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**NEW POSITIONS OF THE STARS IN THE  
HUYGHENIAN REGION OF THE  
GREAT NEBULA IN ORION**

**From Observations Made at the Leander McCormick Observatory**

**BY**

**RALPH E. WILSON**

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**UNIVERSITY OF VIRGINIA  
Charlottesville, Virginia, U. S. A.**

## UNIVERSITY OF VIRGINIA PUBLICATIONS

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BULLETIN OF THE PHILOSOPHICAL SOCIETY

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PART I.

INTRODUCTION.

The first survey of the Great Nebula in Orion for star positions was made by Sir John Herschel at the Cape of Good Hope in the years 1834-8. This survey was made for the purpose of plotting the stars on a drawing of the nebula and included 150 stars, some of which were faint. The positions of the stars with reference to  $\theta$  Orionis were determined by eye estimates of position within the "skeleton" triangles, the vertices of which were determined by micrometrical measurement. The differences in right

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ascension were estimated to tenths of seconds of time and those in declination to "parts," the value of each "part" being approximately 0."2. Even the brighter stars were liable to an error of at least one or two of the units in which their positions were read, and a relatively large error must be expected for the fainter stars.

In the years 1847-8 Professor W. C. Bond, at Harvard College Observatory, made a series of micrometrical observations of 96 stars in the nebula. [H. C. O. Annals, Vol. V.] In most cases the relative positions of the stars are based on but one or two measures, and consequently have large probable errors.

The work of Lassell, published in the Memoirs of the Royal Astronomical Society, 1854, contains positions of 59 of the brighter stars. The position angles with reference to  $\odot$  were read to minutes and the distances to seconds of arc, so that the probable error of all the positions is quite large.

More accurate as well as more extensive were the later surveys of Liapunoff and Struve, St. Petersburg, 1862, and of G. P. Bond, at Harvard College Observatory, 1859-65 [H. C. O. Annals, Vol. V]. The work of Professor Bond was an extensive survey of the whole nebula to determine the positions of all the stars visible in the 15-inch equatorial of the Harvard Observatory. The catalogue contains the positions, relative to  $\odot$  Orionis, of 1101 stars, down to approximately the fourteenth magnitude. The positions were for the most part determined by transits for right ascension and mica scale readings for declination. In the cases of the fainter stars, however, these methods were found impracticable and the positions of a large number of these stars were determined from diagrams. In some cases the diagrams were supplemented by one or two micrometer measures, but for all the faint stars there is reason to suspect an appreciable probable error. I was especially surprised to note the number of such determinations in the Huyghenian region of the nebula. Out of 51 stars assigned to this region by Professor E. S. Holden in his "Monograph on the Central Positions of the Nebula in Orion," the positions of eighteen were determined by means of diagrams, while those of eight others were determined from measures with reference to auxiliary stars, the positions of which were no more accurately determined than those of the average of the brighter stars.

The positions of 47 of the bright stars in the nebula were determined heliometrically by Bruno Meyermann at Groningen in 1905. Considering the large probable errors of former work on the faint stars, and

having placed at my disposal the 26-inch refractor of the Leander McCormick Observatory, it seemed desirable to apply direct micrometrical measurements to these stars in the Huyghenian region in sufficient numbers to obtain fairly accurate results. It further seemed probable: 1, that some of the brighter stars, the former positions of which ought to be fairly accurate, might in fifty or more years show some proper motion independent of that of the trapezium; 2, that, during the same period of time, new variable stars might have appeared; 3, that some stars fainter than those catalogued by Professor Bond might be seen with a telescope of larger aperture.

The observations were begun in September, 1908, and cover a period of eighteen months. All the observations were made in position-angle and distance. With the view to decreasing the errors arising from the measurement of long distances, I adopted as fundamental stars 628 ( $\theta$  Orionis) and 558, 669, and 685, stars forming a triangle about 628. These numbers are the numbers of the stars in Bond's catalogue [*H. C. O. Annals*, Vol. V], and his designations are used throughout this paper, except in the cases of stars which he did not catalogue. The position-angle of all six possible combinations of the fundamental stars were measured on forty nights. The measures of distances of the same combinations would average about three less. From the average of the observed position-angles and distances, differences in right ascension and declination were determined, and from these the final differential positions with reference to 628 were determined by a least square solution. The positions of the stars within 100" of the trapezium were determined by measures with reference to 628 directly. The positions of all stars outside of this central group were measured with reference to the nearest fundamental star and through it referred to 628. In some cases exceptions were made to this plan and two sets of measures were made, one with reference to the nearest fundamental star, the other with reference to 628 direct. In such cases both sets have been reduced to differences in right ascension and declination. The first set has then been referred to 628 by means of the definitive position of the fundamental star and the two sets have then been combined, giving each observation equal weight, to form the final position relative to 628. As far as practicable, measures of position-angle and distance were made on ten nights for each star. This plan has been carried out on all but five of the Bond stars and none of these five, save 625, has been observed on less than seven nights. See note on 625 in Part VI.

The pitch of the micrometer screw was determined at different temperatures by transits of polar and equatorial stars and by measures of differences in right ascension of stars in the Pleiades. The observed and adopted values of the pitch are given in the following table:

<i>Temperature.</i>	<i>Observed.</i>	<i>Adopted.</i>
70°	9."862	9."861
50	.855	.856
30	.852	.851

The value of the pitch of the screw for the mean temperature for each set of observations is given by the formula—

$$P = 9."856 - 0."00025(50^\circ - t).$$

The values derived from this formula were used for the fundamental stars. For the other stars the mean value 9."856 was used, the errors arising therefrom being negligible in comparison with the errors of observation.

On the best nights it was my custom to observe the fainter stars and to look for others not catalogued by Professor Bond. Through this search I found five stars, the existence of which is certain. I do not believe that these stars have been catalogued before, and make a special note of their positions in the hope that some one may be interested enough to look them up.

	$\Delta\alpha$	$\Delta\delta$	<i>Nights.</i>
1.	— 86."6	+ 89."5	4
2.	62.6	— 24.5	4
3.	40.6	+ 77.3	2
4.	23.7	+ 43.8	10
5.	— 22.3	+ 84.7	3

No. 2 is certainly variable. It was not seen at all during the first year of observation, but on November 10, 11, and 12, 1909, it was nearly as bright as 589, from which it is distant about 6". Upon February 1, 1910, it was considerably fainter. No. 4 must also be variable, since during the fall of 1909 it was almost as bright as 612 and 618 and considerably brighter than several of the Bond stars in the region. Upon February 1, 1910, it also seemed to be much fainter. If either No. 2 or No. 4 had attained a maximum during the period covered by Professor Bond's observations, it is hardly probable that they would have been overlooked by him. The other three stars are very faint and would hardly have been seen by Professor Bond.

In addition to these I obtained measures upon two other stars not catalogued by Professor Bond, the Alvan Clark star within the trapezium and a companion star to Bond 642 which is given by Professor O. Stone in his work on the Nebula in Orion. [Leander McCormick Obs. Publ., Vol. I, Pt. 7.]

The following will serve to explain the tabulation of the observations in Parts II and III:

- Column 1. Dates.
2. Seeing on a scale of 5.
  3. Mean temperature of the series of observations on the date given.
  4. Position-angle.
  5. Number of settings in position-angle.
  6. Residuals in position-angle.
  7. Distance in revolutions of the micrometer screw.
  8. Number of settings in distance.
  9. Residuals in distance.

In Part II are given the observations on the fundamental stars, followed by the solution for their definitive positions. In Part III are given the observations of the remaining stars, arranged in sets according to the fundamental stars with reference to which the measures were made. After these are added a few miscellaneous measures, most of which were made before the general plan of work was mapped out. These have been given small weight and used in determining the final positions of the stars.

The catalogue of positions given in Part IV will be explained by the following:

- Column 1. Number.
2. G. P. Bond's number or other designation, in case the star was not catalogued by Professor Bond.
  3. Herschel and Struve number.
  4. Herschel's letter.
  5. W. C. Bond's number.
  6. Lassell's designation.
  7. Liapunoff's letter.
  8. Magnitude. [L. McCormick Publ., Vol. I, Pt. 7.]
  9. Position in right ascension relative to  $\odot$  Orionis.
  10. Position in declination relative to  $\odot$  Orionis.
  11. Number of nights observed.

In order to obtain comparisons between my results and those of former observers, all the positions were reduced for precession and proper motion to 1910.0. The proper motion of  $\odot$  was taken from Newcomb's Fundamental Catalogue. In computing his precession coefficients Professor Bond used Mädler's proper motion of  $\odot$ , which is erroneous by at least 2" a century, so that the use of his coefficients for reducing observations separated by any considerable period of time will result in a large error.

The precessions for Part V were computed by means of the formulæ,

$$\frac{d(a' - a)}{dt} = n \left\{ \sin a' (\tan \delta' - \tan \delta) + 2 \sin \frac{1}{2}(a' - a) \cos \frac{1}{2}(a' + a) \tan \delta \right\},$$

$$\frac{d(\delta' - \delta)}{dt} = n (\cos a' - \cos a),$$

These may be written,

$$\frac{d(a' - a)}{dt} = \left\{ \frac{\sin a'}{\cos \delta \cos \delta'} \sin(\delta' - \delta) + 2 \sin \frac{1}{2}(a' - a) \cos \frac{1}{2}(a' + a) \tan \delta \right\},$$

$$\frac{d(\delta' - \delta)}{dt} = 2n \sin \frac{1}{2}(a' + a) \sin \frac{1}{2}(a' - a).$$

Taking into consideration the small relative distances of the stars, we may simplify the formulæ by putting  $\sin a' = \sin a$ ,

$$\frac{1}{2}(a' + a) = a, \text{ and } \cos \delta = \cos \delta', \text{ whence}$$

$$\frac{d(a' - a)}{dt} = n \{ P \sin(\delta' - \delta) + Q \sin \frac{1}{2}(a' - a) \}, \quad (A)$$

$$\frac{d(\delta' - \delta)}{dt} = R \sin \frac{1}{2}(a' - a),$$

where we have put  $P = \frac{\sin a}{\cos^2 \delta}$ ,  $Q = 2 \cos a \tan \delta$ , and  $R = 2n \sin a$ .

Newcomb's value of  $n$ , 20."069, was used, and the position of  $\odot$  for 18830, the mean of the epoch of Professor Bond's observations and my own, was taken from Newcomb's Fundamental Catalogue. The following tables of precessions were thus computed:



		p. for D $\alpha$			
$\Delta\alpha$	$\Delta\delta \pm 30''$	60"	100"	150"	200"
$\pm 30''$	$\pm 0.00295$	$\pm 0.00588$	$\pm 0.00976$	$\pm 0.01462$	$\pm 0.01949$
60	299	592	980	1466	1953
100	303	596	985	1470	1957
150	309	602	991	1476	1963
200	315	608	997	1482	1969
$\pm 30$	287	575	960	1440	1921
60	283	570	956	1436	1917
100	280	566	952	1432	1913
150	276	562	948	1428	1909
200	$\pm 0.00272$	$\pm 0.00558$	$\pm 0.00944$	$\pm 0.01424$	$\pm 0.01905$

		p. for D $\delta$	
$\Delta\alpha$			
$\pm 30''$		$\pm 0.00289$	
60		578	
100		964	
150		1445	
200		$\pm 0.01927$	

The values of former observations reduced to 1910.0 are given in Part V. Below each set is given the mean of the results obtained by using the following weights:

H.	Herschel	1
W. B.	W. C. Bond	2
Ll.	Lassell	2
G. B.	G. P. Bond	4
L. S.	Liapunoff-Struve	4
N.	Newcomb	4
A. G. C.	Astronomische Gesellschaft	4
Hl.	Hall	4
B.	Burnham	4
M.	Meyermann	4

Below the mean is given my position for each star for the sake of comparison. The comparisons with the weighted means and with the Bond positions are given in the last table. An examination of these results seems to show no evidence of any proper motion in the great majority of the stars. Almost without exception the largest residuals occur in the case of those stars, Bond's positions of which were determined by eye estimates and diagrams, and which are therefore liable to the largest

errors. Six of the stars, however, show differences which, I do not think, arise from this cause. They are 612, 618, 622, 636, 686, and 688, and may be studied in pairs. 612 and 618 are a pair of stars, just below the trapezium, of sufficient brightness to permit Professor Bond to make two measures of position in addition to several diagrams. The differences in the case of these two stars would seem to indicate a northward proper motion in declination of between 4" and 5" a century.

