$3p^5(^2P^\circ_{1\frac{1}{2}})4p$	$4p$ [½]	1	104102.144	1.985
$2p_9$	"	$4p$ [2½]	3	105462.804	1.338
$2p_8$			2	105617.315	1.112
$2p_7$	"	$4p$ [1½]	1	106087.305	0.838
$2p_6$			2	106237.597	1.305
$2p_5$	"	$4p$ [½]	0	107054.319	
$2p_4$	$3p^5(^2P^\circ_{\frac{1}{2}})4p$	$4p'$ [1½]	1	107131.755	0.819
$2p_3$			2	107289.747	1.260
$2p_2$	"	$4p'$ [½]	1	107496.463	1.380
$2p_1$			0	108722.668	
$3d_6$	$3p^5(^2P^\circ_{1\frac{1}{2}})3d$	$3d$ [½]°	0	*111667.87*	
$3d_5$			1	*111818.09*	
$3d'_4$	"	$3d$ [3½]°	4	*112750.22*	
$3d_4$			3	*113020.39*	
$3d_3$	"	$3d$ [1½]°	2	*112138.98*	
$3d_2$			1	*114147.75*	
$3d''_1$	"	$3d$ [2½]°	2	*113426.05*	
$3d'_1$			3	*113716.61*	
$3s''''_1$	$3p^5(^2P^\circ_{\frac{1}{2}})3d$	$3d'$ [2½]°	2	*114641.04*	
$3s'''_1$			3	*114821.99*	
$3s''_1$	"	$3d'$ [1½]°	2	*114805.18*	
$3s'_1$			1	*115366.90*	
$2s_5$	$3p^5(^2P^\circ_{1\frac{1}{2}})5s$	$5s$ [1½]°	2	*113468.55*	
$2s_4$			1	*113643.26*	
$2s_3$	$3p^5(^2P^\circ_{\frac{1}{2}})5s$	$5s'$ [½]°	0	*114861.67*	
$2s_2$			1	*114975.07*	
$3p_{10}$	$3p^5(^2P^\circ_{1\frac{1}{2}})5p$	$5p$ [½]	1	116660.054	1.90
$3p_9$	"	$5p$ [2½]	3	116942.815	
$3p_8$			2	116999.389	1.09
$3p_7$	"	$5p$ [1½]	1	117151.387	1.01
$3p_6$			2	117183.654	1.42
$3p_5$	"	$5p$ [½]	0	117563.020	
$3p_4$	$3p^5(^2P^\circ_{\frac{1}{2}})5p$	$5p'$ [1½]	1	118407.494	0.61
$3p_3$			2	118469.117	1.18
$3p_2$	"	$5p'$ [½]	1	118459.662	1.45
$3p_1$			0	118870.981	
$4d_6$	$3p^5(^2P^\circ_{1\frac{1}{2}})4d$	$4d$ [½]°	0	*118512.17*	
$4d_5$			1	*118651.447*	1.467
$4d'_4$	"	$4d$ [3½]°	4	*119023.699*	1.255
$4d_4$			3	*119212.93*	1.077
$4d_3$	"	$4d$ [1½]°	2	*118906.665*	1.437
$4d_2$			1	*119847.81*	0.768
$4d''_1$	"	$4d$ [2½]°	2	*119444.88*	0.908
$4d'_1$			3	*119566.11*	
$4s''''_1$	$3p^5(^2P^\circ_{\frac{1}{2}})4d$	$4d'$ [2½]°	2	*120619.076*	0.987
$4s'''_1$			3	*120753.52*	1.133
$4s''_1$	"	$4d'$ [1½]°	2	*120600.944*	1.057
$4s'_1$			1	*121011.979*	0.877
$3s_5$	$3p^5(^2P^\circ_{1\frac{1}{2}})6s$	$6s$ [1½]°	2	*119683.113*	1.500
$3s_4$			1	*119760.22*	1.184
$3s_3$	$3p^5(^2P^\circ_{\frac{1}{2}})6s$	$6s'$ [½]°	0	*121096.67*	
$3s_2$			1	*121161.356*	1.271
4X	$3p^5(^2P^\circ_{1\frac{1}{2}})4f$	$4f$ [1½]	1	120188.34	
4X			2	120188.66	
4V	"	$4f$ [4½]	5	120207.32	
			4	120207.77	
4Y					
4Y	"	$4f$ [2½]	3	120229.81	
			2	120230.07	

A I—Continued

Authors	Config.	Desig.	J	Level	Obs. g
4U	$3p^5(^2P^\circ_{1\frac{1}{2}})4f$	$4f$ [3½]	3, 4	120250.15	
4W	$3p^5(^2P^\circ_{\frac{1}{2}})4f$	$4f'$ [3½]	*3, 4*	121653.40	
4Z	″	$4f'$ [2½]	3	121654.32	
4Z			*2*	121654.58	
$4p_{10}$	$3p^5(^2P^\circ_{1\frac{1}{2}})6p$	$6p$ [½]	1	121068.804	
$4p_9$	″	$6p$ [2½]	3	121165.431	
$4p_8$			2	121191.92	
$4p_7$	″	$6p$ [1½]	1	121257.227	
$4p_6$			2	121270.682	
$4p_5$	″	$6p$ [½]	0	121470.304	
$4p_4$	$3p^5(^2P^\circ_{\frac{1}{2}})6p$	$6p'$ [1½]	1	122609.76	
$4p_3$			2	122635.128	
$4p_2$	″	$6p'$ [½]	1	122601.290	
$4p_1$			0	122790.612	
$5d_6$	$3p^5(^2P^\circ_{1\frac{1}{2}})5d$	$5d$ [½]°	0	*121794.158*	
$5d_5$			1	*121932.908*	1.400
$5d'_4$	″	$5d$ [3½]°	4	*122036.134*	1.253
$5d_4$			3	*122160.22*	1.076
$5d_3$	″	$5d$ [1½]°	2	*122086.974*	1.387
$5d_2$			1	*122514.29*	0.813
$5d''_1$	″	$5d$ [2½]°	2	*122282.134*	0.941
$5d'_1$			3	*122329.72*	1.199
$5s''''_1$	$3p^5(^2P^\circ_{\frac{1}{2}})5d$	$5d'$ [2½]°	2	*123505.536*	0.802
$5s'''_1$			3	*123557.459*	1.127
$5s''_1$	″	$5d'$ [1½]°	2	*123372.987*	1.265
$5s'_1$			1	*123815.53*	0.846
$4s_5$	$3p^5(^2P^\circ_{1\frac{1}{2}})7s$	$7s$ [1½]°	2	*122440.109*	1.506
$4s_4$			1	*122479.459*	1.164
$4s_3$	$3p^5(^2P^\circ_{\frac{1}{2}})7s$	$7s'$ [½]°	0	*123873.07*	
$4s_2$			1	*123882.30*	1.296
5X	$3p^5(^2P^\circ_{1\frac{1}{2}})5f$	$5f$ [1½]	*1*	122686.20	
5X			*2*	122686.40	
5V	″	$5f$ [4½]	*4, 5*	122695.70	
5Y	″	$5f$ [2½]	*3*	122707.94	
5Y			*2*	122708.18	
5U	″	$5f$ [3½]	*3, 4*	122717.90	
5W	$3p^5(^2P^\circ_{\frac{1}{2}})5f$	$5f'$ [3½]	*3, 4*	124135.74	
5Z	″	$5f'$ [2½]	3	124137.29	
5Z			*2*	124137.45	
$5p_{10}$	$3p^5(^2P^\circ_{1\frac{1}{2}})7p$	$7p$ [½]	1	123172.09	
$5p_9$	″	$7p$ [2½]	3	123205.83	
$5p_8$			2	123220.73	
$5p_7$	″	$7p$ [1½]	1	123254.99	
$5p_6$			2	123261.593	
$5p_5$	″	$7p$ [½]	0	123385.13	
$5p_4$	$3p^5(^2P^\circ_{\frac{1}{2}})7p$	$7p'$ [1½]	1	124643.54	
$5p_3$			2	124658.52	

A I—Continued

Authors	Config.	Desig.	J	Level	Obs. g
$5p_2$	$3p^5(^2P^\circ_{\frac{1}{2}})7p$	$7p'$ [½]	1	124651.05	
$5p_1$			0	124749.89	
$6d_6$	$3p^5(^2P^\circ_{1\frac{1}{2}})6d$	$6d$ [½]°	0	*123508.96*	
$6d_5$			1	*123468.034*	1.233
$6d'_4$	″	$6d$ [3½]°	4	*123653.238*	1.256
$6d_4$			3	*123773.920*	1.052
$6d_3$	″	$6d$ [1½]°	2	*123808.60*	1.206
			1		
$6d''_1$	″	$6d$ [2½]°	2	*123826.85*	1.107
$6d'_1$			3	*123832.50*	1.245
$6s''''_1$	$3p^5(^2P^\circ_{\frac{1}{2}})6d$	$6d'$ [2½]°	2	*125113.48*	0.777
$6s'''_1$			3	*125150.00*	1.098
$6s''_1$	″	$6d'$ [1½]°	2	*125066.501*	1.264
$6s'_1$			1	*125286.28*	
$5s_5$	$3p^5(^2P^\circ_{1\frac{1}{2}})8s$	$8s$ [1½]°	2	*123903.295*	1.50
$5s_4$			1	*123935.97*	
$5s_3$	$3p^5(^2P^\circ_{\frac{1}{2}})8s$	$8s'$ [½]°	0	*125334.75*	
$5s_2$			1	*125353.31*	1.26
6X	$3p^5(^2P^\circ_{1\frac{1}{2}})6f$	$6f$ [1½]	*1*	124041.20	
6X			*2*	124041.38	
6V	″	$6f$ [4½]	*4, 5*	124046.64	
6Y	″	$6f$ [2½]	*3*	124051.44	
6Y			*2*	124051.65	
6U	″	$6f$ [3½]	*3, 4*	124058.36	
6W	$3p^5(^2P^\circ_{\frac{1}{2}})6f$	$6f'$ [3½]	*3, 4*	125482.70	
6Z	″	$6f'$ [2½]	3	125483.16	
6Z			*2*	125483.34	
$6p_{10}$	$3p^5(^2P^\circ_{1\frac{1}{2}})8p$	$8p$ [½]	1	124311.72	
$6p_9$	″	$8p$ [2½]	3	124349.04	
$6p_8$			2	124356.73	
$6p_7$	″	$8p$ [1½]	1	124376.38	
$6p_6$			2	124381.01	
$6p_5$	″	$8p$ [½]	0	124439.41	
$6p_4$	$3p^5(^2P^\circ_{\frac{1}{2}})8p$	$8p'$ [1½]	1	125783.8	
$6p_3$			2	125791.94	
$6p_2$	″	$8p'$ [½]	1	125777.3	
$6p_1$			0	125831.45	
$7d_6$	$3p^5(^2P^\circ_{1\frac{1}{2}})7d$	$7d$ [½]°	0	*124526.75*	
$7d_5$			1	*124554.939*	
$7d'_4$	″	$7d$ [3½]°	4	*124609.917*	
$7d_4$			3	*124649.549*	
$7d_3$	″	$7d$ [1½]°	2	*124603.957*	
$7d_2$			1	*124788.39*	
$7d''_1$	″	$7d$ [2½]°	2	*124692.02*	
$7d'_1$			3	*124715.16*	
$7s''''_1$	$3p^5(^2P^\circ_{\frac{1}{2}})7d$	$7d'$ [2½]°	2	*126064.50*	
$7s'''_1$			3	*126089.56*	

A I—Continued

Authors	Config.	Desig.	J	Level	Obs. g
$7s_1''$	$3p^5(^2P^\circ_{\frac{1}{2}})7d$	7d′ [1½]°	2	126053.21	
			1		
$6s_5$	$3p^5(^2P^\circ_{1\frac{1}{2}})9s$	9s [1½]°	2	124771.67	
$6s_4$			1	124782.77	
$6s_3$	$3p^5(^2P^\circ_{\frac{1}{2}})9s$	9s′ [½]°	0	126202.82	
$6s_2$			1	126211.57	
7X	$3p^5(^2P^\circ_{1\frac{1}{2}})7f$	7f [1½]	1	124857.27	
7X			2	124857.42	
7V	"	7f [4½]	4, 5	124860.64	
7Y	"	7f [2½]	3	124865.04	
7Y			2	124865.19	
7U	"	7f [3½]	3, 4	124868.77	
7W	$3p^5(^2P^\circ_{\frac{1}{2}})7f$	7f′ [3½]	3, 4	126294.90	
7Z	"	7f′ [2½]	3	126295.02	
			2		
$7p_{10}$	$3p^5(^2P^\circ_{1\frac{1}{2}})9p$	9p [½]	1	125039.60	
$7p_9$	"	9p [2½]	3	125054.1	
$7p_8$			2	125059.8	
$7p_7$	"	9p [1½]	1	125072.6	
$7p_6$			2	125074.9	
$7p_5$	"	9p [½]	0	125122.54	
	$3p^5(^2P^\circ_{\frac{1}{2}})9p$	9p′ [½]	1		
$7p_1$			0	126524.2	
$8d_6$	$3p^5(^2P^\circ_{1\frac{1}{2}})8d$	8d [½]°	0	125163.00	
$8d_5$			1	125135.898	
$8d_4'$	"	8d [3½]°	4	125219.88	
$8d_4$			3	125269.52	
$8d_3$	"	8d [1½]°	2	125282.97	
			1		
$8d_1''$	"	8d [2½]°	2	125291.45	
$8d_1'$			3	125293.65	
$7s_5$	$3p^5(^2P^\circ_{1\frac{1}{2}})10s$	10s [1½]°	2	125329.99	
$7s_4$			1	125331.93	
8X	$3p^5(^2P^\circ_{1\frac{1}{2}})8f$	8f [1½]	1, 2	125386.41	
8V	"	8f [4½]	4, 5	125388.65	
8Y	"	8f [2½]	3	125391.04	
8Y			2	125391.17	
8U	"	8f [3½]	3, 4	125393.79	
$8p_{10}$	$3p^5(^2P^\circ_{1\frac{1}{2}})10p$	10p [½]	1	125505.5	
$8p_9$	"	10p [2½]	3	125519.9	
			2		
$8p_7$	"	10p [1½]	1	125531.5	
$8p_6$			2	125533.8	
$8p_5$	"	10p [½]	0	125561.9	
$9d_6$	$3p^5(^2P^\circ_{1\frac{1}{2}})9d$	9d [½]°	0	125595.11	
$9d_5$			1	125613.12	
$9d_4'$	$3p^5(^2P^\circ_{1\frac{1}{2}})9d$	9d [3½]°	4	125631.69	
$9d_4$			3	125652.04	
$9d_3$	"	9d [1½]°	2	125637.93	
$9d_2$			1	125718.12	
$9d_1''$	"	9d [2½]°	2	125671.53	
$9d_1'$			3	125680.52	
	$3p^5(^2P^\circ_{\frac{1}{2}})9d'$	9d′ [1½]°	2		
$9s_1'$			1	127130	
$8s_5$	$3p^5(^2P^\circ_{1\frac{1}{2}})11s$	11s [1½]°	2	125709.45	
$8s_4$			1	125715.50	
	$3p^5(^2P^\circ_{\frac{1}{2}})11s$	11s′ [½]°	0		
$8s_2$			1	127130	
9X	$3p^5(^2P^\circ_{1\frac{1}{2}})9f$	9f [1½]	1, 2	125748.9	
9V	"	9f [4½]	4, 5	125750.39	
9Y	"	9f [2½]	3	125752.8	
			2		
9U	"	9f [3½]	3, 4	125754.21	
$9p_{10}$	$3p^5(^2P^\circ_{1\frac{1}{2}})11p$	11p [½]	1	125844.3	
$9p_7$	"	11p [1½]	1	125853.3	
$9p_6$			2	125853.8	
$9p_5$	"	11p [½]	0	125888.9	
$10d_6$	$3p^5(^2P^\circ_{1\frac{1}{2}})10d$	10d [½]°	0	125895.72	
$10d_5$			1	125898.64	
$10d_4'$	"	10d [3½]°	4	125922.53	
$10d_4$			3	125932.59	
$10d_3$	"	10d [1½]°	2	125906.61	
			1		
$10d_1''$	"	10d [2½]°	2	125945.72	
$10d_1'$			3	125957.40	
	$3p^5(^2P^\circ_{\frac{1}{2}})10d$	10d′ [1½]°	2		
$10s_1'$			1	127410	
$9s_5$	$3p^5(^2P^\circ_{1\frac{1}{2}})12s$	12s [1½]°	2	125979.41	
$9s_4$			1	125984.35	
	$3p^5(^2P^\circ_{\frac{1}{2}})12s$	12s′ [½]°	0		
$9s_2$			1	127410	
$10p_{10}$	$3p^5(^2P^\circ_{1\frac{1}{2}})12p$	12p [½]	1	126072.6	
$10p_5$			0	126101.7	
$11d_6$	$3p^5(^2P^\circ_{1\frac{1}{2}})11d$	11d [½]°	0	126114.66	
$11d_5$			1	126099.49	
$11d_4'$	"	11d [3½]°	4	126135.42	
$11d_4$			3	126154.55	
$11d_3$	"	11d [1½]°	2	126159.9	
			1		
$11d_1''$	"	11d [2½]°	2	126162.5	
$11d_1'$			3	126163.24	

A I—Continued

Authors	Config.	Desig.	J	Level	Obs. g
	$3p^5(^2P^\circ_{½})11d$	$11d'$ [1½]°	2		
$11s_1'$			1	*127610*	
$10s_5$	$3p^5(^2P^\circ_{1½})13s$	$13s$ [1½]°	2	*126178.27*	
$10s_4$			1	*126181.30*	
	$3p^5(^2P^\circ_{½})13s$	$13s'$ [½]°	0		
$10s_2$			1	*127610*	
	$3p^5(^2P^\circ_{1½})13p$	$13p$ [½]	1		
$11p_5$			0	126270.0	
$12d_6$	$3p^5(^2P^\circ_{1½})12d$	$12d$ [½]°	0	*126281.3*	
$12d_5$			1	*126292.71*	
$12d_4'$	"	$12d$ [3½]°	4	*126295.79*	
$12d_4$			3	*126305.28*	
$12d_3$	$3p^5(^2P^\circ_{1½})13d$	$12d$ [1½]°	2	*126302.6*	
			1		
$12d_1''$	"	$12d$ [2½]°	2	*126313.1*	
$12d_1'$			3	*126316.1*	
	$3p^5(^2P^\circ_{½})12d$	$12d'$ [1½]°	2		
$12s_1'$			1	*127760*	
$11s_5$	$3p^5(^2P^\circ_{1½})14s$	$14s$ [1½]°	2	*126328.80*	
$11s_4$			1	*126332.0*	
	$3p^5(^2P^\circ_{½})14s$	$14s'$ [½]°	0		
$11s_2$			1	*127760*	
	$3p^5(^2P^\circ_{1½})13d$	$13d$ [½]°	0		
$13d_5$			1	*126412.99*	
$13d_4'$	"	$13d$ [3½]°	4	*126419.65*	
$13d_4$			3	*126426.07*	
$13d_3$	$3p^5(^2P^\circ_{1½})13d$	$13d$ [1½]°	2	*126420.8*	
			1		
$13d_1''$	"	$13d$ [2½]°	2	*126432.1*	
$13d_1'$			3	*126435.5*	
	$3p^5(^2P^\circ_{½})13d$	$13d'$ [1½]°	2		
$13s_1'$			1	*127880*	
$14d_6$	$3p^5(^2P^\circ_{1½})14d$	$14d$ [½]°	0	*126508.1*	
$14d_5$			1	*126510.06*	
$14d_4'$	"	$14d$ [3½]°	4	*126517.41*	
$14d_4$			3	*126521.71*	
$14d_3$	"	$14d$ [1½]°	2	*126514.8*	
			1		
	"	$14d$ [2½]°	2		
$14d_1'$			3	*126530.1*	
	$3p^5(^2P^\circ_{½})14d$	$14d'$ [1½]°	2		
$14s_1'$			1	*127970*	
	A II $(^2P^\circ_{1½})$	***Limit***	-----	**127109.9**	
	$3p^5(^2P^\circ_{½})15s$	$15s'$ [½]°	0		
$12s_2$			1	*127880*	
	$3p^5(^2P^\circ_{½})16s$	$16s'$ [½]°	0		
$13s_2$			1	*127970*	
	A II $(^2P^\circ_{½})$	*Limit*	-----	128541.3	

April 1948.

A I Observed Levels*

Config. $1s^2\ 2s^2\ 2p^6\ 3s^2+$	Observed Terms			
$3p^6$	$3p^6\ ^1S$			
	$ns\ (n \geq 4)$	$np\ (n \geq 4)$	$nd\ (n \geq 3)$	
$3p^5(^2P^\circ)nx$	{ 4–16s $^3P^\circ$ 4–9, 11–16s $^1P^\circ$	$4p\ ^3S$ $4p\ ^3P$ $4p\ ^3D$ $4p\ ^1S$ $4p\ ^1P$ $4p\ ^1D$	$4d\ ^3P^\circ$ $4d\ ^3D^\circ$ $4d\ ^3F^\circ$ $4d\ ^1P^\circ$ $4d\ ^1D^\circ$ $4d\ ^1F^\circ$	
jl-Coupling Notation				
	Observed Pairs			
	$ns\ (n \geq 4)$	$np\ (n \geq 4)$	$nd\ (n \geq 3)$	$nf\ (n \geq 4)$
$3p^5(^2P^\circ_{1½})nx$	4–14s [1½]°	4–13p [½] 4–10p [2½] 4–11p [1½]	3–14d [½]° 3–14d [3½]° 3–14d [1½]° 3–14d [2½]°	4–9f [1½] 5–9f [4½] 4–9f [2½] 5–9f [3½]
$3p^5(^2P^\circ_{½})nx'$	4–9, 11–16s'[½]°	4–8p'[1½] 4–9p'[½]	3– 7d'[2½]° 3–7, 9–14d'[1½]°	4–7f'[3½] 4–7f'[2½]

*For predicted levels in the spectra of the A I isoelectronic sequence, see Introduction.

A II

(Cl I sequence; 17 electrons) $Z=18$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5\ {}^2P^\circ_{1\frac{1}{2}}$

$3p^5\ {}^2P^\circ_{1\frac{1}{2}}$ *222820±300* cm^{-1} I. P. 27.62 volts

A monograph containing the complete and detailed analysis of this spectrum is needed. Most of the analysis is by de Bruin, but his work has been revised and extended by a number of investigators who are not in complete agreement on all details of interpretation.

The term list published by Boyce forms the basis of the present compilation, but the later additions and revisions by Minnhagen, Edlén, and de Bruin have been incorporated into the present list. The writer has prepared a complete multiplet array for this spectrum and in dubious cases she has attempted to adopt the term assignments that appear to be best confirmed from the multiplet evidence.

One term labeled "${}^2P$" in the table, ("*a* ${}^2P$" in the published papers), has as yet no configuration assignment. Three miscellaneous levels assigned by de Bruin (1937) to the $4f$ configuration have been omitted pending further confirmation.

The doublet and quartet terms are well connected by observed intersystem combinations.

Edlén has derived the series limit quoted here from the $({}^3P)ns\ {}^4P\ {}^2P$ series ($n=4, 5, 6$).

REFERENCES

T. L. de Bruin, Zeit. Phys. **51**, 108 (1928); Proc. Roy. Acad. Amsterdam **31**, No. 7, 771 (1928). (I P) (T) (C L)

T. L. de Bruin, Zeit. Phys. **61**, 307 (1930); Proc. Roy. Acad. Amsterdam **33**, No. 2, 198 (1930). (I P) (T) (C L)

A. H. Rosenthal, Ann. der Phys. [5] **4**, 49 (1930). (T) (C L)

J. C. Boyce, Phys. Rev. **48**, 397 (1935). (I P) (T) (C L)

T. L. de Bruin, Proc. Roy. Acad. Amsterdam **40**, No. 4, 340 (1937). (T) (C L)

B. Edlén, Zeit. Phys. **104**, 413 (1937). (I P) (T) (C L)

R. Bezler, Zeit. Phys. **116**, 480 (1940). (Z E)

L. Minnhagen, Ark. Mat. Astr. Fys. (Stockholm) **34A**, No. 22 p. 4 (1947). (T) (C L)

L. Minnhagen, Ark. Mat. Astr. Fys. (Stockholm) **35A**, No. 16 p. 3 (1948). (E D)

A II

Config.	Desig.	J	Level	Interval	Obs. g
$3s^2\ 3p^5$	$3p^5\ {}^2P^\circ$	1½	*0.0*	−1432.0	
		½	*1432.0*		
$3s\ 3p^6$	$3p^6\ {}^2S$	½	108722.5		
$3s^2\ 3p^4({}^3P)3d$	$3d\ {}^4D$	3½	132328.22	−153.90	
		2½	132482.12	−149.52	
		1½	132631.64	−106.96	
		½	132738.60		
$3s^2\ 3p^4({}^3P)4s$	$4s\ {}^4P$	2½	134242.62	−844.26	1.598
		1½	135086.88	−515.74	1.722
		½	135602.62		2.650
$3s^2\ 3p^4({}^3P)4s$	$4s\ {}^2P$	1½	138244.51	−1014.71	1.334
		½	139259.22		0.676
$3s^2\ 3p^4({}^3P)3d$	$3d\ {}^4F$	4½	142187.42	−530.59	
		3½	142718.01	−390.62	
		2½	143108.63	−263.85	
		1½	143372.48		
$3s^2\ 3p^4({}^3P)3d$	$3d\ {}^2P$	½	144710.90	958.94	
		1½	145669.84		
$3s^2\ 3p^4({}^3P)3d$	$3d\ {}^4P$	½	147229.17	274.95	
		1½	147504.12	372.86	
		2½	147876.98		

A II

Config.	Desig.	J	Level	Interval	Obs. g
$3s^2\ 3p^4({}^1D)4s$	$4s'\ {}^2D$	1½	148620.98	222.31	0.803
		2½	148843.29		1.202
$3s^2\ 3p^4({}^3P)3d$	$3d\ {}^2F$	3½	149180.18	−968.36	
		2½	150148.54		
$3s^2\ 3p^4({}^3P)3d$	$3d\ {}^2D$	1½	150475.82	612.36	
		2½	151088.18		
$3s^2\ 3p^4({}^3P)4p$	$4p\ {}^4P^\circ$	2½	*155044.07*	−307.97	1.599
		1½	*155352.04*	−356.98	1.720
		½	*155709.02*		2.638
$3s^2\ 3p^4({}^3P)4p$	$4p\ {}^4D^\circ$	3½	*157234.93*	−439.37	1.427
		2½	*157674.30*	−494.41	1.334
		1½	*158168.71*	−260.34	1.199
		½	*158429.05*		0.000
$3s^2\ 3p^4({}^3P)4p$	$4p\ {}^2D^\circ$	2½	*158731.20*	−663.12	1.241
		1½	*159394.32*		0.918
$3s^2\ 3p^4({}^3P)4p$	$4p\ {}^2P^\circ$	½	*159707.46*	532.89	0.983
		1½	*160240.35*		1.244
$3s^2\ 3p^4({}^3P)4p$	$4p\ {}^4S^\circ$	1½	*161049.65*		1.987
$3s^2\ 3p^4({}^3P)4p$	$4p\ {}^2S^\circ$	½	*161090.31*		1.695

A II—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$3s^2\,3p^4(^1S)4s$	$4s''\ ^2S$	½	167308. 66		1. 993
$3s^2\,3p^4(^1D)4p$	$4p'\ ^2F^\circ$	2½ 3½	*170401. 88* *170531. 29*	129. 41	0. 857 1. 140
$3s^2\,3p^4(^1D)4p$	$4p'\ ^2P^\circ$	1½ ½	*172214. 74* *172817. 14*	−602. 40	1. 332 0. 677
$3s^2\,3p^4(^1D)3d$	$3d'\ ^2D$	2½ 1½	172336. 47 172830. 63	−494. 16	
$3s^2\,3p^4(^1D)4p$	$4p'\ ^2D^\circ$	1½ 2½	*173348. 78* *173394. 33*	45. 55	0. 804 1. 202
$3s^2\,3p^4(^1D)3d$	$3d'\ ^2P$	1½ ½	174410. 74 174821. 94?	−411. 20	
	^2P	1½ ½	179593. 09 179932. 83	−339. 74	
$3s^2\,3p^4(^3P)5s$	$5s\ ^4P$	2½ 1½ ½	181595. 04 182223. 06 182952. 14	−628. 02 −729. 08	1. 603 1. 609 2. 550
$3s^2\,3p^4(^3P)5s$	$5s\ ^2P$	1½ ½	183091. 83 183915. 58	−823. 75	1. 445 0. 816
$3s^2\,3p^4(^3P)4d$	$4d\ ^4D$	3½ 2½ 1½ ½	183676. 42 183798. 22 183986. 83 184193. 12	−121. 80 −188. 61 −206. 29	1. 427 1. 370 1. 198 0. 380
$3s^2\,3p^4(^1D)3d$	$3d'\ ^2S$	½	184094. 10		
$3s^2\,3p^4(^3P)4d$	$4d\ ^4F$	4½ 3½ 2½ 1½	185093. 92 185625. 47 186075. 06 186341. 39	−531. 55 −449. 59 −266. 33	1. 330 1. 217 1. 045 0. 612
$3s^2\,3p^4(^3P)4d$	$4d\ ^4P$	½ 1½ 2½	186172. 32 186471. 32 186891. 92	299. 00 420. 60	2. 600 1. 494 1. 588
$3s^2\,3p^4(^1S)3d$	$3d''\ ^2D$	2½ 1½	186728. 28 186750. 78	−22. 50	
$3s^2\,3p^4(^3P)4d$	$4d\ ^2F$	3½ 2½	186817. 12 187589. 62	−772. 50	1. 167 0. 861
$3s^2\,3p^4(^3P)4d$	$4d\ ^2P$	½ 1½	189935. 62 190593. 62	658. 00	0. 667 1. 322
$3s^2\,3p^4(^3P)5p$	$5p\ ^2P^\circ$	1½ ½	*190106. 84* *190196. 80*	−89. 96	
$3s^2\,3p^4(^3P)5p$	$5p\ ^2D^\circ$	2½ 1½	 *190508. 00*		
$3s^2\,3p^4(^3P)5p$	$5p\ ^2S^\circ$	½	*191708. 46*		
$3s^2\,3p^4(^1S)4p$	$4p''\ ^2P^\circ$	1½ ½	*191975. 16* *192334. 09*	−358. 93	1. 332 0. 760

A II—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$3s^2\,3p^4(^3P)4d$	$4d\ ^2D$	2½ 1½	192557. 77 192712. 93	−155. 16	1. 198 0. 833
$3s^2\,3p^4(^3P)4f$	$4f\ ^4F^\circ$	4½ 3½ 2½ 1½	*194800. 97* *194822. 95* *194862. 31* *194997. 65*	−21. 98 −39. 36 −135. 34	
$3s^2\,3p^4(^3P)4f$	$4f\ ^4D^\circ$	3½ 2½ 1½ ½	*194883. 96* *195032. 13* *195298. 62* *195282. 50*	−148. 17 −266. 49 16. 12	
$3s^2\,3p^4(^1D)5s$	$5s'\ ^2D$	2½ 1½	195865. 61 195867. 73	−2. 12	
$3s^2\,3p^4(^3P)4f$	$4f\ \ 1^\circ$	1½	*196077. 40*		
$3s^2\,3p^4(^3P)4f$	$4f\ \ 2^\circ$	½	*196091. 04*		
$3s^2\,3p^4(^3P)4f$	$4f\ ^2D^\circ$	1½ 2½	*196622. 78* *196633. 93*	11. 15	
$3s^2\,3p^4(^1D)4d$	$4d'\ ^2G$	3½ 4½	198595. 91 198604. 78	8. 87	
$3s^2\,3p^4(^3P)6s$	$6s\ ^4P$	2½ 1½ ½	198813. 17 199138. 92 200111. 16	−325. 75 −972. 24	
$3s^2\,3p^4(^1D)4d$	$4d'\ ^2P$	½ 1½	199447. 56 199982. 96	535. 40	0. 670
$3s^2\,3p^4(^1D)4d$	$4d'\ ^2D$	1½ 2½	199525. 96 199680. 58	154. 62	1. 196
$3s^2\,3p^4(^3P)6s$	$6s\ ^2P$	1½ ½	200032. 65 200624. 00	−591. 35	
$3s^2\,3p^4(^1D)4d$	$4d'\ ^2F$	3½ 2½	200139. 84 200235. 70	−95. 86	0. 862
$3s^2\,3p^4(^3P)5d$	$5d\ ^2P$	1½ ½	204418. 50 204515. 81	−97. 31	
$3s^2\,3p^4(^3P)5d$	$5d\ ^2D$	2½ 1½	204586. 40		
$3s^2\,3p^4(^1D)4d$	$4d'\ ^2S$	½	205243. 96		2. 004
$3s^2\,3p^4(^1D)4f$	$4f'\ ^2P^\circ$	1½ ½	*208592. 90*		
$3s^2\,3p^4(^1D)6s$	$6s'\ ^2D$	1½ 2½	212932. 88 212934. 30	1. 42	
A III ($^3P_2$)	*Limit*		*222820*		

April 1948.

A II OBSERVED TERMS*

Config. $1s^2\ 2s^2\ 2p^6$	Observed Terms	
$3s^2\ 3p^5$	$3p^5\ ^2P^\circ$	
$3s\ 3p^6$	$3p^6\ ^2S$	
	ns ($n \geq 4$)	np ($n \geq 4$)
$3s^2\ 3p^4(^3P)nx$	{ 4–$6s\ ^4P$; 4–$6s\ ^2P$	$4p\ ^4S^\circ$ $4p\ ^4P^\circ$ $4p\ ^4D^\circ$; $4, 5p\ ^2S^\circ$ $4, 5p\ ^2P^\circ$ $4, 5p\ ^2D^\circ$
$3s^2\ 3p^4(^1D)nx'$	4–$6s'\ ^2D$	$4p'\ ^2P^\circ$ $4p'\ ^2D^\circ$ $4p'\ ^2F^\circ$
$3s^2\ 3p^4(^1S)nx''$	$4s''\ ^2S$	$4p''\ ^2P^\circ$
	nd ($n \geq 3$)	nf ($n \geq 4$)
$3s^2\ 3p^4(^3P)nx$	{ $3, 4d\ ^4P$ $3, 4d\ ^4D$ $3, 4d\ ^4F$; 3–$5d\ ^2P$ 3–$5d\ ^2D$ $3, 4d\ ^2F$	$4f\ ^4D^\circ$ $4f\ ^4F^\circ$; $4f\ ^2D^\circ$
$3s^2\ 3p^4(^1D)nx'$	$3, 4d'\ ^2S$ $3, 4d'\ ^2P$ $3, 4d'\ ^2D$ $4d'\ ^2F$ $4d'\ ^2G$	$4f'\ ^2P^\circ$
$3s^2\ 3p^4(^1S)nx''$	$3d''\ ^2D$	

*For predicted terms in the spectra of the Cl I isoelectronic sequence, see Introduction.

A III

(S I sequence; 16 electrons) $Z=18$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^4\ ^3P_2$

$3p^4\ ^3P_2$ **329965.80** cm^{-1} I. P. 40.90 volts

The terms are from de Bruin's 1937 paper except for singlets which are from Boyce and Edlén. The $3p^4\ ^1S$ term, according to Edlén, is derived from the nebular line at 5191.4 A, identified as the forbidden transition $3p^4\ ^1D - 3p^4\ ^1S$.

Intersystem combinations connecting the three systems of terms have been observed.

Unfortunately, no complete or homogeneous list of classified lines exists. Such a list is needed to improve the present term values and to explain the numerical discrepancies in the various published papers. De Bruin's terms here designated $3d'\ ^3P^\circ$, $4d''\ ^3P^\circ\ D^\circ\ F^\circ$, and $5s''\ ^3P^\circ$ are apparently based on unpublished observational material.

REFERENCES

V. v. Keussler, Zeit. Phys. **84,** 42 (1933). (I P) (T) (C L)

T. L. de Bruin, Proc. Roy. Acad. Amsterdam **36,** No. 7, 724 (1933). (T) (C L)

T. L. de Bruin, *Zeeman Verhandelingen* p. 414 (Martinus Nÿhoff, The Hague, 1935). (T) (C L)

J. C. Boyce, Phys. Rev. **48,** 397 (1935). (I P) (T) (C L)

J. C. Boyce, Phys. Rev. **49,** 351 (1936). (T) (C L)

T. L. de Bruin, Proc. Roy. Acad. Amsterdam **40,** No. 4, 343 (1937). (I P) (T) (C L)

B. Edlén, Phys. Rev. **62,** 434 (1942). (T) (C L)

Config.	Desig.	J	Level	Interval
$3s^2\,3p^4$	$3p^4\ ^3P$	2	0.00	−1112.40
		1	1112.40	−457.80
		0	1570.20	
$3s^2\,3p^4$	$3p^4\ ^1D$	2	14010	
$3s^2\,3p^4$	$3p^4\ ^1S$	0	33267	
$3s\ 3p^5$	$3p^5\ ^3P^\circ$	2	*113800.70*	−996.90
		1	*114797.60*	−530.80
		0	*115328.40*	
$3s\ 3p^5$	$3p^5\ ^1P^\circ$	1	*144023*	
$3s^2\,3p^3(^4S^\circ)3d$	$3d\ ^5D^\circ$	0		
		1	*144882.93*	3.04
		2	*144885.97*	6.98
		3	*144892.95*	14.05
		4	*144907.00*	
$3s^2\,3p^3(^4S^\circ)3d$	$3d\ ^3D^\circ$	3	*156917.62*	−7.06
		2	*156924.68*	−106.72
		1	*157031.40*	
$3s^2\,3p^3(^4S^\circ)4s$	$4s\ ^5S^\circ$	2	*174375.00*	
$3s^2\,3p^3(^4S^\circ)4s$	$4s\ ^3S^\circ$	1	*180679.00*	
$3s^2\,3p^3(^2D^\circ)3d$	$3d'\ ^3F^\circ$	4	*186402.15*	−255.05
		3	*186657.20*	−245.85
		2	*186903.05*	
$3s^2\,3p^3(^2D^\circ)3d$	$3d'\ ^3D^\circ$	1	*187171.12*	651.93
		2	*187823.05*	891.00
		3	*188714.05*	
$3s^2\,3p^3(^2D^\circ)3d$	$3d'\ ^3P^\circ$	0		
		1	*188517.32*	
		2		
$3s^2\,3p^3(^2D^\circ)4s$	$4s'\ ^3D^\circ$	1	*196589.20*	24.71
		2	*196613.91*	65.89
		3	*196679.80*	
$3s^2\,3p^3(^4S^\circ)4p$	$4p\ ^5P$	1	204563.53	85.71
		2	204649.24	148.13
		3	204797.37	
$3s^2\,3p^3(^2D^\circ)3d$	$3d'\ ^3S^\circ$	1	*204727.47*	
$3s^2\,3p^3(^2P^\circ)4s$	$4s''\ ^3P^\circ$	2	*207233.09*	−299.06
		1	*207532.15*	−141.01
		0	*207673.16*	
$3s^2\,3p^3(^4S^\circ)4p$	$4p\ ^3P$	2	209151.82	24.78
		1	209127.04	−39.31
		0	209166.35	
$3s^2\,3p^3(^2P^\circ)3d$	$3d''\ ^3D^\circ$	3	*210212.26*	−792.59
		2	*211004.85*	−558.98
		1	*211563.83*	
$3s^2\,3p^3(^2P^\circ)3d$	$3d''\ ^3P^\circ$	2	*213950.87*	−395.83
		1	*214346.70*	−221.79
		0	*214568.49*	
$3s^2\,3p^3(^2D^\circ)4p$	$4p'\ ^3D$	1	225155.18	−7.25
		2	225147.93	254.66
		3	225402.59	
$3s^2\,3p^3(^2D^\circ)4p$	$4p'\ ^3F$	2	226355.96	147.26
		3	226503.22	142.84
		4	226646.06	

Config.	Desig.	J	Level	Interval
$3s^2\,3p^3(^2D^\circ)4p$	$4p'\ ^3P$	2	231341.80	−285.50
		1	231627.30	−127.50
		0	231754.80	
$3s^2\,3p^3(^2P^\circ)4p$	$4p''\ ^3S$	1	239193.48	
$3s^2\,3p^3(^2P^\circ)4p$	$4p''\ ^3D$	1	240150.66	106.93
		2	240257.59	34.07
		3	240291.66	
$3s^2\,3p^3(^2P^\circ)4p$	$4p''\ ^3P$	0	242923.96	221.80
		1	243145.76	279.21
		2	243424.97	
$3s^2\,3p^3(^4S^\circ)4d$	$4d\ ^5D^\circ$	0		
		1	*246029.76*	4.03
		2	*246033.79*	2.85
		3	*246036.64*	9.93
		4	*246046.57*	
$3s^2\,3p^3(^4S^\circ)5s$	$5s\ ^5S^\circ$	2	*250712.27*	
$3s^2\,3p^3(^4S^\circ)4d$	$4d\ ^3D^\circ$	1	*252272.92*	−19.23
		2	*252253.69*	35.33
		3	*252289.02*	
$3s^2\,3p^3(^4S^\circ)5s$	$5s\ ^3S^\circ$	1	*252575.88*	
$3s^2\,3p^3(^2D^\circ)4d$	$4d'\ ^3F^\circ$	2	*266722.80*	154.70
		3	*266877.50*	193.72
		4	*267071.22*	
$3s^2\,3p^3(^2D^\circ)4d$	$4d'\ ^3G^\circ$	3	*267782.10*	51.10
		4	*267833.20*	62.62
		5	*267895.82*	
$3s^2\,3p^3(^2D^\circ)4d$	$4d'\ ^3D^\circ$	1	*268978.80*	34.00
		2	*269012.80*	−12.00
		3	*269000.80*	
$3s^2\,3p^3(^2D^\circ)4d$	$4d'\ ^3P^\circ$	2	*271507.88*	−164.20
		1	*271672.08*	−24.14
		0	*271696.22*	
$3s^2\,3p^3(^2D^\circ)4d$	$4d'\ ^3S^\circ$	1	*272068.45*	
$3s^2\,3p^3(^2D^\circ)5s$	$5s'\ ^3D^\circ$	1	*272127.82*	60.34
		2	*272188.16*	62.74
		3	*272250.90*	
$3s^2\,3p^3(^2P^\circ)4d$	$4d''\ ^3F^\circ$	2	*281461.97*	11.85
		3	*281473.82*	
		4		
$3s^2\,3p^3(^2P^\circ)4d$	$4d''\ ^3P^\circ$	0	*281947.88*	52.38
		1	*282000.26*	98.88
		2	*282099.14*	
$3s^2\,3p^3(^2P^\circ)4d$	$4d''\ ^3D^\circ$	3	*283919.78*	−176.48
		2	*284096.26*	−22.25
		1	*284118.51*	
$3s^2\,3p^3(^2P^\circ)5s$	$5s''\ ^3P^\circ$	0	*285831.20*	50.80
		1	*285882.00*	127.21
		2	*286009.21*	
A IV ($^4S^\circ_{1\frac{1}{2}}$)	*Limit*	-------	**329965.80**	

February 1948.

A III OBSERVED TERMS*

Config. $1s^2\,2s^2\,2p^6+$	Observed Terms								
$3s^2\,3p^4$	$3p^4\ ^1S$	$3p^4\ ^3P$	$3p^4\ ^1D$						
$3s\,3p^5$		$3p^5\ ^3P^o$ $3p^5\ ^1P^o$							
	$ns\ (n\geq 4)$					$np\ (n\geq 4)$			
$3s^2\,3p^3(^4S^o)nx$	$4, 5s\ ^5S^o$ $4, 5s\ ^3S^o$						$4p\ ^5P$ $4p\ ^3P$		
$3s^2\,3p^3(^2D^o)nx'$			$4, 5s'\ ^3D^o$				$4p'\ ^3P$	$4p'\ ^3D$	$4p'\ ^3F$
$3s^2\,3p^3(^2P^o)nx''$		$4, 5s''\ ^3P^o$				$4p''\ ^3S$	$4p''\ ^3P$	$4p''\ ^3D$	
	$nd\ (n\geq 3)$								
$3s^2\,3p^3(^4S^o)nx$			$3, 4d\ ^5D^o$ $3, 4d\ ^3D^o$						
$3s^2\,3p^3(^2D^o)nx'$	$3, 4d'\ ^3S^o$	$3, 4d'\ ^3P^o$	$3, 4d'\ ^3D^o$	$3, 4d'\ ^3F^o$	$4d'\ ^3G^o$				
$3s^2\,3p^3(^2P^o)nx''$		$3, 4d''\ ^3P^o$	$3, 4d''\ ^3D^o$	$4d''\ ^3F^o$					

*For predicted terms in the spectra of the S I isoelectronic sequence, see Introduction.

