PUBLICATIONS

OF THE

WASHBURN OBSERVATORY

OF THE

UNIVERSITY OF WISCONSIN

VOL. XIII, PART I

MERIDIAN OBSERVATIONS FOR STELLAR PARALLAX

Second Series, 1898-1905

BY ALBERT S. FLINT
ASTRONOMER

MADISON, WISCONSIN
DEMOCRAT PRINTING COMPANY, STATE PRINTER
1919

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Vol. XIII   Part I   (1898-1905)

Wasbburn Observatory undecided about whether or not there will be more parts to this volume

Mr. Bumstead, U. C. Library, suggests binding this part; and rebinding with other parts if they are published later.

N.M.

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The Washburn Observatory

FOUNDED BY

Cadwallader C. Washburn

Born 1818; Died 1882.

CONTENTS.

PUBLICATIONS OF THE WASHBURN OBSERVATORY

April, 1928

Vols. I–XII, 1882–1908; Complete.

XIII, Part 1, 1919; Part 2 in preparation.

XIV, Parts 1, 2, 1922–1926; Complete.

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1. INTRODUCTION.

The observations whose constants and results for stellar parallax are presented in the present volume were conducted by the method of meridian transits, and are similar to those which were published in Vol. XI of the Publications of the Washburn Observatory except for a few changes in the conditions, the most important of which was the introduction of the registering transit micrometer. They were undertaken primarily to determine the annual parallax of stars of the second magnitude; but other stars were added to the list where the time intervals allowed.

The data of the individual observations are omitted here as a measure of economy. But they are given for the first star of the list, as an example, and for α Ursae Minoris because of its high declination and because its reduction differs somewhat from that of the remaining stars of the list.

The complete list of stars and the series of parallax results, together with a comparison of the latter *inter se* were published in the *Astronomical Journal,* Nos. 631 and 636. An extensive comparison of the present results for stellar parallax with the several larger series of similar results that have appeared from different observatories of the world was published in the same journal, No. 696.

The making of all the observations, the reading of most of the chronograph sheets, and the recording of the readings from the remainder, the inspection of all data in the observing books, the entering of these data on the reduction sheets, and all the solutions after the normal equations were formed, were done by myself.

Twelve assistants were employed in the course of the computations, undergraduate and graduate students of the university or clerical assistants in the observatory. Special mention for continued and intelligent service should be made of Messrs. A. G. Worthing, Joel Stebbins, Willibald Weniger, Samuel R. Hatch, and of Miss Winifred Hatch, and my daughter, Miss Helen Flint.

2. SELECTION OF STARS FOR OBSERVATION.

The list of stars observed extends from —35° in declination to the pole and was made, with regard to these limits, as follows:

1. All stars from 1.5 to 2.5 in magnitude, except β Cassiopeiae, $0^h\ 3^m$, which was in the previous list, Vol. XI, and was omitted from the present list in favor of α Andromedae. These stars are thirty-nine in number, while the number of stars in the entire heavens between these limits of magnitude is sixty-two.

2. Over twenty stars between magnitudes 2.5 and 3, from the list of standard stars of the British Nautical Almanac for 1900, which list includes all stars of magnitude 3.5 or brighter.
3. Certain stars of larger proper motion not previously observed.
4. Double stars of considerable proper motion, from a manuscript list sent by Professor S. W. Burnham.
5. Certain stars from Professor T. J. J. See's list of binaries, for which list orbits had been computed by him.
6. A few miscellaneous stars from the list of Vol. XI which were inadequately observed in that series or which attracted special interest.

The comparison stars were selected from the Bonner Durchmusterung and the Argentine General Catalogue. Each parallax star, in general, was observed with two comparison stars. The selection of the latter was made chiefly with reference to securing stars as near the standard magnitude 7.0 as possible, at least between the limits 6.5 and 8, with due regard to symmetry of position. The list of comparison stars was compared with the Cincinnati Catalogue of Proper Motion Stars, 1900.0, and with catalogues of double stars in order to avoid stars unsuitable in the respects thus indicated.

The entire list of stars observed is given in Table VII, where the parallax stars alone have serial numbers printed in the first column. These numbers are the same as those given in the first publication of results, *Astronomical Journal,* No. 631, and are printed here in heavier type. References in the present text to parallax stars and to comparison stars, are made by means of the serial numbers of the entire list. These numbers are printed in the second column of Tables VII, VIII, and X.

3. METHOD OF OBSERVATION.

The instrument employed was the Repsold meridian circle of 12.2 cm. aperture with ocular giving a power of 180 diameters and fitted with the Repsold registering transit micrometer. This was the first regular series of observations at this observatory in which this form of micrometer was employed; but a description of it is given in Vol. XII, page 242. The adopted value of one revolution of the screw was $6^s.2923 \pm 0^s.00045$, determined from 19 transits of stars of different declinations from 0° to 78°, observed in March, 1901 and February, 1903. An incidental determination of possible corrections to this value, will be found in the explanations of the observations on α Ursae Minoris. One revolution of the turning heads makes three revolutions of the screw or $18^s.9$ at the equator. There are three movable threads of which two form a pair distant apart by about 11″, while the third is distant about 30″ from the middle of the pair. Five fixed vertical threads serve to define the portions of the field.

The pointing on the star images was made by maintaining the bisection of the space between the close pair of threads. Although this method is presumably more liable to systematic error in series of observations for star positions, it seemed advisable to adopt it in the present work, inasmuch as a large portion of the observations would be made in the twilight and because a fainter star, of 8.0 magnitude or fainter, is completely hidden behind a single thread. Preliminary observations indicated that the probable error of a single chronograph signal, on brighter stars, was the same for either method of maintaining bisection. Certain of the stars observed are pairs of greater or less width. The closer pairs of stars were observed in the middle of the space between the threads; but if the components fell each near one of the pairs of threads, the pointing was made by maintaining the space between one star image and its nearer thread equal to the space between the other star image and the other thread. The former cases are distinguished in the list by the abbreviation *med.*, the latter by the word "pair."

Two methods of reducing the apparent magnitudes of the brighter stars were available. The old brass wire screens which are described in Vol. XI, page 2, and which are entirely separate from the instrument, were still in service; and the new slat screen, designed by Professor Comstock, and first described in the *Astronomical Journal*, No. 470, had been fitted to the object end of the telescope, Oct. 9, 1898.

The purpose of the latter device was to provide something which should be attached to the telescope and so be made equally applicable at all zenith distances and which should allow the observer to make a gradual diminution of apparent magnitude. A rectangular frame of aluminum clamped to the objective end of the telescope holds a series of five parallel slats before the object glass, each 25 mm. wide, and so placed that when they lie in one plane they completely cover the objective. Each slat rotates about its longitudinal axis, and all are made to open at exactly the same angle by means of a connecting rod at each side of the frame joined to the series of axes. Since there is no occasion to turn the slats through an angle of more than 90°, there is always a good leverage for turning the slats and no possibility of a dead point. The middle slat has a pulley attached to its axis, over which a wire cord passes to a second pulley secured to the telescope tube near the eye end. Each branch of the cord contains a coil spring to equalize the tension. The weight of the entire slat apparatus is 27 oz. (0.76 kg.). When the slats are wide open there is no appreciable deterioration of the star images, and with very bright stars the interference pattern appears as a row of minute sharp stellar points 4″.5 apart, extending to either side of the stellar image in a line at right angles to the direction of the slats. The diminution of light also is insensible. The thickness of each slat is one millimeter or less and the computed reduction in stellar magnitude is less than 0.005. As the slats are turned the interference images at first become brighter and the line extends rapidly in a series of spectral images, while the central group remain in appearance as stellar points. As employed in the present work the slats were set perpendicular to the meridian so that the line of interference images was in line with the meridian. The attention of the observer while maintaining bisection in right ascension was kept upon the middle group of three or five images. A comparison of the transits of a number of faint stars observed with the slats wide open and of bright stars with the slats partly closed, shows no difference in the probable error of a single chronograph signal.

The old wire screens, I and II, were employed on certain of the bright stars of the list and the slat screen on the remainder of the bright stars as indicated in Table VII. The reduction of apparent magnitude by means of the former may be adopted as 2.5 and 5.0 respectively. With the slat screen the standard apparent magnitude was 7.0 as far as practicable.

Care was taken to keep the instrument in as free a condition as possible as a transit instrument. The clamp arm was detached from the pier and allowed to swing with the telescope so that the latter rested only on the friction rollers and the pivots. The pivots and bearings were examined and cleaned and oiled at intervals of one or two months, according to the weather. The instrument remained Circle East throughout the series of observations. The chronograph was the same as mentioned in the previous volumes of this observatory. A space of 18 mm. to 19 mm. represented an interval of one second of time.

The purpose was to secure about sixty observations on each parallax set, but to avoid observing on nights when the condition of the star images was decidedly inferior. The observations on each set of stars were to begin and end with the same phase of the parallax with the aim to eliminate all unknown terms which progress with the time. This was expected to require the observation of each parallax set through at least five periods of maximum parallax, which would occupy nearly four years to complete the observations on the entire list; but, owing to unfavorable weather and other causes, additional time was required, and the observations actually extended from July 15, 1898 to March 10, 1905. While the observations on some nights towards the close were made for the sake of deficient sets of stars, the intervals of time were occupied in securing further observations on other parallax sets for which such additional data seemed not undesirable. Thus some of the stars have many more observations than was intended in the original program.

4. METHOD OF REDUCTION.

The reduction of the observations consisted in principle of a comparison of the observed time of transit of the parallax star across the true meridian with the mean of the corresponding times for the two comparison stars. The observations belonging to each parallax star were subjected to a solution by the method of least squares, in which three unknowns were involved—the correction to the assumed difference of right ascension, the correction to the assumed difference of proper motion, and the parallax assumed to pertain to the middle star alone. Since a number of symbols will appear in the detailed publication of these observations, it seems advisable to make here a complete presentation of the formulae and symbols employed. Without these at hand the computer and the reader are liable to error, especially in the algebraic sign, and this most of all in connection with the proper motion and the precession. The constants and factors of the several terms of the equations will be taken in such sense that all terms that enter into the computations of the absolute terms of the observation equations shall have the positive sign in the formulae, while the parallax and proper motion terms will be retained in their conventional sense. It will be convenient to present first the formulae employed in the case where a parallax star is observed or reduced with only one comparison star; in the complete work there were a number of such cases.

Let α_1 and δ_1 denote respectively the right ascension and declination of a comparison star, whether preceding or following, and α_2 and δ_2 denote the corresponding coordinates for the parallax star. Also let these positions be for the selected epoch 1900.0. Then we have

$$\alpha_1 = T_1 + e_1 + \Delta T_1 + m + c'''.\sec\delta_1 + n.\tan\delta_1 + \Delta\alpha_1 + (1900.0 - t)\ (\mu_1 + \Delta\mu_1) - P_1\pi_1,$$
$$\alpha_2 = T_2 + e_2 + \Delta T_2 + m + c'''.\sec\delta_2 + n.\tan\delta_2 + \Delta\alpha_2 + (1900.0 - t)\ (\mu_2 + \Delta\mu_2) - P_2\pi_2;$$

where the significations of the symbols employed in the right-hand members of the equation are as follows:—

T_1 = the mean of the chronograph times read on the comparison star;
e_1 = the correction to T_1 due to unknown errors;
ΔT_1 = the clock correction at the time T_1;
m and n = Bessel's constants, defining the position of the rotation axis;
c''' = the equatorial interval from the mean of the adopted series of contacts on the micrometer to the standard position 7.05 revolutions, combined with the collimation (including the constant of diurnal abberation for the latitude of the station), and the contact correction of the micrometer;
$\Delta\alpha_1$ = the reduction to 1900.0 for the comparison star on account of precession and nutation;
t = the epoch of the observation;
μ_1 = the assumed proper motion of the comparison star in right ascension;
$\Delta\mu_1$ = the unknown correction to μ_1;
P_1 = the parallax coefficient of the comparison star at the time of observation;
π_1 = the unknown parallax of the comparison star in seconds of arc;

and where the symbols denote the corresponding quantities for the parallax star when the suffix 1 is replaced by 2.

If we put

r = the clock rate,	$\tau = t - 1900.0,$
$\Delta_1 \sec\delta = \sec\delta_2 - \sec\delta_1,$	$P_1 = P_2 = P,$
$\Delta_1 \tan\delta = \tan\delta_2 - \tan\delta_1,$	$\pi_1 = o,$
	$\pi_2 = \pi,$

and subtract the equation for α_1 from that for α_2 we have

$$\alpha_2 - \alpha_1 = (T_2 - T_1) + (e_2 - e_1) + r\ (\alpha_2 - \alpha_1) + c'''.\Delta_1 \sec\delta + n.\Delta_1 \tan\delta + (\Delta\alpha_2 - \Delta\alpha_1)$$
$$+ \tau\ (\mu_1 - \mu_2) + \tau\ (\Delta\mu_1 - \Delta\mu_2) - P\pi.$$

If we put

u = the sum of all the terms of the second member of the equation for $\alpha_2 - \alpha_1$, except the second and the last two,
u_0 = an assumed value for $\alpha_2 - \alpha_1$, for the epoch 1900.0,
$d_1(\Delta\alpha)$ = the correction to u_0 required to produce the true value,
$d_1(\Delta\mu) = \Delta\mu_2 - \Delta\mu_1,$
$v'_1 = e_2 - e_1,$

we may write

$$a_2 - a_1 = u_0 + d_1 (\Delta a);$$

and substituting in the equation for $a_2 - a_1$, we have

$$d_1 (\Delta a) + \tau . d_1 (\Delta \mu) + P\pi + (u_0 - u) = v'_1 .$$

Assuming that the comparison stars have no sensible parallax, we have for the parallax coefficient

$$P = {}^1/_{15} R\, k \sin (L - K) \sec \delta_2 ;$$

where

R = the radius vector of the earth at the time of observation;
L = the longitude of the sun at the time of observation;

and k and K are determined by the equations

$$k \sin K = \sin a_2 ,$$
$$k \cos K = \cos a_2 \cos \epsilon,$$

in which ϵ is the inclination of the ecliptic, 23° 27′ 8″ for 1900.0.

We may put $R = 1$ without sensible error and, employing conventional symbols, we may write for the observation equation,

$$x' + \tau y' + \sin (L - K)\, P' z' + n'_1 = v'_1$$

where we have

$$P' = k/15 . \sec \delta_2$$
$$z' = \pi ;$$

and where the significations of the remaining symbols are apparent by comparison of this form of the equation, term by term, with the preceding equation in $d_1(\Delta a)$, $d_1(\Delta \mu)$, and π.

The absolute terms n'_1 were computed to three decimal places, except for a few stars of high declination for which two places were ample, while two decimal places were sufficient for the coefficients τ and sin $(L - K)$ in the solutions of the equations for the values of the unknowns. The form of the observation equation, therefore, was better adapted to the solution by writing

$$10x' + \tau\, 10y' + \sin (L - K)\, 10P' z' + 10n'_1 = 10v'_1$$

or

$$x + \tau y + \sin (L - K)\, z + n_1 = v_1 .$$

Consequently we have, for the results of a solution,

$d_1 (\Delta a) = {}^1/_{10}\, x$, in seconds of time,
$d_1 (\Delta \mu) = {}^1/_{10}\, y$, in seconds of time,

$$\pi = \frac{1}{10P'}\, z = \frac{3}{2}\,\frac{\cos\delta_2}{k}\, z, \text{ in seconds of arc.}$$

But, since the observations were liable to be assigned different weights, each observation equation is to be multiplied by the square root of its weight, and we have

$$\sqrt{p}.x + \sqrt{p}.\tau y + \sqrt{p}.\sin(L-K)\,z + \sqrt{p}.n_1 = \sqrt{p}.v_1;$$

or

$$ax + by + cz + n = v,$$

in which form the equations were solved by the method of least squares.

When the observations of the parallax star and both comparison stars were reduced in one solution, as was done in the first instance for the entire list, the data of one observation of all three stars were combined in a single equation. If we substitute the suffix 3 for the suffix 1 in the equation for $a_2 - a_1$, except in the fourth and fifth terms of the right-hand member, we shall have the corresponding equation for the difference in right ascension between the parallax star and the other comparison star:—

$$a_2 - a_3 = (T_2 - T_3) + (e_2 - e_3) + r\,(a_2 - a_3) + c'''.\Delta_2 \sec\delta + n.\Delta_2 \tan\delta + (\Delta a_2 - \Delta a_3) + \tau\,(\mu_3 - \mu_2) + \tau\,(\Delta\mu_3 - \Delta\mu_2) - P\pi;$$

where the symbols with the suffix 2 are employed in the fourth and fifth terms of the right-hand member to indicate the corresponding difference for the second comparison star.

Adding the equations for $a_2 - a_1$, and $a_2 - a_3$ we may write

$$2a_2 - (a_1 + a_3) = DT + De + r.Da + c'''.D\sec\delta + n.D\tan\delta + D\,\Delta a + \tau.D\mu + \tau D.\Delta\mu - 2P\pi.$$

In the right-hand member of this equation the symbol D in the several terms indicates the combination of the corresponding quantities for the three stars in the same sense as in the left hand member. Thus we have

$$DT = 2T_2 - (T_1 + T_3), \text{ or } DT = (T_2 - T_1) - (T_3 - T_2),$$

as computed in the observing books,

$$De = 2e_2 - (e_1 + e_3),$$

and so on; except that we have

$$D\mu = (\mu_1 + \mu_3) - 2\mu_2,$$
$$D.\Delta\mu = (\Delta\mu_1 + \Delta\mu_3) - 2\Delta\mu_2.$$

In certain cases all three stars of a parallax set are not observed in the same positions of the micrometer. In such cases we must distinguish between c_1''' and c_2''', for the pair of first and second stars and for the pair of second and third stars respectively, and also write

$$DT = (T_2 - T_1) - (T_3 - T_2');$$

where T_2 and T_2' indicate the means of the observed times on the parallax star corresponding to the means for the first and second comparison stars respectively.

If we put

u = the sum of all the terms of the right-hand member of the equation for $2a_2 - (a_1 + a_3)$ except the second and the last two,
u_0 = an assumed value for $2a_2 - (a_1 + a_3)$, for the epoch 1900.0,
$d\,(D\alpha)$ = the correction to u_0 required to produce the true value,
$d\,(D\mu) = -D.\Delta\mu = 2\Delta\mu_2 - (\Delta\mu_1 + \Delta\mu_3)$,
$v_1' = De$,

we may write

$$2a_2 - (a_1 + a_3) = u_0 + d\,(D\alpha);$$

and, substituting in the equation for $2a_2 - (a_1 + a_3)$, we have

$$d\,(D\alpha) + r.d\,(D\mu) + 2P\pi + (u_0 - u) = v'_1.$$

Employing conventional symbols, as in the equation for $a_2 - a_1$, we may write

$$x' + ry' + \sin\,(L - K)\;2P'\,z' + n'_1 = v'_1,$$

where we have

$$z' = \pi,$$
$$P' = k/15.\sec\delta_2$$

and where the significations of the remaining symbols are apparent by comparison, term by term, with the preceding form of the equation.

Multiplying through by 10 and dropping the accents, we have

$$x + ry + \sin\,(L - K)\,z + n_1 = v_1.$$

Consequently we have for the results of a solution

$d\,(D\alpha) = d_1\,(\Delta\alpha) + d_2\,(\Delta\alpha) = {}^1/_{10}\,x$, in seconds of time,
$d\,(D\mu) = d_1\,(\Delta\mu) + d_2\,(\Delta\mu) = {}^1/_{10}\,y$, in seconds of time,

$$\pi = \frac{1}{20P'}z = \frac{3}{4}\cdot\frac{\cos\delta_0}{k}\,.\,z,\ \text{in seconds of arc.}$$

Multiplying the observation equation by the square root of the weight, we have

$$\sqrt{p}.x + \sqrt{p}.ry + \sqrt{p}.\sin\,(L - K)z + \sqrt{p}.n_1 = \sqrt{p}.v_1,$$

or

$$ax + by + cz + n = v;$$

in which form the equation enters into the solution by the method of least squares.

There may be included here the formulae by which the probable errors printed in the tables were computed in both series of observations. These probable errors are represented by the symbols $r(\pi)$, r, and r_1. In the table of observations, Table IX, the observed differences of the times, their reduction terms, and residuals are given in their actual magnitudes; and the multiplication by 10 appears only in the normal equations and the values of x, y, and z. Accordingly the control sums as printed in Vol. XI [pnn.3] and [$p.vv$] and in the present volume [nn.3] and [vv] are also in their actual magnitude, and strictly should be represented in both volumes by the expressions $^1/_{100}$ [nn.3] and $^1/_{100}$ [vv]. In Vol. XI the normal observation has the weight 4, in the present volume the weight 1.

The definitions of the probable errors that occur in either of the volumes, are as follows:

For Vol. XI r' = the probable error of a single observation of weight unity; and the absolute term is twice the observed difference between the time of the middle star and the mean of the times of the comparison stars.

For both volumes r = the probable error of a single normal observation, that is, an observation of full weight; and it is the probable error of twice the observed difference between the time of the middle star and the mean of the times of the comparison stars.

$r(z)$ = the probable error of the unknown z.
$r(\pi)$ = the probable error of the result for parallax.
r_1 = the probable error of a single observed difference between the time of the middle star and the mean of the times of the comparison stars. This pertains to the normal observation, that is, of full weight.

The formulae are as follows:

FIRST SERIES

$$r' = 0.6745 \sqrt{\frac{[pnn.\,3]}{m-\mu}} \text{ (secs. of time); weight} = 1.$$
$r(z) = 1/\sqrt{p(z)}\ .10r'$ (secs. of time),
$r(\pi) = 1/(20P')\ .r(z)$ (secs. of arc),
$r = 1/2\, r'$ (secs. of time); weight = 4,
$r_1 = 15/4.\cos\delta_2\, r'$ (secs. of arc).

SECOND SERIES

$$r = 0.6745 \sqrt{\frac{[pnn.\,3]}{m-\mu}} \text{ (secs. of time); weight} = 1.$$
$r(z) = 1/\sqrt{p(z)}\ .10r$ (secs. of time),
$r(\pi) = 1/(20P')\ .r(z)$ (secs. of arc),
$r_1 = 15/2.\cos\delta_2\ .r$ (secs. of arc).

The constants $\log\frac{k}{15}$ and K of the parallax coefficients, are obtained from Table VI adapted from the form given by Kapteyn, Groningen Publications, No. 1, p. 57. The values of L were taken from the Berliner Jahrbuch because they are given there in one body for the entire year. The intervals following Berlin noon were adopted as 15 hours for all evening observations and 23 hours for all morning observations. The values of L were taken to the nearest tenth of a degree for the Berlin mean noon on the same astronomical date as that of the observation. The average increase in L is 2′.5 in one hour, and the constant interpolation terms, 0°.6 and 1°.0, were combined with K, so that we have, for Madison,

$K_1 = K - 0°.6$ for evening observations,
$K_2 = K - 1\ .0$ for morning observations.

The computation of the term for precession and nutation $\Delta\alpha_2 - \Delta\alpha_1$ and $D(\Delta\alpha)$ was made as follows. If we employ the Besselian star-numbers and star-constants and put

$$t_0 = \text{the beginning of the year of observation,}$$
$$A' = t_0 - 1900.0 + A,$$
$$a'_1 - a'_2 = a_1 - a_2 = 1^s.3368\ (\sin \alpha_1 \tan \delta_1 - \sin \alpha_2 \tan \delta_2),$$

we have in the case of an observation with one comparison star

$$\Delta\alpha_1 = (1900.0 - t_0)\ a_1 - Aa_1 - Bb_1 - Cc_1 - Dd_1,$$
$$\Delta\alpha_2 = (1900.0 - t_0)\ a_2 - Aa_2 - Bb_2 - Cc_2 - Dd_2\ ;$$

whence

$$\Delta\alpha_2 - \Delta\alpha_1 = A'\ (a'_2 - a'_2) + B\ (b_1 - b_2) + C\ (c_1 - c_2) \quad + D\ (d_1 - d_2).$$

The numbers A', B, C, D, at intervals of twenty days, are presented in Table V. The differences of the star constants were computed as follows. Let

$$m = \sin \alpha \tan \delta, \qquad p = \cos \alpha \sec \delta,$$
$$n = \cos \alpha \tan \delta, \qquad q = \sin \alpha \sec \delta.$$

Then we have, in the case of two stars,

$$\Delta_1 m = m_1 - m_2, \qquad \Delta_1 p = p_1 - p_2,$$
$$\Delta_1 n = n_1 - n_2, \qquad \Delta_1 q = q_1 - q_2,$$

and

$$\Delta\alpha_2 - \Delta\alpha_1 = {}^1/_{15}\ (20.052\ A' . \Delta_1 m + B . \Delta_1 n + C . \Delta_1 p + D . \Delta_1 q) \text{ in seconds of time.}$$

In the case of three stars, employing a notation similar to that previously introduced, we have

$$Dm = m_1 + m_3 - 2m_2, \qquad Dp = p_1 + p_3 - 2p_2,$$
$$Dn = n_1 + n_3 - 2n_2, \qquad Dq = q_1 + q_3 - 2q_2.$$

The products and their sums were computed at intervals of twenty days and tabulated for interpolation. It was more convenient to express the differences of the star-constants in seconds of time, and the expressions then became

$$\Delta\alpha_2 - \Delta\alpha_1 = A' . \Delta_1 a + B . \Delta_1 b + C . \Delta_1 c + D . \Delta_1 d \text{ for two stars,}$$
$$D\ (\Delta\alpha) = A' . Da + B . Db + C . Dc + D . Dd \text{ for three stars;}$$

where a, b, c, d, denote the Besselian star-constants in accordance with the notation of the American and French Ephemerides. These constants were computed in duplicate independently by Mr. Worthing and myself.

For some stars the epoch of the proper motion terms, in computing the absolute terms of the observation-equations, is not the same as that of the coefficients τ. The computation of the former was made for the earlier observations before the extent of the entire series was determined, while a later epoch was selected for the coefficients in order to secure a better balance in the normal equations. Star No. 54, δ Eridani, is the first to show this want of coincidence in the epochs. This manifestly makes no difference in the results, except in the value of $d . Da$, to correspond to the change in epoch; and the residuals v also evidently remain unchanged. All that is required, therefore, in order to obtain the normal difference of the right ascensions for the new epoch, is to bring the Assumed $D\alpha$ from 1900.0, up to the new epoch by means of the complete proper motion and to apply the value of $d.D\alpha$ resulting from the solution; or in terms of the symbols, letting t and t' represent the old and the new epochs respectively,

$$D\alpha + d.D\alpha \text{ (for epoch } t') = D\alpha \text{ (for epoch } t) + (d.D\mu - D\mu)(t' - t) + d.D\alpha.$$

In the case of one star at least, No. 106, α Geminorum, the solution, which had been made for the earlier epoch, 1900.0, was transferred to 1901.0 by the application of the required correction quantities to certain of the coefficients in the normal equations. These are readily computed as follows. Suppose it is required to change the epoch from t to t', and that we put

$$t' = t + \Delta t, \qquad \Delta\tau = -\Delta t, \qquad \Delta b = \Delta s = -\sqrt{p}.\Delta t = -a.\Delta t.$$

Then the only corrections to the terms of the normal equations are as follows:

$$\begin{aligned}
\Delta[ab] &= \Delta[as] = -[aa].\Delta t,\\
\Delta[bb] &= \quad + [aa]\Delta t.\Delta t - 2[ab]\Delta t,\\
\Delta[bc] &= \Delta[cs] = -[ac]\Delta t,\\
\Delta[bn] &= \quad -[an]\Delta t,\\
\Delta[bs] &= +[aa]\Delta t.\Delta t - [ab].\Delta t - [as].\Delta t,\\
\Delta[ns] &= -[an]\Delta t.
\end{aligned}$$

But, since the normal difference of the right ascensions is of no particular interest, the results in general have been left just as they came out from the solutions.

In the normal observation the times of twenty signals were read from the chronograph record for each star of a parallax set. The differences of the corresponding times were written down and the means computed. These means of differences were then controlled by comparison with the means of the corresponding observed times. In a number of cases the observations depart from the normal in the number of signals available in the correspondence of the signals throughout a parallax set. A preliminary examination of a number of observations indicated that the system of weights adopted in Vol. XI was still applicable in general, and that system was followed, especially as represented in Diagram A, which applies to the ordinary case where the number of the times is the same on all three stars of a parallax set. For a considerable period the chronographic record was very defective, owing to the light pressure kept on the electric contact of the micrometer. Consequently, for a number of observations all the signals that could be obtained from the chronograph sheet on any one star were read and reduced to standard position, 7.05 rev., and the absolute terms of the observation-equations were formed from the differences of the separate means.

Practically all the computations have been checked, either by a revision made by assistants or by self-controlling methods such as are customary in the application of the method of least squares. The application of all the correction terms to the observed differences of transit times on the computation sheets, was checked for each period of observation on each star as follows. The sums of all the columns pertaining tc the successive constants were computed and compared with the difference between the corresponding sum of the observed differences of times and the sum of the reduced differences of times. A large amount of additional work was done by myself in going over the residuals and trying to find some explanation for those which seemed to be beyond, or on the border of, admissible magnitude. In the course of this work a number of errors in computation were detected so that the additional labor seemed justified. As noted elsewhere the rejected observations are not printed separately as in Vol. XI, but appear in their regular order and are indicated by the enclosure of the absolute term and of the full residual within square brackets. The slight extent to which occasion arose for greatly reducing or excluding the influence of individual observations, is shown by the fact, that out of a total of 10,103 observation-equations in the present work only 44 were assigned a value of $\sqrt{p}$ equal to or less than 0.2, and of these only 24 had $\sqrt{p} = 0$; that is only that number were rejected from the solutions. No observation was rejected or re-weighted after the normal equations were once formed, except in such supplementary solutions as were made subsequently and which are described in the notes of Table IX.

5. OBSERVED CORRECTIONS TO THE DIFFERENCES OF ASSUMED PROPER MOTIONS.

No effort was made to obtain highly accurate values for the assumed proper motions, and no special significance has been ascribed to the corresponding corrections resulting from the solutions. The unknown y was introduced to allow for any simple progressive change of whatever nature. Jost, who made solutions throughout for pairs of stars, finds an apparently marked variation of the values of $y \cos \delta$ corresponding to the differences between the magnitudes of the stars. A similar comparison may be made for the solutions which happened to be made for pairs of stars in the former series of observations at this observatory and also for the present work. To these may be added a comparison of Kapteyn's observations also. The quantity y in these comparisons must be understood to be the same as that designated by d_1 $(\Delta\mu)$ at page 5, except that both Δm and y in every case here are taken in the sense Following Star minus Preceding Star. But Δm is the algebraic difference of the numbers that denote the magnitudes of the stars; consequently Jost's signs for Δm must be reversed here from those given by him.

EACH PARALLAX STAR WITH ONE COMPARISON STAR

Jost[1]			Kapteyn[2] (Solution I)			Flint I[3]		
Δm	$y \cos \delta$ (s)	No. of Pairs	Δm	$y \cos \delta$ (s)	No. of Pairs	Δm	$y \cos \delta$ (s)	No. of Pairs
−1.21	−0.0022	8				−1.52	0.0000	11
−0.69	− .0034	15	−0.81	−0.0001	10	−0.59	+ .0045	10
−0.27	− .0020	27						
0.00	− .0020	7	+0.07	− .0010	9			
+0.27	+ .0018	19				+0.13	− .0014	10
+0.65	+ .0019	15	+0.61	− .0009	10	+0.60	+ .0022	10
+1.28	+ .0077	10				+1.55	− .0114	10
Totals,		101			29			51

Flint II[4]			Flint II. Combined Means		
Δm	$y \cos \delta$ (s)	No. of Pairs	Δm	$y \cos \delta$ (s)	No. of Pairs
−0.70	−0.0021	6	−0.55	−0.0009	11
−0.40	+ .0003	5			
−0.24	+ .0050	5			
−0.06	− .0023	5	−0.15	+ .0013	10
+0.28	− .0008	5	+0.46	+ .0015	11
+0.65	+ .0038	6			
		32			32

[1] *Untersuchen über die Parallaxen von 29 Fixsternen. Von* E. Jost. Heidelberg IV, p. 162 (Karlsruhe, 1906).
[2] *Bestimmung von Parallaxen* etc. *Von* J. C. Kapteyn. (Leiden VII, 1897.)
[3] Meridian Observations for Stellar Parallax. By Albert S. Flint. First Series. Washburn Observatory XI. (Madison, 1902).
[4] The present, Second Series.

The registering transit-micrometer was employed only in the fourth set of observations represented above. There seems to be no material systematic variation in the values of $y \cos \delta$ except in the Jost series.

