PHILOSOPHICAL TRANSACTIONS.

XIII. *On the Results of Periodical Observations of the Positions and Distances of Nineteen of the Stars in Sir* John Herschel's *Lists of Stars, favourably situated for the investigation of Parallax, contained in Part III. of the Philosophical Transactions for* 1826, *and Part I.* 1827*. *By Lord* Wrottesley, *F.R.S. &c.*

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In these communications, Sir John Herschel shows, that if the component members of a double star occupy a certain position with reference to the pole of the ecliptic, and one of them be supposed to be situated within a given distance from the earth, a change will be periodically produced in the angle of position, and in the distance of the two stars forming the double star, consequent on the motion of the earth in her orbit; that the maximum of the change in the angle of position will occur at two periods of the year distant from each other about six months; and he gives formulæ by which the epochs at which that maximum occurs may be computed, and by which the amount of parallax due to a given change in the angle of position may be also found for each star; also lists of stars favourably situated for the investigation of that element, with the times of the year at which they should be observed, and the amount of parallax, which an observed change of 30′ in the angle of position would indicate in the case of each star.

On the erection of my observatory in the autumn of 1842, comprising among its instruments an equatoreal of very considerable power, I determined to employ it in the observations of the double stars contained in these lists, with the view of ascertaining whether they exhibited such decided differences in their positions, when observed at the proper periods, as to give good grounds of hope that some definite conclusion might be arrived at, as to the existence of a parallax in the objects observed, capable of being measured, or at the least, confidently announced as subsisting in fact.

* I have to acknowledge my obligations to Mr. Main of the Royal Observatory, Greenwich, for many valuable suggestions during the preparation of this communication for the press.

In conducting the observations, however, difficulties arose that had not been anticipated: Sir JOHN HERSCHEL's lists contain sixty-nine stars; many of these, at the periods announced in the lists as proper for observation, if observed at all, must be observed at distances from the meridian too great, when the delicate nature of the inquiry is considered; many of them, having south or small northern declinations, are near the horizon when the proper period for their observation arrives. Another very serious impediment existed in the obligation imposed of obtaining half of the measures in the early morning hours; the observer, if employed in the observatory on the preceding night, was sometimes fatigued and unequal to the task; heavy fogs frequently came on at that time, and an enormous deposit of dew on the interior surface of the object-glass often seriously incommoded the observer; an evil which, until an opening was made in the tube near it, was irremediable, since the use of dew-tubes failed in preventing it.

To these and other causes it is owing, that after more than six years devoted to this course of observation, I am compelled to apologise for the meagre results which, for reasons about to be mentioned, I have still ventured to lay before the Royal Society in their present shape. Of sixty-nine stars I have only obtained observations of forty-eight, and of these forty-eight, twenty-nine have only been observed at one period of the year.

It is a most discouraging feature in this class of observations, that, however numerous and trustworthy the measures obtained at one period of the year may be, there may still be a failure to procure, at the expiration of six months from their date, measures worthy to be compared with them; and the function of the parallax, being the difference between the two results, the value of that element is of course affected by the whole amount of error with which either result is charged.

It has often happened that a star has been observed at one of the assigned periods, and that no corresponding observations have been procured at the expiration of six months, or the next succeeding period; thus, for example, calling the first epoch in the year at which the star is marked for observation, the *early*, and the second the *late* period, a star has been observed two or more times successively at the early period, when no corresponding observations could be procured at the following late period.

The question then naturally occurs, whether the communication of the measures actually obtained may not be deemed premature. I consider, however, that I have proceeded sufficiently far to demonstrate the impolicy of further perseverance, with the means at my command; the rather that instruments are now erected both at Liverpool and Oxford, which are pre-eminently suited to this class of observations, and therefore it would be only a waste of time and force, which may be more profitably employed in other ways, to devote any further attention to the inquiry.

I proceed, therefore, without further apology, to describe the means employed, the mode of employing them, and the results obtained.

The instrument employed was an equatoreally mounted telescope of 10 feet 9 inches focal length, with an object-glass of $7\frac{3}{4}$ inches clear aperture, of which the flint-glass is by GUINAND, and the crown glass English, the whole having been finished and perfected by DOLLOND.

This telescope is mounted in the manner usually adopted by the opticians of this country in a fixed observatory, in the immediate vicinity of my residence in Staffordshire; the polar axis is formed of four mahogany planks 14 feet 3 inches long and 10 inches square in the middle, the pivots of which are of hard bell-metal, and rest above and below on Y^s attached to large and solid stone piers, which are supported by a foundation of brick-work, joined with cement, and formed into a solid mass of great extent by filling up the space enclosed by an outward circuit of brick with stones and mortar pounded together: this mass of brick-work and stone extends beyond the equatoreal room, and forms also the support of the piers of a 5-foot transit.

The Declination and the Hour Circle are each 3 feet in diameter; the two verniers of the former read off to $10''$ in space, and that of the latter to seconds of time. To the telescope there is attached a parallel-wire micrometer with one equatoreal fixed, and two moveable wires; the screw heads are divided into 100 parts; the micrometer is provided with the usual position circle, graduated on silver, with its vernier which reads to $6'$ in space. The value of one part of the micrometer first employed was $0''\cdot15628$, but from the 1st of January 1847 the value $0''\cdot15641$ was used, the first having been determined by Mr. BEAUMONT, the former possessor of the instrument, and the latter by myself. There are six eye-tubes that can be used with the micrometer, with powers varying from 85 to 820, but the power almost invariably used in the observations about to be described was 450; one of 320, and sometimes a lower power, was occasionally, but very rarely, employed, and when this occurs a notice to that effect will be found in the Table containing the results of observations subjoined. The telescope is provided with a clock-work motion; the performance of the object-glass, so far as its powers have been tested, leaves nothing to be desired, but the mounting of the telescope, notwithstanding the precautions above mentioned, does not appear to be equally steady with that of some other recently erected equatoreals. Whenever the night admitted of it, ten measures both in position and distance were obtained of each object observed; when in the sequel I speak of a *set* of observations, the term is to be understood as applying to all the observations of a single night, which almost always comprised that number of measures both of position and distance. To each individual measure, whether of position or distance, an arbitrary weight was assigned, and registered at the time of making it, the number 10 being supposed to express a result with which the observer was entirely satisfied, and smaller numbers to denote a less degree of confidence in the value obtained; in point of fact, however, no higher number than 8 seems to have been used, and the weights employed generally range from 4 to 7. The sum of the weights of the individual measures, or the weight of the set, has been divided by 10 prior to its entry in the subjoined tables; while therefore the number 5 should express the weight of a set of average goodness, the number expressive of that weight is reduced in practice to 4. The measures when made are registered in the printed skeleton forms, originally proposed by Sir JOHN HERSCHEL, and adopted, I believe, by almost all observers of double stars in this country. A number of these forms were bound together in a volume, and care was taken to fill up the different columns, so far at least as they refer to measures of position and distance. Whenever the weather permitted, a set of measures was obtained of each double star, on three separate days, at each period of the year marked out as the proper one for observation. The common arithmetical mean was used in taking the average of the partial measures, comprising each set, without taking the arbitrary weights into account. At the commencement of the series, the zero of the position circle was frequently determined; but it was found to undergo no alteration that might not be attributed to error of observation; from that time it became the practice to ascertain it about every two months; but it was never found to vary more than about 2′, a quantity very much within the error of observation in determining an angle, as will appear in the sequel; no zero was required for distance, as it was the practice to take an equal number of positive and negative readings.

The observations were commenced on the 15th February 1843, and terminated the 9th October 1849; and they were made almost exclusively by three gentlemen, who acted successively as my astronomical assistants, during the progress of the work. I have always found, that observations are better made when entrusted to one competent individual, who after a short time gains experience, and a facility of manipulation, which cannot be acquired by one who only occasionally observes; and this uniformity in the mode of observing is particularly desirable, where the quantities to be determined depend on comparisons of observations made at different periods; it was a subject of great regret to me, therefore, that I was compelled to make any change in the staff of my observatory during the course of this investigation, and I only observed myself on a few nights at the time of the first appointment of each assistant.

Mr. GODDARD observed from the commencement of the observations to October 2, 1843; Mr. SIMMS from that time to the 11th of June 1844; and Mr. PHILPOTT, my present assistant, from thence to the conclusion.

The results of the observations are embodied in five tables, and it now remains to explain the manner in which those tables have been formed.

The First Table.—In the first table the stars are arranged in the order of their R.A.'s; and the observations of each day, or sets, follow one another in the order of their date.

An asterisk will be found attached to four of the stars in the list; these are stars, which, on comparing their mean positions as ascertained in the course of this inquiry, with those given by other observers, exhibit changes of such an amount in their angle of position as to afford satisfactory evidence of orbital motion.

This fact being admitted, it is plain that these stars cannot be rendered available in the present inquiry; it was deemed unnecessary therefore to extend to them the method of reduction employed in the case of the other stars; the observations, however, are given with the others in their proper place.

The *third and seventh columns* of the table contain the arithmetical mean of the individual measures, both in position and distance, obtained on the day specified in the first column.