A IV

(P I sequence; 15 electrons) $Z=18$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^3\ ^4S^o_{1\frac{1}{2}}$

$3p^3\ ^4S^o_{1\frac{1}{2}}$ *482400* cm^{-1} I. P. 59.79 volts

The analysis is incomplete. Boyce has classified 26 lines in the range between 396 A and 1197 A and listed 8 terms.

De Bruin has extended the analysis and published the term list which is quoted here. Intersystem combinations connecting the doublet and quartet terms have been observed.

The ionization potential estimated by Edlén from isoelectronic sequence data has been used to calculate the limit (entered in brackets in the table).

REFERENCES

J. C. Boyce, Phys. Rev. **48**, 401 (1935). (I P) (T) (C L)

B. Edlén, *Zeeman Verhandelingen* p. 91 (Martinus Nÿhoff, The Hague, 1935). (I P)

T. L. de Bruin, Physica **3**, No. 8, 809 (1936). (T) (C L)

A. B. Rao, Ind. J. Phys. **12**, 399 (1938). (T) (C L)

A IV

Config.	Desig.	J	Level	Interval
$3s^2\ 3p^3$	$3p^3\ {}^4S^\circ$	1½	*0.00*	
$3s^2\ 3p^3$	$3p^3\ {}^2D^\circ$	1½ 2½	*21090* *21219*	129
$3s^2\ 3p^3$	$3p^3\ {}^2P^\circ$	½ 1½	*34854* *35035*	181
$3s\ 3p^4$	$3p^4\ {}^4P$	2½ 1½ ½	117564 118515 119044	−951 −529
$3s\ 3p^4$	$3p^4\ {}^2D$	1½ 2½	145921 146000	79
$3s\ 3p^4$	$3p^4\ {}^2P$	1½ ½	166356 167444	−1088
$3p^4$	$3p^4\ {}^2S$	½	177833	
$3s^2\ 3p^2(^3P)4s$	$4s\ {}^4P$	½ 1½ 2½	250219.45 250906.60 251972.00	687.15 1065.40
$3s^2\ 3p^2(^3P)4s$	$4s\ {}^2P$	½ 1½	256093.29 257348.89	1255.60
$3s^2\ 3p^2(^1D)4s$	$4s'\ {}^2D$	2½ 1½	268151.38 268171.38	−20.00
$3s^2\ 3p^2(^3P)4p$	$4p\ {}^4D^\circ$	½ 1½ 2½ 3½	*285960.17* *286228.80* *286751.68* *287555.83*	268.63 522.88 804.15
$3s^2\ 3p^2(^3P)4p$	$4p\ {}^4P^\circ$	½ 1½ 2½	*289125.88* *289237.82* *289834.68*	111.94 596.86
$3s^2\ 3p^2(^3P)4p$	$4p\ {}^2D^\circ$	1½ 2½	*290256.45* *291667.73*	1411.28
$3s^2\ 3p^2(^3P)4p$	$4p\ {}^4S^\circ$	1½	*291748.70*	
$3s^2\ 3p^2(^3P)4p$	$4p\ {}^2P^\circ$	½ 1½	*295674.54* *295806.77*	132.23
$3s^2\ 3p^2(^3P)4p$	$4p\ {}^2S^\circ$	½	*299563.20*	
$3s^2\ 3p^2(^1D)4p$	$4p'\ {}^2F^\circ$	2½ 3½	*304074.29* *304399.90*	325.61
$3s^2\ 3p^2(^1D)4p$	$4p'\ {}^2D^\circ$	2½ 1½	*306236.28* *306308.25*	−71.97
A v ($^3P_0$)	*Limit*	-------	[*482400*]	

November 1947.

A IV Observed Terms*

Config. $1s^2\ 2s^2\ 2p^6+$	Observed Terms					
$3s^2\ 3p^3$	$3p^3\ {}^4S^\circ$	$3p^3\ {}^2P^\circ$	$3p^3\ {}^2D^\circ$			
$3s\ 3p^4$	$3p^4\ {}^2S$	$3p^4\ {}^4P$ $3p^4\ {}^2P$	$3p^4\ {}^2D$			
	ns ($n\geq 4$)			*np* ($n\geq 4$)		
$3s^2\ 3p^2(^3P)nx$		$4s\ {}^4P$ $4s\ {}^2P$		$4p\ {}^4S^\circ$ $4p\ {}^2S^\circ$	$4p\ {}^4P^\circ$ $4p\ {}^2P^\circ$	$4p\ {}^4D^\circ$ $4p\ {}^2D^\circ$
$3s^2\ 3p^2(^1D)nx'$			$4s'\ {}^2D$			$4p'\ {}^2D^\circ$ $4p'\ {}^2F^\circ$

*For predicted terms in the spectra of the P I isoelectronic sequence, see Introduction.

A V

(Si I sequence; 14 electrons) $Z=18$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^2\ {}^3P_0$

$3p^2\ {}^3P_0$ **605100** cm^{-1} I. P. 75.0 volts

The terms have been taken from the paper by Phillips and Parker. This includes the earlier work by Boyce. Thirty-six lines have been classified in the region between 336 A and 836 A. Intersystem combinations connecting the singlet and triplet terms have been observed. No quintet terms have been found.

Using the method suggested by Edlén for extrapolation along the isoelectronic sequence, the writer has estimated the value of the limit quoted above and entered in brackets in the table.

REFERENCES

J. C. Boyce, Phys. Rev. **48**, 401 (1935). (I P) (T) (C L)

B. Edlén, *Zeeman Verhandelingen* p. 91 (Martinus Nÿhoff, The Hague, 1935). (I P)

L. W. Phillips and W. L. Parker, Phys. Rev. **60**, 301 (1941). (T) (C L)

A V

Config.	Desig.	J	Level	Interval
$3s^2\ 3p^2$	$3p^2\ {}^3P$	0	0	
				765
		1	765	
				1267
		2	2032	
$3s^2\ 3p^2$	$3p^2\ {}^1D$	2	16301	
$3s\ 3p^3$	$3p^3\ {}^3D^\circ$	1	*121632*	
				46
		2	*121678*	
				132
		3	*121810*	
$3s\ 3p^3$	$3p^3\ {}^3P^\circ$	2	*141764*	
				−9
		1, 0	*141773*	
$3s\ 3p^3$	$3p^3\ {}^3S^\circ$	1	*191537*	
$3s\ 3p^3$	$3p^3\ {}^1P^\circ$	1	*195356*	
$3s^2\ 3p(^2P^\circ)3d$	$3d\ {}^3P^\circ$	2	*217578*	
				−708
		1	*218286*	
				−356
		0	*218642*	
$3s^2\ 3p(^2P^\circ)3d$	$3d\ {}^3D^\circ$	1	*224216*	
				289
		2	*224505*	
				212
		3	*224717*	
$3s^2\ 3p(^2P^\circ)4s$	$4s\ {}^3P^\circ$	0	*295742*	
				507
		1	*296249*	
				1644
		2	*297893*	
$3s^2\ 3p(^2P^\circ)4s$	$4s\ {}^1P^\circ$	1	*301300*	
A VI ($^2P^\circ_{1/2}$)	*Limit*		[605100]	

October 1947.

A VI

(Al I sequence; 13 electrons) $Z=18$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p\ ^2P^\circ_{1/2}$

$3p\ ^2P^\circ_{1/2}$ *736600* cm^{-1} I. P. 91.3 volts

The analysis is by Phillips and Parker, who have classified 37 lines in the region between 180 A and 596 A. No intersystem combinations have been observed. They estimate that $3p^2\ ^4P_{1/2}$ is 100,000 cm^{-1} above the ground state, with an uncertainty x equal to ± 1000 cm^{-1}. This value is entered in brackets in the table, and it has been added to the published values of all quartet terms.

Their limit, derived from the three members of the $3p\ ^2P^\circ - nd\ ^2D$ series is 721300 ± 300 cm^{-1} (I. P. 89.41 ± 0.04). Using the method suggested by Edlén, the writer has extrapolated the value of the limit quoted above and entered in brackets in the table. The uncertainty in this estimate is large because of the incompleteness of the isoelectronic sequence data.

REFERENCE

L. W. Phillips and W. L. Parker, Phys. Rev. **60**, 301 (1941). (I P) (T) (C L)

A VI

Config.	Desig.	J	Level	Interval
$3s^2(^1S)3p$	$3p\ ^2P^\circ$	½	*0*	
		1½	*2210*	2210
$3s\ 3p^2$	$3p^2\ ^4P$	½	[100000]+x	
		1½	100802 +x	802
		2½	102034 +x	1232
$3s\ 3p^2$	$3p^2\ ^2S$	½	169801	
$3s\ 3p^2$	$3p^2\ ^2P$	½	182182	
		1½	183577	1395
$3s^2(^1S)3d$	$3d\ ^2D$	1½	218592	
		2½	218657	65
$3p^3$	$3p^3\ ^4S^\circ$	1½	*270356* +x	
$3s\ 3p(^3P^\circ)3d$	$3d\ ^4P^\circ$	2½	*316199* +x	
		1½	*316815* +x	−616
		½	*317298* +x	−483

A VI

Config.	Desig.	J	Level	Interval
$3s\ 3p(^3P^\circ)3d$	$3d\ ^4D^\circ$	½	*319121*+x	
		1½	*319393*+x	272
		2½	*319615*+x	222
		3½	*319747*+x	132
$3s^2(^1S)4s$	$4s\ ^2S$	½	342286	
$3s\ 3p(^3P^\circ)4s$	$4s\ ^4P^\circ$	½	*453954*+x	
		1½	*454716*+x	762
		2½	*456115*+x	1399
$3s^2(^1S)4d$	$4d\ ^2D$	1½	454760	
		2½	454810	50
$3s^2(^1S)5d$	$5d\ ^2D$	1½	555330	
		2½	555555	225
A VII ($^1S_0$)	*Limit*	-------	[*736600*]	

September 1947.

A VI OBSERVED TERMS*

Config. $1s^2\ 2s^2\ 2p^6+$	Observed Terms	
$3s^2(^1S)3p$	$3p\ ^2P^\circ$	
$3s\ 3p^2$	$3p^2\ ^2S$; $3p^2\ ^4P$; $3p^2\ ^2P$	
$3p^3$	$3p^3\ ^4S^\circ$	
	ns ($n \geq 4$)	*nd* ($n \geq 3$)
$3s^2(^1S)nx$	$4s\ ^2S$	3–5$d\ ^2D$
$3s\ 3p(^3P^\circ)nx$	$4s\ ^4P^\circ$	$3d\ ^4P^\circ$ $3d\ ^4D^\circ$

*For predicted terms in the spectra of the Al I isoelectronic sequence, see Introduction.

A VII

(Mg I sequence; 12 electrons) $Z=18$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\;^1S_0$

$3s^2\;^1S_0$ **1000400** cm^{-1} I. P. 124.0 volts

Phillips and Parker have classified 25 lines in the interval between 151 A and 644 A. No intersystem combinations have been observed.

From the D-series they derive an absolute value of $3p\;^3P^\circ_0$ equal to 891000 ± 200 cm^{-1}, and by extrapolation along the isoelectronic sequence estimate the absolute value of $3s^2\;^1S_0$ as 1005000 ± 1000 cm^{-1}.

From later data on this sequence the writer has extrapolated these values by the method suggested by Edlén, and adopted the revised entries given in the table in brackets.

REFERENCE

L. W. Phillips and W. L. Parker, Phys. Rev. **60**, 305 (1941). (I P) (T) (C L)

A VII

Config.	Desig.	J	Level	Interval
$3s^2$	$3s^2\;^1S$	0	0	
$3s(^2S)3p$	$3p\;^3P^\circ$	0	*[113095]*+x	
		1	*113900* +x	805
		2	*115581* +x	1681
$3s(^2S)3p$	$3p\;^1P^\circ$	1	*170720*	
$3p^2$	$3p^2\;^3P$	0	269829 +x	
		1	270770 +x	941
		2	272554 +x	1784
$3s(^2S)3d$	$3d\;^3D$	1	324097 +x	
		2	324136 +x	39
		3	324184 +x	48
$3s(^2S)4s$	$4s\;^3S$	1	514083 +x	
$3s(^2S)4p$	$4p\;^1P^\circ$	1	*566362*	
$3s(^2S)4d$	$4d\;^3D$	1	634584+x	
		2	634622+x	38
		3	634697+x	75
$3s(^2S)4f$	$4f\;^3F^\circ$	2, 3, 4	*660092*	
$3s(^2S)5d$	$5d\;^3D$	1	772300+x	
		2	772325+x	25
		3	772355+x	30
A VIII ($^2S_{1/2}$)	*Limit*	-------	**[1000400]**	

August 1947.

A VIII

(Na I sequence; 11 electrons) $Z=18$

Ground state $1s^2\,2s^2\,2p^6\,3s\;^2S_{1/2}$

$3s\;^2S_{1/2}$ **1157400** cm^{-1} I. P. 143.46 ± 0.05 volts

Phillips and Parker classified 23 lines in the interval 120 A to 526 A. The resonance lines calculated at 700.398 A and 713.990 A, have not been observed. Absolute term values were derived from four members of the ^2D-series.

REFERENCE

L. W. Phillips and W. L. Parker, Phys. Rev. **60**, 305 (1941). (I P) (T) (C L)

A VIII

Config.	Desig.	J	Level	Interval
$3s$	$3s\ ^2S$	½	0	
$3p$	$3p\ ^2P^\circ$	½ 1½	*140058* *142776*	2718
$3d$	$3d\ ^2D$	1½ 2½	332576 332727	151
$4s$	$4s\ ^2S$	½	575910	
$4p$	$4p\ ^2P^\circ$	½ 1½	*628240* *629237*	997
$4d$	$4d\ ^2D$	1½ 2½	697471 697548	77
$4f$	$4f\ ^2F^\circ$	2½ 3½	*716818* *716852*	34
$5s$	$5s\ ^2S$	½	812422	
$5p$	$5p\ ^2P^\circ$	½ 1½	*832245* *832691*	446
$5d$	$5d\ ^2D$	1½ 2½	865084 865111	27
$5f$	$5f\ ^2F^\circ$	2½ 3½	*875248* *875277*	29
$6d$	$6d\ ^2D$	{1½, 2½}	955560	
A IX ($^1S_0$)	*Limit*	-------	1157400	

June 1947.

A IX

(Ne I sequence; 10 electrons) $Z=18$

Ground state $1s^2\ 2s^2\ 2p^6\ ^1S_0$

$2p^6\ ^1S_0$ cm^{-1} I. P. 421 volts

Two lines observed at 49.180 A and 48.730 A have been classified by Phillips and Parker as combinations with the ground term. The measurements may be in error by ± 0.002 A or ± 100 cm^{-1}.

As for Ne I, the *jl*-coupling notation in the general form suggested by Racah is here introduced.

REFERENCES

L. W. Phillips and W. L. Parker, Phys. Rev. **60**, 306 (1941). (T) (C L)

G. Racah, Phys. Rev. **61**, 537 (L) (1942).

B. Edlén, Zeit. Astroph. **22**, 62 (1942). (I P)

A IX

Authors	Config.	Desig.	J	Level
$^1S_0$	$2p^6$	$2p^6\ ^1S$	0	0
$^3P_1$	$2p^5(^2P^\circ_{1\frac{1}{2}})3s$	$3s\ [1\frac{1}{2}]^\circ$	2 1	 *2033350*
$^1P_1$	$2p^5(^2P^\circ_{\frac{1}{2}})3s$	$3s'\ [\frac{1}{2}]^\circ$	0 1	 *2052120*

April 1947.

A X

(F I sequence; 9 electrons) $Z=18$

Ground state $1s^2\,2s^2\,2p^5\;{}^2P^\circ_{1\frac{1}{2}}$

$2p^5\;{}^2P^\circ_{1\frac{1}{2}}$ cm⁻¹ I. P. volts

This spectrum has not been analyzed. By interpolation along the F I isoelectronic sequence from F I through Ca XII, Edlén derives a reliable estimated value of the interval of the ground term, $2p^5\;{}^2P^\circ_{1\frac{1}{2}}-2p^5\;{}^2P^\circ_{\frac{1}{2}}$, equal to 18063 cm^{-1}. The faint coronal line observed at 5536 A, wave number 18059 cm^{-1}, may thus be tentatively identified as this forbidden line of A X, according to Edlén.

REFERENCE

B. Edlén, Zeit. Astroph. **22**, 59 (1942). (T)

March 1947.

A XI

(O I sequence; 8 electrons) $Z=18$

Ground state $1s^2\,2s^2\,2p^4\;{}^3P_2$

$2p^4\;{}^3P_2$ cm⁻¹ I. P. volts

This spectrum has not been analyzed. By extrapolation along the O I isoelectronic sequence Edlén estimates the separation $2p^4\;{}^3P_2-2p^4\;{}^3P_1$ to be approximately 14449 cm^{-1}, or 6919 A. This line has not been identified in the solar corona.

REFERENCE

B. Edlén, Zeit. Astroph. **22**, 59 (1942). (T)

March 1947.

A XIV

(B I sequence; 5 electrons) $Z=18$

Ground state $1s^2\,2s^2\,2p\;{}^2P^\circ_{\frac{1}{2}}$

$2p\;{}^2P^\circ_{\frac{1}{2}}$ cm⁻¹ I. P. volts

By extrapolation of the B I isoelectronic sequence, Edlén estimates that the separation of the lowest term $2p\;{}^2P^\circ_{\frac{1}{2}}-2p\;{}^2P^\circ_{1\frac{1}{2}}$, falls near enough to warrant tentative identification of the coronal line observed at 4359 A (wave number 22935 cm^{-1}) as [A XIV].

REFERENCE

B. Edlén, Zeit. Astroph. **22**, 59 (1942). (T)

March 1947.

POTASSIUM

K I

19 electrons $Z=19$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s\ ^2S_{1/2}$

$4s\ ^2S_{1/2}$ **35009.78** cm^{-1} I. P. 4.339 volts

H. R. Kratz has observed in absorption the $np\ ^2P^\circ$ series to $n=79$. He has generously furnished a list of his final term values in advance of publication, for inclusion here. His value of the limit is quoted. The series $ns\ ^2S$ ($n=4$ to 8), $nd\ ^2D$ ($n=3$ to 6), and $nf\ ^2F^\circ$ ($n=4$ to 9) are from Edlén, who revised the older values. Edlén remarks that the $ns\ ^2S$ and $nd\ ^2D$ series can best be continued by an extrapolation of the appropriate series formula, since the observed wavelengths are uncertain. This comment applies to the listed values of $ns\ ^2S$($n=9$ to 13), which are from Fowler's Report. Mack has furnished revised values of $nd\ ^2D$($n=8$ to 13), derived from observations of the forbidden transitions $6s-nd$ on the plates of Kratz. The last two members of this series are, respectively, 34213.1 and 34332.6.

From Paschen's classifications of far infrared lines Edlén concludes that the $5g\ ^2G$ and $6h\ ^2H^\circ$ terms are H-like. The terms derived from these calculations are entered in brackets in the table. Compared with all others, the terms $4f\ ^2F^\circ$, $5f\ ^2F^\circ$, and $5s\ ^2S$, derived from far infrared observations, are somewhat uncertain, according to Edlén.

No attempt has been made to give a complete bibliography of papers dealing with hyperfine structure of K I. From interferometric measures of the combinations $4p\ ^2P^\circ-nd\ ^2D$ ($n=5$ to 8) Masaki and Kobayakawa observe the following term intervals:

	$n=5$	6	7	8
$nd\ ^2D$	−0. 503	−0. 262	−0. 158	−0. 096
$4p\ ^2P^\circ_{1/2}-4p\ ^2P^\circ_{1 1/2}$	57. 600	57. 600	57. 599	57. 600

The papers on Zeeman effect deal only with forbidden transitions of K I. From observations in a magnetic field of the lines at 4642 A and 4641 A ($4s\ ^2S-3d\ ^2D$) Segrè and Bakker observe the interval of $3d\ ^2D$ to be 2.325 ± 0.015 cm^{-1}.

The K I^b resonance lines have been observed in absorption by Beutler and Guggenheimer at 662.38 A and 653.31 A. The $4s^2\ ^2P^\circ$ term in the table has been calculated from these lines.

REFERENCES

S. Datta, Proc. Roy. Soc. London [A] **101,** 539 (1922). (I P) (T) (C L)

A. Fowler, *Report on Series in Line Spectra* p. 101 (Fleetway Press, London, 1922). (I P) (T) (C L)

F. Paschen und R. Götze, *Seriengesetze der Linienspektren* p. 59 (Julius Springer, Berlin, 1922). (I P) (T) (C L)

W. Grotrian, *Graphische Darstellung der Spektren von Atomen und Ionen mit ein, zwei and drei Valenzelektronen,* Part II, p. 29 (Julius Springer, Berlin, 1928). (G D)

E. Segrè und C. J. Bakker, Zeit. Phys. **72,** 724 (1931). (Z E)

H. Beutler und K. Guggenheimer, Zeit. Phys. **87,** 188 (1933). (T) (C L)

W. F. Meggers, Bur. Std. J. Research **10,** 673, RP558 (1933). (C L)

W. F. Meggers, J. Research Nat. Bur. Std. **14,** 497, RP781 (1935). (C L)

B. Edlén, Zeit. Phys. **98,** 453 (1936). (I P) (T) (C L)

O. Masaki and K. Kobayakawa, J. Sci. Hirosima Univ. [A] **6,** 217 (1936). (C L)

F. A. Jenkins and E. Segrè, Phys. Rev. **55,** 545 (1939). (Z E)

W. F. Meggers, J. Opt. Soc. Am. **36,** 431 (1946). (Summary hfs)

H. R. Kratz, unpublished material (Dec. 1947). (I P) (T)

Config.	Desig.	J	Level	Interval
$3p^6(^1S)4s$	$4s\ ^2S$	½	0. 00	
$3p^6(^1S)4p$	$4p\ ^2P^\circ$	½ 1½	*12985. 17* *13042. 89*	57. 72
$3p^6(^1S)5s$	$5s\ ^2S$	½	21026. 8	
$3p^6(^1S)3d$	$3d\ ^2D$	2½ 1½	21534. 42 21536. 75	−2. 33
$3p^6(^1S)5p$	$5p\ ^2P^\circ$	½ 1½	*24701. 44* *24720. 20*	18. 76
$3p^6(^1S)4d$	$4d\ ^2D$	2½ 1½	27397. 01 27398. 11	−1. 10
$3p^6(^1S)6s$	$6s\ ^2S$	½	27450. 65	
$3p^6(^1S)4f$	$4f\ ^2F^\circ$	{3½ 2½}	*28127. 7*	
$3p^6(^1S)6p$	$6p\ ^2P^\circ$	½ 1½	*28999. 29* *29007. 70*	8. 41
$3p^6(^1S)5d$	$5d\ ^2D$	2½ 1½	30185. 18 30185. 69	−0. 51
$3p^6(^1S)7s$	$7s\ ^2S$	½	30274. 26	
$3p^6(^1S)5f$	$5f\ ^2F^\circ$	{3½ 2½}	*30605. 6*	
$3p^6(^1S)5g$	$5g\ ^2G$	{3½ 4½}	[30619. 8]	
$3p^6(^1S)7p$	$7p\ ^2P^\circ$	½ 1½	*31069. 98* *31074. 46*	4. 48
$3p^6(^1S)6d$	$6d\ ^2D$	2½ 1½	31695. 51 31695. 75	−0. 24
$3p^6(^1S)8s$	$8s\ ^2S$	½	31764. 95	
$3p^6(^1S)6f$	$6f\ ^2F^\circ$	{3½ 2½}	*31953. 0*	
$3p^6(^1S)6h$	$6h\ ^2H^\circ$	{4½ 5½}	[*31960. 6*]	
$3p^6(^1S)6g$	$6g\ ^2G$	{3½ 4½}	[31960. 8]	
$3p^6(^1S)8p$	$8p\ ^2P^\circ$	½ 1½	*32227. 42* *32230. 12*	2. 70
$3p^6(^1S)7d$	$7d\ ^2D$	{2½ 1½}	32598. 46	
$3p^6(^1S)9s$	$9s\ ^2S$	½	32648. 17	
$3p^6(^1S)7f$	$7f\ ^2F^\circ$	{3½ 2½}	*32764. 52*	
$3p^6(^1S)9p$	$9p\ ^2P^\circ$	½ 1½	*32940. 34* *32942. 08*	1. 74
$3p^6(^1S)8d$	$8d\ ^2D$	{2½ 1½}	33178. 36	
$3p^6(^1S)10s$	$10s\ ^2S$	½	33214. 39	
$3p^6(^1S)8f$	$8f\ ^2F^\circ$	{3½ 2½}	*33291. 04*	
$3p^6(^1S)10p$	$10p\ ^2P^\circ$	½ 1½	*33410. 34* *33411. 54*	1. 20
$3p^6(^1S)9d$	$9d\ ^2D$	{2½ 1½}	33572. 11	

Config.	Desig.	J	Level	Interval
$3p^6(^1S)11s$	$11s\ ^2S$	½	33598. 17	
$3p^6(^1S)9f$	$9f\ ^2F^\circ$	{3½ 2½}	*33652. 0*	
$3p^6(^1S)11p$	$11p\ ^2P^\circ$	½ 1½	*33736. 60* *33737. 44*	0. 84
$3p^6(^1S)10d$	$10d\ ^2D$	{2½ 1½}	33851. 76	
$3p^6(^1S)12s$	$12s\ ^2S$	½	33869. 7	
$3p^6(^1S)12p$	$12p\ ^2P^\circ$	½ 1½	*33972. 34* *33972. 94*	0. 60
$3p^6(^1S)11d$	$11d\ ^2D$	{2½ 1½}	34056. 9	
$3p^6(^1S)13s$	$13s\ ^2S$	½	34069. 3	
$3p^6(^1S)13p$	$13p\ ^2P^\circ$	½ 1½	*34148. 15* *34148. 63*	0. 48
$3p^6(^1S)14p$	$14p\ ^2P^\circ$	½ 1½	*34282. 77* *34283. 15*	0. 38
$3p^6(^1S)15p$	$15p\ ^2P^\circ$	½ 1½	*34388. 16* *34388. 46*	0. 30
$3p^6(^1S)16p$	$16p\ ^2P^\circ$	½ 1½	*34472. 18* *34472. 43*	0. 25
$3p^6(^1S)17p$	$17p\ ^2P^\circ$	½ 1½	*34540. 23* *34540. 44*	0. 21
$3p^6(^1S)18p$	$18p\ ^2P^\circ$	{½ 1½}	*34596. 27*	
$3p^6(^1S)19p$	$19p\ ^2P^\circ$	{½ 1½}	*34642. 78*	
$3p^6(^1S)20p$	$20p\ ^2P^\circ$	{½ 1½}	*34681. 84*	
$3p^6(^1S)21p$	$21p\ ^2P^\circ$	{½ 1½}	*34714. 98*	
$3p^6(^1S)22p$	$22p\ ^2P^\circ$	{½ 1½}	*34743. 37*	
$3p^6(^1S)23p$	$23p\ ^2P^\circ$	{½ 1½}	*34767. 78*	
$3p^6(^1S)24p$	$24p\ ^2P^\circ$	{½ 1½}	*34789. 03*	
$3p^6(^1S)25p$	$25p\ ^2P^\circ$	{½ 1½}	*34807. 62*	
$3p^6(^1S)26p$	$26p\ ^2P^\circ$	{½ 1½}	*34823. 83*	
$3p^6(^1S)27p$	$27p\ ^2P^\circ$	{½ 1½}	*34838. 30*	
$3p^6(^1S)28p$	$28p\ ^2P^\circ$	{½ 1½}	*34851. 11*	
$3p^6(^1S)29p$	$29p\ ^2P^\circ$	{½ 1½}	*34862. 52*	
$3p^6(^1S)30p$	$30p\ ^2P^\circ$	{½ 1½}	*34872. 70*	
$3p^6(^1S)31p$	$31p\ ^2P^\circ$	{½ 1½}	*34881. 94*	
$3p^6(^1S)32p$	$32p\ ^2P^\circ$	{½ 1½}	*34890. 20*	

K I—Continued

Config.	Desig.	J	Level	Interval
$3p^6(^1S)33p$	$33p\ ^2P^{\circ}$	½, 1½	34897.75	
$3p^6(^1S)34p$	$34p\ ^2P^{\circ}$	½, 1½	34904.57	
$3p^6(^1S)35p$	$35p\ ^2P^{\circ}$	½, 1½	34910.79	
$3p^6(^1S)36p$	$36p\ ^2P^{\circ}$	½, 1½	34916.51	
$3p^6(^1S)37p$	$37p\ ^2P^{\circ}$	½, 1½	34921.69	
$3p^6(^1S)38p$	$38p\ ^2P^{\circ}$	½, 1½	34926.47	
$3p^6(^1S)39p$	$39p\ ^2P^{\circ}$	½, 1½	34930.91	
$3p^6(^1S)40p$	$40p\ ^2P^{\circ}$	½, 1½	34934.97	
$3p^6(^1S)41p$	$41p\ ^2P^{\circ}$	½, 1½	34938.72	
$3p^6(^1S)42p$	$42p\ ^2P^{\circ}$	½, 1½	34942.20	
$3p^6(^1S)43p$	$43p\ ^2P^{\circ}$	½, 1½	34945.49	
$3p^6(^1S)44p$	$44p\ ^2P^{\circ}$	½, 1½	34948.48	
$3p^6(^1S)45p$	$45p\ ^2P^{\circ}$	½, 1½	34951.26	
$3p^6(^1S)46p$	$46p\ ^2P^{\circ}$	½, 1½	34953.85	
$3p^6(^1S)47p$	$47p\ ^2P^{\circ}$	½, 1½	34956.32	
$3p^6(^1S)48p$	$48p\ ^2P^{\circ}$	½, 1½	34958.61	
$3p^6(^1S)49p$	$49p\ ^2P^{\circ}$	½, 1½	34960.73	
$3p^6(^1S)50p$	$50p\ ^2P^{\circ}$	½, 1½	34962.83	
$3p^6(^1S)51p$	$51p\ ^2P^{\circ}$	½, 1½	34964.67	
$3p^6(^1S)52p$	$52p\ ^2P^{\circ}$	½, 1½	34966.45	
$3p^6(^1S)53p$	$53p\ ^2P^{\circ}$	½, 1½	34968.09	
$3p^6(^1S)54p$	$54p\ ^2P^{\circ}$	½, 1½	34969.69	
$3p^6(^1S)55p$	$55p\ ^2P^{\circ}$	½, 1½	34971.17	
$3p^6(^1S)56p$	$56p\ ^2P^{\circ}$	½, 1½	34972.57	
$3p^6(^1S)57p$	$57p\ ^2P^{\circ}$	½, 1½	34973.88	

K I—Continued

Config.	Desig.	J	Level	Interval
$3p^6(^1S)58p$	$58p\ ^2P^{\circ}$	½, 1½	34975.15	
$3p^6(^1S)59p$	$59p\ ^2P^{\circ}$	½, 1½	34976.36	
$3p^6(^1S)60p$	$60p\ ^2P^{\circ}$	½, 1½	34977.50	
$3p^6(^1S)61p$	$61p\ ^2P^{\circ}$	½, 1½	34978.62	
$3p^6(^1S)62p$	$62p\ ^2P^{\circ}$	½, 1½	34979.60	
$3p^6(^1S)63p$	$63p\ ^2P^{\circ}$	½, 1½	34980.65	
$3p^6(^1S)64p$	$64p\ ^2P^{\circ}$	½, 1½	34981.58	
$3p^6(^1S)65p$	$65p\ ^2P^{\circ}$	½, 1½	34982.47	
$3p^6(^1S)66p$	$66p\ ^2P^{\circ}$	½, 1½	34983.27	
$3p^6(^1S)67p$	$67p\ ^2P^{\circ}$	½, 1½	34984.10	
$3p^6(^1S)68p$	$68p\ ^2P^{\circ}$	½, 1½	34984.83	
$3p^6(^1S)69p$	$69p\ ^2P^{\circ}$	½, 1½	34985.57	
$3p^6(^1S)70p$	$70p\ ^2P^{\circ}$	½, 1½	34986.25	
$3p^6(^1S)71p$	$71p\ ^2P^{\circ}$	½, 1½	34986.96	
$3p^6(^1S)72p$	$72p\ ^2P^{\circ}$	½, 1½	34987.53	
$3p^6(^1S)73p$	$73p\ ^2P^{\circ}$	½, 1½	34988.19	
$3p^6(^1S)74p$	$74p\ ^2P^{\circ}$	½, 1½	34988.85	
$3p^6(^1S)75p$	$75p\ ^2P^{\circ}$	½, 1½	34989.4	
$3p^6(^1S)76p$	$76p\ ^2P^{\circ}$	½, 1½	34989.9	
$3p^6(^1S)77p$	$77p\ ^2P^{\circ}$	½, 1½	34990.5	
$3p^6(^1S)78p$	$78p\ ^2P^{\circ}$	½, 1½	34990.8	
$3p^6(^1S)79p$	$79p\ ^2P^{\circ}$	½, 1½	34991.2	
-------	-------	-------	-------	
K II ($^1S_0$)	*Limit*	-------	**35009.78**	
$3p^5(^3P^{\circ}_2)4s^2$	$4s^2\ ^2P^{\circ}$	1½	150970	−2096
$3p^5(^1P^{\circ}_1)4s^2$		½	153066	

May 1948.

K II

(A I sequence; 18 electrons) $Z=19$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ {}^1S_0$

$3p^6\ {}^1S_0$ **256637** cm^{-1} I. P. 31.81 volts

Most of the levels were found by de Bruin, whose analysis is repeated in the three references listed under his name. The present list is taken from the paper by Bowen, who extended the earlier work by observations in the ultraviolet near 600 A, which served to connect de Bruin's levels with the ground term. Bowen also determined the limit from the 4*s*- and 5*s*-series and extended the assignments of the Paschen notation to all but 2 of the 20 levels thus far identified in this spectrum. This notation is entered in column one of the table under the heading "A I".

As for A I, the *jl*-coupling notation in the general form suggested by Racah is adopted. The writer has suggested tentatively the tabular designation of the level labeled Y_{11} by de Bruin. The pairs $nd[3\frac{1}{2}]^\circ$ and $nd[1\frac{1}{2}]^\circ$ are partially inverted as compared with Ne I.

The *LS*-designations $ns\ {}^3P^\circ_{210}$, ${}^1P^\circ_1$ can probably be safely assigned to the levels ns_5, ns_4, ns_3, ns_2, respectively.

REFERENCES

T. L. de Bruin, Zeit. Phys. **38,** 94, 1926; Proc. Royal Acad. Amsterdam **29,** No. 5, 713 (1926); Arch. Néerl. Sci. exactes et naturelles, [IIIA] **11,** 75 (1928). (T) (C L) (E D) (Z E)

I. S. Bowen, Phys. Rev. **31,** 499 (1928). (I P) (T) (C L)

G. Racah, Phys. Rev. **61,** 537 (L) (1942).

K II

A I	de Bruin	Config.	Desig.	J	Level
$1p_0$		$3p^6$	$3p^6\ {}^1S$	0	0
$1s_5$	X_2	$3p^5(^2P^\circ_{1\frac{1}{2}})4s$	$4s\ [1\frac{1}{2}]^\circ$	2	*162507.0*
$1s_4$	X_3			1	*163237.0*
$1s_3$	X_7	$3p^5(^2P^\circ_{\frac{1}{2}})4s$	$4s'\ [\frac{1}{2}]^\circ$	0	*165149.5*
$1s_2$	X_8			1	*166461.5*
$3d_6$	X_4	$3p^5(^2P^\circ_{1\frac{1}{2}})3d$	$3d\ [\frac{1}{2}]^\circ$	0	*163436.3*
$3d_5$	X_5			1	*164496.1*
		"	$3d\ [3\frac{1}{2}]^\circ$	4	
$3d_4$	X_9			3	*170835.4*
$3d_3$	X_6	"	$3d\ [1\frac{1}{2}]^\circ$	2	*164932.3*
				1	
$3d''_1$	X_{10}	"	$3d\ [2\frac{1}{2}]^\circ$	2	*171526.8*
				3	
$2p_{10}$	P_1	$3p^5(^2P^\circ_{1\frac{1}{2}})4p$	$4p\ [\frac{1}{2}]$	1	183208.4
$2p_9$	P_2	"	$4p\ [2\frac{1}{2}]$	3	186388.5
$2p_8$	P_3			2	186685.6
$2p_7$	P_4	"	$4p\ [1\frac{1}{2}]$	1	187531.1
$2p_6$	P_5			2	188154.4
$2p_5$	P_8	"	$4p\ [\frac{1}{2}]$	0	189772.0
$2p_4$	P_6	$3p^5(^2P^\circ_{\frac{1}{2}})4p$	$4p'\ [1\frac{1}{2}]$	1	189243.7
$2p_3$	P_7			2	189661.7

K II

A I	de Bruin	Config.	Desig.	J	Level
$2p_2$	P_9	$3p^5(^2P^\circ_{\frac{1}{2}})4p$	$4p'\ [\frac{1}{2}]$	1	190134.8
$2p_1$	P_{10}			0	194776.1
$2s_5$	Y_2	$3p^5(^2P^\circ_{1\frac{1}{2}})5s$	$5s\ [1\frac{1}{2}]^\circ$	2	*212575.5*
$2s_4$	Y_3			1	*212992.9*
$2s_3$	Y_4	$3p^5(^2P^\circ_{\frac{1}{2}})5s$	$5s'\ [\frac{1}{2}]^\circ$	0	*214727.0*
$2s_2$	Y_5			1	*215018.8*
		$3p^5(^2P^\circ_{1\frac{1}{2}})4d$	$4d\ [\frac{1}{2}]^\circ$	0	
$4d_5$	Y_6			1	*215404.9*
		"	$4d\ [3\frac{1}{2}]^\circ$	4	
$4d_4$	Y_9			3	*217726.4*
$4d_3$	Y_7	"	$4d\ [1\frac{1}{2}]^\circ$	2	*215855.8*
				1	
$4d''_1$	Y_{10}	"	$4d\ [2\frac{1}{2}]^\circ$	2	*219196.2*
				3	
	Y_8	$3p^5(^2P^\circ_{\frac{1}{2}})4d$	$4d'\ [\ ?\ ]^\circ$	2	*217066.3*
		"	$4d'\ [1\frac{1}{2}]^\circ$	2	
	Y_{11}			1	*223124.1*
		K III $(^2P^\circ_{1\frac{1}{2}})$	***Limit***	------	**256637**
		K III $(^2P^\circ_{\frac{1}{2}})$	*Limit*	------	258803

May 1948.

K II OBSERVED LEVELS *

Config. $1s^2\ 2s^2\ 2p^6\ 3s^2+$	Observed Terms		
$3p^6$	$3p^6\ ^1S$		
	$ns\ (n\geq 4)$		
$3p^5(^2P^\circ)nx$	{ 4, 5s $^3P^\circ$ 4, 5s $^1P^\circ$		
jl-Coupling Notation			
	Observed Levels		
	$ns\ (n\geq 4)$	$np\ (n\geq 4)$	$nd\ (n\geq 3)$
$3p^5(^2P^\circ_{1\frac{1}{2}})nx$	4, 5s [1½]°	4p [½] 4p [2½] 4p [1½]	3, 4d [½]° 3, 4d [3½]° 3, 4d [1½]° 3, 4d [2½]°
$3p^5(^2P^\circ_{\frac{1}{2}})nx'$	4, 5s′[½]°	4p′[1½] 4p′[½]	4d′[1½]°

*For predicted levels in the spectra of the A I isoelectronic sequence, see Introduction.

K III

(Cl I sequence; 17 electrons) $Z=19$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5\ ^2P^\circ_{1\frac{1}{2}}$

$3p^5\ ^2P^\circ_{1\frac{1}{2}}$ ***369000*** cm^{-1} I. P. 46 volts

The analyses by various investigators are discordant, but nearly 80 lines have been classified in the range between 325 A and 3885 A.

From observed intersystem combinations Edlén has derived a correction of +667.7 cm^{-1} to the absolute values of the doublet terms given by de Bruin, to connect them with the quartet terms. Edlén also states that the limit derived by extrapolation along the isoelectronic sequence is 369000 cm^{-1}. This limit (entered in brackets in the table), indicates a correction of about −8000 cm^{-1} to the limit listed by de Bruin, 377000 cm^{-1}.

The doublet terms as given by Edlén and the quartet terms from de Bruin have been used in compiling the present list. The additional terms are from Tsien.

Kruger and Phillips designate as $4s''\ ^2S_{\frac{1}{2}}$ the level at 246012 cm^{-1}, given by Tsien as $3d'\ ^2D_{1\frac{1}{2}}$. Further study is needed to confirm the terms from the higher limits.

REFERENCES

T. L. de Bruin, Zeit. Phys. **53,** 658 (1929). (IP) (T) (C L)

B. Edlén, Zeit. Phys. **104,** 410 (1937). (I P) (T) (C L)

P. G. Kruger and L. W. Phillips, Phys. Rev. **51,** 1087 (1937). (T) (C L)

W.-Z. Tsien, Chinese J. Phys. **3,** No. 2, 118 (1939). (T) (C L)

K III

Config.	Desig.	J	Level	Interval
$3s^2\,3p^5$	$3p^5\ ^2P^\circ$	1½ ½	*0* *2162*	−2162
$3p^6$	$3p^6\ ^2S$	½	130609	
$3s^2\,3p^4(^3P)3d$	$3d\ ^2D$	1½ 2½	190916 192082	1166
$3s^2\,3p^4(^3P)3d$	$3d\ ^2F$	{ 3½ 2½ }	201165	
$3s^2\,3p^4(^3P)4s$	$4s\ ^4P$	2½ 1½ ½	207421.9 208687.8 209461.3	−1265.9 −773.5
$3s^2\,3p^4(^3P)4s$	$4s\ ^2P$	1½ ½	212725.4 214232.3	−1506.9
$3s^2\,3p^4(^1D)4s$	$4s'\ ^2D$	2½ 1½	225051 225082	−31
$3s^2\,3p^4(^3P)4p$	$4p\ ^4P^\circ$	2½ 1½ ½	*237512.0* *237912.2* *238455.1*	−400.2 −542.9
$3s^2\,3p^4(^3P)4p$	$4p\ ^4D^\circ$	3½ 2½ 1½ ½	*240829.9* *241443.5* *242165.3* *242526.7*	−613.6 −721.8 −361.4
$3s^2\,3p^4(^1D)3d$	$3d'\ ^2P$	1½ ½	241039 242548	−1509

K III

Config.	Desig.	J	Level	Interval
$3s^2\,3p^4(^1S)4s$	$4s''\ ^2S$	½	241667	
$3s^2\,3p^4(^3P)4p$	$4p\ ^2D^\circ$	2½ 1½	*243120.6* *243448.2*	−327.6
$3s^2\,3p^4(^3P)4p$	$4p\ ^2P^\circ$	1½ ½	*243947.4* *245382.3*	−1434.9
$3s^2\,3p^4(^1D)3d$	$3d'\ ^2D$	2½ 1½	244523 246012	−1489
$3s^2\,3p^4(^3P)4p$	$4p\ ^4S^\circ$	1½	*246625.6*	
$3s^2\,3p^4(^1D)3d$	$3d'\ ^2S$	½	250857	
	1		252040	
$3s^2\,3p^4(^3P)5s$	$5s\ ^2P$	1½ ½	262828 263770	−942
$3s^2\,3p^4(^1D)5s$	$5s'\ ^2D$	2½ 1½	289400 289515	−115
$3s^2\,3p^4(^1S)3d$	$3d''\ ^2D$	2½ 1½	302404 303902	−1498
	2		307429	
K IV ($^3P_2$)	*Limit*	-------	[*369000*]	

January 1948.