With the preceding numbers may be compared the corresponding values from the solutions for three stars in all the series of observations except those made by Jost, who gives solutions only for pairs of stars. The quantities $\frac{1}{2}Dm$ are taken here as the algebraic excess of the number of expressing the apparent magnitude of the middle or parallax star over the mean of the apparent magnitudes of the comparison stars. The quantities $y \cos \delta$ are taken in the corresponding sense, that is as the observed correction to the excess of the assumed proper motion of the parallax star over the mean of the assumed proper motions of the comparison stars.

EACH PARALLAX STAR WITH TWO COMPARISON STARS

Kapteyn (Solutions III)

½*Dm*	$y \cos \delta$	No. of Sets
	s	
—0.44	— 0.0010	5
—0.11	+ .0014	5
+0.11	— .0008	5
		——
Total,		15

Flint. First Series

½*Dm*	$y \cos \delta$	No. of Sets
	s	
—1.78	+ 0.0060	10
—1.36	+ .0042	10
—0.88	— .0044	10
—0.46	+ .0078	10
—0.11	+ .0047	10
+0.16	+ .0066	10
+0.40	+ .0001	10
+0.64	+ .0072	10
+1.02	— .0017	10
+1.50	— .0030	10
		——
Total,		100

Flint. Second Series

½*Dm*	$y \cos \delta$	No. of Sets
	s	
—0.49	— 0.0030	11
—0.23	+ .0008	11
—0.14	— .0024	11
—0.08	— .0014	10
—0.01	— .0055	11
0.00	— .0016	10
+0.05	— .0026	10
+0.10	+ .0003	10
+0.16	+ .0012	10
+0.23	— .0015	11
+0.41	— .0025	11
+0.68	+ .0035	11
		——
Total,		127

Combined Means

Flint. First Series

½*Dm*	$y \cos \delta$	No. of Sets
	s	
—1.57	+ 0.0051	20
—0.67	+ .0017	20
+0.02	+ .0056	20
+0.52	+ .0036	20
+1.26	— .0024	20
	———	——
Mean,	+ 0.0027	Total, 100

Flint. Second Series

½*Dm*	$y \cos \delta$	No. of Sets
	s	
—0.40	— 0.0011	22
—0.12	— .0019	21
—0.01	— .0035	21
+0.08	— .0012	20
+0.20	— .0002	21
+0.55	+ .0005	22
	———	——
Mean,	— 0.0012	Total, 127

There is a marked persistence of signs in the values of $y \cos \delta$ in the last two of the tables above. In order to adjudge these numbers better, the probable errors of $y \cos \delta$ were computed for ten representative stars from each of the two series as follows. The data for these stars were similar as regards extent of observation and freedom from any peculiar, disadvantageous feature.

First Series

List No.	Parallax Star	R. A. h m	Decl. °	Prob. Err. of $y \cos \delta$ ″	No of Periods	No. of Obs.
5	Groom. 34	0 12	+43.4	±0.0352	5	53
18	μ Cassiop.	1 1	+54.4	.0306	5	57
91	Lal. 13565	7 54	+29.5	.0258	6	53
177	Lal. 27744	15 8	— 1.0	.0281	5	59
189	γ Serpentis	15 51	+16.0	.0266	5	55
195	Lal. 30044	16 25	+ 4.5	.0345	6	66
217	ν' Draconis	17 30	+55.3	.0341	5	62
228	α Lyrae	18 33	+38.7	.0356	5	57
246	Lal. 38383	19 59	+23.1	.0325	6	61
261	61 Cygni, *prec.*	21 2	+38.2	.0274	6	57
				Mean, ±0.0310 = ±0s.002,07		

Corresponding computed probable error for the mean value of $y \cos \delta$ from a group of twenty stars = ±0s.000,46.

Second Series

List No.	Parallax Star	R. A. h m	Decl. °	Prob. Err. of $y \cos \delta$ ″	No of Periods	No. of Obs.
2	α Andromedae	0 3	+28.5	±0.0263	7	63
48	α Persei	3 17	+49.5	.0243	7	74
69	λ Aurigae	5 12	+40.0	.0222	7	67
112	9 Puppis	7 47	—13.6	.0152	11	77
127	Σ 3121	9 12	+29.0	.0198	9	65
187	ϵ Virginis	12 57	+11.5	.0150	13	81
245	ζ Ophiuchi	16 31	—10.4	.0329	7	64
261	W. B. xvii, 322	17 20	+ 2.2	.0223	7	84
316	ϵ Cygni	20 42	+33.6	.0094	11	122
343	34 Pegasi	22 21	+ 3.9	.0127	11	95

Mean value of the probable error for the six stars having the number of periods 7 to 9, = ±0″.0246 = ±0s.001,64; mean for the four stars having the number of periods from 11 to 13, = ±0″.0131 = ± 0s.000,87.

Corresponding computed probable error of the mean value of $y \cos \delta$ from a group of 20 stars, number of periods 7 to 9, = ±0s.000,38.

The mean values of $y \cos \delta$ for groups of 20 to 22 stars in the tables above exceed considerably the corresponding probable errors and seem to have been due mainly to some systematic change pertaining to the entire series of observations or possibly only to the closing observations as compared with those at the beginning. The fact that the values of $y \cos \delta$ in the second series are only about one-half as great numerically as those of the first series, combined with the fact that the interval of time covered is much longer in the second series, points to the latter supposition.

6. COMPARISON OF WEIGHTS

On pages 18–19 of Vol. XI an examination was made of the justness of the weights employed therein, as shown in their relative effects on the magnitudes of the residuals of the observation-equations multiplied by the square roots of the weights. The corresponding material in the present work is comparatively very small, as will be evident from a cursory inspection of the column $\sqrt{p}$ in the table of the data of the observations. But, after an examination of the entire list, eighteen stars were selected which appeared to have sufficient variation in the weights to justify employing their data for the present purpose. These stars by their numbers in the complete list are the following: 91, 97, 100, 103, 109, 118, 121, 142, 163, 166, 169, 200, 205, 208, 276, 298, 310, 358. Naturally, the majority, thirteen, are stars far south, beyond—10° in declination. The mean value of the weighted residuals for these eighteen stars, taken without regard to signs, are given in the following table.

$\sqrt{p}$	$\sqrt{p}\, v \cos\delta$ s	Number of Residuals	$\sqrt{p}$	$\sqrt{p}\, v \cos\delta$ s	Number of Residuals
0.1, 0.2	0.0168	16	0.7	0.0323	166
0.3	.0238	42	0.8	.0365	28
0.4, 0.5	.0275	203	0.9	.....	0
0.6	.0408	20	1.0	.0404	604
				Total,	1079

There is some indication here that the weights applied were somewhat too small for the observations estimated to be very poor. If we compare the values of r_1, the probable error of a single observation of weight unity, the normal observation, we have

Mean value of r_1 for the 18 stars of the table above, $\pm 0''.237$.
Mean value of r_1 for the 13 stars which are included in the 18 stars and which are south of —10° in declination, $\pm 0''.241$.
General mean value of r_1 for the entire list of stars, $\pm 0''.215$.

It thus appears that the average value of r_1 was not unduly lowered by the lower weights applied in the cases of the 18 stars represented above.

7. PROBABLE ERRORS.

The probable errors of the parallax and of a single observation-equation of weight unity, designated by the symbols $r(\pi)$ and r_1 respectively and presented in Table X, exhibit a good degree of uniformity throughout the list. The highest values of $r(\pi)$ occur in the cases of stars No. 200, θ Centauri, No. 169, γ Ursae Majoris, and No. 358_1, W. B. xxiii, 175. Star No. 200 has a moderate value of r_1 and the large value of $r(\pi)$ must be due to the reduced weights corresponding to the poor seeing at the low altitude. Star No. 169 has an average value for r_1, in spite of the faintness of the stars and their crowded position in the observing list, and the large value of $r(\pi)$ seems to be due to the reduced weight owing largely to the small number of observations. Star No. 358 has high values for both $r(\pi)$ and r_1, owing probably to the excessive faintness of No. 358. Star No. 203, Lalande 26196, is the only other one showing a markedly high value of r_1. No adequate reason appears for this, especially as compared with star No. 205, the next following, which has one comparison star in common with No. 203.

In the following table are exhibited the means of the probable errors in groups, in order of right ascension, omitting $r(\pi)$ for stars Nos. 169, 200, and 358_1, and r_1 for No. 358_1 only, and also omitting both $r(\pi)$ and r_1, in the cases where only one comparison star was employed, namely, No. 23, 196_2, 278, and 358_2. Star No. 38, δ Trianguli, is counted twice, once for each pair of comparison stars.

Limits of R. A.		Mean Value of $r(\pi)$	Mean Value of r_1	No. of Par. Stars	Limits of R. A.		Mean Value of $r(\pi)$	Mean Value of r_1	No. of Par. Stars
h	h	"	"		h	h	"	"	
0.0 —	1.9	±0.035	±0.22	10	12.6 —	14.7	±0.033	±0.24	10–11
2.0	4.6	.027	.20	10	14.8	16.4	.033	.20	10
4.8	5.9	.027	.20	10	16.4	17.7	.032	.23	10
6.3	8.2	.032	.22	10	17.9	19.8	.028	.21	10
8.6	10.4	.032	.21	10	20.0	21.4	.027	.20	10
10.5	12.5	.038	.22	9–10	21.6	23.9	.032	.22	11
					General Mean		±0.0313	±0.214	
								Total,	120–122

It thus appears that there is no marked variation in the probable errors through the hours of right ascension. And the probable error of a single normal observation r_1 appears not to have been affected by the season of the year; or possibly the effect of the moderate reduction made by means of the weights employed was just sufficient to bring the residuals on the average to the normal magnitude. An inspection of the dates of observation shows that the stars from about 1^h to 6^h in right ascension were subject to winter morning observation and those from about 11^h to 16^h to winter evening observation. The mean values of the probable errors for these two groups of hours combined and for the remaining series of hours separately, are as follows:

For lower temperatures, R. A. 1h — 6h, 11h — 16h, number of groups, 6:
$r(\pi) = \pm 0''.0322$, $r_1 = \pm 0''.213$.
For moderate and higher temperatures, the remaining hours, number of groups, 6:
$r(\pi) = \pm 0''.0305$, $r_1 = \pm 0''.215$.

The groups of stars to which reference is made here are those of the table just above. Thus there appears to be no difference, as regards accuracy of results, between the summer and winter observing. This conclusion seems surprising at first sight. The winter observing is subject to more disturbance of the star-images and discomfort to the observer, but where many rather faint stars are involved, as in the present work, there is more trouble in summer from dust and general smoke.

In the following table are presented the means of the probable errors for groups in order of declination with the same omissions of certain stars as in the preceding table in which the stars were in the order of right ascension.

Mean of Decls. °	Mean Value of $r(\pi)$ "	No. of Par. Stars	Mean of Decls. °	Mean Value of r_1 "	No. of Par. Stars
—30.3	±0.0373		—30.8	±0.239	11
—20.5	.0373	10	—20.0	.228	10
—10.8	.0352	10	—10.8	.239	10
— 1.9	.0328	10	— 1.9	.239	10
+ 8.3	.0333	10	+ 8.3	.228	10
+16.2	.0319	10	+16.2	.244	10
+25.5	.0313	10	+25.5	.203	10
+30.2	.0270	10	+30.2	.194	10
+34.2	.0287	10	+34.2	.193	10
+41.5	.0276	10	+41.5	.196	10
+50.7	.0264	10	+51.1	.193	11
+62.3	.0297	10	+62.3	.188	10
General Mean, ±0.0315			General Mean, ±0.215		
Total number of stars, 120			Total number of stars, 122		

Representative mean values for better observations in the First Series from the data given on page 30, Vol. XI are $r(\pi) = \pm 0''.0303$ and $r_1 = \pm 0''.144$ from 21 parallax stars and from 83 parallax stars respectively. It will be noted that while this value of $r(\pi)$ agrees very closely with the general mean value in the table above, the accompanying value of r_1, $\pm 0''.144$, is materially less than the general mean, $\pm 0''.215$ above. Both of these values of r_1 pertain to the normal, standard observation, each in its own series, and it is not apparent why there should be so large a difference between them. If two series of similar observations are equally good, the computed values of the probable error of the normal observation should be sensibly equal as between the two series. But if low weights were applied to the poorer observations, as compared with the better, more severely in the one series than in the other series, then the computed probable error in the former series should be too small, as compared with that of the other series. It was concluded from a comparison of weighted residuals, presented on pages 18–19 of Vol. XI, that the weights there applied did correspond to actual conditions on the whole; while from the similar data at page 16 preceding, it appears doubtful whether the same holds equally true for the present series. It would be expected that the fault, if any, would be in the treatment of the First Series; for the natural tendency seems to be to reduce weights too severely in the case of observations noted as very poor—and there were many such in that series. On the other hand, the disposition to regard the present observations as of nearly uniform quality might result in a computed probable error too large for the normal observation. It may be of interest to compare here the probable errors and weights of two representative sets of stars, one from each of the series. The same ten stars are selected from the First Series that were employed for the comparison of the probable errors of the *y* unknowns. A set of ten stars are selected from the Second Series which correspond approximately to the former set in number and distribution of observations. The data for these two sets of stars are presented in the following two tables.

FROM FIRST SERIES

List No.	Name	R. A. h	m	Decl. °	$r\ (\pi)$ "	r_1 "	Mean $\sqrt{p}$	$p\ (z)$	No. of Obs.	No. of Periods
5	Groom. 34	0	12	+43.4	±0.034	±0.15	1.52	88.6	53	5
18	μ Cassiop.	1	1	+54.4	.026	.12	1.50	98.8	57	5
91	Lal. 15565	7	54	+29.5	.026	.13	1.53	103.6	53	6
177	Lal. 27744	15	8	— 1.0	.031	.15	1.61	104.7	59	5
189	γ Serpentis	15	51	+16.0	.028	.14	1.61	101.8	55	5
195	Lal. 30044	16	25	+ 4.5	.032	.18	1.62	136.9	66	6
217	ν' Draconis	17	30	+55.2	.028	.11	1.18	59.7	62	5
228	α Lyrae	18	33	+38.7	.030	.14	1.65	89.5	57	5
246	Lal. 38383	19	59	+23.1	.028	.15	1.68	119.9	61	6
261	61 Cygni *pr.*	21	2	+38.2	.029	.14	1.61	98.7	57	6
				Mean,	±0.0292	±0.141	1.551	100.2	580	54

FROM SECOND SERIES

List No.	Name	R. A. h	m	Decl. °	$r\ (\pi)$ "	r_1 "	Mean $\sqrt{p}$	$p\ (z)$	No. of Obs.	No. of Periods
2	α Andromedae	0	3	+28.5	±0.033	±0.21	0.968	47.2	63	7
20	β Andromedae	1	4	+35.1	.031	.20	.960	45.2	62	7
48	α Persei	3	17	+49.5	.025	.17	.903	51.6	74	7
60	Groom. 864	4	34	+41.9	.025	.19	.970	57.0	74	7
69	λ Aurigae	5	12	+40.0	.028	.20	.988	51.0	67	7
127	Σ 3121	9	11	+29.0	.026	.18	.978	53.3	65	9
245	ζ Ophiuchi	16	31	—10.4	.042	.25	.950	36.0	64	7
248	ζ Herculis	16	37	+31.8	.029	.21	.990	50.5	79	7
261	W. B. xvii, 322	17	20	+ 2.2	.027	.21	.989	58.2	84	7
270	γ Draconis	17	54	+51.5	.021	.17	.989	63.6	91	7
				Mean,	±0.0287	±0.199	0.968	51.4	723	72

With these mean values of $r(\pi)$ and r_1 may be compared the mean values in the general tables above $r(\pi) = \pm 0''.0315$ from 120 stars and $r_1 = \pm 0''.215$ from 122 stars. It is seen that while the mean values of $r(\pi)$ are about the same, as regards the two sets of ten stars, the value of r_1 is noticeably larger in the later series. So far as the present work indicates, therefore, the superiority of the transit micrometer rests chiefly in its great reduction of the personal error due to difference of stellar magnitude.

Since the slat-screen and the cord by which it is turned are attached to the telescope, while the wire screens are entirely separate from the instrument, it might be expected that the observations made with the former would suffer some increase of accidental error in comparison. To test the matter the following tables were computed exhibiting successive mean values of r_1, the probable error of a single observation-equation of weight unity, reduced to a great circle.

STARS OBSERVED WITH WIRE SCREENS OR NONE AT ALL

Limits in R. A.		Mean Value of r_1	No. of Stars
h	h	"	
0.1—	2.2	±0.210	10
3.5	5.6	.200	10
5.7	11.5	.201	11
12.1	16.2	.207	10
16.4	17.7	.220	10
17.9	20.6	.206	11
20.7	23.9	0.206	10
General Mean,		±0.207	72

STARS OBSERVED WITH SLAT-SCREEN

Limits in R. A.		Mean Value of r_1	No. of Stars
h	h	"	
0.6—	3.9	±0.211	8
6.9	9.4	.217	10
9.6	12.5	.217	10
12.6	15.9	.238	11
16.7	23.0	0.236	11
General Mean,		±0.224	50

But this is not a fair comparison, inasmuch as the range of the wire screens in zenith distance was limited, so that the observations of stars far south and thus subject to poorer seeing were thrown entirely upon the slat-screen. Accordingly, a revised comparison was made omitting from both classes those stars which would be expected to show peculiarly large or peculiarly small values of the probable error. These stars omitted were in three classes: (1) All south of —20° in declination, (2) All north of +60° in declination, (3) All having any mean estimated magnitude fainter than 8.0. The results were as follows:

With wire screens or none.	Number of stars, 51.	Mean value of r_1, ±0.206,
With slat-screen,	Number of stars, 27.	Mean value of r_1, ±0.220.

But the 27 stars of the second line include star No. 203 which alone of these 78 stars, has an abnormally high value of r_1, $\pm 0''.32$, like that of star No. 358. If star No. 203 also be omitted, the second line above becomes

With slat-screen,	Number of stars, 26.	Mean value of r_1, ±0.216.

The range of values of r_1 is from $0''.15$ to $0''.28$ among the 51 stars of the first line and from $0''.17$ to $0''.29$ among the 26 stars of the second line. The increase of accidental error, if any, due to the employment of the slat-screen thus appears to be immaterial.

In view of the novelty of the method of observing, a careful computation has been made of the probable error of a chronograph signal corresponding to a single contact of the micrometer, for ten different periods representing practically the entire interval of time covered by the series of observations. For this purpose the differences between the individual chronograph times of pairs of stars in the parallax sets were employed. These differences were already written down in the observing books. Their sums were taken in pairs symmetrical to the standard position of the micrometer. The differences between each of these ten pair-sums and their mean for each pair of stars on a given date were next written down and reduced to a great circle. Pairs of stars from five parallax sets for each of ten periods were selected at random, except for the conditions that the seeing should be Good, (3.5 or better) and that no star should be fainter than 7.5 in magnitude. The probable error was computed for each period separately from residuals formed by subtracting the individual pair-sum differences from the mean for each of the five stars respectively. Thus the resulting probable error for any period is independent of any mechanical uncertainty in the electric contacts, so far as they held constant through any one period; but it would be affected by any possible disturbance of the instrument in changing from one star to the next in any parallax set. The average results for this computation are as follows:

PROBABLE ERROR OF A SINGLE CONTACT SIGNAL ON THE CHRONOGRAPH

Bisection of space 10″ between Double Threads. Declinations from —25°.5 to +51°.4

Periods	Season	Probable Error	Number of Contacts	Extreme Values
		s		s s
1898.7, 99.6, 1900.5, 02.5, 03.5	Summer	±0.0327	1000	±0.0267 to ±0.0387
1899.0, 1900.1, 02.0, 03.1, 04.1	Winter	0.0355	1000	0.0257 to 0.0462
		Mean, ±0.0341	2000	

A similar computation was made for the extreme distances between the observing pair of threads as occurring at certain times in the course of the observations. The results were as follows:

Bisection of Space 4″.3 between Double Threads.

1903, Jan. 22.3 and Jan. 22.7. Seeing, very good.

Limits in Declination	Probable Error	Number of Stars	Number of Contacts
° °	s		
—36 to +18	±0.0460	10	400
+28 to +75	±0.0361	10	400
	Mean, ±0.0410		800

Bisection of Space 12″.4 between Double Threads

1903, April 16.3 and April 16.7. Motion of Micrometer rather hard.

Limits of Declination	Probable Error	Number of Stars	Number of Contacts
—34° to +62°	±0s.0391	11	440

A computation was made for a more pronounced difference of season with the following results:

Bisection of Standard Space 10″ between Double Threads.

		Limits of Declination ° °	Probable Error s	No. of Stars	No. of Contacts
1898, Aug. 22.3, 24.3, 26.7	Microm. motion very easy.	—30 to +52	±0.0270	5	254
1898, Dec. 30.3, 1899, Dec. 31.3	Temp. —4° to —5° Fahr.	—19 to +60	±0.0480	8	462

This last computation differs somewhat from the preceding in that it began with the sums of the pairs of chronograph times on the individual stars instead of the sums of pairs of differences between stars; so that these results are not affected by possible disturbances of the instrument in changing from one star to another in the parallax set.

A series of observations for star positions was begun in October, 1903, before the parallax observations were completed, and continued until 1911. These were made on the single thread; and it will be of interest to compare the probable errors of a single contact time in the two methods of observation. First 60 stars were selected from 12 dates, equally divided between Circle West and Circle East and also between winter and summer, and the residuals formed by subtracting each of the ten sums of the symmetrical contact times from their mean on each star. The results were as follows:

Bisection of Star Image on a Single Thread.

From 1907, Dec. 20 to 1910, Dec. 12.

	Limits of Declination ° °	Probable Error s	Number of Stars	Number of Contacts
Winter	—10.2 to +59.4	±0.0340	30	600
Summer	—17.8 to +73.3	±0.0276	30	600
	General Mean,	±0.0308	60	1200

Second, all available stars were selected from a series of eight dates equally divided between Circle West and Circle East, and the residuals were formed by subtracting the sum of the times for the same pair of contacts, for each of the stars of a given date, from the mean for that particular pair for all those stars on that date. Different pairs of contacts were taken for the different dates. This method has an advantage over both of the preceding methods so far as the electric contacts could be assumed to remain constant through a given night. The result was as follows:

Limits of Declination	Probable Error	Number of Stars	Number of Contacts
—10° to +50°	±0s.0322	269	538

Of these eight dates, three were in the winter season; but in this series of observations very cold nights were avoided.

The outcome of these computations, including those represented in Vol. XI, p. 14, appears to be that for the present instrument and observer and under good conditions, the probable error of a single chronographic signal, for stars of a moderate declination reduced to a great circle, may be taken as ±0s.030, whether the transits be observed over fixed threads or with the transit-micrometer turned entirely by hand. Also, the probable error remains the same with the latter method whether the star image be maintained in bisection on a single thread or in the space between a pair of threads.

8. ABNORMAL RESIDUALS.

An inspection was made of the residuals of the observation-equations, and for many apparently abnormal residuals a further examination was made back to the data of the observing books. In order to ascertain whether the apparent excess on a given date arose from a systematic deviation of the relative transit times, the individual differences of the observed times on pairs of stars, as written in the books were compared with the differences corresponding to the same positions of the micrometer, for a neighboring date whose residual appeared normal. A control upon the mean result was available by comparison of the corresponding difference of the values of $D\alpha$ 1900.0 and also, very closely, by comparison of the difference in the residuals v of the equations. But, since several factors, chiefly the reduction to mean epoch and the proper motion, tend to produce a deviation in the relative transit times for a given pair of stars, two dates of comparison in general were selected, one preceding, the other following the date in question, and the simple mean or interpolated mean of the differences of times for these two dates was adopted as the true difference for the date in question.

In some cases the micrometer positions corresponding to the observed times were not identical on one date as compared with another for a given pair of stars. In such cases a fair distribution of the transit times of each star over the micrometer range usually traversed, was regarded as satisfactory; or only such differences of times were employed in comparison as did correspond to the same micrometer contacts. In some cases, again, the individual differences were reduced to standard position 7.05 rev. so that all were included.

A nearly typical example of such comparison is represented here, in which an observation of 1901, April 9.4 is called in question and compared with the mean of April 8 and April 10. Each date has 20 transit times recorded on each star. The micrometer contacts are not quite identical; but, as shown by the differences of the sec δ coefficients given below, the means of the micrometer positions on either pair of stars would require to differ by one entire revolution., in order to affect the differences of time by so much as $0^s.10$.

Stars 141, 142, 143. Lalande 19780. $10^h\ 3^m$, —19° 15′

$\alpha_2 - \alpha_1 = +2^m\ 12^s$ $\delta_2 - \delta_1 = +1°\ 12'.3$

$\alpha_3 - \alpha_2 = +2\ \ 11$ $\delta_3 - \delta_2 = +1\ \ 8.7$

$R(\sec\delta_2 - \sec\delta_1) = -0^s.0508$ $R(\sec\delta_3 - \sec\delta_2) = -0^s.0450$

R = Value of one revolution of the micrometer screw = $6^s.2923$

	Estimated Magnitudes	Seeing Steadiness	Seeing Images	Micrometer Rev. Rev.
April 8	7.4, 7.6, 7.6	4	4	4.8 to 9.3
9	7.2, 7.6, 7.5	4	4	5.2 to 8.8
10	7.7, 7.6, 7.5	4.5	3.5	5.4 to 8.8

$T_2 - T_1$ 1901, m	Apr. 8 s	Apr. 9 s	Apr. 10 s	$T_3 - T_2$ 1901, m	Apr. 8 s	Apr. 9 s	Apr. 10 s
2	11.93	11.98	11.84	2	10.29	10.29	10.32
	.71	2.04	.81		.31	.43	.38
	.91	1.98	.89		.41	.23	.39
	.77	.84	.93		.45	.40	.10
	.73	.88	.84		.40	.41	.31
	.76	.87	.82		.24	.21	.39
	.72	.73	.90		.35	.32	.36
	.70	.90	.90		.50	.20	.36
	.80	.82	.91		.34	.23	.32
	.70	.89	.83		.41	.25	.23
	.78	.95	.72		.38	.12	.32
	.72	.81	.80		.10	.21	.20
	.71	.87	.77		.17	.13	.30
	.60	.75	.64		.31	.19	.34
	.68	.70	.80		.24	.21	.31
	.73	.92	.76		.20	.04	.29
	.63	.83	.88		.31	.10	.20
	.66	.78	.78		.29	.03	.23
	.77	.80	.70		.13	.01	.20
	.80	.69	.58		.17	.09	.30

	Differences in $T_2 - T_1$		Differences in $T_3 - T_2$	
	Apr. 9–Apr. 8	Apr. 9–Apr. 10	Apr. 9–Apr. 8	Apr. 9–Apr. 10
	s	s	s	s
	+0.05	+0.14	0.00	—0.03
	+ .33	+ .23	+ .12	+ .05
	+ .07	+ .09	— .18	— .16
	+ .07	— .09	— .05	+ .30
	+ .15	+ .04	+ .01	+ .10
	+ .11	+ .05	— .03	— .18
	+ .01	— .17	— .03	— .04
	+ .20	.00	— .30	— .16
	+ .02	— .09	— .11	— .09
	+ .19	+ .06	— .16	+ .02
	+ .17	+ .23	— .26	— .20
	+ .09	+ .01	+ .11	+ .01
	+ .16	+ .10	— .04	— .17
	+ .15	+ .11	— .12	— .15
	+ .02	— .10	— .03	— .10
	+ .19	+ .16	— .16	— .25
	+ .20	— .05	— .21	— .10
	+ .12	.00	— .26	— .20
	+ .03	+ .10	— .12	— .19
	—0.11	+0.11	—0.08	—0.21
Sums,	+2.33	+1.43	+0.24	+0.48
	—0.11	—0.50	—2.14	—2.23
Algbr. Sum,	+2.22	+0.93	—1.90	—1.75
Mean,	+0.111	+0.046	—0.095	—0.088

Mean for first and second columns, $\Delta d_1 = +0^s.078$.

Mean for third and fourth columns, $\Delta d_2 = -0^s.092$.

It is evident that the deviation for Apr. 9 is systematic, holding throughout the observation; but it is not yet apparent on what star or stars the deviation occurs and to what amount on each. The method adopted for determining these points was as follows. For the sake of brevity the cases of two dates only will be considered.

Let T_1, T_2, T_3 = the observed times, for the three stars respectively, on the date which is normal in appearance. These times are assumed to fall at the correct intervals sensibly from their mean.

Let T'_1, T'_2, T'_3 = the corresponding times for the date which is called in question, as regards this set of stars.

The differences as written in the observing book, and in the example above, are represented as follows:

First date: $T_2 - T_1$, $T_3 - T_2$. Second date: $T'_2 - T'_1$, $T'_3 - T'_2$.

Let

$$\Delta d_1 = (T'_2 - T'_1) - (T_2 - T_1), \quad \Delta d_2 = (T'_3 - T'_2) - (T_3 - T_2)$$

Let E_1, E_2, E_3 = the apparent deviations of the transit times, of the three stars respectively, on the second date as compared with the transit times respectively on the first date. We are concerned here only with the difference between the transit of any one star and the mean of the transits for all three stars. The latter may then be dropped out of consideration or assumed to be the same on both dates. Accordingly, we may write

$$\Delta d_1 = (T_2 + E_2) - (T_1 + E_1) - (T_2 - T_1) = E_2 - E_1,$$
$$\Delta d_2 = (T_3 + E_3) - (T_2 + E_2) - (T_3 - T_2) = E_3 - E_2.$$

We have also the conditional equation

$$0 = E_1 + E_2 + E_3.$$

From these three equations we have

$$E_1 = -\tfrac{1}{3}\,(2\Delta d_1 + \Delta d_2),$$
$$E_2 = +\tfrac{1}{3}\,(\Delta d_1 - \Delta d_2),$$
$$E_3 = +\tfrac{1}{3}\,(\Delta d_1 + 2\Delta d_2).$$

For Δd_1 and Δd_2, we have the means of the respective columns of differences, and for the case of three dates, as in the example above, we have the mean values of the two columns of differences Δd for each pair of stars. Substituting these mean values, we have for the observation of April 9,

$$E_1 = -0^s.021, \qquad E_2 = +0^s.057 \qquad E_3 = -0^s.035.$$

It appears then that on April 9, as compared with the mean of April 8 and April 10, star 141 was observed early by $0^s.021$, star 142 late by $0^s.057$, and star 143 early by $0^s.035$, as referred to the mean of the transit times for the three stars.

As a control we have the following comparisons of data.

Da, 1900.0	s	Relative Errors	Residuals s
1901, Apr. 9,	+1.670	$2E_2$, +0.114	$\frac{1}{2}(v_1 + v_3)$, +0.049
Apr. 8 and Apr. 10, Mean,	+1.500	$E_1 + E_3$, —0.056	v_2, —0.121
Difference,	+0.170	+0.170	+0.170

The agreement of the three differences is not so close in all cases, since it is not always practicable to employ in the comparison all the observed data involved.

This is an interesting example of what may happen even when all the physical relations of the set of stars appear most favorable to constancy in the observations. Of the 180 transit times included in these three observations of this set of three stars, only one appears abnormal amongst its fellows; and this is from $0^s.15$ to $0^s.20$ different from what would appear normal.

For 21 cases the date of the abnormal residual instead of being [illegible] middle date, is one of the extreme dates of the three selected for comparison. In [illegible]ch cases the values given for E_1, E_2, E_3, still refer to the middle date; so that, if the observation on the middle date and the other extreme date are regarded as normal, the values of E_1, E_2, E_3, for the abnormal, extreme date will be twice as great as the values printed and with the opposite signs. An example is found at observation 19 of stars 16, 17, 18, γ Cassiopeiae, $0^h\ 50^m$, Table IX, where the errors are given in the notes as follows:

$$E_1 = -0^s.041, \quad E_2 = -0^s.027, \quad E_3 = +0^s.069.$$

If all the deviation is put on observation 19, we have

$$E_1 = +0^s.082, \quad E_2 = +0^s.054, \quad E_3 = -0^s.138.$$

In a few cases, again, comparison was made of an abnormal appearing observation with only one other date. The means of the differences of times in these cases were corrected for changes in the constants of the instrument, in the reduction to mean epoch, and the other known terms affecting the results.

In the case of comparison with two dates, as described above, there may arise a sensible error, due to the reduction to mean epoch, if the middle date falls near a maximum of the aberration terms $C.\Delta c$ or $D\ \Delta d$, but the two terms would not conspire. The largest error thus arising, for an interval of ten days, would be $0^s.0052$; and this would be reached only in the case of two or three stars of the present list and rarely with them.

