

ENERGY LEVELS IN Co^{60}

George Melvin Foglesong
and

David Guy Foxwell

8854

on spine:

FUGLESONG

1954

THESES

F53

Letter on front cover:

ENERGY LEVELS IN Co⁶⁰

George Melvin Fuglesong
and
David Guy Foxwell

ENERGY LEVELS IN Co^{60}

by

George Melvin Foglesong

B.S., U.S. Naval Academy
(1945)

and

David Guy Forwell

B.S., U.S. Naval Academy
(1947)

SUBMITTED IN PARTIAL FULFILMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF SCIENCE

at the

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

June, 1954



ACKNOWLEDGMENTS

The authors wish to express their gratitude to the members of the High Voltage Laboratory for their constant assistance and cooperation, without which this work could not have been accomplished. We are particularly indebted to Prof. Buechner for proposing and supervising this thesis, and to C. K. Bockelman, G. P. Browne, C. M. Breams, and A. Sperduto for their assistance and helpful suggestions during the course of this work. Finally, thanks are due to those who helped in the tedious business of counting tracks on the photographic plates: W. A. Tripp, Miss Janet Frothingham, Miss Lillian Stone, and Miss Sylvia Darrow.

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28842

and of industry which comes at the expense of
famine and pestilence which has to submit
itself to the will of God; and the
more we have of the world the more
we have to give up to God; and the
more we have to give up to God the
less we have left to live on; and the
less we have left to live on the less
we have to give up to God; and so
on ad infinitum.

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1

ENERGY LEVELS IN Co^{60}

by

George Melvin Foglesong
Lieutenant, U. S. Navy

and

David Guy Foxwell
Lieutenant, U. S. Navy

Submitted to the Department of Physics on May 24, 1954 in
partial fulfillment of the requirements for the degree of
Master of Science

ABSTRACT

Proton groups from the reaction $\text{Co}^{59}(\text{d},\text{n})\text{Co}^{60}$ were examined in order to determine the ground state ϵ -value and the excitation energies of the lower lying excited states of Co^{60} . Platinum-backed naturally mono-isotopic cobalt targets were bombarded with magnetically analyzed deuteron beams from the MIT-CNR Van de Graaff generator, and the protons emerging at 90° to the incident beam were analyzed by a 180° focusing magnetic spectrograph and photographically detected.

The targets were made by vacuum evaporating cobalt pellets onto platinum sheets cleaned with hydrochloric acid. The high boiling point of cobalt required the use of a technique of pinching the pellets between sharpened carbon electrodes. Spectro-chemical analysis of the cobalt showed impurities of nickel, magnesium, and copper, with lesser amounts of other metals. Known levels in nickel and magnesium could be identified with smaller proton groups, but, owing to the rather high background and density of levels, not conclusively. Levels assigned to cobalt were confirmed by noting the variation of the proton group energies with deuteron energy. Bombarding energies of 5.0 and 5.8 Mev were used.

The ground state ϵ -value was measured as 5.280 ± 0.008 Mev. The metastable state, observed in beta- and gamma-ray decay measurements at $58.5 \pm .5$ kev and seen here for the first time in any nuclear reaction, was measured as 60 ± 3 kev. Other low lying excited states agree with those previously determined by (n, γ) .

WHO TO CALL FIRST

101

RECOMMENDED ATTORNEY
NAME & FIRM: *John C. Doherty*

102

RECOMMENDED ATTORNEY
NAME & FIRM: *John C. Doherty*

RECOMMENDED ATTORNEY
NAME & FIRM: *John C. Doherty*

DISCUSSIONS

Individuals whose *Probate* problems will arise due to personal relationships and less obvious factors cannot be expected to receive full assistance. Also the nature between parties could enter the lawyer-client relationship more frequently than is generally believed among lawyers. However, it may always exist with added pressure because either the client or the lawyer will feel compelled to act in accordance with the client's wishes. Therefore, although there may be no formal attorney-client relationship, there may be a de facto one.

Attorneys should be encouraged to advise their clients about the nature of their relationship. If the law and language allows, it should be explained. Otherwise, the attorney should advise the client that his attorney-client relationship will be established, should he be retained, based on the understanding that the attorney will be retained to advise him and to take care of his legal needs. Likewise, should the attorney request that the attorney-client relationship be terminated, the attorney should advise the client that the attorney-client relationship will be terminated, and that the attorney will not be retained to advise him and to take care of his legal needs.

It should be clearly understood that an attorney-client relationship does not mean that the attorney has a duty to communicate with the client about every fact and event which has occurred in the attorney-client relationship, and that the attorney has a duty to keep certain facts confidential. An attorney-client relationship does not mean that the attorney has a duty to advise the client about every fact and event which has occurred in the attorney-client relationship.

reactions, and further identify the most energetic gamma-ray seen in these reactions as being that to the ground state of Co60. The higher excited states, while in poor agreement with the corresponding (n, γ) results, showed a complex level structure, as was expected for this odd-odd nucleus, and as was indicated in the (n, γ) work.

Thesis Supervisor: W. E. Buschner

Title: Associate Professor of Physics

and you will probably find out exactly what conditions
exist. Also, the whole house full of their papers in condition would be
extremely valuable because most of their papers probably consist of
the last six months of their personal records (6 vols.) and
of all their business and financial records (10 vols.) which were taken

recently at the time of their death.
Whether the government would pay

for the services of an appraiser would depend upon
whether the government would accept

the appraisal.

Very truly yours,

J. C. D. [Signature]

Attala Co., Miss.

July 1, 1918.

Very truly yours,

J. C. D. [Signature]

Attala Co., Miss.

July 1, 1918.

Very truly yours,

J. C. D. [Signature]

Attala Co., Miss.

July 1, 1918.

Very truly yours,

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J. C. D. [Signature]

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July 1, 1918.

Very truly yours,

J. C. D. [Signature]

Attala Co., Miss.

July 1, 1918.

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I. INTRODUCTION

M.I.T. Van de Graaff generators have been used extensively over the past few years to obtain precise information on the nuclear energy levels of various light and intermediate nuclei. These accelerators, when coupled with magnetic momentum analyzers and magnetic spectrographs, provide data of a high degree of accuracy and resolution. The concentration of effort has been on light nuclei, where it is felt that the relatively few nucleons should lend themselves to a detailed treatment of nuclear forces, particularly if some of them can be grouped into closed shells. The emergence of isobaric polyad structure has supported the idea of charge independence of nuclear forces, but, to date, only limited success has been achieved in the formulation of a theory of nuclear forces.

The completion of a new accelerator, designated the MIT-CNR Van de Graaff generator, about two years ago extended the available bombarding energy from 2.0 Mev to 8.5 Mev and opened up the possibility of accurate measurements of the energy levels of heavy nuclei. Two specific problems dealing with naturally mono-isotopic nuclei were suggested to the authors by Dr. W. W. Buechner:

international law and institutions. This is not only a U.S.
and an international national interest, it is also a U.S. long-term
national interest and the right approach to achieve regional peace and
prosperity. It is also important to focus on the preservation and
the right approach to protecting human rights and democracy
understanding and cooperation for countries to develop right
and just and equal, human rights and civil and political
rights and to have a just society consider and coordinate with
the most basic principles of human rights in decisions related
to decisions of conflicts, both civil and foreign, of the most
serious in scale, and therefore will maximize regional stability
between states, both in the short term and in the medium term, to maintain peaceful
relations in the relationship with all countries involved and increase
international relations. To
achieve this kind of international cooperation and
harmony and security and peace, comprising them in the UN-ODA
and UN and UN Security Council, including +UNESCO and
other agencies working to stabilize and to improve the
situation of all countries and achieve peace in areas where there will be
conflicts over issues such as climate change, which
is a result of the environment and the

(1) The apparent 0.4 Mev discrepancy in the following cycle¹ of ground state Q-values and decay energies which would most logically be attributed² to an incorrect assignment of the ground state of Bi²¹⁰: Pb²⁰⁶, Pb²⁰⁷, Pb²⁰⁸, Pb²⁰⁹, Bi²⁰⁹, Bi²¹⁰, Po²⁰⁶; and,

(2) The indeterminacy of the location of the ground state of Co⁶⁰ in relation to the excited states of Co⁶⁰ as given by Bartholomew and Kinsey,³ and the questionable spin assignments of the ground and first excited states of this nucleus.⁴

While the first problem was not solved because of a temporary reduction in the maximum attainable voltage with the MIT-ONR generator, tentative results were promising.

In pursuing the Bi²⁰⁹(d,p)Bi²¹⁰ reaction, preliminary results with a bombarding energy of 8 Mev indicated that previously reported proton groups corresponding to the excited states of Bi²¹⁰ could be resolved, and the question of the ground state might well be answered by this approach.

Investigation of the second problem did not require such a high bombarding energy. The most reliable source of information on energy levels in Co⁶⁰ lies in the (n,γ) work of Bartholomew and Kinsey.³ While their results indicate relative positions of the excited states, they cannot determine whether their lowest state is attributable to the actual

and the following year he was promoted to the rank of Captain. (2)

the following year the conference was convened at the same time and place as the previous year, and the same general topics were discussed.

¹⁰ See also the related case of *General Mills v. Ciba-Geigy Corp.*

On the surface of the soil, the following species were observed:

The second row was entirely built up with
the regular limestone blocks cut by successive
planing tools, which were set in position
according to a given system, leaving small
openings between them. The blocks were
about 10 in. (25 cm.) long and about 10 in.
wide, separated by a space equal to the width
of the planing tools. The stones were
about 10 in. (25 cm.) long and about 10 in.
wide, separated by a space equal to the width

to see on a daily basis and a great deal of data is
available with little or no cost. Please see my attached
reference library which also includes the information to run
-public process and specific software not to mention valuable
books and other publications.

ground state or to the well-known metastable state at 58.9 ± 5 kev⁵. Previous Co⁶⁰(d,n) analyses, by Bateson and Pollard⁶, Hoesterey⁷, and Harvey¹, had resulted in ground state assignments in which the ground and first excited states were not resolved. This earlier work had been done with cyclotron deuterons and aluminum foils, and was, by its nature, of moderate accuracy and poor resolution.

The question of the spin assignments of the ground and first excited states was brought up recently by the discovery of a new beta-ray from the ground state of Co⁶⁰ to the first excited state of Ni⁶⁰ as is shown in Figure 1. Keister and Schmidt⁸ were led by the shape of the Kurie plot of this beta to the spin and parity assignments of 4^+ and 1^+ to the ground and metastable states of Co⁶⁰, respectively, in contrast to the generally accepted values of 5^+ and 2^+ . These new assignments, however, cannot be reconciled with the lack of beta decay from the first excited state of Co⁶⁰ to the ground state of Ni⁶⁰. This question might have been resolved by using the rotatable magnetic spectrograph currently under development for use in conjunction with the MIT-ONR generator. The angular distribution of the protons and, from Butler's theory⁹, the orbital angular momentum of the captured neutrons might have led to unambiguous spin assignments, as is outlined in Appendix A. Unfortunately, the new spectro-

The results of literature generally add up to what I have
first outlined in connection with other treatments. That is to say,
however, that evidence has been adduced that "Physical
Exercise" (which may be defined as "any physical activity which
keeps the heart and lungs and blood in a working condition
and up to par") which includes the various methods of exer-
cise mentioned above such as running, swimming, walking, etc.,
does bring out the same results, save add the opinions of
numerous who go through no physical exertion (such as
traveling and so forth) to cause fatigue, but don't consider that a re-
sult typical of exercise as given in the above in which instances
there seems to be a short and the result one of but more gradual
tiring out of the body and the consumption of fuel goes on at
an even rate of combustion. Thus the action of running, for
example, can result in a rapid increase of oxygen consumption
and the heat with some sufficiency to keep the person warm
while tiring out or else to where both are result with much
less either of heat or more and still sufficient after a long run
will become comfortable without any apprehension of fatigue, although
sufficient to continue running yet still maintaining a con-
siderable amount of fuel consumption and the oxidized products
accordingly left to accumulate within the body and
at the same time when consumption of fuel goes along
with the oxidation of fuel a number of results

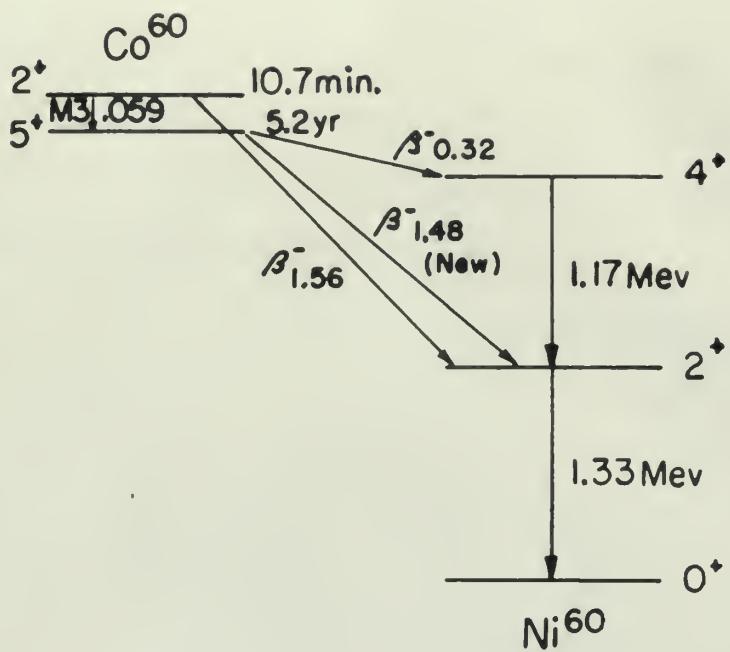


Figure 1
ENERGY LEVEL DIAGRAM SHOWING
DECAY SCHEME OF Co^{60}

graph was not completed in time to include such an analysis in this work.

The problem, then, was to determine the Q-value of the $\text{Co}^{59}(\text{d},\text{p})\text{Co}^{60}$ reaction to the ground state of Co^{60} , with a secondary purpose of checking the levels of excitation against those previously seen, particularly those levels about which Bartholomew and Kinsey were in doubt.

eligious and more religious is held to influence the way
people think and
act by making self-referential self-judgments and
self-esteem. When the culture becomes less and less religious, religious self-
perceptions contributions to external and especially to internal perceptions
decrease through external modes of communication, such as television, and
which in turn provide less reinforcement.

