LIST VI.—*continued.*

N.G.C. Numbers of Clusters classed as Globular, not in Bailey's Catalogue.

136	1697	3041	6101	6553
288	1782	3603	[6221]	6558
[628]	1854	4027	6256	6569
843	1902	4147	6287	6638
1310	2090	4372	6316	6934
1379	2098	5634	6362	6981
1387	2118	5897	[6412]	7099
1436	2298	5927	6522	7214
1512	2537	5946	6528	

Cambridge Observatory:
1911 *June* 9.

Observations of α Orionis by the late Joseph Baxendell, F.R.S.; together with the Magnitudes deduced from the Observations of Sir J. Herschel and of Argelander. Edited by H. C. Plummer, M.A.

1. The circumstances under which the following observations are now published may be briefly related. The known variability of α Orionis, which was discovered by Sir John Herschel,* was brought into general notice by the marked increase of brightness which occurred in the autumn of 1902. Bearing this in mind, I wished, during my stay at the Lick Observatory in 1907–8, to ascertain whether the radial velocity of the star was constant, or whether it showed changes associated with the changes in the luminosity of the star, as appears to be the case always with certain classes of variable stars. Facilities were kindly given by Dr. Campbell, and the results were published.† Changes in the radial velocity were quite clearly suggested, but with regard to their nature, and still more with regard to their period, nothing could with certainty be inferred.

Quite recently Herr Bottlinger ‡ has added other observations made at the Cape and at Potsdam, and from the combined material has deduced a period of six years, and finds the data consistent with the hypothesis that α Orionis is a spectroscopic binary. On the probability that this view is correct I can express no opinion. The changes apparent in the observed velocity are small, and the question is not altogether an easy one.

But the mere suggestion of a period of this kind makes it

* *Memoirs R.A.S.*, xi. p. 269.
† *Publ. Astr. Soc. Pac.*, x. p. 227.
‡ *A.N.*, 4467.

desirable to find whether a similar periodicity can be traced in the light-fluctuations of the star. A series of observations of α Orionis extending over more than forty years was made by the late Mr. Baxendell, and this unpublished material had been placed in the hands of Professor Turner, among a large amount of similar work on a considerable number of variables. The observations relating to α Orionis, extracted from Mr. Baxendell's ledgers, were most kindly put at my disposal by Professor Turner. They were made at Manchester until 1871, and at Southport from this date onwards.

2. The comparison stars used by Baxendell are few in number, and are given in the following list, with the designations here adopted for the sake of brevity, the magnitude taken from the Revised Harvard Photometry, and the spectral type.

Star.	Designation.	Mag.	Type.
α Aurigæ	A	0·21	G
β Orionis	B	0·34	B8p
α Can. Min.	C	0·48	F5
α Tauri	D	1·06	K5
α Orionis	X	...	Ma

Even of these, Capella occurs only in the first observation. Subsequent comparisons were rarely made with more than a single pair of stars, of which one was nearly always Aldebaran. Under these circumstances it is not possible to deduce from the observations any system of corrections to the magnitudes assigned above. A thorough discussion of the accuracy of the observations from internal evidence is thus out of the question; but there is no reason to doubt that the observer's skill and experience enabled him to reach the utmost accuracy attainable with the simple method adopted.

3. Up to the year 1854 the sequences (which are set down throughout in the order of decreasing brightness) are expressed in the notation * of Sir W. Herschel. As punctuation marks do not readily convey a quantitative meaning, numbers enclosed within brackets have been substituted according to the following scheme :—

"Simple Characters."

(0) . "Equality."
(1) , "The least perceptible difference more bright" (than).
(2) — "A very small difference more bright" (than).
(3) —, "A small difference more bright" (than).
(4) — — "A considerable difference more bright" (than).

"Compound Characters, expressing the Wavering of Star Light" between the above steps, are given in Herschel's notation

* *Phil. Trans.*, vol. 205, A, p. 400.

by writing the corresponding symbols one above the other. They are here expressed by writing the corresponding *numbers* in the same bracket. Thus, for example, (23) stands for [=,], and means a variation between (2) and (3). In later years the steps were expressed numerically by Baxendell himself, and are set down here (without brackets) with little change, except for the omission of decimal points which are unnecessary. Further slight variants occur here and there in the notation, and are now recorded in a form which should convey its meaning without ambiguity.