In all it appears that 119 cases of apparently abnormal residuals were examined, as presented in the notes to Table IX. Two of these were omitted from further discussion as extremely abnormal and due probably to very unusual accidental conditions. The results for the remaining 117 observations, were summarized and multiplied by $\cos \delta_2$, in each case, to reduce to a great circle. As an indication of the variability of the individual values on any one star, a probable error was computed as from 351 observations on 117 unknowns. This gave $\pm 0^s.036$ as the probable error of a single value of $E \cos \delta$, and the resulting probable errors of the mean results were as follows:

$$E_1 \cos \delta = +0^s.0013 \pm 0^s.0033, \quad E_2 \cos \delta = -0^s.0051 \pm 0^s.0033, \quad E_3 \cos \delta = +0^s.0037 \pm 0^s.0033.$$

These numbers are not such as to indicate a general systematic error in these abnormal observations, at least with respect to the order of the stars in the parallax sets.

Among the 117 abnormal observations of the present work were some in which one or two of the stars were so faint according to the estimated magnitudes, as to leave the quality of the observation doubtful. In order to ascertain something of the influence of the magnitudes of the stars on these errors, the following comparison was made. The values of $E \cos \delta$ which correspond to stars that differ by half a magnitude or more from the mean of the magnitudes for the set of three stars, were arranged in the order of the differences of magnitude. The resulting means by groups were as follows:

Individual Star Brighter than the Mean	No. of Residuals	Mean E cos δ	Individual Star Fainter than the Mean	No. of Residuals	Mean E cos δ
		s			s
0.52 mag.	10	—0.024	0.50 mag.	7	+0.014
0.67	10	+ .001	0.51	7	+ .009
0.81	10	— .002	0.67	7	+ .017
1.20	7	— .029	0.90	7	+ .033
			1.14	7	+ .021
Mean, 0.80	Total, 37	Mean, —0.014	Mean, 0.74	Total, 35	Mean, +0.019

These results indicate that the fainter stars are observed slightly later. This may be due, however, to the liability of the observer to allow a very faint star image to get ahead of the micrometer either because of its disappearance at times or because of his flagging attention.

Jost[1] found the same condition in his observations, that these abnormal observations have no systematic effect upon the final computed parallax. But he is inclined to ascribe this relative displacement of the stars to lateral refraction, and adds that for a number of the nights on which such displacement occurred in his observations, he found it noted that there was a haze through which the star-images could be pointed on very exactly. As experienced observers know, the star-images in general are remarkably neat and, for the time, steady on calm nights with a haze or fog, but not light clouds, filling the sky or air. In order to test the matter for the present series of observations, the notes of Table IX were reviewed for the selection of cases of abnormally large residuals. All those were taken which fell under the following conditions: (1) where the declination was north of —20°; (2) where none of the star images involved were noted as too faint for satisfactory observation; (3) where the abnormal observation had been checked by comparison with neighboring observations. Also no more than one observation was taken from any one date.

It seemed that if Jost's suggestion offers the true explanation of these discordances that there should be a deficiency of wind-movement on those nights as compared with nights on which the observations had small residuals. Accordingly the deficiency of wind-movement for each of the nights whose observations showed an abnormal residual was noted from the meteorological records for Madison and also for an equal number of nights free from such residuals. The latter were chosen at random, with preference for dates somewhat near the former, but the selection was not confined to the same sets of stars, as compared with the nights of abnormal residuals. There were 68 nights in each series and in each series they were equally divided between morning and evening. The average deficiency of wind-movement for the former series of nights was 28 miles, for the latter 41 miles. The mean daily movement, in twenty-four hours, for the six inclusive years was 231 miles. Also it

[1] *Untersuchung über die Parallaxen von 29 Fixsternen*, von E. Jost. Heidelberg, *Vierter Band*, page 160. (Karlsruhe, 1906.)

happened that in the notes on the observations both series had the same number of nights, seven, described as very quiet. Of course, in general, clear nights would have less wind than cloudy, stormy nights. The deficiencies of wind-movement found above are small and the numbers, so far as they go, hardly bear out Jost's suggestion.

9. PERSONAL EQUATION DEPENDING UPON APPARENT MAGNITUDES OF THE STARS

A large number of observations were made on miscellaneous stars with the screens in the intervals between parallax sets, as a control on any possible effects of personal equation; but the chronograph sheets have been read and the reductions made for only a small portion of the series, at the beginning. These observations were made on the pair of threads and were of two kinds: (1) With the wire screens alone so that the correction dp_1 due to a change of one magnitude, was obtained as a proportionate part of the observed correction due to the reduction 2.5 in the apparent magnitude, and (2) With the wire screen and the slat-screen in turn on a given star, so that any correction dp_2 to the observed transit time and due to the peculiar appearance of the interference images or to disturbance of the instrument in turning the slats, should be detected. These observations were reduced in the manner described in Vol. XI, page 21, including the multiplication by cos δ. The reduced apparent magnitudes involved in both series ranged from 6.7 to 8.8. The results are shown in the following table.

WIRE SCREEN ALONE

Period	dp_1	No. of Obs.
	s	
1898, Nov.—1899, Feb.	+0.0010	76
1898, Oct.—1899 Apr.-June	+0.0010	66
	General Mean, +0.0010±0s.0024 (very nearly)	Total, 142

WIRE SCREEN AND SLAT SCREEN

Period	dp_2	No. of Obs.
	s	
1898, Dec.—1899, Feb.	+0.0055	63
1899, March—June	+0.0082	93
	General Mean, +0.0071±0s.0022 (very nearly)	Total, 156

Of the 142 observations represented in the first division of the table 58 were made in the evening and 84 in the morning.

The value of dp_1 was computed separately for those stars of the first division of the table whose reduced magnitude was 8.0 or fainter. These were 27 in number for screen *in* on the middle portion of the transit and 26 for screen *out*, or 53 in all. The result was $dp_1 = -0^s.0009$. These values of dp_1 are vanishing quantities. The values dp_2 in the second division of the table possibly are of significant magnitude. But personal equation of any sort would have no effect upon the results for parallax except as the former might vary with the season of the year or with change in other conditions. The values resulting for the two different portions of the year do not show a material difference.

Upon inspection of the residuals of the observation equations unexpected differences appear on some stars between the groups of residuals for different periods of observation, and these have a marked appearance of persistency in magnitude and sign. Further investigation of this sort might be made upon the present data; but it seems evident that any systematic error present must be very small. This work was laid aside for several years while three series of observations for star positions were undertaken with this instrument together with the incidental computations. In the meantime there have been published several new series of observed parallaxes from different observatories in the world. Extensive comparisons have been made between all of the larger lists and the present work. The results and their discussion are found in the *Astronomical Journal* No. 696. These indicate that the present series of parallax results is free from material systematic error.

EXPLANATION OF THE TABLES.

Table I. Observed Values of the Level Constant.

The values of the level of the rotation axis were not employed at all in the reductions, but are presented here as a part of the data by which the behavior of the instrument can be judged. They are given in the table, in the column *b*, grouped in means for intervals of approximate constancy determined by inspection of the individual observed values. The observations of level were made in determining the collimation by means of the nadir or in determining the clock correction for the observatory time service, or as an incidental control on the position of the instrument. An underscore in the column *b* indicates that the level of the instrument was adjusted subsequently to the last preceding date; or, at least, that a change was liable to occur, owing to the removal of the instrument from its bearings or some such liability to disturbance. But a number of such occasions came in the midst of certain of the periods formed for computing the mean values of the table, and accordingly are not indicated in the table. The remaining data are given in columns under headings whose significations are evident. The residual given is the largest, numerically, with reference to the mean for each period, in the sense mean minus the individual value. The temperature given is an approximate mean for each period.

TABLE II. ADOPTED VALUES OF THE COLLIMATION CONSTANT.

In this table are given the values of the constant c'', which are derived from the means of the individual observed values of the instrumental collimation c for the periods indicated. This constant was determined in general by means of the nadir and level; but some values, during the period from 1903, November, to 1904, April, were determined by means of the collimators. The individual values were grouped according to periods of approximate constancy, and the mean values computed for these groups. The constant of diurnal abberation for the latitude and the contact correction of the transit micrometer were applied to these mean values of c to form those of c''. (Vol. XII, pp. 246–247.) The value +0.0057 rev. was adopted for the contact correction throughout the period of the observations. This correction is due to the fact that the index does not exactly coincide with the corresponding whole division of the micrometer head when the contact is made on the chronograph. Care was taken to place the image of each star midway between the fixed horizontal threads so that no correction for inclination of the transit threads would be required. In a few cases, when the observer was pressed for time, the first star of a parallax set was observed away from the middle position with reference to the horizontal reticule; but the images of the remaining stars of the set were so disposed as to make the observation as a whole approximately symmetrical with reference to the middle position. Thus the quantities in the column c'' are made up as follows:

$$c'' = c + \text{Diur. Abb.} + \text{Contact Correction, or,}$$
$$c'' = c - 0.0027 \text{ rev.} + 0.0057 \text{ rev.}$$

Considerable difficulty was experienced in keeping the spider threads in good condition. The original threads were displaced slightly from time to time by hitching in the course of motion, especially during a rapid reversal. Finally they were removed and a new set put in. This and subsequent changes in the standard threads of observation are described in the notes that follow the table. After several attempts by the observer to get a set of threads that would remain taut in place, a new vertical reticule was mounted skillfully in December 1904, by Mr. H. G. FISCHER, mechanician of the department of physics in the university. These threads have held perfectly ever since.

The greatest danger from changes in threads appeared to exist during the interval from Dec. 21, 1903 to Dec. 20, 1904. If there were any appreciable error from this source, it should show in the probable error of a single parallax observation-equation reduced to a great circle, the values of which r_1 are given in Table X. There are 36 parallax stars which had ten per cent or more of their observations made in the interval mentioned. The mean values of r_1, for these is $\pm 0''219$. There are 80 stars whose observations were entirely outside of that interval; but, omitting two of these, No. 23, α Ursae Minoris and No. 278, λ Sagittari, as having peculiar conditions, the remaining 78 stars have a mean value of r_1 $\pm 0''.211$. Thus there seems to have been no sensible increase in accidental error during the interval in question.

The remaining data of the table are given under headings whose significations are evident. The residual given is the largest, numerically, with reference to the mean for each period, in the sense mean minus the individual value.

Table III. Adopted Values of Bessel's Constant *n*.

In this table are given the values *n* of the declination of the west end of the rotation axis grouped in means for periods of approximate constancy. The constant was determined for individual dates by means of the observation of some star of high declination in the observing list or some miscellaneous circumpolar star combined with the observations of two or more stars of lower declination including one equatorial star. This was done at intervals throughout the list of dates, or for more than 520 dates out of a total of about 1150 dates, counting evenings and mornings separately. An underscore mark in the column *n* indicates that the instrument was adjusted as to position subsequently to the last preceding date, or that some disturbance occurred that might be expected to change its position.

The remaining data of the table are given under headings whose significations are evident. The residual given is the largest, numerically, with reference to the mean for each period, in the sense mean minus the individual value.

Table IV. Adopted Clock Rates.

In this table are given the mean adopted rates of the Hohwü sidereal clock which was employed throughout. An underscore mark in the second column indicates where a change was made in the adjustment of the clock. The rates were determined from the observations and reductions which were made for the observatory time service. The former were made during the greater part of the time by two or three observers in turn employing the Bamburg transit. The remaining determinations were made from the observations with the meridian circle itself.

Table V. Coefficients for Proper Motion, Precession, and Nutation.

In this table are given, for intervals of twenty days, the coefficients employed in computing the supplementary tables of reductions to the mean equinox of 1900.0. From these tables the values were interpolated for the individual observations. The numbers in the last four columns correspond to the logarithms given in the American Ephemeris.

Table VI. For the Constants of the Parallax Coefficients.

From this table are readily derived the values of the constants K and log $^1/_{15}k$ which enter into the parallax coefficient P. The argument is the right ascension of the parallax star and the tabular values are given at intervals of 10 min. or 2°.5. The construction of the table and the method of its employment are sufficiently indicated by its headings and the formulae of section 4. These examples of its application are given at the foot of the table.

Table VII. List of Parallax and Comparison Stars Observed.

In the first two columns are given two series of reference numbers. In the first are the serial numbers of the parallax stars themselves in heavy type; these are the same as in the table of results in the Astronomical Journal, No. 631. In the second are the serial numbers for the entire list of stars.

In the third column are given the customary designations of the individual stars. Other designations and data for a number of the comparison stars appear in the notes to this table and for some of the parallax stars in the notes to Table X. The observation groups, consisting usually of a parallax star and two comparison stars, are indicated by the spacing of the table. In a few cases a parallax star has only one comparison star, and in several cases two or more parallax stars appear in one group with comparison stars in common.

In the fourth column are given the magnitudes from the Potsdam Photometry (1907) for all stars of the present list to be found therein, from the Harvard Photometry (Vol. L) for all remaining stars of the list to be found in that volume, and from the Bonner Durchmusterung or other common authorities for the remainder. In the case of a variable star a middle magnitude only is given. Where two numbers are given separated by a comma, they indicate the magnitudes of the separate components of a double star. This applies also to the sixth column. The magnitudes that were entered in the observing list, were from the Bonner Durchmusterung, the Argentine General Catalogue, or the national ephemerides and were not considered in the course of the observations except for guidance as to whether a fairly bright star was to be expected.

In the fifth column is indicated the screen through which the brighter stars were observed. The Roman numerals refer to the wire screens described in Vol. XI, page 2. The reductions of magnitude effected by screens I and II are 2.5 and 5.0 respectively. The letter *S* refers to the slat-screen described at page 3 preceding.

In the sixth column are given the magnitudes of the stars as estimated in the present series of observations, including the effect of the interposition of the screens indicated by the symbols in the fifth column. Where the numbers are connected by a hyphen they indicate the magnitudes estimated without and with the screen respectively or with different screens, according as the latter are indicated in the fifth column; but wherever the letter *S* appears against a star in the fifth column the slat screen was turned for all the observations on the star.

In the seventh column are given the numbers of the sixth column reduced to sea level and zenith for atmospheric absorption in all cases where the tenths of a magnitude are affected. These corrections were not applied in cases where the slat-screen was employed, since magnitudes estimated under that condition are not comparable with any other system. The corrections were interpolated from Müller's Table Ia (Die Photometrie der Gestirne, Leipzig, 1897), for the elevation of the Washburn Observatory 293 meters above sea level, and were applied to the means of estimates given in Table IX of the present volume. In the tables following in this text are exhibited the results of a comparison of these estimated magnitudes, after the application of the reduction to sea level and zenith, with the Potsdam and Harvard photometries mentioned above. All the stars in common with the former are included in the first pair of tables, while the remaining stars that were in common with the Harvard Photometry are included in the second pair of tables. In expressing the relations of the Potsdam, Harvard, and the present estimates, these authorities are indicated by means of the symbols *P*, *H*, and *F* respectively.

Limits of Zenith Distance ° °	*P–F*	No. of Stars
0.1 to 6.2	—0.01 mag.	22
6.4 11.5	+ .09	21
12.2 14.1	+ .06	20
14.4 19.6	+ .05	20
20.7 30.7	— .02	20
30.7 43.5	+0.02	20
	Total number,	123

Limits of Magnitude	*P–F*	No. of Stars
6.0 to 6.9	—0.06 mag.	43
7.0 7.4	.00	41
7.5 7.9	+ .11	28
8.0 8.6	+0.32	11
	Total number,	123

The probable error of a single value of *P–F*, as computed from the residuals formed with reference to the six group means in the first of these tables above, that for zenith distance, is ±0.125 mag., and for the mean of 20 values it is ±0.028. From the data of the second table, that for magnitude, the probable error of a single value of *P–F* was found to be ±0.089 mag.

It appears from these values of *P–F* that there was no marked systematic change with zenith distance, but a decided tendency on the part of the present estimates to run too bright on the fainter magnitudes.

Limits of Zenith Distance ° °	*H–F*	No. of Stars
38.3 to 64.0	—0.41 mag.	13
67.9 to 77.1	—0.45	12
	Total number,	25

Limits of Magnitude	*H–F*	No. of Stars
5.2 to 5.9	—0.46	10
6.0 to 6.7	—0.41	15
	Total number,	25

In the eighth column are given the proper motions in a great circle for those stars, 138 in number, for which recorded proper motions were found. These were computed from the data of Newcomb's catalogue, 1900, for the 93 stars of the present list found therein. The data for the remaining 45 stars were taken from the Auwers-Bradley catalogue of 1755.0–1865.0, the Cincinnati catalogue, 1900.0 or the Astronomische Gesellschaft Zone catalogue, 1875.0.

In the ninth and tenth columns are given the right ascensions and declinations for 1900.0. These were obtained from the ephemerides for the brighter stars and from some catalogue for the remaining parallax stars. As the constants of reduction depend chiefly upon the differences of position between the stars of a given parallax set, the right ascension of the comparison stars were formed by applying to the catalogue position of the parallax star the approximate differences of right ascension given by the observations themselves. The declinations were all obtained from catalogues; but for the stars of highest declination, Nos. 23, 214, and 319, a few observations were made with the circle in the course of the present series to determine the differences of declination. The declinations are given to different degrees of approximation, just as they were employed in computing the reductions to standard position of the micrometer and the constants of the precession terms. The requirement was made that the error in the absolute term of any observation equation should not exceed $0^s.005$ due to error in the adopted declination for any one star.

In the eleventh, the last, column are given the assumed proper motions in right ascension for the individual stars. These were obtained from the same authorities as were the data entering into the computation of the numbers in the eighth column. They were employed in the reduction of the observation equations, with the exception of those which are enclosed in square brackets in the tables. The values thus enclosed were regarded as too small to take into account in preparing the data for the solutions.

At the close is given a little table of tabular members of those parallax stars, together with the list numbers of their comparison stars, which enter only into pairs in the observing list or which enter into combinations with comparison stars differing from the regular form of two comparison stars and a single parallax star between.

Table VIII. Reduction Constants for the Parallax Groups and Differences of Apparent Magnitude and Position.

In this table, the third to the tenth columns inclusive, are given the constants of reduction which depend upon the differences in position of the stars of the individual parallax sets. The definitions of the symbols which appear in the headings of the columns, from the third to the eleventh inclusive, are found in section 4, Methods of Reduction. The numbers in the third to the sixth columns inclusive are in the fourth decimal place and those in the seventh to the tenth columns are in the fifth decimal place, as indicated at the head of the table. In the last three columns are given the corresponding differences of magnitude and differences of position in right ascension and declination. The definitions of the headings of the columns are as follows:

$$\tfrac{1}{2}Dm = \tfrac{1}{2}(\text{Mag.}_1 + \text{Mag.}_3) - \text{Mag.}_2\,,$$
$$\tfrac{1}{2}D\alpha = \tfrac{1}{2}(\alpha_1 + \alpha_3) - \alpha_2\,,$$
$$\tfrac{1}{2}D\delta = \tfrac{1}{2}(\delta_1 + \delta_3) - \delta_2\,.$$

The suffixes 1, 2, 3 refer to the first, second, and third stars of a parallax set respectively, in order of right ascension. These differences are given in this algebraic sense to accord with that of the preceding differences given in the table. The magnitudes here concerned, were obtained from Table VII, sixth column. In the cases of stars 23 and 278 and in the second solutions for stars 196 and 358 only one comparison star is involved, and the numbers in the table are the corresponding differences with respect to two stars only, in accordance with the formulae of section 4.

All the numbers contained in this table, with the exception of those in the last three columns, were computed independently by Mr. Worthing and myself and the results compared.

Table IX. Data of the Observations for Parallax and Results of the Solutions.

With the exception of the data printed for these two parallax stars, as samples, this table is omitted here on account of its great size; but the copy is all at hand.

In this table are given the data for the individual observation equations for each parallax star. The individual parallax stars are represented by a series of subdivisions of the table in the order of their right ascension, and at the head of each subdivision are given the reference numbers from Table VII, the name of the parallax star, its approximate position for 1900.0, and, in cases where a screen was employed, an indication of the star in whose observation the screen was applied.

All the numbers in the columns from the fourth to the tenth inclusive and in the last column, are in the third decimal place. These columns include all numbers which express observed quantities, the computed corrections thereto, and the residuals computed after substituting the values of the unknowns resulting from the solutions. At the head of the fourth and tenth columns are shown the number of whole seconds in the differences. The exact significance of each symbol is given in section 4 entitled Method of Reduction.

In the first column are given the serial numbers of the observations, the last of which, for any particular parallax set, shows the total number of observations on that set; but for some stars this number must be reduced, as regards the solution, because of a few observations rejected as indicated by the square brackets in the tenth and last columns.

In the second column are given the dates of the individual observations. The morning and evening dates may be readily distinguished by the signs of sin $(L–K)$, which are positive and negative for morning and evening respectively.

The remaining data are given in columns whose headings are defined as follows:

c''' = the reduction, in revolutions of the micrometer, from the mean position of the micrometer, M_0, to the standard position 7.05 rev. and to the axis of collimation, including the diurnal abberation. This mean position corresponds to the mean of the chronograph signals employed in computing the difference between the observed times for each set of stars. We have therefore

$$c \;= c'' \text{ (Table II)} + (7.05 \text{ Rev.} - M_0).$$

In the normal observation the chronograph signals were read for each star of a parallax set on a standard series of contacts, twenty in number. In such cases, therefore, and in general, the value of c''' is common to both differences of observed times, $T_2 - T_1$ and $T_2 - T_3$, and is very small. But in a considerable number of cases the contacts entering into one mean difference are different from those entering into the other, and in these cases the two values, c''' are given in the notes for the two differences respectively. In some cases, comparatively few in number, the signals on scattered contacts for each star were read off and reduced to standard position individually. These departures from the normal observation were due to the maintenance of too light a pressure on the contact points through a certain period, so that many signals failed to record on the chronograph during that period.

DT = sum of the differences between the transit times of the parallax star and those of the comparison stars in the sense

$$DT = (T_2 - T_1) + (T'_2 - T_3),$$

where T_1 and T_3 denote the means of the transit times for the first and third stars of a set respectively and T_2 and T'_2 denote the corresponding means for the second or parallax star. In the normal observation we have $T'_2 = T_2$. The differences $T_2 - T_1$, $T_2 - T_3$, were actually computed as the means of the differences between the individual chronograph signals.

$dT(c)$ = the reduction to the axis of collimation that corresponds to the constant c'''.

$dT(n)$ = the reduction to the normal position of the instrument that corresponds to the value of Bessel's constant n (Table III).

Rate = the reduction on account of the clock rate. The effect of the rate is insignificant where the three stars observed are disposed in approximate symmetry.

Precess. and Nutat. = the reduction to the selected epoch 1900.0. These were interpolated for the series of observations on each set of stars, from a table computed for each set of stars for twenty day intervals by aid of Tables V and VIII. In the case of a number of stars on which observations continued so that the middle time fell much later than 1900.0, the epoch for the solution is adopted at the beginning of 1901 or 1902 in order to secure a better balance in the coefficients of the normal equations. In these cases the value of the coefficient as employed in the solution and as presented in the eleventh column were changed accordingly. But in all cases the absolute terms of the equations were reduced to the epoch 1900.0 and remained unchanged. In order to refer the difference of the right ascensions to the new epoch in these cases, it will be necessary to correct for proper motion from 1900.0, as shown at page 10 preceding. But this is not required for the correct solution of the normal equations.

Prop. Mot. = reduction to 1900.0 for the assumed proper motions in right ascension given in Table VII. In computing these reductions the coefficients were taken to three decimal places as given in Table V.

In the column DT, 1900.0 are given the sums of the observed differences of right ascension $(\alpha_2 - \alpha_1) + (\alpha_2 - \alpha_3)$ reduced to 1900.0, that is, this column contains for each observation the sum of the quantities in the fourth to the ninth columns inclusive. At the head of this column, as at the head of column *DT*, the entire number of seconds is given with the proper algebraic sign. The sign of each individual number in the column is that with which it must be applied to the whole number at the head, in order to produce the complete absolute term for that particular observation.

The values of the weight-factors $\sqrt{p}$ where they are less than unity, are given in the notes following the table for each set of stars. For the few cases of complete rejection the values of $D\alpha$ 1900.0 and of $\sqrt{p}v'_1$ are enclosed in brackets.

In the next two columns are given the coefficients of proper motion and parallax, τ and sin $(L–K)$.

In the last column are given the residuals $\sqrt{p}v'_1$ from the observation equations as they were entered in the solutions.

These data of the observations for each set of stars are followed by a number of notes, each preceded by the serial number of the observation to which it pertains. In many cases also the estimates of the condition of the star images, or "seeing" as commonly designated now in American publications, is expressed in two numbers, as in Vol. XI, the first of which pertains to the steadiness of the image and the second to its quality, both on a scale of 5 to 0 in which 5 expresses the best condition. The faintness of the images is noted as *f, ff, fff,* as explained in Vol. XI, page 42, where the limits of magnitude are set as follows: *f,* 8.0 to 8.3; *ff,* 8.3 to 8.8; *fff,* 8.8 and fainter. For a number of observations numerical values are found following the symbols, E_1, E_2, E_3. These represent in each case the computed errors of the transit times of the three stars of a parallax set relative to the mean of their three transit times. For further explanation of these comparisons see section 8 entitled Abnormal Residuals.

Following the notes are given the means of the observer's estimates of the apparent magnitudes of the stars, including the effect of the employment of screens. These numbers are intended to represent the normal appearance of the stars to the observer. Estimates made in daylight illumination or under especially unfavorable conditions, such as cloudiness or very poor seeing, were excluded. In the first two lines, designated by the letters *M* and *E* are given the means of the estimates made in the morning and evening respectively and the number of estimates entering into each set of means. In the third line are given the means of all the estimates, in general the simple means of the numbers above without regard to the number of estimates entering into the separate groups. The large number of estimates in each case were not made as a necessary part of the observation; but they added very little to the work, since they were easily noted between times, and they were of assistance in many cases in indicating an inferior condition of the sky or of the star images.

At the right hand side of the page are given the normal equations, in their final form in the unknowns, x, y, z. Accordingly the coefficients of x in the first equation is $[\sqrt{p}]$, that of y in the second equation is $[\sqrt{p}.\tau]$, and that of z in the third equation is $[\sqrt{p}.\sin(L–K)]$.

In the first part of the next division of the data are given the assumed value of $D\alpha$ 1900.0 which was employed in computing the absolute terms of the equations as entering into the solution, and the values of the unknowns x, y, z resulting from the solution of all the data in the table above. In the middle part are given the corresponding values of $d(D\alpha)$, $d(D\mu)$ and π, the last with its probable error. In the third part are given the weight p_z computed for the unknown z in the solution, the control sums $[nn.3]$ and $[vv]$, or strictly the one-hundredth part of these sums as they appear in the solution, and the probable error r of a single observation equation of weight unity, that is, of a single normally observed value of $D\alpha$. 1900.0. The corresponding values of r_1 appear in Table X.

Last of all, in a number of cases, are given the results of special solutions made from the data for two stars alone or of selected groups of the observation equations for all three stars. For the former the probable error r_1 given here is that of a single normal observation of the pair of stars reduced to a great circle.

The Observations of α Ursae Minoris.

The presentation of the data for α Ursae Minoris and its comparison star differs somewhat from that for the other parallax stars. The interval of time between the two stars was such—from 4^m 15^s at the beginning to 5^m 15^s at the close of the series of observations—that the observation on each date was divided into four parts in order of time, of which the first and third were given to star 22, the second and fourth to star 23. Thus, in general, from five to seven contact times were secured on each star in the preceding part of the field, and from five to thirteen in the following part. Those were all reduced individually to the standard position 7.05 rev., with the employment of the ephemeris declinations of star 23 and declinations of star 22 derived from several determinations of the difference between the zenith distances of the two stars. These were made by means of the circle and microscopes on seven dates, and the periods of observation were as follows: 1899, November; 1900, November–December; and 1902, August.

The mean value of the contact correction, +0.0057 rev., as adopted in the reductions of the general list, was applied also for these two stars. Only four determinations of the corrections were made during the progress of the parallax observations, and they agreed very closely. But up to the time of writing, a number of observations of the contacts have been made through a period of twelve years. Small changes occur from time to time and the new values persist for certain periods. These depend largely upon the occasional cleaning of the contact plates. In the following table are given the mean results of these determinations. In the last column of each division are given the products obtained by multiplying the numbers in the third column by 47.0, the approximate value of sec δ for star 23. The probable error of the difference in the table for any one of the ten contacts is ±0.0001 rev.

DIFFERENCES OF INDIVIDUAL CONTACTS FROM THE MEAN OF THE STANDARD SET OF TWENTY CONTACTS.

Tenth of a Rev.	1898, Oct. to 1905, June 1=0r.0001	1=0s.0001	Effect for sec δ = 47.0	1908, July to 1911, May 1=0r.0001	1=0s.0001	Effect for sec δ = 47.0
	r	s	s	r	s	s
0.1	+0.8 =	+ 5	+0.02	— 6.6 =	— 42	—0.20
.2	—2.7	—17	— .08	—16.9	—106	— .50
.3	+0.2	+ 1	+ .00	— 3.3	— 21	— .10
.4	—0.5	— 3	— .01	— 4.3	— 27	— .13
.5	+1.3	+ 8	+ .04	+ 5.5	+ 35	+ .16
(.6)	(+6.4)	+40	(+ .19)	(+18.8)	(+118)	(+ .55)
.7	+1.7	+11	+ .05	+12.5	+ 79	+ .37
.8	—0.4	— 3	— .01	+ 6.0	+ 38	+ .18
.9	+0.5	+ 3	+ .01	+19.2	+121	+ .57
(.0)	(0.0)	(0)	(.00)	(— 5.8)	(— 36)	(— .17)

The numbers for .6 rev. and .0 rev. are enclosed in parentheses here because these tenths do not belong in the standard set to which reference is here made and which was adopted for a later series of observations. Also the fact that the algebraic sums of the numbers in the table are not zero, is due to the fact that the individual contacts did not enter equally into the standard set.

The principal data involved in the computation of the times of transit referred to the standard position of the micrometer 7.05 rev., are presented for the two stars separately in the two tables following. The significations of the column headings, so far as they require explanation, are as follows.

M_1 and M_2 are the means of the micrometer readings for the preceding and following groups of contact times respectively; and m_1 and m_2 are the corresponding numbers of contacts.

T_1 and T_2 are the corresponding means of the contact times after reduction of the latter individually to 7.05 rev.

T_0 is the mean of T_1 and T_2 combined with the weights m_1 and m_2 respectively.

OBSERVED CORRECTIONS TO THE ADOPTED VALUE OF THE MICROMETER.

A solution was made from the data as described in the preceding with the following results:

$d.\Delta\alpha = +0^s.049$	$[nn.3] = 21.52$
$d.\Delta\mu = -0^s.046$	$[vv] = 21.44$
$\pi = +0.011 \pm 0''.016$	$r = \pm 0^s.361$
No. of observations, 78	$r_1 = \pm 0''.115$

But it seemed advisable to take advantage of the separation of each observation into two parts, so far removed from each other in the field, in order to make a test of the adopted value of one revolution of the micrometer. The test would lack, however, the advantage of symmetry in the disposition of positions and times in each observation.

Accordingly the differences $T_2 - T_1$ were tabulated for each period on each star and their sums divided by the corresponding sums of the micrometer intervals. This quotient was divided by a mean value of sec δ for each period, so that the final number expressed the desired correction. The results are presented in the following table:

Period	Star 22	No. of Obs.	Sec δ	Star 23	No. of Obs.	Sec δ	Star 23–Star 22	Adopted Correction
	s			s			s	s
1898, Aug.	(+0.0083)	(1)	29.11	(+0.0367)	(1)	46.36	(+0.0284)	(0.0000)
1899, Aug.	+ .0015	11	29.19	.0000	10	46.56	— .0015	.0000
1900, Aug.	— .0006	7	29.28	— .0008	7	46.77	— .0002	.0000
1901, Aug.	+ .0014	13	29.34	— .0013	13	46.92	— .0027	.0000
Weighted Mean,	+0.0010	31		—0.0008	30		—0.0017	
	s			s			s	s
1898, Dec.–'99, Jan.	+0.0065	10	29.29	+0.0055	10	46.82	—0.0010	+0.0060
1899, Dec.–'00, Jan.	+ .0127	4	29.36	+ .0103	4	46.99	— .0024	+ .0110
1900, Dec.–'01, Jan.	+ .0043	14	29.45	— .0024	13	47.19	— .0067	.0000
1901, Dec.–'02, Jan.	+ .0009	16	29.52	— .0013	16	47.37	— .0022	.0000
Weighted Mean,	+0.0043	44		+0.0010	43		—0.0033	

The consequent corrections to the observed times, for the first two winter periods, are shown in the following table where the corrected times T_1 and T_2 are the same as appear in Table IX. These were adopted in the solution for parallax.