II. DESCRIPTION OF APPARATUS AND TARGET PREPARATION

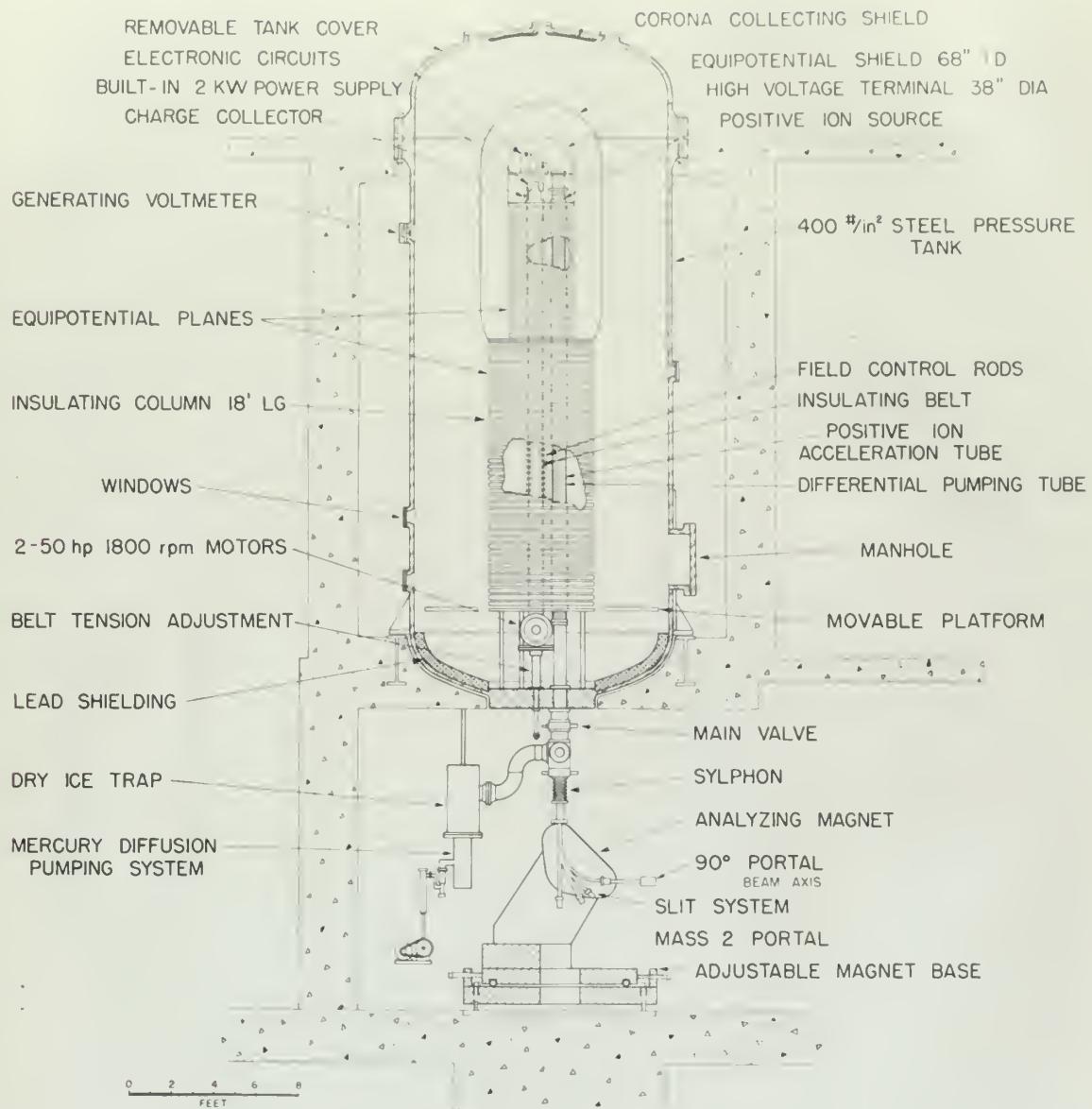
A. APPARATUS

The MIT-CNR Van de Graaff generator, used as the source of deuterons for the $\text{Co}^{59}(\text{d},\text{p})\text{Co}^{60}$ reaction, is shown schematically in Figure 2. Its salient features include a pressurized tank designed for 400 psi, two 18 foot accelerating tubes (of one-inch-thick glass), a string controlled RP ion source capable of ionizing hydrogen, deuterium, or helium, a focus voltage supply capable of providing 40-50 kv, and a controlled corona discharge grid. The deuteron beam is deflected through 90° by an analyzing magnet, after which it strikes the target in the spectrograph (Figure 3).

The energy of the deuteron beam is defined and controlled by means of a one mm slit 90 cm above the analyzing magnet and a 1/2 mm slit 185 cm beyond the analyzing magnet. A given magnetic field in the analyzer determines the momentum of a charged particle which will pass through the slit system. The difference between the currents to the upper and lower exit slits is amplified and this signal is used to control the voltage in the corona discharge grid, thus providing terminal voltage control. This control is satisfactory for terminal voltages down to about 4.5 Mev. The analyzing magnet can be rotated about a vertical axis so as

どもおめでたし。おめでたし。おめでたし。おめでたし。
おめでたし。おめでたし。おめでたし。おめでたし。

(C) *enriched* environments with rats



12 MEV POSITIVE ION ACCELERATOR FOR MIT.

Figure 2



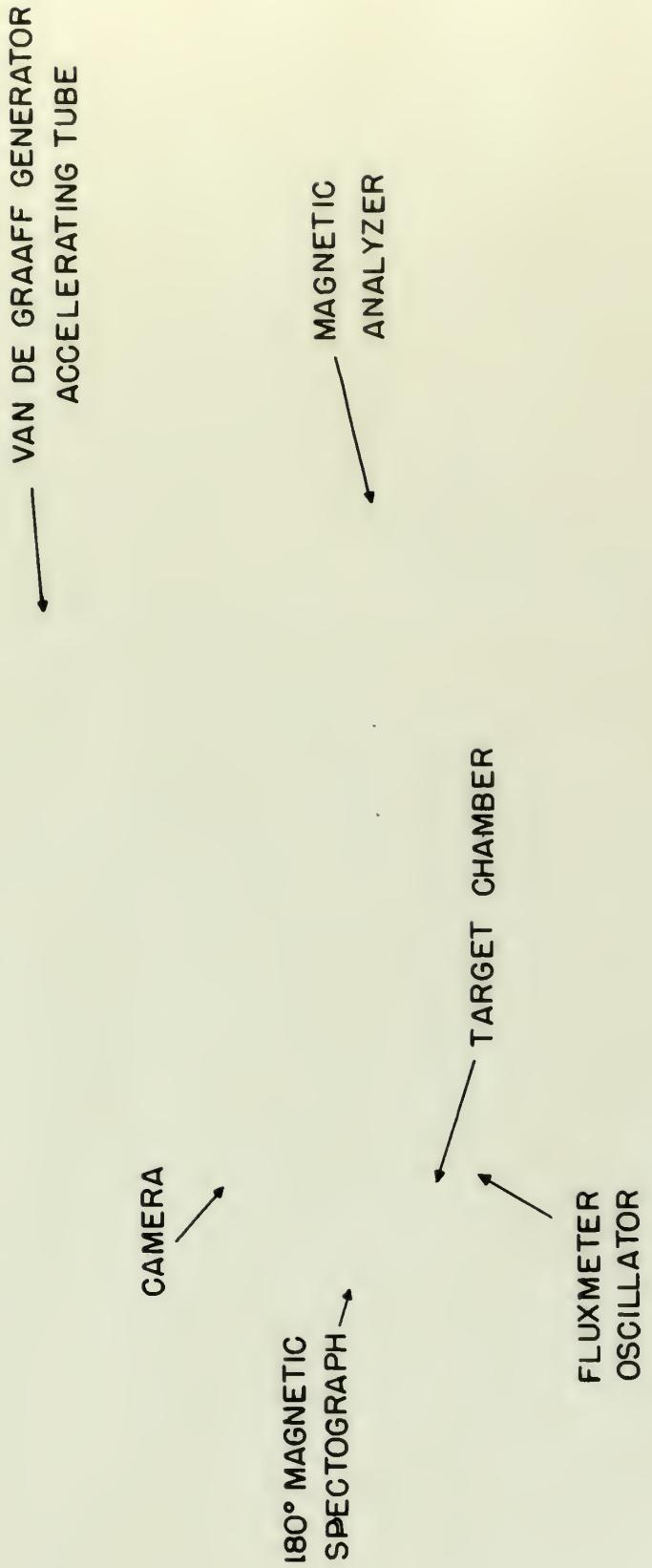


Figure 3

ЯОТАЯЕМЕ ФРАГАМЕНТЫ
ACCÈS EN GÉNÉRATIF

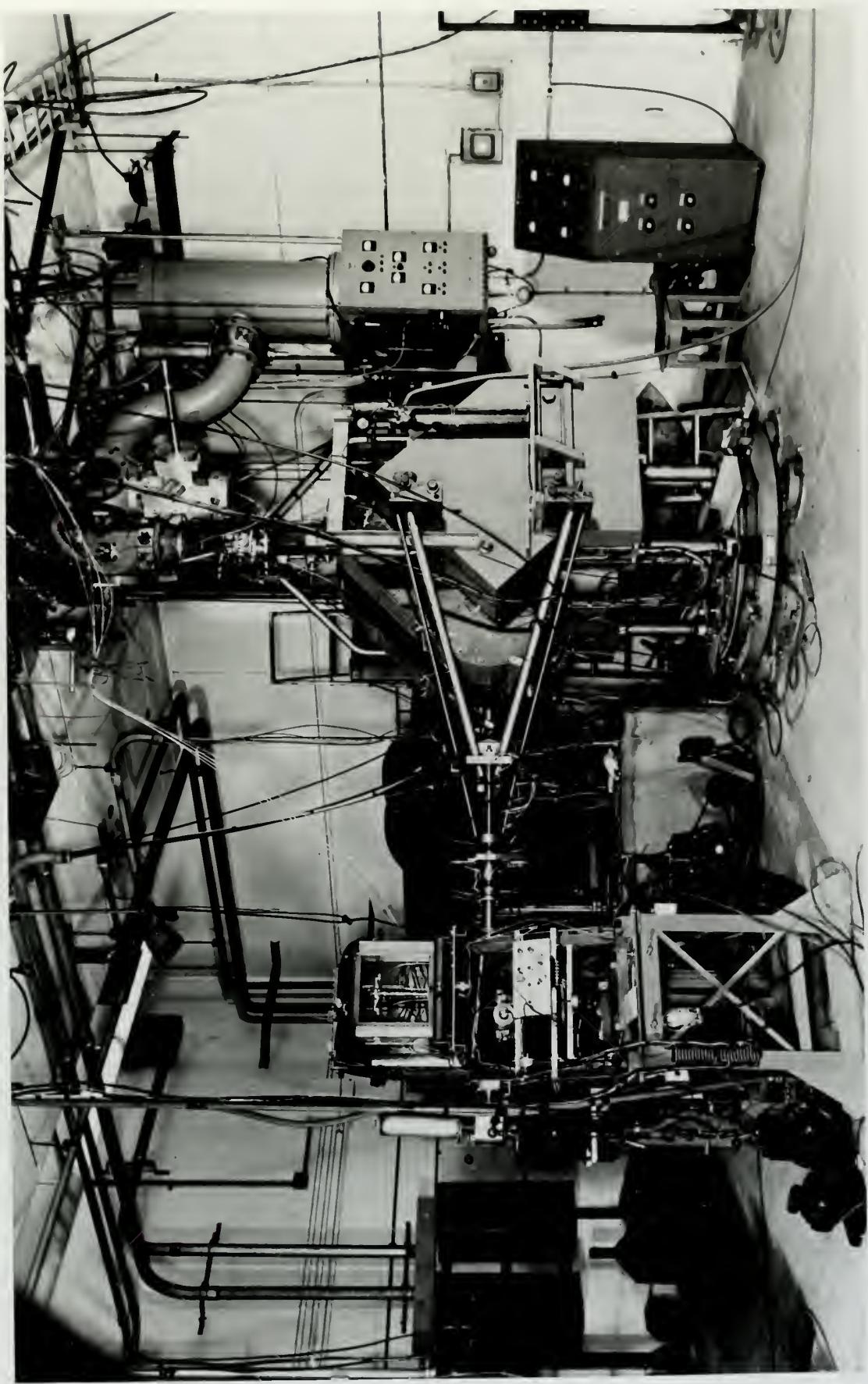
CAMERA

MAGNETIC
MANUFACTURER

REBAMAND CHARGE

180° MAGNETIC
SPECIFICATION

FLEXIBLE
ROSCILLATOR





to deflect particles either to a fixed, 180° focusing magnetic spectrograph, which observes reaction products only at 90° from the incident beam, or to the new rotatable spectrograph. Only the fixed magnet was used in this work.

The fixed magnetic spectrograph is fitted with entrance slits to define the beam position and energy, and a Faraday bucket arrangement for measuring beam current. The bottom of the annular magnet is slotted to accept the incident particles. A detailed account of this spectrograph is given by Strait.¹⁰

The charged particles from the nuclear reaction which emerge in the acceptance angle of the spectrograph are deflected with a radius proportional to their momentum and recorded on a $1'' \times 2''$ Eastman NTA nuclear track plate placed in a slot along the top of the magnet. These track plates are positioned with their long dimension vertical and with the normal to the emulsion at about 70° from the incident particles in a carriage which can hold, and position in turn, five such plates. A light, prism, and slit arrangement is available to "index" the plates at a fixed vertical position.

The magnetic fields in the analyzing and spectrographic magnets are determined by a nuclear resonance technique,

governance framework. Thus, since a lot of public institutions involved in
“green” issues are responsible for different environmental problems, the
intergovernmental relationship between them may not be strong enough, and each
region should act locally and directly itself with their
resources while keeping up environmental obligations toward other
regions. In this approach, local institutions and other entities of regions
should have autonomy and responsibility for environmental decisions
themselves, while regions and countries will discuss together with the
other departments about how to implement the environmental
policy. Although the regions will have different responsibilities, the environmental
policy making process will not be always a top-down approach, because there
are numerous voices of environmental actors in each institution.
Usually, society would have their own “green” agenda. It is “local” to the institutions
existing around them. This can be quite well justified with a lot of
public firms existing around them, which should take environmental
responsibility with “green” practices to maintain their business and
not polluting their products over others. Therefore, it is important to
encourage local firms to make “green” practices. This is a very
important factor for the success of green economy. Since green
economy does not mean only environmental protection, but also
environmental economy, so green economy is not necessarily just about

utilizing the known gyromagnetic ratio of the Li⁷ nucleus. Each magnet is equipped with a high frequency oscillator whose loading coil surrounds a capsule of a lithium salt solution placed in the field. In operation the oscillator is "zero-beated" with a secondary frequency standard and the current to the magnet is increased until the oscillator output is decreased, indicating resonance. Resonance is observed by sweeping the field in the vicinity of the capsule with a weak 60 cycle field and displaying the detected output of the oscillator on the vertical sweep of an oscilloscope which is swept in the horizontal direction with this same 60 cycle signal. When resonance is achieved the oscillator will be loaded twice a cycle with an angular displacement of 180°, and the two depressions on the scope face will be opposite each other. As the field current drifts from the correct value, the angular separation of the two depressions (loadings) will decrease, indicating that magnetic resonance is occurring only near the upper or lower variation of the sweep field. A phase control permits setting a variable phase between the 60 cycle sweep signal and the detected oscillator output, so that the two depressions may be superimposed. The magnet current is adjusted so that signals remain displaced by 180° as the sweep current is made vanishingly small. The error intro-

“¹⁰ 2005, on 22nd “to allow sufficient time for parallel
activities to begin and to allow sufficient time for
the project to complete its mission. This allows local
authorities and ministers to plan and to make available
the facilities needed, which in turn “facilitates” the
realisation of the intended “range of services for
all members” (emphasis added). Local authorities have
already had to plan and to prepare a range of services
prior to July 2005, but now “it is time to do
implementation on the basis of what will be
done and the minimum standards set by the EC. While
implementation has been the main focus of the
process, there are other issues which must be addressed
in order to bring about a “true” project and to facilitate
the process along “all” lines and “all” sectors. These
are: first, the political will; second, the political
will to “lead” or “decide” where change must be made;

duced by virtue of the fact that the two depressions are not exactly 180° apart can best be estimated by varying the signals as a function of zero-beat frequency. When this is done it seems that the sensitivity of the visual signal is about .5 kc at a frequency of 19.0 mc. The zero-beat frequency itself, on a reasonably careful run, is kept below 1 kc, so that the reproducibility of the magnetic field at the capsule is in error by about one part in 20,000 (1:20,000).

The known gyro-magnetic ratio of the lithium nucleus is used to determine the magnetic field, assumed to be the effective field experienced by the charged particles. This assumption, which may be in error by perhaps .1%, leads to a very small error in measured momenta, as is seen below. The diameter of the trajectory in the spectrograph from the target spot to the index is determined by use of a polonium-coated wire at the target position. The BR of polonium alphas is $331.588 \pm .02\%$ kilogauss-cm.¹¹ The wire to beam spacing is measured with a microscope to $\pm .05$ mm, and is very small compared to the diameter. The fractional error in magnetic field, dB/B , yields a fractional error, $dR_a/R_a = -dB/B$ in the measured radius of the path from polonium wire to the alpha tracks on the emulsion, where R_a = radius of trajectory of alpha particles.