4. The method adopted to deduce the magnitude of α Orionis is extremely simple, yet it seems doubtful whether any essential advantage could be gained by following a more complicated procedure. The numbers expressing the steps, whether according to the earlier or later notations, have been treated as differences of magnitude on a scale indicated by the observation itself. In other words, when the variable is placed between two given stars, the magnitude is inferred by simple interpolation between the two assumed magnitudes according to the intervals denoted by the steps recorded. Thus, for example, the observation B(12) X(2)D leads to the equation

$$X = B + \frac{3}{3+4}(D - B) = 0{\cdot}34 + \frac{3}{7}(0{\cdot}72) = 0{\cdot}34 + 0{\cdot}31 = 0{\cdot}65.$$

It has been thought safer to make no attempt to determine the value of a step which could be used as a definite difference of magnitude over a series of dates. Thus, in general, it has been considered impossible to infer the magnitude of the variable unless α Orionis has been compared both with a brighter and a fainter star; and in those cases where a single comparison star has been observed, the observation is of value only in a qualitative sense.

5. The observations of Baxendell, reduced as explained above, are given in Table I. When this reduction had been made, it seemed natural to collect other observations before proceeding with the discussion of the variability of the star. In particular, the series could be prolonged, and certain gaps filled, by including the observations of Sir John Herschel * and of Argelander.† To make these series available, it was necessary to deduce from them the magnitudes of α Orionis according to the same scale, that of the Revised Harvard Photometry. Accordingly, they have been treated in the same way as Baxendell's observations, except for the fact that a wider choice of comparison stars was made by the two observers. The deduced magnitudes are given in Table II. for Sir John Herschel, and in Table III. for Argelander.

6. In the title of his paper, Sir John Herschel refers to the "Variability and Periodical Nature" of α Orionis. But although the fluctuations in the brightness of the star seem to have been unusually well marked during the period covered by his observa-

* *Memoirs R.A.S*, xi. p. 269.
† *Astr. Beob. zu Bonn*, vii. p. 491.

tions, he did not suggest a period, and α Orionis is now regarded as an irregular variable. On the other hand, Argelander * found a period of 196 days. Quite independently, from Baxendell's observations, I found a rather longer period of about 208 days, but the maximum variation in this period was less than ±0·1 magnitude, and this, even if proved to be real and permanent, goes very little way towards representing the observed changes. The longer period agrees with the view of Schmidt,† who in 1856 suspected that the period was perhaps 10 days longer than that assigned by Argelander, or that it might be variable.

But our more immediate purpose is to test the 6-year period found by Herr Bottlinger, as already mentioned. With this object I have used all the observations published in the present paper, and in addition a considerable number of later determinations extending to the year 1905. Unfortunately, in this later period there is no sustained series made by a practised observer available. In order to investigate at the same time a possible systematic error depending on the season, which might reasonably be suspected, the observations for each month have been treated separately. The monthly means have been set down in six columns, each column containing the means for every sixth year, beginning with the year 1836. The means for each column were then formed, and are now given in tabular form.

	1836 +6n.	1837 +6n.	1838 +6n.	1839 +6n.	1840 +6n.	1841 +6n.	Means.
Jan.	0·64	0·59	0·71	0·77	0·69	0·65	0·67
Feb.	0·67	0·51	0·74	0·72	0·73	0·74	0·68
Mar.	0·72	0·49	0·63	0·72	0·66	0·73	0·66
Apr.	0·73	0·60	0·65	0·80	0·67	0·84	0·71
Sept.	0·70	0·70	0·82	0·50	0·91	0·68	0·72
Oct.	0·65	0·55	0·77	0·49	0·62	0·68	0·63
Nov.	0·65	0·62	0·76	0·59	0·50	0·64	0·63
Dec.	0·62	0·73	0·65	0·67	0·56	0·64	0·65
Means	0·67	0·60	0·72	0·63	0·63	0·65	0·67

7. From the above figures and from an inspection of the observations, certain conclusions can now be drawn :—

(1) The mean magnitude of α Orionis between the years 1836 and 1905 was 0·67 on the Harvard scale.

(2) Extreme deviations of about ±0·4 mag. from this mean have been observed, but the times at which such deviations are to be expected are not yet within the possibility of prediction.

(3) The observations are practically free from any systematic error depending on the season of the year at which they are made.

* *Astr. Beob. zu Bonn*, vii. p. 388.
† *A.N.*, 1080.

(4) There is no significant variation of the magnitude with a period of 6 years.

No special investigation has been made of the effect of atmospheric absorption due to the altitude of the stars, and indeed the time of observation has been omitted in Table I. The precise time is not always clearly indicated in Baxendell's ledgers, and a satisfactory examination of the effect on this class of observations would have been difficult. It has been considered that an experienced observer like Baxendell would naturally bear this point in mind, and avoid large errors by choosing favourable times for observation. That this view is so far justified that errors of this kind may be treated as accidental seems to be sufficiently confirmed by the conclusion (3) above, and the evidence on which it is based.