No. of Obs.	Date	M_2–M_1	T_1	T_2	ΔT_1	ΔT_2	T_1	T_2
	Star 22. B. D. +87°, 12							
		r	s	s	s	s	s	s
2	1898 Dec. 17.3	2.85	26.74	27.18	+0.16	—0.34	26.90	26.84
3	18	2.25	26.75	27.20	.12	.27	26.87	26.93
4	25	2.50	32.13	31.77	.19	.25	32.32	31.52
5	30	3.40	13.75	14.90	.19	.41	13.94	14.49
6	31	2.25	10.27	10.00	.12	.27	10.39	9.73
7	1899 Jan. 6.2	2.70	11.30	13.32	.18	.30	11.48	13.02
8	7	2.30	59.08	59.38	.12	.28	59.20	59.10
9	8	3.20	58.42	59.60	.18	.39	58.60	59.21
10	14	2.80	49.18	49.57	.25	.25	49.43	49.32
11	15	2.25	46.96	46.70	.06	.33	47.02	46.37
12	18.2	[0.65]	36.60	34.86	+0.04	—0.08	36.64	34.78
$n = 11$								
24	1899 Dec. 4.4	2.10	7.12	8.70	+0.24	—0.44	7.36	8.26
25	7.3	2.60	13.06	14.01	.47	.37	13.53	13.64
26	23	....	.....	6.49	...	.21	.....	6.28
27	1900 Jan. 7	2.40	52.22	52.92	.34	.42	52.56	52.50
28	20.2	2.40	54.82	55.11	+0.47	—0.31	55.29	54.80
$n = 4$								

No. of Obs.	Date		M_2–M_1	T_1	T_2	ΔT_1	ΔT_2	T_1	T_2
			Star 23.	α Ursae Minoris					
			r	s	s	s	s	s	s
2	1898 Dec.	17.3	2.25	58.55	60.15	+0.17	—0.46	58.72	59.69
3		18	2.30	59.35	60.49	.20	.45	59.55	60.04
4		25	2.10	01.03	01.53	.24	.35	01.27	01.18
5		30	2.80	42.10	40.81	.18	.60	42.28	40.21
6		31	2.20	37.17	37.98	.20	.42	37.37	37.56
7	1899 Jan.	6.2	2.25	34.02	35.54	.20	.44	34.22	35.10
8		7	2.30	15.90	17.41	.20	.45	16.10	16.96
9		8	2.75	17.02	17.42	.21	.55	17.23	16.87
10		14	2.70	9.30	8.40	.37	.39	9.67	8.01
11		15	2.40	6.28	7.13	.14	.53	6.42	6.60
12		18.2	[0.65]	50.75	51.68	+0.06	—0.13	50.81	51.55
$n=11$									
24	1899 Dec.	4.4	2.05	43.50	44.80	+0.36	—0.70	43.86	44.10
25		7.3	2.50	50.83	52.75	.70	.59	51.53	52.16
26		23	....	.....	40.49	...	.34	.....	40.15
27	1900 Jan.	7	2.35	16.32	16.78	.54	.67	16.86	16.11
28		20.2	2.30	16.93	17.69	+0.70	—0.49	17.63	17.20
$n=4$									

Following the tables of data for the two stars separately, is a table in which are presented the data of the observation equations in the same general form as for the entire list of stars. The value of the collimation constant c'' is given for each period, and that of Bessel's constant n foreach date. Since c'' is given here in seconds of time, instead of revolutions of the micrometer, the coefficient in the fourth column becomes Δ sec δ instead of $R.\Delta$ sec δ.

In the column ΔT is given the difference between the reduced times T_0 of the two preceding tables, and in the column ΔT 1900.0 the sum of ΔT and the numbers in the four columns following ΔT. The annual proper motion of star 23 was assumed to be $+0^s.1364$ throughout. This is from Newcomb's centennial proper motion $+13^s.64$ for 1900.0. His value of the secular variation of the proper motion is $+5^s.97$ for 1900; but the assumption made above involves an error of less than $0^s.005$ in the largest proper motion terms of the table.

The absolute terms were not multiplied by ten, as was done for the stars in general, and are taken to two decimal places only. At the conclusion are given the normal equations and the results of their solution.

Table X. Results of the Observations for Parallax.

In the first column are given the serial numbers from the list of parallax stars proper, and in the second column the serial numbers from the entire observing list. In the fourth column is given the magnitude as entered in the observing list; but a better series of magnitudes is given in Table VII, fourth column. The remaining data are given in columns under headings whose significations are as follows:

$\frac{1}{2}d(D\mu)$ = the correction to the difference of the assumed proper motions in right ascension, as resulting directly from the same solution as that from which the value of π in the next column was derived. This difference is taken in the sense parallax star minus the mean of the comparison stars, and in the few cases where only two stars were observed together, in the sense parallax star minus comparison star.

π = the adopted value of the relative parallax resulting from the solution of the observations. This is transcribed for each star from the numbers which would have been printed in heavy type in the complete Table IX.

$r(\pi)$ and r_1 = the probable errors of π and of a single observation of weight unity respectively, each reduced to a great circle. These probable errors were computed by means of the formulae presented in section 4, Method of Reduction. The probable error r_1 pertains to the normal observed difference between the transit time of a parallax star and the mean of the transit times of its comparison stars.

In the last column but one is given the number of observations entering into the solution for π, not including the few rejected observations which are indicated in Table IX by the enclosure of the values of $D\alpha$ 1900.0 and of $\sqrt{p}v'_1$ in brackets. In the last column is given the number of periods, near positive or negative maximum of parallactic effect, among which the observations were distributed.

Following the table are a few notes which give other designations that came to notice for certain of the parallax stars in preparing the observing list.

Table of Constants
List of Stars Observed, and Results

TABLE I.

Period		Level b	Largest Residual v	No. of Determinations m	Temp. Fahr. t
		s			°
1898, July 15.3–'98	July 24.3	+0.264	+ 81	7	73
25.3	Aug. 1.3	.378	+ 48	4	72
Aug. 3.3	Sept. 27.3	.298	— 70	14	64
Sept. 28.3	Oct. 4.3	.215	± 43	2	70
Oct. 5.3	5.7	.318	± 1	2	44
8.3	15.3	+0.199	+ 59	4	46
26.3	Nov. 3.7	.024	— 45	4	40
Nov. 6.3	Dec. 31.3	.062	—113	9	22
1899, Jan. 5.3	Jan. 15.3	+0.277	—105	6	16
17.7	23.7	+0.342	— 95	3	17
Feb. 18.3	Mch. 8.3	+0.838	— 51	3	18
Mch. 19.7	Apr. 4.7	—0.178	— 15	4	15
Apr. 11.7	16.7	.322	+ 11	3	43
Apr. 25.7		—0.805	...	1	60
Apr. 28.3	June 13.3	+0.662	+114	10	58
June 29.7		+0.838	...	1	59
June 30.3	Aug. 15.7	—0.376	—109	7	68
Aug. 22.7		— .223	...	1	64
Aug. 27.7	Sept. 18.7	— .402	— 41	3	64
Sept. 26.7	Oct. 15.3	— .623	+ 59	3	52
Nov. 3.7		—0.846	..	1	31
Nov. 6.3	Nov. 26.7	—0.720	— 92	3	39
Dec. 15.3	Dec. 23.3	—0.323	± 55	2	24
1900 Jan. 7.3		+ .050	..	1	31
Jan. 20.3	Feb. 1.7	— .244	+103	3	20
Feb. 4.3	Feb. 6.3	+0.052	+102	4	16
Feb. 9.3	Feb. 19.3	+ .258	— 70	4	11
Feb. 22.3	Mch. 2.7	+ .451	— 49	3	12
Mch. 6.7	Mch. 30.3	+0.320	— 60	4	22
Apr. 4.3		+ .166	..	1	39
Apr. 6.3		+0.364	..	1	58
Apr. 19.3	May 9.3	— .268	— 66	3	48
June 4.7	Sept. 17.7	—0.177	+108	10	65
Sept. 21.7	Sept. 30.7	—0.370	± 1	2	51
Oct. 7.7	Nov. 1.7	—0.606	+ 78	5	51

TABLE I—Continued

Period					Level b	Largest Residual v	No. of Determinations m	Temp. Fahr. t
					s			°
1900,		Nov. 8.7			—0.811	..	1	26
	Nov. 15.7		Dec.	31.3	+0.105	—108	6	23
1901,	Jan. 12.3	-'01,	Jan.	14.3	+0.480	± 16	2	26
		Jan. 17.3			+ .210	..	1	10
		21.3			+0.477	..	1	22
		23.3			+0.533	..	1	27
		Feb. 1.7			+ .864	..	1	8
		2.3			—0.123	..	1	10
	Feb. 11.3		Feb.	21.3	+ .070	0	2	12
	Mch. 1.8		Mch.	21.7	+ .363	+ 84	5	25
		Mch. 31.7			+0.161	..	1	29
	Apr. 3.7		Apr.	8.7	— .002	± 71	2	32
		Apr. 10.7			—0.164	..	1	34
	Apr. 23.3		Apr.	29.3	— .391	± 46	2	57
	May 1.7		May	2.7	+ .117	± 40	2	65
	May 4.3		May	31.7	—0.302	+ 72	5	53
		June 6.7			—0.171	..	1	45
		June 12.3			— .408	..	1	78
	June 16.7		July	15.3	— .123	+ 87	6	73
		July 21.7			+ .043	..	1	76
	July 31.7		Sept.	1.7	—0.131	— 63	3	64
	Sept. 15.7		Nov.	2.2	—0.426	+126	5	48
	Nov. 18.7		Dec.	20.2	+0.324	— 17	3	17
1901,	Dec. 30.3	-'02,	Jan.	24.7	+ .632	— 37	5	21
1902,		Feb. 14.7			+0.084	..	1	7
		23.7			+0.227	..	1	30
	Mch. 13.2		Mch.	13.7	—0.080	± 15	2	38
	Mch. 26.7		Apr.	29.3	— .335	+ 30	3	42
		May 8.7			—0.184	..	1	46
		18.3			— .623	..	1	60
	May 22.3		Aug.	15.7	— .240	+137	11	64
		Sept. 1.7			—0.125	..	1	56
	Sept. 15.7		Nov.	2.7	— .418	—106	5	43
	Nov. 19.7		Dec.	3.9	— .586	— 48	3	24
	Dec. 6.4		Dec.	18.4	— .728	± 4	2	22

TABLE I—Continued

Period	Level b	Largest Residual v	No. of Determinations m	Temp. Fahr. t
	s			°
1903, Jan. 1.3-'03, Jan. 12.3	—0.572	+ 94	3	10
Jan. 14.7	— .215	..	1	12
Jan. 16.7 Feb. 9.3	—0.057	+116	9	18
Feb. 13.3	+ .102	..	1	15
Feb. 16.3 Feb. 21.3	— .061	+123	4	3
Mch. 7.3 Mch. 13.3	+ .166	± 90	2	38
Mch. 21.3 May 15.7	—0.339	+ 86	8	43
June 2.7 June 11.7	—0.045	— 36	3	58
June 14.7	+ .164	..	1	50
June 23.7 July 2.3	— .010	— 81	4	67
July 4.7 Sept. 22.7	+0.128	—112	9	63
Oct. 4.7	— .135	..	1	40
Oct. 17.7 Nov. 12.7	—0.287	+111	9	42
Nov. 19.7 Nov. 29.7	— .544	± 24	2	14
Dec. 16.7 Dec. 22.7	—0.079	+133	4	10
1904, Jan. 6.5–'04, Jan. 13.5	+0.394	± 14	2	10
Feb. 24.9 Mch. 22.5	+0.970	+ 67	4	23
Apr. 3.5	+ .867	..	1	33
6.5	+ .613	..	1	40
16.5	+ .418	..	1	35
21.5	+ .245	..	1	37
26.5	+0.119	..	1	42
28.7	+ .047	..	1	44
Apr. 30.3 May 20.3	—0.233	+ 98	7	55
May 23.3 May 27.7	— .060	+ 66	3	58
June 1.7 July 17.7	—0.187	— 79	15	65
July 19.7 July 22.7	— .028	± 53	2	62
Aug. 10.4 Sept. 3.5	— .238	+ 43	4	64
Sept. 9.4 Sept. 26.3	— .438	± 16	2	64
Oct. 8.3 Oct. 16.3	—0.543	± 1	2	59
Oct. 27.3 Nov. 2.3	— .611	± 62	2	45
Nov. 4.4	— .432	..	1	47
Nov. 11.6–'05, Jan. 3.5	— .660	+115	6	29
1905, Jan. 13.4 Jan. 16.4	— .290	± 9	2	2
Jan. 25.7	—0.057	..	1	2
Jan. 29.7 Feb. 6.7	+0.208	± 48	2	1
Feb. 22.3 Mch. 10.7	+0.474	— 45	4	28

TABLE II.

One Revolution of the Micrometer = 6.s2923 ±0.s00045

Period	Coll. Const. c''	Largest Residual v	No. of Determinations m	Method of Pointing upon the Star-Images
				Bisection of Interval between a Pair of Movable Threads
	r	r		"
1898, July 16.4–1898, Nov. 3.8	+0.1210	+0.0115	9	Interval = 9.8
98, Nov. 6.3 98, Nov. 26.7	+ .0131	± 27	2	Interval = 9.8[1]
98, Dec. 17.3 1900, Feb. 6.3	+ .0265	+ 118	30	After 1899, June 1.8, interval = 11.0[2]
1900, Feb. 9.3 00, May 12.3	+ .0366	— 026	5	Interval = 11.0
00, June 4.3 00, Oct. 18.3	+ .0303	+ 34	12	Interval = 11.0
00, Oct. 19.6 01, June 26.7	+0.0456	+0.0106	23	Interval = 11.0
01, June 30.3 01, Oct. 5.3	+ .0389	+ 30	8	Interval = 11.0
01, Oct. 18.3 02, Mar. 4.7	+ .0434	+ 58	11	Interval = 11.0
02, Mar. 13.2 02, May 8.7	+ .0387	+ 25	5	Interval = 11.0
02, May 11.3 02, Dec. 3.3	+ .0309	— 59	13	Interval = 11.0[3]
02, Dec. 18.3	+0.0509	..	1	Interval = 11.0
02, Dec. 31.3 03, Jan. 15.6	+ .0179	±0.0026	2	Standard interval = 4.″3[4]
				"
03, Jan. 16.2 03, Feb. 2.7	+ .0222	± 04	2	Interval = 4.3
03, Feb. 4.7 03, Feb. 5.7	+0.0235	..	..	Interval = 12.5[5]
03, Feb. 8.3 03, Mar. 13.3	—0.1843	+ 40	4	Interval = 4.3[6]
03, Mar. 21.3 03, Sept. 17.7	—0.2025	—0.0097	13	Interval = 4.3
03, Sept. 21.7 03, Oct. 10.7	— .1247	± 94	2	Interval = 9.2[7]
03, Oct. 17.7 03, Nov. 29.7	—0.1169	— 109	6	Interval = 9.2
03, Dec. 16.7 03, Dec. 22.7	+0.0374	— 28	3	Interval = 10.5[8]
04, Mar. 3.7 04, May 21.3	+ .0342	— 89	11	Interval = 12.0[9] [10]
04, May 26.3 04, Oct. 17.3	+0.0258	— 53	11	Interval = 12.0
04, Oct. 27.3	+ .0355	..	..	Interval = 9.9[10]
1904, Oct. 28.3–1904, Nov. 6.3	+ .0258	— 53	11	Interval = 12.0[11]
04, Nov. 11.3	+ .0346	..	..	Interval = 12.0[12]
				Bisection of Star-Image upon a Single Thread[13]
04, Nov. 15.3 04, Dec. 10.3	+0.0913	± 22	2	

TABLE II—Continued

Period		Coll. Const. c''	Largest Residual v	No. of Determinations m	Method of Pointing upon the Star-Images
					Bisection of Interval between a Pair of Movable Threads
					″
04, Dec. 20.3	05, Feb. 6.7	+0.0307	+0.0041	4	Interval = 8.6[14]
05, Feb. 14.6	05, Mar. 10.7	+0.0196	+0.0014	3	Interval = 8.6

1. 1898, July 28.2. An attempt was made to adjust the collimation but the screws were found to be set too hard. 1898, Nov. 6.3. Sometime between Nov. 3.8 and this date a change occurred in the collimation without known cause. With this exception no marked change in the collimation was noted during the entire course of the observations, nor was there any reason to suspect such change. The apparent large changes which occurred subsequently, were due to the adoption of new standard threads of observation. 2. 1899, June 1.8. Frame carrying movable R. A. threads removed to disentangle threads and replaced. On one date early in February, 1900, the threads were found close together. Upon disturbing them slightly they appeared to resume their normal distance. 3. 1902, Dec. 14. New set of movable R. A. threads placed on the micrometer. Interval somewhat greater than that of former threads. 4. 1902, Dec. 31, Movable R. A. threads again taken out and a new set put on; a close pair, interval 4.″3, employed in general; a wide pair, interval 12.″5 employed on certain stars. 5. 1903, Feb. 4.7, Feb. 5.7. Wide pair of threads employed alone following the close pair by 0.802 rev. Standard position, 7.85 rev. Value of collimation reduced from observations on other dates. 6. 1903, Feb. 8.3. Micrometer head adjusted so as to resume the standard position at 7.05 rev.; wide pair of threads alone employed until 1903, Sept. 20. 7. 1903, Sept. 20. Standard threads found slack Sept. 18. Picked out one thread and adopted a new standard pair, interval 9.″2. 8. 1903, Dec. 16.1. Threads again out of order. There are now five movable R. A. threads in all; a single close pair and a wide pair. Threads adjusted and the close pair adopted as the standard, interval 10.″5. 9. 1904, Jan.–Feb. Parallax observations suspended owing to the completion of a part of the list. 10. 1904, Feb. 21. Spider threads all removed from the movable R. A. frame and a single pair of silk fibers mounted, interval 12.″0. They appear about the same as the original spider threads. One abnormal value of the interval noted, 1904, Oct. 27.4, 9.″9; special value of the collimation adopted for this date deduced from change in coincidence with the fixed thread. 11. This period should be joined to the period 1904, May 26.3–Oct. 17.3. The numbers given belong to the periods combined. 12. 1904, Nov. 11.3. Threads hitching and changing slightly. 13. 1904, Nov. 15.3. One thread of pair found slack. Employed the remaining single thread. Certain sets of fainter stars observed by placing the star image at the front edge (farther from the micrometer head) of the thread during the first half of the observation and at the rear edge during the second half of the observation. 1904, Nov. 18.3–Dec. 10.3. All stars observed on the edge of the single thread, as described in the preceding note. 14. 1904, Dec. 12. A new set of three spider threads, similar to the original set, put in by Mr. H. G. Fischer, mechanician.

TABLE III

Period	Constant n	Largest Residual v	No. of Determinations m
	s	s	
1898, July 15.3–1898, July 20.3	—1.883	0.030	2
21.7 22.7	—1.762	27	2
23.3 Aug. 13.3	—0.034	48	7
Sept. 15.3	+0.035	..	1
Sept. 16.3 Sept. 30.3	—0.244	55	4
Oct. 4.3 Oct. 15.3	—0.144	34	5
26.3 Nov. 6.3	— .354	57	6
Nov. 10.3 16.7	— .213	37	4
23.3 26.7	+ .049	..	1
Dec. 17.3 Dec. 30.3	— .061	14	3
30.7 '99 Jan. 15.7	+0.068	40	4
'99, Jan. 17.7 24.3	+0.175	13	3
Feb. 15.3 Mch. 13.3	+0.940	81	3
Mch. 19.7 Apr. 4.7	+0.511	30	3
Apr. 7.7	+ .270	..	1
8.3	+ .230	..	1
9.7	+ .160	..	1
Apr. 11.7 Apr. 12.3	+ .032	..	1
14.7 19.3	— .168	62	2
23.7 25.7	—0.500	76	4
28.3 May 6.7	+0.532	65	3
May 8.7 21.7	+ .445	37	3
22.3 24.3	+ .526	..	1
29.3 June 10.7	+ .345	7	3
June 12.3 13.3	+ .148	..	1
15.3 16.7	+ .414	10	2
18.3 29.7	+0.339	58	4
30.3 July 10.3	—0.406	46	4
July 11.3 Aug. 8.3	— .280	67	11
Aug. 9.7 11.7	— .494	3	2
12.3 16.3	— .311	74	4
17.7 20.7	— .482	20	4
21.3 24.7	— .259	87	4
26.3 28.7	— .426	107[1]	4
29.3 Sept. 1.3	— .339	73[2]	4
Sept. 3.7	—0.176	..	1
Sept. 10.7 12.7	—0.348	80	3
13.3 30.3	— .250	54	4
Oct. 1.7 Oct. 8.7	— .400	65	3

TABLE III—Continued

Period		Constant n	Largest Residual v	No. of Determinations m
		s	s	
1899, Oct. 18.3		—0.435	..	1
19.3	21.3	— .266	100[3]	3
Oct. 23.3		— .735	..	1
Oct. 24.2		— .621	..	1
28.3	30.7	— .296	63	4
Nov. 3.3	Nov. 26.7	—0.424	82	7
27.3	Dec. 4.3	+0.576	7	2
Dec. 7.3	7.7	+0.376	..	1
14.3	23.3	+ .560	27	2
1900, Jan. 5.3–	1900, Jan. 7.3	+ .703	..	1
20.3	27.3	+0.494	29	3
Feb. 1.7	Feb. 5.7	+1.148	52	3
Feb. 6.3		—0.310	..	1
9.3	10.3	— .160	..	1
13.3	22.7	— .083	3	2
Feb. 25.3		+ .033	..	1
26.7		+ .246	..	1
Mch. 1.3	Mch. 2.7	+0.073	12	2
6.7	20.7	—0.132	21	2
21.3	23.7	— .019	59	2
30.3	30.7	— .361	17	2
31.3	31.7	— .472[4]	..	..
Apr. 1.7	Apr. 10.3	—0.584	14	2
19.3	June 18.7	—1.049	137	7
July 8.3	July 18.7	—0.891	65	3
Aug. 15.3	Sept. 9.7	—1.052	127	6
Sept. 12.3	17.7	—0.868	66	2
19.7	30.7	—1.193	117	4
Oct. 7.7	Oct. 8.7	+0.018	3	2
9.3	26.6	— .206	133	8
Nov. 1.3	Nov. 8.7	—0.022	22	3
15.3	'01 Jan. 1.3	+0.195	148	11
'01, Jan. 1.7		+ .363	..	1
Jan. 2.3	3.3	+0.501	187[5]	3
12.3	17.3	+0.308	13	2
18.7	28.3	+ .510	144	6
31.3	Feb. 1.7	+0.856	..	1
Feb. 2.3		+0.354	..	1
Feb. 4.7	18.3	+ .599	91	5
20.3	Mch. 1.8	+0.932	87	4

TABLE III—Continued

Period		Constant n	Largest Residual v	No. of Determinations m
		s	s	
1901, Mch. 6.3	1901, Mch. 22.7	+0.671	74	3
28.7	31.7	+ .354	46	2
Apr. 2.7	Apr. 8.7	+0.138	40	2
9.3	20.3	—0.069	115	3
23.3	30.3	— .275	62	5
May 1.3	May 28.7	+ .017	79	5
31.7	June 8.7	— .124	43	3
June 11.3	16.3	— .213	86	5
16.7	July 3.7	— .056	61	6
July 4.3	9.7	+ .208	70	2
12.7	26.7	— .038	43	4
29.7	31.7	+ .253	56	3
Aug. 3.3	Sept. 6.3	+ .035	152	16
Sept. 12.7	16.7	— .160	46	2
17.7	18.3	+ .069	..	1
20.3	30.3	— .106	102	4
Oct. 2.3	Oct. 5.3	+ .036	10	3
Oct. 18.3		— .215	..	1
21.3		+ .078	..	1
21.7	27.7	— .101	120	6
Oct. 29.3		—0.362	..	1
31.3	Nov. 5.2	+0.050	..	1
Nov. 7.3	7.7	— .230	..	1
9.3	18.3	—0.027	51	3
18.7	30.8	+0.531	72*	4
Dec. 11.3		+0.378	..	1
Dec. 17.2	Dec. 18.3	+1.166	..	1
19.3	23.3	+0.909	37	3
29.7	'02, Jan. 22.3	+ .667	100	9
'02, Jan. 24.3	24.7	+0.820	..	1
Feb. 6.7	Feb. 12.7	+1.480	71	3
14.7	19.7	+0.308	36	2
21.3	25.3	+0.151	10	2
Mch. 4.3	Mch. 4.7	—0.101	..	1
13.2	15.3	—0.516	..	1
24.3	May 14.7	—0.709	97	7
May 18.3	22.3	—1.125	52	2
25.3	June 9.3	—0.819	78	4
June 14.3	Aug. 16.7	— .939	83	6
Aug. 25.7	Sept. 30.7	—0.869	102	5

TABLE III—Continued

Period		Constant n	Largest Residual v	No. of Determinations m
		s	s	
1902, Oct. 6.7	1902, Oct. 19.7	—1.027	37	3
29.7	'03 Jan. 1.3	—0.922	84	7
'03, Jan. 8.7	9.7	— .551	..	1
12.3	30.7	—0.261	145	7
31.3	Feb. 5.7	—0.423	59	4
Feb. 8.3		— .057	..	1
Feb. 9.3	16.3	— .394	49	3
Feb. 17.3		— .115	..	1
18.3	18.7	— .352	..	1
19.7	Mch. 8.3	— .078	42	5
Mch. 12.3	13.3	— .464	..	1
21.3	Apr. 26.7	—0.904	85	4
Apr. 30.3	May 25.3	—1.008	91	4
May 27.3	July 2.3	—0.763	69	5
July 4.7	7.7	—0.606	37	2
12.7	Aug. 5.7	—0.757	59	4
Sept. 1.3	Sept. 28.7	—1.044	..	1
Oct. 3.7	Oct. 4.7	—0.720	..	1
8.7	Nov. 12.7	—0.907	152	7
Nov. 19.7		— .570	..	1
29.7		—0.847	..	1
Dec. 16.7	Dec. 22.7	—0.346	34	2
'04, Mch. 3.7	'04, Mch. 15.6	+ .450	80	2
Apr. 16.5	Apr. 21.5	— .408	55	2
26.3	28.7	—0.688	60	2
30.3	May 26.7	—0.907	100	10
May 27.4	July 16.7	—0.772	100	14
July 17.7	23.7	—0.612	51	2
Sept. 26.3	Nov. 18.3	—0.974	86	8
Nov. 30.3	'05, Jan. 2.7	— .765	24	3
'05, Jan. 25.7	Feb. 6.7	+ .215	43	3
Feb. 14.7		+ .464	..	1
27.7		+ .212	..	1
Mch. 9.4		— .007	..	1
10.7		+0.271	..	1

1, 2, 3, 6. Weight of residual, one-half. 4. Value of n interpolated between group means next preceding and next following. 5. Weight of residual, small.

Table IV.

Period		Hourly Rate	Largest Residual	No. of Determinations
		s	s	
1898, July 15–	1898, Sept. 30	—0.004	0.002	7
Oct. 1	Oct. 26	0	1	2
Oct. 27	Nov. 30	+ 7	1	4
Dec. 1	Dec. 18	+ 16	0	2
Dec. 19	99, Jan. 2	+ 8	0	2
99, Jan. 3	Jan. 19	+ 90	7	4
Jan. 20	Jan. 25	— 88	..	1
Jan. 26	Mar. 5	— 41	8	3
Mar. 6	Apr. 30	— 18	7	5
May 1	Aug. 30	— 4	4	11
Aug. 31	1900, Jan. 1	— 10	7	13
1900, Jan. 2	Apr. 17	— 11	5	13
Apr. 18	Apr. 25	— 16	4	3
Apr. 26	Aug. 28	— 30	5	15
Aug. 29	Dec. 26	— 28	8	18
Dec. 27	01 Apr. 30	— 27	7	16
01, May 1	Aug. 31	— 32	4	15
Sept. 1	02, Jan. 27	— 27	7	17
02, Jan. 28	Feb. 21	— 16	2	2
Feb. 22	Apr. 14	— 27	4	6
Apr. 15	Aug. 16	— 35	4	11
Aug. 17	Nov. 30	— 31	5	9
Dec. 1	03, Mch. 28	— 22	4	8
03, Mch. 29	July 27	— 31	5	9
July 28	Oct. 15	— 32	2	5
Oct. 16	04, Feb. 24	— 18	8	9
04, Feb. 25	Apr. 28	— 21	2	5
Apr. 29	May 2	— 28	..	1
May 3	May 4	— 36	..	1
May 5	May 10	— 66	..	1
May 15	May 20	+ 14	1	2
May 21	June 15	+ 2	3	6
June 16	June 28	— 4	4	4
June 29	July 24	— 10	2	6
July 25	Aug. 7	+ 38	1	2
Aug. 8	05, Jan. 12	+ 12	4	13
05, Jan. 13	Mar. 24	+ 20	2	4
Mar. 25	May 31	+0.014	0.004	6

1899, Jan. 3.0. Clock was stopped in order to clean and adjust mercury contact apparatus. 1899, Jan. 20.2, Jan. 26.9, March 6. Rate adjusted. 1900, April 18 and 1904, May 15. Clock cleaned. 1904, July 24. Clock dismounted. A screw found loose. 1904, Aug. 8. Rate adjusted.

Table V.

For Madison Mean Midnight.

$A, B, C, D =$ the Besselian Star Numbers.

$\tau = t - 1900.0$. $t_0 =$ Beginning of the Year of Observation. $A' = t_0 - 1900.0 + A$.