The quantities inserted in *the fourth and fifth columns* headed "probable error" and "computed weight," refer to the positions only, and have been computed from the formulæ

$$P^2=\frac{0{\cdot}45494}{n(n-1)}\times \text{sum of } \varepsilon^2,$$

$$W=\frac{1}{P^2},$$

where $P=$ probable error of a single set of measures,

$n=$ the number of measures,

$\varepsilon=$ the individual errors,

and $W=$ the weight of the result;

numbers proportional to the computed values of W being inserted in the Table.

The average probable error of all the sets, 211 in number, is $8'{\cdot}98$, and the average weight, 0·0124.

The quantities inserted in the *sixth and eighth columns,* headed "assigned weight," represent the sum of the weights, divided by 10, assigned by the observer to the individual measures of position and distance forming the set, or the arbitrary weights of the sets.

The magnitudes and colours of the stars were noted on each night of observation, and are inserted in the *ninth and tenth columns*; where one colour only is named, it is to be understood as applying to both stars; and where two are specified, the colour of the brighter component, or, in cases of equal brightness, of the star called A, is placed first in order.

The *eleventh column* contains the initial of the observer's name.

The results of each epoch and year are for the sake of distinctness separated by a blank space.

Table I.

Year, Month and Day.	Fraction of year.	Position.	Probable error.	Computed weight.	Assigned weight.	Distance.	Assigned weight.	Magnitudes.	Colours.	Observer.
						γ Arietis.				
1843. July 11.	·523	179° 44′	21′·18	2	5	9″·383	5	5—5	White.	G.
Aug. 7.	·597	178 59	14·02	5	7	9·103	7	6—6	Yellowish green.	G.
11.	·608	179 8	9·40	11	8	8·865	8	6—6	Yellowish.	G.
1844. Jan. 13.	·033	179 42	8·66	13	5·3	8·976	5·1	5—5	White.	S.
Feb. 8.	·104	179 43	15·23	4	4·1	8·933	4·2	5—5	White.	S.
1845. Jan. 21.	·055	178 48	13·96	5	3·2	8·720	2·8	5—5	Yellowish.	P.
24.	·063	181 24	8·94	13	2·9	8·943	3·1	5·6—5·6	Yellowish.	P.
Feb. 1.	·085	180 59	11·98	7	1·9	8·837	1·8	5·6—5·6	Yellowish.	P.
17.	·129	179 57	16·02	4	7·1	8·794	7·3	5·6—5·6	Yellow.	P.
1847. Jan. 29.	·077	178 13	7·36	19	5·7	8·796	5·8	5—5	Yellow.	P.
31.	·082	178 15	9·86	10	5·8	8·750	5·9	5·6—5·6	Yellow.	P.
Aug. 3.	·586	179 19	11·04	8	5·6	8·736	5·8	5—5	Yellowish.	P.
19.	·630	178 36	8·14	15	6·1	8·700	6·2	5·6—5·6	Yellowish.	P.
						32 Eridani.				
1843. Aug. 18.	·627	346 29	9·91	10	8	6·866	8	6·7—8	White.	G.
Sept. 4.	·674	345 24	7·10	20	6	6·784	6	6—7	White.	G.
7.	·682	345 56	7·58	18	7	6·981	7	6·7—8	White.	G.
1845. Feb. *7.	·101	351 51	9·28	12	2·9	6·677	3·2	6·7—8	Yellow and blue.	P.
16.	·126	350 42	10·85	9	7	6·898	6·8	6·7—8·9	Red.	P.
17.	·129	349 41	11·72	7	6·8	6·758	6·6	6·7—8·9	Orange.	P.
1846. Feb. 10.	·110	348 23	8·44	14	4·1	6·664	4·2	7—9	White and bluish.	P.
1847. Jan. 31.	·082	347 12	6·60	23	4·8	6·642	5	7—9	Yellow and blue.	P.
1849. Feb. 17.	·129	346 39	11·97	7	2·2	6·714	2·1	6—8	Yellow and bluish.	P.
						ω Aurigæ.				
1843. Sept. 8.	·684	349 28	11·46	8	7·4	6·588	7·4	7·8—9·10	White.	G.
16.	·706	350 20	14·38	5	7	6·367	7	7·8—9·10	White.	G.
24.	·728	351 19	10·55	9	7	6·343	7	8—10	White.	G.
1844. Sept. 25.	·734	351 37	12·30	7	6·6	6·724	6·7	7·8—10	Yellowish and light blue.	P.
26.	·736	351 6	13·43	6	6·9	6·546	6·6	7·8—10	Yellowish and light blue.	P.
Oct. 10.	·775	351 19	14·92	5	5·5	6·539	5·6	7·8—10	Yellowish and light blue.	P.
1845. Sept. 22.	·723	351 4	11·93	7	5·7	6·229	5·8	7·8—10	Yellowish and light blue.	P.
30.	·745	351 59	23·20	2	3·5	6·384	3·1	7—10	Yellowish and light blue.	P.
1846. Mar. 7.	·178	350 37	9·35	11	4·8	6·457	4·8	7·8—10	Yellow and whitish.	P.
12.	·192	351 37	14·81	5	5·8	6·442	5·9	7—10	Yellow and white.	P.
13.	·194	349 51	13·15	6	4·8	6·292	4·9	7—9·10	Yellow and blue.	P.
1847. Mar. 12.	·192	351 10	12·52	6	5·6	6·250	5·5	8—9·10	White and pale blue.	P.
24.	·225	351 35	20·59	2	2·2	6·297	2·1	7·8—9·10	Pale yellow and pale blue.	P.

* A power of 190 used.

TABLE I. (Continued.)

Year, Month and Day.	Fraction of year.	Position.	Probable error.	Computed weight.	Assigned weight.	Distance.	Assigned weight.	Magnitudes.	Colours.	Observer.
1848. Mar. 31.	·246	351° 47′	11′·05	8	5	6″·233	5	6·7—9	Yellow and pale yellow.	P.
Apr. 1.	·249	352 8	10·61	9	5·8	6·230	5·4	6·7—8·9	Yellow.	P.
1849. Mar. 17.	·205	351 14	12·01	7	5·4	6·260	5·5	7·8—9·10	Yellow and white.	P.
						118 Tauri.				
1843. Sept. 24.	·728	196 46	11·31	8	7	4·866	7	8—9	White.	G.
27.	·736	196 36	5·48	33	7	4·612	7	8—9	White.	G.
1844. Mar. 10.	·189	195 20	5·53	33	3·6	5·065	3·4	8—9·10	White.	S.
29.	·241	195 22	8·57	14	5·8	4·967	5·6	8—9·10	Reddish.	S.
31.	·246	196 40	8·73	13	4	5·030	4	8—9·10	Reddish.	S.
Sept. 24.	·731	193 25	10·71	9	5·4	5·129	5·1	8—9	Light blue and bluish.	P.
25.	·734	195 9	8·93	13	7	5·087	7	8—9·10	Light blue and bluish.	P.
29.	·745	195 54	13·20	6	2·2	5·232	2·2	8—9·10	Light blue and bluish.	P.
1845. Feb. 26.	·153	192 1	25·48	2	5·8	4·796	5·5	7·8—9	Yellow and blue.	P.
Mar. 7.	·178	193 30	8·86	13	5·5	4·939	5·7	7·8—9	Light blue.	P.
8.	·181	194 8	15·76	4	3·3	4·984	3·3	7—9	Yellow and light blue.	P.
*13.	·194	191 17	43·84	1	1·4	5·033	1·3	7—9	Blue.	P.
20.	·214	196 49	17·13	3	5	5·097	4·8	7—9	Blue.	P.
Sept. 22.	·723	193 23	13·62	5	6·2	4·835	6·4	7—9	Yellow and light blue.	P.
1846. Feb. 28.	·159	196 7	10·35	9	3·9	5·035	3·6	7—8·9	Bluish and blue.	P.
Mar. 7.	·178	195 11	7·59	17	5·5	5·034	5·7	7—8·9	Bluish and white.	P.
						41 Aurigæ.				
1843. Feb. †15.	·123	351 25	16·19	4	4·6	7·856	3·6	7—8	White.	W. and G.
Mar. 1.	·162	352 2	24·41	2	4·2	8·393	4·5	7—8	White.	W. and G.
17.	·205	355 0	9·35	11	7	8·445	7	7·8—8	White.	G.
Sept. 1.	·665	352 0	14·44	5	5·9	7·857	5·9	8—9	White and rather blue.	W. and G.
8.	·684	354 18	4·66	46	7·8	7·930	7·8	8—9	White.	G.
16.	·706	353 9	10·20	10	6·8	7·820	6·8	8—9	White.	G.
1845. Feb. 26.	·153	352 41	11·46	8	5	8·097	5·2	8—9	White.	P.
Mar. 7.	·178	352 22	19·92	3	5·2	7·836	5	8—9	White.	P.
12.	·192	351 57	9·54	11	2·2	8·262	2·3	7·8—8·9	Blue.	P.
17.	·205	351 23	9·20	12	5·8	7·681	5·7	8—9	White.	P.
20.	·214	351 20	14·94	5	6	7·849	6·1	7·8—9	Yellowish.	P.
1846. Feb. 28.	·159	351 34	10·90	8	5·6	7·816	5·7	7·8—9	White and blue.	P.
Mar. 7.	·178	352 3	9·40	11	6	7·949	6·2	7·8—8·9	Whitish.	P.
1847. Mar. 10.	·186	352 42	9·79	10	4·6	7·925	4·4	7·8—9	Pale yellow.	P.
12.	·192	353 11	8·71	13	6·9	7·851	7	7·8—8·9	Pale blue.	P.
1848. Mar. 31.	·246	353 8	4·91	42	5·8	7·843	5·8	7·8—8·9	White.	P.
Apr. 1.	·249	353 18	7·71	17	5·9	7·876	6	7·8—8	White.	P.