TABLE I.

Baxendell's Observations.

Date.	J.D.		Mag.	Date.	J.D.		Mag.
1837.	(239)			1848.	(239)		
Jan. 10	2020	X=C+2, A=B+2	0·35	Nov. 13	6345	D(0) X	1·06
1840.				14	6346	D(0) X	1·06
Feb. 19	3155	X(1) D		17	6349	D(0) X	1·06
22	3158	X(1) D		18	6350	X(0) D	
24	3160	X(3) D				C(1) X(01) D	1·00
29	3165	X(01) D				C(12) X(0) D	
Mar. 3	3168	B(12) X(2) D	0·65	30	6362	D(0) X	1·06
16	3181	X(3) D		Dec. 1	6363	D(0) X	1·06
20	3185	X(3) D		2	6364	X(01) D	
1842.				13	6375	X(1) D	
Mar. 6	3901	X(3) D		14	6376	C(12) X(12) D	0·77
1846.				15	6377	X(2) D	
Jan. 20	5317	B(4) X(2) D	0·82	16	6378	C(1) X(12) D	0·71
28	5325	C(4) X(2) D	0·87	17	6379	C(12) X(2) D	0·73
1848.				20	6382	C(1) X(2) D	0·67
Sept. 19	6290	B(3) X(2) D	0·77	28	6390	C(2) X(2) D	0·77
Oct. 5	6306	B(4) X(2) D	0·82	1849.			
11	6312	X(2) D		Jan. 2	6395	X(23) D	
18	6319	B(3) X(2) D	0·77	3	6396	C(12) X(3) D	0·67
21	6322	B(3) X(2) D	0·77	11	6404	X(3) D	
Nov. 4	6336	B(34) X(2) D	0·80	14	6407	C(0) X(3) D	0·48
6	6338	B(4) X(0) D	1·06	15	6408	X(01) C, X(3) D	0·36
8	6340	X(01) D		30	6423	X(2) C, X (3) D	
12	6344	C(2) X(01) D	0·94	Feb. 8	6432	B(0) X(3) C	0·34

TABLE I.—*continued.*

Date.	J.D. (239)		Mag.
1849.			
Feb. 10	6434	X(3) C	
Mar. 6	6458	B(0) X(3) C	0·34
8	6460	B(01) X(23) C	0·36
24	6476	B(1) X(1) C	0·41
Apr. 3	6486	C(0) X(2) D	0·48
Sept. 5	6641	X(2) D	
18	6654	X(1) D	
22	6658	B(1) X(2) D	0·58
Oct. 10	6676	B(12) X(1) D	0·77
12	6678	B : X ≤ X : D	0·70
13	6679	B(2) X(2) D	0·70
15	6681	B(2) X(2) D	0·70
21	6687	B(1) X(1) C	0·41
28	6694	B(0) X(3) D	0·34
Nov. 4	6701	B(1) X(3) D	0·52
11	6708	B(2) X(3) D	0·63
16	6713	B : X < X : D	0·63
23	6720	B(2) X(2) D	0·70
27	6724	B(2) X(2) D	0·70
Dec. 3	6730	B(2) X(2) D	0·70
14	6741	B(2) X(2) D	0·70
22	6749	B(3) X(2) D	0·77
1850.			
Jan. 14	6772	C(2) X(12) D	0·81
26	6784	B(3) X(01) D	0·96
Feb. 1	6790	B(3) X(12) D C : X = X : D	0·80
3	6792	C : X < X : D	
Mar. 3	6820	X(0) C. X (23) D	0·48
12	6829	X(0) C, X(3) D	0·48
Sept. 13	7014	B(1) X(3) D	0·52
28	7029	B(2) X(3) D	0·63
Oct. 1	7032	B(2) X(23) D	0·66
9	7040	B(2) X(23) D	0·66
11	7042	B(2) X(3) D	0·63
21	7052	X(3) D	
28	7059	B(1) X(3) D	0·52
Nov. 2	7064	B : X < X : D	