Date	τ	A'	B	C	D
'98, July 10	—1.475	—1.14	—2.5	+ 6.1	—19.4
30	1.420	1.07	2.5	11.5	16.1
Aug. 19	1.365	1.02	2.9	15.8	11.1
Sept. 8	1.310	0.97	2.8	18.2	— 4.8
28	1.256	0.93	2.8	18.6	+ 2.2
Oct. 18	—1.201	—0.89	—2.3	+16.9	+ 8.9
Nov. 7	1.146	0.84	1.9	13.1	14.7
27	1.091	0.78	1.3	7.6	18.7
Dec. 17	1.037	0.70	1.0	+ 1.2	20.4
'99, Jan. 6	0.982	0.63	0.9	— 5.4	19.6
26	—0.927	—0.56	—1.1	—11.3	+16.3
Feb. 15	0.872	0.51	1.3	15.8	+11.0
Mch. 7	0.818	0.46	1.3	18.3	+ 4.4
27	0.763	0.43	1.3	18.6	— 2.6
Apr. 16	0.708	0.38	0.8	16.7	9.3
May 6	—0.653	—0.33	—0.4	—12.9	—14.8
26	0.598	0.27	+0.2	7.7	18.6
June 15	0.544	0.21	0.4	— 1.7	20.4
July 5	0.489	0.13	0.7	+ 4.5	19.8
25	0.434	0.07	0.4	10.2	17.2
Aug. 14	—0.380	—0.02	+0.4	+14.8	—12.6
Sept. 3	0.325	+0.03	0.2	17.8	— 6.5
23	0.270	0.06	0.3	18.8	+ 0.3
Oct. 13	0.215	0.10	0.6	17.6	7.2
Nov. 2	0.160	0.15	1.1	14.2	13.3
22	—0.106	+0.22	+1.6	+ 9.2	+17.8
Dec. 12	—0.051	0.28	2.0	+ 2.9	20.2
'00, Jan. 1	+0.004	0.35	2.2	— 3.7	20.0
21	0.059	0.42	2.0	9.9	17.4
Feb. 10	0.113	0.48	1.9	14.8	12.6
Mar. 2	+0.168	+0.52	+1.6	—17.9	+ 6.3
22	0.223	0.55	1.9	18.8	— 0.8
Apr. 11	0.278	0.60	2.0	17.4	7.6
May 1	0.332	0.64	2.7	14.1	13.5
21	0.387	0.70	3.0	9.2	17.8
June 10	+0.442	+0.76	+3.5	— 3.3	—20.1
30	0.497	0.83	3.6	+ 2.9	20.2
July 20	0.551	0.89	3.6	8.8	18.1
Aug. 9	0.606	0.95	3.4	13.8	13.9
29	0.661	0.99	3.2	17.2	8.2

TABLE V—Continued

Date		τ	A'	B	C	D
1900, Sept.	18	+0.716	+1.04	+3.3	+18.7	— 1.6
Oct.	8	0.770	1.06	3.4	18.1	+ 5.5
	28	0.825	1.11	4.0	15.3	11.8
Nov.	17	0.880	1.16	4.4	10.6	16.8
Dec.	7	0.935	1.23	5.0	+ 4.6	19.8
	27	+0.990	+1.29	+5.0	— 2.0	+20.3
'01, Jan.	16	1.044	1.36	5.1	8.3	18.3
Feb.	5	1.099	1.42	4.8	13.7	14.0
	25	1.154	1.46	4.7	17.3	8.0
Mch.	17	1.208	1.50	4.6	18.7	+ 1.1
Apr.	6	+1.263	+1.53	+4.9	—17.9	— 5.9
	26	1.318	1.58	5.3	15.1	12.1
May	16	1.373	1.62	5.8	10.6	16.9
June	5	1.428	1.69	6.2	— 4.9	19.7
	25	1.482	1.75	6.3	+ 1.3	20.4
July	15	+1.537	+1.82	+6.4	+ 7.3	—18.8
Aug.	4	1.592	1.87	6.1	12.6	15.2
	24	1.647	1.92	6.0	16.4	9.8
Sept.	13	1.701	1.96	5.8	18.5	— 3.3
Oct.	3	1.756	1.99	6.1	18.4	+ 3.6
	23	+1.811	+2.03	+6.3	+16.2	+10.2
Nov.	12	1.866	2.07	6.9	12.0	15.7
Dec.	2	1.920	2.14	7.2	+ 6.3	19.2
	22	1.975	2.20	7.6	— 0.2	20.4
'02, Jan.	11	2.030	2.27	7.5	6.7	19.1
	31	+2.085	+2.33	+7.3	—12.4	+15.3
Feb.	20	2.139	2.38	7.0	16.5	9.7
Mch.	12	2.194	2.41	6.9	18.6	+ 2.9
Apr.	1	2.249	2.45	7.1	18.4	— 4.1
	21	2.304	2.48	7.3	16.1	10.6
May	11	+2.358	+2.53	+7.9	—11.9	—15.8
	31	2.413	2.58	8.1	6.5	19.2
June	20	2.468	2.65	8.5	— 0.4	20.4
July	10	2.523	2.71	8.4	+ 5.8	19.5
	30	2.578	2.77	8.3	11.3	16.3
Aug.	19	+2.632	+2.82	+7.9	+15.6	—11.4
Sept.	8	2.687	2.85	7.8	18.2	— 5.1
	28	2.742	2.89	7.8	18.7	+ 1.8
Oct.	18	2.796	2.92	8.1	17.0	8.6
Nov.	7	2.851	2.97	8.5	13.3	14.4
	27	+2.906	+3.02	+8.9	+ 7.9	+18.5
Dec.	17	2.961	3.09	9.2	+ 1.5	20.4
'03, Jan.	6	3.016	3.15	9.1	— 5.1	19.7
	26	3.070	3.22	9.0	11.1	16.5
Feb.	15	3.125	3.26	8.5	15.6	11.3

TABLE V—Continued

Date	τ	A′	B	C	D
1903, Mch. 7	+3.180	+3.30	+8.5	—18.2	+ 4.8
27	3.235	3.33	8.3	18.6	— 2.3
Apr. 16	3.289	3.37	8.7	16.9	9.0
May 6	3.344	3.41	8.9	13.2	14.6
26	3.399	3.46	9.5	8.0	18.5
June 15	+3.454	+3.53	+9.6	— 2.0	—20.3
July 5	3.508	3.59	9.7	+ 4.2	19.9
25	3.563	3.65	9.4	9.9	17.3
Aug. 14	3.618	3.69	9.1	14.6	12.8
Sept. 3	3.673	3.74	8.8	17.7	6.8
23	+3.727	+3.76	+8.7	+18.8	— 0.0
Oct. 13	3.782	3.80	8.9	17.7	+ 6.9
Nov. 2	3.837	3.84	9.1	14.4	13.0
22	3.892	3.89	9.6	9.5	17.7
Dec. 12	3.946	3.95	9.7	+ 3.2	20.1
'04, Jan. 1	+4.001	+4.02	+9.9	— 3.4	+20.1
21	4.056	4.08	9.5	9.6	17.6
Feb. 10	4.111	4.13	9.3	14.6	12.8
Mch. 1	4.165	4.18	8.8	17.8	+ 6.6
21	4.220	4.20	8.8	18.8	— 0.4
Apr. 10	+4.275	+4.24	+8.8	—17.5	— 7.3
30	4.330	4.28	9.2	14.3	13.2
May 20	4.384	4.33	9.5	9.5	17.6
June 9	4.439	4.38	9.3	— 3.6	20.1
29	4.494	4.46	9.8	+ 2.6	20.2
July 19	+4.549	+4.51	+9.5	+ 8.5	—18.2
Aug. 8	4.604	4.57	9.2	13.5	14.2
28	4.658	4.61	8.7	17.1	8.5
Sept. 17	4.713	4.64	8.6	18.7	— 1.8
Oct. 7	4.768	4.67	8.5	18.2	+ 5.1
27	+4.822	+4.71	+8.9	+15.3	+11.8
Nov. 16	4.877	4.76	9.1	10.9	16.6
Dec. 6	4.932	4.82	9.5	+ 4.9	19.7
26	4.987	4.89	9.4	— 1.6	20.4
'05, Jan. 15	5.042	4.95	9.2	8.1	18.5
Feb. 4	+5.096	+5.01	+8.7	—13.4	+14.3
24	5.151	5.05	8.3	17.1	8.3
Mch. 16	5.206	5.09	8.1	18.7	+ 1.4
Apr. 5	+5.261	+5.11	+8.1	—18.0	— 5.6

Table VI.

R.A. 0h 0m to 6h 0m; 12h 0m to 18h 0m. Sign of $K - \alpha$ is +.

R.A. 6h 0m to 12h 0m; 18h 0m to 24h 0m. Sign of $K - \alpha$ is —.

$K =$ R. A. in Arc $+ (K - \alpha)$ of Table.

R. A. in Time				R. A. in Arc		$K - \alpha$	Log 1/15. k	R. A. in Arc		R. A. in Time			
h	m	h	m	°	°	°		°	°	h	m	h	m
0	0 or	12	0	0.0 or	180.0	+0.0—	8.786	180.0 or	360.0	12	0 or	24	0
	10		10	2.5	182.5	0.2	.786	177.5	357.5	11	50	23	50
	20		20	5.0	185.0	0.4	.787	175.0	355.0		40		40
	30		30	7.5	187.5	0.7	.787	172.5	352.5		30		30
	40		40	10.0	190.0	0.9	.788	170.0	350.0		20		20
	50		50	12.5	192.5	+1.1—	.788	167.5	347.5	11	10		10
1	0 or	13	0	15.0 or	195.0	+1.3—	8.789	165.0 or	345.0	11	0 or	23	0
	10		10	17.5	197.5	1.5	.790	162.5	342.5	10	50	22	50
	20		20	20.0	200.0	1.6	.791	160.0	340.0		40		40
	30		30	22.5	202.5	1.8	.792	157.5	337.5		30		30
	40		40	25.0	205.0	2.0	.794	155.0	335.0		20		20
	50		50	27.5	207.5	+2.1—	.795	152.5	332.5	10	10	22	10
2	0 or	14	0	30.0 or	210.0	+2.2—	8.797	150.0 or	330.0	10	0 or	22	0
	10		10	32.5	212.5	2.3	.798	147.5	327.5	9	50	21	50
	20		20	35.0	215.0	2.4	.800	145.0	325.0		40		40
	30		30	37.5	217.5	2.4	.801	142.5	322.5		30		30
	40		40	40.0	220.0	2.4	.803	140.0	320.0		20		20
	50		50	42.5	222.5	+2.5—	.804	137.5	317.5	9	10	21	10
3	0 or	15	0	45.0 or	225.0	+2.5—	8.806	135.0 or	315.0	9	0 or	21	0
	10		10	47.5	227.5	2.5	.808	132.5	312.5	8	50	20	50
	20		20	50.0	230.0	2.4	.809	130.0	310.0		40		40
	30		30	52.5	232.5	2.4	.811	127.5	307.5		30		30
	40		40	55.0	235.0	2.3	.812	125.0	305.0		20		20
	50		50	57.5	237.5	+2.2—	.814	122.5	302.5	8	10	20	10
4	0 or	16	0	60.0 or	240.0	+2.1—	8.815	120.0 or	300.0	8	0 or	20	0
	10		10	62.5	242.5	2.0	.816	117.5	297.5	7	50	19	50
	20		20	65.0	245.0	1.8	.818	115.0	295.0		40		40
	30		30	67.5	247.5	1.7	.819	112.5	292.5		30		30
	40		40	70.0	250.0	1.5	.820	110.0	290.0		20		20
	50		50	72.5	252.5	+1.4—	.821	107.5	287.5	7	10	19	10
5	0 or	17	0	75.0 or	255.0	+1.2—	8.822	105.0 or	285.0	7	0 or	19	0
	10		10	77.5	257.5	1.0	.822	102.5	282.5	6	50	18	50
	20		20	80.0	260.0	0.8	.823	100.0	280.0		40		40
	30		30	82.5	262.5	0.6	.823	97.5	277.5		30		30
	40		40	85.0	265.0	0.4	.823	95.0	275.0		20		20
5	50	17	50	87.5	267.5	+0.2—	.824	92.5	272.5	6	10	18	10
6	0 or	18	0	90.0 or	270.0	+0.0—	8.824	90.0 or	270.0	6	0 or	18	0

Examples

R. A.		K	Log 1/15 k
h	m	° ° ° °	
= 4	27.8	= 65.0 + 2.0 + 1.7 = 68.7	= 8.819
13	14.6	197.5 + 1.2 + 1.5 = 200.2	8.790
21	37.4	322.5 + 1.9 — 2.4 = 322.0	8.800

TABLE VII

List of Parallax and Comparison Stars

TABLE VII

No. of Par. Star	No. in Obs. List	Designation of Star	Cat. Mag.	Screen	Appar. Est'd Mag.
	1	B. D. +25°, 5073	7.4		7.5
1	2	α Andromedae	2.4	II	7.4
	3	B. D. +32, 11	7.0		6.9
	4	B. D. +18°, 11	8.2		7.6
2	5	γ Pegasi	3.3	II	7.9
	6	B. D. +13, 27	7.8		7.7
	7	B. D. +57°, 113	7.6		7.5
3	8	α Cassiopeiae	2.5	II	7.6
	9	B. D. +53, 131	7.9		7.6
	10	B. D. —21°, 91	7.5		7.8
4	11	β Ceti	2.2	S	7.4
	12	B. D. —17, 132	6.3		7.1
	13	B. D. +5°, 104	6.1		6.2
5	14	Piazzi o, 189	6.0		6.2
	15	B. D. +1, 149	7.8		7.8
	16	B. D. +56°, 144	7.6		7.5
6	17	γ Cassiopeiae	2.5	II	7.4
	18	B. D. +62, 175	7.7		7.7
	19	B. D. +37°, 210	7.8		7.7
7	20	β Andromedae	2.3	II	7.4
	21	B. D. +31, 197, *seq.*	7.4		7.4
	22	B. D. +87°, 12	8.0		7.9
8	23	α Ursae Minoris	2.3	S	7.9
	24	B. D. —18°, 279	7.3		7.9
9	25	τ Ceti	3.6	S	7.8
	26	B. D. —15, 321	7.3		7.6
	27	B. D. +23°, 246	7.3		7.4
10	28	β Arietis	3.0	S	7.2
	29	B. D. +17, 292	7.7		7.1
	30	B. D. +42°, 430	7.7		7.6
11	31	γ' Andromedae	2.3	II	7.5
	32	B. D. +40, 434	7.1		7.1
	33	B. D. +19°, 324	7.7		7.5
12	34	α Arietis	2.2	II	7.3
	35	B. D. +24, 306	7.6		7.2
	36	B. D. +32°, 390	8.5		8.0
	37	B. D. +33, 385	8.2		8.2
13	38	δ Trianguli	5.1	I	7.6
	39	B. D. +33, 406	8.0		7.9
	40	B. D. +34, 425	6.8		6.9

Table VII

Reduced Est'd Mag.	Prop. Mot.	Right Ascension 1900.0			Declination 1900.0			Assumed Prop. Mot. in R. A.
	"	h	m	s	°	′	"	s
		0	2	12.9	25	53.9		
	0.22		3	13.0	28	32.3		+0.0107
			5	22.2	32	34.5		
		0	6	26.3	18	20.2		
	0.01		8	5.1	14	37.7		[+ .0003]
			11	36.1	13	21.7		
		0	31	37.2	57	27	58	
	0.06		34	49.7	55	59	20	+ .0063
			38	43.5	53	36	17	
7.6		0	36	30.8	—20	50.9		
	0.23		38	34.2	—18	32.1		+ .0160
6.8			40	41.8	—16	58.3		
6.1		0	42	13.3	6	11.7		
6.2	1.34		43	8.2	4	46.0		+ .0483
7.7			45	56.0	2	12.1		
7.5		0	48	12.3	56	28	17	
	0.03		50	40.1	60	10	30	+ .0036
7.7			52	15.5	63	10	23	
		1	1	32.2	38	7.0		
	0.22		4	7.8	35	5.4		+ .0148
			7	20.6	31	32.7		
7.8		1	18	5.2	88	2	30	
7.8	0.04		22	33.4	88	46	27	+ .1364
7.6		1	34	31.3	—18	18.0		
	1.93		39	25.3	—16	27.9		— .1199
7.4			43	45.3	—15	15.7		
		1	45	38.3	24	9.5		
	0.14		49	6.8	20	19.2		+ .0064
			53	25.6	17	52.3		
		1	56	16.5	42	22	0	
	0.07		57	45.4	41	51	0	+ .0046
			59	54.2	41	3	19	
	0.11	2	0	43.7	20	6.9		— .007
	0.24		1	32.0	22	59.4		+ .0139
			2	37.7	24	20.6		
		2	4	22.6	32	53.6		
			8	27.0	33	59.6		
	1.15		10	56.8	33	46.0		+ .0898
			13	19.7	33	34.3		
			17	27.2	34	59.2		

Table VII—Continued

No. of Par. Star	No. in Obs. List	Designation of Star	Cat. Mag.	Screen	Appar. Est'd Mag.
	41	B. D. +32°, 473	6.4	S	7.3
14	42	Lalande 4855	7.6		7.4
	43	B. D. +29, 453	7.7		7.5
	44	B. D. +39°, 699	7.2		7.0
15	45	β Persei	2.1	S	6.8
	46	B. D. +41, 631	6.3		6.4
	47	B. D. +51°, 716	7.5		7.4
16	48	α Persei	2.2	S	7.5
	49	B. D. +47, 835	7.6		7.6
	50	B. D. —7°, 606	6.2		6.4
17	51	ε Eridani	3.8	I	6.9
	52	B. D. —11, 696	5.7		6.1
	53	B. D. —7°, 654	7.0		7.4
18	54	δ Eridani	3.7	S	7.6
	55	B. D. —14, 749	7.3		7.8
	56	B. D. + 39°, 887	7.8		8.0
19	57	ε Persei	3.1	S	7.8
	58	B. D. +39, 909	7.4		7.6
	59	B. D. +41°, 920	7.3		7.5
20	60	Groombridge 864	7.4		7.5
	61	B. D. +42, 1033	7.7		7.7
	62	B. D. +36°, 958	8.0		7.8
21	63	ι Aurigae	2.8	II	7.8
	64	B. D. +29, 744	8.2		7.7
	65	B. D. —6°, 1075	7.2		7.4
22	66	β Eridani	2.9	I–II	5.8–8.3
	67	B. D. —2, 1161	7.0		6.6
	68	B. D. +39°, 1236	7.3		7.3
23	69	λ Aurigae	4.8	I	7.5
	70	B. D. +40, 1255	7.8		7.4
	71	B. D. +28°, 787	7.9		7.6
24	72	β Tauri	2.0	II	7.2
	73	B. D. +29, 909	6.4		6.6
	74	B. D. +5°, 899	7.1		7.3
25	75	γ Orionis	2.1	II	7.2
	76	B. D. +6, 923	6.9		6.8
	77	B. D. +1°, 1032	6.1		6.2
26	78	δ Orionis	2.5	I–II	5.3–7.8
	79	B. D. —1, 950	6.2		6.2
27	80	ε Orionis	1.8	I–II	4.7–7.4
	81	B. D. —3, 1166	6.0		6.5
28	82	ζ Orionis	2.0	II	7.5
	83	B. D. —2, 1346	7.5		6.9

TABLE VII—Continued

Reduced Est'd Mag.	Prop. Mot.	Right Ascension 1900.0	Declination 1900.0	Assumed Prop. Mot. in R. A.
	″	h m s	° ′ ″	s
		2 31 5.3	32 27.3	
	0.61	32 34.7	30 23.6	—0.035
		34 23.1	29 21.9	
		2 58 0.3	39 54 8	
	0.01	3 1 39.5	40 34 14	+ .0008
		5 33.1	41 59 53	
		3 13 9.1	51 15 19	
	0.04	17 10.7	49 30 19	+ .0030
		22 3.4	47 57 24	
6.2		3 24 45.1	— 7 8.8	
6.7	0.98	28 13.0	— 9 47.8	— .0660
6.0		31 11.6	—11 31.7	
7.3		3 34 52.8	— 7 6.1	
	0.74	38 27.4	—10 6.1	— .0062
7.7		42 17.8	—14 47.3	
		3 48 14.4	39 33.9	
	0.04	51 8.4	39 43.3	[+ .0031]
		54 32.3	39 48.9	
		4 31 7.4	41 55 3	
	0.74	34 31.5	41 56 8	+ .052
		37 1.4	42 13 48	
		4 47 13.8	36 35.5	
	0.02	50 28.8	33 0.5	+ .0009
		52 25.5	29 41.6	
7.2		4 59 24.4	— 6 10.3	
5.6	0.11	5 2 55.9	— 5 12.9	— .0056
6.5		5 55.2	— 2 22.4	
		5 10 17.6	39 21 10	
	0.85	12 6.3	40 0 39	+ .0462
		13 54.0	40 46 57	
		5 16 42.9	28 22.4	
	0.18	19 58.2	28 31.4	+ .0025
		23 19.4	29 6.5	
		5 16 51.1	5 17.9	
	0.02	19 45.9	6 15.5	[— .0004]
6.7		21 15.5	6 47.0	
6.1		5 24 43.4	+ 1 42.6	
5.2	0.00	26 53.8	— 0 22.4	— .0000
6.1		29 0.2	— 1 32.3	
4.6	0.00	31 8.3	— 1 15.9	— .0000
6.4		34 32.2	— 3 37.2	
7.4	0.02	35 42.8	— 1 59.7	[+ .0005]
6.8		36 39.3	— 2 56.8	

TABLE VII—Continued

No. of Par. Star	No. in Obs. List	Designation of Star	Cat. Mag.	Screen	Appar. Est'd Mag.
	84	B. D. —10°, 1271	7.0		7.5
29	85	κ Orionis	2.2	I–II	5.4–7.7
	86	B. D. —9, 1255	6.0		6.5
	87	B. D. +41°, 1304	6.8		6.8
30	88	β Aurigae	2.2	II	7.5
	89	B. D. +47, 1236	6.7		6.7
	90	B. D. —20°, 1355	5.7		6.6
31	91	β Canis Majoris	2.0	I–II	5.6–7.9
	92	B. D. —14, 1450	7.0		6.9
	93	B. D. +16°, 1201	6.8		7.0
32	94	γ Geminorum	2.3	II	7.5
	95	B. D. +16, 1242	6.5		6.8
	96	Argent. G. C. 8689	6.4		7.6
33	97	ε Canis Majoris	1.6	S	7.6
	98	Argent. G. C. 8818	7.5		7.6
	99	Argent. G. C. 8979	6.2		7.0
34	100	δ Canis Majoris	2.0	S	7.4
	101	Argent. G. C., 9063	7.5		8.0
	102	Argent. G. C., 9386	7.–		8.3
35	103	η Canis Majoris	2.4	S	7.7
	104	Argent. G. C. 9585	7.1		7.3
	105	B. D. +34°, 1629	8.0		7.8
36	106	α Geminorum (pair)	2.8, 2.0	S	8.4, 7.7
	107	B. D. +31, 1633	8.0		7.9
	108	Argent. G. C. 10028	7.2		8.5
37	109	Lacaille 2957	5.4	S	7.9
	110	Argent. G. C. 10174	7.2		7.6
	111	B. D. —13°, 2247	7.2		6.8
38	112	9 Puppis	5.3	S	6.3–7.4
	113	B. D. —13, 2304	7.8		7.8
	114	B. D. +17°, 1778	7.5		7.6
39	115	ζ Cancri (the wide pair)	4.7, 6.0	S	7.4, 8.1
	116	B. D. +18, 1882	6.6		7.0
	117	B. D. +30°, 1680	8.1		8.5
40	118	W. B. viii, 181–2	8.3		8.7
	119	B. D. +31, 1784	8.3		8.6
	120	B. D. —20°, 2602	7.5		8.0
41	121	Lalande 17103	5.1	S	5.7–7.9
	122	C. D. —23, 7663	7.8		8.3

TABLE VII—Continued

Reduced Est'd Mag.	Prop. Mot.	Right Ascension 1900.0			Declination 1900.0			Assumed Prop. Mot. in R. A.
	"	h	m	s	°	'	"	s
7.4		5	39	33.4	—10	3.4		
5.2	0.00		43	0.8	— 9	42.3		[+0.0001]
6.4			47	21.6	— 9	4.1		
		5	48	52.3	41	18	22	
	0.04		52	11.6	44	56	14	— .0038
			55	10.0	47	48	16	
6.3		6	14	42.6	—20	53.1		
5.4	0.01		18	17.7	—17	54.4		— .0006
6.7			22	9.7	—14	32.6		
	0.04	6	29	7.8	16	17.0		— .003
	0.07		31	56.1	16	29.1		+ .0033
	0.03		35	35.7	16	29.5		— .002
7.0		6	52	7.8	—31	39.6		
	0.00		54	41.7	—28	50.2		— .0001
7.0			57	7.5	—25	48.5		
6.6		7	2	44.7	—24	48.3		
	0.02		4	19.5	—26	14.1		— .0015
7.5			5	43.1	—27	43.2		
7.6		7	17	3.0	—32	17.3		
	0.00		20	8.4	—29	6.5		[+ .0003]
6.9			23	57.2	—26	38.1		
		7	26	39.0	34	9.6		
	0.20		28	13.2	32	6.4		— .0144
			31	8.2	31	50.3		
7.8		7	39	30.2	—33	33.9		
	1.68		41	51.4	—33	58.6		— .021
6.7			43	34.5	—35	49.6		
6.6		7	45	2.3	—13	50.1		
6.1	0.33		47	8.4	—13	38.0		— .0044
7.6			51	2.6	—13	28.1		
	0.02	8	4	18.3	17	18.7		— .001
	0.15		6	28.5	17	57.0		+ .0051
6.9	0.03		8	27.4	17	58.7		— .001
		8	10	48.6	30	38.7		
	0.90		11	59.5	30	56.0		— .024
			13	20.7	31	1.8		
7.7		8	30	26.3	—21	6.9		
5.4	0.45		34	45.3	—22	19.3		— .017
8.0			38	11.5	—23	51.2		

TABLE VII—Continued

No. of Par. Star	No. in Obs. List	Designation of Star	Cat. Mag.	Screen	Appar. Est'd Mag.
	123	B. D. +41°, 1889	8.2		8.0
42	124	10 Ursae Majoris	4.1	S	7.8
	125	B. D. +44, 1817	8.0		7.5
	126	B. D. +25°, 2065	7.0		7.1
43	127	Lalande 18286	7.3		7.3
	128	B. D. +32, 1865	7.1		7.0
	129	B. D. —10°, 2834	7.5		8.0
44	130	α Hydrae	2.2	S	7.7
	131	B. D. —5, 2820	7.0		7.4
	132	B. D. +44°, 1895	7.3	S	7.4–8.4
45	133	Lalande 19022	8.0		7.9
	134	B. D. +42, 2041	7.1		7.0
	135	B. D. +54°, 1329	7.7		7.6
46	136	φ Ursae Majoris	4.7	S	7.6
	137	B. D. +54, 1337	6.7	S	6.9–7.5
	138	B. D. +31°, 2075	8.0		8.1
47	139	20 Leonis Minoris	5.6	S	5.6–7.8
	140	B. D. +33, 1938	7.9		7.8
	141	B. D. —20°, 3101	7.2		7.7
48	142	Lalande 19780	7.2		7.8
	143	B. D. —17, 3078	7.5		7.6
	144	B. D. +22°, 2197	7.9		7.7
49	145	γ Leonis (pair)	2.6, 3.8	II	7.6, 8.8
	146	B. D. +17, 2212	7.8		8.4
	147	B. D. +48°, 1864	8.0		8.1
50	148	Groombridge 1646	6.6	S	6.6–8.1
	149	B. D. +51, 1605	6.9	S	6.5–8.1
	150	B. D. —9°, 3101	7.3		7.9
51	151	W. B. x, 520	5.8	S	6.4–7.8
	152	B. D. —14, 3156	7.5		8.0
	153	B. D. +58°, 1290	7.0		7.0
52	154	β Ursae Majoris	2.6	II	7.8
	155	B. D. +56, 1498	7.4		7.4
	156	B. D. +64°, 824	6.6		6.7
53	157	α Ursae Majoris	2.0	II	7.3
	158	B. D. +59, 1351	7.4		7.3
	159	B. D. +32°, 2124	7.9		7.8
54	160	ξ Urs. Maj., *med.*	3.9	S	7.8
	161	B. D. +32, 2137	8.2		8.0

TABLE VII—Continued

Reduced Est'd Mag.	Prop. Mot.	Right Ascension 1900.0			Declination 1900.0			Assumed Prop. Mot. in R. A.
	″	h	m	s	°	′	″	s
		8	50	38.9	41	43	24	
	0.50		54	9.0	42	10	43	—0.0388
			57	50.1	43	50	19	
		9	8	38.4	25	25.6		
	0.52		11	57.3	28	59.6		+ .005
			15	37.3	32	41.4		
7.8		9	20	3.6	—10	30.2		
	0.04		22	40.4	— 8	13.5		— .0010
7.2			25	55.5	— 5	13.4		
		9	35	27.1	44	5	30	
	0.80		37	6.7	43	10	16	+ .0027
			37	50.3	42	30	41	
		9	41	44.1	54	43	43	
	0.02		45	18.5	54	31	55	[— .0001]
			49	41.0	54	43	5	
		9	52	29.9	30	59.7		
	0.69		55	14.8	32	24.9		— .0431
			58	9.1	33	7.8		
7.4		10	1	25.9	—20	27.7		
7.5	0.38		3	37.6	—19	15.4		— .010
7.4			5	47.8	—18	6.7		
		10	11	28.3	22	24.7		
	0.33		14	27.6	20	20.8		+ .0212
			17	10.0	17	14.8		
		10	19	28.9	48	4	30	
	0.89		21	53.8	49	19	8	+ .0089
			24	3.5	51	4	56	
7.7		10	29	19.8	— 9	23.0		
6.2	0.74		31	33.7	—11	41.6		+ .020
7.8			33	56.5	—15	12.6		
		10	50	19.1	58	2	16	
	0.09		55	48.5	56	55	7	+ .0105
		11	0	44.4	56	37	58	
		10	54	46.8	63	57	34	
	0.14		57	33.6	62	17	27	— .0165
		11	2	57.3	59	45	23	
		11	9	54.6	32	8.6		
	0.73		12	50.9	32	5.5		— .0333
			15	21.3	32	16.9		

TABLE VII—Continued

No. of Par. Star	No. in Obs. List	Designation of Star	Cat. Mag.	Screen	Appar. Est'd Mag.
	162	Argent. G. C. 15777	5.2		6.1
55	163	20 Crateris	6.1		7.1
	164	Argent. G. C. 15854	5.9		7.0
	165	B. D. +15°, 2378	8.0		8.1
56	166	β Leonis	2.6	S	8.3
	167	B. D. +13, 2463	8.3		8.6
	168	B. D. +57°, 1339	8.5		8.8
57	169	γ Ursae Majoris	2.7	S	8.5
	170	B. D. +51, 1713	8.0		8.7
	171	B. D. +41°, 2253	6.8		6.8
58	172	Piazzi xi, 218	6.7	S	6.8–7.7
	173	B. D. +47, 1928	8.6		8.2
	174	B. D. —2°, 3478	6.7		7.2
59	175	W. B. xii, 69	8.–		7.6
	176	B. D. —0, 2554	7.5		7.6
	177	B. D. +44°, 2202	8.0		8.0
60	178	8 Can. Ven.	4.5	S	7.6
	179	B. D. +40, 2551	7.5		7.5
	180	B. D. —0°, 2595	8.0		7.6
61	181	γ Virginis (pair)	3.65, 3.68	S	7.2, 7.1
	182	B. D. —0, 2603	6.1		6.5
	183	B. D. +58°, 1398	7.7		7.9
62	184	ε Ursae Majoris	2.2	S	7.6
	185	B. D. +55, 1564	7.7		7.2
	186	B. D. +10°, 2496	6.8		7.2
63	187	ε Virginis	3.1	S	7.5
	188	B. D. +14, 2578	7.4		7.8
	189	B. D. +19°, 2642	7.0		7.3
64	190	42 Comae	4.5	S	7.3
	191	B. D. +16, 2476	7.7		7.7
	192	B. D. +53°, 1618	8.0		8.2
65	193	ζ^1 Ursae Majoris	2.4	II	7.7
	194	B. D. +58, 1449	8.2		7.9
	195	B. D. +48°, 2147	7.7		7.9
66	196	η Ursae Majoris	2.3	S	7.8
	197	B. D. +50, 2029	8.1		8.3
	198	B. D. +52, 1751	7.7		7.6
	199	Argent. G. C. 19081	7.2		8.3
67	200	θ Centauri	2.3	S	8.0
	201	Argent. G. C. 19186	7.2		8.7

TABLE VII—Continued

Reduced Est'd Mag.	Prop. Mot.	Right Ascension 1900.0			Declination 1900.0			Assumed Prop. Mot. in R. A.
	″	h	m	s	°	′	″	s
5.6		11	27	57.3	—30	32.1		
6.4	1.08		29	37.9	—32	18.1		—0.053
6.3			31	37.2	—33	0.9		
		11	41	40.7	15	33.4		— .0013
	0.51		43	57.5	15	7.9		— .0341
			45	5.3	13	34.0		
		11	47	24.9	57	20	20	
	0.10		48	34.4	54	15	3	+ .0116
			50	16.4	51	33	45	
		11	52	5.9	40	54	10	
	0.70		57	24.7	43	39	18	— .0375
		12	1	54.7	47	41	58	
7.1		12	6	14.9	— 3	13.2		
7.5	0.73		7	25.3	— 2	32.4		— .040
7.5			9	52.8	— 0	46.3		
		12	27	26.3	43	45	12	
	0.75		28	59.7	41	54	2	— .0618
			30	56.3	40	14	7	
		12	33	49.1	— 0	18.3		
	0.55		36	35.4	— 0	54.1		— .0365
6.4			38	29.6	— 1	1.6		+ .006
		12	47	4.3	57	55	3	
	0.11		49	37.8	56	30	8	+ .0138
			51	16.2	55	30	10	
		12	54	44.6	10	3.9		
	0.28		57	12.0	11	29.8		— .0187
		13	0	36.2	13	45.7		
		13	4	11.5	19	9.5		— .0021
	0.49		5	7.4	18	3.6		— .0326
			7	18.5	16	39.6		— .0023
		13	16	47.3	53	14	9	
	0.13		19	54.0	55	26	51	+ .0153
			24	18.2	58	43	37	
		13	37	46.5	47	55	10	
	0.12		43	36.1	49	48	44	— .0118
			45	18.8	49	54	0	
			49	46.0	52	36	18	
7.4		13	58	41.5	—35	10.7		
	0.75	14	0	47.7	—35	52.7		— .0437
8.0			3	29.6	—34	24.4		