* A power of 320 used. † *Ibid.*

TABLE I. (Continued.)

Year, Month and Day.	Fraction of year.	Position.	Probable error.	Computed weight.	Assigned weight.	Distance.	Assigned weight.	Magnitudes.	Colours.	Observer.
					δ Geminorum.					
1843. Apr. 5.	·257	194° 29′	10′·57	9	5·8	7″·610	5·8	3—10	White.	G.
10.	·271	195 34	79·59	0·2	0·4	8·400	0·4	3—10	White.	G.
11.	·274	194 12	9·07	12	5·2	7·614	4·9	3—9	White.	G.
1844. Mar. 29.	·241	197 58	12·35	7	5·5	7·310	5·7	3·4—11	Red.	S.
Apr. 1.	·249	198 5	13·45	6	5·2	7·468	5·5	3·4—11	Red.	S.
25.	·315	198 30	7·89	16	4·6	7·344	4·6	3·4—11	Red.	S.
1845. Oct. 31.	·830	197 54	17·95	3	5·8	7·295	5·6	3—11	Yellow and white.	P.
Nov. 12.	·862	198 30	9·14	12	5·8	7·322	5·8	3—11	Orange and light blue.	P.
1846. Apr. 9.	·268	198 42	9·19	12	5·8	7·355	5·8	3·4—10·11	Yellow and white.	P.
					Anon. Cancri.					
1843. Mar. 18.	·208	353 14	24·99	2	8·6	3·802	8·5	8—8·9	White.	W. and G.
29.	·238	354 33	5·25	36	3·6	4·580	3·6	8—8·9	White.	G.
Apr. 11.	·274	352 59	9·65	11	5·8	4·015	6·9	7—7·8	White.	G.
1844. Apr. 1.	·249	351 25	8·40	14	6·6	3·557	6·6	8·9—9·10	White.	S.
May 1.	·331	352 24	11·06	8	3	3·599	3	8·9—10	White.	S.
2.	·334	352 10	19·26	3	1·8	3·598	1·8	8·9—10	White.	S.
1845. Apr. 3.	·252	354 3	10·23	10	6	3·498	6	8·9—10	White.	P.
8.	·266	353 11	19·53	3	5·6	3·361	5·7	8·9—10	White.	P.
20.	·298	353 10	8·47	14	5	3·314	5·3	8·9—10	White.	P.
Oct. 31.	·830	351 29	11·94	7	5·9	3·563	5·7	7·8—9·10	Light blue.	P.
Nov. 12.	·862	352 5	15·23	4	6	3·617	6·1	7·8—9·10	Light blue.	P.
1848. Apr. 3.	·255	353 42	9·58	11	5·8	3·479	5·7	8—9	Deep yellow and pale yellow.	P.
					ϕ^2 Cancri.					
1843. Mar. 24.	·225	30 59	13·26	6	6·2	4·946	6	7—7	White.	G.
28.	·235	31 10	10·52	9	4	5·074	3·2	7—7	White.	G.
Apr. 20.	·298	31 54	7·44	18	6	4·930	6	5·6—5·6	White.	G.
1844. May 2.	·334	33 3	10·75	9	4·2	4·835	4·2	6·7—6·7	Reddish.	S.
5.	·342	32 52	8·56	14	4·3	4·889	4	6·7—6·7	Reddish.	S.
13.	·364	33 16	5·40	34	5	5·062	4·8	6·7—6·7	White.	S.
1845. Mar. 20.	·214	30 49	19·04	3	6	5·011	6	7—7	Yellow.	P.
24.	·225	32 15	11·54	8	6·2	4·696	5·8	7—7	Yellow.	P.
Apr. 2.	·249	33 2	11·21	8	4·8	4·779	4·1	7—7	Yellow.	P.
3.	·252	33 4	11·88	7	6·4	4·642	6·6	7—7	Yellow.	P.
Nov. 12.	·862	34 47	16·35	4	5·1	4·632	4·5	7—7	Light blue.	P.
22.	·890	33 4	11·43	8	7	4·701	6·8	7—7	Light blue.	P.
1846. Mar. 27.	·233	30 46	16·79	4	4	4·763	4	7—7	Bluish.	P.
Apr. 9.	·268	32 34	11·38	8	5	4·680	4·9	7—7	Bluish.	P.

TABLE I. (Continued.)

Year, Month and Day.	Fraction of year.	Position.	Probable error.	Computed weight.	Assigned weight.	Distance.	Assigned weight.	Magnitudes.	Colours.	Observer.
					2 Comæ Berenices.					
1843. May 2.	·331	235° 15′	38′·45	1	0·6	″3·939	0·6	6·7—8·9	White.	G.
3.	·334	237 16	14·52	5	5	4·056	5	6·7—8·9	Yellowish and white.	G.
5.	·339	238 47	19·61	3	4	3·947	4	6·7—9	White.	G.
10.	·353	237 8	14·97	5	4	3·777	4	6·7—9	White.	G.
1844. May 13.	·364	243 58	6·72	22	4·6	4·092	3·8	6·7—9	Red.	S.
23.	·392	243 31	14·43	5	4	4·129	4	6·7—8·9	Reddish.	S.
June 10.	·441	237 2	6·56	23	6·4	4·145	6	6·7—8·9	Orange.	S.
Nov. 20.	·887	237 23	10·20	10	3·6	4·043	3·6	7—9	Yellowish blue and blue.	P.
1845. May 5.	·339	238 46	19·60	3	4·2	3·990	4·2	6·7—10	Yellow and light blue.	P.
13.	·361	236 55	20·89	2	5·7	4·052	5·4	6·7—9·10	Yellow and bluish.	P.
19.	·378	236 38	17·58	3	5·8	4·066	5·7	6·7—9·10	Yellow.	P.
Nov. 22.	·890	240 25	9·44	11	4·9	3·817	4·8	7—9	White and yellowish.	P.
1846. May 7.	·345	236 20	13·73	5	1·5	3·829	1·5	7—9	White.	P.
May 8.	·348	236 42	22·49	2	4·6	3·809	4·5	7—9	White.	P.
11.	·356	236 41	12·32	7	5·9	3·795	5·6	7—9	Orange and pale blue.	P.
1847. May 26.	·397	238 10	13·91	5	5·4	3·618	5·2	6·7—8	Pale yellow and blue.	P.
1848. May 3.	·337	239 51	11·68	7	5·7	3·709	5·2	6·7—8	White and pale blue.	P.
5.	·342	239 20	17·40	3	1·7	3·868	1·5	6·7—8·9	Yellow and pale blue.	P.
12.	·361	238 28	5·60	32	4·4	3·618	3·5	6·7—8·9	Yellow and pale blue.	P.
						39 Bootis *.				
1843. Mar. *2.	·164	41 11	......	...	0·9	3·993	0·9	7—7·8	White.	W. and G.
†4.	·170	43 1	......	...	2	4·080	2	8—8·9	White.	W. and G.
6.	·175	43 18	......	...	7·6	3·951	7·8	8—8·9	White.	G.
Aug. 18.	·627	43 25	......	...	6	3·764	6	6—6·7	White.	G.
19.	·630	44 1	......	...	7	3·922	7	6—6·7	White.	G.
Sept. 4.	·674	44 3	......	...	7	3·854	7	6—7	White.	G.
						δ Serpentis *.				
1843. Aug. 1.	·580	196 8	......	...	8	3·137	8	4—5	Yellowish.	G.
7.	·597	195 37	......	...	7	3·003	7	3—4	White.	G.
10.	·605	195 1	......	...	5	2·950	5	3—4	White.	G.
1844. July 26.	·567	197 15	......	...	1·5	3·146	1·7	3—5	Yellowish and light blue.	P.
Aug. 4.	·591	192 13	......	...	4	3·718	4	3—5	Yellowish and light blue.	W. and P.
9.	·605	192 58	......	...	1·6	3·133	1·6	3—5	Yellowish and light blue.	P.
28.	·657	197 34	......	...	5	3·310	5	3—5	Yellowish and light blue.	P.
29.	·660	197 16	......	...	5	3·151	5	3—5	Yellowish and yellowish blue.	P.
1845. Feb. 13.	·118	192 18	......	...	5·4	3·185	5·2	3—5	Yellow.	P.
17.	·129	190 47	......	...	7·6	3·135	7·6	3—5	Yellow and yellowish.	P.
17.	·129	192 26	......	...	6·8	3·105	6·3	3—5	Yellow and yellowish.	P.

* A power of 320 used. † *Ibid.*

TABLE I. (Continued.)