K III Observed Terms*

Config. $1s^2\,2s^2\,2p^6$	Observed Terms		
$3s^2\,3p^5$	$3p^5\ ^2P^\circ$		
$3s\,3p^6$	$3p^6\ ^2S$		
	$ns\ (n\geq 4)$	$np\ (n\geq 4)$	$nd\ (n\geq 3)$
$3s^2\,3p^4(^3P)nx$	{ $4s\ ^4P$ $4, 5s\ ^2P$	$4p\ ^4S^\circ$ $4p\ ^4P^\circ$ $4p\ ^4D^\circ$ $4p\ ^2P^\circ$ $4p\ ^2D^\circ$	$3d\ ^2D$ $3d\ ^2F$
$3s^2\,3p^4(^1D)nx'$	$4, 5s'\ ^2D$		$3d'\ ^2S$ $3d'\ ^2P$ $3d'\ ^2D$
$3s^2\,3p^4(^1S)nx''$	$4s''\ ^2S$		$3d''\ ^2D$

*For predicted terms in the spectra of the Cl I isoelectronic sequence, see Introduction.

K IV

(S I sequence; 16 electrons) $Z=19$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^4\,{}^3P_2$

$3p^4\,{}^3P_2$ **491300** cm^{-1} **I. P. 60.90 volts**

The terms are from the papers by Bowen and by Tsien, with the revised values of $3p^4\,{}^1S$ and $3p^5\,{}^1P°$ suggested by Edlén, and of $4s\,{}^3S°$ by Mrs. Beckman. Colons have been added by the writer to some levels that appear to need further confirmation.

Nearly 60 lines have been classified in the region between 271 A and 754 A. Intersystem combinations connecting the singlet and triplet terms have been observed.

The limit is from Edlén's 1937 paper. He has derived it by extrapolation of isoelectronic sequence data.

REFERENCES

M. Ram, Indian J. Phys. **8**, 155 (1933). (T) (C L)

I. S. Bowen, Phys. Rev. **46**, 791 (1934). (T) (C L)

B. Edlen, Zeit. Phys. **104**, 192 (1937). (I P)

A. Beckman, *Bidrag till Kännedomen om Skandiums Spektrum i Yttersta Ultraviolett*, Akademisk Avhandling p. 79 (Almqvist and Wiksells Boktryckeri-A.-B., Uppsala, 1937). (C L)

W.-Z. Tsien, Chinese J. Phys. **3**, No. 2, 131 (1939). (T) (C L)

B. Edlén, Phys. Rev. **62**, 434 (1942). (T) (C L)

K IV

Config.	Desig.	J	Level	Interval
$3s^2\,3p^4$	$3p^4\ {}^3P$	2	0	
		1	1673	1673
		0	2324	651
$3s^2\,3p^4$	$3p^4\ {}^1D$	2	16386	
$3s^2\,3p^4$	$3p^4\ {}^1S$	0	38548	
$3s\ 3p^5$	$3p^5\ {}^3P°$	2	*134181*	
		1	*135659*	−1478
		0	*136453*	−794
$3s\ 3p^5$	$3p^5\ {}^1P°$	1	*171140*	
$3s^2\,3p^3(^4S°)3d$	$3d\ {}^3D°$	3	*189952*	
		2	*191204*	−252
		1	*191403*	−199
$3s^2\,3p^3(^2D°)3d$	$3d'\ {}^1F°$	3	*222420*	
$3s^2\,3p^3(^2D°)3d$	$3d'\ {}^3P°$	2	*225445*	
		1	*226090*	−645
		0	*227652*	−1562
$3s^2\,3p^3(^2D°)3d$	$3d'\ {}^1P°$	1	*235527:*	
$3s^2\,3p^3(^2P°)3d$	$3d''\ {}^3P°$	2	*256034*	
		1	*257124*	−1090
		0	*257811:*	−687

K IV

Config.	Desig.	J	Level	Interval
$3s^2\,3p^3(^4S°)4s$	$4s\ {}^3S°$	1	260352	
$3s^2\,3p^3(^2P°)3d$	$3d''\ {}^1P°$	1	*261445*	
$3s^2\,3p^3(^2P°)3d$	$3d''\ {}^3D°$	3		
		2	*262831*	
		1	*263659*	−828
$3s^2\,3p^3(^2P°)3d$	$3d''\ {}^1D°$	2	*273409*	
$3s^2\,3p^3(^2D°)4s$	$4s'\ {}^3D°$	1	*277795*	
		2	*277851*	56
		3	*277986*	135
$3s^2\,3p^3(^2D°)4s$	$4s'\ {}^1D°$	2	*282373*	
$3s^2\,3p^3(^2P°)4s$	$4s''\ {}^3P°$	0	*293384*	
		1	*293473*	89
		2	*293720*	247
$3s^2\,3p^3(^2P°)4s$	$4s''\ {}^1P°$	1	*298134*	
$3s^2\,3p^3(^4S°)5s$	$5s\ {}^3S°$	1	*367890*	
K V $(^4S°_{1\frac{1}{2}})$	*Limit*		**491300**	

December 1947.

K IV OBSERVED TERMS*

Config. $1s^2\ 2s^2\ 2p^6+$	Observed Terms	
$3s^2\ 3p^4$	$3p^4\ {}^3P$; $3p^4\ {}^1S$; $3p^4\ {}^1D$	
$3s\ 3p^5$	$3p^5\ {}^3P°$; $3p^5\ {}^1P°$	
	$ns\ (n\geq 4)$	$nd\ (n\geq 3)$
$3s^2\ 3p^3(^4S°)nx$	4, 5s ${}^3S°$	$3d\ {}^3D°$
$3s^2\ 3p^3(^2D°)nx'$	$4s'\ {}^3D°$; $4s'\ {}^1D°$	$3d'\ {}^3P°$; $3d'\ {}^1P°$; $3d'\ {}^1F°$
$3s^2\ 3p^3(^2P°)nx''$	$4s''\ {}^3P°$; $4s''\ {}^1P°$	$3d''\ {}^3P°$; $3d''\ {}^1P°$; $3d''\ {}^3D°$; $3d''\ {}^1D°$

*For predicted terms in the spectra of the S I isoelectronic sequence, see Introduction.

K V

(P I sequence; 15 electrons) $Z=19$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3\ {}^4S°_{1\frac{1}{2}}$

$3p^3\ {}^4S°_{1\frac{1}{2}}$ cm^{-1} I. P. volts

The analysis is incomplete. The terms are from the paper by Tsien, who includes those given earlier by Bowen. Seventy-two lines have been classified in the interval between 294 A and 825 A.

The relative position of the doublet terms with respect to the quartet terms was estimated from the irregular doublet law. Tsien lists combinations of $3p^3\ {}^4S°$ and $3p^3\ {}^2P°$ with the level labeled "3", which are not in disagreement with this estimate.

REFERENCES

I. S. Bowen, Phys. Rev. **46**, 791 (1934). (T) (C L)

W.—Z. Tsien, Chinese J. Phys. **3**, No. 2, 136 (1939). (T) (C L)

K v

Config.	Desig.	J	Level	Interval
$3s^2\,3p^3$	$3p^3\ {}^4S^\circ$	1½	*0*	
$3s^2\,3p^3$	$3p^3\ {}^2D^\circ$	1½ 2½	*24000* *24237*	237
$3s^2\,3p^3$	$3p^3\ {}^2P^\circ$	½ 1½	*39745* *40064*	319
$3s\ 3p^4$	$3p^4\ {}^4P$	2½ 1½ ½	136639 138042 138806	−1403 −764
$3s\ 3p^4$	$3p^4\ {}^2D$	1½ 2½	161199 161564	365
	1		169703	
	2		169886	
$3s\ 3p^4$	$3p^4\ {}^2P$	1½ ½	194792 196319	−1527
$3s\ 3p^4$	$3p^4\ {}^2S$	½	205784	
$3s^2\,3p^2(^3P)3d$	$3d\ {}^4F$	1½ 2½ 3½ 4½	206720 207165	445
$3s^2\,3p^2(^3P)3d$	$3d\ {}^4D$	3½ 2½ 1½ ½	 222367 222711	−344
$3s^2\,3p^2(^3P)3d$	$3d\ {}^4P$	2½ 1½ ½	257865 259276 259726	−1411 −450
$3s^2\,3p^2(^3P)3d$	$3d\ {}^2P$	1½ ½	259205 260868	−1663
$3s^2\,3p^2(^3P)3d$	$3d\ {}^2F$	2½ 3½	262487 262874	387
$3s^2\,3p^2(^3P)3d$	$3d\ {}^2D$	2½ 1½	264741 264932	−191
	3		268043	
	4		274375	
$3s^2\,3p^2(^1D)3d$	$3d'\ {}^2D$	1½ 2½	281024	
$3s^2\,3p^2(^1D)3d$	$3d'\ {}^2P$	½ 1½	 290772	
$3s^2\,3p^2(^1D)3d$	$3d'\ {}^2F$	2½ 3½	292710	
$3s^2\,3p^2(^1D)3d$	$3d'\ {}^2S$	1½	292968	
$3s^2\,3p^2(^1S)3d$	$3d''\ {}^2D$	1½ 2½	304461 305978	1517
	5		307717	
	6		310120	
$3s^2\,3p^2(^3P)4s$	$4s\ {}^4P$	½ 1½ 2½	336628 337645 339172	1017 1527
$3s^2\,3p^2(^3P)4s$	$4s\ {}^2P$	½ 1½	343726 345526	1800
$3s^2\,3p^2(^1D)4s$	$4s'\ {}^2D$	2½ 1½	356993 357033	−40

November 1947.

K v Observed Terms*

Config. $1s^2\,2s^2\,2p^6+$	Observed Terms					
$3s^2\,3p^3$	$3p^3\ {}^4S^\circ$	$3p^3\ {}^2P^\circ$	$3p^3\ {}^2D^\circ$			
$3s\ 3p^4$	$3p^4\ {}^2S$	$3p^4\ {}^4P$ $3p^4\ {}^2P$	$3p^4\ {}^2D$			
	ns ($n \geq 4$)		*nd* ($n \geq 3$)			
$3d^2\,3p^2(^3P)nx$	$4s\ {}^4P$ $4s\ {}^2P$			$3d\ {}^4P$ $3d\ {}^2P$	$3d\ {}^4D$ $3d\ {}^2D$	$3d\ {}^4F$ $3d\ {}^2F$
$3s^2\,3p^2(^1D)nx'$		$4s'\ {}^2D$	$3d'\ {}^2S$	$3d'\ {}^2P$	$3d'\ {}^2D$	$3d'\ {}^2F$
$3s^2\,3p^2(^1S)nx''$					$3d''\ {}^2D$	

*For predicted terms in the P I isoelectronic sequence, see Introduction.

K VI

(Si I sequence; 14 electrons) $Z=19$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^2\ {}^3P_0$

$3p^2\ {}^3P_0$ **804513** cm^{-1} I. P. 99.7 volts

The analysis is chiefly by Whitford, with singlet terms added from Robinson's paper. Twenty-seven lines have been classified in the interval between 256 A and 725 A. Intersystem combinations connecting the singlet and triplet terms have been observed.

Using the method suggested by Edlén for extrapolation along the isoelectronic sequence, the writer has estimated the value of the limit quoted above and entered in brackets in the table.

REFERENCES

A. E. Whitford, Phys. Rev. **46**, 793 (1934). (T) (C L)
H. A. Robinson, Phys. Rev. **52**, 725 (1937). (T) (C L)

K VI

Config.	Desig.	J	Level	Interval
$3s^2\ 3p^2$	$3p^2\ {}^3P$	0 1 2	0 1131 2924	1131 1793
$3s^2\ 3p^2$	$3p^2\ {}^1D$	2	18973	
$3s\ 3p^3$	$3p^3\ {}^3D°$	1 2 3	*140743* *140796* *140966*	53 170
$3s\ 3p^3$	$3p^3\ {}^3P°$	2, 1, 0	*163434*	
$3s\ 3p^3$	$3p^3\ {}^3S°$	1	*218316*	

K VI

Config.	Desig.	J	Level	Interval
$3s\ 3p^3$	$3p^3\ {}^1P°$	1	*223840*	
$3s^2\ 3p(^2P°)3d$	$3d\ {}^3P°$	2 1 0	*252332* *253504* *254043*	−1172 −539
$3s^2\ 3p(^2P°)4s$	$4s\ {}^3P°$	0 1 2	*387421* *388114* *390493*	693 2379
K VII ($^2P°_{½}$)	*Limit*	-------	[*804513*]	

October 1947.

K VII

(Al I sequence; 13 electrons) $Z=19$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p\ ^2P^\circ_{1/2}$

$3p\ ^2P^\circ_{1/2}$ *950200* cm^{-1} I. P. 118 volts

Both Whitford and Phillips have worked on the analysis of this spectrum. Thirty lines have been classified in the interval between 175 A and 671 A. No intersystem combinations have been observed, but Phillips estimates that $3p^2\ ^4P_{1/2}$ is approximately 114000cm^{-1} above the ground state. This value is entered in brackets in the table. The uncertainty x may exceed ± 1000 cm^{-1}.

Using the method suggested by Edlén, the writer has extrapolated the value of the limit quoted above and entered in brackets in the table. The uncertainty in this estimate is large owing to the incompleteness of the isoelectronic sequence data.

REFERENCES

A. E. Whitford, Phys. Rev. **46**, 793 (1934). (T) (C L)
L. W. Phillips, Phys. Rev. **55**, 708 (1939). (T) (C L)

K VII

Config.	Desig.	J	Level	Interval
$3s^2(^1S)3p$	$3p\ ^2P^\circ$	½ 1½	*0* *3129*	3129
$3s\ 3p^2$	$3p^2\ ^4P$	½ 1½ 2½	[114000]+x 115145 +x 116871 +x	1145 1726
$3s\ 3p^2$	$3p^2\ ^2D$	1½ 2½	151882 152049	167
$3s\ 3p^2$	$3p^2\ ^2S$	½	193079	
$3s\ 3p^2$	$3p^2\ ^2P$	½ 1½	206507 208434	1927
$3s^2(^1S)3d$	$3d\ ^2D$	1½ 2½	250668 250787	119
$3p^3$	$3p^3\ ^4S^\circ$	1½	*307479* +x	
$3s\ 3p(^3P^\circ)3d$	$3d\ ^4D^\circ$	½ 1½ 2½ 3½	*365092*+x *365463*+x *365778*+x *365916*+x	371 315 138
$3s^2(^1S)4s$	$4s\ ^2S$	½	439297	
$3s\ 3p(^3P^\circ)4s$	$4s\ ^4P^\circ$	½ 1½ 2½	*565314*+x *566443*+x *568375*+x	1129 1932
$3s^2(^1S)4d$	$4d\ ^2D$	1½ 2½	570812 570969	157
K VIII ($^1S_0$)	*Limit*	-------	[*950200*]	

September 1947.

K VII OBSERVED TERMS*

Config. $1s^2\ 2s^2\ 2p^6+$	Observed Terms	
$3s^2(^1S)3p$	$3p\ ^2P^\circ$	
$3s\ 3p^2$	$3p^2\ ^4P$; $3p^2\ ^2S$ $3p^2\ ^2P$ $3p^2\ ^2D$	
$3p^3$	$3p^3\ ^4S^\circ$	
	ns ($n\geq 4$)	nd ($n\geq 3$)
$3s^2(^1S)nx$	$4s\ ^2S$	3, $4d\ ^2D$
$3s\ 3p(^3P^\circ)nx$	$4s\ ^4P^\circ$	$3d\ ^4D^\circ$

*For predicted terms in the spectra of the Al I isoelectronic sequence, see Introduction.

K VIII

(Mg I sequence; 12 electrons) $Z=19$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\;{}^1S_0$

$3s^2\;{}^1S_0$ **1247000±** cm^{-1} I. P. 155± volts

Twenty-six lines have been classified in the range between 155 A and 938 A. The triplet terms are from Parker and Phillips; the singlets from Tsien. By extrapolation along the sequence Mrs. Beckman has classified a line at 774.738 A as the intersystem combination $3s^2\;{}^1S_0-3p\;{}^3P^\circ_1$. The listed values of the triplet terms have been adjusted to fit this assignment.

From isoelectronic sequence data the writer has extrapolated the value of the limit, using the method suggested by Edlén. This value is entered in brackets in the table. Although this estimate may be in error by more than ±1000 cm^{-1}, it gives an approximate value of the ionization potential.

REFERENCES

A. Beckman, *Bidrag till Kännedomen om Skandiums Spektrum i Yttersta Ultraviolett,* Akademisk Avhandling p. 55 (Almqvist and Wiksells Boktryckeri-A.-B., Uppsala, 1937). (C L)

W.-Z. Tsien, Chinese J. Phys. **3,** No. 2, 142 (1939). (T) (C L)

W. L. Parker and L. W. Phillips, Phys. Rev. **57,** 140 (1940). (T) (C L)

K VIII

Config.	Desig.	J	Level	Interval
$3s^2$	$3s^2\;{}^1S$	0	0	
$3s(^2S)3p$	$3p\;{}^3P^\circ$	0	*127968*	
		1	*129080*	1112
		2	*131452*	2372
$3s(^2S)3p$	$3p\;{}^1P^\circ$	1	*192540.2*	
$3s(^2S)3d$	$3d\;{}^1D$	2	299117.4	
$3p^2$	$3p^2\;{}^3P$	0	304669	
		1	306035	1366
		2	308608	2573

K VIII

Config.	Desig.	J	Level	Interval
$3s(^2S)3d$	$3d\;{}^3D$	1	368004	
		2	368060	56
		3	368132	72
$3s(^2S)4s$	$4s\;{}^3S$	1	631654	
$3s(^2S)4d$	$4d\;{}^3D$	1	770165	
		2	770260	95
		3	770401	141
$3s(^2S)4f$	$4f\;{}^3F^\circ$	2, 3, 4	*801511*	
K IX ($^2S_{1/2}$)	*Limit*	-------	[1247000±]	

March 1948.

K IX

(Na I sequence; 11 electrons) Z=19

Ground state $1s^2\ 2s^2\ 2p^6\ 3s\ ^2S_{½}$

$3s\ ^2S_{½}$ **1419425** cm^{-1} I. P. 175.94 volts

All but two of the terms are from the paper by Kruger and Phillips, who extended the earlier work by Edlén and Whitford. Absolute term values are based on three members of the ^{2}D-series.

The two terms $5s\ ^2S$ and $5g\ ^2G$ have been added from the paper by Tsien, but adjusted to agree with the term array by Kruger and Phillips.

Twenty-five lines have been classified, in the range from 112 A to 636 A.

REFERENCES

W.–Z. Tsien, Chinese J. Phys. **3,** No. 2, 145 (1939). (T) (C L)
P. G. Kruger and L. W. Phillips, Phys. Rev. **55,** 352 (1939). (I P) (T) (C L)

K IX

Config.	Desig.	J	Level	Interval
3s	3s ²S	½	0	
3p	3p ²P°	½ 1½	*157159* *160925*	3766
3d	3d ²D	1½ 2½	374788 375080	292
4s	4s ²S	½	698902	
4p	4p ²P°	½ 1½	*758174* *759615*	1441
4d	4d ²D	1½ 2½	836703 836861	158
4f	4f ²F°	2½ 3½	*860763* *860842*	79

K IX

Config.	Desig.	J	Level	Interval
5s	5s ²S	½	979901	
5g	5g ²G	4½ 3½	1044250 1044298	−48
5d	5d ²D	1½ 2½	1049114 1049174	60
5f	5f ²F°	2½ 3½	*1061120* *1061172*	52
K X (¹S₀)	*Limit*		**1419425**	

June 1947.

K X

(Ne I sequence; 10 electrons) Z=19

Ground state $1s^2\ 2s^2\ 2p^6\ ^1S_0$

$2p^6\ ^1S_0$ **4064300** cm^{-1} I. P. 503.8 volts

Eleven lines between 29 A and 41 A have been classified by Edlén and Tyrén as combinations with the ground term. Their absolute term values have been extrapolated along the Ne I isoelectronic sequence.

By analogy with Ne I, *jl*-coupling notation in the general form suggested by Racah is introduced.

The unit adopted by Edlén and Tyrén, 10^3 cm^{-1}, has here been changed to cm^{-1}.

REFERENCES

B. Edlén and F. Tyrén, Zeit. Phys. **101,** 206 (1936). (I P) (T) (C L)
G. Racah, Phys. Rev. **61,** 537 (L) (1942).

K x

Authors	Config.	Desig.	J	Level
$2p\ ^1S_0$	$2s^2\ 2p^6$	$2p^6\ ^1S$	0	0
	$2s^2\ 2p^5(^2P^\circ_{1\frac{1}{2}})3s$	$3s\ [1\frac{1}{2}]^\circ$	2	
$3s\ ^3P_1$			1	*2407300*
	$2s^2\ 2p^5(^2P^\circ_{\frac{1}{2}})3s$	$3s'\ [\ \frac{1}{2}]^\circ$	0	
$3s\ ^1P_1$			1	*2430300*
	$2s^2\ 2p^5(^2P^\circ_{1\frac{1}{2}})3d$	$3d\ [\ \frac{1}{2}]^\circ$	0	
$3d\ ^3P_1$			1	*2760200*
$3d\ ^1P_1$	"	$3d\ [1\frac{1}{2}]^\circ$	1	*2794900*
$3d\ ^3D_1$	$2s^2\ 2p^5(^2P^\circ_{\frac{1}{2}})3d$	$3d'\ [1\frac{1}{2}]^\circ$	1	*2832300*
	$2s^2\ 2p^5(^2P^\circ_{1\frac{1}{2}})4s$	$4s\ [1\frac{1}{2}]^\circ$	2	
$4s\ ^3P_1$			1	*3205100*
	$2s^2\ 2p^5(^2P^\circ_{\frac{1}{2}})4s$	$4s'\ [\ \frac{1}{2}]^\circ$	0	
$4s\ ^1P_1$			1	*3232400*

K x

Authors	Config.	Desig.	J	Level
$3p'\ ^3P_1$	$2s\ 2p^6(^2S)3p$	$3p\ ^3P^\circ$	2 1 0	*3219400*
$3p'\ ^1P_1$	$2s\ 2p^6(^2S)3p$	$3p\ ^1P^\circ$	1	*3237600*
$4d\ ^1P_1$	$2s^2\ 2p^5(^2P^\circ_{1\frac{1}{2}})4d$	$4d\ [1\frac{1}{2}]^\circ$	1	*3356400*
$4d\ ^3D_1$	$2s^2\ 2p^5(^2P^\circ_{\frac{1}{2}})4d$	$4d'\ [1\frac{1}{2}]^\circ$	1	*3379700*
	K XI $(^2P^\circ_{1\frac{1}{2}})$	***Limit***	-------	**4064300**
	K XI $(^2P^\circ_{\frac{1}{2}})$	*Limit*	-------	4087775

April 1947.

K x Observed Levels*

Config. $1s^2+$	Observed Terms		
$2s^2\ 2p^6$	$2p^6\ ^1S$		
	$ns\ (n\geq 3)$	$np(n\geq 3)$	$nd\ (n\geq 3)$
$2s^2\ 2p^5(^2P^\circ)nx$	{ 3, $4s\ ^3P^\circ$ 3, $4s\ ^1P^\circ$		$3d\ ^3P^\circ$ 3, $4d\ ^3D^\circ$ 3, $4d\ ^1P^\circ$
$2s\ 2p^6(^2S)nx$	{	$3p\ ^3P^\circ$ $3p\ ^1P^\circ$	
jl-Coupling Notation			
	Observed Pairs		
	$ns\ (n\geq 3)$		$nd\ (n\geq 3)$
$2s^2\ 2p^5(^2P^\circ_{1\frac{1}{2}})nx$	3, $4s\ [1\frac{1}{2}]^\circ$		$3d\ [\ \frac{1}{2}]^\circ$ 3, $4d\ [1\frac{1}{2}]^\circ$
$2s^2\ 2p^5(^2P^\circ_{\frac{1}{2}})nx'$	3, $4s'[\ \frac{1}{2}]^\circ$		3, $4d'[1\frac{1}{2}]^\circ$

*For predicted levels in the spectra of the Ne I isoelectronic sequence, see Introduction.

K XI

(F I sequence; 9 electrons) $Z=19$

Ground state $1s^2\ 2s^2\ 2p^5\ ^2P^\circ_{1\frac{1}{2}}$

$2p^5\ ^2P^\circ_{1\frac{1}{2}}$ cm^{-1} I. P. volts

Edlén and Tyrén have classified 8 lines, which lie between 32 A and 37 A. They give no term array because the analysis is so incomplete. In the 1942 reference Edlén states that the interval of the ground term is known from his unpublished material to be 23475 cm^{-1}. From these data, preliminary term values have been calculated and listed below.

REFERENCES

B. Edlén and F. Tyrén, Zeit. Phys. **101**, 206 (1936). (C L)
B. Edlén, Zeit. Astroph. **22**, 59 (1942). (T)

K XI

Edlén	Config.	Desig.	J	Level	Interval
$2p\ ^2P_2$ $^2P_1$	$2s^2\ 2p^5$	$2p^5\ ^2P^\circ$	1½ ½	*0* *23475*	−23475
$3s\ ^4P_3$ $^4P_2$	$2s^2\ 2p^4(^3P)3s$	$3s\ ^4P$	2½ 1½ ½	2640600? 2652800?	−12200
$3s\ ^2P_2$	$2s^2\ 2p^4(^3P)3s$	$3s\ ^2P$	1½ ½	2671300?	
$3s'\ ^2D_3$ $^2D_2$	$2s^2\ 2p^4(^1D)3s$	$3s'\ ^2D$	2½ 1½	2727600? 2728300?	−700
$3d$	$2s^2\ 2p^4(^3P)3d$	$3d$ X		3047900?	
$\overline{3d}$	$2s^2\ 2p^4(^1D)3d$	$3d'$ X		3107500?	

March 1947.

CALCIUM

Ca I

20 electrons $Z=20$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ ^1S_0$

$4s^2\ ^1S_0$ **49304.80** cm^{-1} I. P. 6.111 volts

The arc spectrum of calcium occupies an important place in the development of spectroscopic theory. In addition to the "regular" series, the terms involving two excited electrons were first discussed in the classical paper by Russell and Saunders in 1925.

Although the spectrum is well known, further observations in the infrared are urgently needed; and a monograph containing a homogeneous list of lines and term values should be prepared as soon as the analysis can be extended with the aid of these data.

The regular series terms, i. e., those from the ^2S limit in Ca II, are from Fowler and Paschen-Götze. The rest are from Russell and Saunders and from unpublished analysis by Russell, who has generously furnished all of his data on this spectrum. The $6f\ ^3F^\circ$ term has been resolved by Grafenberger. Three-place entries in the table are quoted from Wagman, who derived them from observations made with the interferometer. The writer has prepared a complete multiplet array and calculated all other values from the best available wavelength material. Colons indicate that the term values should be confirmed by further observations.

The singlet and triplet terms are connected by observed intersystem combinations.

REFERENCES

F. Paschen und R. Götze, *Seriengesetze der Linienspektren*, p. 72 (Julius Springer, Berlin, 1922). (I P) (T) (C L)

A. Fowler, *Report on Series in Line Spectra*, p. 121 (Fleetway Press, London, 1922). (I P) (T) (C L)

H. N. Russell and F. A. Saunders, Astroph. J. **61**, 38 (1925). (I P) (T) (C L)

E. Back, Zeit. Phys. **33**, 579 (1925). (Z E)

H. N. Russell, unpublished material (1927?). (T) (C L)

A. G. Shenstone and H. N. Russell, Phys. Rev. **39**, 417 (1932). (T)

W. F. Meggers, Bur. Std. J. Research **10**, 676, RP558 (1933). (I P) (T) (C L)

N. E. Wagman, Univ. Pittsburgh Bul. **34**, 1 (1937). (T) (C L)

H. Grafenberger, Ann. der Phys. [5] **30**, 267 (1937). (C L)

Ca I

Config.	Desig.	J	Level	Interval	Obs. g
$4s^2$	$4s^2\ ^1S$	0	0. 000		
$4s(^2S)4p$	$4p\ ^3P^\circ$	0	*15157. 910*	52. 157	
		1	*15210. 067*	105. 881	
		2	*15315. 948*		
$4s(^2S)3d$	$3d\ ^3D$	1	20335. 344	13. 903	0. 501
		2	20349. 247	21. 740	1. 162
		3	20370. 987		1. 329
$4s(^2S)3d$	$3d\ ^1D$	2	21849. 610		1. 007
$4s(^2S)4p$	$4p\ ^1P^\circ$	1	*23652. 324*		
$4s(^2S)5s$	$5s\ ^3S$	1	31539. 510		
$4s(^2S)5s$	$5s\ ^1S$	0	33317. 25		
$3d(^2D)4p$	$4p'\ ^3F^\circ$	2	*35730. 450*	88. 262	0. 754
		3	*35818. 712*	78. 178	1. 076
		4	*35896. 890*		1. 245
$3d(^2D)4p$	$4p'\ ^1D^\circ$	2	*35835. 400*		0. 893
$4s(^2S)5p$	$5p\ ^3P^\circ$	0	*36547. 671*	7. 051	
		1	*36554. 722*	20. 410	
		2	*36575. 132*		
$3d(^2D)4p$	$4p'\ ^1P^\circ$	1	*36731. 622*		
$4s(^2S)4d$	$4d\ ^1D$	2	37298. 312		
$4s(^2S)4d$	$4d\ ^3D$	1	37748. 192	3. 682	
		2	37751. 884	5. 578	
		3	37757. 462		
$3d(^2D)4p$	$4p'\ ^3D^\circ$	1	*38192. 373*	26. 721	
		2	*38219. 094*	40. 008	
		3	*38259. 102*		
$4p^2$	$4p^2\ ^3P$	0	38417. 585	47. 259	
		1	38464. 844	86. 744	
		2	38551. 588		
$3d(^2D)4p$	$4p'\ ^3P^\circ$	0	*39333. 371*	1. 945	
		1	*39335. 316*	4. 762	
		2	*39340. 078*		
$4s(^2S)6s$	$6s\ ^3S$	1	40474. 275		
$3d(^2D)4p$	$4p'\ ^1F^\circ$	3	*40537. 860*		
$4p^2$	$4p^2\ ^1S$	0	40690. 436		
$4p^2$	$4p^2\ ^1D$	2	40719. 867		
$4s(^2S)5p$	$5p\ ^1P^\circ$	1	*41678. 997*		
$4s(^2S)6s$	$6s\ ^1S$	0	41786. 312		
$4s(^2S)4f$	$4f\ ^3F^\circ$	2	*42170. 183*	0. 348	
		3	*42170. 531*	0. 475	
		4	*42171. 006*		

Ca I

Config.	Desig.	J	Level	Interval	Obs. g
$4s(^2S)4f$	$4f\ ^1F^\circ$	3	*42343. 554*		
$4s(^2S)6p$	$6p\ ^3P^\circ$	0	*42514. 79:*	3. 93	
		1	*42518. 72*	7. 81	
		2	*42526. 528*		
$4s(^2S)5d$	$5d\ ^3D$	1	42743. 058	1. 718	
		2	42744. 776	2. 667	
		3	42747. 443		
$4s(^2S)5d$	$5d\ ^1D$	2	42919. 074		
$4s(^2S)6p$	$6p\ ^1P^\circ$	1	*43933. 341*		
$4s(^2S)7s$	$7s\ ^3S$	1	43980. 798		
$4s(^2S)7s$	$7s\ ^1S$	0	44276. 638		
$4s(^2S)5f$	$5f\ ^3F^\circ$	2	*44762. 620*	0. 202	
		3	*44762. 822*	0. 279	
		4	*44763. 101*		
$4s(^2S)5f$	$5f\ ^1F^\circ$	3	*44804. 786*		
$4s(^2S)7p$	$7p\ ^3P^\circ$	0			
		1	*44957. 8*	3. 8	
		2	*44961. 6*		
$4s(^2S)6d$	$6d\ ^1D$	2	44989. 882		
$4s(^2S)6d$	$6d\ ^3D$	1	45049. 066	1. 340	
		2	45050. 406	1. 953	
		3	45052. 359		
$4s(^2S)7p$	$7p\ ^1P^\circ$	1	*45425. 283*		
$4s(^2S)8s$	$8s\ ^3S$	1	45738. 732		
$4s(^2S)8s$	$8s\ ^1S$	0	45887. 31		
$4s(^2S)6f$	$6f\ ^3F^\circ$	2	*46164. 66*	0. 14	
		3	*46164. 80*	0. 19	
		4	*46164. 99*		
$4s(^2S)6f$	$6f\ ^1F^\circ$	3	*46182. 23*		
$4s(^2S)7d$	$7d\ ^3D$	1	46302. 18	1. 74	
		2	46303. 92	2. 25	
		3	46306. 170		
$4s(^2S)7d$	$7d\ ^1D$	2	46309. 9		
$4s(^2S)8p$	$8p\ ^1P^\circ$	1	*46479. 95*		
$4s(^2S)9s$	$9s\ ^3S$	1	46748. 21		
$4s(^2S)9s$	$9s\ ^1S$	0	46835. 2		
$4s(^2S)7f$	$7f\ ^3F^\circ$	2, 3, 4	*47006. 11*		
$4s(^2S)7f$	$7f\ ^1F^\circ$	3	*47015. 137*		

Ca I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
4s(^{2}S)8d	8d ^{3}D	1	47036. 32	3. 68	
		2	47040. 00	5. 38	
		3	47045. 384		
4s(^{2}S)9p	9p ^{1}P°	1	*47184. 26*		
4s(^{2}S)10s	10s ^{3}S	1	47382. 10		
4s(^{2}S)10s	10s ^{1}S	0	47436. 9		
3d(^{2}D)5s	5s′ ^{3}D	1	47456. 1	9. 8	
		2	47465. 9	9. 8	
		3	47475. 7		
4s(^{2}S)8f	8f ^{3}F°	2, 3, 4	*47550. 11*		
4s(^{2}S)8f	8f ^{1}F°	3	*47554. 97*		
4s(^{2}S)10p	10p ^{1}P°	1	*47660. 8*		
4s(^{2}S)9d	9d ^{3}D	1	47753. 3	4. 2	
		2	47757. 5	8. 0	
		3	47765. 5		
4s(^{2}S)11s	11s ^{3}S	1	47805. 85		
4s(^{2}S)11s	11s ^{1}S	0	47843. 1		
4s(^{2}S)9f	9f ^{3}F°	2, 3, 4	*47922. 2*		
4s(^{2}S)9f	9f ^{1}F°	3	*47924. 9*		
4s(^{2}S)11p	11p ^{1}P°	1	*47998. 6*		
4s(^{2}S)10d	10d ^{3}D	1	48032. 0	1. 5	
		2	48033. 5	2. 7	
		3	48036. 2		
4s(^{2}S)12s	12s ^{3}S	1	48103. 89		
4s(^{2}S)12s	12s ^{1}S	0	48128. 2		
4s(^{2}S)10f	10f ^{3}F°	2, 3, 4	*48186. 61*		
4s(^{2}S)10f	10f ^{1}F°	3	*48188. 3*		
4s(^{2}S)12p	12p ^{1}P°	1	*48222. 9*		
4s(^{2}S)11d	11d ^{3}D	1, 2, 3	48259. 2		
4s(^{2}S)13s	13s ^{3}S	1	48320. 4		
4s(^{2}S)11f	11f ^{3}F°	2, 3, 4	*48382. 90*		
4s(^{2}S)11f	11f ^{1}F°	3	*48385. 5*		
4s(^{2}S)13p	13p ^{1}P°	1	*48416. 0*		
4s(^{2}S)12d	12d ^{3}D	1, 2, 3	48434. 8		
4s(^{2}S)14s	14s ^{3}S	1	48484. 7		
3d^2	3d^2 ^{3}P	0	48524. 130	13. 543	
		1	48537. 673	25. 957	
		2	48563. 630		

Ca I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
4s(^{2}S)12f	12f ^{3}F°	2, 3, 4	*48531. 4*		
4s(^{2}S)13d	13d ^{3}D	1, 2, 3	48570. 7		
4s(^{2}S)13f	13f ^{3}F°	2, 3, 4	*48647. 1*		
4s(^{2}S)14d	14d ^{3}D	1, 2, 3	48676. 6		
4s(^{2}S)15d	15d ^{3}D	1, 2, 3	48762. 4		
4s(^{2}S)16d	16d ^{3}D	1, 2, 3	48830. 7		
Ca II (^{2}S$_{1/2}$)	***Limit***	-------	**49304. 80**		
3d(^{2}D)5p	5p′ ^{3}F°	2	*51235. 2*:	24. 3	
		3	*51259. 5*:	59. 2	
		4	*51318. 7*:		
3d(^{2}D)4d	4d′ ^{3}D	1	51351. 1	18. 5	
		2	51369. 6	25. 9	
		3	51395. 5		
3d(^{2}D)4d	4d′ ^{3}G	3	51553. 6:	25. 4	
		4	51579. 0:	31. 5	
		5	51611. 5:		
3d(^{2}D)4d	4d′ ^{3}S	1	51571. 4		
3d(^{2}D)5p	5p′ ^{3}D°	1	*51710. 9*	23. 1	
		2	*51734. 0*	32. 5	
		3	*51766. 5*		
3d(^{2}D)4d	4d′ ^{3}F	2	53214. 6	33. 3	
		3	53247. 9	12. 5	
		4	53260. 4		
3d(^{2}D)4d	4d′ ^{3}P	0	54282. 2	5. 8	
		1	54288. 0	16. 2	
		2	54304. 2		
3d(^{2}D)5d	5d′ ^{3}D	1	56444. 8	24. 3	
		2	56469. 1	25. 6	
		3	56494. 7		
3d(^{2}D)5d	5d′ ^{3}G	3	56526. 3:	20. 3	
		4	56546. 6:	31. 6	
		5	56578. 2:		
3d(^{2}D)5d	5d′ ^{3}S	1	56558. 8		
3d(^{2}D)5d	5d′ ^{3}F	2	56900. 7:	23. 4	
		3	56924. 1:	55. 4	
		4	56979. 5:		
3d(^{2}D)5d	5d′ ^{3}P	0	57601. 0	16. 8	
		1	57617. 8	20. 4	
		2	57638. 2		
3d(^{2}D)6d	6d′ ^{3}P	0			
		1	59366. 8:	25. 2	
		2	59392. 0:		

May 1948.

Ca I Observed Terms*

Config. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6+$	Observed Terms	
$4s^2$	$4s^2\ {}^1S$	
$3d^2$	$3d^2\ {}^3P$	
$4p^2$	$4p^2\ {}^1S$ $4p^2\ {}^3P$ $4p^2\ {}^1D$	
	$ns\ (n \geq 5)$	$np\ (n \geq 4)$
$4s(^2S)nx$	$5\text{–}14s\ {}^3S$ $5\text{–}12s\ {}^1S$	$4\text{–}\ 7p\ {}^3P^\circ$ $4\text{–}13p\ {}^1P^\circ$
$3d(^2D)nx'$	$5s'\ {}^3D$	$4p'\ {}^3P^\circ$ $4,\ 5p'\ {}^3D^\circ$ $4,\ 5p'\ {}^3F^\circ$ $4p'\ {}^1P^\circ$ $4p'\ {}^1D^\circ$ $4p'\ {}^1F^\circ$
	$nd\ (n \geq 3)$	$nf\ (n \geq 4)$
$4s(^2S)nx$	$3\text{–}16d\ {}^3D$ $3\text{–}\ 7d\ {}^1D$	$4\text{–}13f\ {}^3F^\circ$ $4\text{–}11f\ {}^1F^\circ$
$3d(^2D)nx'$	$4,\ 5d'\ {}^3S$ $4\text{–}6d'\ {}^3P$ $4,\ 5d'\ {}^3D$ $4,\ 5d'\ {}^3F$ $4,\ 5d'\ {}^3G$	

*For predicted terms in the spectra of the Ca I isoelectronic sequence, see Introduction.

Ca II

(K I sequence; 19 electrons) $Z=20$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s\ {}^2S_{1/2}$

$4s\ {}^2S_{1/2}$ **95748.0** cm^{-1} I. P. 11.87 volts

The analysis is chiefly from the paper by Saunders and Russell, who extended the earlier work on this spectrum. Their estimated value of $5g\ {}^2G$ is entered in brackets. The terms $nd\ {}^2D$ ($n=11$ to 16) and $nf\ {}^2F^\circ$ ($n=8$ to 10) have been added from an unpublished manuscript by Shenstone who made additional observations in the region between 2897 A and 3758 A. Shenstone has also generously furnished his recent unpublished observations of the pair of lines at 8927.34 A and 8912.10 A, having intensities 20 and 15, respectively, and classified as $4d\ {}^2D - 4f\ {}^2F^\circ$. These lines have been used to calculate the value of $4f\ {}^2F^\circ$ listed in the table.

The three-place entries are quoted from Wagman's paper. They are derived from his observations made with the interferometer. The writer has made slight adjustments in the rest of the term values in order to fit the various sets of observations together.

A monograph on this spectrum is needed.

REFERENCES

F. A. Saunders and H. N. Russell, Astroph. J. **62**, 1 (1925). (I P) (T) (C L)

H. E. White, *Introduction to Atomic Spectra*, p. 97 (McGraw-Hill Book Co., Inc., New York, N. Y., 1934). (E D)

N. E. Wagman, Univ. Pittsburgh Bul. **34**, 1 (1937). (T) (C L)

A. G. Shenstone, unpublished material (1930, 1946). (T) (C L)

Ca II

Config.	Desig.	J	Level	Interval
$3p^6(^1S)4s$	$4s\ ^2S$	½	0.00	
$3p^6(^1S)3d$	$3d\ ^2D$	1½ 2½	13650.212 13710.901	60.689
$3p^6(^1S)4p$	$4p\ ^2P^\circ$	½ 1½	*25191.541* *25414.427*	222.886
$3p^6(^1S)5s$	$5s\ ^2S$	½	52166.982	
$3p^6(^1S)4d$	$4d\ ^2D$	1½ 2½	56839.309 56858.511	19.202
$3p^6(^1S)5p$	$5p\ ^2P^\circ$	½ 1½	*60535.0* *60613.2*	78.2
$3p^6(^1S)4f$	$4f\ ^2F^\circ$	{2½ 3½}	*68056.96*	
$3p^6(^1S)6s$	$6s\ ^2S$	½	70677.61	
$3p^6(^1S)5d$	$5d\ ^2D$	1½ 2½	72722.11 72730.77	8.66
$3p^6(^1S)6p$	$6p\ ^2P^\circ$	½ 1½	*74485.8* *74521.7*	35.9
$3p^6(^1S)5f$	$5f\ ^2F^\circ$	{2½ 3½}	*78027.8*	
$3p^6(^1S)5g$	$5g\ ^2G$	{3½ 4½}	[78163]	
$3p^6(^1S)7s$	$7s\ ^2S$	½	79449.9	
$3p^6(^1S)6d$	$6d\ ^2D$	1½ 2½	80523.47 80528.06	4.59
$3p^6(^1S)6f$	$6f\ ^2F^\circ$	{2½ 3½}	*83458.4*	
$3p^6(^1S)6g$	$6g\ ^2G$	{3½ 4½}	83540.0	
$3p^6(^1S)8s$	$8s\ ^2S$	½	84302.6	
$3p^6(^1S)7d$	$7d\ ^2D$	1½ 2½	84935.4 84938.3	2.9
$3p^6(^1S)7f$	$7f\ ^2F^\circ$	{2½ 3½}	*86727.5*	

Ca II

Config.	Desig.	J	Level	Interval
$3p^6(^1S)7g$	$7g\ ^2G$	{3½ 4½}	86780.9	
$3p^6(^1S)8d$	$8d\ ^2D$	1½ 2½	87674.0 87675.7	1.7
$3p^6(^1S)8f$	$8f\ ^2F^\circ$	{2½ 3½}	*88847.6*	
$3p^6(^1S)8g$	$8g\ ^2G$	{3½ 4½}	88883.8	
$3p^6(^1S)9d$	$9d\ ^2D$	1½ 2½	89489.8 89490.8	1.0
$3p^6(^1S)9f$	$9f\ ^2F^\circ$	{2½ 3½}	*90300.0*	
$3p^6(^1S)9g$	$9g\ ^2G$	{3½ 4½}	90326.4	
$3p^6(^1S)10d$	$10d\ ^2D$	1½ 2½	90755.3 90756.1	0.8
$3p^6(^1S)10f$	$10f\ ^2F^\circ$	{2½ 3½}	*91338.0*	
$3p^6(^1S)11d$	$11d\ ^2D$	{1½ 2½}	91674.0	
$3p^6(^1S)12d$	$12d\ ^2D$	{1½ 2½}	92360.9	
$3p^6(^1S)13d$	$13d\ ^2D$	{1½ 2½}	92885.0	
$3p^6(^1S)14d$	$14d\ ^2D$	{1½ 2½}	93299.6	
$3p^6(^1S)15d$	$15d\ ^2D$	{1½ 2½}	93628.8	
$3p^6(^1S)16d$	$16d\ ^2D$	{1½ 2½}	93896.4	
Ca III ($^1S_0$)	*Limit*	-------	**95748.0**	

May 1948.

