

## Observations of Phoebe in August and September 1906.

(Harvard College Observatory Circular No. 119).

Nine additional photographs of Saturn, showing images of Phoebe, have been obtained with the 24-inch Bruce Telescope at Arequipa. The positions of Phoebe, as determined by these plates, are given in Table I, the form of which is the same as that contained in Circular 118 (A. N. 173.41). The designation of the plate, the date, the Greenwich Mean Time of the middle of the exposure, and the duration of the exposure are given in the first four columns. The difference in right ascension, the difference in declination, the distance, and the position angle are given in the fifth, sixth, seventh,

and eighth columns. Of these, the sixth and seventh are the measured quantities, the fifth and eighth are derived from them by computation. Computed values for the differences in right ascension and declination were taken from the ephemeris given on the leaf following the Contents in the second edition of the American Ephemeris and Nautical Almanac for 1906, and subtracted from the observed values in the fifth and sixth columns. The residuals are given in the ninth and tenth columns. The measures were made by Mr. *E. S. Manson, Jr.*

Table I. Positions of Phoebe. 1906.

Plate	1906	G. M. T.	Exp.	Difference in R. A.	Difference in Decl.	Di- stance	P. A.	O - C R. A.	O - C Decl.
A 7993	Aug. 11	15 <sup>h</sup> 58 <sup>m</sup>	119 <sup>m</sup>	-47.3	-4.0	12.4	251°	-0.4	-0.2
A 8000	» 16	15 27	120	-42.9	-3.3	11.1	253	-1.2	-0.1
A 8016	» 19	15 23	105	-38.4	-3.0	10.0	253	-0.8	-0.2
A 8028	» 21	20 54	120	-36.6	-2.6	9.4	254	-0.5	-0.1
A 8037	» 23	20 41	120	-35.0	-2.1	8.9	256	-1.2	+0.1
A 8046	» 25	17 46	120	-32.9	-2.1	8.4	256	-1.1	-0.1
A 8090	Sept. 12	15 55	120	-13.7	+0.4	3.4	277	-2.3	-0.1
A 8094	» 13	13 55	120	-11.5	+0.6	2.9	282	-1.1	0.0
A 8099	» 17	13 41	120	-7.0	+1.0	2.0	300	-1.3	-0.2

Harvard College Observatory, Cambridge, Mass., 1906 Nov. 6.

*Edward C. Pickering.*

## Thirty-one new variable stars.

(Harvard College Observatory Circular No. 120).

The study of the distribution of variable stars by superposing a negative on a positive of a different date, has been continued this fall by Miss *Henrietta S. Leavitt*, with the following results. Five plates taken with the 24-inch Bruce Telescope, with centres at about RA. = 3<sup>h</sup> 40<sup>m</sup>, Decl. = +23°5', and having exposures of from one to four hours, were examined with the usual care, and only one new variable was discovered. The plates, most of which are of excellent quality, cover a region five degrees square with good definition, and it is estimated that about 150000 stars were examined. The Pleiades are near the centre of the plates. The single variable discovered is in remarkable contrast with the large numbers found in other regions by the same observer, and announced in recent circulars. The only known variable in this region is 032723 = 90.1901 Tauri, which is near the edge of the plates. Apparently conditions in the vicinity of the Pleiades favor unusual constancy in light, as no stars were even suspected of variability, though there are many suspected variables in the other regions as yet examined in this way.

A plate with the Nebula of Orion in the centre,

RA. = 5<sup>h</sup> 30<sup>m</sup>, Decl. = -5°5', exposure 74<sup>m</sup>, taken last winter, has been compared with an early plate, with the result that two new variables were found, while seventeen known variables were re-discovered. The method used is not adapted to the discovery of variables in regions where nebulosity is strong, unless the variations are large. Star 053004<sub>n</sub> in Table I, is in such a region, but it had been previously suspected, and its variation was confirmed by direct comparison of several negatives. The region of the Southern Cross and the »Coal-Sack« has been examined on thirteen plates, three of which have centres at about RA. = 12<sup>h</sup> 20<sup>m</sup>, Decl. = -62°5', and ten have centres at about RA. = 12<sup>h</sup> 50<sup>m</sup>, Decl. = -62°5'. Twenty-eight new variables were discovered, and the known variables, 121861<sub>n</sub> R Crucis, and 131360<sub>n</sub> ... Centauri\*), were also found.