The differences in right ascension in the cases of 622 and 636 can be largely explained by assuming that these stars are physically connected with the trapezium and share in its motion. This assumption is not improbable, as both the stars are within 30" of the trapezium. The residuals in right ascension would then reduce from

- 1."0 to 0."2 in the case of 622, and
- 1. 3 to 0. 5 in the case of 636.

There still remain, however, small residuals in declination which cannot be explained in this way, and there is need for more accurate measures upon which to base a discussion of this motion.

The cases of 686 and 688 are peculiar. The only basis of comparison in each case is a single estimate of position given by Prof. Bond, from which the following residuals were obtained:

	$\Delta\Delta\alpha$	$\Delta\Delta\delta$
686	+ 2".6	+ 22".0
688	— 23.8	4.6

Evidently either something is wrong or these stars have large proper motion. The stars themselves are distinctly visible with the 26-inch equatorial on any night with the seeing 4 on a scale of 5. There are no other stars in the immediate vicinity except 671 and 676, and certainly none in the positions given by Professor Bond. These must be the stars which he has catalogued, but unless they are affected by large proper motions, Professor Bond's positions must be erroneous. It may be of interest ten years hence to measure the positions of these two stars in order to see if any great change of position is indicated.

Part VI contains a few notes which may be of interest to any one who is working on the Nebula of Orion.

I wish to thank Professor Stone for the use of the Leander McCormick equatorial and for the many helpful suggestions which he has given me throughout this work.

RALPH E. WILSON.

## PART II.

*Observations of the Fundamental Stars.*

DATE		S	T	P	n	Δ	R	n	Δ
628-685									
1908	Sept.	9	2½	53°	134°4	4	+0.3		
		11	2	55	4.6	4	+0.5		
		16	3½	53	3.8	4	-0.3		
		25	3½	63	4.1	6	0.0	13.737	8 +0.03
	Nov.	9	2½	44	4.4	4	+0.3	.696	4 -0.01
		15	1½	22				.646	2 -0.06
		16	2½	27	4.3	4	0.2		
		18	2	41	4.2	6	0.1	.721	4 +0.01
		20	1	42	4.2	4	+0.1	.685	4 -0.02
		21	1	36	3.8	4	-0.3	.795	4 +0.09
		22	3	37	4.1	4	0.0	.645	4 -0.06
		26	1	55	3.8	4	-0.3		
	Dec.	2	1½	30	4.1	4	0.0		
		3	2	18	4.2	4	+0.1	.676	4 -0.03
		8	1½	23	3.8	4	-0.3	.696	4 0.01
		14	2	32	4.1	4	0.0	.688	4 -0.02
		17	1	36	3.9	4	-0.2	.794	4 +0.09
		19	2	45	4.2	4	+0.1	.694	4 -0.01
1909	Jan.	10	2	32	4.4	4	0.3	.780	2 +0.07
		21	3	32	4.2	4	+0.1	.677	4 -0.03
		22	2½	42	4.1	4	0.0	.651	4 0.06
		23	3	47	4.0	4	-0.1	.649	4 0.06
	Feb.	4	2	40	4.0	4	0.1	.705	4 0.00
		6	2	35	4.1	4	0.0	.669	2 0.04
		20	2½	50	3.9	4	-0.2	.630	2 0.08
		22	1½	40	4.4	4	+0.3	.690	4 -0.02
	Mar.	19	1½	58	4.0	4	-0.1	.751	2 +0.04
		25	2	51	4.1	4	0.0	.700	2 -0.01
	Oct.	1	3	51	3.8	4	0.3	.765	4 +0.06
		2	2	44	4.0	4	-0.1	.683	4 0.08
		8	3	56	4.6	2	+0.5	.769	4 +0.06
		9	2½	55	4.2	4	+0.1	.700	2 -0.01
		12	1	49	3.9	6	-0.2	.664	3 -0.04
		13	1½	35	4.3	4	+0.2	.754	4 +0.05
		17	2	42	4.5	4	+0.4	.773	3 0.07
		20	2	36	4.0	4	-0.1	.731	3 +0.02
26		1½	38	4.2	4	+0.1	.693	4 -0.01	
27		2	47	4.0	4	-0.1	.727	4 +0.02	
Nov.	10	3	42	4.1	4	0.0	.666	4 -0.04	
	11	3½	46	134.2	4	+0.1	13.730	4 +0.02	
	Mean			42°	134.128	±0.022		13.707	±0.006

*Observations of the Fundamental Stars—Continued.*

DATE	S	T	P	n	$\Delta$	R	n	$\Delta$
628-669								
1908 Sept. 16	3½	53°	32°5	4	0.0			
22	3	59	2.6	4	+0.1			
25	3½	63	2.4	4	-0.1			
Nov. 9	2½	44	2.8	4	+0.3	11.853	4	-0.05
18	2	41	2.8	4	0.3	.803	4	0.10
20	1	42	2.6	4	0.1	.861	4	0.04
21	1	36	2.5	4	0.0	.903	4	0.00
22	3	37	2.8	4	0.3	.893	4	-0.01
Dec. 2	1½	30	2.8	4	0.3			
3	2	18	2.8	4	0.3	.918	4	+0.02
8	1½	23	2.6	4	+0.1	.889	4	-0.01
14	2	32	2.5	4	0.0	.853	4	-0.05
17	1	36	2.2	4	-0.3	.957	4	+0.05
1909 Jan. 6	2	45	2.8	4	+0.3	.794	4	-0.11
10	2	32	2.4	4	-0.1	.961	4	+0.06
21	3	32	2.6	4	+0.1	.896	4	-0.01
22	2½	42	2.7	4	+0.2	11.972	4	+0.07
23	3	47	2.3	4	-0.2	12.005	2	+0.10
Feb. 2	2½	35	2.6	4	+0.1	11.786	2	-0.12
4	2	40	2.4	4	-0.1	.849	2	-0.05
6	2	35	2.7	4	+0.2	.995	2	+0.09
20	2½	50	2.3	4	-0.2	.934	4	+0.03
25	2	30	2.0	4	0.5	.886	2	-0.02
26	2½	35	2.2	4	0.3	.941	2	+0.04
Mar. 22	1½	40	2.2	4	0.3	11.849	3	-0.05
Sept. 19	1½	58	1.7	4	0.8	12.040	2	+0.14
24	1½	55	2.2	4	0.3	11.854	2	-0.05
25	2	51	2.4	4	-0.1	.953	3	+0.05
Oct. 1	3	51	2.7	4	+0.2	.875	3	-0.03
2	2	44	1.9	4	-0.6	.920	4	+0.02
4	3	46	2.3	4	0.2	.963	3	0.06
8	3	56	2.4	2	-0.1	.985	2	+0.08
9	2½	55	2.8	4	+0.3	.872	2	-0.03
12	1	49	2.5	4	0.0	.805	4	-0.10
13	1½	35	2.2	4	-0.3	.934	4	+0.03
17	2	42	2.2	4	0.3	.859	3	-0.04
20	2	36	2.3	4	0.2	.885	3	0.02
26	2½	38	2.2	4	-0.3	.884	4	-0.02
27	2	47	2.7	4	+0.2	.916	4	+0.01
Nov. 10	3	42	32.6	4	+0.1	11.954	4	+0.05
Mean		42°	32.455	±0.029		11.903	±0.007	

*Observations of the Fundamental Stars—Continued.*

DATE		S	T	P	n	$\Delta$	R	n	$\Delta$
628-558									
1908	Sept.	29	2½	44°	233°	4	3	—0.4	
	Oct.	2	1½	45	4.0	6	4	+0.2	
		5	2	51	3.9	4	4	+0.1	
	Nov.	7	3	47	3.7	4	4	—0.1	
		9	2½	44	4.0	4	4	+0.2	
		16	2½	27	3.8	4	4	0.0	
		18	2	41	4.1	4	4	0.3	20.257
		20	1	42	3.8	4	4	0.0	.301
		21	1	36	4.1	6	4	0.3	.283
		22	3	37	4.1	4	4	0.3	.262
	Dec.	2	1½	30	3.9	4	4	+0.1	.117
		3	2	18	3.7	4	4	—0.1	.187
		8	1½	23	3.7	4	4	0.1	.335
		14	2	32	3.5	4	4	—0.3	.122
1909	Jan.	10	2	32	4.2	4	4	+0.4	.184
		21	3	32	3.7	4	6	—0.1	.155
		22	2½	42	3.4	4	4	0.4	.276
		23	3	47	3.5	4	4	0.3	.274
	Feb.	4	2	40	3.5	4	4	—0.3	.195
		6	2	35	4.0	4	3	+0.2	.268
		20	2½	50	3.5	4	2	—0.3	.241
		25	2	30	3.6	4	2	0.2	.225
		26	2½	35	3.7	4	2	0.1	.276
	Mar.	15	2	37	3.6	4	2	0.2	.208
		22	1½	40	3.5	4	2	—0.3	.204
	Sept.	24	1½	55	3.8	4	3	0.0	.184
		25	2	51	4.3	4	4	+0.5	.250
		28	1½	46	4.0	4	3	0.2	.273
	Oct.	1	3	51	3.8	4	3	0.0	.371
		2	2	44	3.9	4	2	0.1	.146
		4	3	46	3.9	4	2	0.1	.238
		8	3	56	3.8	4	3	0.0	.221
		9	2½	55	4.1	4	2	0.3	.118
		12	1	49	4.2	4	4	0.4	.226
		13	1½	35	4.0	4	4	0.2	.260
		17	2	42	4.0	4	4	0.2	.348
		20	2	36	3.8	4	3	0.0	.215
		26	1½	38	3.8	4	3	0.0	.335
		27	2	47	4.2	4	4	+0.4	.212
	Nov.	10	3	42	233.7	4	4	—0.1	20.251
Mean			41°	233.830	±0.026		20.236	±0.007	

*Observations of the Fundamental Stars—Continued.*

DATE			S	T	P	n	$\Delta$	R	n	$\Delta$
685-669										
1908	Nov.	20	1	42°	350°0	4	0.0	19.878	4	-0.02
		21	1	36	49.7	8	-0.3	20.013	4	+0.12
		22	3	37	50.0	4	0.0	19.847	4	-0.05
	Dec.	26	1	55	50.1	4	+0.1			
		2	1½	30	50.0	4	0.0	.949	4	+0.06
		3	2	18	50.0	4	0.0	.848	4	-0.04
		8	1½	23	50.1	4	+0.1	.825	4	0.07
		14	2	32	49.9	4	-0.1	.803	4	-0.09
		17	1	36	50.3	4	+0.3	.958	4	+0.06
		1909	Jan.	6	2	45	50.1	4	0.1	.860
10	2			32	50.4	4	+0.4	.963	4	+0.07
21	3			32	49.7	4	-0.3	19.886	4	-0.01
22	2½			42	50.1	4	+0.1	20.063	4	+0.17
23	3			47	50.5	4	0.5	19.899	4	0.00
Feb.	2		2½	35	50.0	4	0.0	.933	2	0.04
	4		2	40	50.0	4	0.0	.917	2	+0.02
	6		2	35	50.2	4	+0.2	.880	2	-0.01
	20		2½	50	50.0	4	0.0	.931	2	+0.04
	25		2	30	49.9	4	-0.1	.957	2	+0.06
Mar.	26	2½	35	49.6	4	0.4	.790	2	-0.10	
	22	1½	40	49.7	4	0.3	.939	3	+0.05	
	Sept.	19	1½	58	50.0	4	0.0	.954	2	0.06
		24	1½	55	49.7	4	0.3	.902	2	+0.01
		25	2	51	49.8	4	-0.2	.893	2	0.00
Oct.		28	2	46	50.1	4	+0.1	.883	2	-0.01
		1	3	51	50.0	4	0.0	.818	4	-0.08
	2	2	44	49.9	4	-0.1	.930	4	+0.04	
	8	3	56	49.8	2	0.2	.909	2	0.02	
	9	2½	55	50.0	4	0.0	.911	2	+0.02	
	12	1	49	49.9	4	0.1	.779	4	-0.12	
	13	1½	35	50.0	4	0.0	.911	3	+0.02	
	17	2	42	49.8	4	0.2	.849	4	-0.04	
	20	2	36	49.8	5	-0.2	.834	3	0.06	
	26	2	38	50.2	4	+0.2	.846	4	0.05	
Nov.	27	2	47	49.9	4	-0.1	.890	4	0.00	
	10	3	42	49.8	4	0.2	.872	4	-0.02	
	11	3½	46	49.9	4	0.1	.889	4	0.00	
	12	3½	52	49.7	4	-0.3	.913	4	+0.02	
	Dec.	1	2½	30	50.1	4	+0.1	.867	4	-0.03
7		2½	32	349.8	4	-0.2	19.875	4	-0.02	
Mean			41°	349.962	±0.020		19.894	±0.006		