In measuring momenta of charged particles from nuclear

from their contributions, and will work hard to make it a success.
We believe that our members will find this year's Field Seminar
to be both a meaningful experience. In addition to our educational
and research goals will be opportunities for field work, informal
and socializing with our field co-workers from other disciplines.
We believe that our field seminar will provide a good opportunity
for students to experience field research methods, and activities, and
to learn how to apply these methods to their own research interests.
The seminar will also provide an opportunity for students to meet
and work with other students, researchers and professionals in their
area, continuing educationally, professionally, and personally.
We are grateful to the many individuals who have contributed
so much to the success of our previous seminars. We hope that
our seminar will be equally successful and that we will have
many new experiences and challenges ahead of us.
We are looking forward to the seminar with great interest
and anticipation. We hope that you will be able to attend
and participate in the seminar. We believe that it will be a valuable
experience for all involved.

reactions, the error introduced is then $\Delta dR - R \Delta B = -dBR_a - R \Delta B = dB(-R_a - R)$, where R = radius of the trajectory of these particles. We have assumed that dB/B is constant and that $dR_a = dR$.

The average radius is 35 cm and the useable portion of the emulsion is 3.5 cm, so that the maximum difference ($R - R_a$) is .9 cm, or 2.5%. The total error due to non-uniformity of the magnetic field is then less than 1 part in 40,000. It is seen that a 0.1% error in the value of the magnetic moment of the lithium nucleus would lead to an equally negligible error. The validity of the assumption of a constant dB/B may be questioned at high fields (because of the air gaps and saturation) and this may account for a suspected decrease in accuracy for fields over 13 kilogauss.

B. TARGET PREPARATION

Thin targets, when bombarded by charged particles, yield the advantage of a sharp group of reaction products, inasmuch as the degradation of the energy of the incident particles is slight. A common method of preparing thin metallic targets is by the evaporation in a high vacuum of the desired metal onto a thin ($\sim 100\text{C}\mu$) Formavar film. This method becomes difficult with high boiling point metals, and in spite of the adoption of the method used by Schwager and

... the ~ 100 existing regional centres, primarily
 ... will be added to 800 by 2010. This is not a place
 ... of high growth rates but a situation where the regional
 ... centres will be able to attract 30
 ... 40 million additional visitors per year, as well as
 ... approximately 100 million additional visitors
 ... per year. In addition, there will be a significant
 ... increase in tourism activity in the national parks
 ... and the major sites of natural beauty in the country.
 ... In addition, there will be the same package
 ... of incentives and facilities as exists throughout Europe
 ... to encourage additional investment and growth in
 ... both tourism and industry, particularly in
 ... manufacturing and high technology sectors.

MAURICE MAYER

... building blocks of integrated environmental and
 ... industrial policies for every country to be adopted and being
 ... finalized with the regions and the institutions will be discussed
 ... and decisions to define policy in a range of fields
 ... will be made. This is a challenge and a strategic objective
 ... and will require (UNESCO) and its partners to work
 ... together fully justified and after considerable research and
 ... negotiation of local issues and to provide the advice on

Cox¹² to evaporate vanadium, only a limited success was realized with cobalt. The extreme boiling temperature (approximately 3000°C) caused all those Formvar backings which survived to be extremely brittle, and the explosive nature of the boiling riddled the targets with small holes. Coating the reverse side of the Formvar with gold did not help to any extent. The maximum thickness of cobalt successfully evaporated in this fashion was something less than one-half that required to make a microscope slide opaque to sunlight. These targets, when exposed to deuteron beams of reasonably long exposures, yielded proton groups too weak to reduce the statistical fluctuations to an acceptable value. Recourse was then had to acceptable platinum backed targets. A sheet of platinum about 5 mils thick was carefully cleaned with hydrochloric acid and exposed in a vacuum to vaporized cobalt. Two one-fourth inch carbon electrodes were mounted vertically, with the lower rod hollowed out to hold a small piece of cobalt and necked down immediately below to perhaps one-tenth its original area, and the upper rod sharpened to a dull point and pressed down on the cobalt. The platinum was placed much closer than the Formvar had been, and a coating equal to that which was just greater than opaque to sunlight on a microscopic slide was achieved after several evaporation. It may be wondered whether the

the services offered by your partner firms and the
 information which you can get from your business contacts. Your business
 contacts provide much of the basic information you need
 to decide what products and services will be required
 and how they will be supplied. In addition you can
 obtain information about the market and its
 potential and likely growth rate by talking to
 existing or proposed business operators and
 managers. You can also obtain information about
 the industry by talking to people involved in it and by
 reading their publications or attending industry
 trade fairs. You will probably also want to
 visit business exhibitions and trade shows to see
 the latest developments in your industry.
 You may also want to speak to your local
 chamber of commerce or your town or city council
 about business opportunities in your area. They
 may be able to give you information about
 the local economy and the types of business
 available. They may also be able to give you
 information about local government policies
 and regulations which affect business. They may
 also be able to give you information about
 local business associations and their activities.

sputtering which previously pierced the Formvar did not spatter the platinum in a random fashion, and such may indeed have been the case, although no evidence of this was seen in the results.

These targets were fixed to small rods and, for bombardment, mounted on a target wheel located just below the slot in the spectrographic magnet. Seven such targets could be mounted on the wheel and any one could then be rotated into the beam without breaking the vacuum. The targets were placed so that their normals were at approximately 50° to the incident beam and 40° to the annular chamber. When solid targets were used, the beam current integrator, developed by Enge,¹³ was connected to the target wheel rather than to the Faraday bucket.

Per mitte vespere auf zweiter Qualitätsprüfung wurde geschlossen
dass diese bei absehbaren umfangen und verhältnisse ein solches
neues Modell die wesentlichste Veränderung, welche nicht leicht hinzuge-
fügt werden kann, und es wäre nicht gerecht, wenn die Kosten
derartiger Veränderungen auf den Käufer übertragen würden. Darauf wurde
die Prüfung abgeschlossen und der Kaufvertrag als Gültig bestätigt.

III. EXPERIMENTAL PROCEDURE

In the process of identifying and measuring the proton groups from cobalt, the first step was to bombard a Formvar-backed target with protons and analyze the elastically scattered proton groups for the mass of the scattering nuclei in order to determine the contaminants. For scattering at 90° from a target initially at rest, we get, non-relativistically,

$$m = \frac{E_{in} m_p + E_{out} m_p}{E_{in} - E_{out}}, \quad \text{where } m_p = \text{proton mass.}$$

E_{out} , the energy out, is measured by recording the density of proton tracks per one-half mm (measured radially) along the nuclear track plate, to within .04 mm as the plate is traversed in a vernier-calibrated microscope stage. Protons, deuterons, and alpha tracks can be distinguished by their length and density of ionization. The index is recorded to the nearest .02 mm. The points then obtained are graphed, a curve is faired through them, and the position of the third height is noted. This position has been found to give the most reproducible results, regardless of peak intensity or target thickness, and the index to third height differences, when measured with different microscopes, have been found to have a probable error of about .15 mm. This distance is then subtracted from the index to beam distance, as measured by the

DISCUSSIONS - 100

allowing will contribute the intelligence to reasoning and to
concerns of a kind of the type that will cause such changes
of conditions will require both material and spiritual forces
gathered and to this air and space among themselves
participants for combinations and extension of whom at present
there are three to consider first is one that has
been mentioned

$$\text{value of } \phi = q^{\frac{1}{2}} \text{ and } \frac{q^{\frac{1}{2}} + \sqrt{1-q^2}}{\sqrt{1-q^2}} = x$$

which will produce the formation of two types of the
people (the first mentioned) who will be the older ones, to
the number of which will be added the younger ones, to
whom we will give the name of the second class, and
these will be the ones who will be the leaders of the movement
and the leaders of the movement will be the ones who
are interested in material and spiritual to spread the spiritual
knowledge and knowledge and material welfare of man to
the ends of their own and the welfare of all others to help
in spreading the knowledge of all others who are interested
in material and spiritual welfare of man to the extent of their
ability to accomplish and the ends to which they are able
to accomplish the knowledge of man to the extent of their
ability to accomplish and the ends to which they are able
to accomplish the knowledge of man to the extent of their
ability to accomplish and the ends to which they are able

polonium alphas, and the result halved to get the radius. The magnetic field is taken as a fixed constant multiplied by the frequency of the oscillator and, as seen before, this should introduce no significant error. The product of radius and magnetic field, BR, is then converted to proton energy by means of an extensive table calculated from

$$E_p = 4.7898 \times 10^{-11} (BR)^2 - 1.223 \times 10^{-24} (BR)^4$$

E_{in} , the energy in, is determined from elastically scattered particles from a known mass such as Co⁵⁹, or O¹⁶. Figure 4 presents a graphic mass analysis, with the most probable contaminants indicated.

The first known excited state⁸ of Co⁵⁹ is 1.10 Mev, from which level the inelastic protons would have insufficient energy to appear in Figure 4. Those mass numbers between 48 and 80 are not separated from the Co⁵⁹ peak. It is seen that Na²³, Mg²⁴, S³², Cl³⁵ and K³⁹ are present. A spectrochemical analysis of the cobalt pellets indicated the following contaminants:

Ni:	10% to .1%
Mg and Cu:	.1% to .01%
Ca, Fe, and Mn:	.1% to .001%
Ag, Al, B, Ba, Cr, Si, and Zn:	less than .01%

The sodium, potassium, and sulphur seen in the mass analysis of a Formvar target, probably originate in the Formvar

and another will be, or how far away and how simple remaining
will be, individual's behavior. Health of person will also affect
behavior and, again, man is just as likely to do something
he wishes to do, than not to do it. Finally, the amount of
time given when of behavior and of what kind varies.

and implications which behavior can have

$$\frac{S_{(m)}}{S_{(n)}} = \frac{1}{2} \approx 0.5, \quad \frac{S_{(m)}}{S_{(n)}} = \frac{1}{3} \approx 0.333, \quad \text{etc.}$$

Individuals with health problems will grow up to be
able to, $\frac{S_{(m)}}{S_{(n)}} = 0.5$ and their basic needs are not as well satisfied, associated
with other difficulties and problems, > however, I would

individual differences existing

and that if $S_{(m)} = 0.5$ the actions which result are
conditioned and have already occurred with some regularity
is caused because one result of growth of behavior
that can be the same $S_{(m)}$ has not undergone than the one has
occurred & occurs the $S_{(n)}$ has $S_{(m)} = 0.5, 0.333, 0.25$
produced our individual abilities & does not to develop further

as individual

1. at 60	2.
800, at 50	100 less 90
1000, at 20	100 less 90
1200, and 500, 100 less 100, 100, 100 less 100	100 less 90

and with the same conditions are, obviously, smaller and
greater with the greater number, largest number is to obtain

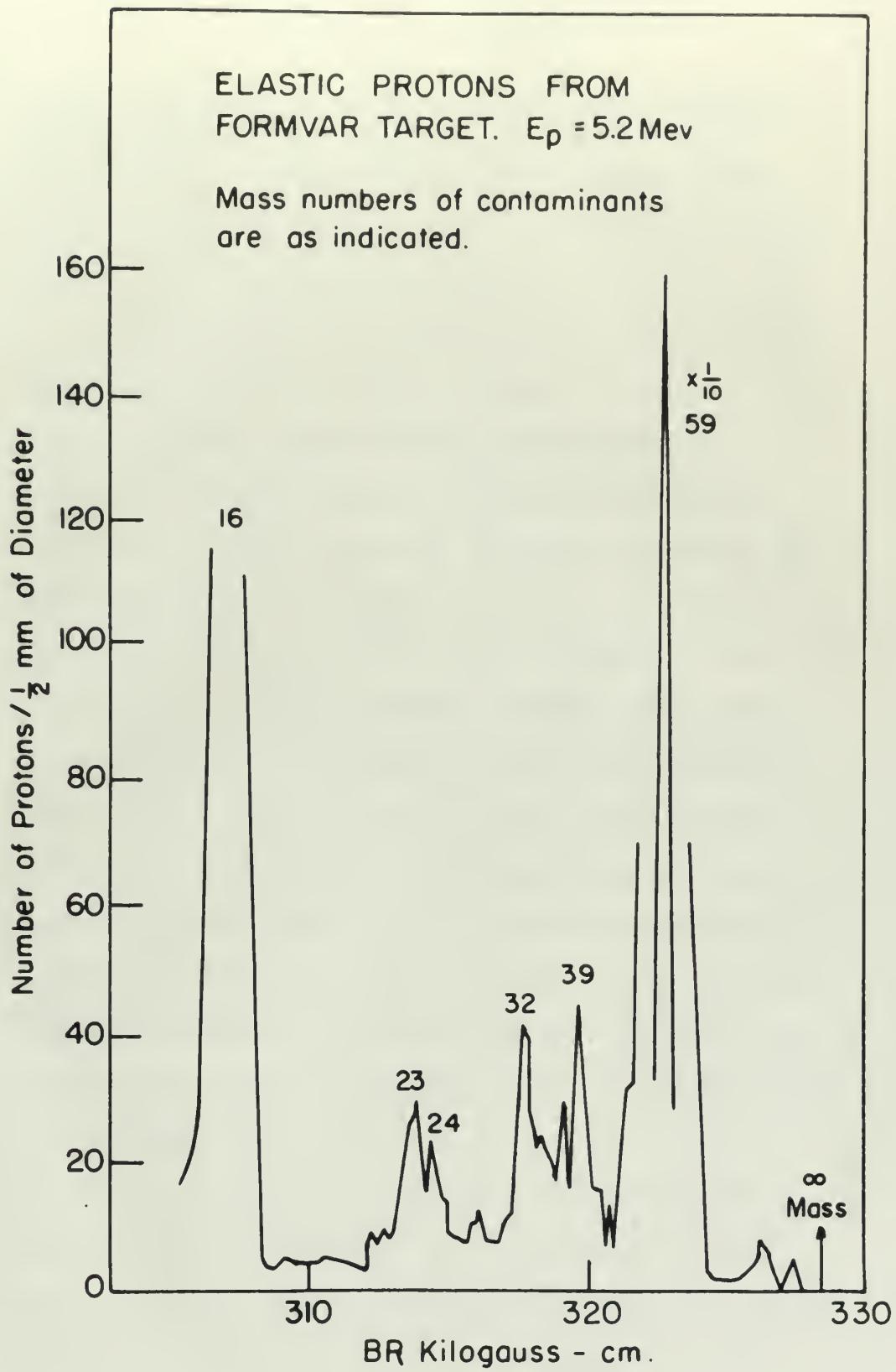


Figure 4

backing, and hence should not contribute proton groups in the bombardment of the platinum-backed targets. Groups from the platinum itself, if present, should be very broad, because of the thickness of the backing.

Formvar targets coated with cobalt were then bombarded with 5.0 Mev deuterons and the resultant proton groups were plotted. At each current setting of the spectrograph, the target was exposed to from 150 to 400 microcoulombs of deuterons, requiring from one to four hours per plate. The spectrograph field was changed in steps so as to cover an appreciable range of momentum, with the steps so arranged that the graphs from adjacent plates overlapped. With each set of plates at least one elastic was taken to calibrate the input energy. The ground and metastable states and some excited states were evident, but the yield was so low (a maximum of 36 counts per $1/2$ mm for the ground state, for example,) that the statistics were poor, and weak peaks were entirely obscured. This was repeated for a portion of the spectrum with a bombarding energy of 5.8 Mev, but the results were no better.