Ca III

(A I sequence; 18 electrons) Z=20

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\;{}^1S_0$

$3p^6\;{}^1S_0$ **413127 cm^{-1}** I. P. 51.21 volts

This spectrum is incompletely analyzed. The present list has been compiled from the paper by Bowen, who has classified 137 lines in the region between 403 A and 4081 A.

The Paschen notation as given by Bowen is entered in column one of the table, under the heading "A I". Bowen remarks, however, that these assignments are in many cases doubtful for levels having the $3d$ configuration. The writer has, nevertheless, adopted them tentatively in order to introduce the jl-coupling notation in the general form suggested by Racah, as in the case of all spectra like A I. The pairs $nd[3\frac{1}{2}]^\circ$ and $nd[1\frac{1}{2}]^\circ$ are partially inverted as compared with Ne I.

The LS-designations $ns\;{}^3P^\circ_{210}\;{}^1P^\circ_1$ can probably be safely assigned to the levels ns_5, ns_4, ns_3, ns_2, respectively.

REFERENCE

I. S. Bowen, Phys. Rev. **31**, 499 (1928). (I P) (T) (C L)

Ca III

A I	Bowen	Config.	Desig.	J	Level
$1p_0$	$3p$	$3p^6$	$3p^6\;{}^1S$	0	0.0
		$3p^5(^2P^\circ_{1\frac{1}{2}})3d$	$3d\;[\frac{1}{2}]^\circ$	0	
$3d_5$	$3D_1$			1	*203845.1*
		"	$3d\;[3\frac{1}{2}]^\circ$	4	
$3d_4$	$3D_3$			3	*213378.3*
$3d_3$	$3D_2$	"	$3d\;[1\frac{1}{2}]^\circ$	2	*204835.4*
$3d_2$	$3D_5$			1	*224552.4*
$3d_1''$	$3D_4$	"	$3d\;[2\frac{1}{2}]^\circ$	2	*214332.3*
				3	
$3s_1''''$	$3D_6$	$3p^5(^2P^\circ_{\frac{1}{2}})3d$	$3d'\;[2\frac{1}{2}]^\circ$	2	*225823.2*
$3s_1'''$	$3D_8$			3	*228411.6*
$3s_1''$	$3D_7$	"	$3d'\;[1\frac{1}{2}]^\circ$	2	*227387.8*
$3s_1'$	$3D_9$			1	*232831.4*
$1s_5$	$4s_5$	$3p^5(^2P^\circ_{1\frac{1}{2}})4s$	$4s\;[1\frac{1}{2}]^\circ$	2	*242543.5*
$1s_4$	$4s_4$			1	*243927.0*
$1s_3$	$4s_3$	$3p^5(^2P^\circ_{\frac{1}{2}})4s$	$4s'\;[\frac{1}{2}]^\circ$	0	*245608.4*
$1s_2$	$4s_2$			1	*247693.4*
$2p_{10}$	$4p_{10}$	$3p^5(^2P^\circ_{1\frac{1}{2}})4p$	$4p\;[\frac{1}{2}]$	1	272185.4
$2p_9$	$4p_9$	"	$4p\;[2\frac{1}{2}]$	3	277018.8
$2p_8$	$4p_8$			2	277377.5
$2p_7$	$4p_7$	"	$4p\;[1\frac{1}{2}]$	1	278616.7
$2p_6$	$4p_6$			2	279738.2

Ca III

A I	Bowen	Config.	Desig.	J	Level
$2p_5$	$4p_5$	$3p^5(^2P^\circ_{1\frac{1}{2}})4p$	$4p\;[\frac{1}{2}]$	0	282072
$2p_4$	$4p_4$	$3p^5(^2P^\circ_{\frac{1}{2}})4p$	$4p'\;[1\frac{1}{2}]$	1	281136.3
$2p_3$	$4p_3$			2	281878.8
$2p_2$	$4p_2$	"	$4p'\;[\frac{1}{2}]$	1	282568.4
				0	
		$3p^5(^2P^\circ_{1\frac{1}{2}})4d$	$4d\;[\frac{1}{2}]^\circ$	0	
$4d_5$	$4D_1$			1	*322998.9*
		"	$4d\;[3\frac{1}{2}]^\circ$	4	
$4d_4$	$4D_3$			3	*326182*
$4d_3$	$4D_2$	"	$4d\;[1\frac{1}{2}]^\circ$	2	*323650.6*
				1	
$4d_1''$	$4D_4$	"	$4d\;[2\frac{1}{2}]^\circ$	2	*328086.5*
				3	
		$3p^5(^2P^\circ_{\frac{1}{2}})4d$	$4d'\;[2\frac{1}{2}]^\circ$	2	
$4s_1'''$	$4D_5$			3	*335285.9*
$2s_5$	$5s_5$	$3p^5(^2P^\circ_{1\frac{1}{2}})5s$	$5s\;[1\frac{1}{2}]^\circ$	2	*327917*
$2s_4$	$5s_4$			1	*328580.4*
$2s_3$	$5s_3$	$3p^5(^2P^\circ_{\frac{1}{2}})5s$	$5s'\;[\frac{1}{2}]^\circ$	0	*331042.7*
$2s_2$	$5s_2$			1	*331398.6*
		Ca IV $(^2P^\circ_{1\frac{1}{2}})$	*Limit*	-------	**413127**
		Ca IV $(^2P^\circ_{\frac{1}{2}})$	*Limit*	-------	416261

May 1948.

Ca III Observed Levels*

Config. $1s^2\ 2s^2\ 2p^6\ 3s^2+$	Observed Terms		
$3p^6$	$3p^6\ {}^1S$		
	ns ($n \geq 4$)		
$3p^5(^2P^\circ)nx$	{ 4, 5*s* $^3P^\circ$ 4, 5*s* $^1P^\circ$		
jl-Coupling Notation			
	Observed Levels		
	ns ($n \geq 4$)	*np* ($n \geq 4$)	*nd* ($n \geq 3$)
$3p^5(^2P^\circ_{1\frac{1}{2}})nx$	4, 5*s* [1½]°	4*p* [½] 4*p* [2½] 4*p* [1½]	3, 4*d* [½]° 3, 4*d* [3½]° 3, 4*d* [1½]° 3, 4*d* [2½]°
$3p^5(^2P^\circ_{\frac{1}{2}})nx'$	4, 5*s*'[½]°	4*p*'[1½] 4*p*'[½]	3, 4*d*'[2½]° 3*d*'[1½]°

*For predicted levels in the spectra of the A I isoelectronic sequence, see Introduction.

Ca IV

(Cl I sequence; 17 electrons) $Z=20$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5\ {}^2P^\circ_{1\frac{1}{2}}$

$3p^5\ {}^2P^\circ_{1\frac{1}{2}}$ *542000* cm^{-1} I. P. 67 volts

Various investigators disagree about the interpretation of this spectrum. Tsien has published 34 classified lines in the region between 249 A and 669 A, all but one of which are due to combinations from the ground term. His terms are listed except for $4s\ {}^4P$, $4s\ {}^2P$, and $4s'\ {}^2D$, which are from the paper by Kruger and Phillips. Further study of this spectrum is desirable to confirm the present analysis.

The limit (entered in brackets in the table) is from Edlén, who has estimated it by extrapolation along the isoelectronic sequence.

REFERENCES

I. S. Bowen, Phys. Rev. **31**, 498 (1928). (C L)
B. Edlén, Zeit. Phys. **104**, 410 (1947). (I P)
P. G. Kruger and L. W. Phillips, Phys. Rev. **51**, 1087 (1937). (T) (C L)
W.-Z. Tsien, Chinese J. Phys. **3**, No. 2, 118 (1939). (T) (C L)

Ca IV

Config.	Desig.	J	Level	Interval
$3s^2\,3p^5$	$3p^5\ ^2P^\circ$	1½ ½	*0* *3115*	−3115
$3s\ 3p^6$	$3p^6\ ^2S$	½	152430	
$3s^2\,3p^4(^3P)3d$	$3d\ ^4F$	4½ 3½ 2½ 1½	 221944	
$3s^2\,3p^4(^3P)3d$	$3d\ ^4D$	3½ 2½ 1½ ½	 227427 227827 228691	 −400 −864
$3s^2\,3p^4(^3P)3d$	$3d\ ^2D$	1½ 2½	228429 230113	1684
$3s^2\,3p^4(^3P)3d$	$3d\ ^2F$	3½ 2½	 266840	
$3s^2\,3p^4(^3P)4s$	$4s\ ^4P$	2½ 1½ ½	291373 293011 294291	−1638 −1280
$3s^2\,3p^4(^3P)4s$	$4s\ ^2P$	1½ ½	298175 300249	−2074
$3s^2\,3p^4(^1D)3d$	$3d'\ ^2D$	2½ 1½	 303591	
$3s^2\,3p^4(^1D)3d$	$3d'\ ^2S$	½	303844	
$3s^2\,3p^4(^1D)4s$	$4s'\ ^2D$	1½ 2½	314079 314373	294
$3s^2\,3p^4(^3P)4p$	$4p\ ^2P^\circ$	1½ ½	*329277*	
$3s^2\,3p^4(^1S)4s$	$4s''\ ^2S$	½	337207	
$3s^2\,3p^4(^1D)5s$	$5s'\ ^2D$	2½ 1½	399755 400949	−1194
Ca V ($3p^4\ ^3P_2$)	*Limit*	-------	*[542000]*	

March 1948.

Ca IV Observed Terms*

Config. $1s^2\,2s^2\,2p^6$	Observed Terms		
$3s^2\,3p^5$	$3p^5\ ^2P^\circ$		
$3s\ 3p^6$	$3p^6\ ^2S$		
	$ns\ (n\geq 4)$	$np\ (n\geq 4)$	$nd\ (n\geq 3)$
$3s^2\,3p^4(^3P)nx$	$4s\ ^4P$ $4s\ ^2P$	$4p\ ^2P^\circ$	$3d\ ^4D$ $3d\ ^4F$ $3d\ ^2D$ $3d\ ^2F$
$3s^2\,3p^4(^1D)nx'$	4, $5s'\ ^2D$		$3d'\ ^2S$ $3d'\ ^2D$
$3s^2\,3p^4(^1S)nx''$	$4s''\ ^2S$		

*For predicted terms in the spectra of the Cl I isoelectronic sequence, see Introduction.

Ca V

(S I sequence; 16 electrons) $Z=20$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^4\ ^3P_2$

$3p^4\ ^3P_2$ 680800 cm^{-1} I. P. 84.39 volts

The terms are from the papers by Bowen and by Tsien with the revised value of $3p^5\ ^1P^\circ$ suggested by Edlén.

More than 70 lines have been classified in the interval 184 A to 656 A. Intersystem combinations connecting the singlet and triplet terms have been observed.

REFERENCES

M. Ram, Indian J. Phys. **8**, 167 (1933). (T) (C L)
I. S. Bowen, Phys. Rev. **46**, 791 (1934). (T) (C L)
B. Edlén, Zeit. Phys. **104**, 192 (1937). (I P)
W.-Z. Tsien, Chinese J. Phys. **3**, No. 2, 131 (1939). (T) (C L)
B. Edlén, Phys. Rev. **62**, 434 (1942). (T) (C L)

Ca V

Config.	Desig.	J	Level	Interval
$3s^2\,3p^4$	$3p^4\ {}^3P$	2	0	
		1	2404	−2404
		0	3276	−872
$3s^2\,3p^4$	$3p^4\ {}^1D$	2	18831	
$3s^2\,3p^4$	$3p^4\ {}^1S$	0	43847	
$3s\ 3p^5$	$3p^5\ {}^3P^\circ$	2	154664	
		1	156756	−2092
		0	157897	−1141
$3s\ 3p^5$	$3p^5\ {}^1P^\circ$	1	197849	
$3s^2\,3p^3(^2D^\circ)3d$	$3d'\ {}^1F^\circ$	3	254125	
$3s^2\,3p^3(^2P^\circ)3d$	$3d''\ {}^3P^\circ$	2	298204	
		1	299535	−1331
		0		
$3s^2\,3p^3(^2P^\circ)3d$	$3d''\ {}^1P^\circ$	1	302184	
$3s^2\,3p^3(^2P^\circ)3d$	$3d''\ {}^3D^\circ$	3		
		2	309834	
		1	310945	−1111
$3s^2\,3p^3(^2P^\circ)3d$	$3d''\ {}^1D^\circ$	2	329230	
$3s^2\,3p^3(^4S^\circ)4s$	$4s\ {}^3S^\circ$	1	350914	
$3s^2\,3p^3(^2D^\circ)4s$	$4s'\ {}^3D^\circ$	1	369590	
		2	369696	106
		3	369959	263
$3s^2\,3p^3(^2D^\circ)4s$	$4s'\ {}^1D^\circ$	2	374728	
$3s^2\,3p^3(^2P^\circ)4s$	$4s''\ {}^3P^\circ$	0	387039	
		1	387226	187
		2	387652	426
$3s^2\,3p^3(^2P^\circ)4s$	$4s''\ {}^1P^\circ$	1	392283	
$3s^2\,3p^3(^4S^\circ)5s$	$5s\ {}^3S^\circ$	1	501127	
$3s^2\,3p^3(^2D^\circ)5s$	$5s'\ {}^3D^\circ$	1	524651	
		2	524770	119
		3	525053	283
$3s^2\,3p^3(^2D^\circ)5s$	$5s'\ {}^1D^\circ$	2	526523	
$3s^2\,3p^3(^2P^\circ)5s$	$5s''\ {}^3P^\circ$	0		
		1	542249	
		2	542650	401
$3s^2\,3p^3(^2P^\circ)5s$	$5s''\ {}^1P^\circ$	1	544143	
Ca VI $(^4S^\circ_{1\frac{1}{2}})$	*Limit*		**680800**	

December 1947.

Ca V Observed Terms*

Config. $1s^2\,2s^2\,2p^6+$	Observed Terms	
$3s^2\,3p^4$	$3p^4\ {}^1S$; $3p^4\ {}^3P$; $3p^4\ {}^1D$	
$3s\ 3p^5$	$3p^5\ {}^3P^\circ$; $3p^5\ {}^1P^\circ$	
	$ns\ (n\geq 4)$	$nd\ (n\geq 3)$
$3s^2\,3p^3(^4S^\circ)nx$	4, 5s $^3S^\circ$	
$3s^2\,3p^3(^2D^\circ)nx'$	4, 5s′ $^3D^\circ$; 4, 5s′ $^1D^\circ$	$3d'\ {}^1F^\circ$
$3s^2\,3p^3(^2P^\circ)nx''$	4, 5s″ $^3P^\circ$; 4, 5s″ $^1P^\circ$	$3d''\ {}^3P^\circ$; $3d''\ {}^1P^\circ$; $3d''\ {}^3D^\circ$; $3d''\ {}^1D^\circ$

*For predicted terms in the spectra of the S I isoelectronic sequence, see Introduction.

Ca VI

(P I sequence; 15 electrons) Z=20

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3\ {}^4S^\circ_{1\frac{1}{2}}$

$3p^3\ {}^4S^\circ_{1\frac{1}{2}}$ ______ cm^{-1} I. P. ______ volts

The terms are from the paper by Tsien, who includes those given earlier by Bowen. Fifty-three lines have been classified in the interval between 228 A and 766 A. For the term $3p^4\ {}^2P$ the value given by Mrs. Beckman is quoted in place of that by Tsien.

The relative positions of the doublet and quartet systems of terms were estimated from the irregular doublet law. No intersystem combinations have been observed, as indicated by the uncertainty x in the table and the brackets around $3p^3\ {}^2D^\circ_{1\frac{1}{2}}$.

REFERENCES

I. S. Bowen, Phys. Rev. **46**, 791 (1934). (T) (C L)

A. Beckman, *Bidrag till Kännedomen om Skandiums Spektrum i Yttersta Ultraviolett*, Akademisk Avhandling p. 74 (Almqvist and Wiksells Boktryckeri –A.–B., Uppsala, 1937). (C L)

W.–Z. Tsien, Chinese J. Phys. **3**, No. 2, 136 (1939). (T) (C L)

Ca VI

Config.	Desig.	J	Level	Interval
$3s^2\ 3p^3$	$3p^3\ {}^4S^\circ$	1½	*0*	
$3s^2\ 3p^3$	$3p^3\ {}^2D^\circ$	1½	*[27000]+x*	417
		2½	*27417+x*	
$3s^2\ 3p^3$	$3p^3\ {}^2P^\circ$	½	*44754+x*	556
		1½	*45310+x*	
$3s\ 3p^4$	$3p^4\ {}^4P$	2½	155792	−1983
		1½	157775	−1058
		½	158833	
	1 (²D)	2½	175758+x	−399
	2	1½	176157+x	
$3s\ 3p^4$	$3p^4\ {}^2D$	1½	193412+x	201
		2½	193613+x	
$3s\ 3p^4$	$3p^4\ {}^2P$	1½	223170+x	
		½		
$3s\ 3p^4$	$3p^4\ {}^2S$	½	231318+x	
$3s^2\ 3p^2({}^3P)3d$	$3d\ {}^2F$	2½	291165+x	
		3½		
$3s^2\ 3p^2({}^3P)3d$	$3d\ {}^2P$	1½	294798+x	−2452
		½	297250+x	

Ca VI

Config.	Desig.	J	Level	Interval
	3		303651+x	
$3s^2\ 3p^2({}^1D)3d$	$3d'\ {}^2S$	½	320397+x	
$3s^2\ 3p^2({}^1D)3d$	$3d'\ {}^2D$	2½	321084+x	−500
		1½	321584+x	
$3s^2\ 3p^2({}^1D)3d$	$3d'\ {}^2P$	½	332138+x	1354
		1½	333492+x	
$3s^2\ 3p^2({}^1S)3d$	$3d''\ {}^2D$	1½	360821+x	
		2½		
$3s^2\ 3p^2({}^3P)3d$	$3d\ {}^2D$	2½		
		1½	383743+x	
$3s^2\ 3p^2({}^3P)4s$	$4s\ {}^4P$	½	433849	1437
		1½	435286	2106
		2½	437392	
$3s^2\ 3p^2({}^3P)4s$	$4s\ {}^2P$	½	442423+x	2467
		1½	444890+x	
$3s^2\ 3p^2({}^1D)4s$	$4s'\ {}^2D$	2½	457458+x	−67
		1½	457525+x	

November 1947.

Ca VI Observed Terms*

Config. $1s^2\ 2s^2\ 2p^6+$	Observed Terms				
$3s^2\ 3p^3$	$3p^3\ ^4S^\circ$	$3p^3\ ^2P^\circ$	$3p^3\ ^2D^\circ$		
$3s\ 3p^4$	$3p^4\ ^2S$	$3p^4\ ^4P$ $3p^4\ ^2P$	$3p^4\ ^2D$		
	$ns\ (n\geq 4)$		$nd\ (n\geq 3)$		
$3s^2\ 3p^2(^3P)nx$	$4s\ ^4P$ $4s\ ^2P$		$3d'\ ^2P$	$3d\ ^2D$	$3d\ ^2F$
$3s^2\ 3p^2(^1D)nx'$	$4s'\ ^2D$	$3d'\ ^2S$	$3d'\ ^2P$	$3d'\ ^2D$	
$3s^2\ 3p^2(^1S)nx''$				$3d''\ ^2D$	

*For predicted terms in the spectra of the P I isoelectronic sequence, see Introduction.

Ca VII

(Si I sequence; 14 electrons) $Z=20$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^2\ ^3P_0$

$3p^2\ ^3P_0$ **1030000 cm^{-1}** I. P. 128 volts

The terms are from the paper by Phillips, who includes those found by Whitford and by Robinson. In the interval between 202 A and 640 A, 33 lines have been classified in all. Intersystem combinations connecting the singlet and triplet terms have been observed.

The limit entered in brackets in the table has been estimated by Phillips.

REFERENCES

A. E. Whitford, Phys. Rev. **46**, 793 (1934). (T) (C L)
H. A. Robinson, Phys. Rev. **52**, 725 (1937). (T) (C L)
L. W. Phillips, Phys. Rev. **55**, 708 (1939). (I P) (T) (C L)

Ca VII

Config.	Desig.	J	Level	Interval
$3s^2\ 3p^2$	$3p^2\ ^3P$	0	0	
		1	1627	1627
		2	4070	2443
$3s^2\ 3p^2$	$3p^2\ ^1D$	2	21870	
$3s\ 3p^3$	$3p^3\ ^3D^\circ$	1	*160160*	
		2	*160228*	68
		3	*160527*	299
$3s\ 3p^3$	$3p^3\ ^3P^\circ$	2, 1, 0	*185405*	
$3s\ 3p^3$	$3p^3\ ^3S^\circ$	1	*245232*	
$3s\ 3p^3$	$3p^3\ ^1P^\circ$	1	*252493*	

Ca VII

Config.	Desig.	J	Level	Interval
$3s^2\ 3p(^2P^\circ)3d$	$3d\ ^3P^\circ$	2	*286232*	
		1	*288169*	−1937
		0	*289011*	−842
$3s^2\ 3p(^2P^\circ)3d$	$3d\ ^3D^\circ$	1	*302663*	
		2	*303151*	488
		3	*303349*	198
$3s^2\ 3p(^2P^\circ)4s$	$4s\ ^3P^\circ$	0	*490012*	
		1	*490918*	906
		2	*494264*	3346
Ca VIII ($^2P^\circ_{1/2}$)	*Limit*	-------	[1030000]	

October 1947.

Ca VIII

(Al I sequence; 13 electrons) $Z=20$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p\;{}^2P^\circ_{1/2}$

$3p\;{}^2P^\circ_{1/2}$ ***1189000*** cm^{-1} I. P. 147 volts

The analysis is by Whitford and by Phillips. Thirty-five lines have been classified in the interval between 114 A and 596 A. No intersystem combinations have been observed, but Phillips estimates that $3p^2\;{}^4P_{1/2}$ is approximately 128000 cm^{-1} above the ground state. This value is entered in brackets in the table. The uncertainty x may exceed ± 1000 cm^{-1}.

Using the method suggested by Edlén, the writer has extrapolated the value of the limit quoted above and entered in brackets in the table. The uncertainty in this estimate is large owing to the incompleteness of the isoelectronic sequence data.

REFERENCES

A. E. Whitford, Phys. Rev. **46**, 793 (1934). (T) (C L)

L. W. Phillips, Phys. Rev. **55**, 708 (1939). (T) (C L)

Ca VIII

Config.	Desig.	J	Level	Interval
$3s^2(^1S)3p$	$3p\;{}^2P^\circ$	½	*0*	
		1½	*4305*	4305
$3s\,3p^2$	$3p^2\;{}^4P$	½	[128000]$+x$	
		1½	129581 $+x$	1581
		2½	131942 $+x$	2361
$3s\,3p^2$	$3p^2\;{}^2D$	1½	171573	
		2½	171828	255
$3s\,3p^2$	$3p^2\;{}^2S$	½	216590	
$3s\,3p^2$	$3p^2\;{}^2P$	½	231012	
		1½	233584	2572
$3s^2(^1S)3d$	$3d\;{}^2D$	1½	282362	
		2½	282574	212
$3p^3$	$3p^3\;{}^4S^\circ$	1½	*344176* $+x$	
$3s\,3p(^3P^\circ)3d$	$3d\;{}^4D^\circ$	½	*410725* $+x$	
		1½	*411283* $+x$	558
		2½	*411664* $+x$	381
		3½	*411782* $+x$	118
$3s^2(^1S)4s$	$4s\;{}^2S$	½	547308	
$3s\,3p(^3P^\circ)4s$	$4s\;{}^4P^\circ$	½	*687650* $+x$	
		1½	*689017* $+x$	1367
		2½	*691726* $+x$	2709
$3s^2(^1S)4d$	$4d\;{}^2D$	1½	697981	
		2½	698172	191
$3s^2(^1S)5d$	$5d\;{}^2D$	1½	872860	
		2½	873070	210
Ca IV ($^1S_0$)	*Limit*	-------	**[1189000]**	

September 1947.

Ca VIII OBSERVED TERMS*

Config. $1s^2\,2s^2\,2p^6+$	Observed Terms	
$3s^2(^1S)3p$	$3p\;{}^2P^\circ$	
$3s\,3p^2$	{ $3p^2\;{}^2S$; $3p^2\;{}^4P$; $3p^2\;{}^2P$; $3p^2\;{}^2D$	
$3p^3$	$3p^3\;{}^4S^\circ$	
	$ns\;(n\geq 4)$	$nd\;(n\geq 3)$
$3s^2(^1S)nx$	$4s\;{}^2S$	3–$5d\;{}^2D$
$3s\,3p(^3P^\circ)nx$	$4s\;{}^4P^\circ$	$3d\;{}^4D^\circ$

*For predicted terms in the spectra of the Al I isoelectronic sequence, see Introduction.

Ca IX

(Mg I sequence; 12 electrons) $Z=20$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ {}^1S_0$

$3s^2\ {}^1S_0$ **1519000±** cm^{-1} I. P. 188± volts

Twenty-eight lines have been classified in the range between 100 A and 828 A. The triplet terms are from Parker and Phillips; the singlets from Tsien. By extrapolation along the sequence, Mrs. Beckman has classified a line at 693.824 A as the intersystem combination $3s^2\ {}^1S_0-3p\ {}^3P^\circ_1$. The listed values of the triplet terms have been adjusted to fit this assignment.

From isoelectronic sequence data, the writer has extrapolated the value of the limit, using the method suggested by Edlén. This value is entered in brackets in the table. Although this estimate may be in error by more than ±1000 cm^{-1}, it gives an approximate value of the ionization potential.

REFERENCES

A. Beckman, *Bidrag till Kännedomen om Skandiums Spektrum i Yttersta Ultraviolett,* Akademisk Avhandling p. 55 (Almqvist and Wiksells Boktryckeri –A.–B., Uppsala, 1937). (C L)

W.–Z. Tsien, Chinese J. Phys. **3**, No. 2, 142 (1939). (T) (C L)

W. L. Parker and L. W. Phillips, Phys. Rev. **57**, 140 (1940). (T) (C L)

Ca IX

Config.	Desig.	J	Level	Interval
$3s^2$	$3s^2\ {}^1S$	0	0	
$3s(^2S)3p$	$3p\ {}^3P^\circ$	0	*142635*	
		1	*144130*	1495
		2	*147370*	3240
$3s(^2S)3p$	$3p\ {}^1P^\circ$	1	*214487.8*	
$3s(^2S)3d$	$3d\ {}^1D$	2	335195.0	
$3p^2$	$3p^2\ {}^3P$	0	339420	
		1	341333	1913
		2	344935	3602
$3s(^2S)3d$	$3d\ {}^3D$	1	411525	
		2	411652	127
		3	411858	206

Ca IX

Config.	Desig.	J	Level	Interval
$3s(^2S)4s$	$4s\ {}^3S$	1	760002	
$3s(^2S)4d$	$4d\ {}^3D$	1	916652	
		2	916780	128
		3	916990	210
$3s(^2S)4f$	$4f\ {}^3F^\circ$	2	*954003*	
		3	*954023*	20
		4	*954055*	32
$3s(^2S)5d$	$5d\ {}^3D$	1		
		2	1137720	
		3	1137880	160
Ca X ($^2S_{1/2}$)	*Limit*	-------	[1519000]	

March 1948.

Ca x

(Na I sequence; 11 electrons) $Z=20$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s\ ^2S_{½}$

$3s\ ^2S_{½}$ **1704660** cm^{-1} I. P. 211.29 volts

Kruger and Phillips extended the earlier analysis by Edlén. Their absolute term values are derived from three members of the ^2D-series. One term, $5s\ ^2S$ has been added from the work of Tsien but adjusted to agree with those by Kruger and Phillips.

Twenty-two lines have been classified in the range from 93 A to 574 A.

REFERENCES

W.-Z. Tsien, Chinese J. Phys **3**, No. 2, 145 (1939). (T) (C L)
P. G. Kruger and L. W. Phillips, Phys. Rev. **55**, 352 (1939). (I P) (T) (C L)

Ca x

Config.	Desig.	J	Level	Interval
3s	3s ²S	½	0	
3p	3p ²P°	½	*174214*	5081
		1½	*179295*	
3d	3d ²D	1½	417113	414
		2½	417527	
4s	4s ²S	½	832838	
4p	4p ²P°	½	*899305*	1905
		1½	*901210*	
4d	4d ²D	1½	987259	225
		2½	987484	
4f	4f ²F°	2½	*1016113*	95
		3½	*1016208*	
5s	5s ²S	½	1170098	
5d	5d ²D	1½	1248686	105
		2½	1248791	
5f	5f ²F°	2½	*1263323*	60
		3½	*1263383*	
6f	6f ²F°	2½		
		3½	*1398140*	
Ca XI (¹S₀)	*Limit*		1704660	

June 1947.

Ca xi

(Ne I sequence; 10 electrons) $Z=20$

Ground state $1s^2\ 2s^2\ 2p^6\ ^1S_0$

$2p^6\ ^1S_0$ **4774300** cm^{-1} I. P. 591.8 volts

Eleven lines between 25 A and 35 A have been classified by Edlén and Tyrén as combinations with the ground term. Their absolute term values have been extrapolated along the Ne I isoelectronic sequence.

By analogy with Ne I, the *jl*-coupling notation in the general form suggested by Racah is introduced.

The unit adopted by Edlén and Tyrén, $10^3\ cm^{-1}$, has here been changed to cm^{-1}.

REFERENCES

B. Edlén and F. Tyrén, Zeit. Phys. **101**, 206 (1936). (I P) (T) (C L)
G. Racah, Phys. Rev. **61**, 537 (L) (1942).

Ca XI

Authors	Config.	Desig.	J	Level
$2p\ ^1S_0$	$2s^2\,2p^6$	$2p^6\ ^1S$	0	0
	$2s^2\,2p^5(^2P^\circ_{1\frac{1}{2}})3s$	$3s\ [1\frac{1}{2}]^\circ$	2	
$3s\ ^3P_1$			1	*2810900*
	$2s^2\,2p^5(^2P^\circ_{\frac{1}{2}})3s$	$3s'\ [\frac{1}{2}]^\circ$	0	
$3s\ ^1P_1$			1	*2839900*
	$2s^2\,2p^5(^2P^\circ_{1\frac{1}{2}})3d$	$3d\ [\frac{1}{2}]^\circ$	0	
$3d\ ^3P_1$			1	*3199300*
$3d\ ^1P_1$	"	$3d\ [1\frac{1}{2}]^\circ$	1	*3239700*
$3d\ ^3D_1$	$2s^2\,2p^5(^2P^\circ_{\frac{1}{2}})3d$	$3d'\ [1\frac{1}{2}]^\circ$	1	*3284300*
	$2s\ 2p^6(^2S)3p$	$3p\ ^3P^\circ$	2	
$3p'\ ^3P_1$			1	*3692900*
			0	

Ca XI

Authors	Config.	Desig.	J	Level
$3p'\ ^1P_1$	$2s\ 2p^6(^2S)3p$	$3p\ ^1P^\circ$	1	*3708900*
	$2s^2\,2p^5(^2P^\circ_{1\frac{1}{2}})4s$	$4s\ [1\frac{1}{2}]^\circ$	2	
$4s\ ^3P_1$			1	*3753900*
	$2s^2\,2p^5(^2P^\circ_{\frac{1}{2}})4s$	$4s'\ [\frac{1}{2}]^\circ$	0	
$4s\ ^1P_1$			1	*3781900*
$4d\ ^1P_1$	$2s^2\,2p^5(^2P^\circ_{1\frac{1}{2}})4d$	$4d\ [1\frac{1}{2}]^\circ$	1	*3919000*
$4d\ ^3D_1$	$2s^2\,2p^5(^2P^\circ_{\frac{1}{2}})4d$	$4d'\ [1\frac{1}{2}]^\circ$	1	*3948400*
	Ca XII $(^2P^\circ_{1\frac{1}{2}})$	----------	*Limit*	**4774300**
	Ca XII $(^2P^\circ_{\frac{1}{2}})$	----------	*Limit*	4804328

April 1947.

Ca XI Observed Levels*

Config. $1s^2+$	Observed Terms		
$2s^2\,2p^6$	$2p^6\ ^1S$		
	$ns\ (n\geq 3)$	$np\ (n\geq 3)$	$nd\ (n\geq 3)$
$2s^2\,2p^5(^2P^\circ)nx$	3, 4s $^3P^\circ$ 3, 4s $^1P^\circ$		3d $^3P^\circ$ 3, 4d $^3D^\circ$ 3, 4d $^1P^\circ$
$2s\ 2p^6(^2S)nx$		3p $^3P^\circ$ 3p $^1P^\circ$	
***jl*-Coupling Notation**			
	Observed Pairs		
	$ns\ (n\geq 3)$		$nd\ (n\geq 3)$
$2s^2\,2p^5(^2P^\circ_{1\frac{1}{2}})nx$	3, 4s $[1\frac{1}{2}]^\circ$		3d $[\frac{1}{2}]^\circ$ 3, 4d $[1\frac{1}{2}]^\circ$
$2s^2\,2p^5(^2P^\circ_{\frac{1}{2}})nx'$	3, 4s' $[\frac{1}{2}]^\circ$		3, 4d' $[1\frac{1}{2}]^\circ$

*For predicted levels in the spectra of the Ne I isoelectronic sequence, see Introduction.

Ca XII

(F I sequence; 9 electrons) $Z=20$

Ground state $1s^2\ 2s^2\ 2p^5\ {}^2P^\circ_{1\frac{1}{2}}$

$2p^5\ {}^2P^\circ_{1\frac{1}{2}}$ cm^{-1} I. P. 655 volts

Edlén and Tyrén have classified 9 lines in the range 27 A to 32 A. They have published no term array because the analysis is so incomplete. In the 1942 paper Edlén lists the interval of the ground term as 30028 cm^{-1}, a value based on unpublished material. From these data preliminary term values have been calculated and entered in the table.

REFERENCES

B. Edlén and F. Tyrén, Zeit. Phys. **101,** 206 (1936). (C L)
B. Edlén, Zeit. Astroph. **22,** 59 (1942). (I P) (T)

Ca XII

Edlén	Config.	Desig.	J	Level	Interval
$2p\ {}^2P_2$	$2s^2\ 2p^5$	$2p^5\ {}^2P^\circ$	$1\frac{1}{2}$	*0*	−30028
${}^2P_1$			$\frac{1}{2}$	*30028*	
$3s\ {}^4P_3$	$2s^2\ 2p^4(^3P)3s$	$3s\ {}^4P$	$2\frac{1}{2}$	3062300	−14800
${}^4P_2$			$1\frac{1}{2}$	3077100	
			$\frac{1}{2}$		
$3s\ {}^2P_2$	$2s^2\ 2p^4(^3P)3s$	$3s\ {}^2P$	$1\frac{1}{2}$	3097900	
${}^2P_1$			$\frac{1}{2}$		
$\overline{3s}\ {}^2D_3$	$2s^2\ 2p^4(^1D)3s$	$3s'\ {}^2D$	$2\frac{1}{2}$	3158600	−300
${}^2D_2$			$1\frac{1}{2}$	3158900	
$\overline{3d}$	$2s^2\ 2p^4(^1D)3d$	$3d'$ X		3574200	
$\overline{\overline{3d}}\ {}^2D_3$	$2s^2\ 2p^4(^1S)3d$	$3d''\ {}^2D$	$2\frac{1}{2}$	3648000	−4400
${}^2D_2$			$1\frac{1}{2}$	3652400	

March 1947.

Ca XIII

(O I sequence; 8 electrons) $Z=20$

Ground state $1s^2\ 2s^2\ 2p^4\ {}^3P_2$

$2p^4\ {}^3P_2$ cm^{-1} I. P. volts

This spectrum has not been analyzed. Edlén suggests the possibility that the line observed in the coronal spectrum at 4086.3 A (24465 cm^{-1}) may be due to the forbidden transition $2p^4\ {}^3P_2 - 2p^4\ {}^3P_1$ of Ca XIII. This separation for the leading components of the ground term is not inconsistent with that extrapolated along the O I isoelectronic sequence.

REFERENCE

B. Edlén, Zeit. Astroph. **22**, 62 (1942). (T)

March 1947.

Ca XV

(C I sequence; 6 electrons) $Z=20$

Ground state $1s^2\ 2s^2\ 2p^2\ {}^3P_0$

$2p^2\ {}^3P_0$ cm^{-1} I. P. volts

An extrapolation of the ground term interval along the C I isoelectronic sequence indicates that the separations of the components of the ground term, $2s^2\ 2p^2\ {}^3P$, should be approximately 17700 cm^{-1}, according to Edlén. He suggests that the line observed in the solar corona at 5694.42 A, wave number 17556 cm^{-1}, may tentatively be identified as [Ca XV]?, $2s^2\ 2p^2\ {}^3P_0 - 2s^2\ 2p^2\ {}^3P_1$.

REFERENCE

B. Edlén, Zeit. Astroph. **22**, 59 (1942). (T)

March 1947

SCANDIUM

Sc I

21 electrons $Z=21$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d\ 4s^2\ {}^2D_{1\frac{1}{2}}$

$a\ {}^2D_{1\frac{1}{2}}$ **52920 cm⁻¹** I. P. 6.56 volts

The analysis is chiefly from the paper by Russell and Meggers with some additions from unpublished manuscript generously furnished by Russell. In the published analysis the terms $a\ {}^4P$, $y\ {}^4P°$, and $z\ {}^4S°$ were unconnected with the rest and $a\ {}^4P_{\frac{1}{2}}$ was assigned the value x. The connection is now established from observed combinations.

Similarly, the group $a\ {}^2P$, $v\ {}^2D°$, $z\ {}^2S°$ and $u\ {}^2D°$ were connected with the rest only by the relation $a\ {}^2P_{\frac{1}{2}}=y$. Ufford has predicted the relative position of $a\ {}^2P$. His estimated value, $a\ {}^2P_{\frac{1}{2}}=21400$, is entered in brackets in the table and has been added to all levels in this group of terms. The uncertainty is indicated by y since the group is not connected with the rest by observed combinations.

The two terms, $f\ {}^4P$ and $x\ {}^4D°$ have been added from the unpublished material mentioned above. The limit is also from a recalculation of the series recently made by Russell for inclusion here.

Russell and Meggers have noted that the assignment of the limit terms to the two triads $z\ {}^2P°$ $z\ {}^2D°$ $z\ {}^2F°$, $y\ {}^2P°$ $y\ {}^2D°$ $y\ {}^2F°$ is uncertain. One triad has the limit $a\ {}^3D$ in Sc II and the other, $a\ {}^1D$. Russell, in discussing the behavior of the d electrons in related spectra, concludes that the higher triad has as its limit the term of higher multiplicity. (See 1927 reference below.)

The doublet and quartet terms are connected by observed intersystem combinations.

In the 1925 paper mentioned below some observed Zeeman patterns are given. Catalán has calculated from these patterns the g-values listed in the table.

REFERENCES

S. Goudsmit, J. van der Mark, and P. Zeeman, Proc. Roy. Acad. Amsterdam **28**, No. 2, 127 (1925). (Z E)

H. N. Russell and W. F. Meggers, Sci. Papers Bur. Std. **22**, No. 558, 340 (1927). (I P) (T) (C L) (G D)

H. N. Russell, Astroph. J. **66**, 201 (1927); Mt. Wilson Contr. No. 341 (1927).

C. W. Ufford, unpublished material (July 1941). (T)

H. N. Russell, unpublished material (Jan. 1934, May 1948). (I P) (T) (C L)

M. A. Catalân, unpublished material (June 1948). (Z E)

W. F. Meggers, J. Opt. Soc. Am. **36**, 431 (1946). (Summary hfs.)

Sc I

Config.	Desig.	J	Level	Interval	Obs. g
$3d\,4s^2$	$a\,^2D$	1½	0.00	168.34	0.79
		2½	168.34		1.20
$3d^2(a\,^3F)4s$	$a\,^4F$	1½	11520.15	37.49	
		2½	11557.64	52.60	
		3½	11610.24	67.07	
		4½	11677.31		
$3d^2(a\,^3F)4s$	$a\,^2F$	2½	14926.24	115.74	
		3½	15041.98		
$3d\,4s(a\,^3D)4p$	$z\,^4F^\circ$	1½	*15672.55*	83.96	
		2½	*15756.51*	125.25	
		3½	*15881.76*	144.76	
		4½	*16026.52*		
$3d\,4s(a\,^3D)4p$	$z\,^4D^\circ$	½	*16009.71*	12.07	
		1½	*16021.78*	119.26	
		2½	*16141.04*	69.76	
		3½	*16210.80*		
$3d\,4s(a\,^1D)4p$	$z\,^2D^\circ$	2½	*16022.72*	−74.14	
		1½	*16096.86*		
$3d^2(b\,^1D)4s$	$b\,^2D$	2½	17012.98	−12.38	
		1½	17025.36		
$3d^2(a\,^3P)4s$	$a\,^4P$	½	17918.85	29.13	
		1½	17947.98	52.27	
		2½	18000.25		
$3d\,4s(a\,^3D)4p$	$z\,^4P^\circ$	½	*18504.05*	11.72	
		1½	*18515.77*	55.63	
		2½	*18571.40*		
$3d\,4s(a\,^1D)4p$	$z\,^2P^\circ$	½	*18711.03*	144.73	
		1½	*18855.76*		
$3d^2(a\,^1G)4s$	$a\,^2G$	4½	20237.10	−2.82	
		3½	20239.92		
$3d\,4s(a\,^1D)4p$	$z\,^2F^\circ$	2½	*21032.78*	53.06	
		3½	*21085.84*		
$3d^2(a\,^3P)4s$	$a\,^2P$	½	[21400]+y	80.40	
		1½	21480.40+y		
$3d\,4s(a\,^3D)4p$	$y\,^2P^\circ$	{½, 1½}	*24656.80*		
$3d\,4s(a\,^3D)4p$	$y\,^2D^\circ$	1½	*24866.18*	147.97	0.82
		2½	*25014.15*		1.17
$3d\,4s(a\,^3D)4p$	$y\,^2F^\circ$	2½	*25584.64*	140.08	0.90
		3½	*25724.72*		1.14
$3d^2(a\,^3F)4p$	$z\,^4G^\circ$	2½	*29022.87*	73.33	
		3½	*29096.20*	93.63	
		4½	*29189.83*	113.69	
		5½	*29303.52*		
$3d^2(a\,^1S)4p$	$x\,^2P^\circ$	½	*30573.10*	133.51	0.68
		1½	*30706.61*		
$3d^2(a\,^3F)4p$	$y\,^4F^\circ$	1½	*31172.62*	43.14	
		2½	*31215.76*	59.56	
		3½	*31275.32*	75.49	
		4½	*31350.81*		
$3d^2(a\,^3F)4p$	$y\,^4D^\circ$	½	*32637.40*	21.81	
		1½	*32659.21*	37.63	
		2½	*32696.84*	54.70	
		3½	*32751.54*		
$3d^2(a\,^3F)4p$	$z\,^2G^\circ$	3½	*33056.19*	95.21	
		4½	*33151.40*		
$3d^2(a\,^3F)4p$	$x\,^2F^\circ$	2½	*33154.01*	124.63	
		3½	*33278.64*		
$3d^2(a\,^3F)4p$	$x\,^2D^\circ$	1½	*33615.06*	92.19	
		2½	*33707.25*		
$3d^3$	$e\,^4F$	1½	33763.57	35.11	
		2½	33798.68	47.94	
		3½	33846.62	59.78	
		4½	33906.40		
$3d\,4s(a\,^3D)5s$	$e\,^4D$	½	34390.25	32.60	
		1½	34422.85	57.20	
		2½	34480.05	87.05	
		3½	34567.10		
$3d\,4s(a\,^3D)5s$	$e\,^2D$	1½	35671.00	74.57	
		2½	35745.57		
$3d^3$:	$f\,^2D$	1½	36276.76	53.73	
		2½	36330.49		
$3d^3$	$e\,^4P$	½	36492.82	22.94	
		1½	36515.76	57.04	
		2½	36572.80		
$3d^2(b\,^1D)4p$	$w\,^2D^\circ$	1½	*36934.15*	105.62	
		2½	*37039.77*		
$3d\,4s(a\,^3D)4d$	$e\,^2P$	½	37085.72	62.53	
		1½	37148.25		
$3d^2(b\,^1D)4p$	$w\,^2P^\circ$	1½	*37086.31*	−39.41	
		½	*37125.72*		
$3d^2(a\,^3P)4p$	$x\,^4D^\circ$	½			
		1½	*37486.48*	66.86	
		2½	*37553.34*	163.77	
		3½	*37717.11*		
$3d\,4s(a\,^3D)4d$	$g\,^2D$	1½	37780.83	74.67	
		2½	37855.50		
$3d^2(a\,^3P)4p$	$z\,^4S^\circ$	1½	*38179.92*		
$3d^2(a\,^3P)4p$	$y\,^4P^\circ$	½	*38570.64*	30.86	
		1½	*38601.50*	56.43	
		2½	*38657.93*		
$3d\,4s(a\,^3D)4d$	$e\,^2G$	3½	38571.70	86.53	
		4½	38658.23		
$3d\,4s(a\,^3D)4d$	$e\,^2F$	2½	38871.60	87.56	
		3½	38959.16		
$3d^2(a\,^1G)4p$	$z\,^2H^\circ$	4½	*39153.42*	95.85	
		5½	*39249.27*		
$3d^2(a\,^1G)4p$	$y\,^2G^\circ$	3½	*39392.95*	30.78	
		4½	*39423.73*		

Sc I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
3d 4s(a ^{3}D)4d	*f* ^{4}D	½	39701.30	20.41	
		1½	39721.71	33.22	
		2½	39754.93	44.92	
		3½	39799.85		
3d 4s(a ^{3}D)4d	*e* ^{4}G	2½	39861.25	41.40	
		3½	39902.65	55.06	
		4½	39957.71	70.52	
		5½	40028.23		
3d^2(a ^{1}G)4p	*w* ^{2}F°	2½	*39881.25*	7.86	
		3½	*39889.11*		
3d 4s(a ^{3}D)4d	*f* ^{4}F	1½	40521.21	33.77	
		2½	40554.98	49.04	
		3½	40604.02	66.85	
		4½	40670.87		
	h ^{2}D	1½	40802.72	22.93	
		2½	40825.65		
3d 4s(a ^{3}D)4d	*f* ^{4}P	½	41447.02	27.86	
		1½	41474.88	30.77	
		2½	41505.65		
3d^2(a ^{3}F)5s	*g* ^{4}F	1½	41921.94	38.92	
		2½	41960.86	54.71	
		3½	42015.57	69.44	
		4½	42085.01		

Sc I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
3d^2(a ^{3}P)4p:	*v* ^{2}D°	1½	*43166.52+y*	54.22	
		2½	*43220.74+y*		
3d^2(a ^{3}P)4p:	*z* ^{2}S°	½	*43337.03+y*		
	g ^{4}D	½			
		1½			
		2½			
		3½	44598.80		
4p^2(f ^{3}P)3d	*h* ^{4}F	1½	44823.06	86.44	
		2½	44909.50	106.87	
		3½	45016.37	109.20	
		4½	45125.57		
	i ^{4}F	1½	47898.95	47.30	
		2½	47946.25	125.52	
		3½	48071.77	251.81?	
		4½	48323.58?		
	u ^{2}D°	1½	*51231.50+y*	98.04	
		2½	*51329.54+y*		
Sc II (a ^{3}D$_1$)	*Limit*	-----	52920		

June 1948.