*Observations of the Fundamental Stars—Continued.*

DATE			S	T	P	n	$\Delta$	R	n	$\Delta$
685-558										
1908	Nov.	20	1	42°	264.7	4	0.0	26.280	4	+0.01
		21	1	36	4.4	4	-0.3	.388	4	+0.12
		22	3	37	4.8	4	+0.1	.233	4	-0.04
	Dec.	2	1½	30	4.7	4	0.0	.379	4	+0.11
		3	2	18	4.6	4	-0.1	.137	4	-0.13
8		1½	23	4.6	4	0.1	.207	4	0.06	
1909	Jan.	14	2	32	4.4	4	-0.3	.157	4	0.11
		10	2	32	4.9	4	+0.2	.273	4	+0.01
		21	3	32	4.7	4	0.0	.196	4	-0.07
	Feb.	22	2½	42	4.4	4	-0.3	.371	4	+0.10
		23	3	47	4.6	4	-0.1	.423	4	+0.15
		4	2	40	5.0	4	+0.3	.230	2	-0.04
	Mar.	6	2	35	4.8	4	+0.1	.331	2	+0.06
		20	3	50	4.6	4	-0.1	.190	4	-0.08
		25	2	30	4.5	4	-0.2	.214	3	0.06
	Sept.	26	2½	35	4.8	4	+0.1	.204	4	-0.07
		22	1½	40	4.4	4	-0.3	.361	3	+0.09
		19	1½	58	4.9	4	+0.2	.372	3	+0.10
	Oct.	24	1½	55	4.7	4	0.0	.151	2	-0.12
		25	2	51	4.8	4	+0.1	.391	2	+0.12
		28	1½	46	4.3	4	-0.1	.393	2	0.12
		1	3	51	5.0	4	+0.3	.375	3	0.10
		2	2	44	4.8	4	0.1	.419	4	0.15
		4	3	46	5.0	4	0.3	.317	3	+0.05
		8	3	56	4.8	2	0.1	.245	4	-0.02
Nov.	9	2½	55	4.9	4	+0.2	.176	4	0.09	
	12	1	49	4.7	4	0.0	.197	3	0.07	
	13	1½	35	4.7	4	0.0	.196	4	0.07	
	17	2	42	4.7	4	0.0	.207	4	0.06	
	20	2	36	4.6	4	-0.1	.205	4	0.06	
	26	1½	38	4.4	4	-0.3	.215	4	0.05	
	27	2	47	4.9	4	+0.2	.259	4	0.01	
	10	3	42	4.9	4	0.2	.219	3	-0.05	
	11	2½	46	5.2	4	0.5	.347	4	+0.08	
	12	3½	52	5.3	4	+0.6	.262	4	-0.01	
Dec.	1	2½	30	4.4	4	-0.3	.168	4	0.10	
	7	2½	32	4.8	4	+0.1	.248	4	0.02	
	8	1	29	4.7	4	0.0				
1910	Jan.	10	2½	25	5.2	4	0.5	.233	4	0.04
	Feb.	1	3	33	264.9	4	+0.2	26.226	4	-0.04
Mean				40°	264°.738	±0.025		26.267	±0.010	

*Observations of the Fundamental Stars—Continued.*

DATE			S	T	P	n	Δ	R	n	Δ
669-558										
1908	Nov.	20	1	42°	226°·1	4	+0.3	31.526	4	-0.12
		21	1	36	5.6	4	-0.2	.853	4	+0.20
		22	3	37	5.7	4	-0.1	.633	4	-0.02
	Dec.	2	1½	30	6.0	4	+0.2	.611	4	0.04
		3	2	18	5.9	4	+0.1	.558	4	0.09
		8	1½	23	5.7	4	-0.1	.621	4	0.03
		14	2	32	5.8	4	0.0	.537	4	-0.11
		17	1	36	5.6	4	-0.2	.888	4	+0.24
		10	2	32	6.1	4	+0.3	.572	4	-0.08
		21	3	32	5.9	4	0.1	.671	4	+0.02
1909	Jan.	22	2½	42	5.8	4	0.0	.764	4	+0.11
		23	3	47	6.0	4	+0.2	.613	4	-0.04
		4	2	40	5.8	4	0.0	.604	2	-0.05
	Feb.	6	2	35	5.7	4	-0.1	.723	4	+0.07
		20	2½	50	5.4	4	0.4	.539	4	-0.11
		25	2	30	5.5	4	0.3	.635	4	-0.02
		26	2½	35	5.5	4	0.3	.692	4	+0.04
	Mar.	22	1½	40	5.4	4	-0.4	.584	4	-0.07
		Sept.	24	1½	55	5.9	4	+0.1	.561	3
	Oct.		25	2	51	5.8	4	0.0	.693	2
28		1½	46	6.0	4	+0.2	.680	2	0.03	
1		3	51	5.8	4	0.0	.695	3	0.04	
2		2	44	5.7	4	-0.1	.728	4	0.08	
4		3	46	5.9	4	+0.1	.730	3	0.08	
8		3	56	5.6	4	-0.2	.652	3	0.00	
9		2½	55	6.0	4	+0.2	.667	3	+0.01	
12		1½	49	5.8	4	0.0	.613	4	-0.04	
13		2	35	6.1	4	0.3	.671	4	+0.02	
17		2	42	6.0	4	0.2	.675	4	+0.02	
1910	Nov.	20	2	36	5.8	4	0.0	.520	4	-0.13
		26	1½	38	6.0	4	0.2	.688	4	+0.04
		27	2	47	6.1	4	0.3	.715	4	0.06
		10	3	42	5.9	4	0.1	.726	4	0.07
	Dec.	11	3½	46	5.8	4	0.0	.729	4	0.08
		12	3½	52	6.1	4	0.3	.675	4	+0.02
		1	2½	30	5.9	4	0.1	.546	4	-0.10
		7	2½	32	6.1	4	+0.3	.581	4	-0.07
	Jan.	8	1	29	5.6	4	-0.2	.702	2	+0.05
		10	2½	25	6.2	4	+0.4	.582	4	-0.07
Feb.	1	3	33	226.2	4	+0.4	31.653	4	0.00	
Mean			40°	225.838	±0.024	31.653	±0.009			



The reduction of the mean position-angles and distances for the fundamental stars to differences in right ascension and declination gives the following results:

		$\Delta\alpha$		$\Delta\delta$
628—685	$x_1$	96."97	$y_1$	—94."06
—669	$x_2$	62.95	$y_2$	98.98
—558	$x_3$	—160.99	$y_3$	—117.70
685—669	$x_1-x_2$	34.17	$y_1-y_2$	—193.06
—558	$x_3-x_1$	—257.77	$y_3-y_1$	—23.74
669—558	$x_2-x_3$	223.78	$y_2-y_3$	217.32

A least square solution of these twelve equations gives as definitive positions with reference to 628,

	$\Delta\alpha$	$\Delta\delta$
685	96."96	—94."04
669	62.87	99.14
558	—160.91	—117.87

## PART III.

*Observations with reference to 628.*

DATE		S	T	P	n	$\Delta$	R	n	$\Delta$
567									
1908	Nov.	8	2½	41°	268°3	2 ±1.0			
1909	Feb.	11	3½	35	7.2	4 —0.1	10.030	2	—0.11
		17	4	35	6.3	4 —1.0	.049	2	—0.09
		20	3	50	8.0	4 +0.7			
		25	2	30	6.8	4 —0.5	.147	4	+0.01
		26	2½	35	6.2	4 1.1	.136	2	0.00
	Sept.	24	2½	35	6.3	4 —1.0	.248	2	0.11
		29	3½	46	7.4	4 +0.1			
	Oct.	2	4	44	7.4	4 0.1	.154	3	0.02
		4	3	46	8.2	4 0.9	.129	4	+0.01
		8	3½	56	7.6	4 0.3	.076	3	—0.06
		9	2½	55	267.4	4 +0.1	10.268	2	+0.013
Mean			45°	267.26	±0.14		10.137	±0.020	

*Observations with reference to 628—Continued.*

DATE			S	T	P	n	$\Delta$	R	n	$\Delta$
575										
1908	Nov.	16----	2½	27°	255°9	4	+0.5	9.057	4	+0.08
		18----	2	41	6.0	4	+0.6	9.020	2	+0.05
		22----	3	37	5.1	4	-0.3	8.914	4	-0.06
	Dec.	3-----	2	18	5.4	4	0.0	8.820	4	-0.15
1909	Jan.	21----	3	32	5.4	4	0.0	9.085	2	+0.11
		23----	3	47	5.5	4	+0.1	9.015	2	+0.04
	Feb.	2-----	2½	35	5.4	6	0.0	8.808	2	-0.17
		6-----	2	35	5.6	4	+0.2	9.101	2	+0.13
		20----	3	50	4.9	4	-0.5	8.988	4	+0.01
	Mar.	22----	1½	40	254.9	4	-0.5	8.931	3	-0.04
Mean-----				37°	255.41		±0.07	8.974		±0.022
589										
1908	Nov.	16----	3	27°	250°0	4	+0.1			
		18----	2½	41	50.3	2	0.4			
		22----	3	37	50.0	4	+0.1	6.158	4	-0.05
1909	Jan.	23----	3	47	49.8	4	-0.1	.249	2	+0.04
	Feb.	2-----	2½	35	49.6	4	0.3	.251	2	0.05
		20----	3	50	49.8	4	0.1	.402	2	+0.20
		25----	2	30	49.5	4	0.4	.130	2	-0.08
		26----	2½	35	49.5	4	0.4	.140	2	-0.06
	Mar.	15----	2	37	49.7	4	-0.2	.283	2	+0.08
		17----	2½	37	50.1	4	+0.2	.174	2	-0.03
	Sept.	29----	3	46	49.9	4	0.0	.060	1	-0.14
	Oct.	8-----	3½	56	250.2	4	+0.3	6.204	3	0.00
Mean-----				40°	249.88		±0.05	6.205		±0.020
595										
1909	Feb.	11----	3½	35°	250°6	4	0.0	5.000	2	0.00
		17----	4	35	50.2	4	-0.4	5.030	4	+0.03
	Oct.	7-----	4	56	49.3	4	1.3	4.950	4	-0.05
		8-----	4	56	49.3	4	1.3	5.056	4	+0.05
		9-----	2½	55	50.5	4	-0.1	4.963	4	-0.04
	Nov.	11----	3½	46	53.2	4	+2.6	5.000	6	0.00
		12----	3	52	52.0	4	+1.4	5.074	3	+0.07
1910	Feb.	1-----	3	33	249.9	4	-0.7	4.941	4	-0.06
Mean-----				46°	250.62		±0.31	5.002		±0.012

*Observations with reference to 628—Continued.*

DATE			S	T	P	n	$\Delta$	R	n	$\Delta$
601										
1909	Feb.	11----	3½	35°	227°·8	4	-1.5	4.460	2	+0.05
		17-----	4	35	26.0	4	-3.3	.450	2	+0.04
	Oct.	7-----	4	56	30.9	4	+1.6	.277	4	-0.14
		8-----	4	56	29.1	6	-0.2	.552	4	+0.14
	Nov.	9-----	2½	55	28.8	6	-0.5	.288	3	-0.13
		11-----	3½	46	31.5	6	+2.2	.460	4	+0.05
		12-----	3½	52	330.7	4	+1.4	4.405	5	-0.01
		Mean-----			48°	229.26	±0.53		4.413	±0.028
602										
1909	Feb.	11----	3½	35°	208°·2	4	+0.1	7.103	2	+0.02
		17-----	4	35	8.3	4	+0.2	.047	2	-0.03
	Sept.	9-----	4	58	7.5	4	-0.6	.199	3	+0.12
		24-----	2½	55	7.8	4	-0.3	.147	2	+0.07
	Oct.	4-----	3	46	8.6	4	+0.5	7.043	2	-0.04
		7-----	4	56	6.4	4	-1.7	6.927	4	0.15
	Nov.	8-----	3	56	8.8	4	+0.7	7.062	3	-0.02
		10-----	3	42	8.4	4	0.3	.172	4	+0.09
		11-----	3½	46	9.3	4	+1.2	.095	4	+0.01
		12-----	3	52	207.8	4	-0.3	7.014	4	-0.07
	Mean-----			47°	208.07	±0.16		7.081	±0.017	
608										
1909	Feb.	11----	3½	35°	233°·4	4	-1.6	2.829	2	-0.04
		17-----	4	35	4.9	4	0.1	.847	4	0.02
	Sept.	9-----	4	58	3.6	4	-1.4	.779	3	0.09
		Oct.	7-----	4	56	7.0	4	+2.0	.804	3
	8-----		4	56	3.9	5	-1.1	.946	3	+0.07
	Nov.	9-----	2½	55	5.0	6	0.0	2.875	3	0.00
		17-----	2½	42	5.3	4	+0.3	3.048	3	+0.18
		10-----	3½	42	7.6	4	+2.6	2.801	4	-0.07
		11-----	3½	46	3.5	6	-1.5	.913	3	+0.04
	12-----	3½	52	235.5	5	+0.5	2.885	4	+0.01	
	Mean-----			48°	234.97	±0.30		2.872	±0.016	