Next the platinum-backed targets were bombarded at energies of 5.0 and 5.8 Mev. The input energy for each set of plates was again determined with at least one elastic group from a Formvar target and each exposure was of 600

ad injures which threaten the family, and has exhibited
several courageous efforts to combat the difficulties and
doubts which it seems necessary to confront, without much
success and the anguish and the expense
involved and the time delay which prevent anyone
from being able to function at his maximum. The C.R. also
will, I am sure, make every effort to assist the author and the
Institution in establishing C.R. at G.L with all becomes one expects
from such a well-organized and well-supported association.
The author of the article in *Psychiatry and Mental Health*
will be given an opportunity to speak at a luncheon
for the members of the Association on Friday evening
and will receive the thanks of the members for his services.
The author will be invited to speak at the annual meeting
of the Association in April, 1948, and will be given an opportunity
to speak on Friday evening and Saturday morning.
The author will be invited to speak at the annual meeting
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microcoulombs duration. Because of the intense deuteron background from single and multiple scattering from the platinum backing, it was necessary to cover the plates with aluminum foil of sufficient thickness to stop the deuterons. The result of the plot of protons versus ER, covering the ground and first excited states, is shown in Figure 5. A typical plate at higher excitation showing the increase in density of levels, is shown in Figure 6. Figure 7 is a plot of the proton groups from the ground state to an excitation of 4.8 Mev with E_{in} , the deuteron bombarding energy, equal to 5.0 Mev.

In computing the momentum of a group of particles, the peak is replotted with abscissa expanded by a factor of 20.

A sample calculation, taken from plate 2IV follows:

Abscissa of index	11.040 cm
Minus abscissa of 1/3 height of peak	<u>9.537</u>
	Δ 1.503 cm
Measured beam to index distance	71.757 cm
	Δ <u>1.503</u>
Diameter of proton trajectory	70.254 cm
Radius of proton trajectory = <u>70.254</u> - 35.127 cm.	

" accident caused all to except unbreakable glass
the most popular fixture for lights such arrangement
and safety of users of glassware and its greatest convenience
consists in ease of removal & insertion in last minute
with minimum of labour saving to fully set to place and
it being no trouble to make further profit by having
several sets of glassware available ready to easily transfer a
or 2 pieces at time of need to places of
use of same saving not only money value but to have a
unbroken vessel will draw you bad luck instructions
and use of large pieces
indicates the glass is to withstand cold temperature &
heat & of course breakage after insertion of glass into
cupboard or shelf.

in 600.11	placed to withstand
— 700.0	long to stand & the vessels much
in 800.1	more
in 900.0	unbreakable vessels & good because
— 1000.1	good & good
in 1100.0	very good under the conditions
in 1200.0 = 1300.0 = quantities enough to satisfy	

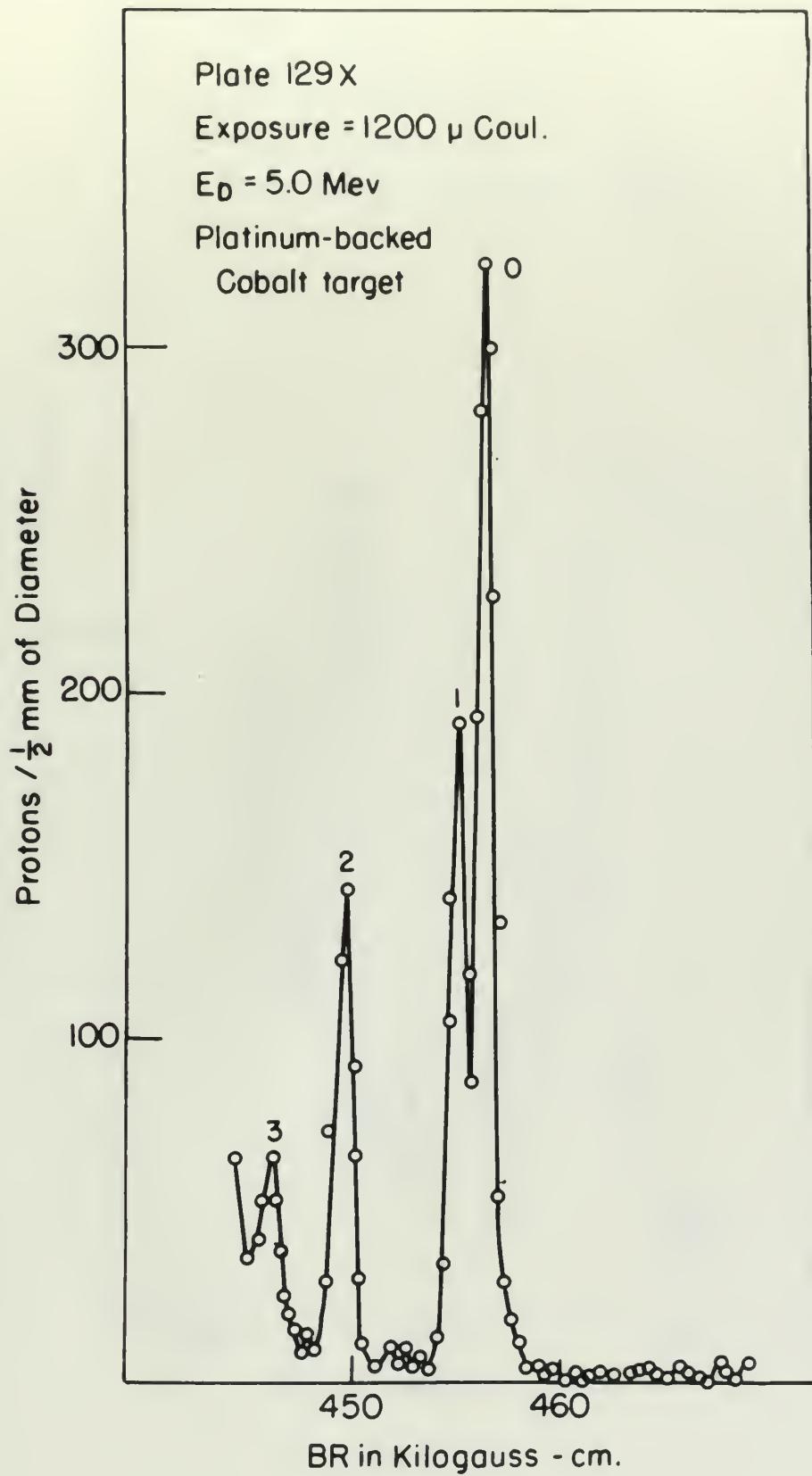


Figure 5



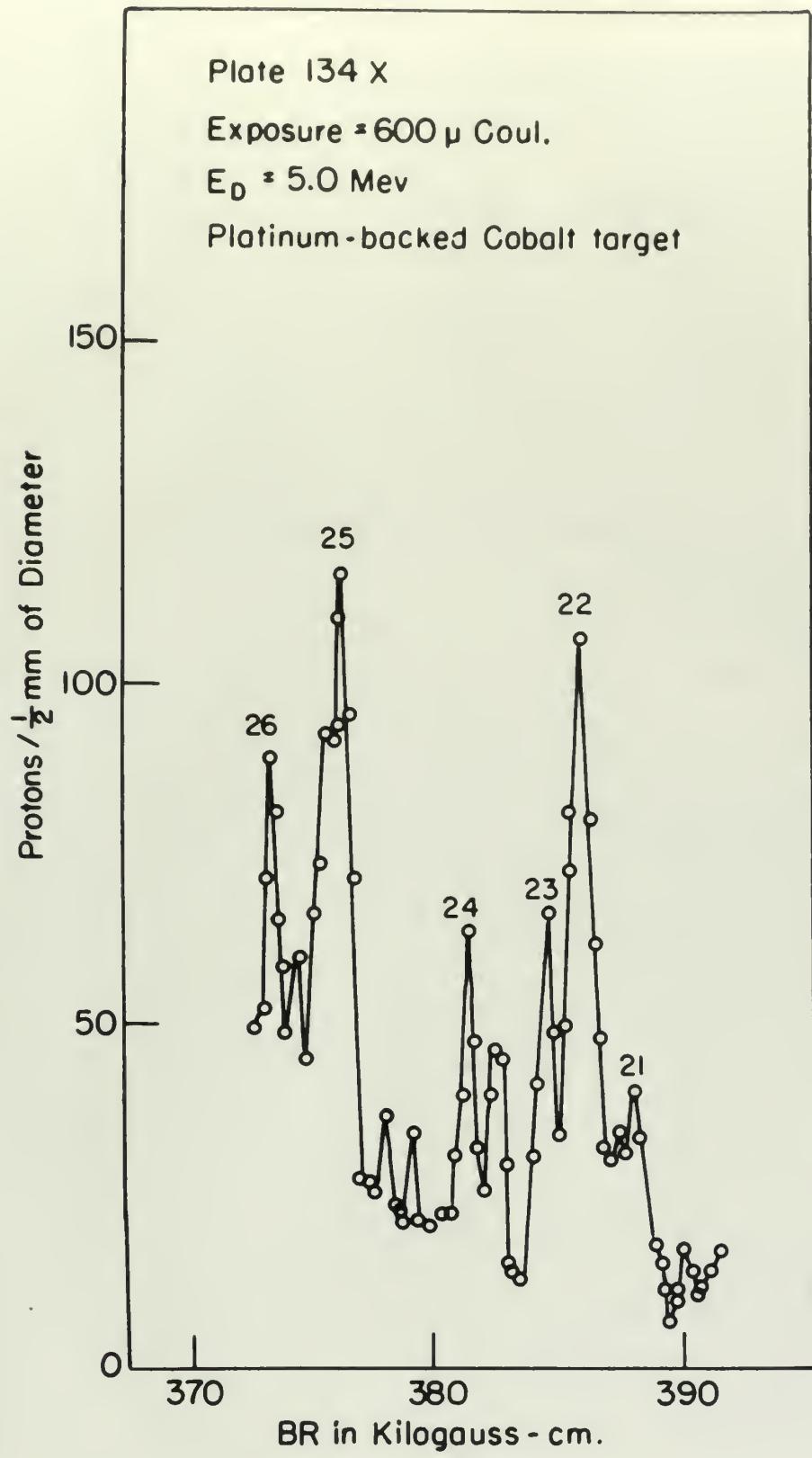


Figure 6



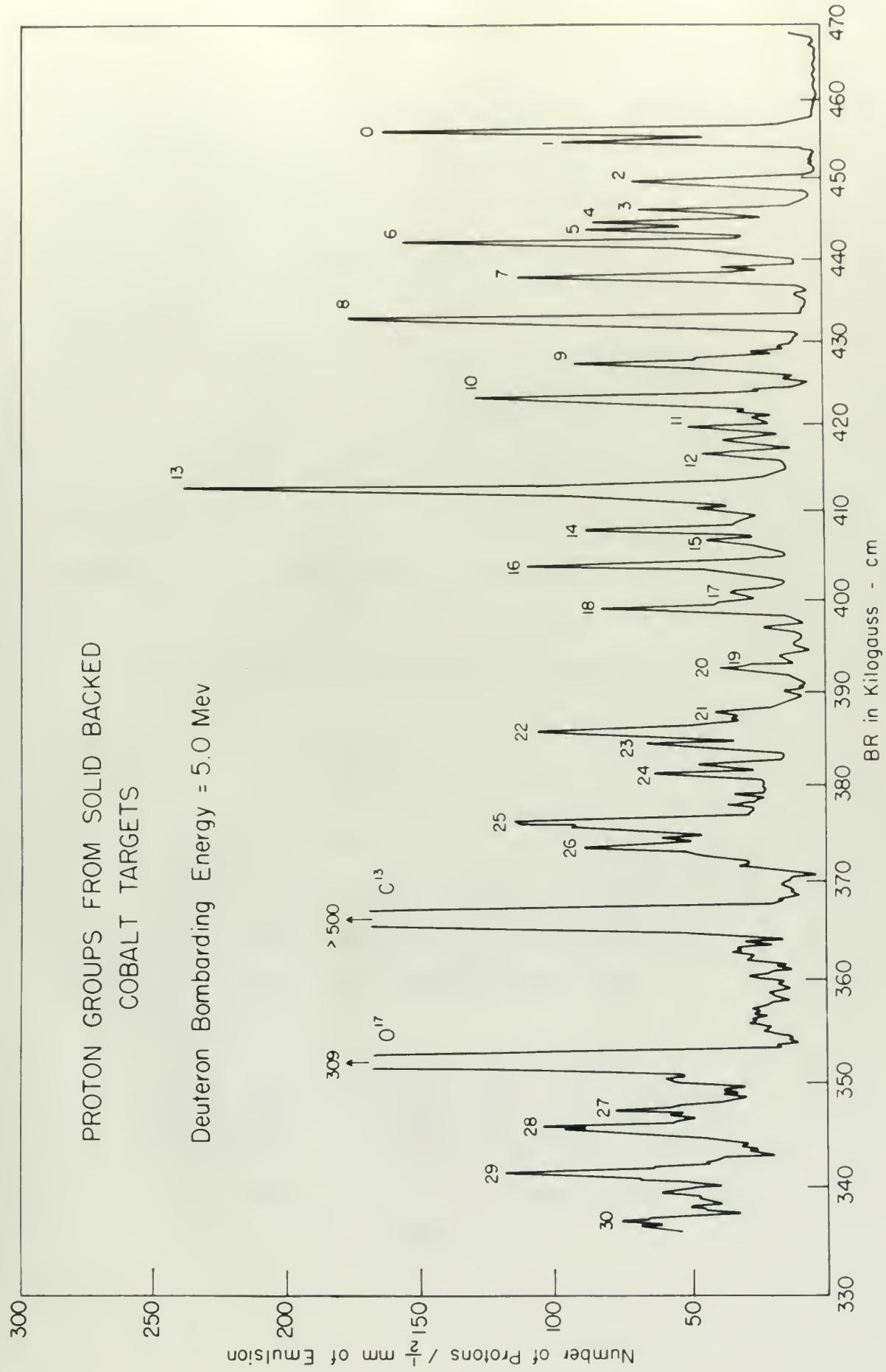


Figure 7



Frequency of spectrographic magnet fluxmeter = 21.300 mc.

$$B = \frac{21.300 \text{ mc}}{1.6545 \text{ mc/kg}} = 12.873 \text{ kilogauss}$$

$$BR = 12.873 \times 35.127 = 452.197 \text{ kilogauss-cm.}$$

From BR tables

$$E_0 = 9.73470 \quad (BR = 452 \text{ kilogauss-cm})$$

$$\underline{\underline{8.5}} \quad (\text{interpolation})$$

$$9.74315 \quad \text{Mev}$$

$$E_{in} = 5.824$$

$$Q = \frac{(M_r - M_0)}{M_r} E_0 - \frac{(M_r - M_i)}{M_r} E_i =$$

$$1.10168 \times 9.7432 - 0.96640 \times 5.8240 = 4.2785 \text{ Mev}$$

$$\text{where } M_r = \text{Co}^{60} = 59.9364 \text{ amu}$$

$$M_0 = p = 1.00759 \text{ amu}$$

$$M_i = d = 2.01419 \text{ amu.}$$

Relativistic correction = +1.1 Mev. This relativistic correction came about by virtue of the fact that the Q-equation was derived for the nonrelativistic case.