Year, Month and Day.	Fraction of year.	Position.	Probable error.	Computed weight.	Assigned weight.	Distance.	Assigned weight.	Magnitudes.	Colours.	Observer.
1845. Aug. 7.	·597	194° 40′	′	...	5·4	″ 3·105	5·2	4·5—6	Yellow.	P.
16.	·621	194 53	......	...	5·4	2·910	5·6	4—5·6	Yellow.	P.
Aug. 28.	·654	195 20	......	...	6·6	2·990	6·6	4—6	Yellow and light blue.	P.
1846. July 25.	·561	194 35	......	...	4·9	2·829	4·6	3·4—5·6	Yellow and light blue.	P.
30.	·575	195 4	......	...	1·5	2·970	1·4	3·4—5	Yellow and pale blue.	P.
Aug. 5.	·591	194 19	......	...	4·9	2·764	4·7	3·4—5	Yellow and pale blue.	P.
1847. Mar. 10.	·186	192 41	......	...	6	2·903	5·4	3·4—5·6	Yellow and yellowish.	P.
July 29.	·572	193 32	......	...	4·9	3·021	4·4	3·4—6	Orange and pale yellow.	P.
30.	·575	193 3	......	...	4·6	2·974	4·2	3·4—5·6	Orange and yellow.	P.
Aug. 1.	·580	193 35	......	...	6·2	2·805	6·3	3·4—6	Orange and yellow.	P.
1848. Aug. 19.	·632	195 9	......	...	0·8	2·847	0·7	4·5—6·7	Yellow and pale yellow.	P.
30.	·663	196 3	......	...	4·3	2·908	4·3	4—6	Yellow.	P.
Sept. 4.	·676	195 11	......	...	4·9	2·986	4·7	4—6	Yellow and pale yellow.	P.

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Year, Month and Day.	Fraction of year.	Position.	Probable error.	Computed weight.	Assigned weight.	Distance.	Assigned weight.	Magnitudes.	Colours.	Observer.
1843. Aug. 1.	·580	7 39	7·92	16	7	12·374	7	8—8	White.	G.
7.	·597	6 49	11·65	7	5·4	11·798	5·4	8—8	White.	G.
11.	·608	8 14	8·47	14	5	12·195	5	8—8	White.	G.
1845. Feb. 14.	·120	7 15	15·12	4	3	12·232	3	8—8	Yellow and white.	P.
1847. Aug. *2.	·583	7 39	5·25	36	4·2	11·706	4·6	7·8—7·8	White.	P.
3.	·586	7 15	7·55	18	5·1	11·844	4·6	7·8—7·8	White.	P.

μ Draconis *.

Year, Month and Day.	Fraction of year.	Position.	Probable error.	Computed weight.	Assigned weight.	Distance.	Assigned weight.	Magnitudes.	Colours.	Observer.
1843. Mar. †8.	·181	15 0	......	...	0·8	2·844	0·9	7—7·8	Bluish.	W.
17.	·205	17 12	......	...	4·3	3·693	4·3	8—8	White.	G.
24.	·225	17 27	......	...	5·7	3·402	5·3	7—7·8	Bluish.	W. and G.
Aug. 22.	·638	17 47	......	...	6	3·793	6	8—8	White.	G.
26.	·649	16 36	......	...	6	3·233	6	8—8	White.	G.
26.	·649	15 19	......	...	6·1	3·271	6·1	7·8—7·8	Bluish.	W.
1844. Aug. 28.	·657	17 46	......	...	4	3·241	4	7·8—7·8	Light blue.	P.
30.	·663	16 40	......	...	5	3·238	5	7—7	Light blue.	P.
31.	·665	17 5	......	...	5	3·285	5	7—7	Light blue.	P.
Sept. 2.	·671	17 16	......	...	4·2	3·110	4·2	7—7	Light blue.	P.
1845. Aug. 24.	·643	13 16	......	...	6·1	3·202	6·1	7—7	Bluish.	P.
27.	·652	12 27	......	...	6·8	3·209	6·4	7—7	Bluish.	P.
28.	·654	12 58	......	...	7	3·199	6·9	6·7—6·7	Bluish.	P.
1846. Mar. 9.	·183	13 16	......	...	6·9	3 074	6·8	7—7	Blue.	P.
20.	·214	12 29	......	...	5·3	3·063	4·8	7—7	Blue.	P.
Sept. 1.	·665	11 36	......	...	1·8	2·943	1·7	6·7—6·7	Pale yellow.	P.
2.	·668	11 35	......	...	6·5	2·996	6·3	6·7—6·7	Yellow.	P.
4.	·674	11 52	......	...	6	3·007	5·9	6·7—6·7	Yellow.	P.
1849. Sept. 5.	·676	10 0	......	...	5·2	2·980	5·3	6—6	Yellow.	P.
8.	·684	9 24	......	...	4·6	3·023	4·2	6·7—6·7	Pale yellow.	P.

* A power of 190 used.

† The powers of 320 and 450 used.

TABLE I. (Continued.)

Year, Month and Day.	Fraction of year.	Position.	Probable error.	Computed weight.	Assigned weight.	Distance.	Assigned weight.	Magnitudes.	Colours.	Observer.
		° ′	′			″				
						100 Herculis.				
1843. Mar. 28.	·235	1 25	10·02	10	6	13·855	6	6·7—7	Bluish.	G.
Apr.* 13.	·279	0 50	18·24	3	4·5	14·471	4·2	5—5·6	Bluish.	W. and G.
18.	·293	2 6	10·87	9	5	14·508	5	6—6	Bluish.	G.
Aug.† 22.	·638	2 52	6·02	28	8	14·276	8	6—6	White.	G.
24.	·643	2 20	2·77	130	8	13·951	8	6—6	White.	G.
30.	·660	2 34	6·62	23	7	14·057	7	7—7	White.	G.
1844. Aug. 30.	·663	2 12	10·24	10	5	13·916	5	6—6	Light blue.	P.
Sept. 7.	·684	2 41	6·33	25	5·7	13·941	5·7	6—6	Bluish.	P.
10.	·693	2 38	4·44	51	5·9	14·031	5·9	6—6	Bluish.	P.
1845. Mar. 11.	·189	1 34	10·94	8	5·3	13·986	5·1	6—6	Blue.	P.
17.	·205	1 44	11·08	8	6	14·031	6	6·7—6·7	Bluish.	P.
19.	·211	1 41	13·06	6	6·3	13·858	6·3	6·7—6·7	Yellowish blue.	P.
Aug. 24.	·643	2 11	3·80	69	7	13·772	6·7	6·7—6·7	Blue.	P.
27.	·652	1 54	3·26	94	6	14·022	6	6·7—6·7	Bluish.	P.
28.	·654	2 1	4·61	47	7	13·900	6·9	6—6	Yellow.	P.
29.	·657	2 18	3·63	76	6	14·015	6	6—6	Yellow.	P.
1846. Aug. 29.	·657	2 32	6·24	26	2·3	13·944	2·4	6·7—6·7	Pale yellow.	P.
Sept. 2.	·668	2 9	6·51	24	6·1	13·893	5·8	7—7	Pale yellow.	P.
4.	·674	2 9	7·13	20	5·6	13·970	5·9	7—7	Pale yellow.	P.
1847. Mar. 18.	·208	2 45	4·73	45	5·1	13·989	5·2	6·7—6·7	Bluish.	P.
28.	·235	2 57	8·09	15	4·2	13·977	4·3	6·7—6·7	Pale yellow.	P.
Sept. 8.	·684	2 45	5·49	33	6·8	13·993	6·5	6·7—6·7	Pale yellow.	P.
27.	·736	2 10	6·00	28	6·6	13·941	6·5	6·7—6·7	Pale yellow.	P.
1848. Sept. 4.	·676	2 30	4·99	40	5·5	13·826	5·7	6·7—6·7	Yellow.	P.
16.	·709	2 25	4·61	47	6·7	13·993	6·6	6·7—6·7	Yellow.	P.
1849. Sept. 8.	·684	1 4	4·52	49	5·3	14·083	5·6	7—7	Yellow.	P.
Oct. 9.	·769	1 41	5·22	37	5·2	14·057	5·3	6·7—6·7	Yellow.	P.
						579 Struve.				
1843. Sept. 9.	·687	159 56	6·83	22	7	5·249	7	9—9	White.	G.
16.	·706	159 29	12·44	7	7	5·056	7	9—9	White.	G.
20.	·717	159 25	11·14	8	6	4·850	6	9—9	White.	G.
1844. Oct. 5.	·761	160 8	12·41	7	5·1	5·441	4·9	8—8	Bluish.	P.
7.	·767	159 28	26·85	1	3·4	5·240	3·6	8·9—8·9	Light blue.	P.
10.	·775	160 8	10·14	10	5·7	5·332	5·5	8·9—8·9	Bluish.	P.
15.	·789	159 36	14·68	5	5·9	5·299	5·6	8·9—8·9	Light blue.	P.
1845. Apr. 6.	·260	159 2	20·31	2	6·2	5·188	6	8·9—8·9	Light blue.	P.
Oct. 5.	·758	158 4	14·47	5	5·5	4·981	5·5	8·9—8·9	Bluish.	P.
11.	·775	158 44	21·23	2	5·5	5·092	5·2	8·9—8·9	Bluish.	P.
13.	·780	158 37	10·08	10	5·2	5·111	5·4	8·9—8·9	Bluish.	P.
1847. Oct. 7.	·764	159 22	13·02	6	4·5	4·875	5	8—8	White.	P.
12.	·778	159 20	16·32	4	3·3	4·976	3·1	8—8	Pale blue.	P.

* A power of 140 used.

† A power of 320 used.

TABLE I. (Continued.)