## Observations with reference to 628—Continued.

DATE		S	T	P	n	$\Delta$	R	n	$\Delta$
612									
1909	Jan. 23	3	47°	326°.4	6	+1.0	3.263	2	+0.02
	Feb. 17	4	35	4.6	4	-0.8	.189	2	-0.06
	20	3	50	5.2	4	0.2	.327	2	+0.08
	26	2½	35	5.2	4	-0.2	.240	4	-0.01
	Mar. 15	2	37	6.1	4	+0.7	.232	3	-0.02
	17	2½	37	6.1	4	+0.7	.279	3	+0.03
	23	3½	40	4.5	4	-0.9	.305	3	+0.06
	Sept. 9	4	58	5.2	4	0.2	.150	2	-0.10
	29	3½	46	4.9	4	-0.5	.228	2	-0.02
	Oct. 1	3	51	325.8	4	+0.4	3.254	2	+0.01
Mean			44°	325.40		±0.15	3.247		±0.011
617									
1908	Sept. 9	2½	53°	321°.2	6	-0.4	1.696	4	+0.01
	16	3½	53	2.2	4	+0.6			
	22	3	59	2.6	4	+1.0	.655	4	-0.03
	25	3½	63	0.9	4	-0.7	.685	8	0.00
	Nov. 9	2½	44	2.0	4	+0.4	.660	4	0.03
1909	Jan. 21	3	32	1.3	4	-0.3	.666	8	-0.02
	22	2½	42	1.4	4	0.2	.720	4	+0.03
	Mar. 17	2½	37	1.5	4	-0.1	.753	4	+0.06
	Oct. 1	3½	51	2.8	4	+1.2	.682	4	-0.01
	8	2½	56	0.5	4	-1.1	.647	3	-0.04
	Nov. 10	2½	42	321.1	4	-0.5	1.724	4	+0.03
Mean			48°	321.59		±0.14	1.689		±0.007
618									
1908	Nov. 22	3	37°				2.873	4	-0.06
1909	Jan. 23	3	47	335.3	4	+0.1	3.079	2	+0.14
	Feb. 17	4	35	5.0	4	-0.2	2.857	3	-0.08
	20	3	50	5.4	4	+0.2	.907	2	0.03
	26	2½	35	5.4	4	0.2	.863	4	-0.08
	Mar. 15	2	37	5.7	4	+0.5	.982	2	+0.04
	17	2½	37	5.2	6	0.0	2.972	4	0.03
	23	3½	40	3.5	3	-1.7	3.033	2	+0.10
	Sept. 9	4	58	5.7	4	+0.5	2.900	2	-0.04
	29	3½	46	5.1	4	-0.1	.905	3	-0.03
	Oct. 1	3	51	335.9	4	+0.7	2.951	3	+0.01
Mean			43°	335.22		±0.14	2.938		±0.017

## NEW POSITIONS OF STARS IN ORION

103

*Observations with reference to 628—Continued.*

DATE	S	T	P	n	$\Delta$	R	n	$\Delta$
619								
1908 Sept. 9	2½	53°	311.6	4	0.0	1.306	4	-0.02
11	2	55	2.5	6	+0.9	.324	8	0.00
16	3½	53	2.1	4	+0.5	.309	8	0.02
22	3	59	1.1	4	-0.5	.317	4	0.01
25	3½	63	312.3	4	+0.7	1.309	8	-0.02
Nov. 9	2½	44	311.8	4	+0.2	1.310	4	-0.02
21	2	36	0.7	4	-0.9	.357	8	+0.03
1909 Jan. 21	3	32	2.6	4	+1.0	.325	8	0.00
22	2½	42	1.0	4	-0.6	.338	4	0.01
Mar. 17	2½	37	310.2	4	-1.4	1.354	4	+0.03
Mean		47°	311.59		±0.18	1.325		±0.004
621								
1909 Feb. 11	3½	35°	181°1	4	+0.2	3.979	3	-0.04
17	4	35	82.1	4	1.2	4.035	2	+0.02
Mar. 18	3	37	81.1	4	+0.2	3.980	3	-0.04
Sept. 9	4	58	79.3	4	-1.6	4.056	3	+0.03
Oct. 1	3½	51	80.6	4	0.3	4.092	3	0.08
4	3	46	79.0	6	1.9	4.067	4	+0.05
8	3	56	80.7	6	-0.2	4.005	3	-0.01
Nov. 10	3½	42	82.0	4	+1.1	3.903	4	-0.11
11	3½	46	81.8	4	0.9	4.032	7	+0.02
12	3½	52	181.1	4	+0.2	4.020	4	0.00
Mean		46°	180.88		±0.21	4.017		±0.011
622								
1908 Nov. 16	2½	27°	196°3	6	+0.8			
18	2	41	5.6	4	+0.1	2.890	4	+0.06
22	3	37	4.3	6	-1.2	.843	4	+0.01
1909 Jan. 23	3	47	5.7	4	+0.2			
Feb. 2	2½	35	6.3	4	0.8	.803	2	-0.03
11	3½	35	5.5	4	0.0	.831	2	0.00
17	4	35	5.7	4	+0.2	.835	2	0.00
20	3	50	4.7	6	-0.8	.830	4	0.00
25	2	30	4.1	4	-1.4	.803	2	0.03
26	2½	35	5.8	4	+0.3	.813	4	-0.02
Mar. 15	2	37	195.7	4	+0.2	2.848	2	+0.02
Mean		37°	195.47		±0.13	2.830		±0.006

*Observations with reference to 628—Continued.*

DATE		S	T	P	n	$\Delta$	R	n	$\Delta$
<b>624</b>									
1908	Sept. 9	2½	53°	342°6	4	-0.5	1.690	4	-0.02
	11	2	55	3.4	6	+0.3	.708	8	0.00
	16	3½	53	3.2	4	+0.1	.668	8	0.04
	22	3	59	2.9	4	-0.2	.707	4	0.00
	25	3½	63	2.7	4	-0.4	.691	8	0.02
	Nov. 9	2½	44	3.4	4	+0.3	.692	4	-0.02
	21	2	36	2.4	4	-0.7	.734	8	+0.02
1909	Jan. 21	3	32	4.4	4	+1.3	.761	8	+0.05
	22	2½	42	2.4	4	-0.7	.700	8	-0.01
	Mar. 17	2½	37	343.4	4	+0.3	1.743	4	+0.04
Mean			47°	343.08		±0.10	1.709		±0.006
<b>625</b>									
1909	Feb. 17	4	35°	178°5	4		3.064	2	
	Sept. 9	4	58	177.0	3				
Mean			46°	177.75			3.064		
<b>631</b>									
1909	Feb. 11	3½	35°	174°1	4	+0.9	4.100	2	-0.02
	17	4	35	3.4	4	0.2	4.238	2	+0.12
	26	2½	35	3.2	4	0.0	3.824	2	-0.30
	Mar. 18	3	37	3.8	4	0.6	4.013	3	-0.11
	23	3½	40	3.4	4	0.2	.446	4	+0.32
	Sept. 9	4	58	3.6	4	+0.4	.176	2	0.06
	Oct. 1	3½	51	2.7	4	-0.5	.169	3	+0.05
	4	3	46	1.8	6	1.4	.003	4	-0.12
	8	3	56	1.7	6	-1.5	.131	3	+0.01
	9	2½	55	174.4	4	+1.2	4.113	2	-0.01
Mean			45°	173.21		±0.26	4.121		±0.047
<b>633</b>									
1908	Sept. 16	3½	53°	119°5	6	+0.5			
	22	3	59	19.9	6	0.9	0.407	4	-0.01
	25	3½	63	19.2	4	0.2	.414	4	0.00
	Oct. 5	2	51	20.2	4	1.2	.399	8	-0.02
	Nov. 9	2½	44	19.3	4	0.3	.431	4	+0.01
1909	Jan. 22	2½	42	20.6	6	+1.6	.438	4	0.02
	Oct. 1	3½	51	18.7	4	-0.3	.428	8	0.01
	8	2½	56	19.5	8	+0.5	.424	4	0.00
	Nov. 10	3	42	17.2	8	-1.8	.426	8	0.00
	11	3½	46	115.6	8	-3.4	0.425	8	0.00
Mean			51°	118.97		±0.29	0.421		±0.002

## NEW POSITIONS OF STARS IN ORION

105

Observations with reference to 628—Continued.

DATE	S	T	P	n	$\Delta$	R	n	$\Delta$
635								
1908 Sept. 16	3½	53°	4.2	4	-0.1			
22	3	59	4.0	4	-0.3			
25	3½	63	4.4	6	+0.1			
Nov. 9	2½	44	4.2	4	-0.1	9.886	4	+0.01
16	2½	27	3.8	4	-0.5			
18	2	41	4.4	4	+0.1	.877	4	0.00
20	1	42	4.4	4	+0.1	.885	4	+0.01
21	1	36	4.1	6	-0.2	.697	4	-0.08
Dec. 3	2	18	4.3	4	0.0	.929	4	+0.06
14	2	32	4.3	4	0.0	.911	4	0.04
1909 Jan. 21	3	32	4.5	4	+0.2	.929	4	0.06
22	2½	42	4.1	4	-0.2	.994	4	+0.12
23	3	47	4.3	4	0.0	.841	2	-0.03
Feb. 2	2½	35	3.7	4	-0.6	9.779	2	-0.09
Mean		41°	4.27		±0.04	9.872		±0.013
636								
1908 Nov. 18	2½	41°	139.1	6	-1.4			
1909 Feb. 11	3½	35	43.2	4	+2.7	1.317	2	-0.11
17	4	35	39.5	4	-1.0	.353	4	-0.07
Mar. 18	3	37	39.1	4	-1.4	.498	3	+0.07
23	3½	40	42.6	4	+2.1	.518	3	0.09
Sept. 9	4	58	40.0	6	-0.5	.433	4	0.01
24	2½	51	40.8	4	+0.3	.454	3	+0.03
25	2½	51	41.5	4	+1.0	.412	2	-0.01
Oct. 1	3	51	38.5	4	-2.0	.376	2	-0.05
2	4	44	40.4	4	0.1	.448	4	+0.02
4	3	46	140.4	6	-0.1	1.429	3	0.00
Mean		45°	140.46		±0.29	1.424		±0.012
640								
1908 Sept. 9	2½	53°	60.8	6	-0.2	1.353	8	-0.02
11	2	55	1.0	6	0.0	.348	8	0.02
16	3½	53	1.0	6	0.0	.376	8	0.00
22	3	59	1.7	4	+0.7	.376	4	0.00
25	3½	63	0.9	4	-0.1	.349	8	-0.02
Nov. 9	2½	44	1.4	4	+0.4	.374	4	0.00
21	2	36	0.6	8	-0.4	.377	8	+0.01
22	3	37	1.0	4	0.0	.364	8	-0.01
Dec. 3	2	18	1.2	6	+0.2	.370	8	0.00
1909 Jan. 21	3	32	0.6	4	-0.4	.352	8	-0.02
22	2½	42	0.6	4	-0.4	.392	4	+0.02
Mar. 17	2½	37	61.3	4	+0.3	1.417	4	+0.05
Mean		44°	61.01		±0.06	1.371		±0.003