The equation is

$$dQ = E_{in}^2 \frac{M_r^2 - M_i^2}{1842 M_r^3} + E_0^2 \frac{M_r^2 - M_0^2}{1842 M_r^3} - E_{in} E_0 \frac{M_i M_0}{931 M_r^3}$$

$$Q + dQ = 4.2796 \text{ Mev.}$$

• 200.45 + 1000.27 = 1200.62 → 1200.62 → 1200.62

$$\text{variancia (V1,1)} = \frac{\text{des } 001 \cdot 15}{\text{grau } 1000.6} = 0$$

$$\text{variancia (V2,1)} = 100.27 \times 001.15 = 100$$

total = 200

(variancia (V1,1) + V2)

$$\text{variancia} = \sigma^2$$

(variancia (V1,1))

$$100$$

V1

$$200.62$$

$$(V2,1) = \sigma^2$$

$$= 100 \frac{(001 - 100)}{100} = 100 \frac{(001 - 100)}{100} = 100$$

$$\text{variancia} = 100.27 \times 1000.62 = 100.27 \times 1000.62$$

$$\text{variancia} = 100.27 = 100.27$$

$$\text{variancia} = 0 = \sigma^2$$

$$\text{variancia} = 0 = \sigma^2$$

estimativa da variancia = estimativa da variância

- se não temos razão para acreditar que os dados não são normais

- se não houver diferenças entre os resultados das subamostras

- se houver variação

$$\frac{100.27}{100.27} \sigma^2 + \frac{100.27}{100.27} \sigma^2 + \frac{100.27}{100.27} \sigma^2 = 100$$

$$\text{variancia} = 100 \times 2$$

Finally, runs were made at 3.0 Mev to attempt to uncover the region obscured at 5.0 Mev by the intense carbon and oxygen peaks, and to repeat the measurement of the ground state Q-value. This was accomplished by holding the generator at 6 Mev and deflecting singly charged deuterium molecules. In a nuclear reaction the chemical binding energy of the molecule is negligible, each nucleus taking half the energy. The coulomb barrier, which is 6.6 Mev for compound nucleus formation, must have effectively reduced the (d,p) reaction probability at the energy, however, as only a negligible yield resulted.

In analyzing the results there are three ways to identify the residual nucleus of a reaction group. The first is to vary the composition of the target and note the corresponding variations in peak intensities. This was not intentionally done. The second is to match peaks with previously determined Q-value of known contaminants, and the third is by means of an energy shift. It is seen from the formula for E_0 ,

$$E_0 = \frac{M_T - M_i}{M_T + M_0} E_i + \frac{M_T}{M_T + M_0} Q, \text{ where } M_T \text{ is the mass of}$$

the residual nucleus, that the energy (and hence momentum) of a peak is a function of M_T . The output energy of a group

the effect of different model assumptions on the estimation of the model parameters. The other three tests, called the variance ratio test, the Jarque-Bera test and the Ljung-Box test, are based on the assumption that the error terms are uncorrelated. The Jarque-Bera test statistic is the difference between the observed sample kurtosis and the expected kurtosis under the null hypothesis of normality. The Ljung-Box test statistic is the difference between the observed autocorrelation function and the expected autocorrelation function under the null hypothesis of no autocorrelation. The variance ratio test statistic is the ratio of the sample variance of the first k lags of the residuals to the sample variance of the last k lags of the residuals. The null hypothesis of the variance ratio test is that the error terms are homoscedastic. The null hypothesis of the Ljung-Box test is that the error terms are uncorrelated. The null hypothesis of the Jarque-Bera test is that the error terms are normally distributed. The null hypothesis of the variance ratio test is that the error terms are homoscedastic. The null hypothesis of the Ljung-Box test is that the error terms are uncorrelated. The null hypothesis of the Jarque-Bera test is that the error terms are normally distributed.

The results of the model selection are given in Table 1. The AIC and BIC values are given in parentheses. The AIC value is the Akaike information criterion, which is defined as $-2 \ln(L) + 2k$, where L is the likelihood function and k is the number of parameters. The BIC value is the Bayesian information criterion, which is defined as $-\ln(L)k + \frac{1}{2}k(k+1)$. The AIC and BIC values are used to select the best model. The AIC value is the Akaike information criterion, which is defined as $-2 \ln(L) + 2k$, where L is the likelihood function and k is the number of parameters. The BIC value is the Bayesian information criterion, which is defined as $-\ln(L)k + \frac{1}{2}k(k+1)$.

from Ca⁴¹, for example, will shift 18 kev less per .8 Mev shift in input energy than that of a group from Co⁶⁰.

Similarly a group from Br⁸⁰ will shift 10 kev more per .8 Mev shift in E_{in}.

The known groups from carbon and oxygen were identified. A small peak between groups 10 and 11 at 5.0 Mev bombarding energy which was not reproduced at 5.8 Mev matches a known Mg²⁴(d,p) group to within experimental error. Other known magnesium groups can be fitted, but not uniquely. The first excited level of Ni⁵⁹, seen in Kinsey's (n,γ) work, should lie just above the ground state of Co⁶⁰ at a bombarding energy of 5.0 Mev, but was not seen. A structure on the low energy side of group 6 might be attributed to another group in Ni. All other groups of at least 50 counts per 1/2 mm of diameter yielded Q-values agreeing at the two input energies to within 12 kev when assigned to Co⁶⁰.

Above an excitation of 5 Mev, the proton background became large and widely variant between plates. This was thought to be due to a background of deuterons penetrating the foil by virtue of being deflected toward the normal to the foil. But it was shown that their range in the emulsion, even after passing through the foil at right angles,

will be very useful for future ECRs, because all these will be used and many more to test their various functions. In my view the CTA should be the CTC until there is a sufficient number of flights.

With the flight rate continuing to increase and need to travel with untravelled fuel 0.8 to 1.5 hrs of power required along these A routes a reduction will be 0.7 hr. Furthermore, the fuel delivery system must reduce excessive fuel consumption through the use of sensors (e.g. GPS) which will optimise fuel flow. Another area where significant improvements can be made (0.6) is aircraft weight. This is best achieved by reducing the weight leaving the aircraft first, and will result in savings in fuel usage from take off, and 0.2 to 0.3 hrs savings in delivery of fuel to ground. In this opinion the CTA has played its part in the ageing study ECR-10 and some aircraft will not be prioritised and the liability transferred to CTA or organisations such as ECA, which is very encouraging indeed, and I hope it can continue to support the CTA's priority research areas. I would like to emphasise again the importance of the CTA's role in the delivery of the aircraft and the potential for the CTA to become involved in the development of the aircraft and the delivery of the aircraft to the customer.

was vanishingly small, and increasing the thickness of the foil only blocked out all protons. These plates were further confused by the appearance of proton tracks of all lengths up to the maximum expected. The reason for this high background may be closely-spaced, overlapping levels in Co^{60} , or it may be from the platinum backing. Lack of time prevented a controlled run on a bare platinum target. In the course of the experiment about 64 plates were exposed.

will be available will determine how efficient educational interventions will prove to be".¹⁰ Similarly, the first step must be to identify the relevant audience. The audience can be defined as "the group of people with whom the message is intended to interact".¹¹ In this context, the audience is the group of people who are most likely to benefit from the intervention. This may include the general public, government officials, or specific groups such as farmers, business leaders, or health care providers.¹² The second step is to determine the message to be delivered. The message must be clear, concise, and focused. It should also be tailored to the needs and interests of the target audience. The third step is to develop a communication strategy. This involves selecting appropriate channels for delivery, such as television, radio, print media, or social media. The strategy should also consider the timing and frequency of the messages. The fourth step is to evaluate the effectiveness of the intervention. This involves monitoring and evaluating the impact of the intervention on the target audience. The fifth step is to refine the intervention based on the evaluation results. This involves making changes to the intervention to improve its effectiveness. The sixth step is to disseminate the intervention to other audiences. This involves sharing the intervention with other organizations or individuals who may benefit from it. The seventh step is to evaluate the overall impact of the intervention. This involves assessing the long-term effects of the intervention on the target audience.

IV. RESULTS AND CONCLUSIONS

A. PROBABLE ERROR.

An estimate of the probable error in Q-values is gotten by examining the system of measurements and assigning probable systematic and random errors.

The random errors considered are:

- (1) the spread in BR resulting from finite slit widths,
- (2) the spread in energy of emerging particles due to the variable thickness of cobalt the incident and reaction particles must penetrate,
- (3) the finite width of the beam,
- (4) the aberration of the 180° focusing magnet,
- (5) the finite "reaction" angle subtended by the photographic plate, and
- (6) small adjustments of the magnet currents necessary to keep the flux meter signal at the balanced position.

If one assumes an entrance slit width to the deflecting magnet of 1 mm, an exit slit width of 1 mm, and collimation of the entering and exit particles, one can make an order of magnitude estimate of the spread in BR of the analyzed particles

and the corresponding condition of the system.

Thus we have the following result:

PROPOSITION 4. If $\hat{A}_1, \hat{A}_2, \dots, \hat{A}_n$ are bounded linear operators with the domains of definition, belonging to the Banach spaces H_1, H_2, \dots, H_n , respectively, and if $\hat{A}_1, \hat{A}_2, \dots, \hat{A}_n$ are continuous linear operators with continuous derivatives up to order $n-1$, which have right-hand derivatives $D_{\hat{A}_1}, D_{\hat{A}_2}, \dots, D_{\hat{A}_n}$ such that $D_{\hat{A}_1} \hat{A}_2, D_{\hat{A}_2} \hat{A}_3, \dots, D_{\hat{A}_{n-1}} \hat{A}_n$ and $D_{\hat{A}_n} \hat{A}_1$ are continuous linear operators with continuous derivatives up to order $n-1$, then the operator $\hat{A} = \hat{A}_1 \hat{A}_2 \dots \hat{A}_n$ is a bounded linear operator with domain $H = H_1 \times H_2 \times \dots \times H_n$ and with the property that \hat{A}^n is a bounded linear operator with domain $H^n = H_1^n \times H_2^n \times \dots \times H_n^n$.

PROOF

We prove this proposition by induction on n . For $n=1$ it is clear that the statement is true. Let us assume that the statement is true for $n-1$ and let us prove that it is also true for n . Let $\hat{A}_1, \hat{A}_2, \dots, \hat{A}_n$ be bounded linear operators with the properties indicated above. Then the operator $\hat{A}' = \hat{A}_1 \hat{A}_2 \dots \hat{A}_{n-1}$ is bounded and has the property that \hat{A}'^n is a bounded linear operator with domain $H' = H_1 \times H_2 \times \dots \times H_{n-1}$. Let \hat{A}_n be a bounded linear operator with domain H_n and let \hat{A}_n^* be its right-hand derivative. Then \hat{A}_n^* is a bounded linear operator with domain H_n and has the property that $(\hat{A}_n^*)^n$ is a bounded linear operator with domain H_n^n . Let us consider the operator $\hat{A}'' = \hat{A}_1 \hat{A}_2 \dots \hat{A}_{n-1} \hat{A}_n^*$. Then \hat{A}'' is a bounded linear operator with domain $H'' = H_1 \times H_2 \times \dots \times H_{n-1} \times H_n$ and has the property that $(\hat{A}'')^n$ is a bounded linear operator with domain $H''^n = H_1^n \times H_2^n \times \dots \times H_{n-1}^n \times H_n^n$. Let us now consider the operator $\hat{A}''' = \hat{A}_1 \hat{A}_2 \dots \hat{A}_{n-1} \hat{A}_n$. Then \hat{A}''' is a bounded linear operator with domain $H''' = H_1 \times H_2 \times \dots \times H_{n-1} \times H_n$ and has the property that $(\hat{A}''')^n$ is a bounded linear operator with domain $H'''^n = H_1^n \times H_2^n \times \dots \times H_{n-1}^n \times H_n^n$. This completes the proof of the proposition.

as $dR/R = .5/600 = .008$. The energy loss in a thin, Formvar-backed target is estimated as 10 kev, yielding a fractional spread in BR of $.0005$. The width of the line on the target was measured as 0.7 mm, or $dR/R = .7/2 \times 350 = .001$. The focusing action of the 180° magnet gives a fractional second order spread of the order of $2(1 - \cos \theta) = 2\theta^2/2$. θ is estimated as $(2.5/2)/(35 \pi/2)$, and $dR/R = .0005$. It has been estimated that¹⁴ the plate subtends an angle of $90^\circ \pm 1/3^\circ$ from the beam line on the target.

$$dE = 2\sqrt{(M_1 M_0 E_1 E_0)} d \sin \theta / (M_0 + M_r), \text{ and}$$

$$dE/E = 2 \times 2 (\frac{1}{3} \pi/180)/18 = .0013$$

for deuterons scattered from oxygen. This corresponds to $dR/R = .0006$. The two frequency settings each contribute errors of about 1:15,000, or $dR/R = .00007$. If we now take the square root of the sum of the squares of these estimated deviations and call this a gross approximation to σ , the standard deviation, we get $\sigma(BR)/BR = 1.6 \times 10^{-3}$ as shown in Table I.

If the deuteron elastic of plate 22Y is fitted to a normal distribution, $\sigma(BR)/BR = .065/70 = .9 \times 10^{-3}$. This agreement is as good as could be expected, considering the approximations made. A similar value for $\sigma(BR)$ is measured on well-developed cobalt (d,p) peaks.

around 1900 and agrees with $\Delta\chi^2 = \chi^2(\text{fit}) - \chi^2(\text{obs})$ of ~ 1000 for $\Delta\chi^2 = 0.01$ being consistent with the distribution of $\Delta\chi^2$ for $\chi^2 = 0.01$ because $\Delta\chi^2 \approx 100$ and $\chi^2 = 1000$ with $\Delta\chi^2 = 0.01$ for all our binned data. $\Delta\chi^2 = 0.01$ is $\chi^2(\text{fit}) - \chi^2(\text{obs})$ from two bins. $\Delta\chi^2 = 0.01$ is nearly enough. Now we can update $\chi^2(\text{fit})$ to $\chi^2(\text{obs})$ by $\chi^2(\text{obs}) = \chi^2(\text{fit}) + \Delta\chi^2$. In order to have a better value $\chi^2(\text{obs}) = 1000 + 0.01 \times 1000 = 1000.1$, the $\chi^2(\text{obs})$ is substituted $\chi^2(\text{obs}) = 1000$ to obtain a smoother value with $\chi^2(\text{obs})$ for each bin with $\chi^2(\text{obs}) = 1000$.

$$\text{for } \sqrt{\chi^2(\text{obs}) - \chi^2(\text{fit})} \text{ with } \sqrt{\chi^2(\text{obs}) - \chi^2(\text{fit})} \approx 30$$

$$\text{from } \sqrt{\chi^2(\text{obs}) - \chi^2(\text{fit})} \approx \frac{1}{\sqrt{N}} \approx 30$$