Sc I Observed Terms*

Config. 1s^2 2s^2 2p^6 3s^2 3p^6+	Observed Terms		
3d 4s^2	a ^{2}D		
3d^3	{e ^{4}P, f ^{2}D:, e ^{4}F		
	ns (n≥ 4)	np (n≥4)	nd (n≥ 3)
3d 4s(a ^{3}D)nx	{e ^{4}D, e ^{2}D	z ^{4}P° z ^{4}D° z ^{4}F°; y ^{2}P° y ^{2}D° y ^{2}F°	f ^{4}P f ^{4}D f ^{4}F e ^{4}G; e ^{2}P g ^{2}D e ^{2}F e ^{2}G
3d 4s(a ^{1}D)nx		z ^{2}P° z ^{2}D° z ^{2}F°	
3d^2(a ^{3}F)nx	{a, g ^{4}F; a ^{2}F	y ^{4}D° y ^{4}F° z ^{4}G°; x ^{2}D° x ^{2}F° z ^{2}G°	
3d^2(b ^{1}D)nx	b ^{2}D	w ^{2}P° w ^{2}D°	
3d^2(a ^{1}S)nx		x ^{2}P°	
3d^2(a ^{3}P)nx	{a ^{4}P, a ^{2}P	z ^{4}S° y ^{4}P° x ^{4}D°; z ^{2}S°: v ^{2}D°:	
3d^2(a ^{1}G)nx	a ^{2}G	w ^{2}F° y ^{2}G° z ^{2}H°	
4p^2(f ^{3}P)nx			h ^{4}F

*For predicted terms in the spectra of the Sc I isoelectronic sequence, see Introduction.

Sc II

(Ca I sequence; 20 electrons) $Z=21$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d\ 4s\ ^3D_1$

$a\ ^3D_1$ **104000** cm^{-1} **I. P. 12.89 volts**

The analysis is from Russell and Meggers. All the terms are from the 1927 paper, except $y\ ^1P°$, which has been taken from the later reference. By analogy with Y II they assign $a\ ^1S$ to the configuration $4s^2$ in place of the earlier assignment to $3d^2$.

The singlet and triplet terms are connected by observed intersystem combinations.

The g-values have been generously furnished by Catalán, who has calculated them from the observed Zeeman patterns given in the 1925 reference below.

REFERENCES

S. Goudsmit, J. van der Mark, and P. Zeeman, Proc. Roy. Acad. Amsterdam **28,** No. 2, 130 (1925). (Z E)
H. N. Russell and W. F. Meggers, Sci. Papers Bur. Std. **22,** No. 558, 331 (1927). (I P) (T) (C L) (G D)
W. F. Meggers and H. N. Russell, Bur. Std. J. Research **2,** 761, RP 55 (1929). (T) (C L)
M. A. Catalán, unpublished material (June 1948). (Z E)

Sc II

Config.	Desig.	J	Level	Interval	Obs. g
$3d(^2D)4s$	$a\ ^3D$	1	0.00	67.68	0.50
		2	67.68	109.95	1.17
		3	177.63		1.33
$3d(^2D)4s$	$a\ ^1D$	2	2540.97		1.00
$3d^2$	$a\ ^3F$	2	4802.75	80.67	0.67
		3	4883.42	104.22	1.07
		4	4987.64		1.24
$3d^2$	$b\ ^1D$	2	10944.51		
$4s^2$	$a\ ^1S$	0	11736.35		
$3d^2$	$a\ ^3P$	0	12074.00	27.45	
		1	12101.45	52.89	
		2	12154.34		
$3d^2$	$a\ ^1G$	4	14261.40		
$3d(^2D)4p$	$z\ ^1D°$	2	*26081.32*		1.00
$3d(^2D)4p$	$z\ ^3F°$	2	*27443.65*	158.67	0.65
		3	*27602.32*	238.85	1.10
		4	*27841.17*		1.25
$3d(^2D)4p$	$z\ ^3D°$	1	*27917.69*	103.52	0.51
		2	*28021.21*	139.82	1.16
		3	*28161.03*		1.33
$3d(^2D)4p$	$z\ ^3P°$	0	*29736.22*	5.90	
		1	*29742.12*	81.80	
		2	*29823.92*		1.50
$3d(^2D)4p$	$z\ ^1P°$	1	*30815.65*		1.00
$3d(^2D)4p$	$z\ ^1F°$	3	*32349.98*		1.00
$4s(^2S)4p$	$y\ ^3P°$	0	*39001.59*	112.85	
		1	*39114.44*	230.46	
		2	*39344.90*		
$4s(^2S)4p$	$y\ ^1P°$	1	*55715 52*		

Sc II

Config.	Desig.	J	Level	Interval	Obs. g
$3d(^2D)5s$	$e\ ^3D$	1	57551.46	62.48	
		2	57613.94	129.43	
		3	57743.37		
$3d(^2D)5s$	$e\ ^1D$	2	58251.92		
$3d(^2D)4d$	$e\ ^1F$	3	59528.22		
$3d(^2D)4d$	$f\ ^3D$	1	59874.79	54.39	
		2	59929.18	72.42	
		3	60001.60		
$3d(^2D)4d$	$e\ ^3G$	3	60266.95	81.25	
		4	60348.20	108.77	
		5	60456.97		
$3d(^2D)4d$	$e\ ^1P$	1	60400.02		
$3d(^2D)4d$	$e\ ^3S$	1	61071.10		
$3d(^2D)4d$	$e\ ^3F$	2	63373.91	70.52	
		3	63444.43	83.30	
		4	63527.73		
$3d(^2D)4d$	$f\ ^1D$	2	64366.15		
$3d(^2D)4d$	$e\ ^3P$	0	64615.28	30.80	
		1	64646.08	59.08	
		2	64705.16		
$3d(^2D)4d$	$e\ ^1S$	0	64942.79		
$3d(^2D)4d$	$e\ ^1G$	4	65235.83		
$4p^2$	$f\ ^3P$	0	76242.40	117.41	
		1	76359.81	228.67	
		2	76588.48		
Sc III ($^2D_{1½}$)	*Limit*	-----	104000		

June 1948.

Sc II Observed Terms*

Config. $1s^2\,2s^2\,2p^6\,3s^2\,3p^6+$	Observed Terms										
$3d^2$	*a* ³P, *b* ¹D, *a* ³F, *a* ¹G										
$4s^2$	*a* ¹S										
$4p^2$	*f* ³P										
	ns ($n\geq 4$)	*np* ($n\geq 4$)			*nd* ($n\geq 4$)						
$3d(^2D)nx$	*a, e* ³D *a, e* ¹D	*z* ³P° *z* ¹P°	*z* ³D° *z* ¹D°	*z* ³F° *z* ¹F°	*e* ³S *e* ¹S	*e* ³P *e* ¹P	*f* ³D *f* ¹D	*e* ³F *e* ¹F	*e* ³G *e* ¹G		
$4s(^2S)nx$		*y* ³P° *y* ¹P°									

*A chart of predicted terms in the spectra of the Ca I isoelectronic sequence is given in the Introduction. Owing to the change in binding energies of the 3*d* and 4*s* electrons along this sequence, the arrangement of the charts of observed and predicted terms is not identical. In Sc II no primes are used to indicate higher limits, and the prefixes *a, b, . . . e, z, y,* replace those indicating the running electron.

Sc III

(K I sequence; 19 electrons) $Z=21$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d\;^2D_{1\frac{1}{2}}$

$3d\;^2D_{1\frac{1}{2}}$ 199693.0 cm⁻¹ I. P. 24.75 volts

The early analysis by Gibbs and White was revised and extended by Smith. By analogy with Ti IV, Russell and Lang confirmed Smith's interpretation, added the 5*s* ²S term, and predicted a number of series members. Their term array has been used for the present compilation, predicted values being entered in brackets. Fourteen lines in the range from 730 A to 4069 A have been classified.

REFERENCES

R. C. Gibbs and H. E. White, Proc. Nat. Acad. Sci. **12,** 598 (1926). (T) (C L)

S. Smith, Proc. Nat. Acad. Sci. **13,** 65 (1927). (I P) (T) (C L)

H. N. Russell and R. J. Lang, Astroph. J. **66,** 19; Mt. Wilson Contr. No. 337 (1927). (I P) (T) (C L)

Sc III

Config.	Desig.	J	Level	Interval
$3p^6(^1S)3d$	3*d* ²D	1½ 2½	0. 0 197. 5	197. 5
$3p^6(^1S)4s$	4*s* ²S	½	25536. 7	
$3p^6(^1S)4p$	4*p* ²P°	½ 1½	*62102. 2* *62575. 9*	473. 7
$3p^6(^1S)4d$	4*d* ²D	1½ 2½	112254. 2 112299. 2	45. 0
$3p^6(^1S)5s$	5*s* ²S	½	114863. 8	
$3p^6(^1S)5p$	5*p* ²P°	½ 1½	[*128183*] [*128363*]	180
$3p^6(^1S)4f$	4*f* ²F°	{2½, 3½}	*136871. 0*	
$3p^6(^1S)5d$	5*d* ²D	1½ 2½	[148263] [148283]	20
$3p^6(^1S)6s$	6*s* ²S	½	[149253]	
$3p^6(^1S)5f$	5*f* ²F°	{2½, 3½}	[*159553*]	
$3p^6(^1S)5g$	5*g* ²G	{3½, 4½}	[160133]	
Sc IV (¹S₀)	*Limit*		199693. 0	

May 1948.

Sc IV

(A I sequence; 18 electrons) Z=21

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ ^1S_0$

$3p^6\ ^1S_0$ **596300** cm^{-1} I. P. 73.9 volts

The analysis is seriously incomplete, but four lines between 215 A and 298 A have been independently classified, in the first two references quoted below, as combinations with the ground term. The two sets of wavelengths are not completely accordant, but the interpretation is the same in both papers.

The levels given in the table are from Mrs. Beckman's observations, and the limit is from the other paper. Mrs. Beckman's unit, 10^3 cm^{-1}, has here been changed to cm^{-1}, and all values have been rounded off in the last places. The limit may be in error by several hundred cm^{-1}.

For convenience, the Paschen notation has been added by the writer in column one of the table, under the heading "A I". As for A I, the *jl*-coupling notation in the general form suggested by Racah is here introduced, although *LS*-designations as indicated in column two under the heading "Authors" are perhaps preferable for the terms thus far identified.

REFERENCES

A. Beckman, *Bidrag till Kännedomen om Skandiums Spektrum i Yttersta Ultraviolett,* Akademisk Avhandling p. 90 (Almqvist and Wiksells Boktryckeri -A.-B., Uppsala, 1937). (T) (C L)

P. G. Kruger, S. G. Weissberg and L. W. Phillips, Phys. Rev. **51,** 1090 (1937). (I P) (T) (C L)

G. Racah, Phys. Rev. **61,** 537 (L) (1942).

Sc IV

A I	Authors	Config.	Desig.	J	Level
$1p_0$	$3p^6\ ^1S$	$3p^6$	$3p^6\ ^1S$	0	0
$1s_4$	$3p^5\ 4s\ ^3P^\circ$	$3p^5(^2P^\circ_{1\frac{1}{2}})4s$	$4s\ [1\frac{1}{2}]^\circ$	2 1	 *335090*
$1s_2$	$3p^5\ 4s\ ^1P^\circ$	$3p^5(^2P^\circ_{\frac{1}{2}})4s$	$4s'\ [\ \frac{1}{2}]^\circ$	0 1	 *341010*
$2s_4$	$3p^5\ 5s\ ^3P^\circ$	$3p^5[^2P^\circ_{1\frac{1}{2}})5s$	$5s\ [1\frac{1}{2}]^\circ$	2 1	 *460430*
$2s_2$	$3p^5\ 5s\ ^1P^\circ$	$3p^5(^2P^\circ_{\frac{1}{2}})5s$	$5s'\ [\ \frac{1}{2}]^\circ$	0 1	 *463990*
		Sc V $(^2P^\circ_{1\frac{1}{2}})$	*Limit*	-----	**596300**
		Sc V $(^2P^\circ_{\frac{1}{2}})$	*Limit*	-----	600630

May 1948.

Sc V

(Cl I sequence; 17 electrons) $Z=21$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5\ ^2P^\circ_{1\frac{1}{2}}$

$3p^5\ ^2P^\circ_{1\frac{1}{2}}$ *741000* cm^{-1} I. P. 92 volts

Fifteen lines have been classified in the region from 228 A to 587 A, as combinations from the ground term. Two independent sets of term values have been published, that are in agreement except for the level $4s\ ^4P_{2\frac{1}{2}}$, for which Kruger and Phillips give 387508 cm^{-1}; and the level $4s\ ^4P_{\frac{1}{2}}$, which was not found by Mrs. Beckman. All other entries in the table are from the latter list. The unit adopted by Mrs. Beckman, 10^3 cm^{-1}, has here been changed to cm^{-1}.

From isoelectronic sequence data Edlén has estimated the limit given above and entered in brackets in the table.

REFERENCES

A. Beckman, *Bidrag till Kännedomen om Skandiums Spektrum i Yttersta Ultraviolett*, Akademisk Avhandling p. 86 (Almqvist and Wiksells Boktryckeri –A.–B., Uppsala, 1937). (T) (C L)

P. G. Kruger and L. W. Phillips, Phys. Rev. **51**, 1087 (1937). (T) (C L)

B. Edlén, Zeit. Phys. **104**, 413 (1937). (I P)

Sc V

Config.	Desig.	J	Level	Interval
$3s^2\ 3p^5$	$3p^5\ ^2P^\circ$	1½ ½	*0* *4328*	−4328
$3s\ 3p^6$	$3p^6\ ^2S$	½	174412	
$3s^2\ 3p^4(^3P)4s$	$4s\ ^4P$	2½ 1½ ½	386387 388868 391575?	−2481 −2707
$3s^2\ 3p^4(^3P)4s$	$4s\ ^2P$	1½ ½	395503 398447	−2944
$3s^2\ 3p^4(^1D)4s$	$4s'\ ^2D$	2½ 1½	410050 410133	−83
$3s^2\ 3p^4(^1S)4s$	$4s''\ ^2S$	½	437512	
Sc VI ($^3P_2$)	*Limit*	-------	[*741000*]	

January 1948.

Sc VI

(S I sequence; 16 electrons) **Z=21**

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^4\ {}^3P_2$

$3p^4\ {}^3P_2$ **896000** cm^{-1} **I. P. 111.1 volts**

The analysis has been done independently by Mrs. Beckman and by Kruger and Pattin with results that are substantially in agreement. The triplet terms are quoted from the former and the singlets from the latter paper. Twenty-nine lines have been classified in the interval between 200 A and 581 A. The unit adopted by Mrs. Beckman, 10^3 cm^{-1}, has here been changed to cm^{-1}.

Intersystem combinations connecting the singlet and triplet terms have been observed.

The limit is from Edlén, who has extrapolated it from isoelectronic sequence data.

REFERENCES

A. Beckman, *Bidrag till Kännedomen om Skandiums Spektrum i Yttersta Ultraviolett,* Akademisk Avhandling p. 76 (Almqvist and Wiksells Boktryckeri –A.–B., Uppsala 1937). (T) (C L)

P. G. Kruger and H. S. Pattin, Phys. Rev. **52**, 621 (1937). (T) (C L)

B. Edlén, Zeit. Phys. **104**, 192 (1937). (I P)

Sc VI

Config.	Desig.	J	Level	Interval
$3s^2\ 3p^4$	$3p^4\ {}^3P$	2	0	−3352
		1	3352	−1101
		0	4453	
$3s^2\ 3p^4$	$3p^4\ {}^1D$	2	21397	
$3s^2\ 3p^4$	$3p^4\ {}^1S$	0	49238	
$3s\ 3p^5$	$3p^5\ {}^3P°$	2	*175344*	−2853
		1	*178197*	−1587
		0	*179784*	
$3s^2\ 3p^3(^4S°)4s$	$4s\ {}^3S°$	1	*452070*	
$3s^2\ 3p^3(^2D°)4s$	$4s'\ {}^3D°$	1	*472400*	163
		2	*472563*	438
		3	*473001*	

Sc VI

Config.	Desig.	J	Level	Interval
$3s^2\ 3p^3(^2D°)4s$	$4s'\ {}^1D°$	2	*478354*	
$3s^2\ 3p^3(^2P°)4s$	$4s''\ {}^3P°$	0	*491826*	261
		1	*492087*	715
		2	*492802*	
$3s^2\ 3p^3(^2P°)4s$	$4s''\ {}^1P°$	1	*497984*	
Sc VII ($^4S_{1½}$)	*Limit*	-------	**896000**	

January 1948.

Sc VII

(P I sequence; 15 electrons) Z=21

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3\ {}^4S^\circ_{1\frac{1}{2}}$

$3p^3\ {}^4S^\circ_{1\frac{1}{2}}$ cm⁻¹ I. P. volts

The analysis is incomplete. Six multiplets have been published by Kruger and Pattin, who derive term intervals but give no term values. Mrs. Beckman has extended their analysis slightly and estimated the relative positions of the doublet and quartet systems of terms from isoelectronic sequence data. Her terms are, in general, quoted, except for the term $3p^4\ {}^4P$, which is based on the wavelengths by Kruger and Pattin.

Twenty lines have been classified in the interval between 182 A and 571 A. No intersystem combinations have been observed, as indicated by the uncertainty x in the table and brackets around $3p^3\ {}^2D^\circ_{1\frac{1}{2}}$.

The unit adopted by Mrs. Beckman, 10^3 cm^{-1}, has here been changed to cm^{-1}.

REFERENCES

P. G. Kruger and H. S. Pattin, Phys. Rev. **52**, 624 (1937). (C L)

A. Beckman, *Bidrag till Kännedomen om Skandiums Spektrum i Yttersta Ultraviolett*, Akademisk Avhandling p. 71 (Almqvist and Wiksells Boktryckeri –A.–B., Uppsala, 1937). (T) (C L)

Sc VII

Config.	Desig.	J	Level	Interval
$3s^2\ 3p^3$	$3p^3\ {}^4S^\circ$	1½	*0*	
$3s^2\ 3p^3$	$3p^3\ {}^2D^\circ$	1½ 2½	*[30000]*+x *30670* +x	670
$3s^2\ 3p^3$	$3p^3\ {}^2P^\circ$	½ 1½	*49840* +x *50740* +x	900
$3s\ 3p^4$	$3p^4\ {}^4P$	2½ 1½ ½	175050 177760 179200	−2710 −1440

Sc VII

Config.	Desig.	J	Level	Interval
$3s^2\ 3p^2(^3P)3d$	$3d\ {}^2P$	1½ ½	329950 +x 333360 +x	−3410
$3s^2\ 3p^2(^3P)4s$	$4s\ {}^4P$	½ 1½ 2½	541670 543600? 546490	1930 2890
$3s^2\ 3p^2(^3P)4s$	$4s\ {}^2P$	½ 1½	551940 +x 555200 +x	3260
$3s^2\ 3p^2(^1D)4s$	$4s'\ {}^2D$	2½ 1½	568860 +x 568990 +x	−130

December 1947.

Sc VII Observed Terms*

Config. $1s^2\ 2s^2\ 2p^6$+	Observed Terms	
$3s^2\ 3p^3$	$3p^3\ {}^4S^\circ$ $3p^3\ {}^2P^\circ$ $3p^3\ {}^2D^\circ$	
$3s\ 3p^4$	$3p^4\ {}^4P$	
	ns ($n\geq 4$)	nd ($n\geq 3$)
$3s^2\ 3p^2(^3P)nx$	$4s\ {}^4P$ $4s\ {}^2P$	$3d\ {}^2P$
$3s^2\ 3p^2(^1D)nx'$	$4s'\ {}^2D$	

*For predicted terms in the spectra of the P I isoelectronic sequence, see Introduction.

Sc VIII

(Si I sequence; 14 electrons) **Z=21**

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^2\ ^3P_0$

$3p^2\ ^3P_0$ **1280000 cm⁻¹** **I. P. 159 volts**

The analysis is incomplete. The results by Kruger and Phillips are not entirely in agreement with those by Mrs. Beckman. The present list has been compiled from the three references below. One term, $4s\ ^1P^\circ_1$, has been calculated from its combination with $3p^2\ ^1D_2$ as given by Mrs. Beckman. Twenty-five lines are classified in the region between 164 A and 494 A. Intersystem combinations connecting the singlet and triplet terms have been observed. The limit, entered in brackets in the table, has been estimated by Phillips.

REFERENCES

A. Beckman, *Bidrag till Kännedomen om Skandiums Spektrum i Yttersta Ultraviolett*, Akademisk Avhandling p. 65 (Almqvist and Wiksells Boktryckeri -A.-B., Uppsala, 1937). (T) (C L)

P. G. Kruger and L. W. Phillips, Phys. Rev. **52**, 97 (1937). (T) (C L)

L. W. Phillips, Phys. Rev. **55**, 708 (1939). (I P) (T) (C L)

Sc VIII

Config.	Desig.	J	Level	Interval
$3s^2\,3p^2$	$3p^2\ ^3P$	0 1 2	0 2280 5510	2280 3230
$3s^2\,3p^2$	$3p^2\ ^1D$	2	25030	
$3s\ 3p^3$	$3p^3\ ^3P^\circ$	2, 1, 0	*207760*	
$3s\ 3p^3$	$3p^3\ ^3S^\circ$	1	*271680*	
$3s\ 3p^3$	$3p^3\ ^1P^\circ$	1	*281520*	

Sc VIII

Config.	Desig.	J	Level	Interval
$3s^2\,3p(^2P^\circ)3d$	$3d\ ^3P^\circ$	2 1 0	*319570* *322540* *323670*	−2970 −1130
$3s^2\,3p(^2P^\circ)4s$	$4s\ ^3P^\circ$	0 1 2	*603540* *604610* *609180*	1070 4570
$3s^2\,3p(^2P^\circ)4s$	$4s\ ^1P^\circ$	1	*614100*	
Sc IX ($^2P^\circ_{1/2}$)	*Limit*	-------	[*1280000*]	

October 1947.

Sc IX

(Al I sequence; 13 electrons) $Z=21$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p\;{}^2P^\circ_{1/2}$

$3p\;{}^2P^\circ_{1/2}$ ***1456000*** cm^{-1} I. P. 180 volts

The analysis is incomplete, but 17 lines have been classified in the region between 119 A and 537 A. The listed term values have been calculated by the writer from the combinations given in the references below.

No intersystem combinations have been observed. Using the method of extrapolation suggested by Edlén, the writer has estimated that $3p^2\;{}^4P_{1/2}$ is about 141000 cm^{-1} above the ground state. This value is entered in brackets in the table and has been added to all quartet terms. The uncertainty x may well exceed ± 1000 cm^{-1}. Similarly, she has extrapolated the value of the limit quoted above and entered in brackets in the table. The uncertainty in this estimate is large owing to the incompleteness of the isoelectronic sequence data.

REFERENCES

A. Beckman, *Bidrag till Kännedomen om Skandiums Spektrum i Yttersta Ultraviolett*, Akademisk Avhandling p. 59 (Almqvist and Wiksells Boktryckeri -A.-B., Uppsala 1937). (T) (C L)

P. G. Kruger and L. W. Phillips, Phys. Rev. **52**, 97 (1937). (T) (C L)

Sc IX

Config.	Desig.	J	Level	Interval
$3s^2(^1S)3p$	$3p\;{}^2P^\circ$	½ 1½	*0* *5760*	5760
$3s\,3p^2$	$3p^2\;{}^4P$	½ 1½ 2½	[141000]+x 143120 +x 146280 +x	2120 3160
$3s\,3p^2$	$3p^2\;{}^2D$	1½ 2½	 191760	
$3s\,3p^2$	$3p^2\;{}^2S$	½	240410	
$3s\,3p^2$	$3p^2\;{}^2P$	½ 1½	255830 259150	3320
$3s^2(^1S)3d$	$3d\;{}^2D$	1½ 2½	313860 314210	350
$3s^2(^1S)4s$	$4s\;{}^2S$	½	666260	
$3s\,3p(^3P^\circ)4s$	$4s\;{}^4P^\circ$	½ 1½ 2½	*819550* +x *821490* +x *825120* +x	1940 3630
$3s^2(^1S)4d$	$4d\;{}^2D$	1½ 2½	837210 837450	240
Sc X ($^1S_0$)	*Limit*	-------	[*1456000*]	

October 1947.

Sc IX Observed Terms*

Config. $1s^2\,2s^2\,2p^6+$	Observed Terms	
$3s^2(^1S)3p$	$3p\;{}^2P^\circ$	
$3s\,3p^2$	$3p^2\;{}^4P$ $3p^2\;{}^2S$ $3p^2\;{}^2P$ $3p^2\;{}^2D$	
	$ns\;(n\geq 4)$	$nd\;(n\geq 3)$
$3s^2(^1S)nx$	$4s\;{}^2S$	3, $4d\;{}^2D$
$3s\,3p(^3P^\circ)nx$	$4s\;{}^4P^\circ$	

*For predicted terms in the spectra of the Al I isoelectronic sequence, see Introduction.

Sc X

(Mg I sequence; 12 electrons) $Z=21$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\ {}^1S_0$

$3s^2\ {}^1S_0$ **1819530** cm^{-1} I. P. 225.5 volts

The terms are from the paper by Mrs. Beckman, who has classified 26 lines in the region between 76 A and 628 A. She lists one intersystem combination, $3s^2\ {}^1S_0-3p\ {}^3P^\circ_1$, and derives absolute term values from the $3d\ {}^3D-nf\ {}^3F^\circ$ series (n=4, 5, 6).

Parker and Phillips have independently found four triplet terms $3p\ {}^3P^\circ$, $3d\ {}^3D$, $4s\ {}^3S$, and $4f\ {}^3F^\circ$. Their arrangement of the $3p\ {}^3P^\circ-4s\ {}^3S$ and $3d\ {}^3D-4f\ {}^3F^\circ$ multiplets is identical with Mrs. Beckman's but they differ from her in the interpretation of the group of lines ascribed to $3p\ {}^3P^\circ-3d\ {}^3D$.

Their resulting terms that differ from those listed below (adjusted to the same zero point) are as follows:

Desig.	Level	Desig.	Level
$3d\ {}^3D_3$	455510	$4f\ {}^3F^\circ_4$	1117757
${}^3D_2$	455199	${}^3F^\circ_3$	1117710
${}^3D_1$	455007	${}^3F^\circ_2$	1117689

By extrapolation along the isoelectronic sequence, using the method suggested by Edlén, the writer calculates the limit to be approximately 1818600 cm^{-1} (I. P. 225.4), or about 1000 cm^{-1} lower than that derived by Mrs. Beckman from the ${}^3F^\circ$ series.

The unit adopted by Mrs. Beckman, $10^3\ cm^{-1}$, has here been changed to cm^{-1}.

REFERENCES

A. Beckman, *Bidrag till Kännedomen om Skandiums Spektrum i Yttersta Ultraviolett*, Akademisk Avhandling p. 53 (Almqvist and Wiksells Boktryckeri -A.-B., Uppsala, 1937). (I P) (T) (C L) (G D)

W. L. Parker and L. W. Phillips, Phys. Rev. **57**, 140 (1940). (T) (C L)

Sc X

Config.	Desig.	J	Level	Interval
$3s^2$	$3s^2\ {}^1S$	0	0	
$3s({}^2S)3p$	$3p\ {}^3P^\circ$	0	*157230*	
		1	*159210*	1980
		2	*163530*	4320
$3s({}^2S)3p$	$3p\ {}^1P^\circ$	1	*236490*	
$3s({}^2S)3d$	$3d\ {}^3D$	1	458710	
		2	459030	320
		3	459470	440
$3s({}^2S)4s$	$4s\ {}^3S$	1	899250	
$3s({}^2S)4p$	$4p\ {}^1P^\circ$	1	*980600*	
$3s({}^2S)4d$	$4d\ {}^3D$	1	1074060	
		2	1074250	190
		3	1074530	280
$3s({}^2S)4f$	$4f\ {}^3F^\circ$	2	*1121400*	
		3	*1121550*	150
		4	*1121740*	190

Sc X

Config.	Desig.	J	Level	Interval
$3s({}^2S)5p$	$5p\ {}^1P^\circ$	1	*1309880*	
$3s({}^2S)5d$	$5d\ {}^3D$	1		
		2		
		3	1351120	
$3s({}^2S)5f$	$5f\ {}^3F^\circ$	2	*1374440*	
		3	*1374550*	110
		4		
$3s({}^2S)6f$	$6f\ {}^3F^\circ$	2		
		3		
		4	*1511130*	
Sc XI (${}^2S_{1/2}$)	*Limit*	-------	**1819530**	

March 1948.

Sc XI

(Na I sequence; 11 electrons) $Z=21$

Ground state $1s^2\,2s^2\,2p^6\,3s\ ^2S_{1/2}$

$3s\ ^2S_{1/2}$ **2015030 cm^{-1}** **I. P. 249.76 volts**

The analysis is by Mrs. Beckman who has extended the work of Edlén and of Kruger and Phillips. She has published 30 classified lines in the interval from 62 A to 168 A.

The absolute value of the ground state is extrapolated from isoelectronic sequence data.

The unit adopted by Mrs. Beckman, 10^3 cm^{-1}, has here been changed to cm^{-1}.

REFERENCES

B. Edlén, Zeit. Phys. **100,** 621 (1936). (T) (C L)

A. Beckman, *Bidrag till Kännedomen om Skandiums Spektrum i Yttersta Ultraviolett,* Akademisk Avhandling, p. 45 (Almqvist and Wiksells Boktryckérí -A.-B., Uppsala, 1937). (I P) (T) (C L) (G D)

Sc XI

Config.	Desig.	J	Level	Interval
$3s$	$3s\ ^2S$	½	0	
$3p$	$3p\ ^2P°$	½ 1½	*191030* *197720*	6690
$3d$	$3d\ ^2D$	1½ 2½	459410 460030	620
$4s$	$4s\ ^2S$	½	**977470**	
$4p$	$4p\ ^2P°$	½ 1½	*1051340* *1053870*	2530
$4d$	$4d\ ^2D$	1½ 2½	1148560 1148830	270
$4f$	$4f\ ^2F°$	2½ 3½	*1182570* *1182680*	110
$5s$	$5s\ ^2S$	½	1382110	
$5p$	$5p\ ^2P°$	½ 1½	*1418280* *1419550*	1270
$5d$	$5d\ ^2D$	1½ 2½	1464770 1464870	100

Sc XI

Config.	Desig.	J	Level	Interval
$5f$	$5f\ ^2F°$	2½ 3½	*1482160* *1482210*	50
$6s$	$6s\ ^2S$	½	1588790	
$6p$	$6p\ ^2P°$	½ 1½	*1609480*	
$6d$	$6d\ ^2D$	1½ 2½	1635020	
$6f$	$6f\ ^2F°$	2½ 3½	*1645030*	
$7d$	$7d\ ^2D$	1½ 2½	**1736700**	
$7f$	$7f\ ^2F°$	2½ 3½	*1743430*	
Sc XII ($^1S_0$)	*Limit*	-------	2015030	

June 1947.

Sc XII

(Ne I sequence; 10 electrons) $Z=21$

Ground state $1s^2\ 2s^2\ 2p^6\ {}^1S_0$

$2p^6\ {}^1S_0$ 5539700 cm^{-1} I. P. 686.6 volts

Edlén and Tyrén have classified five lines in the range 26 A to 30 A, as combinations with the ground term. Their absolute term values are based on extrapolation along the Ne I isoelectronic sequence. Their unit, 10^3 cm^{-1}, has here been changed to cm^{-1}.

As for Ne I, the *jl*-coupling notation in the general form suggested by Racah is introduced.

REFERENCES

B. Edlén and F. Tyrén, Zeit. Phys. **101,** 210 (1936). (I P) (T) (C L)
G. Racah, Phys. Rev. **61,** 537 (L) (1942).

Sc XII

Authors	Config.	Desig.	*J*	Level
$2p\ {}^1S_0$	$2p^6$	$2p^6\ {}^1S$	0	0
	$2p^5(^2P^\circ_{1\frac{1}{2}})3s$	$3s\ [1\frac{1}{2}]^\circ$	2	
$3s\ {}^3P_1$			1	*3245100*
	$2p^5(^2P^\circ_{\frac{1}{2}})3s$	$3s'\ [\frac{1}{2}]^\circ$	0	
$3s\ {}^1P_1$			1	*3280800*
	$2p^5(^2P^\circ_{1\frac{1}{2}})3d$	$3d\ [\frac{1}{2}]^\circ$	0	
$3d\ {}^3P_1$			1	*3668400*
$3d\ {}^1P_1$	"	$3d\ [1\frac{1}{2}]^\circ$	1	*3714700*
$3d\ {}^3D_1$	$2p^5(^2P^\circ_{\frac{1}{2}})3d$	$3d'\ [1\frac{1}{2}]^\circ$	1	*3767300*
	------------	------	---	-------
	Sc XIII ($^2P^\circ_{1\frac{1}{2}}$)	*Limit*	---	5539700
	Sc XIII ($^2P^\circ_{\frac{1}{2}}$)	*Limit*	---	5577400

April 1947.

TITANIUM

Ti I

22 electrons $Z=22$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^2\ 4s^2\ {}^3F_2$

$a\ {}^3F_2$ 55138 cm^{-1} I. P. 6.83 volts

The arc spectrum of titanium was one of the first highly complex spectra to be analyzed fairly completely. The detailed analysis published by Russell in 1927 contains 142 terms based on 422 multiplets, and lists 1394 classified lines. Singlet, triplet, and quintet terms are connected by intersystem combinations. This paper, which represents the work of many early contributions as well, by King, Meggers, Kiess, Babcock, and many others, is concluded with the noteworthy statement "The present theories of atomic and spectral structure suffice to give a most satisfactory account, in full and complete detail, of all the features of the very complex spectrum of titanium."

From infrared observations Kiess and Meggers have added the terms $d\ {}^3P$ and $a\ {}^5D$. In 1940 Russell added $e\ {}^3H$ and in 1947 he revised the configuration assignments for inclusion here, as given in column one of the table.

The term values given to three places in the table are from the 1928 paper by Kiess, who calculated them from lines he observed with the interferometer.

Approximate g-values have been calculated by the writer from the Zeeman patterns observed by King and Babcock and quoted by Russell (1927). Most of the observed patterns are unresolved, and consequently the observed g-values differ from the theoretical ones, by a few percent in some cases. They verify the analysis, however, with remarkable consistency. Colons indicate that the observational data are insufficient to give an independent g-value. It is highly desirable to extend this work with the aid of Harrison's unpublished Zeeman observations of titanium.

Both Many and Rohrlich have made theoretical investigations of this spectrum. In the former paper the reality of the term $a\ {}^1S_0$ at 15166.59 is questioned and this term has been rejected by Russell. Rohrlich has suggested that the ${}^1P°$ term at 39265.80 may be a ${}^1D°$ term. This change has been adopted in the table and the labels of higher ${}^1P°$ and ${}^1D°$ terms changed accordingly, since it has been noted by Russell that this term may equally well be a ${}^1D°$ term. In cases where Rohrlich's configuration assignments differ from those of Russell a colon is entered in column one after the configuration.