Date.	J.D. (239)		Mag.
1850.			
Nov. 7	7069	B : X < X : D	
27	7089	B : X < X : D, X(1) C	
28	7090	B(2) X(3) D, C(0) X	0·55
Dec. 5	7097	B(1) X(3) D	0·52
6	7098	X(0) C	0·48
9	7101	X(01) C	
17	7109	B(1) X(3) D	0·52
1851.			
Jan. 5	7128	B : X = X : D	0·70
Feb. 1	7155	B(3) X(2) D	0·77
23	7177	B(2) X(2) D C(1) X(2) D	0·68
Mar. 1	7183	C(2) X(3) D	0·71
20	7202	C : X ≥ X : D	0·77
Apr. 7	7220	C(2) X(01) D	0·94
Nov. 2	7429	B(2) X(3) D	0·63
Dec 3	7460	B(01) X(1) C	0·39
1852.			
Feb. 18	7537	B(2) X(3) D	0·63
24	7543	C(1) X(3) D	0·63
Mar. 3	7551	X(01) C	
Apr. 3	7582	C : X ≤ X : D	0·77
1853.			
Nov. 1	8159	B : X = X : D	0·70
1854.			
Oct. 31	8523	B3 X2 D	0·77
Nov. 3	8526	B : X ≥ X : D	0·70
8	8531	B2 X1 D	0·82
15	8538	B2½ X1 D	0·85
Dec. 9	8562	B2½ X1 D	0·85
18	8571	B2 X1 D	0·82
27	8580	B : X = X : D	0·70
1855.			
Feb. 9	8624	X(0) B	0·34
Oct. 23	8880	X(3) D	
27	8884	X(0) B	0·34
31	8888	B(0) X	0·34
Nov. 3	8891	B(01) X	

TABLE I.—*continued.*

Date.	J.D. (239)		Mag.
1855.			
Nov. 10	8898	B(01) X(3) D	0·44
16	8904	B(01) X(3) D	0·44
20	8908	B(0) X(3) D	0·34
24	8912	B(1) X(3) D	0·52
27	8915	B1 X2 D	0·58
29	8917	B1 X1 D	0·70
Dec. 5	8923	B1 X2 D	0·58
6	8924	B1 X2 D	0·58
12	8930	B1 X2 D	0·58
18	8936	B1 X2 D	0·58
19	8937	B1 X3 D	0·52
20	8938	B1 X3 D	0·52
21	8939	B1 X2 D	0·58
29	8947	B1 X1½ D	0·63
1856.			
Jan. 9	8958	B1 X2 D	0·58
10	8959	B1 X1½ D	0·63
15	8964	B1 X1½ D	0·63
Feb. 2	8982	B(1) X(2) D	0·58
Oct. 19	9242	B2½ X1 D	0·85
Nov. 6	9260	X2 D	
8	9262	B1 X3 D	0·52
9	9263	B1 X3 D	0·52
10	9264	B1 X3 D	0·52
12	9266	B1 X3 D	0·52
27	9281	B1 X3 D	0·52
29	9283	B1 X2½ D	0·55
30	9284	B1 X3 D	0·52
Dec. 13	9297	B1 X2½ D	0·55
14	9298	B1 X2 D	0·58
28	9312	B1 X2 D	0·58
1857.			
Jan. 6	9321	B1 X3 D	0·52
12	9327	B1 X2 D	0·58
13	9328	B1 X3 D	0·52
19	9334	B1 X3 D	0·52
21	9336	B1 X2½ D	0·55
23	9338	B1 X3½ D	0·50
1857.			
Jan. 28	9343	B1 X3 D	0·52
Feb. 11	9357	B=X1½ C	0·34
Mar. 8	9382	B1 X1¼ D	0·66
9	9383	B1 X1¼ D	0·66
25	9399	C1 X2 D	0·67
Oct. 28	9616	B=X2 D	0·34
Nov. 15	9634	B1 X2½ D	0·55
18	9637	B1 X2½ D	0·55
23	9642	B1½ X2 D	0·65
26	9645	B1 X2 D	0·58
27	9646	B1¼ X2 D	0·61
Dec. 4	9653	B1 X1 D	0·70
7	9656	B1 X2 D	0·58
20	9669	B1 X2 D	0·58
24	9673	B=X3 D	0·34
31	9680	B½ X2½ D	0·46
1858.			
Jan. 4	9684	B½ X2 D	0·48
16	9696	B1 X2 D	0·58
20	9700	B1 X3 D	0·52
Feb. 14	9725	B½ X2¾ D	0·45
19	9730	B½ X3 D	0·44
Mar. 11	9750	C1 X2¾ D	0·64
25	9764	C1 X2 D	0·67
Apr. 13	9783	X>C, X5 D	
17	9787	C½ X4 D	0·54
Oct. 28	9981	D≥X	
Nov. 2	9986	B3½ X½ D	0·97
10	9994	B4 X=D	1·06
12	9996	B4½ X=D	1·06
15	9999	B4½ X½ D	0·99
	(240)		
17	0001	B4 X¾ D	0·95
18	0002	B3½ X1 D	0·90
21	0005	B3 X1 D	0·88
Dec. 2	0016	B2½ X1½ D	0·79
18	0032	B3 X2 D	0·77
21	0035	B2 X1 D	0·82