TABLE VII—Continued

No. of Par. Star	No. in Obs. List	Designation of Star	Cat. Mag.	Screen	Appar. Est'd Mag.
	202	B. D. —7°, 3813	7.2		7.4
68	203	Lalande 26196	7.5		7.8
	204	B. D. —1, 2943	6.7	S	7.4–8.0
69	205	Lalande 26289	6.5	S	6.8–7.8
	206	B. D. +5, 2879	7.8		8.0
	207	B. D. —14°, 3964	8.2		8.3
70	208	Lalande 26481	8.0		8.5
	209	B. D. —16, 3892	7.2	S	7.6–8.5
	210	B. D. +29°, 2568	7.8		7.8
71	211	ϵ^2 Boötis	2.7	II	7.7
	212	B. D. +24, 2776	7.6		7.5
	213	B. D. +72°, 653	8.1		7.7
72	214	β Ursae Minoris	2.3	II	7.3
	215	B. D. +75, 545	7.1		6.9
	216	B. D. —10°, 4055	7.0		6.9
73	217	β Librae	2.7	S	7.1
	218	B. D. —8, 3947	7.0		7.5
	219	B. D. +34°, 2637	7.4		7.5
74	220	μ^2 Boötis	6.7		7.0
	221	B. D. +39, 2875	6.9		6.9
	222	B. D. +28°, 2439	8.2		7.9
75	223	α Cor. Bor.	2.6	II	7.6
	224	B. D. +24, 2901	6.8		6.9
	225	B. D. +7°, 3010	7.4		7.3
76	226	α Serpentis	2.9	I–II	5.2–7.9
	227	B. D. +5, 3072	6.0		6.0
	228	Argent. G. C. 21622	7.5		7.5
77	229	δ Scorpii	2.5	S	7.5
	230	B. D. —21°, 4255	7.3		7.7
78	231	β^1 Scorpii	2.9	II	8.2
	232	B. D. —17, 4494	7.0		7.5
	233	B. D. +39°, 2954	7.8		8.2
79	234	τ Cor. Bor.	5.0	I	7.4
	235	B. D. +33, 2696	6.6		6.4
80	236	σ Cor. Bor., *seq.*	5.4	IV	6.7
	237	B. D. +34, 2759	7.8		7.6
	238	B. D. +62°, 1470	7.5		7.4
81	239	η Draconis	3.0	II	7.9
	240	B. D. +58, 1641	7.8		8.0
	241	B. D. +19°, 3107	7.5		7.4
82	242	β Herculis	3.0	II	7.9
	243	B. D. +25, 3094	7.7		7.8

TABLE VII—Continued

Reduced Est'd Mag.	Prop. Mot.	Right Ascension 1900.0			Declination 1900.0			Prop. Mot. in R. A. Assumed
	″	h	m	s	°	′	″	s
7.3		14	12	41.1	− 7	29.9		
7.7	0.66		14	25.3	− 4	41.3		−0.043
7.3	0.11		16	49.2	− 1	31.9		− .0073
6.7	0.50		18	8.4	+ 1	42.6		+ .010
7.9			20	54.6	+ 5	18.5		
8.1		14	23	44.1	−14	56.7		
8.3	0.46		25	48.7	−15	11.1		+ .015
7.4			28	32.0	−16	22.8		
		14	37	3.0	29	29.5		
	0.05		40	37.2	27	29.7		− .0035
			43	12.0	24	30.9		
		14	47	8.0	72	0	50	
	0.03		50	59.5	74	33	51	− .0065
			55	40.3	75	16	58	
6.8		15	7	48.8	−10	37.8		
	0.10		11	37.4	− 9	0.8		− .0066
7.3			13	58.4	− 8	46.8		
		15	18	36.5	34	34.6		
	0.17		20	44.7	37	41.8		− .0121
			24	48.7	39	4.1		
		15	26	8.6	28	0.0		
	0.16		30	27.2	27	3.1		+ .0090
			33	59.0	24	51.0		
7.2		15	37	58.2	7	12.1		
5.1	0.14		39	20.5	6	44.4		+ .0089
6.0			40	26.8	5	45.6		
7.1		15	51	51.9	−23	14.3		
	0.04		54	25.1	−22	20.2		− .0012
7.4			56	1.8	−21	41.9		
7.9	0.03		59	37.1	−19	31.9		− .0011
7.3		16	2	21.2	−17	58.3		
		16	3	51.5	39	25.2		
	0.33		5	18.8	36	44.7		− .0049
			7	50.3	33	36.0		
	0.29		10	56.0	34	6.7		− .0224
			14	21.9	34	43.7		
		16	16	50.6	62	40	15	
	0.06		22	38.2	61	44	25	− .0019
			26	41.3	58	27	32	
		16	24	12.8	19	14.4		
	0.11		25	55.2	21	42.4		− .0076
			28	10.3	25	3.7		

TABLE VII—Continued

No. of Par. Star	No. in Obs. List	Designation of Star	Cat. Mag.	Screen	Appar. Est'd Mag.
	244	B. D. —9°, 4413	7.8		8.0
83	245	ζ Ophiuchi	2.7	II	7.9
	246	B. D. —9, 4427	7.3		7.9
	247	B. D. +29°, 2864	7.5		7.4
84	248	ζ Herculis	3.2	II	7.8
	249	B. D. +32, 2774	7.7		7.4
	250	Argent. G. C. 22697	6.7		7.3
85	251	ε Scorpii	2.4	S	7.5
	252	Argent. G. C. 22808	7.2		8.3
	253	B. D. –16°, 4425	7.7		7.9
86	254	η Ophiuchi	2.6	II	7.8
	255	B. D. —14, 4565	6.8		7.4
	256	Argent. G. C. 23324	7.0		7.0
87	257	36 Ophiuchi (pair)	5.33, 5.29		6.2, 6.3
88	258	Lacaille 7203	6.8		7.0
	259	Argent. G. C. 23408	7.4		7.6
	260	B. D. +5°, 3379	8.1		7.7
89	261	W. B. xvii, 322	7.5		7.5
	262	B. D. —0, 3296	8.0		7.8
	263	B. D. +12°, 3241	6.6		6.6
90	264	α Ophiuchi	2.5	II	7.3
	265	B. D. +13, 3421	6.3		6.3
	266	B. D. +29°, 3091	6.9		6.6
91	267	μ Herculis	3.6	I	6.1
	268	B. D. +25, 3353	5.2		5.3
	269	B. D. +51°, 2265	7.6		7.6
92	270	γ Draconis	2.5	II	7.5
	271	B. D. +51, 2302	7.6		7.6
	272	B. D. +32°, 3047	6.0		5.6
93	273	99*b* Herculis	5.3	IV–I	5.3–7.8
	274	B. D. +30, 3138	6.4		6.5
	275	Argent. G. C. 24983	7.2		8.0
94	276	ε Sagittarii	2.0	S	7.6
	277	Argent. G. C. 25104	6.4		7.5
95	278	λ Sagittarii	2.9	S	7.5
	279	Argent. G. C. 25217	6.2		7.5
	280	Argent. G. C. 25810	6.3		7.1
96	281	σ Sagittarii	2.1	S	7.6
	282	Argent. G. C. 25906	7.2		8.1
	283	Argent. G. C. 25930	6.1		6.9
97	284	ζ Sagittarii	2.7	S	7.5
	285	Argent. G. C. 26121	7.0		7.9

TABLE VII—Continued

Reduced Est'd Mag.	Prop. Mot.	Right Ascension 1900.0			Declination 1900.0			Assumed Prop. Mot. in R. A.
	″	h	m	s	°	′	″	s
7.8		16	29	52.1	— 9	27.9		
7.7	0.02		31	39.0	—10	21.9		+0.0007
7.7			33	29.5	—10	4.0		
		16	35	28.7	29	24.8		
	0.61		37	30.9	31	47.0		— .0363
			39	52.2	32	52.8		
6.7		16	42	0.9	—31	1.5		
	0.68		43	41.1	—34	6.7		— .0505
7.6			46	37.1	—33	6.9		
7.6		17	3	14.5	—16	46.3		
7.6	0.09		4	38.4	—15	36.1		+ .0017
7.2			6	17.4	—14	29.8		
6.6		17	8	0.3	—26	51.9		
5.8, 5.9	1.27		9	11.8	—26	27.4		— .0370
6.6	1.25		10	4.4	—26	24.1		— .038
7.2			11	26.6	—26	31.2		
7.6		17	17	14.1	+ 5	18.7		
7.4	1.31		20	46.8	+ 2	14.0		— .0404
7.7			24	25.0	— 0	5.3		
		17	27	35.6	12	0.1		
	0.26		30	17.5	12	38.0		+ .0079
			34	22.2	13	23.0		
		17	38	44.6	29	27.9		
	0.81		42	32.6	27	46.7		— .0239
			44	45.7	25	39.4		
		17	48	16.9	51	15	59	
	0.02		54	16.9	51	30	2	— .0006
			59	57.9	51	38	11	
		18	2	9.3	32	13.3		
	0.14		3	16.7	30	32.8		[— .0089]
			5	23.7	30	26.8		
7.3		18	14	20.6	—33	22.6		— .0041
	0.13		17	32.0	—34	25.9		
6.7			19	17.5	—34	0.0		
	0.20	18	21	47.9	—25	28.6		— .0034
7.1			23	11.8	—25	19.2		
6.6		18	46	15.2	—26	46.1		[— .0003]
	0.07		49	3.8	—26	25.3		
7.7			50	35.8	—24	45.0		
6.3		18	51	55.9	—31	10.1		— .0024
	0.04		56	14.9	—30	1.4		
7.4			59	27.6	—29	13.9		

Table VII—Continued

No. of Par. Star	No. in Obs. List	Designation of Star	Cat. Mag.	Screen	Appar. Est'd Mag.
	286	B. D. +50°, 2734	7.2		7.3
98	287	Groombridge 2789 (pair)	7.2, 6.9		7.2, 7.0
	288	B. D. +49, 2969	7.4		7.4
	289	B. D. +25°, 3803	7.7		7.6
99	290	Bradley 2459	6.4	IV–I	6.4–8.7
	291	B. D. +24, 3758	7.2		7.2
	292	B. D. +48°, 2914	6.1		6.3
100	293	θ Cygni	4.6	I	7.4
	294	B. D. +50, 2829	7.7		7.2
	295	B. D. +9°, 4233	6.7		6.7
101	296	γ Aquilae	3.1	I–II	5.6–7.9
	297	B. D. +11, 3996	6.7		6.8
102	298	α Aquilae	1.1	II–III	6.3–8.6
	299	B. D. +7, 4267	7.2		7.3
	300	B. D. +30°, 3853	7.2		7.1
103	301	Lalande 38380	6.0	IV–I	6.0–8.3
	302	B. D. +27, 3612	7.8		7.6
	303	Argent. G. C. 27592	7.2		7.9
104	304	Lalande 38692	5.7	S	6.6–7.7
	305	Argent. G. C. 27847	6.3		7.5
	306	B. D. +40°, 4116	7.6		7.7
105	307	γ Cygni	2.5	II	7.5
	308	B. D. +38, 4081	7.9		7.9
	309	B. D. —13°, 5684	7.5		8.0
106	310	β 668	5.8	IV–I	6.1–8.3
	311	B. D. —6, 5521	7.3		7.2
	312	B. D. +17°, 4370	6.0	IV–I	6.5–8.7
107	313	B. D. +14, 4389	8.0		7.9
	314	B. D. +9, 4616	8.3		8.0
	315	B. D. +31°, 4204	8.0		7.8
108	316	ε Cygni	2.7	II	7.6
	317	B. D. +35, 4282	6.7		6.7
	318	B. D. +73°, 916	8.2		8.2
109	319	Fed. 3638	7.5		7.7
	320	B. D. +75, 765	7.1		6.7
	321	B. D. +18°, 4719	7.1		7.0
110	322	W. B. xxi, 97	7.6		7.5
	323	B. D. +15, 4379	7.2		7.0
	324	B. D. +63°, 1711	7.8		8.0
111	325	α Cephei	2.8	II	7.7
	326	B. D. +60, 2233	8.1		7.7

TABLE VII—Continued

Reduced Est'd Mag.	Prop. Mot.	Right Ascension 1900.0			Declination 1900.0			Assumed Prop. Mot. in R. A.
	″	h	m	s	°	′	″	s
		19	5	59.8	50	12	9	
	0.63		9	29.7	49	40	0	—0.0167
			13	41.9	49	14	40	
		19	17	31.5	25	23.1		
	0.66		21	17.4	24	43.9		— .0135
			24	16.5	24	47.4		
		19	30	56.4	49	2	39	
	0.25		33	45.6	49	59	21	— .0023
			35	35.2	51	0	24	
		19	39	14.3	9	16.7		
	0.00		41	30.3	10	22.2		+ .0007
			44	10.3	11	26.1		
	0.66		45	54.2	8	36.2		+ .0361
			47	16.3	7	12.1		
		19	57	1.4	30	57.2		
	0.86		59	30.7	29	37.8		+ .052
		20	1	41.7	27	50.7		
7.5		20	4	5.3	—25	34.7		
6.2	1.28		9	3.2	—27	19.9		+ .094
6.9			14	18.5	—29	30.7		
		20	15	49.9	41	4	35	
	0.00		18	38.3	39	56	12	[+ .0004]
			22	29.1	38	31	59	
7.8		20	24	42.7	—13	21.7		
6.0	0.31		26	55.4	—10	11.7		+ .020
7.0			28	6.3	— 6	33.6		
	0.07	20	33	21.4	17	54.9		+ .002
7.8			36	1.5	14	10.6		
			37	33.4	10	6.9		
		20	40	21.5	31	20.0		
	0.49		42	9.9	33	35.7		+ .0294
			45	15.4	35	11.6		
		20	49	16.7	74	6	46	
	0.70		52	21.8	74	23	4	+ .106
			57	14.3	75	19	48	
	0.02	21	5	10.0	18	48.2		— .001
	0.92		7	21.1	17	20.6		— .0073
			10	4.7	16	3.9		
		21	12	51.2	64	4	43	
	0.16		16	11.5	62	9	42	+ .0223
			21	36.7	60	21	59	

TABLE VII—Continued

No. of Par. Star	No. in Obs. List	Designation of Star	Cat. Mag.	Screen	Appar. Est'd Mag.
	327	B. D. —5°, 5564	8.0		7.7
112	328	β Aquarii	3.1	II	8.1
	329	B. D. —6, 5781	8.2		7.8
	330	B. D. +9°, 4872	7.1		7.0
113	331	ϵ Pegasi	2.8	II	7.7
	332	B. D. +8, 4734	8.1		7.8
	333	B. D. +30°, 4558	7.8		7.7
114	334	Lalande 42883–5	7.3	S	7.3–7.8
	335	B. D. +29, 4569	7.7		7.7
	336	B. D. +50°, 3549	7.5		7.4
115	337	Groombridge 3689	7.9		7.7
	338	B. D. +53, 2798	8.3		7.9
	339	B. D. +11°, 4765	7.6		7.5
116	340	Lalande 43492	7.2		7.2
	341	B. D. +13, 4887	7.0		7.0
	342	B. D. +5°, 5008	7.9		7.5
117	343	β 290 (34 Pegasi)	6.2	S	6.2–7.6
	344	B. D. +1, 4623	7.7	S	7.3–7.7
	345	B. D. +30°, 4761	8.1		7.8
118	346	η Pegasi	3.2	S	7.8
	347	B. D. +29, 4753	6.6	S	6.8–7.8
	348	B. D. +7°, 4931	7.8		7.9
119	349	σ Pegasi	5.3	S	8.0
	350	B. D. +10, 4845	8.0		8.3
	351	B. D. +25°, 4861	7.8		8.3
120	352	β Pegasi	2.5	S	8.0
	353	B. D. +28, 4518	7.2		7.6
	354	B. D. +12°, 4928	7.7		7.1
121	355	α Pegasi	3.2	S	7.1
	356	B. D. +17, 4875	7.1		7.1
	357	B. D. —12°, 6453	7.7		7.9
122	358	W. B. xxiii, 175	8.2		8.4
	359	B. D. —14, 6441	6.8	S	7.0–8.5
	360	B. D. —16, 6259	7.0		7.6
	361	B. D. +55°, 2990	7.2		7.2
123	362	Piazzi xxiii, 164	7.4		7.3
	363	B. D. +59, 2777	6.5		6.6

TABLE VII—Continued

Reduced Est'd Mag.	Prop. Mot.	Right Ascension 1900.0			Declination 1900.0			Assumed Prop. Mot. in R. A.
	″	h	m	s	°	′	″	s
7.6		21	25	0.7	— 4	56.4		
8.0	0.02		26	17.7	— 6	0.7		+0.0012
7.7			28	30.9	— 5	51.6		
		21	35	40.3	10	9.5		
7.6	0.02		39	16.4	9	25.0		+ .0016
7.7			41	23.9	8	52.8		
		21	50	58.6	30	21.2		
	0.56		54	15.1	29	20.7		— .029
			58	50.3	29	15.9		
		22	1	22.0	51	12	56	
	0.61		3	5.5	52	39	7	— .055
			5	47.2	53	40	34	
7.4		22	11	5.4	11	15.8		
	0.84		12	15.2	12	23.8		+ .057
			13	10.5	13	27.1		
		22	17	33.0	5	58.1		
6.1	0.26		21	31.9	3	53.0		+ .0171
7.2			27	16.7	2	4.4		
		22	35	3.6	30	37.5		
	0.04		38	18.8	29	41.9		+ .0011
	0.48		40	54.6	29	55.7		— .021
		22	43	38.8	7	19.0		
	0.51		47	19.9	9	18.2		+ .0344
			49	43.1	10	57.4		
		22	56	16.1	26	14.7		
	0.24	22	58	55.4	27	32.4		+ .0146
		23	0	39.7	28	26.9		
7.0		22	55	33.2	12	56.0		
	0.07	22	59	46.7	14	40.0		+ .0040
		23	4	25.5	18	11.7		
7.8		23	10	7.9	—12	6.6		
8.2	1.31		11	54.5	—14	21.8		— .0350
6.8			12	42.6	—14	20.5		
7.5			14	25.9	—16	19.7		
		23	32	26.1	55	19	24	
	0.62		38	32.3	57	30	44	+ .0492
			43	59.5	59	25	23	

TABLE VII—Continued

No. of Par. Star	No. in Obs. List	Designation of Star	Cat. Mag.	Screen	Appar. Est'd Mag.
	364	B. D. +24°, 4857	8.0		7.9
124	365	B. D. +26, 4721	8.1		7.8
	366	B. D. +27, 4667	8.0		8.0

6. 37 Piscium, Boss 42. 13. 60 Piscium, Boss 165. 14. Mayer 20. 31. Star γ^2 invisible through screen II. 36. Σ 219, the north, following star. Companion 9.0 at 11″, 182°, noticed a few times. 52. Boss 822. 77. Boss 1328. 90. Boss 1597. 106, 145, 181, 257, 258. Observed as pairs: the space between one star and its nearer thread was maintained in equality with the space between the other star and its nearer thread. 106. Companion 0.s37 prec., 4.″3 south. 115. Companion 0.s33 foll., 2.″9 south. This pair, ½ (A + B), C, was so wide that the bright close pair was kept in contact with the inner edge of the preceding thread and star C with that of the following thread. 121. β 208. 127. Σ 3121, W. B. ix, 176. 133. B. B. vii, 85. 142. β 911. 145. Companion 0.s26 foll., 2.″2 south. 148. Boss 2775. 160. Mags. of components, by Harvard Photometry, Vol. L, 4.87 and 4.41; combined, 4.32. Companion 0.s07 foll., 2.″0 south. Observed like a single star; the central point of light was kept in

List numbers of certain parallax and comparison stars of Table VII which occur in pairs or in observation groups containing more than three stars.

Par. No.	List No. of Par. Star	List Nos. of Comp. Stars
8	23	22
13_1	38_1	36, 40
13_2	38_2	37, 39
26	78	77, 79
27	80	79, 81
28	82	81, 83
66_1	196_1	195, 198
66_2	196_2	197
68	203	202, 204
69	205	204, 206

TABLE VII—Continued

Reduced Est'd Mag.	Prop. Mot.	Right Ascension 1900.0	Declination 1900.0	Assumed Prop. Mot. in R. A.
	″	h m s	° ′ ″	s
		23 49 13.7	24 34.7	
		54 11.5	26 42.8	
		57 33.2	27 59.1	

bisection of the space between the threads. 162. 287 G Hydrae, Boss 3041. 163. 289 G Hydrae, Boss 3047. 164. 291 G Hydrae, Boss 3056. Double, h 4455. Companion 9th mag. 4″, 244°, noted a few times. 181. Companion 0.s20 foll., 5.″2 south. 182. Boss 3317. 190. Σ 1728, 42 Comae. 204. 103 Virginis. Boss 3687. 208. β 117. 220. Σ 1938, d = 1″. Boss 3927. 227. Boss 4007. 236. The magnitudes of the separate components as estimated are given, but the preceding star was ignored in the observations. Companion 0.s20 prec., 3.″8 south. 256. 99 G Ophiuchi. Boss 4367. 252. Companion 0.s12 foll., 5.″0 north. 258. 106 G Ophiuchi, Boss 4372. 268. 87 Hercules. Boss 4508. 273. A. Clark 15. 286. Groom. 2777. Boss 4878. 287. Σ 2486, Cygni 6. Companion 0.s66 prec., 7.″9 south. Each star image kept in contact with the inner edge of its adjacent thread. 290. 3 Cygni. 293. β 1131. 301. Boss 5144. 304. 5 G Capricorni. Boss 5180. 310. Boss 5263. 343. 34 Pegasi. 347. Piazzi xxii, 214. 358. β 182.

List numbers of certain parallax and comparison stars of Table VII which occur in pairs or in observation groups containing more than three stars—Continued.

Par. No.	List No. of Par. Star	List Nos. of Comp. Stars
77	229	228, 230
78	231	230, 232
79	234	233, 235
80	236	235, 237
87	257	256, 259
88	258	256, 259
95	278	279
101	296	295, 297
102	298	297, 299
122_1	358_1	357, 360
122_2	358_2	359

Table VIII

For the third to the sixth columns inclusive 1 = 0.000,1.

Par. No. (1)	List No. (2)	$R.\Delta_1 \sec\delta$ (3)	$R.\Delta_2 \sec\delta$ (4)	$R.D \sec\delta$ (5)	$D \tan\delta$ (6)	Da (7)
		s	s	s		s
1	2	+ 1679	— 3044	— 1365	— 368	+ 588
2	5	— 1258	+ 357	— 901	— 470	+ 389
3	8	— 4511	+ 6446	+ 1935	+ 396	— 662
4	11	— 967	+ 577	— 390	+ 155	— 269
5	14	— 151	+ 171	+ 20	+ 198	— 491
6	17	+12603	—12914	— 311	+ 20	— 392
7	20	— 3077	+ 3065	— 12	+ 66	— 283
8	23	+17.481			+17.487	—8.9530
9	25	— 657	+ 392	— 265	+ 125	— 459
10	28	— 1863	+ 986	— 877	— 304	— 1764
11	31	— 692	+ 1028	+ 336	+ 83	— 286
12	34	+ 1341	— 712	+ 629	+ 299	— 1919
13_1	38_1	+ 753	— 1112	— 359	— 94	+ 790
13_2	38_2	— 201	+ 172	— 29	— 8	+ 1
14	42	— 1621	+ 749	— 872	— 255	+ 2140
15	45	+ 813	— 1835	— 1022	— 241	+ 2458
16	48	— 3644	+ 2939	— 705	— 131	+ 1432
17	51	+ 437	— 364	+ 73	— 160	+ 1628
18	54	+ 505	— 1166	— 661	+ 323	— 3704
19	57	+ 185	— 111	+ 74	+ 19	— 97
20	60	+ 23	— 395	— 372	— 88	+ 905
21	63	— 3337	+ 2601	— 736	— 134	+ 1472
22	66	— 104	+ 208	+ 104	— 330	+ 4307
23	69	+ 780	— 946	— 166	— 38	+ 500
24	72	+ 103	— 403	— 300	— 99	+ 1299
25	75	+ 107	— 66	+ 41	+ 76	— 1017
26	78	— 26	— 22	— 48	— 160	+ 2111
27	80	— 7	— 110	— 117	+ 460	— 6105
28	82	— 88	— 47	— 135	+ 451	— 5988
29	85	— 70	+ 117	+ 47	— 51	+ 682
30	88	+ 5127	— 4795	+ 332	+ 139	— 1869
31	91	— 1222	+ 1122	— 100	— 52	+ 694
32	94	+ 69	— 1	+ 68	+ 37	— 519
33	97	— 2097	+ 1935	— 162	— 9	+ 71
34	100	+ 833	— 930	— 97	+ 20	— 254
35	103	— 2415	+ 1626	— 789	+ 198	— 2485
36	106	— 1758	+ 218	— 1540	— 446	+ 5352
37	109	+ 364	— 1729	— 1365	+ 376	— 4614
38	112	— 55	+ 44	— 11	+ 7	+ 33
39	115	+ 235	— 10	+ 225	+ 117	— 1325
40	118	+ 220	— 75	+ 145	+ 46	— 544
41	121	+ 566	— 782	— 216	+ 72	— 793
42	124	+ 604	— 2327	— 1723	— 398	+ 3671
43	127	+ 2268	— 2828	— 560	— 88	+ 442
44	130	— 419	+ 393	— 26	— 123	+ 958

Table VIII

For the seventh to the tenth columns inclusive 1 = 0.000,01.

Db (8)	*Dc* (9)	*Dd* (10)	Log 2*P′* (11)	½*Dm* (12)	½*Da* (13)	½*Dδ* (14)
					s	′
+ 245	+ 143	+ 44	9.144	—0.20	+ 34	+41.9
+ 312	+ 92	+ 57	102	— .25	+ 56	+73.2
— 264	— 208	— 14	340	— .05	+ 20	—27.2
— 102	+ 40	+ 7	111	+ .05	+ 2	—22.5
— 130	— 13	+ 53	090	+ .80	+ 56	—34.1
— 11	+ 37	— 20	9.392	+0.20	— 26	—21.2
— 43	— 4	+ 13	9.177	+ .15	+ 19	—20.6
—1.0777	—1.0773	—0.44636	0.463	+ .00	—267	—43′ 56.″3
— 80	+ 31	— 7	9.112	— .05	— 17	—18.9
— 182	+ 71	+ 60	124	+ .05	+ 25	+41.7
— 56	— 44	+ 3	9.226	—0.15	+ 20	— 8.2
— 175	— 63	— 25	134	+ .05	+ 9	—45.6
+ 45	+ 25	+ 20	179	— .15	— 2	+10.4
+ 6	+ 4	— 3	179	+ .45	— 3	+ 1.0
+ 133	+ 67	+ 64	166	.00	+ 9	+31.0
+ 102	+ 65	+ 85	9.226	—0.10	+ 7	+22.8
+ 46	+ 27	+ 70	297	.00	+ 26	+ 3.5
+ 70	+ 5	— 15	118	— .65	— 15	—27.6
— 111	+ 33	+ 62	119	.00	+ 8	—50.6
— 18	— 21	+ 2	229	.00	+ 15	— 1.9
+ 42	+ 46	+ 23	9.248	+0.10	— 27	+ 8.3
+ 63	+ 73	+ 57	198	— .05	— 39	+ 8.0
+ 47	+ 13	— 16	125	— .47	— 16	+56.6
+ 3	+ 3	+ 17	239	— .15	— 1	+ 3.4
+ 8	+ 1	+ 32	180	— .10	— 3	+13.0
— 6	+ 40	— 12	9.127	—0.15	— 42	—13.1
+ 19	+ 3	+ 4	124	— .77	— 2	+27.6
— 34	— 35	+ 16	124	— .15	+ 36	—78.9
— 33	+ 8	+ 13	124	— .80	— 7	—77.3
+ 5	— 26	— 5	130	+ .45	+ 2	+ 8.5
— 14	— 1	— 36	9.275	—0.75	— 10	—22.9
— 13	— 5	+ 8	146	.00	+ 8	+11.6
— 4	— 25	— 12	142	— .60	+ 26	— 5.9
— 13	+ 5	+ 18	180	.00	— 4	+ 6.2
+ 4	+ 2	+ 11	170	+ .10	— 6	— 1.7
+ 44	— 45	+ 71	9.180	+0.10	+ 22	—21.2
— 132	— 102	+ 134	192	— .20	+ 41	+53.6
+ 99	— 43	+ 138	199	+ .15	— 19	—43.2
+ 13	— 47	— 24	130	— .10	+ 54	— 1.1
+ 42	+ 17	— 18	137	— .45	— 6	—18.3
+ 14	+ 3	— 16	9.181	—0.15	+ 5	— 6.0
+ 26	+ 7	+ 32	145	+ .25	— 26	— 9.7
— 191	— 133	+ 122	238	— .05	+ 6	+36.1
— 58	— 56	+ 23	163	— .25	+ 10	+ 3.9
— 67	— 13	— 13	108	— .00	+ 19	+21.7

TABLE VIII—Continued

For the third to the sixth columns inclusive 1 = 0.000,1.

Par. No. (1)	List No. (2)	*R*. Δ_1 sec δ (3)	*R*. Δ_2 sec δ (4)	*R*. *D* sec δ (5)	*D* tan δ (6)	*Da* (7)
		s	s	s		s
45	133	— 1334	+ 917	— 417	— 92	+ 1164
46	136	— 529	— 501	— 1030	— 199	+ 898
47	139	+ 1133	— 602	+ 531	+ 166	— 1278
48	142	— 508	+ 450	— 58	+ 15	— 152
49	145	— 952	+ 1226	+ 274	+ 188	— 916
50	148	+ 2355	— 3637	— 1282	— 253	+ 1405
51	151	+ 480	— 952	— 472	+ 232	— 1015
52	154	— 3591	+ 873	— 2718	— 510	+ 2592
53	157	— 8011	+10400	+ 2389	+ 461	— 3683
54	160	— 43	— 156	— 199	— 59	+ 307
55	163	+ 1390	— 595	+ 795	— 248	+ 614
56	166	— 132	+ 455	+ 323	+ 211	+ 13
57	169	— 8894	+ 6486	— 2408	— 417	+ 82
58	172	+ 3719	— 6527	— 2808	— 570	— 116
59	175	— 37	+ 56	+ 19	— 190	— 103
60	178	— 2572	+ 2114	— 458	— 90	— 241
61	181	+ 6	— 3	+ 3	— 82	— 163
62	184	— 4457	+ 2913	— 1544	— 284	+ 151
63	187	+ 304	— 572	— 268	— 156	— 738
64	190	— 428	+ 504	+ 76	+ 55	+ 20
65	193	+ 5816	—10269	— 4454	— 807	— 5351
66_1	196_1	+ 3622	— 6101	— 2479	— 479	— 3597
66_2	196_2		— 178	— 178	— 37	— 1281
67	200	+ 674	+ 1390	+ 2064	— 569	— 3642
68	203	— 332	+ 188	— 144	— 57	— 499
69	205	+ 4	— 243	— 239	— 65	— 635
70	208	+ 74	— 385	— 311	+ 180	+ 1545
71	211	— 1354	+ 1780	+ 426	+ 193	+ 2045
72	214	+32648	—11266	+21382	+3560	+29884
73	217	— 312	+ 41	— 271	+ 249	+ 2326
74	220	+ 3103	— 1523	+ 1580	+ 446	+ 3911
75	223	— 612	+ 1309	+ 697	+ 265	+ 3060
76	226	— 63	+ 118	+ 55	+ 91	+ 1019
77	229	— 452	+ 304	— 148	+ 56	+ 493
78	231	— 958	+ 614	— 344	+ 128	+ 1318
79	234	— 2927	+ 2981	+ 54	+ 68	+ 672
80	236	+ 453	— 563	— 110	— 29	— 416
81	239	— 4156	+12613	+ 8457	+1564	+20260
82	242	+ 1081	— 1737	— 656	— 205	— 2612
83	245	+ 176	+ 60	+ 236	— 216	— 2665
84	248	+ 1788	— 902	+ 886	+ 290	+ 3560
85	251	+ 2572	+ 874	+ 3446	—1010	—12589
86	254	— 390	+ 337	— 53	+ 15	+ 191
87	257	— 252	— 39	— 291	+ 103	+ 1406
88	258	— 284	— 71	— 355	+ 127	+ 1607

TABLE VIII—Continued

For the seventh to the tenth columns inclusive 1 = 0.000,01.