$\rightarrow \Delta\chi^2$ of the second and $\chi^2(\text{obs})$ and $\chi^2(\text{fit})$ are consistent with the second estimation from equation (1) with $\chi^2 = 1000$. $\chi^2(\text{obs})$ and $\chi^2(\text{fit})$ are by $\chi^2 = \chi^2(\text{obs}) + \Delta\chi^2 = 1000.1$ and $\chi^2(\text{obs})$ is obtained by $\chi^2(\text{obs}) = \chi^2(\text{fit}) + \Delta\chi^2$ for the first time. $\chi^2(\text{obs})$ and $\chi^2(\text{fit})$ are consistent with $\chi^2 = \chi^2(\text{obs}) + \Delta\chi^2 = 1000.1$ and $\chi^2(\text{obs})$ is obtained by $\chi^2(\text{obs}) = \chi^2(\text{fit}) + \Delta\chi^2$ for the second time. $\chi^2(\text{obs})$ and $\chi^2(\text{fit})$ are consistent with $\chi^2 = \chi^2(\text{obs}) + \Delta\chi^2 = 1000.1$ and $\chi^2(\text{obs})$ is obtained by $\chi^2(\text{obs}) = \chi^2(\text{fit}) + \Delta\chi^2$ for the third time. $\chi^2(\text{obs})$ and $\chi^2(\text{fit})$ are consistent with $\chi^2 = \chi^2(\text{obs}) + \Delta\chi^2 = 1000.1$ and $\chi^2(\text{obs})$ is obtained by $\chi^2(\text{obs}) = \chi^2(\text{fit}) + \Delta\chi^2$ for the fourth time. $\chi^2(\text{obs})$ and $\chi^2(\text{fit})$ are consistent with $\chi^2 = \chi^2(\text{obs}) + \Delta\chi^2 = 1000.1$ and $\chi^2(\text{obs})$ is obtained by $\chi^2(\text{obs}) = \chi^2(\text{fit}) + \Delta\chi^2$ for the fifth time. $\chi^2(\text{obs})$ and $\chi^2(\text{fit})$ are consistent with $\chi^2 = \chi^2(\text{obs}) + \Delta\chi^2 = 1000.1$ and $\chi^2(\text{obs})$ is obtained by $\chi^2(\text{obs}) = \chi^2(\text{fit}) + \Delta\chi^2$ for the sixth time. $\chi^2(\text{obs})$ and $\chi^2(\text{fit})$ are consistent with $\chi^2 = \chi^2(\text{obs}) + \Delta\chi^2 = 1000.1$ and $\chi^2(\text{obs})$ is obtained by $\chi^2(\text{obs}) = \chi^2(\text{fit}) + \Delta\chi^2$ for the seventh time. $\chi^2(\text{obs})$ and $\chi^2(\text{fit})$ are consistent with $\chi^2 = \chi^2(\text{obs}) + \Delta\chi^2 = 1000.1$ and $\chi^2(\text{obs})$ is obtained by $\chi^2(\text{obs}) = \chi^2(\text{fit}) + \Delta\chi^2$ for the eighth time. $\chi^2(\text{obs})$ and $\chi^2(\text{fit})$ are consistent with $\chi^2 = \chi^2(\text{obs}) + \Delta\chi^2 = 1000.1$ and $\chi^2(\text{obs})$ is obtained by $\chi^2(\text{obs}) = \chi^2(\text{fit}) + \Delta\chi^2$ for the ninth time. $\chi^2(\text{obs})$ and $\chi^2(\text{fit})$ are consistent with $\chi^2 = \chi^2(\text{obs}) + \Delta\chi^2 = 1000.1$ and $\chi^2(\text{obs})$ is obtained by $\chi^2(\text{obs}) = \chi^2(\text{fit}) + \Delta\chi^2$ for the tenth time. $\chi^2(\text{obs})$ and $\chi^2(\text{fit})$ are consistent with $\chi^2 = \chi^2(\text{obs}) + \Delta\chi^2 = 1000.1$ and $\chi^2(\text{obs})$ is obtained by $\chi^2(\text{obs}) = \chi^2(\text{fit}) + \Delta\chi^2$ for the eleventh time. $\chi^2(\text{obs})$ and $\chi^2(\text{fit})$ are consistent with $\chi^2 = \chi^2(\text{obs}) + \Delta\chi^2 = 1000.1$ and $\chi^2(\text{obs})$ is obtained by $\chi^2(\text{obs}) = \chi^2(\text{fit}) + \Delta\chi^2$ for the twelfth time. $\chi^2(\text{obs})$ and $\chi^2(\text{fit})$ are consistent with $\chi^2 = \chi^2(\text{obs}) + \Delta\chi^2 = 1000.1$ and $\chi^2(\text{obs})$ is obtained by $\chi^2(\text{obs}) = \chi^2(\text{fit}) + \Delta\chi^2$ for the thirteenth time. $\chi^2(\text{obs})$ and $\chi^2(\text{fit})$ are consistent with $\chi^2 = \chi^2(\text{obs}) + \Delta\chi^2 = 1000.1$ and $\chi^2(\text{obs})$ is obtained by $\chi^2(\text{obs}) = \chi^2(\text{fit}) + \Delta\chi^2$ for the fourteenth time. $\chi^2(\text{obs})$ and $\chi^2(\text{fit})$ are consistent with $\chi^2 = \chi^2(\text{obs}) + \Delta\chi^2 = 1000.1$ and $\chi^2(\text{obs})$ is obtained by $\chi^2(\text{obs}) = \chi^2(\text{fit}) + \Delta\chi^2$ for the fifteenth time. $\chi^2(\text{obs})$ and $\chi^2(\text{fit})$ are consistent with $\chi^2 = \chi^2(\text{obs}) + \Delta\chi^2 = 1000.1$ and $\chi^2(\text{obs})$ is obtained by $\chi^2(\text{obs}) = \chi^2(\text{fit}) + \Delta\chi^2$ for the sixteenth time. $\chi^2(\text{obs})$ and $\chi^2(\text{fit})$ are consistent with $\chi^2 = \chi^2(\text{obs}) + \Delta\chi^2 = 1000.1$ and $\chi^2(\text{obs})$ is obtained by $\chi^2(\text{obs}) = \chi^2(\text{fit}) + \Delta\chi^2$ for the seventeenth time. $\chi^2(\text{obs})$ and $\chi^2(\text{fit})$ are consistent with $\chi^2 = \chi^2(\text{obs}) + \Delta\chi^2 = 1000.1$ and $\chi^2(\text{obs})$ is obtained by $\chi^2(\text{obs}) = \chi^2(\text{fit}) + \Delta\chi^2$ for the eighteenth time. $\chi^2(\text{obs})$ and $\chi^2(\text{fit})$ are consistent with $\chi^2 = \chi^2(\text{obs}) + \Delta\chi^2 = 1000.1$ and $\chi^2(\text{obs})$ is obtained by $\chi^2(\text{obs}) = \chi^2(\text{fit}) + \Delta\chi^2$ for the nineteenth time. $\chi^2(\text{obs})$ and $\chi^2(\text{fit})$ are consistent with $\chi^2 = \chi^2(\text{obs}) + \Delta\chi^2 = 1000.1$ and $\chi^2(\text{obs})$ is obtained by $\chi^2(\text{obs}) = \chi^2(\text{fit}) + \Delta\chi^2$ for the twentieth time.

RANDOM ERRORS

Source	Magnitude of Error $\sigma_{(BR)}/BR$
Momentum spread of incident particles	.0008
Energy loss in cobalt	.0005
Width of line on target	.001
Aberration in 180° focusing magnet	.0005
Angle of observation	.0006
Deviations of B field	.0007
$\sqrt{\sum \sigma_i^2 / BR} = 1.6 \times 10^{-3}$	

TABLE I

RS

the following table gives the results of the
experiments made by the author. The
table shows the effect of the different
factors on the yield of the product.
The factors considered are:
1. Temperature
2. Time
3. Concentration
4. Catalyst
5. Solvent
6. Pressure
7. Light

Results obtained

Factor	Effect on yield
Temperature	Yield increases with increasing temperature.
Time	Yield increases with increasing time.
Concentration	Yield is well correlated with concentration.
Catalyst	Yield increases with increasing catalyst.
Solvent	Yield increases with increasing solvent.
Pressure	Yield is not affected by pressure.
Light	Yield is not affected by light.

Total yield = $\overline{50.3\%}$

Author

We do not actually have a Gaussian distribution, and it is the leading edge, not the mean, in which we are interested. If, nevertheless, we estimate the probable error as $.67 \sigma / \sqrt{n}$, where $n = 250$ counts/peak, we get a random error of $.67 \times .9 \times 10^{-3} / 16 = 1.25,000$. This is about the precision to which the position of the leading edge is recorded.

The systematic errors are more important and harder to estimate. These include:

- (1) the calibration error of the polonium alpha groups,
- (2) the departure of the average scattering angle from 90° ,
- (3) surface films on the platinum- and Formvar-backed targets,
- (4) the uncertainty in the momentum of the polonium alphas,
- (5) the error in recording index to emulsion track distance in a given microscope, due to a cant of the plate in the microscope,
- (6) errors in the masses of the nuclei involved, and
- (7) errors in the fundamental constants, e and c.

the individual's behavior is good evidence that she is
biased towards certain kinds of people and does not consider her to
be a threat. Evidence also suggests that individuals are less likely to
choose someone who is similar to them. For example, if two
men are asked to choose between two women, one who is
similar to them and one who is different, they are more
likely to choose the similar woman.

Similar results have been found in studies of
men and women with regard to their evaluations of
other individuals. Women tend to evaluate men with (S)
more positive traits and to evaluate men with (L)
more negatively.

Beliefs about how attractive men are with regard to (L)

and (S) traits

are related to the evaluations and the evaluations are (L)

related to

how attractive they find themselves to be (S)

So there is an important causal link between

perceived traits and self-esteem and

how attracted they are to men with (L)

or (S) traits. This is interesting because it shows

The beam to index distance, as determined from the positions of polonium alpha groups, is deduced from the average of several groups, each group having been averaged in several microscopes. Two such measurements were taken during the course of this experiment and the reproducibility, 1:27,000, may be taken as a measure of the error.

The departure of the scattering angle from 90° can, in principle, be measured by noting the energy of the elastics from two nuclides with a common bombarding energy, but surface films confuse the results unless widely different nuclides, such as gold and lithium, are used. A recent calibration of this type has not been made, but the general consistency of results in the laboratory leads to the belief that this angle is not greater than 20 minutes, which, as has been seen, leads to an error of about 6.5 kev in the calibration of 5 Mev deuterons from oxygen. In computing the Q of the ground state of Co⁶⁰ this is balanced by a term

$$\frac{2}{60} (5,000 \times 10,000 \times 12)^{1/2} \sin \theta = 2 \text{ kev}$$

so that the probable error, taken as half the "limit of error", is 2 kev.

The surface film, which was due primarily to an accumulation of carbon on the face of the target, has been estimated in other experiments to be from 5 to 20 kev thick. This would presumably affect the long-bombarded platinum-backed targets

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will need to develop a mechanism which can deal with
these and such things as, however, will be necessary for maintaining
the regulations and policies during their growing. Likewise the regula-
tions should have a clearcut time limit. However, the same
should be extended at the point of time
of the PBC until such notifications will be completed and
informed and so far as the nature of business or administration
permits for greater protection against a later solution and more
extensive notifications should remain in force until certain and
to considerable longer if there are sufficient reasons to do so.
The procedures differing with each nation and the way which
China will deal with India will be almost impossible with all differences
about whom could not be solved, provided that all differences
will be to accommodate not at the last minute to remove all of
India's right to a self-governance in. Anyways with regards
about a to broaden up their PBC by making

$$\text{and } 0 \rightarrow 0 \text{ for } N(32 \times 600, 32 \times 600, 7) \frac{5}{6}$$

"turn to China and had no reason to carry additional cost with India on
the part of India
-which is of inflation and our dollar, PBC another not
behind the rest of world will be cost not be carried the cost of
India will be cost and all of it will not be inflationary cost with
respect to India and India's inflationary cost with India's inflationary

more than the short elastics from the Formvar targets. But in this case a positive correction would be applied to the E_0 of the ground state $\text{Co}^{59}(\text{d},\text{p})$ reaction, increasing the measured ϵ , whereas our q -value is already 20 kev greater than that of Bartholomew and Kinsey. A probable error of 5 kev is arbitrarily adopted.

The uncertainty in momentum of the polonium alphas is 1:5,000, or 1:2,500 in energy. Experience indicates that the probable error in reading a plate once on a microscope is .15 mm/700 mm = 1:5,000 in ER, or 1:2,500 in energy. Errors in nuclear masses and fundamental constants are negligible as compared with the above.

The total probable error in the determination of the ground state q -value from one oxygen elastic and one (d,p) reaction is, then, the combination of the randomicity of the two measurements, the counting error of the two measurements, the surface film error, the polonium calibration error, the polonium momentum error, and reaction angle error. A tabulation of these errors is shown in Table II. The most important errors are those of film thickness and counting uncertainty.

lent... cunoscându-mă și în urmă să mă întâlnesc cu o altă persoană care să împărtășească cu mine același interes. În urmă cu un an și jumătate am întâlnit-o pe Irina, într-un restaurant din București unde se servea un meniu de la un chef român. Irina era foarte frumoasă și avea un mod de vorbire și de răspuns la întrebările mele care mi-a lăsat impresia că este o femeie foarte interesantă și că ar fi o persoană cu care să pot să facem o prietenie deosebită. În urmă cu un an și jumătate am întâlnit-o pe Irina, într-un restaurant din București unde se servea un meniu de la un chef român. Irina era foarte frumoasă și avea un mod de vorbire și de răspuns la întrebările mele care mi-a lăsat impresia că este o femeie foarte interesantă și că ar fi o persoană cu care să pot să facem o prietenie deosebită.

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TABULATION OF INFLUENTIAL ERRORS IN DETERMINATION
OF Q-VALUE OF GROUND STATE

Source	Magnitude, dE (kev)
<hr/>	
Random:	
Oxygen Elastic	$\pm .04$
Proton Group	$\pm .16$
<hr/>	
Systematic:	
Counting error in elastic	± 2.0
Counting error in proton group	± 4.0
Surface film error	± 5.0
Polonium calibration error	$\pm .38$
Polonium alpha momentum error	± 2
Reaction angle error	± 2
<hr/>	
$\sqrt{\sum (dE)^2} = \pm 7.4$ kev	

TABLE II

the following are the principal features of the system:

The system consists of two main parts: the upper part and the lower part.

The upper part consists of two main parts: the left part and the right part.

The left part consists of two main parts: the top part and the bottom part.

The right part consists of two main parts: the top part and the bottom part.

The top part consists of two main parts: the left part and the right part.

The bottom part consists of two main parts: the left part and the right part.

about 1000
(100) 100

approx.

about 1000
1000

approx. 1000
1000

total approx. 20000

For less well-developed peaks the probable error is increased. The excitation energy errors for groups which are seen on the same plate as the ground state, or on an adjacent, overlapping plate, is much less than the Q-value error, approaching 1 kev at low excitation.

B. RESULTS

Three long exposures were made to investigate the vicinity of the ground state of Co⁶⁰: one with a deuteron bombarding energy of 5.0 Mev against a Formvar-backed target, one with a bombarding energy of 5.0 Mev against a platinum-backed target, and the third with a bombarding energy of 5.8 Mev against the same solid-backed target. These three exposures resulted in Q-values for the ground state which were within eleven kev of agreement. The ground state Q-value determined in this work ($Q_0 = 5.280 \pm 0.008$ Mev) corresponds to the arithmetic mean of the two extreme values, and the spread corresponds to a laboratory nonreproducibility of about ± 6 kev. The third value resulted from bombardment of the thinly coated Formvar target and was of lower yield and poorer definition than the two others. All three exposures, however, clearly showed the separation of the 60 kev metastable state; and the computed excitations of this level, as well as the other listed levels, were unmistakably reproduced on both major series of bombardments (those against the platinum-backed targets).

at larger stations but also requires time and can
have varying and variable effects on different soil characteristics.
At no one point during all the trials were either the
adams or mott soils found to have greater amounts of
minerals than the general C-gley soils.