TABLE I.—*continued.*

Date.	J.D. (240)		Mag.
1859.			
Jan. 6	0051	B3½ X2 D	0·80
22	0067	B1½ X3½ D	0·56
Oct. 21	0339	X3 D	
26	0344	B2½ X1½ D	0·79
29	0347	B4½ X=D	1·06
Nov. 20	0369	X1 D	
1860.			
Jan. 6	0416	B4 X1 D	0·92
11	0421	X=D	1·06
15	0425	B3½ X1 D	0·90
25	0435	B3 X1 D	0·88
27	0437	B3 X½ D	0·96
Feb. 6	0447	B3½ X½ D	0·97
9	0450	B4½ X=D	1·06
12	0453	D½ X	1·10
13	0454	B4½ X=D	1·06
16	0457	D½ X	1·10
19	0460	D½ X	1·10
26	0467	X=D	1·06
28	0469	X½ D	
Mar. 21	0491	X2 D	
Sept. 27	0681	B2½ X2½ D	0·70
Oct. 11	0695	B1 X2½ D	0·55
1861.			
Jan. 1	0777	B2½ X1½ D	0·79
4	0780	B2 X1½ D	0·75
Feb. 9	0816	B3 X1½ D	0·82
Mar. 8	0843	X2½ D	
30	0865	C=X5 D	0·48
Apr. 11	0877	X5½ D	
Oct. 27	1076	B=X4 D	0·34
Dec. 3	1113	B=X3½ D	0·34
25	1135	B1 X3 D	0·52
1862.			
Jan. 5	1146	B1 X3 D	0·52
Nov. 15	1460	B2 X3 D	0·63
Dec. 30	1505	B=X3 D	0·34
1863.			
Jan. 23	1529	B2½ X3 D	0·67
Oct. 30	1809	B3 X=D	1·06
Nov. 2	1812	B3 X½ D	0·96
4	1814	B3 X1 D	0·88
8	1818	B3 X1 D	0·88
29	1839	B4 X=D	1·06
Dec. 2	1842	B3 X1 D	0 88
5	1845	B3½ X=D	1·06
17	1857	B3½ X1 D	0·90
1864.			
Feb. 8	1910	B2 X1 D	0·82
Oct. 7	2152	B4 X1 D	0·92
9	2154	B4 X1 D	0·92
31	2176	B4 X1 D	0·92
Dec. 21	2227	B3 X1 D	0·88
31	2237	B3 X1 D	0·88
1865.			
Jan. 27	2264	B3 X1 D	0·88
Feb. 8	2276	X1 D	
Oct. 19	2529	B>X2½ D	
Nov. 21	2562	B2 X3 D	0·63
Dec. 22	2593	B3 X1 D	0·88
1866.			
Feb. 3	2636	B3 X2 D	0·77
17	2650	B=X4 D	0·34
Mar. 13	2674	B=X3½ D	0·34
18	2679	B1 X3 D	0·52
Oct. 6	2881	B1 X2 D	0·58
30	2905	B2 X2 D	0·70
Nov. 13	2919	B2 X1½ D	0·75
16	2922	B2 X1½ D	0·75
30	2936	B1½ X2 D	0·65
Dec. 7	2943	B½ X2½ D	0·46
14	2950	B½ X2½ D	0·46
30	2966	B½ X2½ D	0·46
31	2967	B1 X2½ D	0·55
1867.			
Jan. 8	2975	B½ X2½ D	0·46

TABLE I.—*continued.*

Date.	J.D. (240)		Mag.
1867.			
Jan. 28	2995	B1 X2½ D	0·55
Feb. 24	3022	B1 X2½ D	0·55
Oct. 28	3268	B1 X2 D	0·58
Nov. 5	3276	B2 X1½ D	0·75
26	3297	B2 X1½ D	0·75
Dec. 17	3318	B2 X2 D	0·70
1868.			
Jan. 3	3335	B1½ X2 D	0·65
17	3349	B1 X2½ D	0·55
26	3358	B1 X1½ D	0·63
Mar. 27	3419	X>C, X2¼ D	
Nov. 8	3645	B1 X3 D	0·52
1869.			
Feb. 6	3735	B2 X3 D	0·63
Mar. 2	3759	B1 X2½ D	0·55
Nov. 10	4012	B2 X1 D	0·82
Dec. 22	4054	B2 X2 D	0·70
1870.			
Jan. 23	4086	B1 X2 D	0·58
1871.			
Mar. 16	4503	B=X2 D, C=X	0·41
1873.			
Jan. 20	5179	B3 X1 D	0·88
28	5187	C2½ X½ D	0·96
Dec. 13	5506	B2½ X=D	1·06
Dec. 20	5513	B2 X1 D	0·82
1876.			
Jan. 21	6275	B2½ X½ D	0·94
1877.			
Nov. 24	6948	B1½ X2 D	0·65
1878.			
Jan. 25	7010	B1 X1½ D	0·63
31	7016	C½ X1¾ D	0·61
Oct. 27	7285	X3 D	
1880.			
Feb. 21	7767	D>X	
26	7772	D>X	
Mar. 8	7783	C3 X=D	10·6
1881.			
Jan. 21	8102	C4 X2 D	0·87
Feb. 20	8132	C4 X½ D	1·00
23	8135	C5 X=D	1·06
Dec. 10	8425	B7 X, D1 X	1·18
1882.			
Feb. 15	8492	C3 X2 D	0·83
1883.			
Jan. 30	8841	C3 X2 D, B4 X	0·83
Feb. 23	8865	C2 X3 D	0·71
1884.			
Nov. 27	9508	B1 X4½ D	0·47