Db (8)	*Dc* (9)	*Dd* (10)	Log 2*P′* (11)	½*Dm* (12)	½*Dα* (13)	½*Dδ* (14)
					s	′
— 34	— 13	+ 57	9.238	—0.20	— 28	+ 7.7
— 126	— 110	+ 25	336	— .05	+ 24	+11.5
+ 91	+ 45	— 36	172	+ .15	+ 5	—21.1
+ 7	— 4	+ 4	123	— .15	— 1	— 1.8
+ 118	+ 32	— 3	124	— .15	— 7	—31.0
— 153	— 121	+ 60	9.280	0.00	— 8	+15.6
+ 146	— 48	+ 13	102	+ .15	+ 4	—36.2
— 311	— 259	+ 117	353	— .60	— 17	+25.0
+ 272	+ 214	— 192	423	— .30	+ 78	—26.0
— 37	— 17	+ 18	161	+ .10	— 13	+20.0
— 163	+ 82	— 23	9.161	—0.55	+ 9	+29.6
+ 141	+ 37	+ 33	103	+ .05	— 34	—34.2
— 278	— 255	— 4	321	+ .25	+ 16	+12.0
— 377	— 293	+ 13	229	— .20	— 24	+38.7
— 127	+ 3	— 37	088	— .20	+ 38	+32.6
— 58	— 46	— 17	9.216	+0.15	+ 12	+ 5.6
— 54	— 3	+ 25	088	— .10	— 26	+13.9
— 195	— 170	+ 20	347	— .05	— 28	—46.5
— 98	— 19	— 35	099	.00	+ 28	+25.0
+ 38	+ 20	— 34	113	+ .20	+ 38	— 9.0
— 472	— 408	— 250	9.338	+0.35	+ 39	+31.9
— 262	— 211	— 150	9.286	— .05	+ 10	+27.0
+ 4	+ 17	— 78	8.985	+ .50	+103	+ 5.3
— 334	+ 200	+ 93	9.189	+ .50	+ 18	+65.2
— 29	— 2	— 24	101	— .10	+ 20	+10.4
— 31	+ 4	— 49	9.100	+0.20	+ 44	+10.7
+ 92	— 14	— 35	116	— .10	+ 19	—28.7
+ 83	+ 12	+ 58	156	— .05	— 29	—29.5
+1866	+1786	+1416	679	+ .00	+ 25	—55.0
+ 119	— 51	+ 9	114	+ .10	— 44	—41.5
+ 233	+ 167	+ 80	9.212	+0.20	+ 58	—52.4
+ 93	+ 23	+ 78	162	— .20	— 23	—37.6
+ 34	— 3	+ 9	116	+ .10	— 8	—15.6
+ 31	— 34	+ 3	149	+ .10	— 28	+ 7.9
+ 56	— 42	— 16	142	— .60	— 25	—18.2
+ 34	+ 32	— 10	9.213	—0.10	+ 32	—14.1
0	+ 7	— 15	200	+ .30	+ 10	+ 3.1
+ 310	+ 243	+ 880	444	— .20	— 52	—70.6
— 42	— 9	— 71	151	— .25	+ 16	+26.6
— 55	+ 11	+ 23	127	+ .05	+ 2	+36.0
+ 79	+ 46	+ 84	9.192	—0.40	+ 10	—38.2
— 245	+ 162	+ 331	203	+ .30	+ 38	+122.5
+ 2	+ 6	— 7	139	—0.15	+ 8	— 1.9
0	+ 27	— 38	171	+1.05	+ 47	+15.8
+ 29	— 31	— 32	171	+0.30	— 21	—17.5

Table VIII—Continued

For the third to the sixth columns inclusive 1 = 0.000,1.

Par. No. (1)	List No. (2)	$R. \Delta_1 \sec \delta$ (3)	$R. \Delta_2 \sec \delta$ (4)	$R. D \sec \delta$ (5)	$D \tan \delta$ (6)	Da (7)
		s	s	s		s
89	261	— 223	+ 48	— 175	— 134	— 1730
90	264	+ 155	— 196	— 41	— 22	— 318
91	267	— 1151	+ 1314	+ 163	+ 82	+ 1155
92	270	+ 516	— 301	+ 215	+ 43	+ 683
93	273	— 1314	+ 77	— 1237	— 378	— 5038
94	276	+ 938	+ 390	+ 1328	— 377	— 4998
95	278		+ 92	+ 92	— 34	— 483
96	281	— 213	+ 975	+ 762	— 283	— 3614
97	284	— 866	+ 568	— 298	+ 87	+ 1214
98	287	— 1088	+ 834	— 254	— 52	— 496
99	290	— 371	— 33	— 404	— 151	— 1964
100	293	+ 1872	— 2132	— 260	— 47	— 794
101	296	+ 210	— 228	— 18	+ 3	+ 84
102	298	— 558	+ 215	— 343	— 260	— 3164
103	301	— 984	+ 1225	+ 242	+ 96	+ 1016
104	304	+ 1072	— 1473	— 401	+ 110	+ 1027
105	307	— 1408	+ 1624	+ 216	+ 64	+ 930
106	310	— 741	+ 596	— 145	— 72	— 631
107	313	— 1232	+ 981	— 251	+ 35	+ 154
108	316	+ 1876	— 1456	+ 420	+ 145	+ 1891
109	319	+ 3897	—14710	—10813	—1778	—14150
110	322	— 553	+ 439	— 114	— 39	— 333
111	325	— 9200	+ 7490	— 1710	— 282	— 1235
112	328	+ 114	+ 17	+ 131	— 216	— 1843
113	331	— 144	+ 95	— 49	— 37	— 432
114	334	— 733	+ 56	— 677	— 216	— 1166
115	337	+ 3269	— 2506	+ 763	+ 163	+ 1842
116	340	+ 265	— 274	— 9	+ 13	+ 70
117	343	— 198	+ 104	— 94	— 50	— 385
118	346	— 685	— 169	— 854	— 270	— 1489
119	349	+ 322	— 330	— 8	+ 56	+ 231
120	352	+ 808	— 601	+ 207	+ 81	+ 79
121	355	+ 482	— 1192	— 710	— 349	— 894
122_1	358_1	+ 599	— 615	— 16	— 46	— 334
122_2	358_2		+ 6	+ 6	— 4	— 128
123	362	+ 6554	— 6548	+ 6	+ 30	+ 287
124	365	+ 1249	— 814	+ 435	+ 177	— 222

Parallax star No. 8, in general list star No. 23, *α* Urs. Min. With comparison star No. 22 only. The numbers in the third and sixth columns correspond to the mean positions for 1900.0, as given in Table VII; similarly for the numbers in the seventh to the tenth columns inclusive. The values of $\Delta \sec \delta$ and $\Delta \tan \delta$, for the several periods of observation, were computed from the apparent declinations for the extreme dates of each period and interpolated, to the second decimal place, for the intermediate dates. The values of Δa, Δb, Δc, Δd adopted in the reductions, were computed from the mean positions of the stars for the several years of observation.

Table VIII—Continued

For the seventh to the tenth columns inclusive 1 = 0.000,01.

Db (8)	*Dc* (9)	*Dd* (10)	Log 2*P′* (11)	½*Dm* (12)	½*Dα* (13)	½*Dδ* (14)
					s	′
— 25	— 1	— 17	9.124	+0.25	+ 3	+22.7
+ 10	+ 41	— 8	135	— .85	+ 42	+ 3.6
— 27	— 54	+ 23	177	— .15	+ 48	—13.1
— 8	— 12	+ 30	331	+ .10	— 10	— 2.9
+ 19	+ 35	— 130	190	— .50	+ 29	+47.2
+ 46	— 60	+ 137	9.208	+0.15	— 43	+44.6
— 17	+ 44	+ 14	8.867	.00	+ 84	+ 9.4
+ 60	— 59	+ 71	9.171	.00	— 38	+39.7
+ 9	— 31	— 38	186	— .10	— 33	—10.6
+ 28	+ 34	— 15	311	+ .25	+ 21	+ 3.4
+ 24	— 10	— 47	9.163	+0.23	— 23	+21.3
— 14	— 27	— 40	312	— .65	— 30	+ 2.1
+ 3	+ 12	+ 4	125	— .38	+ 12	— 0.8
+ 73	+ 6	— 37	123	— .40	— 11	+42.9
— 40	— 24	+ 17	177	+ .20	— 9	—13.8
— 53	+ 34	— 24	9.166	0.00	+ 9	—12.8
— 10	+ 15	+ 40	229	+ .30	+ 36	— 7.9
+ 38	— 16	— 31	120	+ .40	— 31	+14.1
— 28	— 12	— 43	124	— .10	— 34	— 9.7
— 39	+ 7	+ 66	189	— .35	+ 38	—19.9
— 970	+ 946	— 673	9.678	—0.25	+ 54	+20.2
+ 20	+ 19	+ 4	126	— .50	+ 16	+ 5.4
+ 189	+ 196	— 43	435	+ .15	+ 63	+ 3.7
+ 110	+ 6	+ 31	105	— .35	+ 28	+36.7
+ 15	— 22	— 38	107	— .30	— 44	+ 6.2
+ 132	+ 81	0	9.159	—0.10	+ 39	+27.9
— 74	— 46	+ 86	314	— .05	+ 29	—12.3
— 8	— 2	— 7	105	+ .05	— 7	— 2.4
+ 28	+ 27	+ 43	095	.00	+ 53	+ 8.2
+ 164	+ 76	— 52	153	.00	+ 20	+34.7
— 36	— 12	— 35	9.097	+0.10	— 39	—10.0
— 55	— 29	— 22	142	— .05	— 28	—11.6
+ 228	+ 74	— 3	104	+ .00	+ 13	+53.8
+ 28	+ 6	+ 23	9.103	— .65	+ 24	+ 8.6
+ 1	+ 4	+ 24	8.802	+ .10	+ 48	+ 1.3
— 25	— 9	+ 1	9.358	—0.40	— 20	— 8.3
— 120	— 50	— 47	137	+0.15	— 48	—25.9

The remaining cases of a parallax star reduced with only one comparison star are as follows: Par. No. 66_2, or List No. 196_2, with No. 197; Par. No. 95, or List No. 278, with No. 279; and Par. No. 122_2, or List No. 358_2, with No. 359.

For all of these cases of reduction with one comparison star only, the numbers in the seventh column of the table are the values of log P′.

Table IX

Stars 1, 2, 3. *a* Andromedae. 0h 3m, +28° 32′

Columns 4 to 10 inclusive and column 13. 1 = 0.s001.

No. of Obs.	Date	c'''	DT	$dT(c)$	$dT(n)$	Rate	Prec. and Nutat.	Prop. Mot.	DT 1900.0	τ	Sin $(L-K)$	$\sqrt{p}.v_1'$
	1898	r	—69s						—69s			
1	July 22	+0.091	—202	— 12	+65	0	— 7	+31	—125	—1.44	+0.87	— 31
2	23	...	514	+332	+ 1		— 7	+31	—157	1.44	.86	+ 67
3	26	— .319	201	+ 44	+ 1		— 5	+30	—131	1.43	.83	+ 41
4	28	+ .121	061	— 17	+ 1		— 4	+30	—051	1.43	.81	— 39
5	29	+ .121	037	— 17	+ 1		— 3	+30	—026	1.42	.80	— 64
6	30	...	—138	+ 17	+ 1	0	— 3	+30	—093	—1.42	+0.79	+ 3
											Mean	— 4
	1898											
7	Nov. 16	—0.197	—168	+ 27	+ 8	0	+14	+24	—095	—1.12	—0.81	+ 8
8	Dec. 22	— .158	105	+ 22	+ 2	0	+ 2	+22	—057	1.04	1.00	— 29
9	24	+ .026	129	— 4	+ 2	0	+ 1	+22	—108	1.02	1.00	+ 22
10	25	+ .027	048	— 4	+ 2	—1	+ 1	+22	—028	1.02	1.00	— 58
11	30	+ .026	142	— 4	+ 2	0	— 1	+21	—124	1.00	0.99	+ 38
12	31	+ .027	101	— 4	— 2	0	— 2	+21	—088	1.00	.99	+ 2
	1899											
13	Jan. 5	+ .026	113	— 4	— 3	—2	— 5	+21	—106	0.99	.97	+ 20
14	7	+ .027	—248	— 4	— 2	—2	— 5	+21	—240	—0.98	—0.96	+ 46
											Mean	+ 6
	1899											
15	July 16	—0.614	—191	+ 84	+10	0	+ 4	+ 9	—084	—0.46	+0.91	— 9
16	19	— .044	182	+ 6	+10		+ 5	+ 9	—152	.45	.89	+ 59
17	20	+ .066	106	— 9	+10		+ 6	+ 9	—090	.45	.89	— 3
18	21	+ .026	068	— 4	+11		+ 6	+ 9	—046	.45	.88	— 47
19	22	— .064	183	+ 9	+10		+ 7	+ 9	—148	.44	.87	+ 55
20	23	+ .066	050	— 9	+10		+ 7	+ 9	—033	.44	.86	— 60
21	29	— .058	122	+ 8	+10		+10	+ 9	—085	.42	.81	— 8
22	31	+ .026	092	— 4	+11		+11	+ 9	—065	.42	.79	— 28
23	Aug. 1	— .450	—164	+ 61	+10	0	+11	+ 9	—073	—0.42	+0.78	— 20
											Mean	— 7
	1899											
24	Nov. 17	+0.092	—162	— 12	+16	0	+27	+ 2	—129	—0.12	—0.82	+ 39
25	19	— .124	194	+ 17	+16	0	+27	+ 2	—132	.11	.84	+ 42
26	25	— .264	135	+ 36	+16	0	+25	+ 2	—056	.10	.89	— 34
27	27	— .024	—100	+ 3	—21	+1	+24	+ 2	—091	.09	.90	+ 1
28	Dec. 4	—0.068	+006	+ 9	—21	0	+23	+ 1	+018	.07	.95	—107
29	7	—1.728	—289	+236	—14	0	+22	+ 1	—044	.07	0.97	— 45
30	19	+0.026	118	— 4	—21	+1	+17	0	—125	.03	1.00	+ 36
31	23	+ .026	070	— 4	—21	0	+16	0	—079	— .02	1.00	— 10
	1900											
32	Jan. 7	+0.026	—121	— 4	—26	0	+ 8	0	—143	+0.02	—0.96	+ 54
											Mean	— 3
	1900											
33	July 18	+0.060	—122	— 8	+33	+1	+18	—12	—090	+0.55	+0.90	— 6

TABLE IX—Continued

Columns 4 to 10 inclusive and column 13. 1 = 0.s001.

STARS 1, 2, 3. α ANDROMEDAE. 0h 3m, +28° 32′

No. of Obs.	Date	c‴	DT	dT(c)	dT(n)	Rate	Prec. and Nutat.	Prop. Mot.	DT 1900.0	τ	Sin (L–K)	√p. v₁′
	1900	r	—69s						—69s			
34	Nov. 8	+0.046	—073	— 6	+ 1	+1	+42	—19	—054	+0.87	—0.71	— 39
35	15	+ 46	057	— 6	— 7	0	+40	—19	049	.87	.79	— 44
36	21	+ 45	073	— 6	— 7	+1	+39	—19	065	.89	.85	— 28
37	26	+ 46	136	— 6	— 7	0	+38	—19	130	.90	.90	+ 37
38	Dec. 5	+ 45	052	— 6	— 7	+1	+36	—20	048	.93	.95	— 44
39	8	+ 46	006	— 6	— 7	0	+35	—20	004	.94	.97	— 44
40	9	+ 45	172	— 6	— 7	+1	+34	—20	170	.94	.97	+ 78
41	11	+ 46	120	— 6	— 7	0	+33	—20	120	.95	.98	+ 28
42	12	+ 45	138	— 6	— 7	+1	+33	—20	137	.95	0.98	+ 45
43	18	+ 46	119	— 6	— 7	0	+30	—21	123	.96	1.00	+ 31
44	19	+ 71	042	— 10	— 7	+1	+30	—21	049	.97	1.00	— 43
45	20	+ 46	187	— 6	— 7	0	+29	—21	192	0.97	1.00	+100
46	29	+ 36	068	— 5	— 7	+1	+25	—21	075	1.00	0.99	— 17
47	31	+ 45	163	— 6	— 7	0	+24	—21	173	1.00	.99	+ 37
48	Jan. 1	+ 46	032	— 6	— 7	+1	+24	—21	041	1.00	.98	— 51
49	2	+0.045	—029	— 6	—18	0	+23	—21	—051	+1.01	—0.98	— 47
											Mean	0
	1901											
50	July 16	+0.264	—025	— 36	+ 1	+1	+28	—33	—064	+1.54	+0.92	— 35
51	17	— .041	266	+ 6	+ 1	0	+29	—33	263	1.54	.91	+115
52	19	— .131	159	+ 18	+ 1	+1	+30	—33	142	1.55	.90	+ 43
53	20	+ .084	152	— 11	+ 1	+1	+30	—33	164	1.55	.89	+ 65
54	21	+ 94	004	— 13	+ 1	0	+31	—33	018	1.55	.88	— 81
55	22	+ 39	044	— 5	+ 1	+1	+31	—33	049	1.56	.87	— 50
56	26	+ 59	054	— 8	+ 1	0	+33	—34	062	1.57	.84	— 37
57	30	+ 49	102	— 7	— 9	+1	+35	—34	116	1.58	.80	+ 17
58	31	— 06	066	+ 1	— 9	+1	+35	—34	072	1.58	.79	— 27
59	Aug. 3	+ 64	086	— 9	— 1	0	+37	—34	093	1.59	.76	— 6
60	4	— .161	161	+ 22	— 1	+1	+37	—34	136	1.59	.75	+ 37
61	5	+ .039	105	— 5	— 1	0	+37	—34	108	1.60	.74	+ 9
62	6	+ .014	146	— 2	— 1	+1	+38	—34	144	1.60	.73	+ 45
63	12	—0.001	—072	0	— 1	+1	+40	—34	—066	+1.61	+0.65	— 33
											Mean	+ 4

2. c‴, —1.r619, —1.r984. 6. c‴, —2.r234, —1.r289. 14. Daylight. Seeing, 2—1. Star 1, *fff*. Therm. F, 0°. 28. Compared with obs. 25 on 19 contacts and obs. 30 on 16 contacts: $E_1 = +0.s005$, $E_2 = +0.s055$, $E_3 = -0.s060$. 39. Seeing, 3—1.5. 47. Seeing, 2—0.5. 51. Daylight. Stars 1 and 3, *ff*, star 3 uncertain. Compared with obs. 50 on 20 contacts, reduced to 7.05 rev., and obs. 52 on 15 contacts: $E_1 = +0.s011$, $E_2 = -0.s068$, $E_3 = +0.s058$.

All the observations have weight unity except Nos. 14, 39, 47, and 51, which have $\sqrt{p} = 0.3, 0.5, 0.5$, and 0.7 respectively.

M.	7.43	7.38	6.91	35
E.	7.58	7.48	6.95	27
	7.50	7.43	6.93	62

$$+60.08x + 15.08y - 4.24z - 4.42 = 0$$
$$+15.08 + 68.15 + 1.91 + 0.93 = 0$$
$$-4.24 + 1.91 + 47.67 + 1.68 = 0$$

Assumed $D\alpha$, 1900.0, $= -69.^{s}100$
$x = +0.079$
$y = -0.030$
$z = -0.027$

$d.D\alpha = +0.^{s}0079$
$d.D\mu = -0.0031$

$\pi = -0.''019 \pm 0.''033$

$p_2 = 47.23$
$[nn.3] = 0.1311$
$[vv] = 0.1311$
$r = \pm 0.^{s}032$

Table IX—Continued

Star 22, B. D. +87°, 12 . 1h 16m, 88° 2′

No. of Obs.	Date	Decl.	M_1	M_2	m_1	m_2	T_1	T_2	T_0	
		88° 1′								
		″	R	R			s	s	m	s
1	1898 Aug. 8.7	52.7	5.30	10.50	11	9	7.63	8.88	17	8.19
		88° 2′								
2	1898 Dec. 17.3	35.6	6.15	9.00	10	9	26.90	26.84	17	26.87
3	18	35.7	6.35	8.60	6	7	26.87	26.93		26.90
4	25	36.8	5.95	8.45	12	10	32.32	31.52		31.96
5	30	37.7	5.95	9.35	14	6	13.94	14.49		14.11
6	31	37.8	6.35	8.60	6	7	10.39	09.73	17	10.03
7	1899 Jan. 6.2	38.2	6.05	8.75	12	4	11.48	13.02	18	11.84
8	7	38.3	6.35	8.65	6	8	59.20	59.10	17	59.14
9	8	38.4	6.05	9.25	8	4	58.60	59.21		58.80
10	14	38.8	5.65	8.45	6	6	49.43	49.32		49.38
11	15	38.8	6.70	8.95	5	6	47.02	46.37		46.67
12	18.2	38.8	6.85	7.50	2	5	36.64	34.78	17	35.31
		88° 2′								
13	1899 Aug. 9.7	11.8	5.60	8.45	5	6	59.68	60.27	19	0.00
14	11	12.2	6.40	9.40	5	5	02.02	02.48	19	2.25
15	13	12.6	5.60	8.45	5	6	57.78	58.10	18	57.95
16	14	12.9	5.60	8.18	5	8	59.86	59.95		59.92
17	15	13.2	5.60	8.16	5	11	1.56	1.46	19	01.50
18	17	13.7	5.60	8.05	5	13	6.08	6.92		6.69
19	20.6	14.6	5.60	8.05	5	12	7.04	7.25		7.19
20	24	15.5	6.05	8.39	6	9	6.78	7.07		6.95
21	26	16.0	5.60	8.06	5	13	9.90	10.08		10.03
22	27	16.3	6.14	8.45	7	6	12.80	11.63		12.26
23	28.6	16.6	5.60	7.99	5	13	14.54	14.07	19	14.20
		88° 2′								
24	1899 Dec. 4.4	51.0	6.30	8.40	5	5	7.36	8.26	19	7.81
25	7.3	51.9	5.60	8.20	5	11	13.53	13.64	19	13.71
26	23	55.3	....	7.70	..	7	.....	6.28	19	6.49
27	1900 Jan. 7	57.1	5.95	8.35	6	8	52.56	52.50	18	52.53
28	20.2	57.5	5.60	8.00	5	15	55.29	54.80	18	54.92
		88° 2′								
29	1900 Aug. 19.6	32.3	5.60	8.25	5	10	35.48	35.05	20	35.19
30	21	32.9	5.60	8.11	5	13	33.94	32.51		32.91
31	26	34.3	5.60	8.20	5	9	41.86	41.53		41.65
32	27	34.5	5.60	8.10	5	11	42.82	43.76		43.47
33	28	34.7	5.60	8.10	5	11	44.58	44.45		44.50
34	29	35.0	5.60	8.10	5	11	45.20	45.54		45.43
35	30	35.3	5.60	8.10	5	11	46.02	46.76	20	46.53
		88° 3′								
36	1900 Dec. 8.3	10.0	5.70	8.18	5	4	21.82	20.90	21	21.41
37	9	10.3	5.60	8.40	5	7	15.92	18.59		17.48
38	18	12.2	5.60	8.20	5	9	21.14	22.47		21.99
39	19	12.3	5.65	8.10	6	11	19.07	20.21		19.81
40	29	14.0	5.60	8.35	5	10	21.12	21.31		21.25
41	31	14.3	5.60	8.45	5	4	16.02	15.80		15.92

Table IX—Continued

Star 23, α Ursae Minoris 1h 23m, 88° 46′

No. of Obs.	Date	Decl.	M_1	M_2	m_1	m_2	T_1	T_2	T_0	
		88° 45′								
		″	R	R			s	s	m	s
1	1898 Aug. 8.7	50.2	6.30	7.55	13	4	21.68	23.38	21	22.08
		88° 46′								
2	1898 Dec. 17.3	32.6	6.45	8.70	8	13	58.72	59.69	21	59.32
3	18	32.7	6.35	8.65	6	8	59.55	60.04	21	59.83
4	25	33.8	6.20	8.30	7	13	01.27	01.18	22	01.21
5	30	34.7	6.40	9.20	7	9	42.28	40.21	21	41.12
6	31	34.8	6.35	8.55	6	8	37.37	37.56	21	37.48
7	1899 Jan. 6.2	35.2	6.35	8.60	6	7	34.22	35.10	22	34.69
8	7	35.3	6.35	8.65	6	8	16.10	16.96	22	16.59
9	8	35.4	6.25	9.00	6	9	17.23	16.87	22	17.01
10	14	35.8	5.75	8.45	4	6	9.67	8.01	22	08.67
11	15	35.8	6.55	8.95	6	6	6.42	6.60	22	06.51
12	18.2	35.8	6.85	7.50	2	5	50.81	51.55	21	51.34
		88° 46′								
13	1899 Aug. 9.7	8.3	5.75	8.45	2	6	45.80	45.93	23	45.90
14	11	8.7	6.40	9.40	5	5	47.50	48.96		48.23
15	13	9.1	5.65	8.45	4	6	41.88	40.22		40.88
16	14	9.4	5.60	8.18	5	8	45.10	43.84		44.32
17	15	9.7	5.65	8.16	4	11	48.40	47.04		47.40
18	17	10.2	5.60	8.05	5	13	53.90	55.26		54.88
19	20.6	11.1	5.60	8.05	5	12	55.60	55.32		55.40
20	24	12.0	6.12	8.39	6	9	53.67	55.16		54.56
21	26	12.5	5.60	8.06	5	11	59.20	59.45	23	59.37
22	27	12.8	6.23	8.45	6	6	02.13	02.27	24	02.20
23	28	13.1	5.60	7.99	5	13	6.34	6.07	24	06.15
		88° 46′								
24	1899 Dec. 4.4	47.0	6.35	8.40	6	4	43.86	44.10	23	43.96
25	7.3	47.9	5.70	8.20	3	11	51.53	52.16		52.02
26	23	51.3	....	7.70	..	7	.....	40.15		40.15
27	1900 Jan. 7	53.1	6.00	8.35	5	8	16.86	16.11		16.40
28	20.2	53.5	5.70	8.00	3	14	17.63	17.20	23	17.28
		88° 46′								
29	1900 Aug. 19.6	27.8	5.60	8.08	5	10	48.32	48.72	25	48.59
30	21	28.4	5.60	8.07	5	10	43.40	42.69		42.93
31	26	29.8	5.60	8.20	5	9	53.70	53.50		53.57
32	27	30.0	5.60	8.10	5	11	54.84	56.05		55.68
33	28	30.2	5.60	8.10	5	11	58.30	57.39		57.67
34	29	30.5	5.60	8.10	5	11	58.78	57.66		58.01
35	30	30.8	5.60	8.15	5	8	59.42	60.05	25	59.81
		88° 47′								
36	1900 Dec. 8.3	5.0	5.70	8.30	5	11	16.74	16.45	26	16.54
37	9	5.3	5.65	8.40	4	7	9.02	7.64		08.14
38	18	7.2	5.60	8.20	5	9	14.22	13.00		13.44
39	19	7.3	5.75	8.10	4	11	11.90	11.49		11.60
40	29	9.0	5.60	8.35	5	10	8.54	8.77	26	08.77
41	31	9.3	5.65	8.45	4	4	59.42	57.25	25	58.34

Table IX—Continued

Star 22, B. D. +87°, 12 1h 16m, 88° 2′

No. of Obs.	Date.	Decl.	M_1	M_2	m_1	m_2	T_1	T_2	T_0	
		″	R	R						
		88° 3′					s	s	m	s
42	1901 Jan. 1	14.4	5.60	8.10	5	11	15.32	16.55	21	16.16
43	2	14.3	5.60	8.05	5	10	11.44	11.37		11.39
44	12.2	15.3	6.15	8.45	8	6	11.88	11.23		11.60
45	14	15.3	5.65	8.10	6	11	14.40	14.01		14.15
46	16	15.3	6.50	8.60	5	3	12.64	11.60		12.25
47	17	15.4	6.10	8.25	7	8	13.07	12.51		12.77
48	19	15.5	5.60	8.09	5	10	7.04	7.43		07.30
49	21.2	15.5	5.60	8.10	5	11	11.78	13.21	21	12.76
		88° 2′								
50	1901 Aug. 3.7	46.4	5.60	8.30	5	11	12.08	13.18	24	12.84
51	4	46.6	5.60	7.95	4	14	12.50	13.76		13.48
52	5	46.7	5.60	8.00	5	13	14.42	14.41		14.41
53	11	48.1	5.60	8.00	5	13	26.16	25.01		25.33
54	12	48.3	5.60	8.05	5	12	28.20	27.67		27.82
55	14	48.8	5.60	8.10	5	11	32.70	32.25		32.40
56	15	49.0	5.60	8.00	5	13	31.98	32.77		32.55
57	16	49.2	5.60	8.00	5	13	33.36	32.75		32.92
58	19	49.8	5.60	8.00	5	13	38.36	39.09		38.89
59	23	50.9	5.60	8.00	5	13	42.66	42.52		42.56
60	29	52.6	5.60	8.00	5	12	51.66	51.66		51.66
61	Sept. 1.6	53.4	5.60	8.00	5	13	50.58	50.64		50.62
62	2	53.7	5.60	8.00	5	13	54.56	54.84	24	54.76
		88° 3′								
63	1901 Dec. 11.3	28.1	5.60	8.00	5	13	50.06	49.64	25	49.76
64	18	29.7	5.60	8.10	5	9	37.22	38.08		37.77
65	19	29.8	5.60	8.00	5	12	38.12	38.21		38.18
66	21	30.2	5.60	8.00	5	13	35.32	35.42		35.40
67	23	30.6	5.60	8.00	5	13	34.56	36.28		35.80
68	30	31.8	5.60	8.00	5	13	43.76	43.54		43.60
69	1902 Jan. 2	32.0	5.60	7.90	5	8	42.44	42.80		42.66
70	3	32.1	5.60	8.25	5	12	41.00	41.88		41.62
71	4	32.1	5.60	8.00	5	13	38.62	39.18		39.02
72	7	32.4	5.60	8.00	5	13	43.86	43.42		43.54
73	9	32.6	5.60	8.00	5	13	45.30	44.82		44.96
74	13.2	32.9	6.55	8.60	6	5	41.12	41.44		41.26
75	14	32.9	5.60	8.00	5	13	44.54	44.01		44.16
76	16	32.8	5.60	8.05	5	14	43.66	42.87		43.08
77	18	32.8	5.60	7.80	5	7	45.98	46.43		46.08
78	22.2	32.9	6.15	8.60	8	3	45.72	44.30	25	45.34

7. Clock stopped Jan. 6.0 to clean and adjust electric contact apparatus. 12, 41. Regular program interrupted to change the chronograph sheet. 20, 24. Clouds. 26. Interrupted to attend to chronograph pen. 44. Clouds. No other stars observed. Adopted value of the constant n is the mean of the determinations on five neighboring dates.

Table IX—Continued

Star 23, α Ursae Minoris 1h 23m, 88° 46′

No. of Obs.	Date	Decl.	M_1	M_2	m_1	m_2	T_1	T_2	T_0	
		″	R	R			s	s	m	s
		88° 47′								
42	1901 Jan. 1	9.4	5.60	8.10	5	10	59.12	59.58	25	59.43
43	2	9.5	5.60	8.05	5	10	53.28	49.13		50.51
44	12.2	10.3	6.49	....	8	..	48.69	.....		48.69
45	14	10.3	5.70	8.10	5	11	53.36	52.63		52.86
46	16	10.3	6.55	8.60	4	3	46.82	46.47		46.67
47	17	10.4	6.15	8.25	6	8	48.93	50.70		49.94
48	19	10.5	5.55	8.12	4	11	37.30	38.18		37.95
49	21.2	10.5	5.65	8.10	4	11	47.30	46.80	25	46.93
		88° 46′								
50	1901 Aug. 3.7	40.9	5.60	8.30	5	11	8.96	7.55	29	07.99
51	4	41.1	5.60	7.90	4	14	8.25	9.26		09.04
52	5	41.2	5.60	7.95	5	12	8.80	9.57		09.34
53	11	42.6	5.60	8.00	5	13	25.74	25.59		25.63
54	12	42.8	5.60	8.05	5	12	28.80	28.82		28.81
55	14	43.3	5.60	8.10	5	11	34.56	34.27		34.36
56	15	43.5	5.60	8.00	5	13	33.90	34.55		34.37
57	16	43.7	5.60	8.15	5	10	33.66	34.38		34.14
58	19	44.3	5.65	8.00	6	13	42.78	42.77		42.77
59	23	45.4	5.60	7.99	5	12	48.50	46.02		46.75
60	29	47.1	5.60	8.00	5	13	57.72	58.75		58.47
61	Sept. 1.6	47.9	5.60	8.05	5	12	55.32	55.95	29	55.76
62	2	48.2	5.60	8.00	5	13	01.02	02.50	30	02.09
		88° 47′								
63	1901 Dec. 11.3	22.1	5.60	8.00	5	13	50.40	50.22	30	50.27
64	18	23.7	5.60	8.10	5	9	56.76	56.94		26.88
65	19	23.8	5.60	8.05	5	11	26.42	27.55		27.20
66	21	24.2	5.60	8.00	5	12	21.62	20.82		21.06
67	23	24.6	5.60	8.00	5	13	21.06	23.48		22.81
68	30	25.8	5.60	8.00	5	13	32.08	31.22		31.46
69	1902 Jan. 2	26.0	5.60	7.86	5	10	28.32	28.10		28.17
70	3	26.1	5.65	8.20	4	11	26.40	26.32		26.34
71	4	26.1	5.65	8.00	4	13	21.32	23.20		22.76
72	7	26.4	5.60	8.00	5	13	28.56	29.81		29.46
73	9	26.6	5.60	8.00	5	13	30.90	30.72		30.77
74	13.2	26.9	6.55	8.60	6	5	24.03	22.88		23.51
75	14	26.9	5.60	7.94	5	11	27.52	26.42		26.76
76	16	26.8	5.60	8.05	5	14	26.80	26.02		26.23
77	18	26.8	5.60	7.85	5	8	29.64	28.54		28.96
78	22.2	26.9	6.40	8.60	7	3	28.57	25.87	30	27.76

50. Bright daylight on second part of observation; star 23 almost lost at times. 51. Signal at 5.6 Rev. rejected on both stars; micrometer noted as ahead of the star at that position in each case. 69. Some signals failed to record, especially on star 22. 74. Began at 5.6 Rev. on star 22; but image so bad, stopped to close doors of attic loft, which had been left open. Image became better at once. Fresh south wind. 77. Some signals failing to record. 78. Daylight; star 22 not seen at first.