*Observations with reference to 628—Continued.*

DATE			S	T	P	n	$\Delta$	R	n	$\Delta$
642										
1909	Feb.	11	3½	35°	16.4	4	+0.2	4.875	2	-0.10
	Sept.	14	4	60	7.8	4	+1.6	4.853	2	-0.12
	Oct.	7	4	56	5.9	2	-0.3	5.010	2	+0.04
		8	3½	56	6.0	5	0.2	5.038	3	0.06
	Nov.	10	3	42	5.7	4	0.5	5.021	3	0.05
		11	3½	46	5.8	4	0.4	5.041	4	+0.07
		12	3½	52	5.6	4	-0.6	4.937	4	-0.04
1910	Feb.	1	3½	33	16.6	4	+0.4	5.009	4	+0.03
Mean			48°		16.22	±0.16		4.974	±0.020	
647										
1908	Sept.	16	3½	53°	30° 1	6	-0.1			
		22	3	59	29.7	4	0.5			
	Nov.	9	2½	44	30.2	4	0.0	4.312	4	-0.07
		18	2	41	29.9	4	0.3	.379	4	0.00
		21	1	36	30.0	4	-0.2	.333	4	-0.04
	Dec.	14	2	32	30.3	6	+0.1	.417	4	+0.04
1909	Jan.	21	3	32	29.6	4	-0.6	.323	4	-0.06
		22	2½	42	30.1	4	-0.1	.430	4	+0.05
		23	3	47	30.6	4	+0.4	.491	2	+0.11
	Feb.	2	2½	35	30.8	4	0.6	.382	4	0.00
		25	2	30	30.9	4	0.7	.315	2	-0.06
	Oct.	9	2½	55	30.5	4	+0.3	4.402	2	+0.02
Mean			42°		30.22	±0.08		4.378	±0.012	
648										
1909	Feb.	11	3½	35°	115.9	4	-0.1	2.739	2	-0.10
		17	4	35	6.9	5	+0.9	.723	2	-0.11
	Mar.	23	3½	40	6.0	4	0.0	.929	3	+0.09
	Sept.	9	4	58	7.8	6	+1.8	.856	3	0.02
		24	3	55	4.8	4	-1.2	.864	4	0.03
		25	2½	51	4.5	4	-1.5	.842	2	0.01
	Oct.	1	3½	51	7.8	4	+1.8	.858	4	+0.02
		2	4	44	5.9	4	-0.1	.821	3	-0.01
		4	3	46	5.5	4	0.5	.850	2	+0.02
		8	3½	56	114.9	4	-1.1	2.868	3	+0.03
Mean			47°		116.00	±0.24		2.835	±0.012	



## NEW POSITIONS OF STARS IN ORION

107

*Observations with reference to 628—Continued.*

DATE			S	T	P	n	Δ	R	n	Δ	
651											
1909	Feb.	11-----	3½	35°	32.9	4	+1.1	5.460	2	+0.09	
		20-----	2½	50	2.4	6	+0.6	.296	2	-0.08	
		25-----	2	30	0.6	4	-1.2	.304	4	-0.07	
		26-----	2½	35	2.1	4	+0.3	.403	4	+0.03	
	Mar.	17-----	2½	37	1.8	4	0.0	.458	2	0.08	
		23-----	4	40	2.1	4	0.3	.477	2	+0.10	
	Sept.	9-----	4	58	2.1	4	+0.3	.298	3	-0.08	
		29-----	3	46	1.5	4	-0.3	.318	2	0.06	
	Oct.	1-----	2	51	1.8	4	0.0	.301	4	-0.07	
		2-----	3	44	31.1	5	-0.7	5.425	3	+0.05	
Mean-----			43°		31.84	±0.13		5.374	±0.019		
654											
1909	Mar.	15-----	2	37°	74.0	4	+0.4	3.407	2	-0.05	
		17-----	2½	37	4.4	6	0.8	.394	2	-0.06	
		18-----	3	37	4.3	4	0.7	.554	2	+0.10	
		22-----	1½	40	3.8	6	0.2	.474	2	0.02	
		23-----	4	40	4.5	4	+0.9	.493	2	0.04	
	Sept.	9-----	4	58	3.4	4	-0.2	.497	3	0.04	
		25-----	2½	51	2.0	4	1.6	.489	4	0.03	
	Nov.	10-----	3½	42	2.2	4	-1.4	.474	4	+0.02	
		11-----	3½	46	3.6	4	0.0	.421	4	-0.04	
		12-----	3½	52	73.7	4	+0.1	3.379	4	-0.08	
	Mean-----			44°		73.59	±0.17		3.458	±0.013	
	671										
1908	Sept.	16-----	3½	53°	109° 4	4	-0.7				
		22-----	3	59	09.9	4	-0.2	7.303	4	-0.12	
	Nov.	16-----	2½	27	10.9	4	+0.8	.540	4	+0.12	
		18-----	2	41	10.6	4	0.5	.464	4	+0.04	
		21-----	1	36	10.2	4	0.1				
1909	Jan.	22-----	3	37	10.5	6	+0.4	.429	4	0.00	
		21-----	3	32	09.7	4	-0.4	.451	2	+0.03	
		22-----	2½	42	10.0	4	-0.1	.341	4	-0.08	
		23-----	3	47	10.4	4	+0.3	.485	2	+0.06	
	Feb.	2-----	2½	35	09.8	4	-0.3	.430	2	+0.01	
		Sept. 28-----	2	46	09.4	4	-0.7	.425	2	0.00	
	Oct.	9-----	2½	55	110.8	4	+0.7	7.374	3	-0.05	
		Mean-----			42°		110.13	±0.10		7.424	±0.014

*Observations with reference to 628—Continued.*

DATE		S	T	P	n	$\Delta$	R	n	$\Delta$
<b>676</b>									
1908	Sept. 22	3	59°	110.6	4	-0.1			
	Nov. 16	2½	27	0.9	4	+0.2	8.685	2	+0.01
	22	3	37	0.8	4	+0.1	.761	4	0.09
1909	Jan. 23	3	47	0.4	4	-0.3	.757	2	+0.08
	Feb. 11	3½	35	1.2	4	+0.5	.587	2	-0.09
	20	2½	50	0.7	4	0.0	.701	4	+0.03
	25	2	30	0.7	4	0.0	.637	2	-0.04
	Mar. 17	2½	37	1.2	4	+0.5			
	Sept. 28	2	46				.686	3	+0.01
	Oct. 2	4	44	0.4	4	-0.3	.666	3	-0.01
	4	3	46	110.1	4	-0.6	8.585	2	-0.09
Mean			42°	110.70	±0.07		8.674	±0.014	

**686**

(Other measures referred to 685.)

1909	Feb. 17	4	35°	125°S	4	10.705	2
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**688**

(Other measures referred to 685.)

1909	Feb. 17	4	35°	100°.1	4	13.188	3
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**W 1**

1909	Oct. 8	3½	56°	313°.9	4	-0.2	12.566	2	-0.07
	Nov. 11	3½	46	4.2	4	+0.1	.704	4	+0.07
	12	3½	52	4.2	4	+0.1	12.634	4	0.00
1910	Feb. 1	3½	33	314.0	4	-0.1			
Mean			47°	314.08	±0.06		12.635		

**W 2**

1909	Nov. 10	3½	42°	248.5	4	-0.1	6.832	4	+0.02
	11	3½	46	9.4	4	+0.8	.728	4	-0.09
	12	3½	52	8.0	4	-0.6	.869	4	+0.05
1910	Feb. 1	3½	33	248.5	4	-0.1	6.838	4	+0.02
Mean			43°	248.60	±0.20		6.817	±0.021	

*Observations with reference to 628—Continued.*

DATE			S	T	P	n	Δ	R	n	Δ
W 3										
1909	Nov.	11----	3½	46°	332°.3	2	0.0	8.875	5	+0.01
		12----	4	52	332.3	4	0.0	8.848	3	-0.01
Mean-----			49°		332.3	-----		8.862	-----	
W 4										
1909	Sept.	14----	4	56°	332°.4	3	+0.8	4.960	3	-0.10
		29----	3½	46	1.3	2	-0.3	5.024	2	-0.03
	Oct.	2-----	4	44	1.0	6	0.6	.240	3	+0.18
		4-----	3	46	0.6	4	1.0	.090	3	+0.04
		8-----	3½	56	1.0	4	-0.6	.044	3	-0.01
		9-----	2½	56	2.3	4	+0.7	.020	3	0.04
	Nov.	10----	3½	42	2.3	4	+0.7	.046	4	0.01
		11----	3½	46	1.6	4	0.0	.049	4	-0.01
		12----	3½	52	1.5	4	-0.1	.062	3	+0.01
Feb.	1----	3	33	332.4	4	+0.8	5.021	4	-0.03	
Mean-----			48°		331.64	±0.16		5.055	±0.013	
W 5										
1909	Feb.	17----	4	35°	345°.9	4	+0.7	8.781	2	-0.04
		Nov. 11----	3½	46	4.2	4	-1.0	.822	5	0.00
		12----	4	52	345.4	6	+0.2	8.872	4	+0.05
Mean-----			-----		345.17	±0.38		8.825	±0.018	
Ormond Stone										
1909	Sept.	14----	4	56°	10.4	4	+0.9	5.057	3	-0.01
		Oct. 7-----	3½	56	10.3	2	+0.8	.061	2	-0.01
		8-----	3	56	9.5	4	0.0	.117	3	+0.05
		Nov. 10----	3½	42	8.0	4	-1.5	.116	4	0.05
		11----	3½	46	9.3	6	0.2	5.094	3	+0.03
		12----	3½	52	9.4	4	0.1	4.984	4	-0.08
1910	Feb.	1-----	3	33	9.8	4	+0.3	5.044	4	-0.02
Mean-----			-----		9.53	±0.19		5.068	±0.012	
Alvan Clarke										
1909	Sept.	9----	4	58°	23°.6	4		0.603	4	

*Observations with reference to 558.*

DATE			S	T	P	n	$\Delta$	R	n	$\Delta$	
523											
1909	Oct.	8	3	56°	272.0	4	+0.2	8.346	2	-0.04	
		9	2½	55	1.9	4	+0.1	.402	2	+0.01	
		12	2	49	1.8	4	0.0	.473	3	+0.08	
		13	1½	35	1.7	4	-0.1	.310	3	-0.08	
		17	2	42	1.6	4	-0.2	.408	4	+0.02	
		20	2	36	1.9	4	+0.1	.449	4	0.06	
		26	2½	38	1.7	4	-0.1	.408	3	+0.02	
		27	2	47	1.8	4	0.0	.347	4	-0.04	
		Nov.	10	3	42	1.9	4	+0.1	.319	4	-0.07
	11		3½	46	271.4	4	-0.4	8.431	4	+0.04	
Mean			45°		271.77	±0.03		3.390	±0.012		
570											
1908	Oct.	2	1½	45°	157.4	4	+0.1				
1909	Oct.	1	1½	51	8.0	4	+0.7	16.943	2	+0.06	
		2	2½	44	7.3	4	0.0	.902	4	0.02	
		4	3	46	7.1	4	-0.2	.893	4	+0.01	
		8	3	56	7.1	3	-0.2	.861	4	-0.02	
		9	2½	55	7.4	4	+0.1	.888	3	0.00	
		12	2	49	7.4	4	+0.1	.832	4	0.05	
		13	1½	35	7.0	4	-0.3	.883	6	0.00	
		17	2	42	7.5	4	+0.2	.832	3	0.05	
		20	2	36	7.3	4	0.0	.870	3	-0.01	
		26	2½	38	157.3	4	0.0	16.933	3	+0.05	
Mean			45°		157.34	±0.04		16.884			
573											
1908	Nov.	16	2½	27°	128°9	2	+0.5				
		18	2	41	9.3	4	0.9				
1909	Jan.	23	3	47	9.0	4	0.6	9.503	2	+0.01	
		17	2½	37	8.8	4	+0.4	.448	2	-0.05	
	Mar.	23	3½	40	8.2	4	-0.2	.451	2	-0.04	
		19	2	58	8.5	4	+0.1				
	Sept.	24	2½	55	7.7	5	-0.7	.525	3	+0.03	
		25	2½	51	7.9	4	-0.5	.519	2	+0.02	
		29	2	46				.402	4	-0.09	
	Oct.	1	1½	51	8.5	4	+0.1	.554	3	+0.06	
		2	2½	44	8.0	4	-0.4	.518	4	+0.02	
		4	3	46	8.3	4	0.1	.460	4	-0.04	
8		3	56	127.8	2	-0.6	9.581	2	+0.08		
Mean			46°		128.41	±0.10		9.496	±0.012		

## NEW POSITIONS OF STARS IN ORION

111

*Observations with reference to 558—Continued.*

DATE	S	T	P	n	$\Delta$	R	n	$\Delta$
<b>575</b>								
(Other measures referred to 628.)								
1908 Nov. 16----	2½	27	38.8	4		12.264	2	
<b>581</b>								
1909 Mar. 23----	3½	40°	115.3	4	+0.1	9.878	3	+0.02
Sept. 19----	2	58	5.4	4	0.2	.746	2	-0.11
24----	2½	55	5.4	4	+0.2	.884	2	+0.02
25----	2½	51	4.9	4	-0.3	.871	3	+0.01
29----	2	46	4.6	4	0.6	.660	3	-0.20
Oct. 1----	2	51	4.3	4	-0.9	9.908	4	+0.04
2----	2½	44	5.5	4	+0.3	10.006	3	0.14
4----	3	46	5.6	4	+0.4	9.886	4	0.03
8----	3	56	5.1	4	-0.1	.891	2	+0.03
9----	2½	55	115.5	4	+0.5	9.859	3	0.00
Mean-----		50°	115.16		±0.09	9.859		±0.016