TABLE II.

Magnitudes deduced from Sir John Herschel's Observations.

Date.	J.D. (239)	Mag.	Date.	J.D. (239)	Mag.	Date.	J.D. (239)	Mag.
1836.			1838.			1839.		
Mar. 22	1726	1·20	Jan. 13	2388	0·83	Dec. 11	3085	0·41
Nov. 12	1961	0·34	Feb. 25	2431	0·77	29	3103	0·77
13	1962	0·34	Apr. 14	2479	0·70	1840.		
26	1975	0·47	1839.			Jan. 2	3107	0·67
1837.			Jan. 16	2756	1·20	5	3110	0·67
Dec. 29	2373	0·77	17	2757	1·14	6	3111	0·77
1838.			22	2762	1·14	7	3112	0·77
Jan. 2	2377	0·90	Nov. 26	3070	0·30	Feb. 25	3161	0·87
6	2381	0·83	30	3074	0·48	Apr. 18	3214	0·67

TABLE III.

Magnitudes deduced from Argelander's Observations.

Date.	J.D. (239)	Mag.	Date.	J.D. (239)	Mag.	Date.	J.D. (239)	Mag.
1842.			1843.			1844.		
Oct. 8	4117	1·20	Mar. 20	4280	0·44	Apr. 10	4667	0·43
17	4126	0·65	Apr. 16	4307	0·71	19	4676	0·63
21	4130	0·72	Oct. 2	4476	0·88	26	4683	0·71
28	4137	0·82	22	4496	0·82	28	4685	0·73
Nov. 2	4142	0·74	27	4501	0·81	Oct. 31	4871	0·71
5	4145	0·82	Nov. 3	4508	0·77	Nov. 7	4878	0·56
9	4149	0·92	4	4509	0·75	Dec. 4	4905	0·66
10	4150	0·86	12	4517	0·76	5	4906	0·58
13	4153	0·92	13	4518	0·77	6	4907	0·64
17	4157	0·88	20	4525	0·82	8	4909	0·68
21	4161	1·16	Dec. 10	4545	0·82	11	4912	0·67
26	4166	1·16	16	4551	0·98	21	4922	0·72
28	4168	1·10	1844.			1845.		
Dec. 1	4171	0·97	Jan. 9	4575	1·15	Jan. 28	4960	0·58
2	4172	0·90	11	4577	1·05	Feb. 8	4971	0·66
3	4173	1·03	12	4578	1·06	Oct. 24	5229	0·26
5	4175	1·00	13	4579	1·05	29	5234	0·30
13	4183	0·74	15	4581	1·10	Nov. 3	5239	0·30
14	4184	0·71	23	4589	1·14	5	5241	0·30
15	4185	0·80	Feb. 6	4603	0·97	7	5243	0·30
22	4192	0·85	12	4609	0·83	22	5258	0·34
26	4196	0·80	13	4610	0·85	28	5264	0·40
1843.			14	4611	0·78	30	5266	0·37
Jan. 7	4208	0·65	15	4612	0·79	1846.		
8	4209	0·55	19	4616	0·71	Jan. 13	5310	0·70
10	4211	0·56	27	4624	0·56	15	5312	0·70
13	4214	0·62	Mar. 3	4629	0·58	Feb. 21	5349	0·74
20	4221	0·74	6	4632	0·48	22	5350	0·87
21	4222	0·66	14	4640	0·19	28	5356	0·81
22	4223	0·70	29	4655	0·34	Apr. 9	5396	0·40
Feb. 7	4239	0·59	30	4656	0·43	Oct. 13	5583	0·30
12	4244	0·51	Apr. 1	4658	0·39	23	5593	0·30
13	4245	0·42	2	4659	0·34	Nov. 2	5603	0·30
22	4254	0·60	4	4661	0·36	10	5611	0·40
Mar. 2	4262	0·63	5	4662	0·39	11	5612	0·32
7	4267	0·61	7	4664	0·34	16	5617	0·34
17	4277	0·34	8	4665	0·36	27	5628	0·30