Year, Month and Day.	Fraction of year.	Position.	Probable error.	Computed weight.	Assigned weight.	Distance.	Assigned weight.	Magnitudes.	Colours.	Observer.
					287 **h** and **S.**					
1844. Oct. 5.	·761	289° 28′	19′·90	3	0·8	7″·775	0·8	7·8—9	Light blue.	P.
15.	·789	291 22	13·60	5	3·4	8·486	3·4	7·8—9	Blue and light blue.	P.
18.	·797	291 2	6·63	23	4·3	8·205	4	7·8—9	Blue and bluish.	P.
23.	·810	291 17	4·72	45	0·8	8·557	0·9	7·8—9	Blue and bluish.	P.
1845. Apr. 6.	·260	290 54	8·44	14	3·5	8·486	3·4	7·8—8·9	Bluish.	P.
Oct. 5.	·758	291 57	18·50	3	4·8	8·080	4·6	7·8—9	Whitish and bluish.	P.
11.	·775	291 37	15·61	4	4·8	8·076	4·9	7·8—9	Whitish and bluish.	P.
16.	·789	290 31	12·92	6	4·2	7·949	4	7·8—8·9	Whitish and bluish.	P.
					ε **Draconis.**					
1843. Apr. 18.	·293	357 5	24·33	2	4	3·212	5	5—10	Yellowish and bluish.	G.
19.	·296	354 19	43·84	1	3·4	2·986	3·4	4—10	Bluish and white.	W. and G.
28.	·320	355 34	43·64	1	4·2	3·060	4	4—9	White.	W. and G.
1845. Oct. 24.	·810	354 40	38·58	1	1·8	2·802	1·7	5·6—10·11	Yellow and white.	P.
25.	·813	355 18	30·57	1	5·2	2·938	5·4	5—10	Yellow and white.	P.
31.	·830	357 28	16·91	4	5·8	2·982	6·2	5—9·10	Yellow and white.	P.
Nov. 1.	·832	356 9	9·02	12	6	2·972	6	5—9·10	Yellow and white.	P.
					I of **H** 95.					
1843. May 22.	·386	336 24	26·29	1	1·2	3·380	1·2	6·7—10	White.	G.
24.	·392	338 21	15·83	4	4	3·334	4	6·7—10	White.	G.
25.	·394	336 54	14·29	5	5	3·075	5	6·7—10	White.	G.
June 5.	·424	336 33	28·04	1	4·5	3·002	4·5	6·7—10	White.	G.
Nov. 23.	·893	344 42	44·69	1	1·5	3·523	1·5	6—8	White.	W. and S.
29.	·909	341 24	9·19	12	2·5	3·480	2·4	6—8	White.	S.
Dec. 24.	·977	342 29	25·38	2	3·8	3·149	3·2	6—8	White.	S.
1844. Jan. 2.	·003	344 3	21·48	2	1·2	3·677	1·1	6—8	White.	S.
7.	·016	342 24	12·01	7	5·5	3·115	5·3	6—8·9	White.	S.
June 1.	·416	341 43	9·27	12	5	3·252	4	6—8·9	Orange and white.	S.
3.	·422	341 26	14·52	5	1·4	3·294	1·3	6·7—9	Orange and white.	S.
10.	·441	341 44	17·58	3	4·7	3·286	4·4	6·7—9	Orange and white.	S.
July 29.	·575	339 26	10·39	9	3·2	3·085	3·2	6·7—9	Bluish white.	P.
Aug. 4.	·591	338 12	12·65	6	4·2	3·065	4·2	6·7—9	Bluish white.	P.
14.	·619	341 42	12·49	6	4·4	3·230	4	6·7—9	Bluish and light blue.	P.
24.	·646	341 27	24·86	2	2·4	3·113	2·4	6·7—9	Bluish white.	P.
Nov. 21.	·890	340 16	16·77	4	6·7	3·069	6·7	6·7—9	Bluish white.	P.
25.	·901	339 36	15·45	4	7	3·125	7·5	6·7—9	Bluish white.	P.
26.	·903	340 27	11·75	7	5·8	3·155	5·7	6·7—9	Bluish white.	P.
1845. Oct. 31.	·830	342 36	11·32	8	7	3·179	6·9	7—9	Light blue.	P.
Nov. 3.	·838	339 55	14·47	5	5·2	3·162	5·3	7—9	Bluish.	P.
4.	·841	342 26	22·19	2	4·3	3·163	4·2	7—9	Bluish.	P.
1846. May 10.	·353	342 23	10·17	10	4·8	3·115	4·9	7—9	Pale yellow and pale blue.	P.
29.	·405	342 12	13·47	6	6·7	3·010	6·6	7—9	Pale yellow and pale blue.	P.
Oct. 30.	·827	340 51	12·59	6	4·1	3·049	3·5	7—8·9	Pale yellow and pale blue.	P.

Table I. (Continued.)

Year, Month and Day.	Fraction of year.	Position.	Probable error,	Computed weight.	Assigned weight.	Distance.	Assigned weight.	Magnitudes.	Colours.	Observer.
					P XXII 306 *.					
1843. June 25.	·479	143 2	......	...	6	″ 8·467	6	6·7—9	White.	G.
July 3.	·501	143 56	......	...	6	8·353	6	6·7—9	White.	G.
6.	·509	144 17	......	...	5·5	8·461	5·5	6·7—9	White.	G.
Dec. 17.	·958	145 46	......	...	4·1	8·521	3·5	6·7—8·9	White.	S.
1844. Jan. 11.	·027	145 34	......	...	4·5	8·618	4·2	6·7—9	Reddish and white.	S.
13.	·033	144 13	......	...	4·9	8·788	4·7	6·7—9	White.	S.
Nov.* 27.	·906	146 0	......	...	6·4	8·670	6·5	7—9	Blue.	P.
1846. Dec. 14.	·950	146 18	......	...	1·1	8·350	1·3	8—10	Pale yellow and pale blue.	P.
22.	·972	146 3	......	...	4·1	8·335	3·8	7·8—9	Yellow and pale blue.	P.
1847. Dec. 28.	·988	146 16	......	...	1·7	8·024	1·7	7·8—9	Whitish and pale blue.	P.
1848. Dec. 21.	·972	145 37	......	...	4·6	8·251	4·7	7·8—9·10	Yellow and pale blue.	P.

The Second Table.—This table contains the means of all the results obtained at the same period of each year, when observations have been obtained on two or more days.

The *second column* contains the mean epoch of the results from which the means are formed.

The positions in the *third column* are computed in the ordinary mode by multiplying each individual set by its computed weight as contained in the fifth column of Table I., adding the products, and dividing by the sum of all the weights.

The *fifth column* contains the sum of the computed weights of the individual sets, from which the probable error of the mean in the preceding column is calculated from the equation

$$P=\frac{1}{\sqrt{W}}.$$

The computed weights inserted in the Tables have been multiplied by 1000.

The mean distances in the *seventh column* are computed in the same manner, using, however, the arbitrary or assigned weights in column 8 of Table I., instead of weights computed as above explained; for it was not deemed necessary, for reasons which will appear in the sequel, to apply the calculus of probabilities to the reduction of any of the observations of the distances.

The quantities in the *sixth and eighth* columns, headed "Assigned weight," are the sums of the weights assigned to the individual sets, from which each mean is formed.

* A power of 190 used.

In the case of the four binary stars, to which an asterisk is attached in the Tables, the means, both of the positions and the distances, given in this table are obtained by employing the assigned or arbitrary weights, as before described.

In deference to the objections which may be urged to this mode of reduction, I had originally intended to use the common arithmetical mean in all these cases; but out of fifty-four means of positions computed strictly by the usual formulæ, and compared with means obtained as last described, and also with the arithmetical means of the same quantities, it was found that the mean obtained by using the arbitrary weights differed only in thirteen cases more than 9′ from the strict mean, and that in eight out of the thirteen cases, the result was rendered more erroneous by using the arithmetical mean, instead of the mean derived from the use of arbitrary weights: there were seven cases out of the fifty-four in which the computed and arbitrary weights gave precisely the same result.

TABLE II.