*Observations with reference to 669.*

<b>635</b>								
(Other measures referred to 628.)								
1908 Nov. 18----	2	41°	268.8	4	+0.3			
1909 Jan. 23----	3	47	8.4	4	-0.1	5.627	4	-0.03
Feb. 4----	2	40	9.0	4	+0.5	.655	2	0.00
6----	2	35	8.4	5	-0.1	.743	2	+0.09
20----	2½	50	8.4	4	-0.1	.681	4	+0.02
25----	2	30	8.7	4	+0.2	.595	2	-0.06
26----	2½	35	267.6	4	-0.9	5.632	3	-0.02
Mean-----		40°	268.47		±0.07	5.656		±0.013

**641**

1909 Jan. 23----	3	47°	282.0	4	-1.1			
Feb. 20----	2½	50	3.9	4	+0.8	5.465	2	0.00
Mar. 18----	3	37	3.1	4	0.0	.587	2	+0.12
23----	3½	40	2.9	4	-0.2	.453	4	-0.01
Sept. 19----	2½	58	3.5	4	+0.4	.444	4	0.02
24----	2½	55	2.5	4	-0.6	.350	2	-0.11
25----	2½	51	2.0	4	-1.1	.479	3	+0.02
Oct. 1----	2½	51	3.5	4	+0.4	.488	4	0.03
4----	3	46	3.4	4	0.3	.521	3	+0.06
8----	3	56	3.6	4	0.5	.408	3	-0.05
9----	2½	55	283.6	4	+0.5	5.426	3	-0.04
Mean-----		48°	283.09		±0.14	5.462		±0.012

*Observations with reference to 669—Continued.*

DATE		S	T	P	n	$\Delta$	R	n	$\Delta$	
652										
1909	Sept.	19----	2½	58°	336.6	2	+0.5	7.893	3	+0.05
		24----	2½	55	6.6	4	+0.5	.832	2	-0.01
		25----	2	51	5.6	6	-0.5	.820	3	0.02
		28----	2	46	5.9	4	0.2	.820	2	0.02
	Oct.	29----	2	46	6.1	2	0.0	-----		
		1----	2	51	6.0	4	0.1	.788	2	-0.06
		2----	2½	44	6.1	4	0.0	.863	5	+0.02
		4----	3	46	5.8	4	0.3	.851	3	0.01
		7----	4	56	5.9	4	-0.2	.898	2	+0.06
		8----	3	56	336.3	4	+0.2	7.821	3	-0.02
		Mean-----			51°	336.09	±0.07		7.843	±0.008
657										
1909	Sept.	19----	2½	58°	339.7	2	-0.4	7.012	2	-0.06
		24----	2½	55	40.3	4	+0.2	.072	3	0.00
		25----	2	51	40.5	4	0.4	.049	2	-0.02
		28----	2	46	40.8	4	0.7	.158	3	+0.08
	Oct.	29----	2	46	40.7	4	0.6	.076	2	0.00
		1----	2	51	40.3	4	+0.2	.086	3	+0.01
		2----	2½	44	39.9	4	-0.2	.066	4	-0.01
		4----	3	46	39.4	4	0.7	.054	3	-0.02
		7----	4	56	39.3	4	0.8	.120	2	+0.05
		8----	3	56	339.8	4	-0.3	7.052	2	-0.02
		Mean-----			51°	340.07	±0.12		7.074	±0.007
663										
1909	Sept.	19----	2½	58°	351.4	4	+0.1	4.827	3	-0.01
		24----	2½	55	0.9	4	-0.4	.826	4	-0.01
		25----	2	51	1.7	4	+0.4	.840	2	+0.01
		28----	2	46	1.6	4	0.3	.880	3	+0.05
	Oct.	1----	2½	51	1.8	4	0.5	.758	3	-0.08
		2----	2½	44	1.8	4	+0.5	.867	4	+0.03
		4----	3	46	1.2	4	-0.1	.843	3	+0.01
		8----	3	56	0.3	4	1.0	.832	2	0.00
		9----	2½	55	1.2	4	0.1	.813	4	-0.02
		12----	2	49	350.9	4	-0.4	4.844	3	+0.01
		Mean-----			51°	351.28	±0.10		4.833	±0.006

## NEW POSITIONS OF STARS IN ORION

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*Observations with reference to 669—Continued.*

DATE	S	T	P	n	$\Delta$	R	n	$\Delta$
681								
1909 Sept. 19----	2½	58°	16.8	2	+0.1			
24----	2½	55	16.7	4	0.0	7.950	2	-0.07
25----	2	51	17.2	4	+0.5	8.107	3	+0.09
28----	2	46	16.3	4	-0.4	8.076	3	+0.06
Oct. 1----	2½	51	16.4	4	-0.3	7.960	4	-0.06
2----	2½	44	16.8	4	+0.1	8.036	4	+0.02
4----	3	46	16.6	4	-0.1	7.996	4	-0.02
8----	3	56	16.9	4	+0.2	8.051	2	+0.03
9----	2½	55	16.8	4	+0.1	7.991	3	-0.03
12----	2	49	16.5	4	-0.2	8.011	3	-0.01
Mean-----		51°	16.70	±0.05		8.018	±0.012	

*Observations with reference to 685.*

666								
1909 Sept. 19----	2½	58°	201.7	4	+0.3	10.985	2	-0.03
24----	2	55	1.9	5	+0.5	11.063	3	+0.05
25----	2½	51	1.2	4	-0.2	11.020	2	+0.01
Oct. 1----	2	51	0.7	4	0.7	10.940	3	-0.07
2----	4	44	0.9	4	0.5	10.941	3	-0.07
4----	3	46	1.0	4	0.4	11.027	4	+0.02
8----	3	56	1.2	4	-0.2	11.013	2	0.00
9----	2½	55	2.1	4	+0.7	11.017	3	0.01
17----	2½	42	1.9	4	+0.5	11.016	3	0.00
26----	2½	38	201.0	4	-0.4	11.086	3	+0.08
Mean-----		49°	201.36	±0.12		11.011	±0.011	

675								
1909 Feb. 17----	4	35°	270.8	4	+0.4	2.445	2	-0.02
Sept. 14----	4	58	69.0	3	-1.4			
Oct. 2----	4	44	71.0	4	+0.6	.448	4	-0.02
4----	3	46	70.5	4	+0.1	.472	4	0.00
8----	3	56	69.4	4	-1.0	.480	3	+0.01
9----	2½	55	71.0	4	+0.6	.579	3	0.11
Nov. 10----	3	42	70.2	4	-0.2	.516	4	0.05
11----	3½	46	69.7	4	0.7	.478	4	+0.01
12----	3	52	70.0	4	-0.4	.374	4	-0.10
1910 Feb. 1----	3	33	272.7	4	+1.3	2.431	4	-0.04
Mean-----		47°	270.43	±0.19		2.469	±0.012	

*Observations with reference to 685—Continued.*

DATE		S	T	P	n	$\Delta$	R	n	$\Delta$
677									
1909	Sept. 19	2½	58°	190.7	2	-0.3	11.002	4	+0.06
	25	2½	51	89.9	2	1.1	10.916	3	-0.03
	Oct. 1	2	51	90.4	4	-0.6	.962	3	+0.02
	2	4	44	91.3	4	+0.3	.789	3	-0.16
	4	3	46	90.9	4	-0.1	.948	4	0.00
	8	3	56	191.6	4	+0.6	10.943	2	0.00
	9	2½	55	191.9	4	+0.9	10.949	3	0.00
	17	2½	42	1.2	4	0.2	10.932	4	-0.01
	26	2½	38	1.2	4	+0.2	11.080	4	+0.14
	27	2	47	190.7	4	-0.3	10.914	3	-0.03
Mean			49°	190.98		±0.12	10.944		±0.012
686									
1909	Feb. 17	4	35°	344.1	4	+0.9	3.440	2	-0.12
	Sept. 19	2½	58	4.5	2	1.3	.456	2	-0.10
	Oct. 2	4	44	3.5	4	+0.3	.754	4	+0.19
	4	3	46	3.1	4	-0.1	.694	4	0.13
	8	3½	56	3.4	4	+0.2	.670	3	+0.11
	9	2½	55	2.4	4	-0.8	.524	3	-0.04
	Nov. 10	3½	42	3.2	6	0.0	.563	3	+0.01
	11	3½	46	2.8	4	0.4	.542	4	-0.01
	12	3	52	2.6	4	0.6	.470	4	0.09
1910	Feb. 1	3	33	342.8	4	-0.4	3.446	4	-0.11
Mean			47°	343.24		±0.14	3.556		±0.026
688									
1909	Oct. 2	4	44°	23.6	5	-0.1	7.913	3	-0.05
	4	3	46	4.1	4	+0.4	.957	4	-0.01
	8	3½	56	3.4	4	-0.3	.993	3	+0.03
	9	3	55	3.4	4	-0.3	.979	3	+0.02
	Nov. 11	3½	46	3.8	4	+0.1	.936	4	-0.03
	12	3½	52	3.1	4	-0.6	7.882	4	-0.08
	Feb. 1	3½	33	24.7	4	+1.0	8.082	3	+0.12
Mean			48°	23.73		±0.14	7.963		±0.017



## NEW POSITIONS OF STARS IN ORION

115

Observations with reference to 685—Continued.

DATE		S	T	P	n	$\Delta$	R	n	$\Delta$		
708											
1909	Sept.	9	2½	53°	93.0	4	+0.6	5.352	6	+0.02	
		16	3½	53	2.2	4	-0.2	.355	8	0.02	
		22	3	59	2.1	4	-0.3				
		25	3½	63	2.7	4	+0.3	.427	3	+0.09	
	Oct.	2	1½	45	2.5	4	0.1				
		Nov.	9	2½	44	2.8	4	0.4	.315	4	-0.02
			18	2	41	2.5	4	0.1	.341	4	+0.01
			20	1	42	2.5	4	+0.1	.398	4	+0.06
	Jan.		21	1	36	1.8	4	-0.6	.315	4	-0.02
		21	3	32	2.2	4	0.2	.343	2	+0.01	
		22	2½	42	2.2	4	-0.2	.259	2	-0.08	
		23	3	47	92.4	4	0.0	5.249	2	-0.09	
Mean		46°		92.41	±0.06		5.335	±0.011			
709											
1908	Sept.	16	3½	53°	128.5	4	0.0				
	Oct.	2	1½	45	8.3	4	-0.2				
	Nov.	18	2	41	8.3	4	-0.2	6.705	4	-0.06	
1909	Jan.	21	3	32	8.5	4	0.0	.745	2	-0.02	
		22	2½	42	8.6	4	+0.1	.783	2	+0.02	
		23	3	47	8.0	4	-0.5	.725	2	-0.04	
	Sept.	24	2	55	9.0	4	+0.5				
		25	2	51	8.4	4	-0.1	.819	3	+0.05	
		28	2	46	8.7	4	+0.2	.868	2	+0.10	
		29	2	46	8.7	4	+0.2	.735	4	-0.03	
	Oct.	8	3	56	128.0	2	-0.5	6.752	2	-0.01	
	Mean		47°		128.46	±0.06		6.766	±0.012		
	724										
1908	Sept.	16	3½	53°	134.0	4	-0.3				
		22	3	59	4.4	4	+0.1				
		25	3½	63	4.2	4	-0.1				
	Oct.	2	1½	45	4.5	4	+0.2				
		Nov.	9	2½	44	4.5	4	0.2	11.839	4	-0.05
			18	2	41	4.6	4	0.3	.887	4	0.00
	20		1	42	4.5	4	0.2	.999	4	+0.11	
	Jan.	21	1	36	4.4	4	0.1	.908	4	+0.02	
		21	3	32	4.5	4	+0.2	.890	2	0.00	
		22	2½	42	4.2	4	-0.1	.887	2	0.00	
	Sept.	23	3	47	4.6	4	+0.3	.859	2	-0.03	
		28	2	46	4.0	4	-0.3	.898	2	+0.01	
		Oct.	8	3	56	133.9	2	-0.4	11.805	4	-0.08
	Mean		47°		134.33	±0.05		11.886	±0.012		