TABLE III.—*continued.*

Date.	J.D. (239)	Mag.	Date.	J.D. (239)	Mag.	Date.	J.D. (239)	Mag.
1846.			1848.			1852.		
Dec. 13	5644	0·34	Oct. 23	6324	0·73	Apr. 21	7600	0·72
17	5648	0·39	26	6327	0·71	Oct. 12	7774	0·30
1847.			Nov. 25	6357	0·75	17	7779	0·27
Jan. 10	5672	0·58	Dec. 18	6380	0·57	20	7782	0·25
13	5675	0·57	23	6385	0·62	Nov. 6	7799	0·28
25	5687	0·39	1849.			18	7811	0·28
Feb. 23	5716	0·80	Jan. 15	6408	0·38	Dec. 8	7831	0·30
Mar. 1	5722	0·68	Feb. 11	6435	0·37	1853.		
5	5726	0·77	23	6447	0·64	Jan. 27	7881	0·34
15	5736	0·67	Mar. 20	6472	0·58	Feb. 28	7913	0·63
16	5737	0·77	28	6480	0·60	Mar. 27	7940	0·98
17	5738	0·74	Apr. 4	6487	0·40	28	7941	0·94
Sept. 18	5923	0·30	Oct. 21	6687	0·57	29	7942	0·87
Oct. 15	5950	0·34	1851.			Apr. 1	7945	0·84
Nov. 5	5971	0·30	Jan. 8	7131	0·58	7	7951	0·94
10	5976	0·30	21	7144	0·59	Oct. 24	8151	0·82
Dec. 5	6001	0·30	23	7146	0·63	31	8158	0·70
25	6021	0·44	30	7153	0·70	Nov. 12	8170	0·60
1848.			Feb. 14	7168	0·69	30	8188	0·76
Jan. 3	6030	0·56	Mar. 2	7184	0·81	Dec. 2	8190	0·77
9	6036	0·51	24	7206	0·57	3	8191	0·72
26	6053	0·48	28	7210	0·70	24	8212	0·62
Feb. 1	6059	0·53	Oct. 13	7409	0·28	1854.		
27	6085	0·70	20	7416	0·29	Jan. 18	8237	0·55
Mar. 7	6094	0·74	Nov. 1	7428	0·25	21	8240	0·63
11	6098	0·76	23	7450	0·31	26	8245	0·64
21	6108	0·83	Dec. 12	7469	0·21	Feb. 14	8264	0·55
27	6114	0·80	19	7476	0·33	Mar. 16	8294	0·48
31	6118	0·82	25	7482	0·34	17	8295	0·70
Apr. 1	6119	0·77	1852.			19	8297	0·71
2	6120	0·75	Jan. 10	7498	0·53	Apr. 11	8320	0·56
17	6135	0·73	12	7500	0·61	17	8326	0·64
Sept. 25	6296	0·63	26	7514	0·67	Sept. 27	8489	0·55
Oct. 2	6303	0·61	Feb. 24	7543	0·57	28	8490	0·51
3	6304	0·70	Mar. 14	7562	0·65	Oct. 26	8518	0·43
6	6307	0·85	26	7574	0·73	30	8522	0·70
7	6308	0·58	Apr. 2	7581	0·58	Dec. 26	8579	0·57
22	6323	0·65	16	7595	0·69			

TABLE III.—*continued.*

Date.	J.D. (239)	Mag.
1855.		
Mar. 5	8648	0·34
11	8654	0·45
16	8659	0·41
Apr. 6	8680	0·39
11	8685	0·48
16	8690	0·40
Oct. 20	8877	0·50
1856.		
Jan. 13	8962	0·53
14	8963	0·61
Feb. 3	8983	0·79
4	8984	0·74
16	8996	0·66
Mar. 7	9016	0·68
11	9020	0·79
16	9025	0·89
24	9033	0·72
27	9036	0·77
28	9037	0·81
Apr. 5	9045	0·77
16	9056	0·71
19	9059	0·63
20	9060	0·73
Oct. 4	9227	0·85
20	9243	0·70
25	9248	0·67
27	9250	0·72
29	9252	0·73
Nov. 2	9256	0·77
Dec. 15	9299	0·55
16	9300	0·51
17	9301	0·60
24	9308	0·50
29	9313	0·49
1857.		
Jan. 2	9317	0·47
17	9332	0·71
20	9335	0·55