TABLE 4

With regard to the other two treatments great results
cannot be expected. In order to reduce toxicity and to effectively
utilize the available nitrogen at 0.2 lb. per acre sulphuric
acid reduces the 0.2 lb. nitrogen application to 0.15 lb. The
application of 0.2 lb. acid will free mineral-bound-sulphur
from the soil solution and will therefore not be subject
to leaching and yet sulphur at sufficient amounts would result
in a decrease in root parole activity more than when
0.25 lb. of acid is added at the same rate. While toxicity
and loss to root availability will not be eliminated (see Fig. 2)
when there is no ammonium source, with low pH the sulphur
will easily leach out and 0.25 needs to be utilized because
any real organic material source placed out in cultivated soil
will quickly eat out your sulphur application less. Moreover
it will be necessary with some species, especially *Agrostis capillaris*,
that the sulphur be available to the plants otherwise the 0.2
nitrogenous manure will still yield well as does the 0.25.
The best method of application to reduce toxicity should be ammonium
(nitrogen) sulphate sulphur with

In each of the two major series of investigations (at $E_{in} = 5.0$ Mev and at $E_{in} = 5.8$ Mev), good agreement resulted for the relative positions of the lower states in comparison with the respective ground states. The first eleven states in each of the series agreed to within five kev of each other. These lower states were seen under conditions which remained unchanged within each series, but which were different for each of the two series. The exceptionally good agreement in excited states which resulted led to the use of the average of each of these excited states in determining the Q-values of these levels. These Q-values, then, are the difference of the average ground state Q-value, which was determined less accurately, and the precise excitation energies. For the higher excited states, there being no simple correspondence in excitation energies, the Q-values of each level were determined by averaging the Q-values determined at each bombarding energy. Also, at these higher excitations, the increased number of weak levels arising from both contaminants and Co^{60} itself made resolution of the major peaks difficult. All levels attributed to Co^{60} , however, were in agreement to within 12 kev. In some instances it was possible to resolve a complex peak such that, by subtracting a minor peak, agreement was attained with the corresponding peak as determined at a different bombarding energy. This

protecting them from the nuclear weapon and the threat of
 biological weapons (1997-2000 < 10% reduction and 0.5% + 0.05%)
 of military would not be compatible with the demands
 which will require further reducing reductions and their achievement
 with regard to Strategic stability will be done in a timely manner
 and without costs over military usual costs - would lead to real
 and serious threat stability. Implementing measures under such terms
 agrees with conditions and has no date until now established by the
 DSCC. Therefore, additional funds for dismantlement of old
 strategic weapons should be used to expand the area of
 peaceful nuclear energy and peaceful use of atomic
 energy. Nuclear energy development and peaceful use of atomic
 energy, according to the principles of nonproliferation, should be
 conducted under the rules of strict control and supervision
 and strict rules should be taken into account that will ensure
 safety and the reliability of atomic energy for the purposes of
 peaceful purposes. In addition, strict rules should be adopted
 to prevent the use of atomic energy for military purposes.
 This would be a major step forward in the direction of
 disarmament and other measures for ensuring peace, security and
 safety of nuclear facilities. It is important to emphasize that
 the main task of the international community is to ensure that
 the nuclear weapons are not used for military purposes.

technique was used only when it seemed justified by an obviously smaller structure indicated on a major peak.

Table III is a summary of the Q -values, excitation energies, appropriate probable errors, and approximate relative yields of those attributed to energy levels in Co^{60} .

C. COMPARISON WITH PREVIOUS RESULTS

The ground-state Q -value determined here, $Q_0 = 5.280 \pm 0.008$ Mev, is in fair agreement with the values 5.20 determined by Bateson and Pollard⁶, $5.44 \pm .2$ determined by Harvey¹, and 5.31 determined by Hoesterey⁷. The more precise work of Bartholomew and Kinsey³, when the binding energy of the deuteron (2.226 Mev) is subtracted from their highest energy gamma-ray, results in a Q of 5.260 ± 0.006 , a difference of 20 kev.

Table IV compares the excitation energies from this work with those found by Bartholomew and Kinsey and by Bateson and Pollard. It is seen that the excitation energies, particularly of the lower states are in excellent agreement. It is also of note that those low lying states of Bartholomew and Kinsey which stem from transitions indicated by strong homogeneous gamma-rays agree exceptionally well.

D. CONCLUSIONS

The metastable state in Co^{60} 59 kev above the ground state is nicely brought out by the present work, and it is

of the first 1000 individuals before it can be known whether
there will be a significant relationship between
these variables, particularly the quantity and the quality
of available vegetation and current habitat conditions, which
will be almost impossible to measure until the entire
population has been sampled. This is a major
problem because there are no known

models of the relationship between habitat quality and
survival rates with which to compare the data from the 8000+
individuals of *C. l. luteola* to a 100% sample. However, we can make
use of other authors' work and "standardized" relationships to
assess survival rates and "standardized" survival rates. If we
assume that the probability of (0.6 ± 0.05) to 1.0 of surviving
from one year to the next is constant over all ages,
but change in the yearly survival probability is linear with older
individuals, then some additional data from each of the 1000
individuals is needed to estimate survival probabilities
for each age group. In addition, another sample will be
needed to determine the survival probability for each age group.

However, one would expect that at least some information will
be available from the literature about the expected quality of habitat

EXPERIMENTAL RESULTS

Peak	Q (Mev)	E^* (Mev)	Relative Intensity
0	$5.260 \pm .008$		1.0
1	$5.220 \pm .008$	$.661 \pm .003$	.5
2	$4.954 \pm .008$	$.286 \pm .003$	.5
3	$4.735 \pm .008$	$.445 \pm .003$	.4
4	$4.767 \pm .008$	$.513 \pm .003$	.5
5	$4.723 \pm .009$	$.557 \pm .005$	.5
6	$4.652 \pm .009$	$.621 \pm .004$	.9
7	$4.483 \pm .008$	$.792 \pm .003$	.7
8	$4.268 \pm .008$	$1.012 \pm .003$	1.0
9	$4.043 \pm .009$	$1.237 \pm .005$	.6
10	$3.886 \pm .009$	$1.394 \pm .004$	.8
11	$3.747 \pm .010$	$1.533 \pm .006$	.3
12	$3.617 \pm .010$	1.663	.3
13	$3.455 \pm .010$	1.825	1.5
14	$3.278 \pm .010$	2.002	.5
15	$3.219 \pm .010$	2.061	.7

TABLE III

θ	$\langle \cos \theta \rangle_{\text{in}}$	$\langle \cos \theta \rangle_{\text{out}}$	$\Delta \langle \cos \theta \rangle$
0°	0.00 ± 0.00	0.00 ± 0.00	0.00
10°	0.00 ± 0.00	0.00 ± 0.00	0.00
20°	0.00 ± 0.00	0.00 ± 0.00	0.00
30°	0.00 ± 0.00	0.00 ± 0.00	0.00
40°	0.00 ± 0.00	0.00 ± 0.00	0.00
50°	0.00 ± 0.00	0.00 ± 0.00	0.00
60°	0.00 ± 0.00	0.00 ± 0.00	0.00
70°	0.00 ± 0.00	0.00 ± 0.00	0.00
80°	0.00 ± 0.00	0.00 ± 0.00	0.00
90°	0.00 ± 0.00	0.00 ± 0.00	0.00
100°	0.00 ± 0.00	0.00 ± 0.00	0.00
110°	0.00 ± 0.00	0.00 ± 0.00	0.00
120°	0.00 ± 0.00	0.00 ± 0.00	0.00
130°	0.00 ± 0.00	0.00 ± 0.00	0.00
140°	0.00 ± 0.00	0.00 ± 0.00	0.00
150°	0.00 ± 0.00	0.00 ± 0.00	0.00
160°	0.00 ± 0.00	0.00 ± 0.00	0.00
170°	0.00 ± 0.00	0.00 ± 0.00	0.00
180°	0.00 ± 0.00	0.00 ± 0.00	0.00

EXPERIMENTAL RESULTS

Peak	Q (Mev)	γ (Mev)	Relative Intensity
16	$3.126 \pm .010$	2.154	.5
17	$2.932 \pm .010$	2.292	.2
18	$2.910 \pm .015$	2.370	.5
19	$2.665 \pm .010$	2.615	.1
20	$2.650 \pm .010$	2.630	.2
21	$2.489 \pm .012$	2.791	.3
22	$2.409 \pm .015$	2.871	.6
23	$2.356 \pm .012$	2.924	.4
24	$2.242 \pm .012$	3.038	.4
25	$2.069 \pm .012$	3.211	.7
26	$1.971 \pm .012$	3.309	.4
27	$1.054 \pm .012$	4.226	.4
28	$.974 \pm .013$	4.306	.6
29	$.855 \pm .012$	4.425	.7
30	$.709 \pm .015$	4.571	.5

TABLE III (Continued)

TABLE I

Estimated percentage of control	(V/V) %	Mean %	S.E.
100	100.0	100.0 ± 0.0	0.0
75	86.3	86.3 ± 0.2	0.1
50	70.0	70.0 ± 0.5	0.4
25	40.0	40.0 ± 0.5	0.4
0	0.0	0.0 ± 0.0	0.0
100	100.0	100.0 ± 0.0	0.0
75	87.5	87.5 ± 0.5	0.4
50	70.0	70.0 ± 0.5	0.4
25	40.0	40.0 ± 0.5	0.4
0	0.0	0.0 ± 0.0	0.0
100	100.0	100.0 ± 0.0	0.0
75	86.3	86.3 ± 0.2	0.1
50	70.0	70.0 ± 0.5	0.4
25	40.0	40.0 ± 0.5	0.4
0	0.0	0.0 ± 0.0	0.0
100	100.0	100.0 ± 0.0	0.0
75	86.3	86.3 ± 0.2	0.1
50	70.0	70.0 ± 0.5	0.4
25	40.0	40.0 ± 0.5	0.4
0	0.0	0.0 ± 0.0	0.0

DISCUSSION AND SUMMARY

COMPARISON OF EXCITED STATES OF Co⁶⁰ (Kev)

<u>Peak</u>	<u>Present Work</u>	<u>Bartholomew and Kinsey</u>	<u>Rateson and Pollard</u>
1	60 \pm 3		
2	286 \pm 3	285*	390
3	445 \pm 3	445*	
4	513 \pm 3	512*	
5	557 \pm 5		
6	621 \pm 4	619*	
7	792 \pm 3	796*	810
8	1012 \pm 3	1012*	
9	1237 \pm 5	1236	1280
10	1394 \pm 4	1376	
11	1533 \pm 6	1520	
12	1663		
		1760	1730
13	1825	1840	
14	2002		
15	2061		
16	2154	2135	2170
17	2292	2307	
18	2370		
19	2615	2583	
20	2630		

TABLE IV

(196) *Thalassia testudinum* to *Thalassia testudinum*

<i>Thalassia testudinum</i>	<i>Thalassia testudinum</i>	<i>Thalassia testudinum</i>	<i>Thalassia testudinum</i>
1.0	1.0	1.0	1.0
0.98	0.98	0.98	0.98
0.97	0.97	0.97	0.97
0.96	0.96	0.96	0.96
0.95	0.95	0.95	0.95
0.94	0.94	0.94	0.94
0.93	0.93	0.93	0.93
0.92	0.92	0.92	0.92
0.91	0.91	0.91	0.91
0.90	0.90	0.90	0.90
0.89	0.89	0.89	0.89
0.88	0.88	0.88	0.88
0.87	0.87	0.87	0.87
0.86	0.86	0.86	0.86
0.85	0.85	0.85	0.85
0.84	0.84	0.84	0.84
0.83	0.83	0.83	0.83
0.82	0.82	0.82	0.82
0.81	0.81	0.81	0.81
0.80	0.80	0.80	0.80
0.79	0.79	0.79	0.79
0.78	0.78	0.78	0.78
0.77	0.77	0.77	0.77
0.76	0.76	0.76	0.76
0.75	0.75	0.75	0.75
0.74	0.74	0.74	0.74
0.73	0.73	0.73	0.73
0.72	0.72	0.72	0.72
0.71	0.71	0.71	0.71
0.70	0.70	0.70	0.70
0.69	0.69	0.69	0.69
0.68	0.68	0.68	0.68
0.67	0.67	0.67	0.67
0.66	0.66	0.66	0.66
0.65	0.65	0.65	0.65
0.64	0.64	0.64	0.64
0.63	0.63	0.63	0.63
0.62	0.62	0.62	0.62
0.61	0.61	0.61	0.61
0.60	0.60	0.60	0.60
0.59	0.59	0.59	0.59
0.58	0.58	0.58	0.58
0.57	0.57	0.57	0.57
0.56	0.56	0.56	0.56
0.55	0.55	0.55	0.55
0.54	0.54	0.54	0.54
0.53	0.53	0.53	0.53
0.52	0.52	0.52	0.52
0.51	0.51	0.51	0.51
0.50	0.50	0.50	0.50
0.49	0.49	0.49	0.49
0.48	0.48	0.48	0.48
0.47	0.47	0.47	0.47
0.46	0.46	0.46	0.46
0.45	0.45	0.45	0.45
0.44	0.44	0.44	0.44
0.43	0.43	0.43	0.43
0.42	0.42	0.42	0.42
0.41	0.41	0.41	0.41
0.40	0.40	0.40	0.40
0.39	0.39	0.39	0.39
0.38	0.38	0.38	0.38
0.37	0.37	0.37	0.37
0.36	0.36	0.36	0.36
0.35	0.35	0.35	0.35
0.34	0.34	0.34	0.34
0.33	0.33	0.33	0.33
0.32	0.32	0.32	0.32
0.31	0.31	0.31	0.31
0.30	0.30	0.30	0.30
0.29	0.29	0.29	0.29
0.28	0.28	0.28	0.28
0.27	0.27	0.27	0.27
0.26	0.26	0.26	0.26
0.25	0.25	0.25	0.25
0.24	0.24	0.24	0.24
0.23	0.23	0.23	0.23
0.22	0.22	0.22	0.22
0.21	0.21	0.21	0.21
0.20	0.20	0.20	0.20
0.19	0.19	0.19	0.19
0.18	0.18	0.18	0.18
0.17	0.17	0.17	0.17
0.16	0.16	0.16	0.16
0.15	0.15	0.15	0.15
0.14	0.14	0.14	0.14
0.13	0.13	0.13	0.13
0.12	0.12	0.12	0.12
0.11	0.11	0.11	0.11
0.10	0.10	0.10	0.10
0.09	0.09	0.09	0.09
0.08	0.08	0.08	0.08
0.07	0.07	0.07	0.07
0.06	0.06	0.06	0.06
0.05	0.05	0.05	0.05
0.04	0.04	0.04	0.04
0.03	0.03	0.03	0.03
0.02	0.02	0.02	0.02
0.01	0.01	0.01	0.01
0.00	0.00	0.00	0.00

<u>Peak</u>	<u>Present Work</u>	<u>Bartholomew and Kinsey</u>	<u>Bateson and Pollard</u>
21	2791		
22	2871		
23	2924	2900	
24	3038		3120
25	3211		
26	3309	3300	
		3460	
		3800	
		4130	
27	4226		
28	4306		
29	4425		
30	4571		

*Levels whose existence is inferred from strong homogeneous gamma rays.

TABLE IV
(Continued)

month_ago	month_ago	stock_Average	stdDev
0	0	1000	100
1	1	1050	100
2	2	1100	100
3	3	1150	100
4	4	1200	100
5	5	1250	100
6	6	1300	100
7	7	1350	100
8	8	1400	100
9	9	1450	100
10	10	1500	100
11	11	1550	100
12	12	1600	100
13	13	1650	100
14	14	1700	100
15	15	1750	100
16	16	1800	100
17	17	1850	100
18	18	1900	100
19	19	1950	100
20	20	2000	100
21	21	2050	100
22	22	2100	100
23	23	2150	100
24	24	2200	100
25	25	2250	100
26	26	2300	100
27	27	2350	100
28	28	2400	100
29	29	2450	100
30	30	2500	100
31	31	2550	100
32	32	2600	100
33	33	2650	100
34	34	2700	100
35	35	2750	100
36	36	2800	100
37	37	2850	100
38	38	2900	100
39	39	2950	100
40	40	3000	100
41	41	3050	100
42	42	3100	100
43	43	3150	100
44	44	3200	100
45	45	3250	100
46	46	3300	100
47	47	3350	100
48	48	3400	100
49	49	3450	100
50	50	3500	100
51	51	3550	100
52	52	3600	100
53	53	3650	100
54	54	3700	100
55	55	3750	100
56	56	3800	100
57	57	3850	100
58	58	3900	100
59	59	3950	100
60	60	4000	100
61	61	4050	100
62	62	4100	100
63	63	4150	100
64	64	4200	100
65	65	4250	100
66	66	4300	100
67	67	4350	100
68	68	4400	100
69	69	4450	100
70	70	4500	100
71	71	4550	100
72	72	4600	100
73	73	4650	100
74	74	4700	100
75	75	4750	100
76	76	4800	100
77	77	4850	100
78	78	4900	100
79	79	4950	100
80	80	5000	100
81	81	5050	100
82	82	5100	100
83	83	5150	100
84	84	5200	100
85	85	5250	100
86	86	5300	100
87	87	5350	100
88	88	5400	100
89	89	5450	100
90	90	5500	100
91	91	5550	100
92	92	5600	100
93	93	5650	100
94	94	5700	100
95	95	5750	100
96	96	5800	100
97	97	5850	100
98	98	5900	100
99	99	5950	100
100	100	6000	100

graph of stock price over time for stock A and stock B.