*Observations with reference to 685—Continued.*

DATE	S	T	P	n	$\Delta$	R	n	$\Delta$
741								
1908 Sept. 16	3½	53°	97.5	4	-0.3			
22	3	59	7.6	4	-0.2			
25	3½	63	8.1	4	+0.3			
Oct. 2	1½	45	8.2	4	0.4			
Nov. 9	2½	44	7.8	4	0.0	13.074	4	+0.02
18	2	41	8.2	4	0.4	.033	4	-0.02
20	1	42	7.9	4	+0.1	.129	4	+0.08
21	1	36	7.7	4	-0.1	.069	4	+0.02
1909 Jan. 21	3	32	7.6	4	-0.2	13.053	2	0.00
22	2½	42	7.8	4	0.0	12.949	2	-0.10
23	3	47	7.8	4	0.0	13.043	2	-0.01
Sept. 28	2	46	8.0	4	+0.2	.129	3	+0.08
Oct. 8	3	56	97.6	3	-0.2	13.003	3	-0.05
Mean		47°	97.83		±0.04	13.054		±0.012

*Miscellaneous Observations.*

## 640-619

1908 Sept. 9	2½	53°	275.8	4	0.0	2.174	4	-0.01
11	2	55	275.8	6	0.0	2.192	8	+0.01
Mean		54°	275.80			2.183		

## 640-624

1908 Sept. 9	2½	53°	300.4	4	0.0	1.948	4	0.00
11	2	55	300.5	4	0.0	1.943	8	0.00
Mean		54°	300.45			1.946		

## 640-633

1908 Sept. 22	3	59°	225.6	4		1.195	4	
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## NEW POSITIONS OF STARS IN ORION

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*Miscellaneous Observations—Continued.*

DATE	S	T	P	n	Δ	R	n	Δ
619-624								
1908 Sept. 9----	2½	53°	31.9	4	-1.0	0.877	6	0.00
11----	2	55	33.9	4	+1.0	0.892	8	+0.01
25----	3½	63	33.0	4	+0.1	0.876	8	-0.01
Mean-----	56°		32.93	-----		0.882	-----	
619-617								
1908 Sept. 22----	3	59°	352.8	4	-0.1	0.433	4	+0.02
25----	3½	63	353.0	6	+0.1	0.403	4	-0.02
Mean-----	61°		352.90	-----		0.418	-----	
624-617								
1908 Sept. 22----	3	59°	240.1	6		0.619	4	
628-570								
1908 Sept. 11----	2	55°	199.8	4	+0.1	-----	-----	-----
25----	3½	63	9.5	4	-0.2	-----	-----	-----
Oct. 2----	1½	45	9.8	4	+0.1	-----	-----	-----
5----	2	51	9.7	4	0.0	-----	-----	-----
Nov. 9----	2½	44	199.6	4	-0.1	-----	-----	-----
Mean-----	53°		199.68	±0.04		-----	-----	

*Miscellaneous Observations—Continued.*

DATE		S	T	P	n	$\Delta$	R	n	$\Delta$	
628-708										
1908	Sept.	11	2	55°	123.1	4	+0.3			
		16	3½	53	2.4	4	-0.4			
		22	3	59	2.6	4	-0.2			
		25	3½	63	2.8	4	0.0	18.175	8 +0.08	
	Nov.	9	2½	44	3.1	4	+0.3			
		16	2½	27	2.9	4	0.1			
		18	2	41	3.0	4	+0.2			
		20	1	42	122.5	4	-0.3	18.019	4 -0.08	
	Mean		48°		122.80	±0.07		18.097	±0.048	
628-724										
1908	Sept.	11	2	55°	134.5	4	+0.2			
		16	3½	53	4.1	4	-0.2			
		22	3	59	3.9	4	-0.4			
		25	3½	63	4.3	4	0.0			
	Nov.	9	2½	44	4.4	4	+0.1			
		18	2	41	134.4	4	+0.1			
		Mean		52°		134.27	±0.06			
		628-741								
	1908	Sept.	11	2	55°	116.6	4	+0.2		
16			3½	53	6.2	4	-0.2			
22			3	59	6.2	4	0.2			
25			3½	63	6.3	4	-0.1			
Nov.		9	2½	44	6.6	4	+0.2			
		18	2	41	116.6	4	+0.2			
		Mean		52°		116.42	±0.06			

PART IV.  
Catalogue of Positions.

No.	G.P.B.	H.S.	H.	W.C.B.	Ll.	Li.	Mag.	$\Delta\alpha$	$\Delta\delta$	N.
1	523	45	$\tau$	5	40	l	—	-243".55	-115".32	10
2	558	50	—	9	39	v	10.7	160.91	117.87	120
3	567	51	—	10	—	—	13.3	99.79	4.78	12
4	570	53	$\sigma$	13	33	n	—	96.80	271.42	16
5	573	54	—	12	35	n <sub>1</sub>	12.4	87.58	-176.01	12
6	W <sub>1</sub>	—	—	—	—	—	—	86.63	+89.46	4
7	575	—	—	11	45	—	12.0	85.59	-22.28	11
8	581	ad 54	—	—	—	—	13.1	73.29	159.87	10
9	W <sub>2</sub>	—	—	—	—	—	—	62.57	24.52	4
10	589	57	—	15	—	—	12.4	57.42	21.03	12
11	595	—	—	—	43, e	—	13.2	46.57	-16.36	8
12	W <sub>3</sub>	—	—	—	—	—	—	40.59	+77.31	2
13	601	—	—	—	—	—	13.6	32.93	-28.36	7
14	602	—	—	—	—	—	13.4	32.84	-61.58	10
15	W <sub>4</sub>	—	—	—	—	—	—	23.66	+43.82	10
16	608	—	—	—	f	—	13.1	23.18	-16.22	10
17	W <sub>5</sub>	—	—	—	—	—	—	22.26	+84.08	3
18	612	—	—	16	—	—	13.0	18.18	26.35	10
19	618	—	—	19	h	—	12.8	12.14	26.39	11
20	617	64	$\gamma$	—	—	bb <sub>1</sub>	10.3	10.34	13.04	11
21	619	65	$\gamma$	17	—	b	7.4	9.76	+8.66	10
22	622	II	—	18	—	—	12.0	7.44	-26.88	11
23	621	ad II	—	—	—	—	14.0	6.08	-39.59	10
24	624	67	$\delta$	21	—	d	5.7	4.90	+16.11	10
25	625	ad II	—	—	d	—	—	-1.18	-30.14	2
26	628	69	$\alpha$	22	—	a	5.7	—	—	—
27	A. Clarke	—	—	—	—	—	—	+2.38	+5.44	1
28	633	71	$\alpha'$	—	—	—	10.0	3.60	-2.00	10
29	631	—	—	—	—	—	13.6	4.80	-40.32	10
30	635	70	—	23	2	i	9.5	7.20	+97.40	16
31	O. Stone	—	—	—	—	—	14.2	8.27	+49.27	7
32	636	—	—	24	—	—	13.4	8.93	-10.82	11
33	641	III	—	—	—	—	12.8	10.44	+111.33	11
34	640	73	$\theta$	25	—	c	7.1	11.82	6.55	12
35	642	—	—	—	—	—	13.7	13.68	47.03	8
36	647	75	—	26	9, 1	—	11.0	21.72	+37.29	12
37	648	—	—	—	—	—	13.7	25.11	-12.25	10
38	651	ad 75	—	27	—	—	12.3	27.94	+44.99	10
39	652	76	$\gamma'$	32	—	f''	11.7	31.54	169.80	10
40	654	78	—	31	—	—	13.1	32.69	9.63	10
41	657	80	$\gamma''$	33	4	f''	11.3	39.10	164.68	10
42	663	84	$\omega$	37	—	f''	12.8	55.65	+146.22	10
43	666	81	—	30	—	—	13.4	57.43	-195.10	10
44	669	87	$\nu$	39	10	k	8.8	62.87	+99.20	120
45	671	88	—	41	18	e''	11.2	68.69	-25.18	10
46	675	—	—	—	a	$\kappa$	13.7	72.63	92.21	10
47	677	ad 81	—	34	—	—	13.8	76.42	199.93	10
48	676	ad 88	$\zeta$	43	k	—	12.8	79.96	-30.22	11
49	681	89	—	—	—	e''	—	85.58	+174.83	10
50	686	91	$\epsilon$	44	—	—	13.4	95.95	-60.49	11
51	685	93	—	45	26	c	—	96.96	94.04	120
52	688	—	—	—	—	—	—	128.54	22.13	8
53	709	100	G	51	—	$\mu$	12.0	149.17	135.52	11
54	708	101	$\xi$	50	23	f	6.3	149.48	96.25	20
55	724	104	$\lambda$	55	25	h	8.9	180.77	175.92	19
56	741	110	$\eta$	61	19	g	7.9	+224.41	-111.57	19

## PART V.

*Positions of Other Observers Reduced to 1910.0.*

Star	$\Delta\alpha$	$\Delta\delta$	Obs.	Star	$\Delta\alpha$	$\Delta\delta$	Obs.
523	-246.6	-114.6	H	581	-77.6	-158.7	GB
	244.2	115.6	WB		73.3	159.9	W
	243.5	116.6	LI	589	-58.1	-20.1	GB
	243.8	114.8	GB		58.5	22.3	L-S
	-245.8	-115.5	L-S		58.3	21.2	Mean
	-244.6	-115.4	W		57.4	21.0	W
558	-243.6	115.3	Mean	595	-47.8	-14.8	GB
			W		46.6	16.4	W
	-154.9	-122.0	H	601	-37±	-30.8	GB
	161.0	119.2	WB		32.9	28.4	W
	165.1	115.7	LI	602	-33.1	-67.3	GB
	160.3	117.8	GB		32.8	61.6	W
567	162.5	118.2	L-S	608	-23.7	-17.9	GB
	-161.4	118.1	Mean		23.2	16.2	W
	160.9	117.9	W	612	-17.0	+24.8	GB
					19.0	21.8	L-S
570	-101.8	-10.3	H		18.0	23.3	Mean
	103.7	7.8	GB		18.2	26.4	W
	103.1	8.1	Mean	617	-10.4	+12.8	H
	99.8	4.8	W		10.6	13.0	GB
	-96.1	-270.0	H		10.3	12.4	L-S
	96.4	271.9	WB		10.6	12.8	HI
	93.7	272.6	LI		10.3	12.9	B
	96.9	272.7	GB		10.4	12.8	Mean
	98.4	271.6	L-S		10.3	13.0	W
	96.4	272.0	AGC	618	-11.1	+24.7	GB
573	96.7	271.8	Mean		13.1	22.7	L-S
	96.8	271.4	W		12.1	23.7	Mean
	-92.5	-172.0	H		12.1	26.3	W
	90.1	180.3	WB	619	-10.4	+8.7	H
	87.6	174.7	LI		9.6	8.4	WB
	89.0	178.5	GB		9.9	8.7	GB
	90.4	176.2	L-S		9.4	8.4	L-S
	89.3	177.0	Mean		10.0	8.6	HI
	87.6	176.0	W		9.7	8.6	B
					9.8	8.6	Mean
575					9.8	8.7	W
	-21.4	WB					
	21.4	LI					
	22.0	GB					
	23.9	L-S					
	22.4	Mean					
	22.3	W					

*Positions of Other Observers Reduced to 1910.0—Continued.*

Star	$\Delta\alpha$	$\Delta\delta$	Obs.	Star	$\Delta\alpha$	$\Delta\delta$	Obs.
621	-8.9	-36 $\pm$	GB	640	+12.0	+6.7	H
	8.7	31 $\pm$	L-S		12.4	6.7	WB
	8.8	33.5	Mean		11.6	6.8	GB
	6.1	39.6	W		12.1	6.6	L-S
622	-8.4	-27.8	GB		11.8	6.4	Hl
	8.2	27.6	L-S		11.9	6.5	B
	8.3	27.7	Mean		11.9	6.6	Mean
	7.4	26.9	W		11.8	6.6	W
624	-5.8	+16.1	H	641	+11.6	+111.2	GB
	3.7	16.4	WB		7.2	107.2	L-S
	4.9	16.1	GB		9.4	109.2	Mean
	4.6	15.9	L-S		10.4	111.3	W
	5.0	16.0	Hl	642	+12.4	+48 $\pm$	GB
	4.9	16.0	B		12.4	50.2	OS
	4.8	16.0	Mean		13.7	47.0	W
	4.9	16.1	W	647	+21.6	+42.0	H
625	-4.8	-28 $\pm$	GB		23.4	41.4	Ll
	1.2	30.1	W		22.0	37.9	GB
631	+2.2	-4.2	GB		20.7	39.1	L-S
	4.8	40.3	W		21.7	39.3	Mean
633	+4.5	-1.2	H		21.7	37.3	W
	3.5	2.1	GB	648	+23.6	-8.8	GB
	2.9	1.9	L-S		25.1	12.2	W
	3.4	2.0	Hl	651	+28.8	+47.7	GB
	3.4	2.0	B		25.8	42.7	L-S
	3.4	2.0	Mean		27.3	45.2	Mean
	3.6	2.0	W		27.9	45.0	W
635	+4.0	+95.2	H	652	+31.5	+166.2	H
	5.6	98.5	WB		31.2	168.4	WB
	9.2	96.6	Ll		30.2	171.4	GB
	7.9	98.3	GB		30.4	171.7	L-S
	5.8	98.1	L-S		30.6	170.9	Mean
	6.8	97.8	Mean		31.5	169.8	W
	7.2	97.4	W	654	+32.0	+20.2*	H
636	+7.6	-8.7	GB		32.5	9.8	GB
	8.9	10.8	W		33.8	9.5	L-S
					33.0	9.6	Mean
					32.7	9.6	W