The new variables are given in Table I, in which the successive columns give the designation, the Harvard number, the number of the editor of A. N., the right ascension and declination for 1900, the brightest magnitude so far observed, and the range. The faintest magnitude so far observed may be found by adding the quantities in the two

\*) Der Stern findet sich nicht in den uns zugänglichen Verzeichnissen. Wahrscheinlich ist gemeint Nr. 131561<sub>n</sub> — die Nr. 131360<sub>n</sub> würde der Position für 1875 entsprechen — im Katalog der veränderlichen Sterne Harv. Coll. Annals Bd. 48 p. 102. Dieser von Mrs. Fleming 1898 entdeckte Veränderliche (vgl. Nr. 3488 der A. N.) muß sich notwendig auf den hier untersuchten Platten befunden haben. *K7*.

last columns. Stars 122964<sub>n</sub>, 123263<sub>n</sub>, 125964<sub>a</sub><sub>n</sub>, and 131864<sub>n</sub> probably have long periods, while the periods of stars 124863<sub>n</sub>, 125763<sub>n</sub>, and 125964<sub>b</sub><sub>n</sub> appear to be short.

Table I. New variable stars.

Designation	Harv.No.	Number A. N.	RA. 1900	Decl. 1900	Br.	R.
034725	1237	123.1906 Tauri	3 <sup>h</sup> 47 <sup>m</sup> 2 <sup>s</sup>	+25° 14.9	12.0	3.0
052603 <sub>n</sub>	1238	124.1906 Orionis	5 26 4	— 3 28.0	12.5	0.9
053004 <sub>n</sub>	1239	125.1906 Orionis	5 30 44	— 4 49.8	14.0	0.6
115763 <sub>n</sub>	1240	126.1906 Crucis	11 57 50	—63 10.2	10.8	5.2
120563 <sub>n</sub>	1241	127.1906 Crucis	12 5 57	—63 52.7	10.8	2.7
121261 <sub>n</sub>	1242	128.1906 Crucis	12 12 18	—61 12.3	13.1	1.1
121860 <sub>n</sub>	1243	129.1906 Crucis	12 18 0	—60 2.7	12.5	1.5
122060 <sub>n</sub>	1244	130.1906 Crucis	12 20 24	—60 57.2	13.4	3.0
122964 <sub>n</sub>	1245	131.1906 Crucis	12 29 8	—64 0.8	12.8	1.7
123263 <sub>n</sub>	1246	132.1906 Crucis	12 32 46	—63 48.1	14.2	2.8
123460 <sub>n</sub>	1247	133.1906 Crucis	12 34 17	—60 52.2	15.0	1.0
123564 <sub>n</sub>	1248	134.1906 Muscae	12 35 19	—64 10.2	14.2	> 2.8
124061 <sub>n</sub>	1249	135.1906 Crucis	12 40 19	—61 17.2	11.4	0.8
124361 <sub>n</sub>	1250	136.1906 Crucis	12 43 36	—61 13.5	15.0	1.0
124564 <sub>n</sub>	1251	137.1906 Muscae	12 45 26	—64 55.5	14.0	2.4
124863 <sub>n</sub>	1252	138.1906 Crucis	12 48 22	—63 23.4	12.7	1.1
125162 <sub>n</sub>	1253	139.1906 Crucis	12 51 15	—62 56.5	14.0	1.3
125262 <sub>n</sub>	1254	140.1906 Centauri	12 52 6	—62 25.6	10.2	0.7
125564 <sub>n</sub>	1255	141.1906 Centauri*)	12 55 37	—64 5.4	8.5	0.4
125664 <sub>n</sub>	1256	142.1906 Muscae	12 56 39	—64 42.6	13.2	2.5
125763 <sub>n</sub>	1257	143.1906 Centauri	12 57 13	—63 7.5	14.0	3.1
125764 <sub>n</sub>	1258	144.1906 Muscae	12 57 23	—64 15.1	13.4	1.2
125860 <sub>n</sub>	1259	145.1906 Centauri	12 57 58	—60 14.0	11.5	1.5
125964 <sub>a</sub> <sub>n</sub>	1260	146.1906 Muscae	12 59 21	—64 58.6	10.5	1.6
125964 <sub>b</sub> <sub>n</sub>	1261	147.1906 Muscae	12 59 23	—64 45.6	14.7	> 2.3
130662 <sub>n</sub>	1262	148.1906 Centauri	13 6 26	—62 52.0	11.5	1.0
130763 <sub>n</sub>	1263	149.1906 Centauri	13 7 9	—63 37.1	8.8	1.6
130962 <sub>n</sub>	1264	150.1906 Centauri	13 9 47	—62 30.7	12.3	1.2
131362 <sub>n</sub>	1265	151.1906 Centauri	13 13 2	—62 24.1	12.9	1.3
131560 <sub>n</sub>	1266	152.1906 Centauri	13 15 39	—60 47.1	10.4	4.0
131864 <sub>n</sub>	1267	153.1906 Muscae	13 18 16	—64 8.4	10.5	> 3.5