REFERENCES

H. N. Russell, Astroph. J. **66**, 347 (1927); Mt. Wilson Contr. No. 345 (1927). (I P) (T) (C L) (G D) (Z E)
C. C. Kiess, Bur. Std. J. Research **1**, 77, RP4 (1928). (T) (C L)
W. F. Meggers and C. C. Kiess, Bur. Std. J. Research **9**, 310, RP473 (1932). (T) (C L)
C. C. Kiess, J. Research Nat. Bur. Std. **20**, 35 (RP1062) (1938). (T) (C L)
H. N. Russell, unpublished material (May 1940, April 1947). (T) (C L)
A. Many, Phys. Rev. **70**, 511 (1946).
F. Rohrlich, Phys. Rev. **74**, 1381 (1948).
C. E. Moore, unpublished material (June 1948). (Z E)

Ti I

Config.	Desig.	J	Level	Interval	Obs. g
$3d^2 4s^2$	$a\ ^3$F	2	0.000	170.132	0.66
		3	170.132	216.741	1.08
		4	386.873		1.25
$3d^3(b\ ^4F)4s$	$a\ ^5$F	1	6556.86	41.97	0.00
		2	6598.83	62.17	0.99
		3	6661.00	81.79	1.25
		4	6742.79	100.21	1.35
		5	6843.00		1.41
$3d^2 4s^2$	$a\ ^1$D	2	7255.29		1.02
$3d^2 4s^2$	$a\ ^3$P	0	8436.630	55.807	
		1	8492.437	109.916	1.50
		2	8602.353		1.49
$3d^3(b\ ^4F)4s$	$b\ ^3$F	2	11531.812	108.008	0.67
		3	11639.820	137.000	1.08
		4	11776.820		1.26
$3d^2 4s^2$	a^1 G	4	12118.46		0.98
$3d^3(a\ ^4P)4s$	$a\ ^5$P	1	13981.75	46.72	2.50
		2	14028.47	77.21	1.82
		3	14105.68		1.66
$3d^3(a\ ^2G)4s$	$a\ ^3$G	3	15108.153	48.650	0.74
		4	15156.803	63.597	1.06
		5	15220.400		1.21
$3d^2 4s(a\ ^4F)4p$	$z\ ^5$G°	2	*15877.18*	98.41	0.39
		3	*15975.59*	130.49	0.93
		4	*16106.08*	161.43	1.15
		5	*16267.51*	191.20	1.25
		6	*16458.71*		1.33
$3d^2 4s(a\ ^4F)4p$	$z\ ^5$F°	1	*16817.19*	58.00	0.00
		2	*16875.19*	86.23	
		3	*16961.42*	113.89	1.26:
		4	*17075.31*	140.13	1.34
		5	*17215.44*		1.42
$3d^3(b\ ^2D)4s$	$a\ ^3$D	1	17369.59	54.52	0.49
		2	17424.11	116.22	1.17
		3	17540.33		1.34
$3d^3(a\ ^2P)4s$	$b\ ^3$P	0	17995.75	65.79	
		1	18061.54	83.86	
		2	18145.40		
$3d^3(a\ ^2H)4s$	$a\ ^3$H	4	18037.28	103.97	0.80
		5	18141.252	51.342	1.02
		6	18192.594		1.17
$3d^3(a\ ^2G)4s$	$b\ ^1$G	4	18287.62		1.02
$3d^2 4s(a\ ^4F)4p$	$z\ ^5$D°	0	*18462.83*	20.03	
		1	*18482.86*	42.21	1.65?
		2	*18525.07*	68.92	1.50
		3	*18593.99*	101.24	1.49
		4	*18695.23*		1.51
$3d^3(a\ ^4P)4s$	$c\ ^3$P	0	18818.23	7.66	
		1	18825.89	85.66	1.54?
		2	18911.55		1.54:

Ti I

Config.	Desig.	J	Level	Interval	Obs. g
$3d^2 4s(a\ ^2F)4p$	$z\ ^3$F°	2	*19323.003*	98.577	0.67
		3	*19421.580*	152.400	1.07
		4	*19573.980*		1.26
$3d^2 4s(a\ ^2F)4p$	$z\ ^3$D°	1	*19937.878*	68.171	
		2	*20006.049*	120.023	1.16
		3	*20126.072*		1.34
$3d^3(a\ ^2P)4s$	$a\ ^1$P	1	20062.98		1.03
$3d^3(b\ ^2D)4s$	$b\ ^1$D	2	20209.64		1.01:
$3d^3(a\ ^2H)4s$	$a\ ^1$H	5	20795.65		1.01
$3d^2 4s(a\ ^2F)4p$:	$z\ ^3$G°	3	*21469.534*	118.986	0.75
		4	*21588.520*	151.223	1.05
		5	*21739.743*		1.21
$3d^2 4s(a\ ^2F)4p$	$z\ ^1$D°	2	*22081.15*		1.00
$3d^2 4s(a\ ^2F)4p$	$z\ ^1$F°	3	*22404.69*		1.00
$3d^2 4s(a\ ^2F)4p$	$z\ ^1$G°	4	*24694.81*		0.97
$3d^2 4s(b\ ^4P)4p$	$z\ ^3$S°	1	*24921.19*		1.99
$3d^2 4s(b\ ^4P)4p$	$z\ ^5$S°	2	*25102.88*		1.93
$3d^2 4s(a\ ^4F)4p$:	$y\ ^3$F°	2	*25107.453*	119.783	
		3	*25227.236*	161.109	1.06
		4	*25388.345*		1.21?
$3d^2 4s(a\ ^4F)4p$:	$y\ ^3$D°	1	*25317.842*	121.088	0.50
		2	*25438.930*	204.794	1.17
		3	*25643.724*		1.33
$3d^2 4s(b\ ^4P)4p$	$z\ ^3$P°	2	*25493.78*	−43.61	1.47
		1	*25537.39*		1.50
		0			
$3d^2 4s(b\ ^4P)4p$:	$y\ ^5$D°	0	*25605.03*	30.71	
		1	*25635.74*	64.21	
		2	*25699.95*	97.65	
		3	*25797.60*	129.22	
		4	*25926.82*		1.52
$3d^3(b\ ^4F)4p$	$y\ ^5$G°	2	*26494.37*	70.06	0.34
		3	*26564.43*	92.98	0.91
		4	*26657.41*	115.57	1.15
		5	*26772.98*	137.71	1.25
		6	*26910.69*		1.34
$3d^3(b\ ^4F)4p$:	$x\ ^3$F°	2	*26803.462*	89.484	0.66
		3	*26892.946*	132.721	1.06
		4	*27025.667*		1.23
$3d^3(b\ ^4F)4p$	$x\ ^3$D°	1	*27355.065*	62.972	0.51
		2	*27418.037*	62.040	1.17
		3	*27480.077*		1.36
$3d^3(b\ ^4F)4p$:	$y\ ^3$G°	3	*27499.033*	115.660	0.75
		4	*27614.693*	135.463	1.05
		5	*27750.156*		1.21
$3d^2 4s(b\ ^4P)4p$	$z\ ^5$P°	1	*27665.57*	74.62	
		2	*27740.19*	147.55	
		3	*27887.74*		

Ti I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$3d^2\,4s(a\,^2D)4p$:	$y\,^1D^\circ$	2	*27906.91*		0.98
$3d^3(b\,^4F)4p$	$y\,^5F^\circ$	1	*28596.45*	42.37	0.00
		2	*28638.82*	63.88	1.01
		3	*28702.70*	85.69	1.24
		4	*28788.39*	107.69	1.34
		5	*28896.08*		1.40
$3d^4$	$a\,^5D$	0	28772.86	18.76	
		1	28791.62	36.89	
		2	28828.51	53.93	
		3	28882.44	69.66	
		4	28952.10		
$3d^2\,4s(b\,^4P)4p$:	$w\,^3D^\circ$	1	*29661.272*	107.414	0.51
		2	*29768.686*	143.606	1.16
		3	*29912.292*		1.34
$3d^3(b\,^2F)4s$	$a\,^1F$	3	29818.31		
$3d^3(b\,^4F)4p$	$x\,^5D^\circ$	0	*29829.16*	26.10	
		1	*29855.26*	52.03	1.46
		2	*29907.29*	78.95	1.50
		3	*29986.24*	74.10	1.49
		4	*30060.34*		1.49
$3d^2\,4s(a\,^4F)4p$:	$x\,^3G^\circ$	3	*29914.773*	56.333	
		4	*29971.106*	68.140	
		5	*30039.246*		1.19
$3d^2\,4s(a\,^2D)4p$:	$v\,^3D^\circ$	1	*31184.089*	6.574	0.51
		2	*31190.663*	15.351	1.17
		3	*31206.014*		1.34
$3d^2\,4s(b\,^2G)4p$:	$w\,^3G^\circ$	3	*31373.862*	115.624	0.75
		4	*31489.486*	139.212	1.05
		5	*31628.698*		1.19
$3d^2\,4s(a\,^2D)4p$:	$y\,^3P^\circ$	0	*31685.90*	39.85	
		1	*31725.75*	80.19	1.47
		2	*31805.94*		
$3d^2\,4s(b\,^2G)4p$	$z\,^3H^\circ$	4	*31830.016*	84.288	0.80
		5	*31914.304*	99.251	1.04
		6	*32013.555*		1.17
$3d^2\,4s(a\,^2D)4p$	$y\,^1F^\circ$	3	*32857.76*		0.99?
$3d^2\,4s(b\,^2P)4p$:	$x\,^3P^\circ$	0	*33085.14*	5.41	
		1	*33090.55*	23.94	1.46
		2	*33114.49*		1.46
$3d^2\,4s(a\,^2D)4p$:	$w\,^3F^\circ$	2	*33655.898*	24.264	0.66
		3	*33680.162*	20.735	1.09
		4	*33700.897*		1.26
$3d^2\,4s(a\,^2D)4p$:	$z\,^1P^\circ$	1	*33660.73*		0.94?
$3d^2\,4s(b\,^2G)4p$	$v\,^3F^\circ$	2	*33980.685*	97.927	0.63
		3	*34078.612*	126.389	1.10
		4	*34205.001*		1.23
$3d^4$	$d\,^3P$	0	34170.95	157.01	
		1	34327.96	207.08	
		2	34535.04		
$3d^2\,4s(b\,^2G)4p$:	$z\,^1H^\circ$	5	*34700.31*		1.02

Ti I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$3d^2\,4s(b\,^2P)4p$:	$y\,^1P^\circ$	1	*34947.02*		
$3d^2\,4s(b\,^2P)4p$:	$x\,^1D^\circ$	2	*35035.11*		
$3d^2\,4s(b\,^2P)4p$	$y\,^3S^\circ$	1	*35439.43*		2.18
$3d^3(a\,^2G)4p$	$y\,^3H^\circ$	4	*35454.099*	105.563	0.79
		5	*35559.662*	125.526	1.04
		6	*35685.188*		1.17
$3d^3(a\,^4P)4p$	$w\,^5D^\circ$	0	*35503.40*	24.36	
		1	*35527.76*	49.38	1.51
		2	*35577.14*	75.81	1.53
		3	*35652.95*	104.56	1.46
		4	*35757.51*		1.46
$3d^2\,4s(a\,^4F)5s$	$e\,^5F$	1	35959.07	54.50	0.00
		2	36013.57	82.90	1.03?
		3	36096.47	112.45	1.24
		4	36208.92	142.51	1.34
		5	36351.43		1.42
$3d^2\,4s(b\,^2G)4p$:	$y\,^1G^\circ$	4	*36000.25*		1.00
$3d^4$	$b\,^3G$	3	36065.75	66.46	
		4	36132.21	68.73	
		5	36200.94		
$3d^3(a\,^4P)4p$	$y\,^5P^\circ$	1	*36298.43*	42.24	2.47
		2	*36340.67*	73.91	1.81
		3	*36414.58*		1.66
$3d^3(b\,^2D)4p$:	$w\,^3P^\circ$	0	*37090.65*	82.38	
		1	*37173.03*	152.44	1.53
		2	*37325.47*		1.48
$3d^3(a\,^4P)4p$	$y\,^5S^\circ$	2	*37359.13*		1.99
$3d^2\,4s(a\,^4F)5s$	$e\,^3F$	2	37538.71	121.26	0.67
		3	37659.97	164.72	1.11
		4	37824.69		1.27
$3d^3(a\,^2G)4p$	$v\,^3G^\circ$	3	*37554.99*	62.94	0.77
		4	*37617.93*	72.44	1.05
		5	*37690.37*		1.20
$3d^2\,4s(b\,^2G)4p$:	$x\,^1F^\circ$	3	*37622.63*		0.94
$3d^3(b\,^2D)4p$:	$u\,^3F^\circ$	2	*37654.77*	89.19	0.65
		3	*37743.96*	108.51	1.08
		4	*37852.47*		1.24
$3d^2\,4s(b\,^2P)4p$:	$u\,^3D^\circ$	1	*37851.91*	124.87	0.53
		2	*37976.78*	182.93	1.14:
		3	*38159.71*		1.35
$3d^3(a\,^2P)4p$	$z\,^1S^\circ$	0	*38200.94*		
$3d^3(a\,^2G)4p$	$t\,^3F^\circ$	2	*38451.29*	93.09	0.66
		3	*38544.38*	126.35	1.08
		4	*38670.73*		1.25
$3d^3(a\,^2H)4p$	$z\,^3I^\circ$	5	*38572.75*	96.28	0.81
		6	*38669.03*	110.94	1.02
		7	*38779.97*		1.15
$3d^3(b\,^2D)4p$:	$t\,^3D^\circ$	1	*38654.23*	45.72	0.54:
		2	*38699.95*	65.01	
		3	*38764.96*		1.32

Ti I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$3d^3(a\ ^2G)4p$:	$x\ ^1G°$	4	*38959.53*		1.02
$3d^3(b\ ^2D)4p$	$x\ ^1P°$	1	*39078.00*		
$3d^3(b\ ^4F)5s$	$f\ ^5F$	1	39107.25	42.01	
		2	39149.26	65.12	
		3	39214.38	87.98	
		4	39302.36	110.42	
		5	39412.78		
$3d^3(a\ ^2H)4p$	$x\ ^3H°$	4	*39115.99*	36.15	0.88?
		5	*39152.14*	46.25	1.02
		6	*39198.39*		1.18
$3d^3(a\ ^2P)4p$	$w\ ^1D°$	2	*39265.80*		1.06:
$3d^3(b\ ^4F)5s$	$f\ ^3F$	2	39526.89	114.09	
		3	39640.98	144.96	
		4	39785.94		
$3d^3(a\ ^4P)4p$	$s\ ^3D°$	1	*39662.15*	23.95	0.52
		2	*39686.10*	29.41	
		3	*39715.51*		1.31:
$3d^3(b\ ^2D)4p$	$w\ ^1F°$	3	*40303.04*		1.05:
$3d^3(a\ ^2H)4p$	$z\ ^1I°$	6	*40319.80*		1.03
$3d^3(a\ ^4P)4p$:	$v\ ^3P°$	0	*40369.76*	14.82	
		1	*40384.58*	82.46	
		2	*40467.04*		
$3d^3(a\ ^2P)4p$	$r\ ^3D°$	1	*40556.07*	114.53	0.49
		2	*40670.60*	173.59	
		3	*40844.19*		
$3d^3(a\ ^2P)4p$	$x\ ^3S°$	1	*40844.19*		
	$w\ ^1G°$	4	*40883.30*		0.95:
$3d^3(a\ ^2G)4p$:	$y\ ^1H°$	5	*41039.93*		1.03
$3d^2\ 4s(a\ ^2F)5s$	$e\ ^1F$	3	41087.31		1.01
$3d^3(a\ ^2H)4p$	$u\ ^3G°$	3	*41169.82*	85.62	0.73
		4	*41255.44*	86.18	1.03
		5	*41341.62*		1.19
$3d^2\ 4s(a\ ^4F)4d$	$e\ ^3G$	3	41194.42	174.44	
		4	41368.86	112.27	
		5	41481.13		
	$s\ ^3F°$	2	*41337.43*	120.19	0.66
		3	*41457.62*	166.51	1.09
		4	*41624.13*		1.24
$3d^2\ 4s(a\ ^4F)4d$	$e\ ^3H$	4	41515.09	41.24	
		5	41556.33	58.69	
		6	41615.02		
$3d^3\ (a^2G)4p$:	$v\ ^1F^0$	3	*41585.24*		
$3d^2\ 4s(a\ ^4F)4d$	$e\ ^5G$	2	41714.35	43.12	
		3	41757.47	61.23	
		4	41818.70	84.78	1.12
		5	41903.48	115.74	1.24
		6	42019.22		1.34

Ti I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
	$w\ ^3H°$	4	*41780.95*	114.20	
		5	*41895.15*	100.24	
		6	*41995.39*		
$3d^2\ 4s(a\ ^4F)5p$	$v\ ^5D°$	0	*41822.99*	31.02	
		1	*41854.01*	52.60	
		2	*41906.61*	79.32	
		3	*41985.93*	106.59	
		4	*42092.52*		
$3d^2\ 4s(a\ ^4F)4d$	$e\ ^5H$	3	41823.19	93.86	
		4	41917.05	100.96	
		5	42018.01	105.76	1.15
		6	42123.77	81.82	1.22
		7	42205.59		1.28
$3d^2\ 4s(a\ ^4F)4d$	$e\ ^5D$	0	41871.56	29.80	
		1	41901.36	57.15	
		2	41958.51	94.21	
		3	42052.72	131.94	
		4	42184.66		
$3d^2\ 4s(a\ ^4F)4d$	$g\ ^3F$	2	41871.87	116.52	
		3	41988.39	118.67	
		4	42107.06		
$3d^3(a\ ^2P)4p$:	$u\ ^3P°$	2	*41928.59*	−15.36	
		1	*41943.95*	−15.51	
		0	*41959.46*		
	$q\ ^3D°$	1	*42146.39*	60.49	
		2	*42206.88*	104.43	
		3	*42311.31*		1.32
	$p\ ^3D°$	1	*42193.94*	75.79	
		2	*42269.73*	106.98	
		3	*42376.71*		
$3d^2\ 4s(a\ ^4F)4d$	$e\ ^5P$	1	42611.58	112.53	
		2	42724.11	134.79	
		3	42858.90		1.64
$3d^2\ 4s(a\ ^2S)4p$:	$w\ ^1P°$	1	*42927.55*		1.00:
$3d^2\ 4s(a\ ^4F)4d$	$g\ ^5F$	1	43034.08	46.84	
		2	43080.92	67.23	
		3	43148.15	83.84	
		4	43231.99	98.08	
		5	43330.07		
	$r\ ^3F°$	2	*43467.55*	115.59	
		3	*43583.14*	161.41	
		4	*43744.55*		
$3d^3(a\ ^2H)4p$:	$v\ ^1G°$	4	*43674.31*		0.95
	$v\ ^1D°$	2	*43710.28*		
$3d^3(b\ ^2D)4p$	$u\ ^1D°$	2	*43799.57*		0.98:
$3d^3(b\ ^4F)4d$	$f\ ^5H$	3	43843.82	57.92	
		4	43901.74	69.81	0.91
		5	43971.55	79.82	1.11
		6	44051.37	83.28	1.21
		7	44134.65		1.29
	$o\ ^3D°$	1	*43975.62*	103.77	
		2	*44079.39*	153.76	1.18?
		3	*44233.15*		

Ti I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
	t ^{3}G°	3			
		4	*44162.44*	213.13	
		5	*44375.57*		
3d^3(a ^{2}H)4p	x ^{1}H°	5	*44163.24*		1.03
3d^3(b ^{4}F)4d	f ^{5}D	0			
		1			
		2			
		3	44254.39	126.78	
		4	44381.17		
3d^2 4s(a ^{2}D)5s	e ^{1}D	2	44581.16		
	q ^{3}F°	2	*44825.26*	97.74	
		3	*44923.00*	118.02	
		4	*45041.02*		
3d^3(a ^{4}P)4p	w ^{3}S°	1	*44857.89*		
	n ^{3}D°	1	*44966.36*	97.58	
		2	*45063.94*	142.40	
		3	*45206.34*		
3d^2 4s(a ^{2}S)4p:	t ^{3}P°	0	*45040.70*	50.03	
		1	*45090.73*	87.33	
		2	*45178.06*		
3d^2 4s(a ^{2}F)4d	e ^{1}H	5	45485.35		
3d^3(b ^{4}F)4d?	f ^{5}G	2			
		3	45689.89	21.39	
		4	45711.28	45.17	
		5	45756.45?	148.28	
		6	45904.73		
3d^2 4s(a ^{2}F)4d	f ^{3}H	4	45721.89	110.61	0.80
		5	45832.50	127.89	1.03
		6	45960.39		1.17
3d^2 4s(a ^{4}F)6s	h ^{5}F	1	45764.71	48.30	
		2	45813.01	80.25	
		3	45893.26	114.36	
		4	46007.62	150.14	
		5	46157.76		
3d^2 4s(a ^{2}F)4d	e ^{1}G	4	46068.04		
3d^2 4s(b ^{4}P)5s	e ^{3}P	0			
		1			
		2	46244.60		
3d^3(b ^{2}F)4p:	u ^{1}G°	4	*46257.67*		0.95
3d^2 4s(a ^{4}F)6s	h ^{3}F	2			
		3			
		4	46530.45		
3d^2 4s(a ^{2}F)4d	f ^{1}F	3	46650.26		
3d^2 4p^2	g ^{5}G	2	46943.91	86.37	
		3	47030.28	109.58	
		4	47139.86	140.83	
		5	47280.69	166.15	
		6	47446.84		

Ti I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
3d^2 4s(a ^{2}F)4d	i ^{3}F	2			
		3	47038.16	156.52	
		4	47194.68		
3d^3(b ^{4}F)6s	i ^{5}F	1			
		2			
		3			
		4			
		5	47777.32		
3d^2 4s(a ^{4}F)5d	g ^{5}H	3	47840.62	72.99	
		4	47913.61	80.71	
		5	47994.32	112.51	
		6	48106.83	156.00	
		7	48262.83		
3d^2 4s(a ^{4}F)5d	h ^{5}G	2	47870.61	66.18	
		3	47936.79	81.29	
		4	48018.08	101.39	
		5	48119.47	114.00	
		6	48233.47		
3d^2 4p^2	j ^{5}F	1	48058.85	48.57	
		2	48107.42	101.45	
		3	48208.87	119.94	
		4	48328.81	133.30	
		5	48462.11		
3d^2 4s(a ^{4}F)5d	g ^{5}D	0			
		1			
		2			
		3	48059.82	126.29	
		4	48186.11		
3d^3(b ^{2}F)4p:	u ^{1}F°	3	*48365.09*		
3d^2 4s(a ^{4}F)5d	k ^{5}F	1			
		2	48519.21	69.07	
		3	48588.28	84.38	
		4	48672.66	99.07	
		5	48771.73		
3d^2 4p^2	e ^{3}D	1	48724.83	−0.49	
		2	48724.34	115.40	
		3	48839.74		
3d^2 4p^2	h ^{5}D	0	48802.32	57.19	
		1	48859.51	55.56	
		2	48915.07	109.36	
		3	49024.43	12.03	
		4	49036.46		
	f ^{3}D	1			
		2	49571.69	48.03	
		3	49619.72		
	f ^{1}D	2	50128.08		
	f ^{1}G	4	52125.98		
	e ^{1}P	1	53663.32		
Ti II (a ^{4}F$_{1\frac{1}{2}}$)	*Limit*	-----	55138		

June 1948.

Ti I Observed Terms

Config. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6+$	Observed Terms											
$3d^2\ 4s^2$	a ^{2}P	a ^{1}D	a ^{3}F	a ^{1}G								
$3d^4$	d ^{3}P	a ^{5}D		b ^{3}G								
$3d^2\ 4p^2$		h ^{5}D e ^{3}D	i ^{5}F	g ^{5}G								
	ns $(n\geq 4)$					np $(n\geq 4)$						
$3d^2\ 4s(a\ ^4\mathrm{F})nx$			e, h ^{5}F e, h ^{3}F					z, v ^{5}D° y ^{3}D°	z ^{5}F° y ^{3}F°	z ^{5}G° x ^{3}G°		
$3d^3(b\ ^4\mathrm{F})nx$			a, f, i ^{5}F b, f ^{3}F					x ^{5}D° x ^{3}D°	y ^{5}F° x ^{3}F°	y ^{5}G° y ^{3}G°		
$3d^2\ 4s(a\ ^2\mathrm{F})nx$			e ^{1}F					z ^{3}D° z ^{1}D°	z ^{3}F° z ^{1}F°	z ^{3}G° z ^{1}G°		
$3d^2\ 4s(a\ ^2\mathrm{D})nx$		e ^{1}D					y ^{3}P° z ^{1}P°	v ^{3}D° y ^{1}D°	w ^{3}F° y ^{1}F°			
$3d^3(a\ ^2\mathrm{G})nx$				a ^{3}G b ^{1}G					t ^{3}F° v ^{1}F°	v ^{3}G° x ^{1}G°	y ^{3}H° y ^{1}H°	
$3d^3(a\ ^4\mathrm{P})nx$	a ^{5}P c ^{3}P					y ^{5}S° w ^{3}S°	y ^{5}P° v ^{3}P°	w ^{5}D° s ^{3}D°				
$3d^3(a\ ^2\mathrm{P})nx$	b ^{3}P a ^{1}P					x ^{3}S° z ^{1}S°	u ^{3}P°	r ^{3}D° w ^{1}D°				
$3d^2\ 4s(b\ ^4\mathrm{P})nx$	e ^{3}P					z ^{5}S° z ^{3}S°	z ^{5}P° z ^{3}P°	y ^{5}D° w ^{3}D°				
$3d^3(b\ ^2\mathrm{D})nx$		a ^{3}D b ^{1}D					w ^{3}P° x ^{1}P°	t ^{3}D° u ^{1}D°	u ^{3}F° w ^{1}F°			
$3d^3(a\ ^2\mathrm{H})nx$					a ^{3}H a ^{1}H					u ^{3}G° v ^{1}G°	x ^{3}H° x ^{1}H°	z ^{3}I° z ^{1}I°
$3d^2\ 4s(b\ ^2\mathrm{G})nx$									v ^{3}F° x ^{1}F°	w ^{3}G° y ^{1}G°	z ^{3}H° z ^{1}H°	
$3d^2\ 4s(b\ ^2\mathrm{P})nx$						y ^{3}S°	x ^{3}P° y ^{1}P°	u ^{3}D° x ^{1}D°				
$3d^3(b\ ^2\mathrm{F})nx$			a ^{1}F						u ^{1}F°	u ^{1}G°		
$3d^2\ 4s(a\ ^2\mathrm{S})nx$							t ^{3}P° w ^{1}P°					
	nd $(n\geq 4)$											
$3d^2\ 4s(a\ ^4\mathrm{F})nx$	e ^{5}P	e, g ^{5}D	g, k ^{5}F g ^{3}F	e, h ^{5}G e ^{3}G	e, g ^{5}H e ^{3}H							
$3d^3(b\ ^4\mathrm{F})nx$		f ^{5}D		f ^{5}G?	f ^{5}H							
$3d^2\ 4s(a\ ^2\mathrm{F})nx$			i ^{3}F f ^{1}F	e ^{1}G	f ^{3}H e ^{1}H							

*For predicted terms in the spectra of the Ti I isoelectronic sequence, see Introduction.

Ti II

(Sc I sequence; 21 electrons) $Z=22$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^2\ 4s\ {}^4F_{1\frac{1}{2}}$

$a\ {}^4F_{1\frac{1}{2}}$ **110000 cm⁻¹** I. P. 13.63 volts

This spectrum has been analyzed by Russell. His detailed analysis published in 1927 contains 50 terms derived from 164 multiplets, and includes 529 classified lines. The doublet and quartet terms are connected by observed intersystem combinations.

The configuration assignments are of considerable theoretical interest, as indicated, for example, in the references to the papers by Ufford, Racah, and Many listed below. Many has interchanged the configurations given by Russell to the two low ^{4}F terms. From a detailed study of the series relations Russell has recently shown conclusively that his original assignments were correct, namely that the lower term ($a\ {}^4$F) has the configuration $3d^2$ ($a\ {}^3$F)$4s$ and that the higher one ($b\ {}^4$F) should be ascribed to $3d^3$.

Approximate g-values have been determined by Catalán from the Zeeman patterns observed by King and Babcock and quoted by Russell (1927). Very few patterns have been resolved and consequently the observed g-values differ from the theoretical ones by a few percent in some cases. Colons indicate that LS-coupling has been assumed and a theoretical g-value introduced in order to utilize the observed data. It is highly desirable to extend this work with the aid of Harrison's unpublished Zeeman observations of titanium.

REFERENCES

H. N. Russell, Astroph. J. **66**, 283 (1927); Mt. Wilson Contr. No. 344 (1927). (I P) (T) (C L) (G D) (Z E)
C. W. Ufford, Phys. Rev. **44**, 732 (1933).
G. Racah, Phys. Rev. **62**, 438 (1942).
A. Many, Phys. Rev. **70**, 511 (1946).
H. N. Russell, Phys. Rev. **74**, 689 (1948).
M. A. Catalán, unpublished material (June 1948). (Z E)

Ti II

Config.	Desig.	J	Level	Interval	Obs. g
$3d^2(a\ {}^3F)4s$	$a\ {}^4F$	1½	0.00	93.94	
		2½	93.94	131.53	
		3½	225.47	167.75	
		4½	393.22		
$3d^3$	$b\ {}^4F$	1½	907.96	75.84	
		2½	983.80	103.41	
		3½	1087.21	128.37	
		4½	1215.58		
$3d^2(a\ {}^3F)4s$	$a\ {}^2F$	2½	4628.61	268.99	0.86:
		3½	4897.60		1.14:
$3d^2(a\ {}^1D)4s$	$a\ {}^2D$	1½	8710.47	33.80	0.80
		2½	8744.27		1.20:
$3d^3$	$a\ {}^2G$	3½	8997.69	120.46	0.89:
		4½	9118.15		1.11:
$3d^3$	$a\ {}^4P$	½	9363.71	32.05	2.63
		1½	9395.76	122.29	1.74
		2½	9518.05		1.60:
$3d^3$	$a\ {}^2P$	½	9850.90	125.02	0.66
		1½	9975.92		1.33
$3d^2(a\ {}^3P)4s$	$b\ {}^4P$	½	9872.87	57.87	2.60
		1½	9930.74	94.00	1.72:
		2½	10024.74		1.60:
$3d^3$	$b\ {}^2D$	1½	12628.77	129.38	0.80:
		2½	12758.15		1.20:
$3d^3$	$a\ {}^2H$	4½	12676.99	97.82	0.91:
		5½	12774.81		1.09:
$3d^2(a\ {}^1G)4s$	$b\ {}^2G$	4½	15257.53	−8.07	1.11:
		3½	15265.60		0.89:

Ti II—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$3d^2(a\ ^3P)4s$	$b\ ^2P$	½ 1½	16515. 79 16625. 25	109. 46	0. 66 1. 33
$3d^3$	$b\ ^2F$	3½ 2½	20891. 88 20951. 77	−59. 89	1. 14: 0. 86:
$3d^2(a\ ^1S)4s$	$a\ ^2S$	½	21338. 00:		
$3d\ 4s^2$	$c\ ^2D$	1½ 2½	24961. 34 25193. 04	231. 70	0. 80: 1. 20:
$3d^2(a\ ^3F)4p$	$z\ ^4G°$	2½ 3½ 4½ 5½	*29544. 37* *29734. 45* *29968. 08* *30240. 68*	190. 08 233. 63 272. 60	0. 57: 0. 98:
$3d^2(a\ ^3F)4p$	$z\ ^4F°$	1½ 2½ 3½ 4½	*30836. 52* *30958. 70* *31113. 61* *31300. 92*	122. 18 154. 91 187. 31	0. 40: 1. 03: 1. 24:
$3d^2(a\ ^3F)4p$	$z\ ^2F°$	2½ 3½	*31207. 44* *31490. 82*	283. 38	0. 86: 1. 14:
$3d^2(a\ ^3F)4p$	$z\ ^2D°$	1½ 2½	*31756. 50* *32025. 50*	269. 00	0. 92 1. 20
$3d^2(a\ ^3F)4p$	$z\ ^4D°$	½ 1½ 2½ 3½	*32532. 38* *32602. 51* *32697. 94* *32767. 02*	70. 13 95. 43 69. 08	0. 00 1. 20 1. 37 1. 43:
$3d^2(a\ ^3F)4p$	$z\ ^2G°$	3½ 4½	*34543. 36* *34748. 50*	205. 14	0. 89: 1. 11:
$3d^2(a\ ^3P)4p$	$z\ ^2S°$	½	*37430. 55*		2. 09
$3d^2(a\ ^1D)4p$	$y\ ^2D°$	1½ 2½	*39233. 44* *39476. 87*	243. 43	0. 80: 1. 20:
$3d^3(a\ ^1D)4p$	$z\ ^2P°$	1½ ½	*39602. 90* *39674. 64*	−71. 74	1. 21 0. 67:
$3d^2(a\ ^1D)4p$	$y\ ^2F°$	2½ 3½	*39926. 83* *40074. 71*	147. 88	0. 86: 1. 14:
$3d^2(a\ ^3P)4p$	$z\ ^4S°$	1½	*40027. 28*		
$3d^2(a\ ^3P)4p$	$y\ ^4D°$	½ 1½ 2½ 3½	*40330. 25* *40425. 80* *40581. 80* *40798. 37*	95. 55 156. 00 216. 57	
$3d^2(a\ ^3P)4p$	$z\ ^4P°$	½ 1½ 2½	*41996. 74* *42068. 85* *42208. 84*	72. 11 139. 99	
$3d^2(a\ ^1G)4p$	$y\ ^2G°$	3½ 4½	*43740. 77* *43780. 99*	40. 22	0. 89: 1. 11:
$3d^2(a\ ^3P)4p$	$x\ ^2D°$	2½ 1½	*44902. 42* *44914. 80*	−12. 38	1. 20: 0. 80:
$3d^2(a\ ^3P)4p$	$y\ ^2P°$	½ 1½	*45472. 89* *45548. 90*	76. 01	0. 66: 1. 33:
$3d^2(a\ ^1G)4p$	$z\ ^2H°$	4½ 5½	*45673. 75* *45908. 56*	234. 81	

Ti II—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$3d^2(a\ ^1G)4p$	$x\ ^2F°$	3½ 2½	*47466. 80* *47625. 17*	−158. 37	1. 14: 0. 86:
$3d\ 4s(a\ ^3D)4p$	$x\ ^4D°$	½ 1½ 2½ 3½	*52329. 78* *52458. 98* *52471. 48* *52631. 07*	129. 20 12. 50 159. 59	
$3d\ 4s(a\ ^3D)4p$	$x\ ^2P°$	½ 1½	*53121. 48* *53128. 17*	6. 69	
$3d\ 4s(a\ ^3D)4p$	$w\ ^2D°$	2½ 1½	*53554. 90* *53596. 70*	−41. 80	
$3d\ 4s(a\ ^3D)4p$	$y\ ^4P°$	½ 1½ 2½	*56223. 13* *56249. 11* *56325. 94*	25. 98 76. 83	
$3d\ 4s(a\ ^3D)4p$	$w\ ^2F°$	2½ 3½	*59321. 79* *59467. 81*	146. 02	
$3d^2(a\ ^3F)5s$	$e\ ^4F$	1½ 2½ 3½ 4½	62180. 02 62271. 25 62409. 58 62594. 27	91. 23 138. 33 184. 69	
$3d^2(a\ ^3F)5s$	$e\ ^2F$	2½ 3½	63168. 23 63444. 76	276. 53	
$3d^2(a\ ^3F)4d$	$e\ ^4G$	2½ 3½ 4½ 5½	64884. 65 64977. 57 65094. 29 65241. 60	92. 92 116. 72 147. 31	
$3d^2(a\ ^3F)4d$	$e\ ^4H$	3½ 4½ 5½ 6½	65184. 72 65307. 45 65445. 85 65589. 10	122. 73 138. 40 143. 25	
$3d^2(a\ ^3F)4d$	$f\ ^2F$	2½ 3½	65312. 71 65458. 65	145. 94	
$3d^2(a\ ^3F)4d$	$e\ ^4D$	½ 1½ 2½ 3½	66767. 43? 66816. 49 66937. 70 66996. 67	49. 06 121. 21 58. 97	
$3d^2(a\ ^3F)4d$	$e\ ^2G$	3½ 4½	67604. 20 67820. 87	216. 67	
$3d^2(a\ ^3F)4d$	$e\ ^2H$	4½ 5½	68328. 95 68582. 34	253. 39	
$3d^2(a\ ^3F)4d$	$f\ ^4F$	1½ 2½ 3½ 4½	68767. 66 68845. 14 68950. 39 69081. 35	77. 48 105. 25 130. 96	
$3d\ 4s(b\ ^1D)4p$	$v\ ^2D°$	1½ 2½	*69327. 32* *69622. 15*	294. 83	
$3d\ 4s(b\ ^1D)4p$	$v\ ^2F°$	2½ 3½	*70606. 35* *70893. 00*	286. 65	
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Ti III ($a\ ^3F_2$)	*Limit*	-----	110000		

June 1948.

Ti II OBSERVED TERMS*

Config. $1s^2\,2s^2\,2p^6\,3s^2\,3p^6+$	Observed Terms		
$3d^3$	$a\,{}^4\mathrm{P}$ $b\,{}^4\mathrm{F}$ $a\,{}^2\mathrm{P}$ $b\,{}^2\mathrm{D}$ $b\,{}^2\mathrm{F}$ $a\,{}^2\mathrm{G}$ $a\,{}^2\mathrm{H}$		
$3d\,4s^2$	$c\,{}^2\mathrm{D}$		
	ns $(n\geq 4)$	np $(n\geq 4)$	nd $(n\geq 4)$
$3d^2(a\,{}^3\mathrm{F})nx$	$a, e\,{}^4\mathrm{F}$ $a, e\,{}^2\mathrm{F}$	$z\,{}^4\mathrm{D}^\circ$ $z\,{}^4\mathrm{F}^\circ$ $z\,{}^4\mathrm{G}^\circ$ $z\,{}^2\mathrm{D}^\circ$ $z\,{}^2\mathrm{F}^\circ$ $z\,{}^2\mathrm{G}^\circ$	$e\,{}^4\mathrm{D}$ $f\,{}^4\mathrm{F}$ $e\,{}^4\mathrm{G}$ $e\,{}^4\mathrm{H}$ $f\,{}^2\mathrm{F}$ $e\,{}^2\mathrm{G}$ $e\,{}^2\mathrm{H}$
$3d^2(a\,{}^1\mathrm{D})nx$	$a\,{}^2\mathrm{D}$	$z\,{}^2\mathrm{P}^\circ$ $y\,{}^2\mathrm{D}^\circ$ $y\,{}^2\mathrm{F}^\circ$	
$3d^2(a\,{}^3\mathrm{P})nx$	$b\,{}^4\mathrm{P}$ $b\,{}^2\mathrm{P}$	$z\,{}^4\mathrm{S}^\circ$ $z\,{}^4\mathrm{P}^\circ$ $y\,{}^4\mathrm{D}^\circ$ $z\,{}^2\mathrm{S}^\circ$ $y\,{}^2\mathrm{P}^\circ$ $x\,{}^2\mathrm{D}^\circ$	
$3d^2(a\,{}^1\mathrm{S})nx$	$a\,{}^2\mathrm{S}$		
$3d^2(a\,{}^1\mathrm{G})nx$	$b\,{}^2\mathrm{G}$	$x\,{}^2\mathrm{F}^\circ$ $y\,{}^2\mathrm{G}^\circ$ $z\,{}^2\mathrm{H}^\circ$	
$3d\,4s(a\,{}^3\mathrm{D})nx$		$y\,{}^4\mathrm{P}^\circ$ $x\,{}^4\mathrm{D}^\circ$ $x\,{}^2\mathrm{P}^\circ$ $w\,{}^2\mathrm{D}^\circ$ $w\,{}^2\mathrm{F}^\circ$	
$3d\,4s(b\,{}^1\mathrm{D})nx$		$v\,{}^2\mathrm{D}^\circ$ $v\,{}^2\mathrm{F}^\circ$	

*A chart of predicted terms in the spectra of the Sc I isoelectronic sequence is given in the Introduction. Owing to the difference in binding energies of the $3d$ and $4s$ electrons along this sequence, the charts of observed and predicted terms are not similarly arranged for Ti II.

Ti III

(Ca I sequence; 20 electrons) $Z=22$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^2\,{}^3\mathrm{F}_2$

$a\,{}^3\mathrm{F}_2$ **227000** cm^{-1} I. P. 28.14 volts

The analysis is by Russell and Lang who have classified 84 lines in the interval between 1002 A and 2984 A.

The singlet and triplet terms are connected by observed intersystem combinations.

REFERENCE

H. N. Russell and R. J. Lang, Astroph. J. **66**, 25 ; Mt. Wilson Contr. No. 337 (1927). (I P) (T) (C L)

Ti III

Config.	Desig.	J	Level	Interval
$3d^2$	$a\ ^3F$	2	0.0	
		3	183.7	183.7
		4	421.9	238.2
$3d^2$	$a\ ^1D$	2	8472.6	
$3d^2$	$a\ ^3P$	0	10536.4	
		1	10603.5	67.1
		2	10721.1	117.6
$3d^2$	$a\ ^1S$	0	14052.7?	
$3d^2$	$a\ ^1G$	4	14398.5	
$3d(^2D)4s$	$a\ ^3D$	1	38063.50	
		2	38197.98	134.48
		3	38425.19	227.21
$3d(^2D)4s$	$b\ ^1D$	2	41703.65	
$3d(^2D)4p$	$z\ ^1D^\circ$	2	*75197.43*	
$3d(^2D)4p$	$z\ ^3D^\circ$	1	*76999.70*	
		2	*77166.65*	166.95
		3	*77424.20*	257.55
$3d(^2D)4p$	$z\ ^3F^\circ$	2	*77421.48*	
		3	*77746.18*	324.70
		4	*78158.71*	412.53
$3d(^2D)4p$	$z\ ^3P^\circ$	0	*80943.95*	
		1	*80938.02*	−5.93
		2	*81023.60*	85.58
$3d(^2D)4p$	$z\ ^1F^\circ$	3	*83116.58*	
$3d(^2D)4p$	$z\ ^1P^\circ$	1	*83795.70*	
$3d(^2D)4d$	$e\ ^3G$	3	129096.3	
		4	129256.0	159.7
		5	129472.6	216.6
$3d(^2D)4d$	$e\ ^3D$	1		
		2	129873.9	
		3	130019.5	145.6
$3d(^2D)4d$	$e\ ^3S$	2	132854.6	
$3d(^2D)4d$	$e\ ^3F$	2	133067.2	
		3	133209.7	142.5
		4	133373.7	164.0
$3d(^2D)4d$	$e\ ^3P$	0	135543.8	
		1	135602.4	58.6
		2	135724.1	121.7
$4s(^2S)4p$	$y\ ^3P^\circ$	0	*137262*	
		1	*137490*	228
		2	*137971*	481
Ti IV $(^2D)_{1\frac{1}{2}}$	*Limit*	-------	227000	

June 1948.

Ti III Observed Terms*

Config. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6+$	Observed Terms		
$3d^2$	$a\ ^1S$ $a\ ^3P$ $a\ ^1D$ $a\ ^3F$ $a\ ^1G$		
	$ns\ (n\geq 4)$	$np\ (n\geq 4)$	$nd\ (n\geq 4)$
$3d(^2D)nx$	$a\ ^3D$ $b\ ^1D$	$z\ ^3P^\circ$ $z\ ^3D^\circ$ $z\ ^3F^\circ$ $z\ ^1P^\circ$ $z\ ^1D^\circ$ $z\ ^1F^\circ$	$e\ ^3S$ $e\ ^3P$ $e\ ^3D$ $e\ ^3F$ $e\ ^3G$
$4s(^2S)nx$		$y\ ^3P^\circ$	

*A chart of predicted terms in the spectra of the Ca I isoelectronic sequence is given in the Introduction. Owing to the change in binding energies of the 3*d* and 4*s* electrons along this sequence, the arrangement of the charts of observed and predicted terms is not identical. In Ti III no primes are used to indicate higher limits, and the prefixes *a*, *b* . . . *e*, *z*, *y* replace those indicating the running electron.

Ti IV

(K I sequence; 19 electrons) $Z=22$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d\ ^2D_{1\frac{1}{2}}$

$3d\ ^2D_{1\frac{1}{2}}$ **348817.8** cm^{-1} I. P. 43.24 volts

The analysis is from Russell and Lang, who have revised and extended the early work of Gibbs and White. Thirty-one lines have been classified in the range between 423 A and 5492 A.

REFERENCES

R. C. Gibbs and H. E. White, Proc. Nat. Acad. Sci. **12,** 598 (1926). (T) (C L)

H. N. Russell and R. J. Lang, Astroph. J. **66,** 15 (1927); Mt. Wilson Contr. No. 337 (1927). (I P) (T) (C L)

Ti IV

Config.	Desig.	J	Level	Interval
$3p^6(^1S)3d$	$3d\ ^2D$	1½ 2½	0. 0 384. 3	384. 3
$3p^6(^1S)4s$	$4s\ ^2S$	½	80378. 6	
$3p^6(^1S)4p$	$4p\ ^2P^\circ$	½ 1½	*127912. 5* *128730. 9*	818. 4
$3p^6(^1S)4d$	$4d\ ^2D$	1½ 2½	196794. 8 196880. 5	85. 7
$3p^6(^1S)5s$	$5s\ ^2S$	½	212395. 8	
$3p^6(^1S)5p$	$5p\ ^2P^\circ$	½ 1½	*230597. 6* *230913. 4*	315. 8
$3p^6(^1S)4f$	$4f\ ^2F^\circ$	2½ 3½	*236125. 3* *236132. 5*	7. 2

Ti IV

Config.	Desig.	J	Level	Interval
$3p^6(^1S)5d$	$5d\ ^2D$	1½ 2½	258827. 2 258866. 7	39. 5
$3p^6(^1S)6s$	$6s\ ^2S$	½	265835. 8	
$3p^6(^1S)5g$	$5g\ ^2G$	{3½ 4½}	278501. 1	
$3p^6(^1S)6h$	$6h\ ^2H^\circ$	{4½ 5½}	*300012. 5*	
$3p^6(^1S)7h$	$7h\ ^2H^\circ$	{4½ 5½}	*312973. 5*	
Ti V ($^1S_0$)	*Limit*	-------	348817. 8	

May 1948.

Ti V

(A I sequence; 18 electrons) $Z=22$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ ^1S_0$

$3p^6\ ^1S_0$ **805500** cm^{-1} I. P. 99.8 volts

Four lines are classified in the region between 163 A and 228 A, as combinations with the ground term. The levels in the table are from the 1937 reference, and all values have been rounded off in the last places.

For convenience, the Paschen notation has been added by the writer in column one of the table, under the heading "A I". As for A I, the *jl*-coupling notation in the general form suggested by Racah is here introduced, although *LS*-designations, as indicated in column two under the heading "Authors", are perhaps preferable for the terms thus far identified.

REFERENCES

P. G. Kruger and S. G. Weissberg, Phys. Rev. **48**, 659 (1935). (C L)
P. G. Kruger, S. G. Weissberg and L. W. Phillips, Phys. Rev. **51**, 1090 (1937). (I P) (T) (C L)
G. Racah, Phys. Rev. **61**, 537 (L) (1942).

Ti V

A I	Authors	Config.	Desig.	*J*	Level
$1p_0$	$3p^6\ ^1S$	$3p^6$	$3p^6\ ^1S$	0	0
$1s_4$	$3p^5\ 4s\ ^3P°$	$3p^5(^2P°_{1½})4s$	$4s\ [1½]°$	2 1	*436880*
$1s_2$	$3p^5\ 4s\ ^1P°$	$3p^5(^2P°_{½})4s$	$4s'[\ ½]°$	0 1	*443780*
$2s_4$	$3p^5\ 5s\ ^3P°$	$3p^5(^2P°_{1½})5s$	$5s\ [\ ½]°$	2 1	*608090*
$2s_2$	$3p^5\ 5s\ ^1P°$	$3p^5(^2P°_{½})5s$	$5s'[\ ½]°$	0 1	*612970*
		Ti VI $(^2P°_{1½})$	***Limit***	-----	**805500**
		Ti VI $(^2P°_{½})$	*Limit*	-----	811330

May 1948.

Ti VI

(Cl I sequence; 17 electrons) $Z=22$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^5\;{}^2P^{\circ}_{1\frac{1}{2}}$

$3p^5\;{}^2P^{\circ}_{1\frac{1}{2}}$ *966000* cm^{-1} I. P. 120 volts

All of the terms except $3p^6\;{}^2S$ are from the paper by Edlén. Twelve lines in the region between 182 A and 524 A have been classified as combinations from the ground term. Edlén has estimated the value of the limit by extrapolation along the isoelectronic sequence, as indicated by brackets in the table. His unit, 10^3 cm^{-1}, has here been changed to cm^{-1}.

REFERENCES

S. G. Weissberg and P. G. Kruger, Phys. Rev. **49**, 872 (A) (1936). (C L)
B. Edlén, Zeit. Phys. **104**, 407 (1937). (I P) (T) (C L)

Ti VI

Config.	Desig.	J	Level	Interval
$3s^2\,3p^5$	$3p^5\;{}^2P^{\circ}$	1½ ½	*0* *5840*	−5840
$3s\;3p^6$	$3p^6\;{}^2S$	½	196620	
$3s^2\,3p^4(^3P)4s$	$4s\;\;{}^4P$	2½ 1½ ½	 495390 	
$3s^2\,3p^4(^3P)4s$	$4s\;\;{}^2P$	1½ ½	502580 506440	−3860
$3s^2\,3p^4(^1D)4s$	$4s'\;{}^2D$	2½ 1½	518820 518930	−110
$3s^2\,3p^4(^1S)4s$	$4s''\;{}^2S$	½	549000	
-----------	------	---	---------	
Ti VII ($^3P_2$)	*Limit*	---	[*966000*]	

January 1948.

Ti VII

(S I sequence; 16 electrons) $Z=22$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^4\ ^3P_2$

$3p^4\ ^3P_2$ **1136000** cm^{-1} I. P. 140.8 volts

All the terms are from Edlén's paper except $3p^5\ ^3P^\circ$, which is from Kruger and Pattin, who have estimated the value entered in brackets in the table. Twenty-four lines have been classified in the region between 164 A and 200 A. The limit is from Edlén, who has extrapolated it from isoelectronic sequence data.