Name.	Fraction of year.	Position.	Probable error.	Computed weight.	Assigned weight.	Distance.	Assigned weight.
γ **Arietis.**	1843. ·576	179° 10′	7′·33	19	20	9″·078	20
	1844. ·069	179 42	7·54	18	9	8·957	9
	1845. ·083	180 38	5·92	29	15	8·816	15
	1847. ·080	178 14	5·89	29	12	8·773	12
	1847. ·608	178 51	6·55	23	12	8·717	12
32 **Eridani.**	1843. ·661	345 50	4·59	48	21	6·881	21
	1845. ·119	350 55	6·04	27	17	6·800	17
ω **Aurigæ.**	1843. ·706	350 26	6·84	21	21	6·436	21
	1844. ·748	351 22	7·76	17	19	6·607	19
	1845. ·734	351 16	10·60	9	9	6·283	9
	1846. ·188	350 37	6·77	22	15	6·400	16
	1847. ·209	351 17	10·66	9	8	6·263	8
	1848. ·248	351 58	7·65	17	11	6·231	10
118 **Tauri.**	1843. ·732	196 38	4·93	41	14	4·739	14
	1844. ·225	195 38	4·10	59	13	5·012	13
	1844. ·737	194 45	6·10	27	15	5·124	14
	1845. ·184	193 58	6·73	22	21	4·951	21
	1846. ·169	195 31	6·13	27	9	5·034	9
41 **Aurigæ.**	1843. ·163	353 54	7·69	17	16	8·290	15
	1843. ·685	353 56	4·07	60	21	7·873	21
	1845. ·188	351 52	5·17	37	24	7·899	24
	1846. ·169	351 51	7·13	20	12	7·885	12
	1847. ·189	352 58	6·51	24	12	7·880	11
	1848. ·248	353 11	4·14	58	12	7·860	12
δ **Geminorum.**	1843. ·267	194 24	6·62	23	11	7·640	11
	1844. ·268	198 18	5·96	28	15	7·375	16
	1845. ·846	198 23	8·14	15	12	7·309	11
Anon. Cancri.	1843. ·240	354 10	4·53	49	18	4·027	19
	1844. ·305	351 49	6·31	25	11	3·575	11
	1845. ·272	353 30	6·19	26	17	3·395	17
	1845. ·846	351 43	9·41	11	12	3·591	12
φ^2 **Cancri.**	1843. ·253	31 32	5·40	33	16	4·967	15
	1844. ·347	33 8	4·20	57	14	4·935	13
	1845. ·235	32 34	6·29	25	23	4·779	23
	1845. ·876	33 37	9·37	11	12	4·674	11
	1846. ·251	32 0	9·45	11	9	4·717	9
2 **Comæ Berenices.**	1843. ·339	237 25	8·94	13	14	3·937	14
	1844. ·399	240 42	4·46	50	15	4·126	14
	1845. ·359	237 24	11·11	8	16	4·040	15
	1846. ·350	236 33	8·48	14	12	3·805	12
	1848. ·347	238 46	4·85	43	12	3·701	10
39 **Bootis** *.	1843. ·170	43 4	......	......	11	3·979	11
	1843. ·644	43 51	......	......	20	3·851	20
δ **Serpentis** *.	1843. ·594	195 40	......	......	20	3·043	20
	1844. ·616	195 46	......	......	17	3·326	17
	1845. ·125	191 46	......	......	20	3·139	19
	1845. ·624	194 59	......	......	17	2·999	17
	1846. ·576	194 32	......	......	11	2·819	11
	1847. ·576	193 25	......	......	16	2·916	15
	1848. ·657	195 33	......	......	10	2·941	10

Table II. (Continued.)

Name.	Fraction of year.		Position.	Probable error.	Computed weight.	Assigned weight.	Distance.	Assigned weight.
178 (**Bode**) **Libræ.**	1843.	·595	7° 42′	5′·19	37	17	12″·144	17
	1847.	·585	7 31	4·31	54	9	11·775	9
μ **Draconis** *.	1843.	·204	17 2	......	......	11	3·521	11
	1843.	·645	16 34	......	......	18	3·431	18
	1844.	·664	17 10	......	......	18	3·222	18
	1845.	·650	12 53	......	......	20	3·203	19
	1846.	·199	12 56	......	......	12	3·069	12
	1846.	·669	11 42	......	......	14	2·994	14
	1849.	·680	9 43	......	......	10	2·999	10
100 **Herculis.**	1843.	·269	1 36	6·82	22	16	14·240	15
	1843.	·647	2 27	2·35	181	23	14·096	23
	1844.	·680	2 36	3·43	85	17	13·965	17
	1845.	·202	1 39	6·68	22	18	13·955	17
	1845.	·652	2 6	1·87	286	26	13·922	26
	1846.	·666	2 18	3·81	69	14	13·934	14
	1847.	·222	2 48	4·08	60	9	13·984	10
	1847.	·710	2 29	4·05	61	13	13·967	13
	1848.	·693	2 27	3·39	87	12	13·916	12
	1849.	·727	1 20	3·42	86	11	14·070	11
579 **Struve.**	1843.	·703	159 44	5·26	36	20	5·062	20
	1844.	·773	159 59	6·71	22	20	5·333	20
	1845.	·771	158 28	7·72	17	16	5·060	16
	1847.	·771	159 21	10·15	10	8	4·914	8
287 **h** and **s.**	1844.	·789	291 9	3·64	76	9	8·307	9
	1845.	·774	291 11	8·77	13	14	8·040	14
ε **Draconis.**	1843.	·303	356 17	19·25	3	12	3·101	12
	1845.	·821	356 18	7·54	18	19	2·951	19
I of H 95.	1843.	·399	337 18	9·29	12	15	3·148	15
	1843.	·960	342 6	6·58	23	15	3·279	14
	1844.	·530	340 40	4·82	43	25	3·187	24
	1844.	·898	340 10	8·17	15	20	3·115	20
	1845.	·836	341 42	8·25	15	17	3·169	16
	1846.	·379	342 19	8·11	15	12	3·055	12
P XXII 306*	1843.	·496	143 44	......	......	18	8·420	18
	1844.	·006	145 8	......	......	14	8·655	12
	1846.	·961	146 6	......	......	5	8·339	5

The Third Table.—This Table contains the general means of all the observations of each star, both in position and distance, reduced to the mean epoch of all the observations, which will be found in *column three.*

The positions in *column four*, and the probable errors and weights in *columns five and six,* are obtained by combining the means and individual sets (where one set only has been obtained at any one period) in accordance with the theory of probabilities, as above mentioned, except in the case of the four binary stars, in which the arbitrary weights are substituted for computed ones, as before explained.

Where two stars are supposed to be of equal brightness, it has been usual to register always the smaller of the two angles, by which the position may be designated, according as the one or the other component be considered as the larger star.

In these cases there is some confusion as to the identity of the two stars, which might be obviated by astronomers agreeing always to designate the northern, or in cases of equal N.P.D., the east star as A.

The *seventh and ninth* columns contain the sums of the assigned or arbitrary weights.

The *eighth column* contains the mean of all the observed distances, obtained in all cases by using the arbitrary weights.

The *tenth column* contains the mean of all the registered magnitudes of each component star, the first No. referring to the brightest of the two components, or in cases of equal brightness, to the star called A.

The *eleventh and twelfth* columns contain the R.A. and N.P.D. of each star, taken from the B. A. C.; and when the star is not found in that Catalogue, from Struve's of 1837.

The *thirteenth column* contains the total number of individual measures in position; the number of measures in distance being equal in every case, except one, that is specified, one column suffices for both position and distance.

In the notes will be found notices of any remarkable differences between the measures contained in this Table, and those given by Struve in his Catalogue of 1837:—they are confined to differences exceeding 1° in position, and 0″·200 in distance.

TABLE III.

No.	Name.	Mean epoch.		Position.		Probable error.	Computed weight.	Assigned weight.	Distance.	Assigned weight.	Magnitudes.	R.A.		N.P.D.		n.
				°	′	′			″			h	m	°	′	
1	γ Arietis[a]	1845.	·483	179	18	2·93	117	68	8·887	68	5·3— 5·3	1	45	71	27	118
2	32 Eridani	1846.	·220	347	37	2·90	119	49	6·803	49	6·5— 8·2	3	47	93	24	86
3	ω Aurigæ	1846.	·434	351	5	3·14	102	89	6·401	88	7·3— 9·7	4	49	52	21	154
4	118 Tauri[b]	1844.	·962	195	27	2·35	182	79	4·955	78	7·6— 9·1	5	20	64	59	150
5	41 Aurigæ	1845.	·607	353	5	2·15	216	95	7·947	95	7·6— 8·7	6	0	41	16	162[o]
6	δ Geminorum[c]	1844.	·912	197	14	3·58	78	44	7·422	44	3·2—10·5	7	11	67	45	82
7	Anon. Cancri[d]	1845.	·384	353	16	2·86	122	64	3·655	65	8·1— 9·3	7	56	62	3	113
8	φ² Cancri[e]	1844.	·992	32	36	2·70	137	74	4·823	71	6·8— 6·8	8	18	62	35	137
9	2 Comæ Berenices[f]	1845.	·746	239	4	2·60	148	82	3·916	78	6·6— 8·8	11	57	67	42	166
10	39 Bootis ✱[g]	1843.	·407	43	35	...	...	31	3·896	31	6·8— 7·4	14	45	40	40	46
11	δ Serpentis ✱[h]	1846.	·119	194	21	...	...	117	3·042	115	3·5— 5·3	15	28	78	57	215
12	178 (Bode) Libræ[i]	1845.	·433	7	34	3·24	95	30	12·038	30	7·8— 7·8	15	29	98	10	56
13	μ Draconis ✱[k]	1845.	·673	14	15	...	...	103	3·217	101	7·0— 7·1	17	2	35	20	184
14	100 Herculis	1846.	·247	2	14	1·02	959	158	14·005	158	6·4— 6·4	18	2	63	55	260
15	579 Struve	1845.	·456	159	29	3·39	87	70	5·131	70	8·5— 8·5	18	31	48	49	124
16	287 h and s[l]	1845.	·274	291	7	3·12	103	27	8·192	26	7·5— 8·9	18	58	83	7	56
17	ε Draconis[m]	1844.	·562	356	18	7·02	20	30	3·010	32	4·8— 9·8	19	49	20	7	64
18	I of H 95	1845.	·118	340	53	2·78	129	106	3·157	103	6·5— 8·8	20	14	35	9	211
19	P XXII 306 ✱[n]	1846.	·055	144	56	...	...	49	8·475	48	7·0— 9·1	22	59	58	7	96

[a] γ Arietis. Distance, Σ—W = −0″·256, period elapsed = 14·64 years.
[b] 118 Tauri. Position, Σ—W = +1° 20′, period = 15·33 years.
[c] δ Geminorum. Distance, Σ—W = −0″·277, period = 15·19 years.
[d] Anon. Cancri. This star is erroneously termed 11 Cancri in HERSCHEL and SOUTH's Catalogue. See SMYTH's Cycle: it is 2688 B.A.C.
[e] φ² Cancri. Distance, Σ—W = −0″·260, period = 15·54 years.
[f] 2 Comæ Berenices. Position, Σ—W = +1° 33′, period = 16·21 years.
[g] 39 Bootis. Comparing the place of this star in position with that given by HERSCHEL and SOUTH and by STRUVE, its mean yearly motion by

Sh—W = −4′·39, period = 20·48 years.
Σ—W = −2′·39, period = 13·39 years.