## Remarks.

053004<sub>n</sub>. Suspected of variation in 1904.

125162<sub>n</sub>. Probably of the Algol Type.

125262<sub>n</sub>. Probably of the Algol Type.

125564<sub>n</sub>. This star is CPD. —63°2485. For period, see below.

125664<sub>n</sub>. Follows a pair of fifteenth magnitude stars by 0.2.

130763<sub>n</sub>. This star is CPD. —63°2632. For period, see below.

131362<sub>n</sub>. Probably of the Algol Type. Has a hazy appearance, and may be double.

131864<sub>n</sub>. Discovered independently from its spectrum, by Mrs. W. P. Fleming, four days after original discovery.

The variable, 130763<sub>n</sub> (149.1906 Centauri) was found to be of the Algol Type, and was observed on 256 plates, of which 27 showed it near minimum brightness. The observed times of minimum are well satisfied by the formula  $J. D. 2410000.35 + 2^d.47871 E$ . The spectrum is of the class B 8 A. A full discussion of the observations will be published in an early number of the Annals.

The variable, 125564<sub>n</sub> (141.1906 Centauri) was observed on a large number of plates, and has been found to be of especial interest on account of the unusual character of its light curve. It varies only from magnitude 8.5 to 8.9, in a period represented by the formula

$$J. D. 2410000.15 + 0^d.93796 E.$$

It was at first thought to be of the Algol Type, but it appears probable that the light is slightly but continuously changing even near maximum, in which case it should be classed as a variable of short period. The observations will be published in the forthcoming number of the Annals mentioned above, but it seems desirable to give here the principal results. The star was difficult to observe, particularly when near maximum, and for this reason was independently measured four times on nearly all of the plates taken with the 1-inch Cooke lens, and on all the plates taken with the 8-inch Bache Telescope when the variable was faint. The errors of observation were thus reduced one-half. The average deviation of a single observation from

\*) Im Zirkular steht irrtümlich Musca als Sternbild angegeben. Kr.

the mean of four, was  $\pm 0.03$  magnitudes. On account of the small range, the phase was computed for each of the plates which were measured four times, 136 in number, although, in the case of Algol variables, this is usually done

only for the plates taken near the times of minima. The observations were then arranged in the order of phase, and the means of the phases and magnitudes were taken for each group of five.

Table II.  $\iota 25564_n$  (141.1906 Centauri). Mean phases and magnitudes.