The singlet and triplet terms are connected by two observed intersystem combinations.

The unit adopted by Edlén, $10^3\ cm^{-1}$, has here been changed to cm^{-1}.

REFERENCES

B. Edlén, Zeit. Phys. **104**, 188 (1937). (I P) (T) (C L)
P. G. Kruger and H. S. Pattin, Phys. Rev. **52**, 622 (1937). (T) (C L)

Ti VII

Config.	Desig.	J	Level	Interval
$3s^2\ 3p^4$	$3p^4\ ^3P$	2	0	
		1	4540	−4540
		0	5900	−1360
$3s^2\ 3p^4$	$3p^4\ ^1D$	2	24120	
$3s^2\ 3p^4$	$3p^4\ ^1S$	0	54770	
$3s\ 3p^5$	$3p^5\ ^3P^\circ$	2	*196260*	
		1	*200060*	−3800
		0	[*202200*]	−[2140]
$3s^2\ 3p^3(^4S^\circ)4s$	$4s\ ^3S^\circ$	1	*564240*	
$3s^2\ 3p^3(^2D^\circ)4s$	$4s'\ ^3D^\circ$	1	*586100*	
		2	*586320*	220
		3	*587000*	680

Ti VII

Config.	Desig.	J	Level	Interval
$3s^2\ 3p^3(^2D^\circ)4s$	$4s'\ ^1D^\circ$	2	*592930*	
$3s^2\ 3p^3(^2P^\circ)4s$	$4s''\ ^3P^\circ$	0	*607550*	
		1	*607990*	440
		2	*609120*	1130
$3s^2\ 3p^3(^2P^\circ)4s$	$4s''\ ^1P^\circ$	1	*614790*	
Ti VIII ($^4S^\circ_{1\frac{1}{2}}$)	*Limit*	-------	**1136000**	

January 1948.

Ti VIII

(P I sequence; 15 electrons) $Z=22$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3\ {}^4S^\circ_{1\frac{1}{2}}$

$3p^3\ {}^4S^\circ_{1\frac{1}{2}}$ cm^{-1} I. P. volts

The analysis is incomplete. Kruger and Pattin have observed 15 lines between 150 A and 162 A and arranged them in five multiplets that give intervals consistent with those found in related isoelectronic spectra.

By a rough extrapolation of $3p^3\ {}^4S^\circ_{1\frac{1}{2}}-3p^3\ {}^2D^\circ_{1\frac{1}{2}}$ along the isoelectronic sequence the writer has estimated the value of $3p^3\ {}^2D^\circ_{1\frac{1}{2}}$ entered in brackets in the table. She has calculated the terms listed below from the observed multiplets. The uncertainty x in the estimated position of the doublet terms relative to the quartets may well exceed $\pm 500\ cm^{-1}$.

REFERENCE

P. G. Kruger and H. S. Pattin, Phys. Rev. **52**, 624 (1937). (C L)

Ti VIII

Config.	Desig.	J	Level	Interval
$3s^2\ 3p^3$	$3p^3\ {}^4S^\circ$	1½	*0*	
$3s^2\ 3p^3$	$3p^3\ {}^2D^\circ$	1½ 2½	*[33000]*+x *34080* +x	1080
$3s^2\ 3p^3$	$3p^3\ {}^2P^\circ$	½ 1½	*55000* *56460*	1460
$3s^2\ 3p^2(^3P)4s$	$4s\ {}^4P$	½ 1½ 2½	660130 662850 666500	2720 3650
$3s^2\ 3p^2(^3P)4s$	$4s\ {}^2P$	½ 1½	672220 +x 676450 +x	4230
$3s^2\ 3p^2(^1D)4s$	$4s'\ {}^2D$	2½ 1½	691260 +x 691490 +x	−230

December 1947.

Ti IX

(Si I sequence; 14 electrons) $Z=22$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^2\;{}^3P_0$

$3p^2\;{}^3P_0$ **1560000** cm^{-1} I. P. 193 volts

The analysis is very incomplete, but seven lines have been classified by Phillips in the interval 281 A to 341 A as combinations among three triplet terms. He states that the interval $3p^2\,{}^3P_0-3p^2\,{}^3P_1$ of the ground term has been extrapolated along the sequence, since no combinations from the ground state $3p^2\,{}^3P_0$ are known. The first interval is, therefore, entered in brackets in the table, as well as his estimated value of the limit.

REFERENCE

L. W. Phillips, Phys. Rev. **55**, 709 (1939). (I P) (T) (C L)

Ti IX

Config.	Desig.	J	Level	Interval
$3s^2\,3p^2$	$3p^2\;{}^3P$	0 1 2	0 3100 7310	[3100] 4210
$3s\;3p^3$	$3p^3\;{}^3S^\circ$	1	299920	
$3s^2\,3p(^2P^\circ)3d$	$3d\;\;{}^3P^\circ$	2 1 0	352460 356800 358380	−4340 −1580
------------	------	---	-------	
Ti x ($^2P^\circ_{1/2}$)	*Limit*	---	[1560000]	

October 1947.

Ti X

(Al I sequence; 13 electrons) $Z=22$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p\;{}^2P^\circ_{1/2}$

$3p\;{}^2P^\circ_{1/2}$ cm^{-1} I. P. volts

This spectrum has not been analyzed, but Edlén has classified two lines as follows:

I. A.	Int.	Wave No.	Desig.
101. 355	[2]	986630	$3p\;{}^2P^\circ-4d\;{}^2D$
102. 107	2	979360	

His unit, 10^3 cm^{-1}, is here changed to cm^{-1}.

REFERENCE

B. Edlén, Zeit. Phys. **103**, 540 (1936). (C L)

December 1947.

Ti XI

(Mg I sequence; 12 electrons) $Z=22$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ ^1S_0$

$3s^2\ ^1S_0$ **2142000** cm^{-1} I. P. 266 volts

Edlén has classified 14 lines in the region between 71 A and 126 A. No intersystem combinations have been observed and the triplet terms are not all connected by observed combinations. He has determined the relative positions of the various groups of terms and also the ionization potential by extrapolation along the isoelectronic sequence. His estimated value of the limit is entered in brackets in the table.

His unit, 10^3 cm^{-1}, has here been changed to cm^{-1}.

REFERENCE

B. Edlén, Zeit. Phys. **103**, 536 (1936). (I P) (T) (C L)

Ti XI

Config.	Desig.	J	Level	Interval
$3s^2$	$3s^2\ ^1S$	0	0	
$3s(^2S)3p$	$3p\ ^3P^\circ$	0 1 2	*172370+x* *174920+x* *180550+x*	2550 5630
$3s(^2S)3d$	$3d\ ^3D$	1 2 3	 504150+x	
$3s(^2S)4s$	$4s\ ^3S$	1	1050030+x	
$3s(^2S)4p$	$4p\ ^1P^\circ$	1	*1139970*	
$3s(^2S)4d$	$4d\ ^3D$	1 2 3	1243080+x 1243350+x 1243770+x	270 420
$3s(^2S)4f$	$4f\ ^3F^\circ$	2 3 4	 *1297420+x*	
$3s(^2S)5d$	$5d\ ^3D$	1 2 3	 1577370+x	
$3s(^2S)5f$	$5f\ ^3F^\circ$	2 3 4	 *1603570+x*	
Ti XII ($^2S_{1/2}$)	*Limit*	-------	[2142000]	

August 1947.

Ti XII

(Na I sequence; 11 electrons) $Z=22$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s\ ^2S_{1/2}$

$3s\ ^2S_{1/2}$ **2351530** cm^{-1} I. P. 291.47 volts

Edlén has classified 16 lines in the interval 60 A to 116 A, and extrapolated the absolute value of the ground term from isoelectronic sequence data.

The unit adopted by Edlén, 10^3 cm^{-1}, has here been changed to cm^{-1}.

REFERENCE

B. Edlén, Zeit. Phys. **100**, 621 (1936). (I P) (T) (C L)

Ti XII

Config.	Desig.	J	Level	Interval
$3s$	$3s\ ^2S$	½	0	
$3p$	$3p\ ^2P^\circ$	½ 1½	*208300* *216960*	8660
$3d$	$3d\ ^2D$	1½ 2½	502370 503260	890
$4s$	$4s\ ^2S$	½	1133370	
$4p$	$4p\ ^2P^\circ$	½ 1½	*1214330* *1217670*	3340
$4d$	$4d\ ^2D$	1½ 2½	1321380 1321840	460
$4f$	$4f\ ^2F^\circ$	2½ 3½	*1360770* *1360930*	160
$5p$	$5p\ ^2P^\circ$	½ 1½	*1645820* *1647310*	1490
$5d$	$5d\ ^2D$	1½ 2½	1697530 1697740	210
$5f$	$5f\ ^2F^\circ$	2½ 3½	*1717270* *1717410*	140
$6f$	$6f\ ^2F^\circ$	2½ 3½	 *1911470*	
Ti XIII ($^1S_0$)	*Limit*	-------	2351530	

June 1947.

Ti XIII

(Ne I sequence; 10 electrons) $Z=22$

Ground state $1s^2\ 2s^2\ 2p^6\ ^1S_0$

$2p^6\ ^1S_0$ 6360600 cm^{-1} I. P. 788.4 volts

Edlén and Tyrén have classified five lines in the interval between 23 A and 26 A, as combinations with the ground term. Their absolute term values are based on extrapolation along the Ne I isoelectronic sequence. Their unit, 10^3 cm^{-1}, has here been changed to cm^{-1}.

As for Ne I, the jl-coupling notation in the general form suggested by Racah is introduced.

REFERENCES

B. Edlén and F. Tyrén, Zeit. Phys. **101,** 210 (1936). (I P) (T) (C L)

G. Racah, Phys. Rev. **61,** 537 (L) (1942).

Ti XIII

Authors	Config.	Desig.	J	Level
$2p\ ^1S_0$	$2p^6$	$2p^6\ ^1S$	0	0
 $3s\ ^3P_1$	$2p^5(^2P^\circ_{1\frac{1}{2}})3s$	$3s\ [1\frac{1}{2}]^\circ$	2 1	 *3709200*
 $3s\ ^1P_1$	$2p^5(^2P^\circ_{\frac{1}{2}})3s$	$3s'[\ \frac{1}{2}]^\circ$	0 1	 *3753600*
 $3d\ ^3P_1$	$2p^5(^2P^\circ_{1\frac{1}{2}})3d$	$3d\ [\ \frac{1}{2}]^\circ$	0 1	 *4168200*
$3d\ ^3P_1$	"	$3d\ [1\frac{1}{2}]^\circ$	1	*4219800*
$3d\ ^3D_1$	$2p^5(^2P^\circ_{\frac{1}{2}})3d$	$3d'[1\frac{1}{2}]^\circ$	1	*4281600*
	Ti XIV ($^2P^\circ_{1\frac{1}{2}}$)	*Limit*	-------	**6360600**
	Ti XIV ($^2P^\circ_{\frac{1}{2}}$)	*Limit*	-------	6407500

April 1947.

VANADIUM

V I

23 electrons $Z=23$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^3\ 4s^2\ ^4F_{1\frac{1}{2}}$

$a\ ^4F_{1\frac{1}{2}}$ **54361** cm^{-1} I. P. 6.74 volts

The arc spectrum of vanadium has been studied since 1923. The early contributions of Meggers, Laporte, Landé, Bechert, Sommer, and many others culminated in the extensive analysis of this highly complex spectrum published by Meggers and Russell in 1936. They list 60 doublet terms, 60 quartet terms, and 28 sextet terms from 634 multiplets, and give 2186 classified lines extending from 2082 A to 11911 A. The terms of all three multiplicities are connected by observed intersystem combinations.

The configuration assignments of many of the odd doublet and quartet terms are extremely uncertain and a number of terms are unassigned. No limit assignment has been attempted for the sextet triad $x\ ^6P^\circ$, $w\ ^6D^\circ$, and $x\ ^6F^\circ$, which comes from $3d^4\ 5p$, and for two quartet triads which may arise from $3d^3\ 4s\ 5p$. Rohrlich has suggested that some of the configurations of odd terms from $d^3\ sp$ and $d^4\ p$ should be interchanged.

Zeeman observations by Babcock of more than 900 lines provided the large array of g-values which greatly facilitated the analysis. Much of this material was generously furnished in manuscript form for inclusion in the 1936 paper. A discussion of the g-sums by Russell and Babcock appears in the 1935 reference below.

Six terms, and miscellaneous odd levels were added by the writer in 1939 from additional observations of the spectrum between 1848 A and 2173 A.

REFERENCES

H. N. Russell and H. D. Babcock, *Zeeman Verhandelingen* p. 286 (Martinus Nijhoff, The Hague 1935). (Z E)
W. F. Meggers and H. N. Russell, J. Research Nat. Bur. Std. **17**, 125, RP906 (1936). (I P) (T) (C L) (Z E)
C. E. Moore, Phys. Rev. **55, 710** (1939). (T) (C L)
W. F. Meggers, J. Opt. Soc. Am. **36**, 431 (1946). (Summary hfs.)
F. Rohrlich, Phys. Rev. **74**, 1393 (1948).

Config.	Desig.	J	Level	Interval	Obs. g
$3d^3\,4s^2$	$a\ ^4\mathrm{F}$	1½	0. 00	137. 38	0. 40
		2½	137. 38	186. 04	1. 01
		3½	323. 42	229. 60	1. 20
		4½	553. 02		1. 28
$3d^4(a\ ^5\mathrm{D})4s$	$a\ ^6\mathrm{D}$	½	2112. 32	40. 88	3. 29
		1½	2153. 20	66. 93	1. 82
		2½	2220. 13	91. 24	1. 61
		3½	2311. 37	113. 52	1. 53
		4½	2424. 89		1. 52
$3d^4(a\ ^5\mathrm{D})4s$	$a\ ^4\mathrm{D}$	½	8412. 94	63. 26	0. 00
		1½	8476. 20	102. 32	1. 19
		2½	8578. 52	137. 20	1. 35
		3½	8715. 72		1. 39
$3d^3\,4s^2$	$a\ ^4\mathrm{P}$	½	9544. 54	92. 42	2. 59
		1½	9636. 96	187. 62	1. 70
		2½	9824. 58		1. 55
$3d^3\,4s^2$	$a\ ^2\mathrm{G}$	3½	10892. 50	208. 15	0. 88
		4½	11100. 65		1. 13
$3d^3\,4s^2$	$a\ ^2\mathrm{P}$	1½	13801. 53	−9. 37	1. 20
		½	13810. 90		0. 64
$3d^3\,4s^2$	$a\ ^2\mathrm{D}$	1½	14514. 75	34. 08	0. 97
		2½	14548. 83		1. 17
$3d^4(a\ ^3\mathrm{H})4s$	$a\ ^4\mathrm{H}$	3½	14910. 04	39. 26	0. 65
		4½	14949. 30	51. 54	0. 94
		5½	15000. 84	62. 10	1. 10
		6½	15062. 94		1. 18
$3d^4(a\ ^3\mathrm{P})4s$	$b\ ^4\mathrm{P}$	½	15078. 25	192. 17	2. 60
		1½	15270. 42	301. 48	1. 68
		2½	15571. 90		1. 54
$3d^3\,4s^2$	$a\ ^2\mathrm{H}$	4½	15103. 77	161. 06	0. 90
		5½	15264. 83		1. 07
$3d^4(b\ ^3\mathrm{F})4s$	$b\ ^4\mathrm{F}$	1½	15664. 75	24. 05	0. 39
		2½	15688. 80	35. 42	1. 05
		3½	15724. 22	46. 50	1. 22
		4½	15770. 72		1. 31
$3d^3\,4s(a\ ^5\mathrm{F})4p$	$z\ ^6\mathrm{G}^\circ$	1½	16361. 45	88. 40	0. 00
		2½	16449. 85	122. 69	0. 78
		3½	16572. 54	156. 21	1. 10
		4½	16728. 75	188. 40	1. 22
		5½	16917. 15	219. 29	1. 26
		6½	17136. 44		1. 43
$3d^4(a\ ^3\mathrm{G})4s$	$a\ ^4\mathrm{G}$	2½	17054. 87	62. 05	0. 59
		3½	17116. 92	65. 06	0. 96
		4½	17181. 98	60. 07	1. 14
		5½	17242. 05		1. 27
$3d^3\,4s(a\ ^5\mathrm{F})4p$	$z\ ^6\mathrm{D}^\circ$	½	18085. 82	40. 45	3. 20
		1½	18126. 27	71. 81	1. 76
		2½	18198. 08	104. 19	1. 58
		3½	18302. 27	135. 80	1. 56
		4½	18438. 07		1. 55
$3d^3\,4s(a\ ^5\mathrm{F})4p$	$z\ ^6\mathrm{F}^\circ$	½	18120. 12	53. 94	−0. 44
		1½	18174. 06	84. 83	1. 14
		2½	18258. 89	113. 57	1. 28
		3½	18372. 46	141. 00	1. 28
		4½	18513. 46	166. 66	1. 38
		5½	18680. 12		1. 42
$3d^4(a\ ^3\mathrm{P})4s$	$b\ ^2\mathrm{P}$	½	18805. 05	384. 23	0. 67
		1½	19189. 28		1. 37

Config.	Desig.	J	Level	Interval	Obs. g
$3d^4(a\ ^3\mathrm{H})4s$	$b\ ^2\mathrm{H}$	4½	19023. 47	121. 66	0. 91
		5½	19145. 13		1. 08
$3d^4(b\ ^3\mathrm{F})4s$	$a\ ^2\mathrm{F}$	2½	19026. 34	51. 81	0. 86
		3½	19078. 15		1. 14
$3d^5$	$a\ ^6\mathrm{S}$	2½	20202. 49		
$3d^3\,4s(a\ ^3\mathrm{F})4p$	$z\ ^4\mathrm{D}^\circ$	½	20606. 43	81. 32	−0. 04
		1½	20687. 75	140. 73	1. 21
		2½	20828. 48	204. 04	1. 35
		3½	21032. 52		1. 45
$3d^4(a\ ^3\mathrm{D})4s$	$b\ ^4\mathrm{D}$	3½	20767. 57	−21. 56	1. 45
		2½	20789. 13	−23. 86	1. 25
		1½	20812. 99	−17. 21	1. 20
		½	20830. 20		0. 10
$3d^4(a\ ^3\mathrm{G})4s$	$b\ ^2\mathrm{G}$	4½	21603. 17	−43. 22	1. 11
		3½	21646. 39		0. 86
$3d^3\,4s(a\ ^3\mathrm{F})4p$	$z\ ^4\mathrm{G}^\circ$	2½	21841. 45	122. 05	0. 55
		3½	21963. 50	157. 67	0. 96
		4½	22121. 17	192. 82	1. 16
		5½	22313. 99		1. 24
$3d^3\,4s(a\ ^3\mathrm{F})4p$	$z\ ^4\mathrm{F}^\circ$	1½	23088. 06	122. 50	0. 39?
		2½	23210. 56	142. 53	0. 98?
		3½	23353. 09	166. 75	1. 23
		4½	23519. 84		1. 31
$3d^3\,4s(a\ ^3\mathrm{F})4p$	$z\ ^2\mathrm{D}^\circ$	1½	23608. 80	326. 35	0. 76
		2½	23935. 15		1. 32?
$3d^4(a\ ^5\mathrm{D})4p$	$z\ ^6\mathrm{P}^\circ$	1½	24648. 10	79. 75	2. 34
		2½	24727. 85	110. 71	1. 85
		3½	24838. 56		1. 67
$3d^4(a\ ^5\mathrm{D})4p$	$z\ ^4\mathrm{P}^\circ$	½	24770. 62	144. 54	2. 54
		1½	24915. 16	215. 80	1. 71
		2½	25130. 96		1. 59
$3d^4(a\ ^5\mathrm{D})4p$	$y\ ^6\mathrm{F}^\circ$	½	24789. 36	40. 82	−0. 58
		1½	24830. 18	68. 55	1. 02
		2½	24898. 73	94. 15	1. 23
		3½	24992. 88	118. 62	1. 37
		4½	25111. 50	142. 03	1. 41
		5½	25253. 53		1. 41
$3d^4(a\ ^5\mathrm{D})4p$	$y\ ^4\mathrm{F}^\circ$	1½	25930 51	73. 71	0. 42
		2½	26004. 22	117. 82	0. 98
		3½	26122. 04	49. 92	1. 15
		4½	26171. 96		1. 23
$3d^3\,4s(a\ ^3\mathrm{F})4p$	$z\ ^2\mathrm{G}^\circ$	3½	26021. 89	323. 05	0. 92
		4½	26344. 94		1. 13
$3d^4(a\ ^5\mathrm{D})4p$	$y\ ^4\mathrm{D}^\circ$	½	26182. 60	66. 88	−0. 06
		1½	26249. 48	103. 11	1. 17
		2½	26352. 59	127. 69	1. 34
		3½	26480. 28		1. 39
$3d^4(a\ ^5\mathrm{D})4p$	$y\ ^6\mathrm{D}^\circ$	½	26397. 36	40. 32	3. 25
		1½	26437. 68	68. 20	1. 86
		2½	26505. 88	98. 89	1. 59
		3½	26604. 77	133. 54	1. 58
		4½	26738. 31		1. 50
$3d^3\,4s(a\ ^3\mathrm{F})4p$	$z\ ^2\mathrm{F}^\circ$	2½	27187. 77	283. 11	1. 01?
		3½	27470. 88		1. 01
$3d^3\,4s(a\ ^5\mathrm{P})4p$	$x\ ^6\mathrm{D}^\circ$	½	28313. 68	55. 08	3. 23
		1½	28368. 76	93. 39	1. 82
		2½	28462. 15	133. 49	1. 58
		3½	28595. 64	172. 49	1. 52
		4½	28768. 13		1. 47

V I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
	$z\ ^4S^\circ$	1½	28621.27		
$3d^3 4s(a\ ^5P)4p$	$y\ ^6P^\circ$	1½	29202.80		2.32
		2½	29296.43	93.63	1.76
		3½	29418.17	121.74	1.62
$3d^3 4s(c\ ^3P)4p$	$y\ ^4P^\circ$	½	30021.57		2.67
		1½	30094.52	72.95	1.74
		2½	30120.78	26.26	1.67
$3d^3 4s(b\ ^3G)4p$?	$y\ ^4G^\circ$	2½	30635.60		0.53
		3½	30694.34	58.74	0.93
		4½	30771.72	77.38	1.13
		5½	30864.34	92.62	1.21
$3d^3 4s(a\ ^5P)4p$	$z\ ^6S^\circ$	2½	30832.58		
$3d^3 4s(b\ ^3G)4p$	$x\ ^4F^\circ$	1½	31200.12		0.38
		2½	31228.98	28.86	1.01
		3½	31268.15	39.17	1.21
		4½	31317.50	49.35	1.32
$3d^3 4s(a\ ^5F)4p$	$x\ ^4G^\circ$	2½	31398.09		0.53
		3½	31541.18	143.09	0.95
		4½	31721.73	180.55	1.12
		5½	31937.18	215.45	1.20
	$z\ ^2S^\circ$	½	31786.19		2.30
	$y\ ^2S^\circ$	½	31962.30		2.21
	$x\ ^4D^\circ$	½	32348.89		0.08
		1½	32456.45	107.56	1.17
		2½	32660.26	203.81	1.29
		3½	32891.06	230.80	1.35
$3d^3 4s(b\ ^3G)4p$	$z\ ^4H^\circ$	3½	32692.09		0.68
		4½	32788.22	96.13	0.98
		5½	32897.81	109.59	1.11
		6½	32963.90	66.09	1.21
	$z\ ^2P^\circ$	½	32724.86		0.73?
		1½	32767.88	43.02	1.22
$3d^3 4s(a\ ^5F)4p$	$w\ ^4F^\circ$	1½	32738.14		0.52
		2½	32846.74	108.60	1.01
		3½	32988.82	142.08	1.18
		4½	33155.30	166.48	1.30
	$y\ ^2G^\circ$	4½	33306.96		1.03
		3½	33360.31	−53.35	0.91
	$y\ ^2F^\circ$	3½	33481.45		1.11
		2½	33527.64	−46.19	0.85
	$z\ ^2H^\circ$	4½	33640.18		0.92
		5½	33695.32	55.14	1.09
$3d^3 4s(c\ ^3P)4p$	$w\ ^4D^\circ$	½	33966.72		0.09
		1½	33976.02	9.30	0.80
		2½	34065.61	89.59	1.30
		3½	34128.04	62.43	1.35
	1°		34019.12		
	$v\ ^4F^\circ$	1½	34030.04		0.86
		2½	34167.84	137.80	1.32?
		3½	34374.81	206.97	1.21
		4½	34529.81	155.00	1.41
	$y\ ^2D^\circ$	1½	34428.76		0.73
		2½	34486.80	58.04	1.18

V I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$3d^3 4s(a\ ^5F)4p$	$v\ ^4D^\circ$	½	34477.40		0.00
		1½	34537.21	59.81	1.05
		2½	34619.52	82.31	1.28
		3½	34747.06	127.54	1.35
	$u\ ^4D^\circ$	½	35012.91		
		1½	35092.36	79.45	1.12
		2½	35225.04	132.68	1.32
		3½	35379.11	154.07	1.33
$3d^4(a\ ^3P)4p$?	$y\ ^4S^\circ$	1½	36408.23		1.85
	$x\ ^2D^\circ$	1½	36416.49		0.89
		2½	36700.78	284.29	1.13
$3d^4(b\ ^3F)4p$	$x\ ^2G^\circ$	3½	36461.26		0.85
		4½	36538.58	77.32	1.05
$3d^3 4s(b\ ^1D)4p$	$y\ ^2P^\circ$	½	36477.75		0.74
		1½	36580.46	102.71	1.17
$3d^4(a\ ^3P)4p$?	$x\ ^4P^\circ$	2½	36611.81		1.54
		1½	36814.80	−202.99	1.77
		½	36695.49	119.31	2.51
	$w\ ^2G^\circ$	3½	36628.82		0.65?
		4½	36828.33	199.51	
$3d^3 4s(b\ ^3H)4p$?	$w\ ^4G^\circ$	2½	36763.41		
		3½	36822.86	59.45	1.06
		4½	36897.88	75.02	1.17
		5½	36938.42	40.54	1.26
	$x\ ^2F^\circ$	2½	36766.00		0.89
		3½	36925.88	159.88	1.05
$3d^5$	$e\ ^4F$	1½	36983.63		
		2½	36989.20	5.57	
		3½	37025.60	36.40	
		4½	37075.64	50.04	
$3d^4(a\ ^5D)5s$	$e\ ^6D$	½	37116.68		3.08
		1½	37158.36	41.68	1.87
		2½	37227.44	69.08	1.61
		3½	37322.09	94.65	1.64
		4½	37440.74	118.65	1.48
$3d^4(a\ ^3H)4p$	$v\ ^2G^\circ$	3½	37174.68		0.99
		4½	37361.95	187.27	1.05
	$y\ ^2H^\circ$	4½	37180.90		0.73
		5½	37210.85	29.95	1.08
$3d^4(a\ ^3H)4p$	$z\ ^4I^\circ$	4½	37285.03		0.87
		5½	37315.83	30.80	0.96
		6½	37404.25	88.42	1.08
		7½	37518.36	114.11	1.15
$3d^4(b\ ^3F)4p$?	$w\ ^2F^\circ$	2½	37342.66		0.84
		3½	37475.08	132.42	1.08
$3d^3 4s(a\ ^5F)5s$	$e\ ^6F$	½	37374.98		−0.72
		1½	37423.17	48.19	1.05
		2½	37503.14	79.97	1.30
		3½	37614.97	111.83	1.33
		4½	37758.07	143.10	1.43
		5½	37931.41	173.34	1.52
$3d^4(b\ ^3F)4p$	$w\ ^2D^\circ$	1½	37457.50		0.80
		2½	37752.54	295.04	1.18
$3d^3 4s(b\ ^3H)4p$?	$y\ ^4H^\circ$	3½	37481.36		0.76
		4½	37516.95	35.59	1.05
		5½	37565.88	48.93	1.09
		6½	37626.44	60.56	1.24

V I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$3d^4(b\,^3\mathrm{F})4p$	$v\,^4\mathrm{G}^\circ$	2½	*37498.76*	57.24	0.60
		3½	*37556.00*	88.41	1.02
		4½	*37644.41*	120.48	1.15
		5½	*37764.89*		1.22
$3d^4(a\,^3\mathrm{H})4p$?	$z\,^2\mathrm{I}^\circ$	5½	*37530.29*	76.03	0.94
		6½	*37606.32*		1.06
$3d^4(b\,^3\mathrm{F})4p$	$t\,^4\mathrm{D}^\circ$	½	*37757.24*	77.74	0.01
		1½	*37834.98*	124.68	1.18
		2½	*37959.66*	155.99	1.33
		3½	*38115.65*		1.35
$3d^4(a\,^5\mathrm{D})5s$	$e\,^4\mathrm{D}$	½	37940.08	63.85	
		1½	38003.93	102.39	
		2½	38106.32	136.14	
		3½	38242.46		
$3d^4(a\,^3\mathrm{H})4p$	$x\,^2\mathrm{H}^\circ$	4½	*38123.76*	96.87	0.88
		5½	*38220.63*		1.10
$3d^4(a\,^3\mathrm{H})4p$	$x\,^4\mathrm{H}^\circ$	3½	*38245.75*	78.12	0.67
		4½	*38323.87*	81.09	0.93
		5½	*38404.96*	78.00	1.11
		6½	*38482.96*		1.22
	$u\,^2\mathrm{G}^\circ$	4½	*38529.78*	−81.16	0.99
		3½	*38610.94*		0.88?
$3d^3\,4s(a\,^1\mathrm{H})4p$?	$y\,^2\mathrm{I}^\circ$	5½	*39008.60*	72.50	0.92
		6½	*39081.10*		1.06
$3d^3\,4s(a\,^5\mathrm{F})5s$	$f\,^4\mathrm{F}$	1½	39127.23	114.11	0.46?
		2½	39241.34	157.48	1.03
		3½	39398.82	198.19	1.22?
		4½	39597.01		1.33?
$3d^3\,4s(a\,^5\mathrm{P})4p$	$w\,^4\mathrm{P}^\circ$	½	*39237.10*	11.80	2.57
		1½	*39248.90*	173.76	1.60
		2½	*39422.66*		1.52
$3d^4(b\,^3\mathrm{F})4p$	$u\,^4\mathrm{F}^\circ$	1½	*39266.60*	33.88	0.54
		2½	*39300.48*	41.28	1.00
		3½	*39341.76*	49.26	1.21
		4½	*39391.02*		1.30
$3d^3\,4s(c\,^3\mathrm{P})4p$	$x\,^4\mathrm{S}^\circ$	1½	*39847.24*		2.00
$3d^4(a\,^3\mathrm{P})4p$	$s\,^4\mathrm{D}^\circ$	½	*39877.62*	57.45	0.01
		1½	*39935.07*	64.82	1.10
		2½	*39999.89*	125.90	1.33
		3½	*40125.79*		1.38
$3d^4(a\,^3\mathrm{P})4p$	$v\,^2\mathrm{D}^\circ$	1½	*39884.43*	234.83	0.92
		2½	*40119.26*		1.14
$3d^4(a\,^3\mathrm{H})4p$	$u\,^4\mathrm{G}^\circ$	2½	*39962.17*	39.01	0.53
		3½	*40001.18*	37.77	0.99
		4½	*40038.95*	24.83	1.19
		5½	*40063.78*		1.23
	$v\,^2\mathrm{F}^\circ$	2½	*40153.51*	433.84	
		3½	*40587.35*		1.01
$3d^3\,4s(a\,^1\mathrm{P})4p$?	$u\,^2\mathrm{D}^\circ$	1½	*40225.38*	100.39	0.70
		2½	*40325.77*		1.12
$3d^3\,4s(a\,^1\mathrm{P})4p$?	$x\,^2\mathrm{S}^\circ$	½	*40299.81*		
$3d^4(a\,^3\mathrm{G})4p$	$w\,^4\mathrm{H}^\circ$	3½	*40314.83*	63.87	0.65
		4½	*40378.70*	73.68	0.92
		5½	*40452.38*	83.24	1.08
		6½	*40535.62*		1.22

V I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
	$x\,^2\mathrm{P}^\circ$	½	*40328.62*	108.80	
		1½	*40437.42*		1.52
	$w\,^2\mathrm{P}^\circ$	½			
		1½	*40693.76*		
	$w\,^2\mathrm{H}^\circ$	5½	*40919.68*	−60.86	0.96?
		4½	*40980.54*		0.99
$3d^4(a\,^3\mathrm{G})4p$	$t\,^4\mathrm{F}^\circ$	1½	*41389.49*	39.44	0.42
		2½	*41428.93*	63.36	0.89?
		3½	*41492.29*	107.07	1.15
		4½	*41599.36*		1.23
$3d^3\,4s(b\,^1\mathrm{G})4p$?	$t\,^2\mathrm{G}^\circ$	3½	*41436.58*	102.56	0.90
		4½	*41539.14*		1.04
$3d^3\,4s(a\,^1\mathrm{H})4p$?	$v\,^2\mathrm{H}^\circ$	4½	*41501.41*	158.30	0.87
		5½	*41659.71*		1.05
$3d^4(a\,^3\mathrm{G})4p$	$t\,^4\mathrm{G}^\circ$	2½	*41654.70*	103.71	0.58
		3½	*41758.41*	102.13	1.03
		4½	*41860.54*	57.70	1.20
		5½	*41918.24*		1.20
	$v\,^4\mathrm{P}^\circ$	½	*41751.78*	96.69	2.56
		1½	*41848.47*	161.46	1.62
		2½	*42009.93*		1.48
$3d^3\,4s(a\,^5\mathrm{P})4p$	$r\,^4\mathrm{D}^\circ$	½	*41928.47*	70.63	0.04
		1½	*41999.10*	138.90	1.20
		2½	*42138.00*	107.61	1.33
		3½	*42245.61*		1.36
$3d^3\,4s(b\,^1\mathrm{D})4p$?	$u\,^2\mathrm{F}^\circ$	2½	*41950.35*	70.58	0.84
		3½	*42020.93*		1.11
$3d^4(a\,^5\mathrm{D})4d$	$e\,^6\mathrm{G}$	1½	42033.84	36.21	
		2½	42070.05	44.12	
		3½	42114.17	63.14	1.08
		4½	42177.31	80.01	1.23
		5½	42257.32	96.10	1.32
		6½	42353.42		1.35
$3d^3\,4s(b\,^1\mathrm{G})4p$	$u\,^2\mathrm{H}^\circ$	4½	*42079.14*	141.55	0.85
		5½	*42220.69*		1.06
$3d^4(a\,^5\mathrm{D})4d$	$e\,^6\mathrm{P}$	1½			
		2½			
		3½	42164.74		1.44?
	2°	3½	*42236.66*		
$3d^3\,4s(a\,^1\mathrm{P})4p$?	$v\,^2\mathrm{P}^\circ$	1½	*42318.42*	−162.20	1.34
		½	*42480.62*		1.14
	$w\,^2\mathrm{S}^\circ$	½	*42362.04*		1.50?
$3d^4(a\,^5\mathrm{D})4d$	$f\,^6\mathrm{F}$	½			
		1½			
		2½			
		3½	42363.62	142.70	
		4½	42506.32	71.66	
		5½	42577.98		1.39
$3d^4(a\,^5\mathrm{D})4d$	$^6\mathrm{D}$	½			
		1½			
		2½			
		3½	42404.89	148.73	
		4½	42553.62		1.61
	$w\,^6\mathrm{D}^\circ$	½			
		1½			
		2½	*42480.31*	107.10	
		3½	*42587.41*	137.92	
		4½	*42725.33*		

V I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$3d^3\,4s(a\,^5P)4p$	$w\,^4S^\circ$	1½	42969.49		1.94
	$s\,^4F^\circ$	1½	42981.34	69.97	
		2½	43051.31	95.78	
		3½	43147.09	119.06	
		4½	43266.15		
	$q\,^4D^\circ$	½	43249.44	59.39	
		1½	43308.83	101.99	
		2½	43410.82	144.30	
		3½	43555.12		1.46
	$u\,^4P^\circ$	½	43443.33	60.66	
		1½	43503.99	81.60	
		2½	43585.59		
$3d^3\,4s(a\,^5F)4d$	$e\,^6H$	2½	43649.40	57.42	0.38
		3½	43706.82	80.78	0.88
		4½	43787.60	106.55	1.11
		5½	43894.15	134.18	1.18
		6½	44028.33	161.62	1.30
		7½	44189.95		1.38
	$x\,^6F^\circ$	½	43707.97?	137.83	
		1½	43845.80?	113.44	
		2½	43959.24?	67.05	
		3½	44026.29?	176.22	
		4½, 5½	44202.51?		
$3d^3\,4s(a\,^5F)4d$	$f\,^6G$	1½	43818.02	29.14	0.38?
		2½	43847.16	64.77	0.78
		3½	43911.93	93.21	1.12
		4½	44005.14	134.55	1.26
		5½	44139.69	187.35	1.34
		6½	44327.04		1.35
$3d^3\,4s(b\,^1G)4p$	$t\,^2F^\circ$	3½	43873.79	−1.46	1.04?
		2½	43875.25		0.86
$3d^3\,4s(a\,^3F)5s$	$e\,^2F$	2½	43918.58	147.47	0.89
		3½	44066.05		1.18
	$x\,^6P^\circ$	1½			
		2½			
		3½	43988.00?		
	$s\,^4G^\circ$	2½	43999.68	43.68	
		3½	44043.36	61.19	0.98
		4½	44104.55	73.90	1.26
		5½	44178.45		1.34
$3d^4(a\,^3G)4p$	$t\,^2H^\circ$	4½	44145.77	38.25	0.90
		5½	44184.02		1.06?
$3d^3\,4s(a\,^5F)4d$	$f\,^6P$	1½	44443.67	88.93	
		2½	44532.60	157.87	
		3½	44690.47		
$3d^4(a\,^3G)4p$	$s\,^2G^\circ$	4½	44463.28	−32.15	1.09
		3½	44495.43		0.91
	$p\,^4D^\circ$	½	44514.34	39.91	
		1½	44554.25	62.43	1.22
		2½	44616.68	84.20	1.37?
		3½	44700.88		1.32?
$3d^3\,4s(a\,^5F)4d$	$g\,^6D$	½	---		
		1½	44844.83	76.25	
		2½	44921.08	135.53	1.55?
		3½	45056.61	101.13	
		4½	45157.74		
	$r\,^4F^\circ$	1½	44973.60	75.57	0.58?
		2½	45049.17	9.45	
		3½	45058.62	86.54	0.97
		4½	45145.16		1.26
	$q\,^4F^\circ$	1½	45066.56	40.65	0.59
		2½	45107.21	50.51	0.93
		3½	45157.72	79.44	1.05
		4½	45237.16		1.22
	$u\,^2P^\circ$	½			
		1½	45159.15		1.66?
$3d^3\,4s(a\,^1H)4p$?	$r\,^2G^\circ$	3½	45175.92	185.50	0.98
		4½	45361.42		1.14
	$2a^\circ$	5½	45353.69		
$3d^3\,4s(a\,^5F)4d$	$g\,^6F$	½			
		1½	45638.54	61.71	
		2½	45700.25	43.37	
		3½	45743.62	69.63	1.26
		4½	45813.25	221.33	
		5½	46034.58		
$3d^4(a\,^3D)4p$	$p\,^4F^\circ$	1½	45648.86	39.55	0.60
		2½	45688.41	71.62	
		3½	45760.03	131.52	1.02
		4½	45891.55		1.32
	$t\,^2P^\circ$	1½	45654.50	−292.16	1.24?
		½	45946.66		
$3d^4(a\,^3D)4p$	$o\,^4D^\circ$	½	45702.14	60.10	
		1½	45762.24	75.82	0.96?
		2½	45838.06	99.01	
		3½	45937.07		1.45
	$r\,^4G^\circ$	2½	46052.79	86.27	0.56
		3½	46139.06	104.58	0.96
		4½	46243.64	119.78	1.15
		5½	46363.42		1.19
	4°	1½, 2½	46322.39:		
	5°	2½	46500.64		
	6°	1½	46707.18		
	$t\,^4P^\circ$	½	46851.10	11.63	
		1½	46862.73	5.37	
		2½	46868.10		
$3d^3\,4s(b\,^3G)4p$	$s\,^2F^\circ$	2½	46996.84	146.40	
		3½	47143.24		1.02
	7°	3½	47348.14		
	3°	1½	47423.18		
$3d^3\,4s(b\,^3G)4p$	$s\,^2H^\circ$	4½	47611.77	89.78	1.01?
		5½	47701.55		0.94
	8°	3½	47615.56		
	9°	{1½, 2½}	47682.68		
	$q\,^4G^\circ$	2½	47690.5	132.7	
		3½	47823.24	190.94	
		4½	48014.18	176.86	
		5½	48191.04		

V I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
	o $^4F^\circ$	1½ 2½ 3½ 4½	47801.6 47915.9 48139.4 48328.8	114.3 223.5 189.4	
	10°	2½	47809.20		
	11°	2½	47925.49:		
$3d^3\,4s(b\,^3G)4p$	q $^2G^\circ$	3½ 4½	47959.82 48157.57	197.75	0.89 1.08
	12°	{2½ 3½}	48001.8:		
	13°	3½	48023.68		
	14°	3½	48047.63		
	15°	2½	48070.91		
	16°	{2½ 3½}	48201.79		
	17°	3½?	48289.8		
$3d^4(a\,^3P)4p$?	v $^2S^\circ$	½	48844.67		2.03
	18°	2½	48881.48		
	19°	2½	48964.99		
	20°	1½	49000.82		
	n $^4D^\circ$	½ 1½ 2½ 3½	49189.74 49283.77 49440.31 49584.09	94.03 156.54 143.78	
	21°	2½	49302.61		
	22°	{3½ 4½}	49341.90:		
$3d^3\,4s(b\,^2D)4s$	t $^2D^\circ$	2½ 1½	49689.01 49722.88	−33.87	1.25
$3d^3\,4s(a\,^5F)5d$	f ^6H	2½ 3½ 4½ 5½ 6½ 7½	49717.57 49797.18 49875.12 49983.16 50164.26 50301.63	79.61 77.94 108.04 181.10 137.37	
$3d^3\,4s(a\,^5F)5d$	g ^6G	1½ 2½ 3½ 4½ 5½ 6½	 49789.17 49932.37 50114.59 50209.05	143.20 182.22 94.46	
$3d^3\,4s(b\,^3H)4p$	x $^2I^\circ$	5½ 6½	49977.90 50120.69	142.79	0.91 1.06
	23°	3½?	50090.28		

V I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
	24°	2½	50130.6		
	25°	3½?	50154.35		
	26°	{2½ 3½}	50333.59		
	27°	1½	50355.89		
	r $^2F^\circ$	2½ 3½	50404.14 50539.27	135.13	
	28°	{2½ 3½}	50438.35		
	p $^4G^\circ$	2½ 3½ 4½ 5½	50452.6: 50579.6 50742.4 50933.58:	127.0 162.8 191.2	
	29°	3½	50529.67		
$3d^3\,4p^2$	h ^6G	1½ 2½ 3½ 4½ 5½ 6½	50584.27 50654.72 50751.83 50876.00 51026.30 51201.12	70.45 97.11 124.17 150.30 174.82	
	30°	3½	50595.73		
	n $^4F^\circ$	1½ 2½ 3½ 4½	50909.7 51021.2 51174.50 51366.6	111.5 153.3 192.1	
	m $^4D^\circ$	½ 1½ 2½ 3½	50976.5: 51067.7 51212.2: 51398.1:	91.2 144.5 185.9	
	31°	{1½ 2½}	51194.2		
	32°	1½	51830.69		
	33°	{2½ 3½}	52008.09		
$3d^3\,4s(b\,^3H)4p$?	p $^2G^\circ$	3½ 4½	52774.08 52947.98	173.90	
$3d^3\,4s(b\,^3H)4p$?	r $^2H^\circ$	4½ 5½	54081.51 54251.26	169.75	
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V II $(a\,^5D_0)$	*Limit*	-----	**54361**		
	34°	2½	55202.44		
	35°	{1½ 2½}	55877.82:		
	s $^2P^\circ$	1½ ½	57561.36? 57744.12?	−182.76	

June 1948.