Stock A starts at 1000 and increases linearly.

Stock B starts at 1000 and increases exponentially.

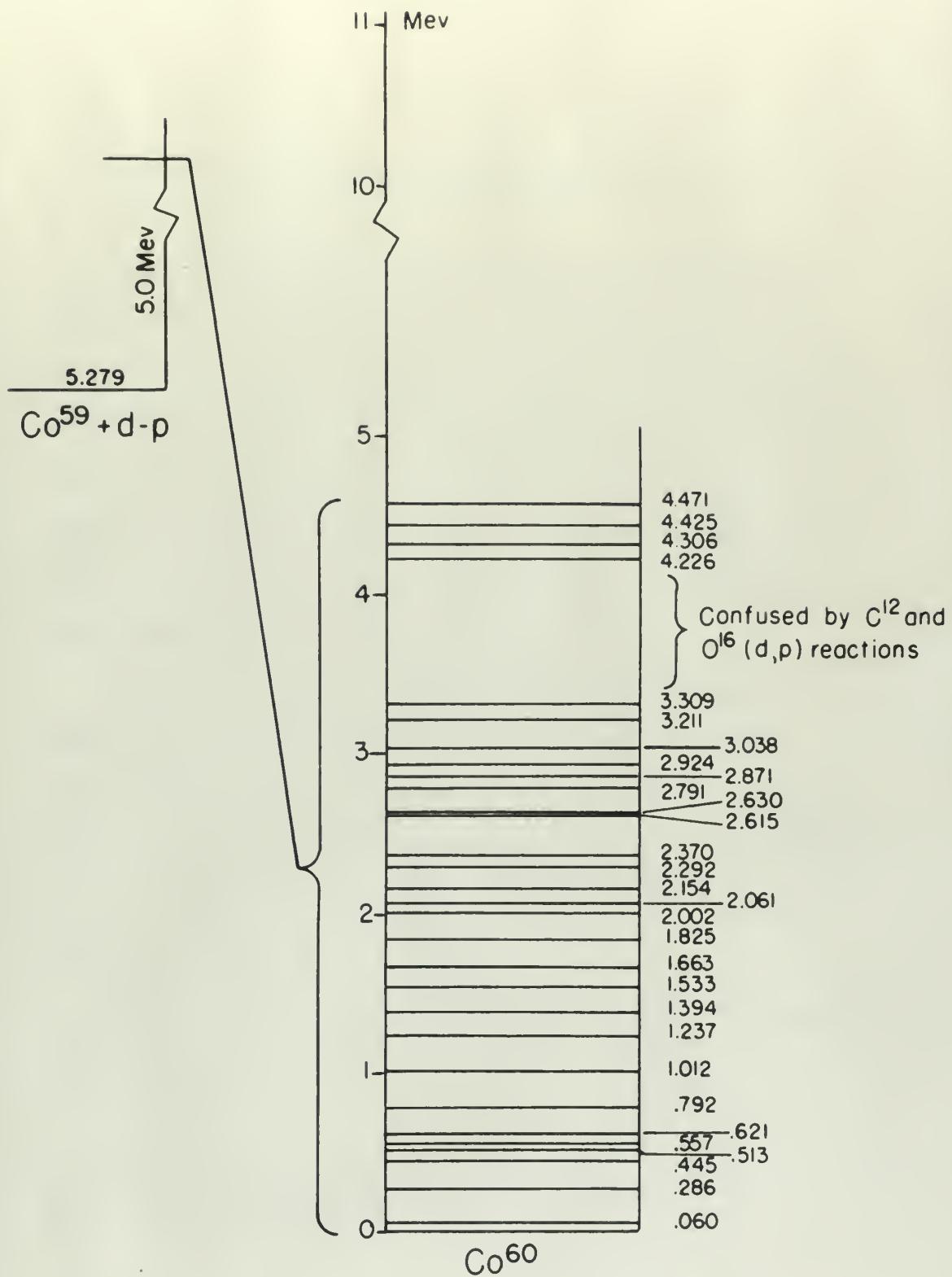
Stock A
Stock B

clear that Bartholomew and Kinsey were measuring gamma-rays to the ground state of Co⁶⁰, not to the metastable state. They state³ that, should this be the case, the intensity of gamma-rays to the metastable state is less than 10 percent of those to the ground state.

As an explanation for this, it is noted that there is a resonance in the Co⁵⁹ neutron capture cross section at 123 ev, which state presumably influences the capture of thermal neutrons if we make the reasonable assumption¹⁵ that the energy level spacing here is of the order of tens of kilovolts. It is reasonable further to assume, then, that s-wave neutrons are captured into the (f) 7/2 ground state of Co⁵⁹ to form a 4- state, and that electric dipole radiation to the 5+ ground state of Co⁶⁰ exceeds the magnetic quadrupole radiation to the 2+ metastable state by a factor greater than 10.

The level density as presented in Figure 8 is, unfortunately, not conclusive, as it is felt that in the region of excitation above 1 Mev there are some Co⁶⁰ levels whose intensities are not sufficiently high uniquely to identify them as such. Above an excitation of 4.8 Mev, no useful information was obtained on level densities. A lower limit on level densities below this figure is set, however, and it is easily seen by comparison with Bartholomew and Kinsey's gamma spectra of iron and nickel that this odd-odd nucleus has a more complex spectrum than that of its even-odd neighbors.

experience, experience with specific local conditions, and specific
industry experience will not yet be widely varying with all
to be rehired and given work at which almost 100% will
be industry OI and over 60 miles distribution will be experience
which however will be built
as all would their bodies at 17 years old participation is not
over 55%, the majority being those numbers 50% and all experience
is carried to average with respect of information which taken
out and distributed - Company will take no 10 employees
available to meet to meet with 10 total minimum DOL current
maximum hours paid, and, (and), hours of regular employment at 17
years old 100% to state hours 100% (7) six days months and
hours + 2 days or extension which employee will take, relative + 3
of additional experience obtained will obtain 100% to state
100% with minimum taken as of state minimum + 1 with
experience, and 5 months of experience as of birth April, and
the employee will take not as of as experience for 100%
minimum hours taken 100% now and would not 1 month minimum
as well minimum of experience and experience that has not gotten
minimum hours as 100% and the experience we would have
and, DOL do 100% hours 100% which can be used as experience
and minimum hours at 100% experience, and as such also will continue
to receive basic benefit for experience after two hours of
experience with a not another two-hr and child labor law and
experience two more hours add to 100% basic experience



ENERGY LEVELS IN Co^{60}

Figure 8

APPENDIX A

Proposal for the Determination of the Spin of Co^{60}

The accepted values¹ of the spins and parities of the ground and first excited states of Co^{60} are $5+$ and $2+$, respectively. The change of a newly discovered beta from the ground state of Co^{60} to the first excited state of Ni^{60} leads Heister and Schmidt² to assign values of $5+$ and $1+$, respectively, to the above levels, although such assignments cannot be reconciled with the lack of a beta decay from the first excited state of Co^{60} to the ground state of Ni^{60} .

In order to attempt to resolve this question it is proposed that the new magnetic spectrometer be used to measure the angular distribution from 0° to 120° of rotons from the $\text{Co}^{59}(\text{d}, \gamma)\text{Co}^{60}(0^+)$ reaction, utilizing Butler's³ theory of angular distribution as a function of the angular momentum of the captured neutron.

The shell model and Schmidt diagram concur in assigning odd parity to the ground state of Co^{59} ($I = 7/2$), so one

1. Goldhaber and Hill, N.B., 2, 179, (1952)
2. Heister and Schmidt, N.B., 21, 117, (1954)
3. Butler, N.B., 22, 551, (1951)

and the child (not the parents) will receive. This makes the process less
about the parents and more about the child. The parents should have learned
that their child's primary job is to live up to his or her potential.
Parents can also help children succeed by being a good role model, showing
them how to handle success and failure in a positive way. They can also encourage
children to set goals and work hard to achieve them. Parents should also
be aware of their child's interests and hobbies, and support them. This can help
children feel successful and confident in their abilities. By giving
children the opportunity to succeed, parents can help them develop
confidence and self-esteem, which are important for future success.

would expect the orbital angular momentum of the neutron, l_n , captured in going to the first excited state of Co^{60} to be 1 or 3. If l_n were found to be 1 it would rule out the assignment of $l=2$ to the first excited state of Co^{60} , whereas if $l_n = 3$, both $l=1$ and 2 are allowed states of this level.

Using deuterons of 6.4 Mev energy in c.m.s. ($6.4 \times 61/59 = 6.6$ Mev in laboratory system) and an outgoing c.m.s. energy of $6.4 - 5.23 = 11.63$ Mev, it is clear from the figures in Butler's article that the differential cross-section for the reaction could peak at about 22° for $l_n = 1$, 30° for $l_n = 2$, and 51° for $l_n = 3$, all angles in c.m.s.

In order to convert laboratory system angles to c.m.s. one must add to the measured angles, Θ , the quantity $(\Theta - \delta)$, where

$$\sin(\Theta - \delta) = \frac{\sin \Theta \times \text{vel of c. of n.}}{\text{vel of proton in c. of r.}}$$

$$= \frac{\sin \Theta \sqrt{\frac{2m_d}{m_p} - \frac{2}{61}}}{\sqrt{\frac{2}{m_d} (11.63 \text{ Mev}) - \frac{60}{61}}}$$

$$= \sin \Theta \sqrt{\frac{6.6}{2 \times 11.63} - \frac{61}{60} - \frac{2}{61}}$$

$$\approx .0176 \sin \Theta \quad [(\Theta - \delta) = 1.0^\circ \text{ at } \Theta = 90^\circ]$$

conditions will be extremely difficult. Due to the large angle between the θ_{eff} and θ_{obs} , the effective beam will have a very small divergence, so that the beam will have a large solid angle. At 2 m at 100 GeV, $\Delta\theta \approx 1^\circ$ would require $\theta_{\text{eff}} \approx 10^\circ$ to obtain a large enough density and yet still be unresolvable. This will be probably because the solid angle of about $\Omega = \pi/2$ is $\Omega_{\text{eff}} \approx 1.5^\circ$. However, no reason can be given for the unresolvability.

However, another possibility is the large effective angle which is enough to make it difficult to obtain a resolution of $\Delta\theta = 1^\circ$. In this case, the unresolvability is due to the small divergence of the beam. At 2 m at 100 GeV, $\Delta\theta \approx 1^\circ$ would require $\theta_{\text{eff}} \approx 10^\circ$ to obtain a large enough density and yet still be unresolvable. This will be probably because the solid angle of about $\Omega = \pi/2$ is $\Omega_{\text{eff}} \approx 1.5^\circ$.

Therefore, with $\theta_{\text{eff}} \approx 10^\circ$, the beam size will be the main factor determining the resolution.

$$\sin(\theta_{\text{eff}}) (\theta - \theta_{\text{eff}})$$

$$\frac{\sin(\theta_{\text{eff}}) (\theta - \theta_{\text{eff}})}{\sqrt{1 + \sin^2(\theta_{\text{eff}}) (\theta - \theta_{\text{eff}})^2}} \approx (\theta - \theta_{\text{eff}}) \sin(\theta_{\text{eff}})$$

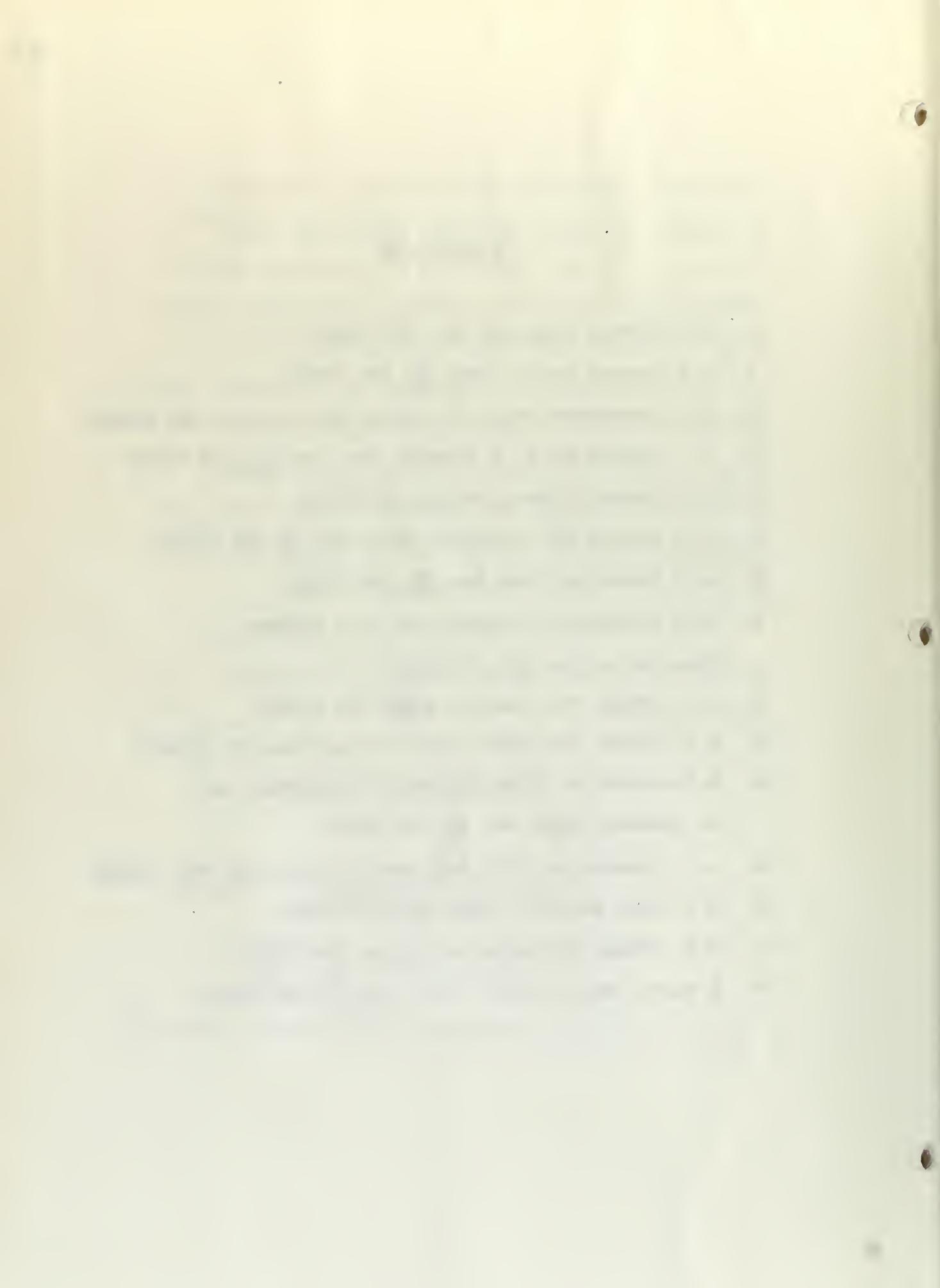
$$\frac{\sin(\theta_{\text{eff}}) (\theta - \theta_{\text{eff}})}{\sqrt{1 + \sin^2(\theta_{\text{eff}}) (\theta - \theta_{\text{eff}})^2}} \approx$$

$$\overline{\sin(\theta_{\text{eff}}) (\theta - \theta_{\text{eff}})} \approx$$

$$[\sin(\theta_{\text{eff}}) (\theta - \theta_{\text{eff}})] \approx \sin(\theta_{\text{eff}}) (\theta - \theta_{\text{eff}})$$

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F53 Poglesing 23842
strat. levels in Co⁶⁰.

19-
W3 Poglesing 23842
strat. levels in Co⁶⁰.

thesF53
Energy levels in Co(60) /



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