Mean Phase	Mean Mag.	Res.	Mean Phase	Mean Mag.	Res.	Mean Phase	Mean Mag.	Res.	Mean Phase	Mean Mag.	Res.
-0.448	8.48	-1	-0.135	8.58	-7	+0.036	8.87	-1	+0.276	8.53	+1
-0.400	8.52	+3	-0.117	8.68	-2	+0.056	8.80	-5	+0.322	8.51	+1
-0.358	8.54	+4	-0.088	8.77	+1	+0.071	8.81	0	+0.358	8.49	-1
-0.307	8.49	-2	-0.069	8.87	+6	+0.089	8.72	-4	+0.383	8.51	+2
-0.243	8.53	0	-0.047	8.83	-3	+0.115	8.73	+3	+0.408	8.48	-1
-0.195	8.58	+1	-0.028	8.89	0	+0.175	8.61	+2	+0.444	8.48	-1
-0.158	8.57	-4	+0.012	8.87	-3	+0.226	8.52	-2			

In Table II, the first column gives the mean phases and the second the mean magnitudes for the successive groups. Six plates are included in the last group, at mean phase +0.444. These quantities were plotted, using the phases as abscissas and the magnitudes as ordinates, and a smooth curve was drawn through the points thus given. The

residuals from this curve, expressed in hundredths of a magnitude, are given in the third column. The average deviation of a single point is  $\pm 0.02$  magnitude, and that of observations on individual plates is  $\pm 0.05$ . The coordinates of the light curve are given in Table III.

Table III. Light curve.

Phase	Mag.	Phase	Mag.
0.00	8.90	0.25	8.53
0.05	8.86	0.30	8.51
0.10	8.73	0.35	8.50
0.15	8.62	0.40	8.49
0.20	8.56	0.45	8.49

The deviations are large enough to make it uncertain whether it is symmetrical, although this has been assumed.

Ephemerides for the two variables are given in Table IV. In the first half of the table, every thirtieth minimum for six months beginning with the epoch 8080 is given for variable  $\iota 25564_n$  (141.1906 Centauri), and in the second

half, every tenth minimum covering the same period and beginning with the epoch 3060 is given for variable  $\iota 30763_n$  (149.1906 Centauri). The successive columns, in each half of the table, give the number of the epoch, the Julian Day and decimal following Greenwich Mean Noon, the date, and the Greenwich Mean Time of minima.

Table IV. Ephemerides for variables  $\iota 25564_n$  and  $\iota 30763_n$  (141 and 149.1906 Centauri).

Epoch	J. D.	Date	Epoch	J. D.	Date
8080	7578.867	1907 Jan. 2 <sup>d</sup> 20 <sup>h</sup> 52 <sup>m</sup>	3060	7585.203	1907 Jan. 9 <sup>d</sup> 4 <sup>h</sup> 53 <sup>m</sup>
8110	7607.006	» » 31 0 8	3070	7609.990	» Febr. 2 23 50
8140	7635.145	» Febr. 28 3 30	3080	7634.777	» » 27 18 42
8170	7663.283	» Mar. 28 6 48	3090	7659.564	» Mar. 24 13 34
8200	7691.422	» April 25 10 10	3100	7684.351	» April 18 8 27
8230	7719.561	» May 23 13 30	3110	7709.139	» May 13 3 20
8260	7747.699	» June 20 16 50	3120	7733.926	» June 6 22 17
8290	7775.838	» July 18 20 10	3130	7758.713	» July 1 17 10

Harvard College Observatory, 1906 Nov. 10.

Edward C. Pickering.

Notiz betr. Nebel nahe BD. -3°696. Die von Herrn E. Esclangon bei BD. -3°696 gesehenen Nebel oder Kometenfragmente konnte ich nicht wahrnehmen, und ebenso blieb die Dez. 17 um Komet 1906 h herum vorgenommene Nachsuche nach Begleitern erfolglos. C. W. Wirtz.