Date.	J.D. (239)	Mag.
1857.		
Jan. 30	9345	0·66
Feb. 5	9351	0·63
8	9354	0·62
12	9358	0·62
14	9360	0·74
15	9361	0·72
20	9366	0·67
22	9368	0·70
24	9370	0·77
Mar. 3	9377	0·73
16	9390	0·67
17	9391	0·63
20	9394	0·67
26	9400	0·77
29	9403	0·68
Apr. 1	9406	0·77
Sept. 27	9585	0·29
Oct. 15	9603	0·26
17	9605	0·24
22	9610	0·34
23	9611	0·37
27	9615	0·48
Nov. 11	9630	0·52
15	9634	0·68
20	9639	0·62
Dec. 4	9653	0·70
14	9663	0·58
18	9667	0·61
1858.		
Jan. 3	9683	0·42
21	9701	0·30
22	9702	0·30
26	9706	0·29
Feb. 7	9718	0·28
17	9728	0·47
21	9732	0·43
26	9737	0·65
Mar. 19	9758	0·64
25	9764	0·71

Date.	J.D. (239)	Mag.
1858.		
Mar. 28	9767	0·68
29	9768	0·70
30	9769	0·68
Apr. 14	9784	0·72
Oct. 8	9961	0·52
12	9965	0·61
15	9968	0·68
30	9983	0·68
31	9984	0·60
Nov. 3	9987	0·77
9	9993	0·85
	(240)	
23	0007	1·00
30	0014	0·88
1859.		
Jan. 1	0046	0·87
5	0050	0·95
9	0054	0·84
20	0065	0·75
21	0066	0·83
Feb. 11	0087	0·84
Mar. 2	0106	0·67
7	0111	0·66
8	0112	0·66
20	0124	0·61
Apr. 1	0136	0·57
Nov. 3	0352	0·77
6	0355	0·70
8	0357	0·75
12	0361	0·76
18	0367	0·85
22	0371	0·77
1861.		
Nov. 9	1089	0·29
1864.		
Feb. 6	1908	0·89
Mar. 8	1939	0·77
9	1940	0·69
Apr. 8	1970	0·87

Observations of Saturn's Ninth Satellite (Phœbe) made at the Royal Observatory, Greenwich, in 1910.

(*Communicated by the Astronomer Royal.*)

The ninth satellite of Saturn was under observation near the opposition of 1910 October, and photographs were obtained with the 30-inch reflector whenever possible, but, owing to the unfavourable weather, successful photographs were secured on five nights only.

The position of the satellite has been measured on the photographs of September 27 and 28 with reference to four faint stars whose positions were determined from an astrographic plate of the region, as described in former communications. It was unfortunately not possible to get an astrographic plate of the region covering the positions Nov. 1–7, owing to cloudy weather and pressure of other work. The positions on these nights were therefore referred to all the stars shown on each plate whose positions were given in the catalogues of the Astronomische Gesellschaft.

To determine the position of the satellite relatively to Saturn, the right ascensions and declinations of the planet given in the *Nautical Almanac* have been corrected as shown in the latter part of this paper.

The G.M.T. is the arithmetical mean of the times of beginning and end of exposure.

Observations of Phœbe.

Date and G.M.T.	Exp.	Apparent R.A.	Apparent Dec.	Phœbe – Saturn. R.A.	Phœbe – Saturn. Dec.
d h m	m	h m s	° ′ ″	m s	′ ″
Sept. 27 15 8·6	45	2 13 48·46	+10 31 28·7	−1 48·59	−12 5·5
28 12 21·7	90	2 13 35·84	10 30 15·6	1 48·60	12 5·3
Nov. 1 9 50·1	90	2 4 8·32	9 38 39·3	1 30·81	10 44·8
1 11 28·8	90	2 4 7·16	9 38 32·9	1 30·71	10 44·7
2 9 22·2	90	2 3 51·35	9 37 12·3	1 29·81	10 39·4
2 10 57·9	90	2 3 50·04	9 37 5·1	1 29·91	10 40·5
7 10 18·7	90	2 2 25·01	9 29 57·6	1 25·02	10 10·6

Errors of the Tabular Place of Saturn.—To eliminate the error of the tabular place of Saturn (for comparison with the R.A. and Dec. of the satellite deduced as above), and also that arising from any systematic error of the catalogues employed, photographs of Saturn were taken with the 26-inch refractor, using the occulting shutter. By this means good measurable images of Saturn were obtained, together with sufficiently exposed images of the reference stars. Four images of Saturn and of six