V I Observed Terms*

Config. $1s^2\,2s^2\,2p^6\,3s^2\,3p^6+$	Observed Terms							
$3d^3\,4s^2$		a ^{4}P a ^{2}P	 a ^{2}D	a ^{4}F	 a ^{2}G	 a ^{2}H		
$3d^5$	a ^{6}S			 e ^{4}F				
$3d^3\,4p^2$					h ^{6}G			
	ns ($n\geq 4$)							
$3d^4$(a ^{5}D)nx			a, e ^{6}D a, e ^{4}D					
$3d^3\,4s$(a ^{5}F)nx				e ^{6}F f ^{4}F				
$3d^3\,4s$(a ^{3}F)nx				e ^{2}F				
$3d^4$(a ^{3}P)nx		b ^{4}P b ^{2}P						
$3d^4$(a ^{3}H)nx						a ^{4}H b ^{2}H		
$3d^4$(b ^{3}F)nx				b ^{4}F a ^{2}F				
$3d^4$(a ^{3}G)nx					a ^{4}G b ^{2}G			
$3d^4$(a ^{3}D)nx			b ^{4}D					
	np ($n\geq 4$)							nd ($n\geq 4$)
$3d^4$(a ^{5}D)nx		z ^{6}P° z ^{4}P°	y ^{6}D° y ^{4}D°	y ^{6}F° y ^{4}F°				e ^{6}P f ^{6}D f ^{6}F e ^{6}G
$3d^3\,4s$(a ^{5}F)nx			z ^{6}D° v ^{4}D°	z ^{6}F° w ^{4}F°	z ^{6}G° x ^{4}G°			f ^{6}P g ^{6}D g ^{6}F f, g ^{6}G e, f ^{6}H
$3d^3\,4s$(a ^{3}F)nx			z ^{4}D° z ^{2}D°	z ^{4}F° z ^{2}F°	z ^{4}G° z ^{2}G°			
$3d^4$(a ^{3}P)nx	y ^{4}S°? v ^{2}S°?	x ^{4}P°?	s ^{4}D° v ^{2}D°					
$3d^4$(a ^{3}H)nx					u ^{4}G° v ^{2}G°	x ^{4}H° x ^{2}H°	z ^{4}I° z ^{2}I°?	
$3d^4$(b ^{3}F)nx			t ^{4}D° w ^{2}D°	u ^{4}F° w ^{2}F°?	v ^{4}G° x ^{2}G°			
$3d^3\,4s$(a ^{5}P)nx	z ^{6}S° w ^{4}S°	y ^{6}P° w ^{4}P°	x ^{6}D° r ^{4}D°					
$3d^4$(a ^{3}G)nx				t ^{4}F°	t ^{4}G° s ^{2}G°	w ^{4}H° t ^{2}H°		
$3d^3\,4s$(b ^{3}G)nx				x ^{4}F° s ^{2}F°	y ^{4}G°? q ^{2}G°	z ^{4}H° s ^{2}H°		
$3d^4$(a ^{3}D)nx			o ^{4}D°	p ^{4}F°				
$3d^3\,4s$(b ^{1}G)nx				t ^{2}F°	t ^{2}G°?	u ^{2}H°		
$3d^3\,4s$(c ^{3}P)nx	x ^{4}S°	y ^{4}P°	w ^{4}D°					
$3d^3\,4s$(b ^{3}H)nx					w ^{4}G°? p ^{2}G°?	y ^{4}H°? r ^{2}H°?	 x ^{2}I°	
$3d^3\,4s$(b ^{3}D)nx			t ^{2}D°					
$3d^3\,4s$(a ^{1}P)nx	x ^{2}S°?	v ^{2}P°?	u ^{2}D°?					
$3d^3\,4s$(a ^{1}H)nx					r ^{2}G°?	v ^{2}H°?	y ^{2}I°?	
$3d^3\,4s$(b ^{1}D)nx		y ^{2}P°		u ^{2}F°?				

*For predicted terms in the spectra of the V I isoelectronic sequence, see Introduction.

V II

(Ti I sequence; 22 electrons) Z=23

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^4\ {}^5D_0$

$a\ {}^5D_0$ **114600** cm^{-1} I. P. 14.2 volts

The analysis is from the paper by Meggers and the writer, who published 89 terms and 1456 classified lines in the region from 1313 A to 7015 A. The terms of the three multiplicities are connected by observed intersystem combinations.

The g-values were calculated from unpublished data kindly furnished by Babcock and given in the 1940 reference below.

This is the first spectrum in which all theoretical terms (except the highest singlet, ^1S), arising from the electron configuration d^4 have been established.

Many has discussed the configuration assignments and suggests from theoretical calculations that the term $c\ {}^1D$ at 44658 cm^{-1} be assigned to $3d^3\ 4s$. The two other terms which he criticizes, $b\ {}^3P$ and $c\ {}^3P$, were published in 1940 with precisely the limits he suggests.

Although intensively sought, series have not been found, probably because this spectrum has been observed only with condensed sparks at atmospheric pressure. The limit, entered in brackets in the table, was estimated by Russell from isoelectronic sequence data.

When the analysis of V III has been extended, the prefixes b, c, assigned by the writer to the limits may be changed. The limits here called $a\ {}^2F$, $b\ {}^2G$, and $c\ {}^2D$ have not yet been observed in V III.

REFERENCES

H. N. Russell, Astroph. J. **66**, 233 (1927); Mt. Wilson Contr. No. 342 (1927). (I P)

W. F. Meggers and C. E. Moore, J. Research Nat. Bur. Std. **25**, 83 RP1317 (1940). (I P) (T) (C L) (E D) (Z E)

A. Many, Phys. Rev. **70**, 511 (1946).

V II

Config.	Desig.	J	Level	Interval	Obs. g
$3d^4$	$a\ {}^5D$	0	0.00		
		1	36.05	36.05	
		2	106.63	70.58	
		3	208.89	102.26	
		4	339.21	130.32	
$3d^3(a\ {}^4F)4s$	$a\ {}^5F$	1	2604.82		
		2	2687.01	82.19	0.97
		3	2808.76	121.75	1.20
		4	2968.22	159.46	1.30:
		5	3162.80	194.58	1.28:
$3d^3(a\ {}^4F)4s$	$a\ {}^3F$	2	8640.21		0.65
		3	8841.97	201.76	1.04
		4	9097.81	255.84	1.22
$3d^4$	$a\ {}^3P$	0	11295.51		
		1	11514.76	219.25	1.48
		2	11908.27	393.51	1.49

V II

Config.	Desig.	J	Level	Interval	Obs. g
$3d^4$	$a\ {}^3H$	4	12545.15		0.83:
		5	12621.57	76.42	1.02
		6	12706.15	84.58	1.27:
$3d^4$	$b\ {}^3F$	2	13490.84		0.59
		3	13542.68	51.84	1.06
		4	13609.00	66.32	1.19
$3d^3(a\ {}^4P)4s$	$a\ {}^5P$	1	13511.71		2.39
		2	13594.73	83.02	1.78
		3	13741.61	146.88	1.62
$3d^4$	$a\ {}^3G$	3	14461.73		0.74
		4	14556.09	94.36	1.00
		5	14655.63	99.54	1.17
$3d^3(a\ {}^2G)4s$	$b\ {}^3G$	3	16340.97		0.76
		4	16421.51	80.54	1.03
		5	16533.00	111.49	1.16

V II—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$3d^4$	$a\ ^1G$	4	17910. 98		0. 95
$3d^4$	$a\ ^3D$	1	18269. 49	24. 38	0. 49
		2	18293. 87	60. 02	1. 13
		3	18353. 89		1. 30
$3d^3(a\ ^2G)4s$	$b\ ^1G$	4	19112. 93		0. 98
$3d^3(a\ ^2P)4s$	$b\ ^3P$	2	19132. 69	−33. 50	1. 38
		1	19166. 19	4. 92	1. 40
		0	19161. 27		
$3d^4$	$a\ ^1I$	6	19191. 50		0. 96:
$3d^4$	$a\ ^1S$	0	19902. 60		
$3d^3(a\ ^4P)4s$	$c\ ^3P$	0	20156. 64	−67. 08	
		1	20089. 56	253. 44	1. 35
		2	20343. 00		1. 36
$3d^3(a\ ^2H)4s$	$b\ ^3H$	4	20242. 32	37. 87	0. 82
		5	20280. 19	83. 03	1. 01
		6	20363. 22		1. 14
$3d^3(a\ ^2D)4s$	$b\ ^3D$	1	20522. 14	94. 91	0. 58
		2	20617. 05	5. 94	1. 25
		3	20622. 99		1. 26
$3d^4$	$a\ ^1D$	2	20980. 92		1. 02
$3d^3(a\ ^2P)4s$	$a\ ^1P$	1	22273. 54		0. 97
$3d^3(a\ ^2H)4s$	$a\ ^1H$	5	23391. 09		1. 04
$3d^3(a\ ^2D)4s$	$b\ ^1D$	2	25191. 08		0. 99
$3d^4$	$a\ ^1F$	3	26839. 82		0. 97
$3d^4$	$c\ ^3F$	2	30267. 46	38. 94	0. 67
		3	30306. 40	12. 23	1. 06
		4	30318. 63		1. 25
$3d^3(a\ ^2F)4s$	$d\ ^3F$	4	30613. 97	−27. 74	1. 23
		3	30641. 71	−31. 43	1. 05
		2	30673. 14		0. 67
$3d^4$	$d\ ^3P$	2	32040. 76	−258. 48	1. 38
		1	32299. 24	−120. 80	1. 48
		0	32420. 04		
$3d^3(a\ ^2F)4s$	$b\ ^1F$	3	34228. 79		1. 00
$3d^3(a\ ^4F)4p$	$z\ ^5G°$	2	34592. 72	153. 00	0. 31
		3	34745. 72	200. 83	0. 93
		4	34946. 55	246. 58	1. 14
		5	35193. 13	290. 26	1. 16
		6	35483. 39		
$3d^4$	$c\ ^1G$	4	36425. 07		0. 96
$3d^3(a\ ^4F)4p$	$z\ ^5F°$	1	36489. 34	184. 17	0. 35
		2	36673. 51	245. 72	1. 08
		3	36919. 23	231. 34	1. 24
		4	37150. 57	201. 82	
		5	37352. 39		1. 40:

V II—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$3d^3(a\ ^4F)4p$	$z\ ^3D°$	1	36954. 58	86. 53	0. 24
		2	37041. 11	163. 90	1. 08
		3	37205. 01		1. 32
$3d^3(a\ ^4F)4p$	$z\ ^5D°$	0	37201. 41	58. 01	
		1	37259. 42	109. 59	1. 39
		2	37369. 01	151. 60	1. 39
		3	37520. 61	10. 48	1. 47
		4	37531. 09		1. 44
$3d^3(a\ ^4F)4p$	$z\ ^3G°$	3	39234. 05	169. 72	0. 84
		4	39403. 77	209. 20	1. 03
		5	39612. 97		1. 19
$3d^3(a\ ^4F)4p$	$z\ ^3F°$	2	40001. 66	193. 86	0. 65
		3	40195. 52	234. 58	1. 02
		4	40430. 10		1. 22
$3d^3(c\ ^2D)4s$	$c\ ^3D$	3	44098. 46	−60. 97	1. 27:
		2	44159. 43	−41. 54	1. 14:
		1	44200. 97:?		0. 50:
$3d^4$	$c\ ^1D$	2	44657. 99		
$3d^3(a\ ^4P)4p$	$z\ ^3P°$	0	46586. 43	104. 00	
		1	46690. 43	49. 55	1. 44
		2	46739. 98		1. 48
$3d^3(a\ ^4P)4p$	$z\ ^5P°$	1	46754. 59	125. 35	2. 28
		2	46879. 94	171. 95	1. 65
		3	47051. 89		1. 58
$3d^3(a\ ^4P)4p$	$y\ ^5D°$	0	47027. 88	80. 10	
		1	47107. 98	−6. 10	1. 43
		2	47101. 88	79. 29	1. 47
		3	47181. 17	238. 93	1. 48:
		4	47420. 10		2. 28
$3d^3(a\ ^2G)4p$	$z\ ^3H°$	4	47056. 32	240. 76	0. 78
		5	47297. 08	310. 71	1. 01
		6	47607. 79		1. 13
$3d^3(a\ ^2P)4p$	$z\ ^1S°$	0	48258. 28		
$3d^3(a\ ^2G)4p$	$y\ ^3G°$	3	48579. 96	150. 80	0. 67
		4	48730. 76	122. 28	1. 02
		5	48853. 04		1. 22
$3d^3(a\ ^2G)4p$	$y\ ^3F°$	2	49201. 66	9. 12	0. 63
		3	49210. 78	57. 83	0. 99
		4	49268. 61		1. 18
$3d^3(a\ ^2G)4p$	$z\ ^1F°$	3	49568. 45		0. 97
$3d^3(a\ ^2G)4p$	$z\ ^1H°$	5	49593. 41		0. 95
$3d^3(a\ ^2G)4p$	$z\ ^1G°$	4	49723. 68		0. 96
$3d^3(a\ ^4P)4p$	$z\ ^5S°$	2	49731. 32		
$3d^3(a\ ^2P)4p$	$z\ ^1D°$	2	49898. 22		0. 93
$3d^3(a\ ^4P)4p$	$y\ ^3D°$	1	50473. 76	301. 71	0. 49
		2	50775. 47	310. 30	1. 11
		3	51085. 77		1. 27
$3d^3(a\ ^2P)4p$	$y\ ^3P°$	0	50662. 36	76. 46	
		1	50738. 82	384. 49	1. 39
		2	51123. 31		1. 51

V II—Continued

Config.	Desig.	J	Level	Interval	Obs. g
3d³(a ²H)4p	y ³H°	4	*52082.88*	70.67	0.70
		5	*52153.55*	99.15	0.98
		6	*52252.70*		1.04:
3d³(a ²P)4p	z ³S°	1	*52181.18*		1.85
3d³(a ²D)4p	x ³F°	2	*52245.68*	146.26	0.68
		3	*52391.94*	265.57	1.07
		4	*52657.51*		1.18:
3d³(a ²P)4p	x ³D°	1	*52604.11*	95.92	0.63
		2	*52700.03*	67.33	1.10
		3	*52767.36*		1.26
3d³(a ²P)4p	z ¹P°	1	*52803.75*		0.92
3d³(a ²H)4p	z ³I°	5	*52877.99*	198.83	0.84:
		6	*53076.82*	242.70	0.98
		7	*53319.52*		1.11:
3d³(a ²D)4p	w ³D°	1	*53751.46*	117.17	0.49:
		2	*53868.63*	58.56	1.10
		3	*53927.19*		1.37
3d³(a ²H)4p	y ¹G°	4	*54144.20*		1.00
3d³(a ²D)4p	x ³P°	2	*54715.63*	−2.22	
		1	*54717.85*	−95.60	
		0	*54813.45*		
3d³(a ²D)4p	y ¹F°	3	*55142.01*		0.94
3d³(a ²H)4p	x ³G°	5	*55206.87*	−97.47	1.15
		4	*55304.34*	−45.29	1.02
		3	*55349.63*		0.82
3d³(a ²H)4p	z ¹I°	6	*55403.38*		1.01:
3d³(a ²H)4p	y ¹H°	5	*55499.38*		1.03:
3d³(a ⁴P)4p	y ³S°	1	*55663.27*		1.92
3d³(a ²D)4p	y ¹P°	1	*56171.49*		1.05:
3d³(a ²D)4p	y ¹D°	2	*57342.59*		0.98
3d³(a ²F)4p	w ³F°	2	*62085.02*	48.37	0.58:
		3	*62133.39*	42.85	1.00
		4	*62176.24*		1.36:
	1°	4	*62761.9*		
3d² 4s(b ⁴F)4p	y ⁵F°	1	*63548.5:*	108.7	
		2	*63657.2*	159.7	
		3	*63816.9*	209.7	
		4	*64026.6*	260.5	
		5	*64287.1*		
3d³(a ²F)4p	w ³G°	3	*64057.39*	73.45	0.72:
		4	*64130.84*	98.26	1.02
		5	*64229.10*		
3d²(a ²F)4p	x ¹D°	2	*64586.23*		1.03:
3d³(a ²F)4p	v ³D°	3	*64603.53*	−200.60	1.22:
		2	*64804.13*	−126.63	1.02:
		1	*64930.76*		0.46:
3d² 4s(b ⁴F)4p	x ⁵D°	0	*65783.4*	32.8	
		1	*65816.2*	69.1	
		2	*65885.3*	111.4	
		3	*65996.7*	161.9	
		4	*66158.6*		

V II—Continued

Config.	Desig.	J	Level	Interval	Obs. g
3d³(a ²F)4p	x ¹G°	4	*65790.28*		0.94
3d² 4s(b ²F)4p	y ⁵G°	2	*66228.4:*	438.9	
		3	*66667.3:*	295.4	
		4	*66962.7:*	393.3	
		5	*67356.0:*	439.7	
		6	*67795.7:?*		
3d³(a ²F)4p	x ¹F°	3	*66303.88*		0.95
3d² 4s(b ⁴F)4p	v ³F°	2	*67737.8*	167.3	
		3	*67905.1*	242.1	
		4	*68147.2*		
3d² 4s(b ⁴F)4p	u ³D°	1	*68759.4*	38.3	
		2	*68797.7*	147.3	
		3	*68945.0*		
3d² 4s(b ⁴F)4p	v ³G°	3	*69644.2*	267.9	
		4	*69912.1*	315.7	
		5	*70227.8*		
3d² 4s(b ²G)4p	x ¹H°	5	*70936.4*		
3d² 4s(b ²G)4p	w ¹G°	4	*72292.2:*		
3d³(a ⁴F)4d	e ⁵H	3	72447.96:	102.75	
		4	72550.71	129.49	
		5	72680.20:	156.80	
		6	72837.00:	183.35	
		7	73020.35:		
3d³(a ⁴F)4d	e ⁵P	1	72517.84:	156.44	
		2	72674.28	233.89	
		3	72908.17		
3d³(a ⁴F)4d	e ⁵D	0			
		1			
		2	72682.06:?	107.17	
		3	72789.23:?	161.77	
		4	72951.00:		
3d³(a ⁴F)4d	e ⁵G	2	73026.76	118.92	
		3	73145.68	133.24	
		4	73278.92	137.71	
		5	73416.63	82.30	
		6	73498.93:		
3d³(a ⁴F)4d	e ⁵F	1			
		2			
		3			
		4	73222.72:	71.10	
		5	73293.82:?		
3d² 4s(b ²G)4p	w ¹F°	3	*74664.5*		
3d³(c ²D)4p?	t ³D°	1	*75715.45:?*	42.84	0.50:
		2	*75758.29*	89.84	1.14:
		3	*75848.13*		1.27:
	u ³F°	2	*76220.4*	165.4	
		3	*76385.8*	257.7	
		4	*76643.5*		
	2°	3	*76405.4*		
	w ¹D°	2	*78791.3:*		
	3°	3	*79040.4*		
V III (a ⁴F$_{1½}$)	*Limit*	----	[114600]		

June 1948.

V II Observed Terms*

Config. $1s^2\,2s^2\,2p^6\,3s^2\,3p^6+$	Observed Terms						
$3d^4$			*a* ^{5}D				
		a ^{3}P	*a* ^{3}D	*b* ^{3}F	*a* ^{3}G	*a* ^{3}H	
		d ^{3}P		*c* ^{3}F			
	a ^{1}S		*a* ^{1}D	*a* ^{1}F	*a* ^{1}G		*a* ^{1}I
			c ^{1}D		*c* ^{1}G		

Config.	*ns* ($n\geq4$)					*np* ($n\geq4$)						
$3d^3(a\,^4\mathrm{F})nx$			*a* ^{5}F *a* ^{3}F					*z* ^{5}D° *z* ^{3}D°	*z* ^{5}F° *z* ^{3}F°	*z* ^{5}G° *z* ^{3}G°		
$3d^3(a\,^2\mathrm{P})nx$	*b* ^{3}P *a* ^{1}P					*z* ^{3}S° *z* ^{1}S°	*y* ^{3}P° *z* ^{1}P°	*x* ^{3}D° *z* ^{1}D°				
$3d^3(a\,^4\mathrm{P})nx$	*a* ^{5}P *c* ^{3}P					*z* ^{5}S° *y* ^{3}S°	*z* ^{5}P° *z* ^{3}P°	*y* ^{5}D° *y* ^{3}D°				
$3d^3(a\,^2\mathrm{G})nx$				*b* ^{3}G *b* ^{1}G					*y* ^{3}F° *z* ^{1}F°	*y* ^{3}G° *z* ^{1}G°	*z* ^{3}H° *z* ^{1}H°	
$3d^3(a\,^2\mathrm{D})nx$		*b* ^{3}D *b* ^{1}D					*x* ^{3}P° *y* ^{1}P°	*w* ^{3}D° *y* ^{1}D°	*x* ^{3}F° *y* ^{1}F°			
$3d^3(a\,^2\mathrm{H})nx$					*b* ^{3}H *a* ^{1}H					*x* ^{3}G° *y* ^{1}G°	*y* ^{3}H° *y* ^{1}H°	*z* ^{3}I° *z* ^{1}I°
$3d^3(a\,^2\mathrm{F})nx$			*d* ^{3}F *b* ^{1}F					*v* ^{3}D° *x* ^{1}D°	*w* ^{3}F° *x* ^{1}F°	*w* ^{3}G° *x* ^{1}G°		
$3d^2\,4s(b\,^4\mathrm{F})nx$								*x* ^{5}D° *u* ^{3}D°	*y* ^{5}F° *v* ^{3}F°	*y* ^{5}G° *v* ^{3}G°		
$3d^2\,4s(b\,^2\mathrm{G})nx$									*w* ^{1}F°	*w* ^{1}G°	*x* ^{1}H°	
$3d^3(c\,^2\mathrm{D})nx$		*c* ^{3}D						*t* ^{3}D°				

Config.	*nd* ($n\geq4$)				
$3d^3(a\,^4\mathrm{F})nx$	*e* ^{5}P	*e* ^{5}D	*e* ^{5}F	*e* ^{5}G	*e* ^{5}H

*A chart of predicted terms in the spectra of the Ti I isoelectronic sequence is given in the Introduction. Owing to the differences in binding energy of the 3*d* and 4*s* electrons the arrangement of the charts of predicted and observed terms is different for V II.

V III

(Sc I sequence; 21 electrons) $Z=23$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^3\ ^4\mathrm{F}_{1\frac{1}{2}}$

a $^4\mathrm{F}_{1\frac{1}{2}}$ **240000** cm^{-1} I.P. 29.7 volts

The analysis is by White, who has classified 120 lines in the interval between 1117 A and 2595 A. The limit (entered in brackets in the table) is derived from his extrapolation of isoelectronic sequence data.

The doublet and quartet terms are connected by observed intersystem combinations.

The reality of the term *a* ^{2}P is questioned in the paper by Many.

REFERENCES

H. E. White, Phys. Rev. **33**, 672 (1929). (I P) (T) (C L)

A. Many, Phys. Rev. **70**, 513 (1946).

V III

Config.	Desig.	J	Level	Interval
$3d^3$	$a\ ^4\mathrm{F}$	1½	0	
		2½	145	145
		3½	339	194
		4½	583	244
$3d^3$	$a\ ^2\mathrm{P}$	½	11207	
		1½	11387	180
$3d^3$	$a\ ^4\mathrm{P}$	½	11513	
		1½	11590	77
		2½	11771	181
$3d^3$	$a\ ^2\mathrm{G}$	3½	11966	
		4½	12187	221
$3d^3$	$a\ ^2\mathrm{D}$	1½	16229	
		2½	16376	147
$3d^3$	$a\ ^2\mathrm{H}$	4½	16822	
		5½	16977	155
$3d^2(a\ ^3\mathrm{F})4s$	$b\ ^4\mathrm{F}$	1½	43941	
		2½	44108	167
		3½	44344	236
		4½	44645	301
$3d^2(a\ ^3\mathrm{F})4s$	$b\ ^2\mathrm{F}$	2½	49329	
		3½	49807	478
$3d^2(a\ ^3\mathrm{F})4p$	$z\ ^4\mathrm{G}^\circ$	2½	*85523*	
		3½	*85874*	351
		4½	*86305*	431
		5½	*86808*	503
$3d^2(a\ ^3\mathrm{F})4p$	$z\ ^4\mathrm{F}^\circ$	1½	*86716*	
		2½	*86937*	221
		3½	*87218*	281
		4½	*87544*	326
$3d^2(a\ ^3\mathrm{F})4p$	$z\ ^2\mathrm{F}^\circ$	2½	*87881*	
		3½	*88329*	448
$3d^2(a\ ^3\mathrm{F})4p$	$z\ ^2\mathrm{D}^\circ$	1½	*88560*	
		2½	*88946*	386
$3d^2(a\ ^3\mathrm{F})4p$	$z\ ^4\mathrm{D}^\circ$	½	*89004*	
		1½	*89191*	187
		2½	*89458*	267
		3½	*89418*	−40
$3d^2(a\ ^3\mathrm{F})4p$	$z\ ^2\mathrm{G}^\circ$	3½	*91712*	
		4½	*92055*	343
$3d^2(a\ ^3\mathrm{F})4d$	$e\ ^4\mathrm{H}$	3½	141269	
		4½	141486	217
		5½	141733	247
		6½	141991	258
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V IV ($a\ ^3\mathrm{F}_2$)	*Limit*	---	[240000]	

June 1948.

V III Observed Terms*

Config. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6+$	Observed Terms		
$3d^3$	$a\ ^4\mathrm{P}$, $a\ ^4\mathrm{F}$; $a\ ^2\mathrm{P}$, $a\ ^2\mathrm{D}$, $a\ ^2\mathrm{G}$, $a\ ^2\mathrm{H}$		
	ns ($n\geq4$)	*np* ($n\geq4$)	*nd* ($n\geq4$)
$3d^2(a\ ^3\mathrm{F})nx$	$b\ ^4\mathrm{F}$ $b\ ^2\mathrm{F}$	$z\ ^4\mathrm{D}^\circ$ $z\ ^4\mathrm{F}^\circ$ $z\ ^4\mathrm{G}^\circ$ $z\ ^2\mathrm{D}^\circ$ $z\ ^2\mathrm{F}^\circ$ $z\ ^2\mathrm{G}^\circ$	$e\ ^4\mathrm{H}$

*For predicted terms in the spectra of the Sc I isoelectronic sequence, see Introduction.

V IV

(Ca I sequence; 20 electrons) $Z=23$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^2\ {}^3F_2$

$a\ {}^3F_2$ **391000** cm^{-1} I. P. 48 volts

White has classified 64 lines in the region between 675 A and 2269 A, and extrapolated the limit from isoelectronic sequence data. The limit derived from his ionization potential is entered in brackets in the table.

From a study of related spectra, Edlén has rejected White's $3d\ {}^1S_0$ term, and his four intersystem combinations. Edlén suggests that the line observed at 734.36 A (136173 cm^{-1}) may be designated $a\ {}^1D_2 - z\ {}^3F^{\circ}_2$, which decreases White's singlet terms by 698 cm^{-1}. This change has been adopted here.

REFERENCE

H. E. White, Phys. Rev. **33**, 538 (1929). (I P) (T) (C L)

B. Edlén- unpublished material (Feb. 1949). (T) (C L)

V IV

Config.	Desig.	J	Level	Interval
$3d^2$	$a\ {}^3F$	2	0	
				318
		3	318	
				412
		4	730	
$3d^2$	$a\ {}^1D$	2	10960	
$3d^2$	$a\ {}^3P$	0	13121	
				117
		1	13238	
				215
		2	13453	
$3d^2$	$a\ {}^1G$	4	18389	
$3d(^2D)4s$	$a\ {}^3D$	1	96195	
				215
		2	96410	
				385
		3	96795	
$3d(^2D)4s$	$b\ {}^1D$	2	100204	
$3d(^2D)4p$	$z\ {}^1D^{\circ}$	0	*144276*	
$3d(^2D)4p$	$z\ {}^3D^{\circ}$	1	*146116*	
				310
		2	*146426*	
				425
		3	*146851*	
$3d(^2D)4p$	$z\ {}^3F^{\circ}$	2	*147133*	
				520
		3	*147653*	
				712
		4	*148365*	
$3d(^2D)4p$	$z\ {}^3P^{\circ}$	0	*151446*	
				−22
		1	*151424*	
				140
		2	*151564*	
$3d(^2D)4p$	$z\ {}^1F^{\circ}$	3	*153920*	
$3d(^2D)4p$	$z\ {}^1P^{\circ}$	1	*155567*	
$3d(^2D)4d$	$e\ {}^3G$	3	217835	
				262
		4	218097	
				364
		5	218461	
$3d(^2D)4d$	$e\ {}^3F$	2	223510	
				323
		3	223833	
				430
		4	224263	
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V v ($^2D_{1\frac{1}{2}}$)	*Limit*	---	[391000]	

Feb. 1949.

V IV OBSERVED TERMS*

Config. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6+$	Observed Terms		
$3d^2$	$a\ {}^3P$, $a\ {}^1D$, $a\ {}^3F$, $a\ {}^1G$		
	$ns\ (n \geq 4)$	$np\ (n \geq 4)$	$nd\ (n \geq 4)$
$3d(^2D)nx$	$a\ {}^3D$ $b\ {}^1D$	$z\ {}^3P^{\circ}$ $z\ {}^3D^{\circ}$ $z\ {}^3F^{\circ}$ $z\ {}^1P^{\circ}$ $z\ {}^1D^{\circ}$ $z\ {}^1F^{\circ}$	$e\ {}^3F$ $e\ {}^3G$

*A chart of predicted terms in the spectra of the Ca I isoelectronic sequence is given in the Introduction. Owing to the change in binding energies of the $3d$ and $4s$ electrons along this sequence, the arrangement of the charts of observed and predicted terms is not identical. In V IV the prefixes a, b, . . . e, z replace those indicating the running electron.

V V

(K I sequence; 19 electrons) $Z=23$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d\ ^2D_{1\frac{1}{2}}$

$3d\ ^2D_{1\frac{1}{2}}$ **526000** cm^{-1} I. P. 65.2 volts

The terms have been calculated from the data published by Gibbs and White, who classified 11 lines in the region between 286 A and 1716 A. From these data Kruger and Weissberg have calculated the limit by fitting a Ritz-Rydberg formula to the ^2S terms. Their limit in round numbers is quoted here.

REFERENCES

R. C. Gibbs and H. E. White, Phys. Rev. **33**, 162 (1929). (C L)
P. G. Kruger and S. G. Weissberg, Phys. Rev. **52**, 317 (1937). (I P)

V V

Config.	Desig.	J	Level	Interval
$3p^6(^1S)3d$	$3d\ ^2D$	1½ 2½	0 620	620
$3p^6(^1S)4s$	$4s\ ^2S$	½	148100	
$3p^6(^1S)4p$	$4p\ ^2P°$	½ 1½	*206347* *207617*	1270
$3p^6(^1S)5s$	$5s\ ^2S$	½	328167	
$3p^6(^1S)4f$	$4f\ ^2F°$	{ 2½ 3½ }	*349204*	
$3p^6(^1S)6s$	$6s\ ^2S$	½	403933	
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V VI ($^1S_0$)	*Limit*	---	526000	

May 1948.

V VI

(A I sequence; 18 electrons) $Z=23$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ ^1S_0$

$3p^6\ ^1S_0$ **1040100** cm^{-1} I. P. 128.9 volts

Four lines are classified in the region between 128 A and 182 A, as combinations with the ground term. The values listed in the table have been rounded off in the last places.

For convenience, the Paschen notation has been added by the writer in column one under the heading "A I". As for A I, the *jl*-coupling notation in the general form suggested by Racah is here introduced, although *LS*-designations, as indicated in column two under the heading "Authors", are perhaps preferable for the terms thus far identified.

REFERENCES

P. G. Kruger and S. G. Weissberg, Phys. Rev. **48**, 659 (1935). (I P) (T) (C L)
P. G. Kruger, S. G. Weissberg and L. W. Phillips, Phys. Rev. **51**, 1090 (1937). (I P) (T)
G. Racah, Phys. Rev. **61**, 537 (L) (1942).

V VI

A I	Authors	Config.	Desig.	J	Level
$1p_0$	$3p^6\ ^1S$	$3p^6$	$3p^6\ ^1S$	0	0
$1s_4$	$3p^5\ 4s\ ^3P^\circ$	$3p^5(^2P^\circ_{1\frac{1}{2}})4s$	$4s\ [1\frac{1}{2}]^\circ$	2 1	*549300*
$1s_2$	$3p^5\ 4s\ ^1P^\circ$	$3p^5(^2P^\circ_{\frac{1}{2}})4s$	$4s'[\ \frac{1}{2}]^\circ$	0 1	*557650*
$2s_4$	$3p^5\ 5s\ ^3P^\circ$	$3p^5(^2P^\circ_{1\frac{1}{2}})5s$	$5s\ [1\frac{1}{2}]^\circ$	2 1	*771760*
$2s_2$	$3p^5\ 5s\ ^1P^\circ$	$3p^5(^2P^\circ_{\frac{1}{2}})5s$	$5s'[\ \frac{1}{2}]^\circ$	0 1	*778920*
		---------	-----	---	------
		V VII $(^2P^\circ_{1\frac{1}{2}})$	***Limit***	---	**1040100**
		V VII $(^2P^\circ_{\frac{1}{2}})$	*Limit*	---	1047760

May 1948.

V VII

(Cl I sequence; 17 electrons) $Z=23$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5\ ^2P^\circ_{1\frac{1}{2}}$

$3p^5\ ^2P^\circ_{1\frac{1}{2}}$ ***1216000*** cm^{-1} I. P. 151 volts

All of the terms except $3p^6\ ^2S$ are from the paper by Edlén. Thirteen lines in the region between 148 A and 472 A have been classified as combinations from the ground state. Edlén has estimated the value of the limit by extrapolation along the isoelectronic sequence, as indicated by brackets in the table. His unit, 10^3 cm^{-1}, has here been changed to cm^{-1}.

REFERENCES

S. G. Weissberg and P. G. Kruger, Phys. Rev. **49**, 872 (A) (1936). (C L)
B. Edlén, Zeit. Phys. **104**, 407 (1937). (I P) (T) (C L)

V VII

Config.	Desig.	J	Level	Interval
$3s^2\ 3p^5$	$3p^5\ ^2P^\circ$	$1\frac{1}{2}$ $\frac{1}{2}$	*0* *7660*	−7660
$3s\ 3p^6$	$3p^6\ ^2S$	$\frac{1}{2}$	219160	
$3s^2\ 3p^4(^3P)4s$	$4s\ ^4P$	$2\frac{1}{2}$ $1\frac{1}{2}$ $\frac{1}{2}$	608640 612810 615480	−4170 −2670
$3s^2\ 3p^4(^3P)4s$	$4s\ ^2P$	$1\frac{1}{2}$ $\frac{1}{2}$	620650 625570	−4920
$3s^2\ 3p^4(^1D)4s$	$4s'\ ^2D$	$2\frac{1}{2}$ $1\frac{1}{2}$	638540 638710	−170
$3s^2\ 3p^4(^1S)4s$	$4s''\ ^2S$	$\frac{1}{2}$	671580	
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V VIII $(^3P_2)$	***Limit***	---	***[1216000]***	

January 1948.

V VIII

(S I sequence; 16 electrons) $Z=23$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^4\ {}^3P_2$

$3p^4\ {}^3P_2$ **1401000** cm^{-1} I. P. 173.7 volts

The analysis is by Edlén, who has classified 19 lines in the range between 135 A and 147 A. He has extrapolated the limit from isoelectronic sequence data. The singlet and triplet terms are connected by two observed intersystem combinations.

Edlén's unit, 10^3 cm^{-1}, has here been changed to cm^{-1}.

REFERENCE

B. Edlén, Zeit. Phys. **104**, 188 (1937). (I P) (T) (C L)

V VIII

Config.	Desig.	*J*	Level	Interval
$3s^2\ 3p^4$	$3p^4\ {}^3P$	2 1 0	0 6000 7580	−6000 −1580
$3s^2\ 3p^4$	$3p^4\ {}^1D$	2	27120	
$3s^2\ 3p^4$	$3p^4\ {}^1S$	0	60720	
$3s^2\ 3p^3(^4S^\circ)4s$	$4s\ {}^3S^\circ$	1	*687250*	
$3s^2\ 3p^3(^2D^\circ)4s$	$4s'\ {}^3D^\circ$	1 2 3	*710600* *710910* *711990*	310 1080
$3s^2\ 3p^3(^2D^\circ)4s$	$4s'\ {}^1D^\circ$	2	*718450*	
$3s^2\ 3p^3(^2P^\circ)4s$	$4s''\ {}^3P^\circ$	0 1 2	*734240* *734870* *736640*	630 1770
$3s^2\ 3p^3(^2P^\circ)4s$	$4s''\ {}^1P^\circ$	1	*742790*	
V IX ($^4S^\circ_{1\frac{1}{2}}$)	*Limit*	---	**1401000**	

January 1948.

V IX

(P I sequence; 15 electrons) $Z=23$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3\ {}^4S^\circ_{1\frac{1}{2}}$

$3p^3\ {}^4S^\circ_{1\frac{1}{2}}$ cm^{-1} I. P. volts

Kruger and Pattin have observed 6 lines near 126 A, and arranged them in two multiplets that give intervals consistent with those found in related isoelectronic spectra.

By a rough extrapolation of $3p^3\ {}^4S^\circ_{1\frac{1}{2}}-3p^3\ {}^2D^\circ_{1\frac{1}{2}}$ along the isoelectronic sequence, the writer has estimated the value of $3p^3\ {}^2D^\circ_{1\frac{1}{2}}$ (entered in brackets in the table), and calculated the terms listed below from the multiplets given by Kruger and Pattin. The uncertainty x in the estimated position of the doublet terms relative to the quartets may exceed ± 500 cm^{-1}.

REFERENCE

P. G. Kruger and H. S. Pattin, Phys. Rev. **52**, 624 (1937). (C L)

V IX

Config.	Desig.	J	Level	Interval
$3s^2\ 3p^3$	$3p^3\ {}^4S^\circ$	$1\frac{1}{2}$	*0*	
$3s^2\ 3p^3$	$3p^3\ {}^2D^\circ$	$1\frac{1}{2}$ $2\frac{1}{2}$	[*36000*]$+x$ *37520* $+x$	1520
$3s^2\ 3p^2({}^3P)4s$	$4s\ {}^4P$	$\frac{1}{2}$ $1\frac{1}{2}$ $2\frac{1}{2}$	789070 792700 797320	3630 4620
$3s^2\ 3p^2({}^1D)4s$	$4s'\ {}^2D$	$2\frac{1}{2}$ $1\frac{1}{2}$	824500 $+x$ 824860 $+x$	-360

December 1947.

V XI

(Al I sequence; 13 electrons) $Z=23$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p\ {}^2P_{\frac{1}{2}}$

$3p\ {}^2P^\circ_{\frac{1}{2}}$ cm^{-1} I. P. volts

This spectrum has not been analyzed, but Edlén has classified two lines as follows:

I. A.	Int.	Wave No.	Desig.
87. 166	3	1147240	$3p\ {}^2P^\circ - 4d\ {}^2D$
87. 868	4	1138070	

His unit, 10^3 cm^{-1}, is here changed to cm^{-1}.

REFERENCE

B. Edlén, Zeit. Phys. **103**, 540 (1936). (C L)

December 1947.

V XII

(Mg I sequence; 12 electrons) $Z=23$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ {}^1S_0$

$3s^2\ {}^1S_0$ **2490000** cm^{-1} I. P. 309 volts

Edlén has classified 15 lines in the region between 61 A and 106 A. No intersystem combinations have been observed, and the triplet terms are not all connected by observed combinations. He has determined the relative positions of the various groups of terms and also the ionization potential by extrapolation along the isoelectronic sequence. His estimated value of the limit is entered in brackets in the table.

His unit, 10^3 cm^{-1}, has here been changed to cm^{-1}.

REFERENCE

B. Edlén, Zeit. Phys. **103**, 536 (1936). (I P) (T) (C L)

V XII

Config.	Desig.	J	Level	Interval
$3s^2$	$3s^2\ ^1S$	0	0	
$3s(^2S)3p$	$3p\ ^3P^\circ$	0 1 2	*188350+x* *191450+x* *198610+x*	3100 7160
$3s(^2S)3d$	$3d\ ^3D$	1 2 3	 549580+x	
$3s(^2S)4s$	$4s\ ^3S$	1	1212500+x	
$3s(^2S)4p$	$4p\ ^1P^\circ$	1	*1310500*	
$3s(^2S)4d$	$4d\ ^3D$	1 2 3	1424530+x 1424850+x 1425410+x	320 560

V XII

Config.	Desig.	J	Level	Interval
$3s(^2S)4f$	$4f\ ^3F^\circ$	2 3 4	 *1485160+x*	
$3s(^2S)5d$	$5d\ ^3D$	1 2 3	 1818660+x 1818910+x	250
$3s(^2S)5f$	$5f\ ^3F^\circ$	2 3 4	 *1848960+x*	
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V XIII ($^2S_{1/2}$)	*Limit*	---	[2490000]	

August 1947.

V XIII

(Na I sequence; 11 electrons) Z=23

Ground state $1s^2\ 2s^2\ 2p^6\ 3s\ ^2S_{1/2}$

$3s\ ^2S_{1/2}$ **2713130** cm^{-1} I. P. 336.29 volts

Edlén has classified 15 lines in the interval 52 A to 99 A, and extrapolated the absolute value of the ground term from isoelectronic sequence data.

The unit adopted by Edlén, 10^3 cm^{-1}, has here been changed to cm^{-1}.

REFERENCE

B. Edlén, Zeit. Phys. **100**, 621 (1936). (I P) (T) (C L)

V XIII

Config.	Desig.	J	Level	Interval
$3s$	$3s\ ^2S$	½	0	
$3p$	$3p\ ^2P^\circ$	½ 1½	*225350* *236430*	11080
$3d$	$3d\ ^2D$	1½ 2½	545500 546730	1230
$4s$	$4s\ ^2S$	½	1300330	
$4p$	$4p\ ^2P^\circ$	½ 1½	*1388410* *1392780*	4370
$4d$	$4d\ ^2D$	1½ 2½	1505740 1506340	600

V XIII

Config.	Desig.	J	Level	Interval
$4f$	$4f\ ^2F^\circ$	2½ 3½	*1550290* *1550510*	220
$5p$	$5p\ ^2P^\circ$	½ 1½	*1889360* *1891430*	2070
$5d$	$5d\ ^2D$	1½ 2½	1946050 1946360	310
$5f$	$5f\ ^2F^\circ$	2½ 3½	 *1968740*	
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V XIV ($^1S_0$)	*Limit*	---	**2713130**	

June 1947.

V XIV

(Ne I sequence; 10 electrons) $Z=23$

Ground state $1s^2\ 2s^2\ 2p^6\ {}^1S_0$

$2p^6\ {}^1S_0$ **7237600** cm^{-1} I. P. 897.1 volts

Edlén and Tyrén have classified four lines in the region between 20 A and 23 A, as combinations with the ground term. They have derived absolute term values by extrapolation along the Ne I isoelectronic sequence. Their unit, $10^3\ cm^{-1}$, has here been changed to cm^{-1}.

As for Ne I, the *jl*-coupling notation in the general form suggested by Racah is introduced.

REFERENCES

B. Edlén and F. Tyrén, Zeit. Phys. **101**, 210 (1936). (I P) (T) (C L).
G. Racah, Phys. Rev. **61**, 537 (L) (1942).

V XIV

Authors	Config.	Desig.	*J*	Level
$2p\ {}^1S_0$	$2p^6$	$2p^6\ {}^1S$	0	0
	$2p^5(^2P^\circ_{1\frac{1}{2}})3s$	$3s\ [1\frac{1}{2}]^\circ$	2	
$3s\ {}^3P_1$			1	*4202700*
	$2p^5(^2P^\circ_{\frac{1}{2}})3s$	$3s'[\ \frac{1}{2}]^\circ$	0	
$3s\ {}^1P_1$			1	*4257100*
$3d\ {}^1P_1$	$2p^5(^2P^\circ_{1\frac{1}{2}})3d$	$3d\ [1\frac{1}{2}]^\circ$	1	*4757800*
$3d\ {}^3D_1$	$2p^5(^2P^\circ_{1\frac{1}{2}})3d$	$3d'[1\frac{1}{2}]^\circ$	1	*4827200*
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	V XV $(^2P^\circ_{1\frac{1}{2}})$	***Limit***	---	**7237600**
	V XV $(^2P^\circ_{\frac{1}{2}})$	*Limit*	---	7295300

April 1947.

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