*Positions of Other Observers Reduced to 1910.0—Continued.*

Star	$\Delta\alpha$	$\Delta\delta$	Obs.	Star	$\Delta\alpha$	$\Delta\delta$	Obs.
657	+39.0	+162.0	H	677	+76.7	-201.8	GB
	39.3	160.3	WB		76.4	199.9	W
	32.2*	165.7	LI	681	84.1	+164.3	H
	39.6	165.0	GB		90.4	172.8	GB
	35.9	164.2	L-S		82.5	172.8	L-S
	38.2	163.9	Mean		85.6	171.7	Mean
	39.1	164.7	W		85.6	174.8	W
663	+56.9	+139.8	H	685	+102.6	-91.8	H
	60.3	148.1	WB		95.9	93.1	WB
	55.4	146.8	GB		95.5	92.4	LI
	53.7	145.8	L-S		97.1	94.2	GB
	55.8	146.0	Mean		97.0	93.2	L-S
	55.6	146.2	W		97.2	93.9	N
666	+37.9*	-156.0*	H		97.1	94.5	M
	57.9	196.0	GB		97.5	94.4	AGC
	55.0	196.1	L-S		97.1	93.8	Mean
	56.4	196.0	Mean		97.0	94.0	W
	57.4	195.1	W	686	+98.6	-38.5	GB
					96.0	60.5	W
669	+64.0	+98.6	H	688	+104.7	-17.5	GB
	63.8	99.3	WB		128.5	22.1	W
	60.7	99.5	LI	708	+149.6	-96.1	H
	63.0	99.7	GB		148.4	96.0	WB
	61.6	99.7	L-S		150.2	97.9	LI
	62.4	99.5	Mean		150.0	99.3	GB
	62.9	99.2	W		149.4	96.8	L-S
					150.4	97.7	AGC
671	+72.5	-23.6	H		149.8	97.6	Mean
	65.4	35.2*	WB		149.5	96.2	W
	66.0	24.8	LI	709	+149.3	-132.9	H
	68.7	24.8	GB		148.1	136.1	WB
	68.1	24.7	L-S		151.3	136.9	GB
	67.9	24.7	Mean		148.1	134.9	L-S
	68.7	25.2	W		149.4	135.7	Mean
					149.2	135.5	W
675	+73.2	-93.8	GB				
	72.6	92.2	W				
676	+73.3	-37.2	WB				
	77.6	28.0	GB				
	73.6	28.0	L-S				
	75.1	28.9	Mean				
	80.0	30.2	W				



*Positions of Other Observers Reduced to 1910.0—Continued.*

Star	$\Delta\alpha$	$\Delta\delta$	Obs.	Star	$\Delta\alpha$	$\Delta\delta$	Obs.
724	+181.6	-173.7	H	741	+223.0	-110.3	H
	178.1	174.4	WB		223.5	111.4	WB
	176.7	169.6	LI		224.1	108.7	LI
	181.5	176.9	GB		224.6	111.6	GB
	180.0	175.6	L-S		180.0	175.6	L-S
					226.4	112.6	AGC
	179.8	174.7	Mean		224.8	111.4	Mean
	180.8	175.9	W		224.4	111.6	W
				Al. Clarke	4.1	6.1	B
					2.4	5.4	W
				O. Stone	3.5	51.8	OS
					8.3	49.3	W

*Comparisons with G. P. Bond and with the Mean of Other Observations.*

Star	Bond—Wilson		Mean—Wilson	
	$\Delta\alpha$	$\Delta\delta$	$\Delta\alpha$	$\Delta\delta$
523.....	-0.2	+0.5	-1.0	-0.1
558.....	+0.6	+0.1	0.5	0.2
567.....	-3.9	-3.0	-3.3	3.3
570.....	0.1	1.3	+0.1	0.4
573.....	1.4	-2.5	-1.7	1.0
575.....	0.1	+0.3	0.3	0.1
581.....	4.3	1.2		
589.....	0.7	0.9	-0.9	0.2
595.....	1.2	+1.6		
601.....	4.1	-2.4		
602.....	0.3	5.7		
608.....	-0.5	1.7		
612.....	+1.2	1.6	+0.2	2.9
617.....	-0.3	0.0	-0.1	0.2
618.....	+1.0	1.6	0.0	2.6
619.....	-0.1	0.0	0.0	-0.1
621.....	2.8	+3.6	2.7	+6.1
622.....	1.0	-0.9	-0.9	-0.8
624.....	0.0	0.0	+0.1	-0.1
625.....	3.6	+2.1		
631.....	2.6	-1.7		
633.....	-0.1	-0.1	-0.2	0.0
635.....	+0.7	+0.9	-0.4	+0.4
636.....	-1.3	2.1		
640.....	-0.2	+0.2	+0.1	0.0
641.....	+1.2	-0.1	-1.0	-2.1
642.....	-1.3	+1.0	1.3	+2.2
647.....	+0.3	0.6	0.0	2.0
648.....	-1.5	3.4		
651.....	+0.9	2.7	0.6	0.2
652.....	-1.3	1.6	-0.9	+1.1
654.....	-0.2	0.2	+0.3	0.0
657.....	+0.5	0.3	-0.9	-0.8
663.....	-0.2	+0.6	+0.2	0.2
666.....	+0.5	-0.9	-1.0	-0.9
669.....	0.1	+0.5	0.5	+0.3
671.....	0.0	+0.4	0.8	0.5
675.....	+0.6	-1.6		
676.....	-2.4	+2.2	-4.9	+1.3
677.....	+0.3	-1.9		
681.....	4.8	2.0	0.0	-3.1
685.....	0.1	-0.2	+0.1	+0.2
686.....	+2.6	+22.0		
688.....	-23.8	+4.6		
708.....	+0.5	-3.1	0.3	-1.4
709.....	2.1	1.4	0.2	-0.2
724.....	0.7	-1.0	-1.0	+1.2
741.....	+0.2	0.0	+0.4	0.2
Alvan Clarke.....			+1.7	0.7
O. Stone.....			-4.8	+2.5

## PART VI.

## NOTES.

1. In Professor G. P. Bond's catalogue [H. C. O. Annals, Vol. V] I find Herschel 51 identified as Bond 575. The positions reduced to 1910.0 would in that case be—

	$\Delta\alpha$	$\Delta\delta$
Herschel	—101".8	—10".3
Bond	—85.7	—22.0

If, however, we identify Herschel 51 as Bond 567, a variable star which is at times nearly as bright as 575, the positions are much closer.

	$\Delta\alpha$	$\Delta\delta$
Herschel	—101".8	—10".3
Bond	—103.7	—7.8

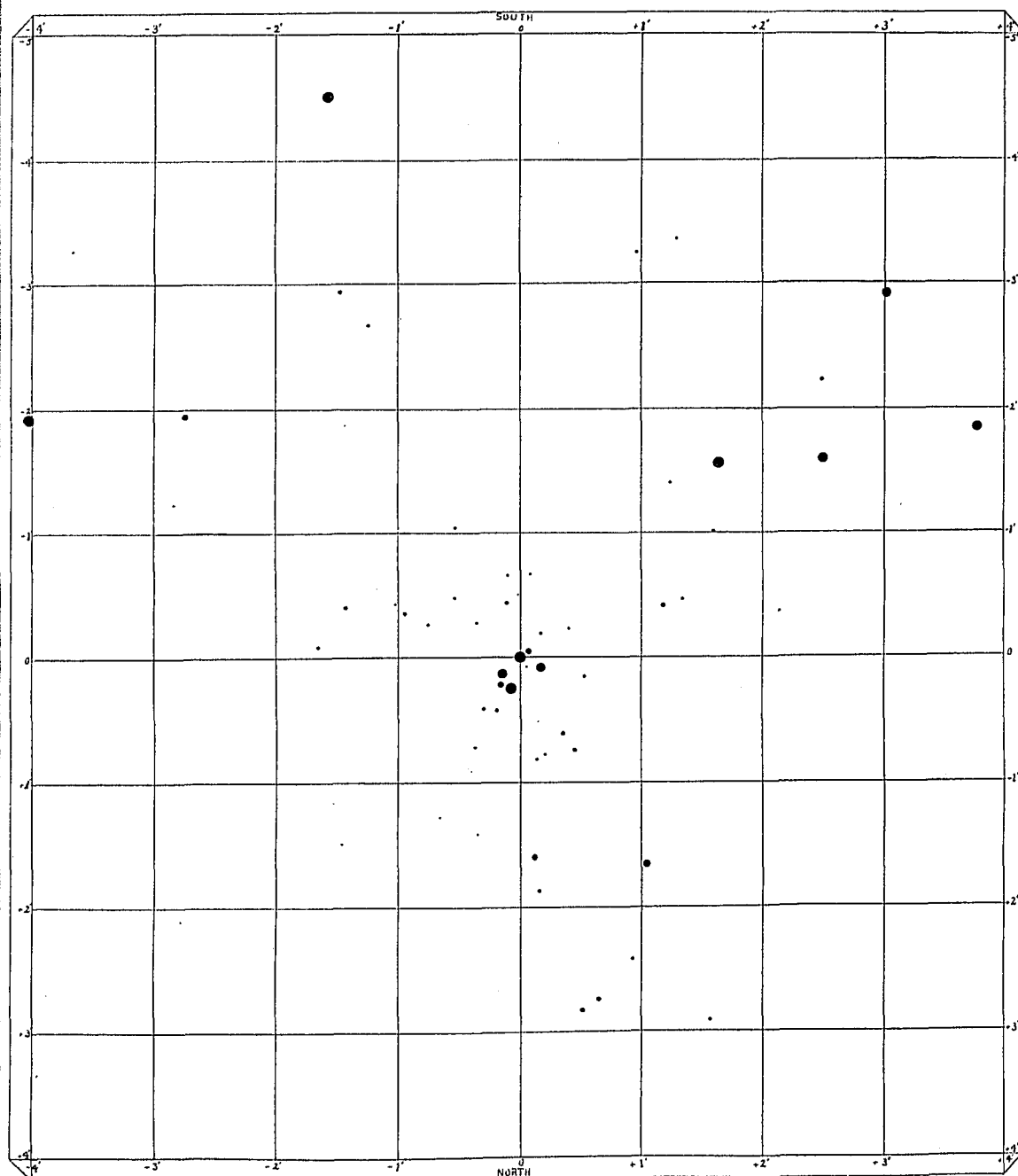
Therefore I have assumed the latter identification to be the correct one.

2. The two measures made on 625 are very doubtful. Bond says in his notes that he "suspects" a faint star in the position given for 625. During a series of observations to determine the magnitudes of the stars in this region Professor Ormond Stone was unable to see any evidence of 625, although he looked for it repeatedly. The two measures given in this paper were exceedingly difficult and the object measured may have been simply a condensation in the nebula.

3. During the first six months of observation from September, 1908, to February 26, 1909, the star 654 was invisible. After a period of cloudy weather work was resumed on March 15, at which time 654 was quite bright. The following comparison of brightness was made on that night:

$$647 - 4 - 654 - 1 - 622 - 3 - 618.$$

Throughout the rest of March 654 was about equal in brightness to 647. As Orion was too near the sun for observation after April 1, the star was not seen again until September 9. At that time it was very faint. On November 10, 11 and 12, it was about at the limit of visibility and has not been seen since.



MAP OF STARS IN THE HUYCHENIAN REGION OF THE ORION NEBULA.