Mean = −3′·39

[h] δ Serpentis. Comparing the place of this star in position with that given by HERSCHEL and SOUTH and by STRUVE, its mean yearly motion by

Sh—W = −12′·18, period = 24·80 years.
Σ—W = −13′·49, period = 13·05 years.

Mean = −12′·84
Distance, Σ—W = −0″·380

[i] 178 (Bode) Libræ. Distance, Σ—W = −0″·225, period = 14·89 years.
[k] μ Draconis. The mean yearly motion of this star in position by

Sh—W = −35′, period = 24·30 years.
Σ—W = −49′, period = 13·45 years.

Mean = −42′

[l] 287 h and s. Position, Σ—W = +1° 13′, period = 15·47 years.
[m] ε Draconis. Position, Σ—W = −1° 46′ } period = 12·12 years.
Distance, Σ—W = −0″·220 }
[n] P XXII 306. The mean yearly motion of this star in position by

Sh—W = −9′·10, period = 22·31 years.
Σ—W = −4′·78, period = 15·47 years.

Mean = −6′·94

[o] The measures of distance are one less in number than those of position in the case of this star.

The Fourth Table.—This Table has been formed for the purpose of exhibiting the results from which, in conformity with the principles explained by Sir JOHN HERSCHEL, the existence or non-existence of parallax in the stars observed must be inferred.

These results are the differences between two angles of position, the one observed at one period of the year, say the early one, and the other at another period (the late) distant from the former about six months.

For reasons which will appear hereafter, it has not been deemed necessary to include the distances in this table.

In so delicate an inquiry as that of parallax, it may not perhaps be considered a legitimate course to pursue, to compare any results except those distant from one another by an interval of about six months, or in other words, results which follow one another immediately at opposite seasons. It is on differences so obtained that many therefore may be disposed to rely exclusively in discussing the questions raised by this investigation; and such differences, when furnished by the observations, are accordingly placed first in the table; but it is in truth only a choice of difficulties; it has been found impossible in the case of some of the stars to obtain such differences at all; and in others, the observations are so few, and their weight consequently so small, at one at least of the periods compared, that little reliance can be placed on the results; it has been thought better therefore to combine in the case of each star, and in the manner already explained, all the observations made in all the years at the early period into one mean result, and all those made at the late period into another, and to insert their difference, leaving it to astronomers to attach whatever importance to the comparison they may think due to it. This difference follows in every case the more legitimate comparisons at intervals of six months.

The four binary stars are excluded from this Table.

The *second column* of this fourth Table contains the mean epoch:—in the case of the *final* means, that is, the means of all the *early* and all the *late* periods, the decimal, following an enumeration of several years, is the mean of all the decimals attached to the years of the individual means or sets, from which the final means are formed.

The *third column* contains the positions, obtained by using the computed weights of the results employed, as before explained.

The *fourth* and *fifth columns* contain the probable errors and weights of these positions.

The *sixth column* contains the differences between the positions, which follow one another in succession, and which have been obtained at opposite periods of the year; or, in other words, the quantity, on which parallax depends, and to which the subjoined remarks on the results of the observations refer.

The *plus* sign is attached to the difference when the change in the angle takes place in that direction, which is in conformity with the hypothesis of a parallax in the stars observed; and the *minus* sign when the change is in the contrary direction.

The *eighth column* contains the weight of the difference computed from the formula

$$W''=\frac{WW'}{W+W'},$$

where W and W′ are the weights of the two positions compared, and W″ the weight of their difference:—from the value of W″ so obtained, that of the probable error of the difference, inserted in the *seventh column*, is computed by the above equation.

The *ninth column* contains the distance, taken from the third Table to the first place of decimals.

All the computations have been very carefully examined.

Table IV.

Name.	Epoch.		Position.	Probable error.	Weight.	Difference.	Probable error of Δ.	Weight of Δ.	Distance.
			° ′	′		′	′		″
γ **Arietis.**	1843.	·576	179 10	7·33	19	− 32	10·52	9	8·9
	1844.	·069	179 42	7·54	18				
	1847.	·080	178 14	5·89	29	+ 37	8·81	13	
	1847.	·608	178 51	6·55	23				
	1843, 7.	·592	178 59	4·89	42	− 30	6·10	27	
	1844, 5, 7.	·077	179 29	3·65	75				
32 **Eridani.**	1843.	·661	345 50	4·59	48	+178	5·92	29	6·8
	1845, 6, 7, 9.	·110	348 48	3·74	72				
ω **Aurigæ.**	1845.	·734	351 16	10·60	9	− 39	12·58	6	6·4
	1846.	·188	350 37	6·77	22				
	1843, 4, 5.	·729	350 55	4·62	47	+ 18	6·30	25	
	1846, 7, 8, 9.	·213	351 13	4·28	55				
118 **Tauri.**	1843.	·732	196 38	4·93	41				5·0
	1844.	·225	195 38	4·10	59	+ 60	6·42	24	
	1844.	·737	194 45	6·10	27	− 53	7·35	19	
	1845.	·184	193 58	6·73	22	+ 47	9·08	12	
	1845.	·723	193 23	13·62	5	− 35	15·18	4	
	1846.	·169	195 31	6·13	27	−128	14·93	5	
	1843, 4, 5.	·731	195 42	3·69	73	+ 26	4·78	44	
	1844, 5, 6.	·193	195 16	3·04	108				
41 **Aurigæ.**	1843.	·163	353 54	7·69	17	− 2	8·22	15	7·9
	1843.	·685	353 56	4·07	60				
	1843, 5, 6, 7, 8.	·191	352 45	2·53	156	− 71	4·79	44	
	1843.	·685	353 56	4·07	60				
δ **Geminorum.**	1845.	·846	198 23	8·14	15	− 19	12·29	7	7·4
	1846.	·268	198 42	9·19	12				
	1843, 4, 6.	·268	196 58	3·99	63	+ 85	9·06	12	
	1845.	·846	198 23	8·14	15				
Anon. Cancri.	1845.	·272	353 30	6·19	26	+107	11·26	8	3·7
	1845.	·846	351 43	9·41	11				
	1843, 4, 5, 8.	·268	353 26	3·00	111	+103	9·88	10	
	1845.	·846	351 43	9·41	11				

Table IV. (Continued.)

Name.	Epoch.	Position.	Probable error.	Weight.	Difference.	Probable error of Δ.	Weight of Δ.	Distance.
		° ′	′		′	′		″
φ^2 **Cancri.**	1845. ·235	32 34	6·29	25	− 63	11·28	8	4·8
	1845. ·876	33 37	9·37	11	− 97	13·30	6	
	1846. ·251	32 0	9·45	11				
	1843, 4, 5. ·278	32 30	2·82	126	− 67	9·78	11	
	1845. ·876	33 37	9·37	11				
2 **Comæ Berenices.**	1844. ·399	240 42	4·46	50	−199	11·14	8	3·9
	1844. ·887	237 23	10·20	10	− 1	15·09	4	
	1845. ·359	237 24	11·11	8	+181	14·59	5	
	1845. ·890	240 25	9·44	11	+232	12·70	6	
	1846. ·350	236 33	8·48	14				
	1843, 4, 5, 6, 7, 8. ·365	239 4	2·80	127	− 3	7·48	18	
	1844, 5. ·889	239 1	6·93	21				
178 (**Bode**) **Libræ.**	1843, 7. ·590	7 35	3·32	91	+ 20	15·44	4	12·0
	1845. ·120	7 15	15·12	4				
100 **Herculis.**	1843. ·269	1 36	6·82	22	+ 51	7·21	19	14·0
	1843. ·647	2 27	2·35	181				
	1844. ·680	2 36	3·43	85	− 57	7·51	18	
	1845. ·202	1 39	6·68	22	+ 27	6·94	21	
	1845. ·652	2 6	1·87	286				
	1846. ·666	2 18	3·81	69	− 30	5·58	32	
	1847. ·222	2 48	4·08	60	− 19	5·75	30	
	1847. ·710	2 29	4·05	61				
	1843, 5, 7. ·231	2 18	3·10	104	− 4	3·28	93	
	1843, 4, 5, 6, 7, 8, 9. ·682	2 14	1·08	855				
579 **Struve.**	1844. ·773	159 59	6·71	22	− 57	21·49	2	5·1
	1845. ·260	159 2	20·31	2	+ 34	21·82	2	
	1845. ·771	158 28	7·72	17				
	1843, 4, 5, 7. ·755	159 30	3·43	85	− 28	20·70	2	
	1845. ·260	159 2	20·31	2				
287 **h** and **s.**	1844. ·789	291 9	3·64	76	+ 15	9·20	12	8·2
	1845. ·260	290 54	8·44	14	+ 17	12·18	7	
	1845. ·774	291 11	8·77	13				
	1844, 5. ·782	291 9	3·36	89	+ 15	9·10	12	
	1845. ·260	290 54	8·44	14				
ε **Draconis.**	1843. ·303	356 17	19·25	3	+ 1	20·67	2	3·0
	1845. ·821	356 18	7·54	18				
I of **H** 95.	1843. ·399	337 18	9·29	12	+288	11·38	8	3·2
	1843. ·960	342 6	6·58	23	+ 86	8·15	15	
	1844. ·530	340 40	4·82	43	− 30	9·48	11	
	1844. ·898	340 10	8·17	15				
	1845. ·836	341 42	8·25	15	− 37	11·57	8	
	1846. ·379	342 19	8·11	15	− 88	14·98	5	
	1846. ·827	340 51	12·59	6				
	1843, 4, 6. ·436	340 28	3·78	70	+ 55	5·59	32	
	1843, 4, 5, 6. ·880	341 23	4·11	59				