TABLE IX—Continued

STARS 22 AND 23. α URSAE MINORIS.

No. of Obs.	Date		c''	Δ sec δ	n	Δ tan δ	ΔT		$c''. \Delta$ sec δ
			s		s		m	s	s
1	1898 Aug.	8.7	+0.761	+17.25	—0.068	+17.26	+4	13.89	+13.13
2	1898 Dec.	17.3	+0.167	+17.53	—0.132	+17.54	+4	32.45	+ 2.93
3		18			.169	.54		32.93	2.93
4		25			.075	.54		29.25	2.93
5		30			.056	.54		27.01	2.93
6		31			—.004	.54		27.45	2.93
7	1899 Jan.	6.2			+ .037	.55		22.85	2.92
8		7			.362	.55		17.45	2.93
9		8			.290	.55		18.21	2.93
10		14			.057	.56		19.29	2.93
11		15			.053	.56		19.84	2.93
12		18.2	+0.167	+17.53	+0.195	+17.56		16.03	+2.92
13	1899 Aug.	9.7	+0.167	+17.37	—0.497	+17.39	+4	45.90	+2.90
14		11			.492	.39		45.98	2.90
15		13			.287	.39		42.93	2.90
16		14			.338	.39		44.40	2.90
17		15			.381	.40		45.90	2.90
18		17			.498	.40		48.19	2.90
19		20.6			.468	.41		48.21	2.90
20		24			.346	.41		47.61	2.90
21		26			.415	.41		49.34	2.90
22		27			.449	.41		49.94	2.90
23		28	+0.167	+17.37	—0.513	+17.41		51.95	+2.91
24	1899 Dec.	4.4	+0.167	+17.63	+0.583	+17.64	+4	36.15	+2.94
25		7.3			.376	.64		38.31	2.94
26		23			.427	.66		33.66	2.95
27	1900 Jan.	7			.703	.67		23.87	2.94
28		20.2	+0.167	+17.63	+0.506	+17.68		22.36	+2.95
29	1900 Aug.	19.6	+0.191	+17.49	—1.179	+17.52	+5	13.40	+3.34
30		21			0.986	.52		10.02	3.34
31		26			1.057	.52		11.92	3.34
32		27			1.065	.52		12.21	3.34
33		28			1.081	.52		13.17	3.34
34		29			1.056	.53		12.58	3.34
35		30	+0.191	+17.49	—1.063	+17.53		13.28	+3.34
36	1900 Dec.	8.3	+0.287	+17.74	+0.048	+17.77	+4	55.13	+5.09
37		9			.227	.77		50.66	5.09
38		18			.047	.77		51.45	5.09
39		19			.085	.77		51.79	5.09
40		29			.101	.77		47.52	5.09
41		31			.310	.77		42.42	5.09

Table IX—Continued

1h 22m. 88° 46′.

$n.\Delta \tan \delta$	Rate Corr.	Prec. and Nutat.	Prop. Mot.	ΔT. 1900.0	τ	Sin $(L-K)$	v
s	s	s	s	m s			s
— 1.17	0.00	+ 3.53	+0.19	+4 29.57	—1.40	+0.91	+1.07
— 2.32	0.00	— 3.05	+0.14	+4 30.15	—1.04	—0.90	+0.42
— 2.96	.00	— 2.75	.14	30.29	1.03	.92	+ .28
— 1.32	.00	— 0.51	.14	30.49	1.02	.95	+ .08
— 0.98	.00	+ 1.16	.14	30.26	1.00	.98	+0.31
— 0.07	.00	+ 1.55	.14	32.00	1.00	0.98	—1.43
+ 0.65	+ .01	+ 3.63	.13	30.19	0.98	1.00	+0.38
+ 6.35	+ .01	+ 3.99	.13	30.86	.98	1.00	— .29
+ 5.09	.00	+ 4.35	.13	30.71	.98	1.00	— .15
+ 1.00	+ .01	+ 6.55	.13	29.91	.96	1.00	+ .65
+ 0.93	+ .01	+ 6.92	.13	30.76	.96	1.00	— .21
+ 3.42	.00	+ 8.02	+0.13	30.52	—0.95	—0.99	+0.04
— 8.64	0.00	— 8.93	+0.05	+4 31.28	—0.39	+0.91	—0.68
8.56		— 9.61	.05	30.76	.39	.89	— .16
4.99		—10.30	.05	30.59	.38	.88	+ .01
5.88		—10.64	.05	30.83	.38	.87	— .23
6.63		—10.98	.05	31.24	.38	.86	— .64
8.66		—11.65	.05	30.83	.37	.84	— .23
8.15		—12.63	.05	30.38	.37	.81	+ .22
6.02		—13.86	.05	30.68	.35	.77	— .09
7.22		—14.47	.05	30.60	.35	.75	— .01
7.82		—14.75	.05	30.32	.34	.74	+ .25
— 8.93	0.00	—15.05	+0.05	30.93	—0.34	+0.73	—0.35
+10.28	0.00	—18.81	+0.01	+4 30.57	—0.07	—0.78	—0.03
6.63		—17.95	+ .01	29.94	.07	.81	+ .58
7.54		—13.44	.00	30.71	— .02	0.94	— .19
12.42		— 8.40	.00	30.83	+ .02	1.00	— .31
+ 8.95	0.00	— 3.58	—0.01	30.67	+0.06	—0.99	—0.15
—20.66	0.00	—24.27	—0.09	+4 31.72	+0.63	+0.83	—1.17
17.27		24.91	.09	31.09	.64	.81	—0.54
18.52		26.48	.09	30.17	.65	.76	+ .37
18.66		26.77	.09	30.03	.66	.74	+ .51
18.94		27.07	.09	30.41	.66	.72	+ .13
18.51		27.35	.09	29.97	.66	.72	+ .56
—18.63	0.00	—27.63	—0.09	30.27	+0.66	+0.71	+0.27
+ 0.85	0.00	—29.88	—0.13	+4 31.06	+0.94	—0.82	—0.58
+ 4.03		29.65	.13	30.00	.94	.83	+ .48
+ 0.84		27.04	.13	30.21	.96	.91	+0.27
+ 1.51		26.72	.13	31.54	0.97	.92	—1.06
+ 1.80		23.46	.14	30.81	1.00	.97	—0.34
+ 5.51		22.83	.14	30.05	1.00	.98	+ .42

Table IX—Continued

Stars 22 and 23. α Ursae Minoris.

No. of Obs.	Date		c''	$\Delta \sec \delta$	n	$\Delta \tan \delta$	ΔT		$c''.\Delta \sec$
			s		s		m	s	s
42	1901 Jan.	1	+0.287	+17.74	+0.268	+17.77	+4	43.27	+5.09
43		2			.450	.77		39.12	5.09
44		12.2			.355	.77		37.09	5.10
45		14			.295	.77		38.71	5.09
46		16			.437	.77		34.42	5.09
47		17			.321	.77		37.17	5.09
48		19			.562	.77		30.65	5.09
49		21	+0.287	+17.74	+0.366	+17.77		34.17	+5.10
50	1901 Aug.	3.7	+0.245	+17.58	+0.049	+17.60	+4	55.15	+4.31
51		4			.081	.60		55.56	4.31
52		5			.101	.61		54.93	4.31
53		11			+ .003	.62	5	0.30	4.30
54		12			— .029	.62		0.99	4.31
55		14			.086	.62		1.96	4.31
56		15			.054	.63		1.82	4.31
57		16			.033	.63		1.22	4.30
58		19			.094	.63		3.88	4.31
59		23			.059	.64		4.19	4.31
60		29			— .113	.65		6.81	4.31
61	Sept.	1.6			+ .039	.65		5.14	4.30
62		2	+0.245	+17.58	—0.065	+17.65		7.33	+4.31
63	1901 Dec.	11.3	+0.273	+17.85	+0.378	+17.87	+5	0.51	+4.87
64		18			.857	.88	4	49.11	4.87
65		19			.872	.89		49.02	4.87
66		21			.940	.89		45.66	4.88
67		23			.914	.89		47.01	4.87
68		30			.663	.90		47.86	4.87
69	1902 Jan.	2			.735	.90		45.51	4.87
70		3			.753	.90		44.72	4.88
71		4			.836	.91		43.74	4.87
72		7			.679	.91		45.92	4.87
73		9			.648	.91		45.81	4.87
74		13.2			.770	.91		42.25	4.88
75		14			.648	.91		42.60	4.87
76		16			.647	.91		43.15	4.87
77		18			.585	.91		42.88	4.87
78		22.2	+0.273	+17.85	+0.567	+17.91	+4	42.42	+4.88

29, 42, 47, 51, 71. Star images poor; quality estimated, 0.5 to 1.5.

$$+78.00x + 55.49y - 17.99z - 0.75 = 0$$
$$+55.49 + 130.28 - 17.43 + 3.78 = 0$$
$$-17.99 - 17.43 + 63.70 - 1.88 = 0$$

Table IX—Continued

1h 22m. 88° 46′.

$n. \Delta \tan \delta$	Rate Corr.	Prec. and Nutat.	Prop. Mot.	ΔT. 1900.0		τ	Sin $(L-K)$	v
s	s	s	s	m	s			s
+ 4.76	0.00	—22.50	—0.14	+4	30.48	+1.00	—0.98	—0.01
+ 8.00		22.17	.14		29.90	1.01	0.99	+ .57
+ 6.31		18.58	.14		29.78	1.03	1.00	+ .69
+ 5.24		17.83	.14		31.07	1.04	1.00	— .60
+ 7.76		17.08	.14		30.05	1.04	1.00	+ .41
5.70		16.71	.14		31.11	1.05	1.00	— .64
9.99		15.95	.14		29.64	1.05	0.99	+ .83
+ 6.50	0.00	—15.19	—0.14		30.44	+1.06	—0.98	+0.03
+ 0.86	0.00	—30.15	—0.22	+4	29.95	+1.59	+0.94	+0.56
+ 1.43		—30.51	.22		30.57	1.59	.94	— .06
+ 1.78		—30.88	.22		29.92	1.60	.93	+ .59
+ 0.05		—33.04	.22		31.39	1.61	.89	— .88
— 0.51		—33.37	.22		31.20	1.61	.88	— .69
— 1.52		—34.06	.22		30.47	1.62	.86	+ .04
— 0.95		—34.40	.22		30.56	1.62	.86	— .05
— 0.58		—34.72	.22		30.00	1.63	.85	+ .51
— 1.66		—35.74	.22		30.57	1.63	.82	— .06
— 1.04		—37.00	.22		30.24	1.64	.78	+ .25
— 1.99		—38.81	.23		30.09	1.66	.71	+ .39
+ 0.69		—39.64	.23		30.26	1.67	.67	+ .23
— 1.15	0.00	—39.92	—0.23		30.34	+1.67	+0.66	+0.15
+ 6.75	0.00	—40.46	—0.25	+4	31.41	+1.94	—0.84	—0.98
+15.32		—38.40	.27		30.63	1.97	.91	— .20
+15.60		—38.09	.27		31.13	1.97	.91	— .70
+16.82		—37.45	.27		29.64	1.97	.93	+ .79
+16.35		—36.81	.27		31.15	1.98	.94	— .72
+11.87		—34.59	.27		29.74	2.00	.97	+ .69
+13.16		—33.60	.27		29.67	2.00	.98	+ .76
+13.48		—33.08	.27		29.73	2.01	.99	+ .70
+14.97		—32.91	.27		30.40	2.01	0.99	+ .03
+12.16		—31.89	.27		30.79	2.02	1.00	— .36
+11.60		—31.67	.27		30.34	2.02	1.00	+ .09
+13.79		—29.57	.28		31.07	2.04	1.00	— .65
+11.60		—29.19	.28		29.60	2.04	1.00	+ .83
+11.59		—28.43	.28		30.90	2.04	1.00	— .47
+10.48		—27.67	.28		30.28	2.05	0.99	+ .15
+10.15	0.00	—26.13	—0.28	+4	31.04	+2.06	—0.98	—0.62

Assumed $\Delta\alpha$ 1900.0 = +4m 30.50s $d.\Delta\alpha = +0.049$s $p(z) = 59.31$

$x = +0.0494$ $d.\Delta\mu = -0.046$ $[nn.3] = 21.52$

$y = -0.0459$ $[vv] = 21.44$

$z = +0.0308$ $\pi = +0.''011 \pm 0.''016$ $r = \pm 0.^s361$

$r_1 = \pm 0.''115$

Table X.

(The references to the parallax stars throughout the text are by the serial numbers of the complete list, the numbers given in the second column of Tables VII and X.)

Par. No.	List No.	Par. Star	Cat. Mag.	Sp.	R. A. 1900			Decl. 1900		½d(Dμ)	Rel. Par. π	Prob. Err. r(π)	Prob. Err. r_1	No. of Obs.	No. of Periods
					h	m	s	°	′	s	″	″	″		
1	2	α Androm.	2.1	A	0	3	13	+28	32	—0.0015	—0.019	±0.033	±0.21	63	7
2	5	γ Pegasi	3.0	B2		8	5	+14	38	— 64	+ .073	47	.28	61	6
3	8	α Cassiop.	2.2	K		34	50	+55	59	+ 59	— .020	34	.20	57	10
4	11	β Ceti	2.1	K		38	34	—18	32	— 43	— .061	42	.22	46	10
5	14	Piazzi o, 189	6.0	K		43	8	+ 4	46	+ 11	+ .170	40	.23	60	6
6	17	γ Cassiop.	2.3	B	0	50	40	+60	10	—0.0098	+0.015	± .030	±0.19	67	7
7	20	β Androm.	2.2	Ma	1	4	8	+35	5	— .0056	+ .028	31	.20	62	7
8	23	α Urs. Min.	2.2	F8		22	33	+88	46	— .046	+ .011	16	.12	78	8
9	25	τ Ceti	3.6	K		39	25	—16	28	— .0144	+ .258	39	.25	72	8
10	28	β Arietis	2.8	A5		49	7	+20	19	— .0185	+ .047	29	.22	82	8
11	31	γ¹ Androm.	2.2	K	1	57	45	+41	51	+0.0002	—0.015	± .027	±0.20	76	7
12	34	α Arietis	2.0	K2	2	1	32	+22	59	— 22	+ .021	28	.20	70	7
13_1	38_1	δ Trianguli	5.0	G		10	57	+33	46	+ 36	+ .062	30	.22	75	7
13_2	38_2	δ Trianguli	5.0	G		10	57	+33	46	— 38	+ .144	24	.17	77	7
14	42	Lalande 4855	7.3	..		32	35	+30	24	— 6	+ .029	25	.18	77	7
15	45	β Persei	2.3	B8	3	1	39	+40	34	—0.0028	+0.122	± .026	±0.19	78	7
16	48	α Persei	1.9	F5		17	11	+49	30	+ 120	+ .101	25	.17	74	7
17	51	ε Eridani	3.7	K		28	13	— 9	48	+ 56	+ .364	25	.22	97	9
18	54	δ Eridani	3.7	K		38	27	—10	6	— 25	+ .078	34	.26	87	9
19	57	ε Persei	3.0	B		51	8	+39	43	— 97	— .044	24	.20	96	9
20	60	Groomb. 864	7.1	..	4	34	32	+41	56	—0.0048	+0.024	± .025	±0.19	74	7
21	63	ι Aurigae	2.7	K2		50	29	+33	0	— 52	— .017	22	.15	62	7
22	66	β Eridani	2.9	A2	5	2	56	— 5	13	— 61	+ .012	28	.19	67	7
23	69	λ Aurigae	4.9	G		12	6	+40	1	+ 32	+ .070	28	.20	67	7
24	72	β Tauri	1.9	B8		19	58	+28	31	+ 06	— .073	28	.18	53	11
25	75	γ Orionis	1.9	B2	5	19	46	+ 6	15	—0.0002	+0.021	± .031	±0.20	51	11
26	78	δ Orionis	2.4	B		26	54	— 0	22	+ 66	+ .072	30	.23	74	9
27	80	ε Orionis	1.8	B		31	8	— 1	16	+ 30	+ .048	25	.24	78	9
28	82	ζ Orionis	2.0	B		35	43	— 2	0	+ 04	— .039	26	.20	78	9
29	85	κ Orionis	2.5	B		43	1	— 9	42	— 40	+ .018	30	.22	74	9
30	88	β Aurigae	2.1	A	5	52	12	+44	56	+0.0040	+0.026	± .020	±0.15	81	9
31	91	β Can. Maj.	2.0	B1	6	18	18	—17	54	+ 25	+ .154	31	.22	79	9
32	94	γ Gem.	2.0	A		31	56	+16	29	0	+ .064	23	.18	79	9
33	97	ε Can. Maj.	1.5	B1		54	42	—28	50	— 150	+ .012	35	.23	79	11
34	100	δ Can. Maj.	1.8	F8	7	4	20	—26	14	— 34	— .067	33	.20	75	11
35	103	η Can. Maj.	2.4	B5	7	20	8	—29	6	—0.0084	+0.049	± .040	±0.25	77	11
36	106	α Gem. (pair)	1.8	A		28	13	+32	6	— 110	+ .167	31	.23	84	11
37	109	Lacaille 2957	6.0	F8		41	51	—33	59	+ 2	+ .056	42	.23	63	11
38	112	9 Puppis	6.0	F8		47	8	—13	38	— 44	+ .028	26	.19	77	11
39	115	ζ Cancri (wide pair)	4.7	G	8	6	28	+17	57	— 48	— .004	33	.24	73	11
40	118	W.B.viii, 181-2	8.3	..	8	12	0	+30	56	+0.0016	+0.081	± .031	±0.18	64	11
41	121	Lal. 17103	5.3	K		34	45	—22	19	+ 20	— .049	36	.20	55	9
42	124	10 Urs. Maj.	4.1	F5		54	9	+42	11	— 79	— .004	27	.19	71	9
43	127	Lalande 18286	7.0	..	9	11	57	+29	0	+ 24	+ .119	26	.18	65	9
44	130	α Hydrae	2.0	K2		22	40	— 8	14	— 62	— .030	31	.21	62	11

TABLE X—Continued

Par. No.	List No.	Par. Star	Cat. Mag.	Sp.	R. A. 1900 h	m	s	Decl. 1900 °	′	½d(Dμ)	Rel. Par. π	Prob. Err. r(π)	Prob. Err. r_1	No. of Obs.	No. of Periods
					h	m	s	°	′	s	″	″	″		
45	133	Lal. 19022	8.0	..	9	37	6	+43	10	+0.0043	+0.121	±0.029	±0.20	66	11
46	136	φ Urs. Maj.	5.0	A2		45	18	+54	32	+ 08	— .049	29	.21	66	11
47	139	20 Leo. Min.	5.8	F2		55	14	+32	25	— 38	+ .000	30	.20	65	11
48	142	Lal. 19780	7.2	..	10	3	37	—19	15	— 6	+ .048	37	.23	66	11
49	145	γ Leo. *med.*	2.5	K		14	27	+20	21	— 82	+ .096	40	.24	63	13
50	148	Groomb. 1646	6.6	F8	10	21	53	+49	19	—0.0023	+0.060	± .032	±0.21	69	13
51	151	W. B. x, 520	5.7	F		31	33	—11	42	— 11	— .036	46	.29	70	13
52	154	β Urs. Maj.	2.6	A		55	48	+56	55	+ 60	+ .125	41	.21	39	12
53	157	α Urs. Maj.	2.0	K		57	33	+62	17	— 22	+ .026	39	.19	40	13
54	160	ξ Urs. Maj. *med.*	3.7	G	11	12	50	+32	5	— 49	+ .160	31	.20	76	13
55	163	20 Crateris	6.2	G	11	29	37	—32	18	+0.0056	+0.226	± .040	±0.21	65	13
56	166	β Leonis	2.2	A2		43	57	+15	8	— 41	+ .031	37	.19	64	13
57	169	γ Urs. Maj.	2.6	A		48	34	+54	15	+ 48	+ .034	58	.22	48	11
58	172	Piazzi xi, 218	6.7	..		57	24	+43	39	+ 116	+ .054	30	.18	67	13
59	175	W. B. xii, 69	8.0	..	12	7	25	— 2	32	+ 60	+ .029	46	.28	72	13
60	178	8 Can. Ven.	4.5	G	12	28	59	+41	54	—0.0030	+0.075	± .036	±0.22	69	12
61	181	γ Virg. (pair)	2.8	F		36	35	— 0	54	— 3	+ .076	34	.21	71	12
62	184	ε Urs. Maj.	1.8	A		49	38	+56	30	— 38	+ .044	27	.19	83	13
63	187	ε Virginis	3.0	K		57	12	+11	30	+ 4	+ .023	34	.24	81	13
64	190	42 Comae	4.5	F5	13	5	7	+18	4	— 4	+ .109	32	.23	87	13
65	193	ζ^1 Urs. Maj.	2.4	A	13	19	54	+55	27	—0.0010	+0.067	± .033	±0.21	77	12
66_1	196_1	η Urs. Maj.	2.0	B3		43	36	+49	49	— 40	— .087	29	.21	88	12
66_2	196_2	η Urs. Maj.	2.0	B3		43	36	+49	49	— 30	— .076	+ 39	.20	88	12
67	200	θ Centauri	1.7	K	14	0	47	—35	53	— 8	— .071	67	.26	54	12
68	203	Lalande 26196	7.5	..		14	25	— 4	41	+ 42	+ .058	44	.32	97	13
69	205	Lalande 26289	6.0	G	14	18	8	+ 1	43	+0.0040	+0.221	± .036	±0.26	99	13
70	208	Lalande 26481	8.0	..		25	48	—15	11	+ 64	+ .210	48	.28	81	13
71	211	ϵ^2 Boötis	2.6	A		40	37	+27	30	+ 19	+ .040	26	.19	85	12
72	214	β Urs. Min.	2.1	K5		50	59	+74	34	— 25	+ .004	23	.16	87	12
73	217	β Librae	2.7	B8	15	11	37	— 9	1	— 32	— .005	34	.22	70	9
74	220	μ^2 Boötis	7.0	K	15	20	45	+37	42	—0.0008	+0.019	± .026	±0.17	69	9
75	223	α Cor. Bor.	2.4	A		30	27	+27	3	— 1	+ .044	29	.18	61	9
76	226	α Serpentis	2.7	K		39	20	+ 6	44	+ 32	+ .139	34	.20	57	7
77	229	δ Scorpii	2.5	B		54	25	—22	20	— 119	— .003	37	.20	58	7
78	231	β^1 Scorpii	2.9	B1		59	37	—19	32	— 26	— .028	48	.26	56	7
79	234	τ Cor. Bor.	5.0	K	16	5	19	+36	45	+0.0025	+0.086	± .035	±0.20	60	7
80	236	σ Cor. Bor. *seq.*	5.7	F5		10	56	+34	7	— 100	+ .020	34	.22	78	7
81	239	η Draconis	2.8	G5		22	38	+61	44	— 68	+ .070	32	.19	56	10
82	242	β Herculis	2.8	K		25	55	+21	42	+ 42	+ .012	30	.18	56	11
83	245	ζ Ophiuchi	2.8	B		31	39	—10	22	+ 64	+ .044	42	.25	64	7
84	248	ζ Herculis	3.1	G	16	37	31	+31	47	+0.0076	+0.138	± .029	±0.21	79	7
85	251	ε Scorpii	2.2	K		43	41	—34	7	— 104	— .065	46	.27	51	7
86	254	η Ophiuchi	2.6	A	17	4	38	—15	36	+ 40	— .054	37	.26	78	7
87	257	36 Oph., *med.*	5.7	K		9	11	—26	27	— 114	+ .090	36	.27	83	7
88	258	Lacaille 7203	6.8	..		10	4	—26	24	+ 43	+ .093	31	.23	83	7
89	261	W. B. xvii, 322	7.5	..	17	20	46	+ 2	14	+0.0080	+0.194	± .027	±0.21	84	7
90	264	α Ophiuchi	2.2	A5		30	17	+12	38	+ 136	+ .118	25	.21	98	7
91	267	μ Herculis	3.5	G5		42	32	+27	47	+ 26	+ .116	22	.19	98	7
92	270	γ Draconis	2.4	K5		54	17	+51	30	— 28	— .006	21	.17	91	7
93	273	99 (b) Herc.	5.0	F8	18	3	16	+30	33	— 154	+ .064	22	.21	118	7

Table X—Continued

Par. No.	List No.	Par. Star	Cat. Mag.	Sp.	R. A. 1900			Decl. 1900		½$d(D\mu)$	Rel. Par. π	Prob. Err. $r(\pi)$	Prob. Err. r_1	No. of Obs.	No. of Periods
					h	m	s	°	′	s	″	″	″		
94	276	ε Sagittarii	2.1	A	18	17	32	—34	26	—0.0048	+0.073	±0.033	±0.23	91	9
95	278	λ Sagittarii	2.9	K		21	47	—25	29	— 18	+ .059	34	.28	112	9
96	281	σ Sagitarrii	2.3	B3		49	3	—26	25	— 80	+ .064	33	.24	92	9
97	284	ζ Sagittarii	2.9	A2		56	14	—30	1	— 50	+ .106	37	.24	89	9
98	287	Groomb. 2789 (Pair)	6.5	K	19	9	29	+49	40	+ 2	+ .038	21	.18	123	11
99	290	Bradley 2459	6.1	K	19	21	17	+24	44	—0.0030	+0.038	± .024	±0.19	112	11
100	293	δ Cygni	5.0	F5		33	45	+49	59	— 2	+ .002	26	.19	101	10
101	296	γ Aquilae	2.8	K2		41	30	+10	22	+ 18	— .018	33	.25	109	10
102	298	α Aquilae	1.0	A5		45	54	+ 8	36	— 55	+ .071	33	.24	111	10
103	301	Lalande 38380	6.0	K		59	30	+29	38	+ 10	+ .070	24	.18	113	11
104	304	Lalande 38692	6.2	G2	20	9	3	—27	20	—0.0026	+0.033	± .033	±0.21	92	11
105	307	γ Cygni	2.3	F8		18	38	+39	56	— 04	— .003	24	.19	120	11
106	310	β 668	6.2	G		26	55	—10	12	— 19	+ .026	36	.25	114	11
107	313	B. D. +14, 4389	7.5	. .		36	2	+14	11	+ 2	.000	29	.22	114	11
108	316	ε Cygni	2.7	K		42	10	+33	36	+ 34	— .023	24	.20	122	11
109	319	Fedor. 3638	7.8	. .	20	52	22	+74	23	—0.0350	—0.037	± .021	±0.17	117	11
110	322	W. B. xxi, 97	7.3	. .	21	7	21	+17	21	— 23	+ .062	24	.19	120	11
111	325	α Cephei	2.6	A5		16	12	+62	10	— 66	+ .078	24	.19	119	11
112	328	β Aquarii	3.1	G		26	18	— 6	1	— 2	— .075	32	.25	111	11
113	331	ε Pegasi	2.4	K		39	16	+ 9	25	— 15	+ .033	30	.23	111	11
114	334	Lal. 42883-5	7.4	. .	21	54	15	+29	21	—0.0030	+0.080	± .027	±0.19	102	11
115	337	Groomb. 3689	7.9	. .	22	3	5	+52	39	— 45	+ .001	28	.20	96	11
116	340	Lalande 43492	7.0	. .		12	15	+12	24	00	+ .010	33	.23	99	11
117	343	β 290 (34 Peg.)	6.0	G		21	32	+ 3	53	+ 33	+ .070	33	.23	95	11
118	346	η Pegasi	3.1	G		38	19	+29	42	— 24	— .037	27	.20	106	11
119	349	σ Pegasi	5.0	F	22	47	20	+ 9	18	—0.0001	+0.051	± .032	±0.23	104	11
120	352	β Pegasi	2.6	Mb		58	55	+27	32	— 110	— .058	46	.24	56	11
121	355	α Pegasi	2.6	A		59	47	+14	40	— 34	+ .026	40	.23	56	11
122_1	358_1	W. B. xxiii, 175	8.2	. .	23	11	54	—14	22	+ 45	— .058	50	.33	88	11
122_2	358_2	W. B. xxiii, 175	8.2	. .		11	54	—14	22	+ .0057	—0.153	.045	.29	89	11
123	362	Piaz. xxiii, 164	7.0	H	23	38	32	+57	31	—0.0069	— .030	±0.026	± .18	86	9
124	365	B. D. +26, 4721	8.1	. .	23	54	11	+26	43	—0.0008	—0.001	±0.035	±0.21	65	7

14. Mayer 20. 121. β 208. 127. Σ 3121, W. B. ix, 176. 133. B. B. vii, 85. 142. β 911. 148. B. B. vii, 94. 163. Br. 1584. 190. Σ 1728. 42 Comae. 208. β 117. 220. Σ 1938. Boss 3927. 273. A. Clark 15. 287. Σ 2486. Cygni 6. 290. 3 Cygni. 21 B Vulpeculae. 293. β 1131. 304. Lac. 8381. P. xx, 29. 310. Mayer 842. 343. 34 Pegasi. 358. β 182.

TABLE X—Continued

List numbers of certain parallax and comparison stars of Table VII which occur in pairs or in observation groups containing more than three stars.

Par. No.	List No. of Par. Star	List Nos. of Comp. Stars
8	23	22
13_1	38_1	36, 40
13_2	38_2	37, 39
26	78	77, 79
27	80	79, 81
28	82	81, 83
66_1	196_1	195, 198
66_2	196_2	197
68	203	202, 204
69	205	204, 206
77	229	228, 230
78	231	230, 232
79	234	233, 235
80	236	235, 237
87	257	256, 259
88	258	256, 259
95	278	279
101	296	295, 297
102	298	297, 299
122_1	358_1	357, 360
122_2	358_2	359

CORRECTIONS

VOLUME XI.

Page 1, 4th column of table. *Add to heading* to total.

Page 6, 13th line from the bottom. *Read* R = the radius vector of the earth at the time of observation.

Page 7, 3d line from bottom. *For* d$D\mu$ *read* $D\Delta\mu$.

Page 41, 9th line. *For* 10 *read* 20.

Page 47, 9th and 13th lines from the bottom. Insert Δ before each μ in the right-hand members of both equations.

Page 57, Table III, 5th division, column under M. Insert the sign ° over the first number 180.0.

Page 57, Table III, division under Proportional Parts. *Dele h* at the head of the first column.

Pages 72 and 73, 3d, 4th, and 5th columns. *Dele* s in headings.

Page 100[1], μ Cassiopeiae, 1^h 1^m, 3d normal equation. *For* +23.99 *read* —23.99.

Page 151, star 62, Weisse-Bessel iv, 1189, 4^h 55^m. *Under* Obs. 29–47 *for* $+0^s.21$ *read* $+0''.21$.

Page 173, 4th line from bottom. *For* d.$D\mu$ *read* d.$\Delta\mu$.

Page 173, 6th line from bottom. *For* r_1 *read* r.

Page 184[1], Lalande 15565, 7^h 54^m, 3d normal equation. *For* +12.06 *read* —12.06.

Page 198, A. Oe. 9342 *prec.*, 8^h45^m.
1st normal equation. *For* —1.17 *read* —0.76.
2d normal equation. *For* +3.69 *read* +3.73.
No sensible change in the results of the solution.

Page 221, middle line. *For* r_1 *read* r.

Page 235, 9th line. *For* $r_1 = \pm 0''.022$ *read* $r = \pm 0^s.022$.

Page 287, under Obs. 42—66. *For* $\pm 0''.021$ *read* $\pm 0^s.021$.

Page 429, 1st number, 1st column. *For* 2 *read* 5.

Page 429, star 37, 2d column. *For* +1.7 *read* +1.0.

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[1] Upon the discovery of the errors in copying at pages 100 and 184, as entered in the list above, the absolute terms of all of the normal equations as printed were compared with the computation sheets. No further cases of such error were found.