Results of the observations.

Distances.—In discussing the results of the observations, little need be said of the measures of distance: it was impracticable, consistently with the due prosecution of the more important task of measuring the angles, to take these measures of distance at shorter intervals, and at the epochs proper for eliminating the changes, if any, due to parallax: the small differences between the measures taken at opposite seasons must be ascribed to errors of observation.

The following Table exhibits these differences; it contains the means of the measures of distance obtained at the early and late periods, with the sums of the assigned weights used in the reduction, and which means correspond, in respect to epoch, with the *final* means of the angles contained in the fourth Table; the mean epochs themselves therefore have been already given in that Table.

The four binary stars are excluded from the following Table.

TABLE V.

Name.	Mean distance.	Assigned weight.	Δ.	Name.	Mean distance.	Assigned weight.	Δ.
γ Arietis	″ 8·943 8·838	32 36	·105	2 Comæ Berenices	″ 3·917 3·914	69·7 8·4	·003
32 Eridani	6·881 6·745	21 27·9	·136	178 (Bode) Libræ	12·016 12·232	26·6 3·0	·216
ω Aurigæ	6·474 6·309	49·2 39·1	·165	100 Herculis	14·064 13·983	42·1 115·5	·081
118 Tauri	4·915 4·987	34·7 42·9	·072	579 Σ	5·126 5·188	63·8 6·0	·062
41 Aurigæ	7·967 7·873	74·5 20·5	·094	287 h and s	8·148 8·486	22·6 3·4	·338
δ Geminorum	7·461 7·309	32·7 11·4	·152	ε Draconis	3·101 2·951	12·4 19·3	·150
Anon. Cancri	3·669 3·591	53·1 11·8	·078	I of H 95	3·145 3·168	49·7 53·3	·023
φ^2 Cancri	4·851 4·674	59·6 11·3	·177				

Angles of position.—In the discussion of the measures of position, it must be remembered that four of the stars observed, viz. 39 Bootis, δ Serpentis, μ Draconis, and P XXII 306, exhibit differences in their mean positions, as compared with those given by other observers, of an amount sufficient to induce the belief that they are binary systems: the observations of these stars may therefore be at once dismissed with the remark, that they are useless for the purposes of this inquiry. Again, in the case of five other stars, viz. γ Arietis, φ^2 Cancri, 178 (Bode) Libræ, 100 Herculis and 579 Struve, the components are of equal magnitude, and parallax is in this case not only *à priori* highly improbable, but there is nothing in the actual observations themselves of these stars, which can lead us to any definite conclusion as to its existence in fact. It is proper, however, to direct attention to the large differences in the case of φ^2 Cancri, accordant in respect of sign.

In order to arrive at any decision on the question, whether the changes in the angles of position of the remaining stars, exhibited in the sixth column of the fourth

Table headed "Difference," should induce us to suspect the existence of a sensible parallax in any of the objects observed, two points are to be considered,—first, the *amount* of those changes, as compared with the probable error of the results themselves; and secondly, their *direction*, considered with reference to the motion of the earth in her orbit.

As to the first point, it would appear, that except the change observed bear a very large proportion to the probable error of the determination, it may be justly treated with little respect, so far as the evidence to be derived from *amount* only be concerned.

This conclusion is supported, first, by the great discordances between the partial differences, in the instances of the three stars, 118 Tauri, 100 Herculis, and I of H 95, the only objects that can be said to have been satisfactorily observed, if the delicate nature of the investigation be considered.

2ndly. These discordances are the more remarkable, when we view them in connection with the large ratios which some of the differences bear to their probable errors. Indeed a bare inspection of the measured angles of position given in Table I. in connexion with the computed weights and errors, will convince us that the differences of the results obtained on different evenings are greater in many instances than those of the separate measures obtained on the same evening. This circumstance, which, it is believed, is not unfrequent in observations requiring the same delicacy of estimation as those under consideration, renders the application of the calculus of probabilities embarrassing and its conclusions uncertain. It is certain, in fact, that in the greater number of instances given in this paper, the computed probable errors of the results on which the parallaxes depend, form no probable criterion of the magnitude or even of the existence of parallax. The only probable explanation that can be given in such cases, where purely instrumental errors can scarcely have place, must arise from an unsuspected bias of the observer in the selection of the line of direction passing through the centres of the stars, which causes an estimation constant on the same evening, but differing on different nights. The weight of each evening's result, calculated according to the amount of discordance of the individual measures, may still be an adequate representative of the degree of dependence to be placed on it, as far as the steadiness of the atmosphere and other favourable circumstances are concerned; but the probable errors of combined and final results, calculated on ordinary principles, will not form a good criterion of the accuracy of such results. Supposing, however, the bias of the observer on different evenings likely to be as often in excess as in defect, or not to be of the nature of a constant error, a better estimation of the probable error of the final means would be obtained by considering each evening's set of measures as a single result without regard to their number, and then comparing the separate results in the usual way*. If the results in the present paper had been of a more positive character, a re-reduction of some of them on this principle might have been desirable, but as the case stands this explanation is sufficient. It is proper to add, that I have no reason to

* Putting p for the probable error of 10 *sets* of 118 Tauri for the early period, treated as *individual* measures, and p' for the mean of the probable errors, as given in Table I., of the same sets, $p : p' :: 24 : 15$. In the case of 10 sets of I of H 95 for the late period, $p : p' :: 11 : 9$.

believe, that a single *individual* measure, either in position or distance, however discordant, has been ever rejected on that or any other ground; but all *sets* containing less than four measures have been invariably rejected.

It would seem, then, that though, in one point of view, comparisons at opposite seasons must be treated as possessing value, yet we are after all driven to rely in a great measure on the final means; for notwithstanding the well-founded objections that may be urged to combining observations made in different years, the discordances above alluded to show, that a greater number of measures are required to eliminate error, than can possibly be obtained in any one, or even two years.

Now if we examine the final means of the two periods in Table IV., we shall find five stars only, viz. 32 Eridani, 41 Aurigæ, δ Geminorum, Anon. Cancri, and I of H 95, of which we can affirm that they have any pretensions whatever to be considered as fulfilling the condition above stated:—with respect to δ Geminorum and Anon. Cancri, the small weights of the results of the late period render any conclusions drawn from them extremely liable to doubt: this is the more to be regretted, in the case of the last-mentioned star, inasmuch as the smallness of the distance of its components renders it a very eligible object for observation.

When however we examine the results obtained with reference to the *direction* of the changes observed, they seem to be entitled to rather more consideration.

In the *nf* and *np* quadrants an apparent motion to the westward of the larger star, assumed to be the nearest to the earth, must increase the angle of position, and in the *sf* and *sp* quadrants the contrary effect must take place:—therefore at that epoch of observation when the sun is to the west, and therefore the earth to the east, of the star observed, the *maximum* angle may be expected to occur in the two first named quadrants, and the *minimum* in the others; in the case of double stars, whose components are equal, it is plain that two different conclusions may be drawn from the periods at which the maxima occur, according as the one or the other be taken as the nearest star.

Omitting therefore the five stars, whose components are of equal magnitude, omitting also the four binary stars, and 2 Comæ Berenices and ε Draconis (which exhibit differences less than their probable errors), this interesting result appears, that of the eight that remain, there is only one, that is, 41 Aurigæ, the changes in whose angles, however small and little entitled to confidence they may be, do not conform in direction to those, which would take place, were a sensible parallax admitted in the brighter of the stars themselves.

This is most probably only an accidental coincidence, and I am very far from wishing to estimate it at more than its real worth; but in the case of 32 Eridani and I of H 95, where large, and to a certain extent trustworthy, differences concur with normal directions of motion, it may not perhaps be too much to assert, that this constitutes them objects of interest to the astronomer, possessed of adequate means to prosecute an inquiry, which, I fear, I must be said rather to have attempted than to have succeeded in.

Wrottesley, October 22, 1850.