

## Reports of the Observing Sections.

### Variable Star Section.

#### *Interim Report No. 10.*

By Colonel E. E. MARKWICK, F.R.A.S.

The following table contains the principal results of work done during 1904 by the Section on the long-period Variable Stars on our working list. The members who have taken part in this, together with the number of their observations, are :—

Name.	Abbreviation.	Observations.
Miss M. A. Orr	Or.	20
T. H. Astbury	Ast.	3
T. W. Backhouse, F.R.A.S.	—	12
C. L. Brook, F.R.A.S.	Br.	70
J. W. L. Child, F.R.A.S.	Ch.	12
H. Corder	Co.	243
J. M. Field	Fd.	6
Colonel E. E. Markwick, F.R.A.S.	Ma.	505
H. Moye	My.	28
W. Oakes	Oa.	30
Rev. L. A. Williams	Wm.	25

The method of reduction of the observations is the same as that adopted in previous reports. After assembly they are plotted on squared paper, and a most probable curve drawn among the dots representing the observations. This plan has many advantages, one of which is that the variations or inflections in the light-curve are rendered easily visible to the naked eye; also any idiosyncrasies or marked departures from the mean light-curve on the part of a particular observer reveal themselves distinctly. It is, of course, impracticable as a rule to reproduce these diagrams here.

The Director has been much encouraged by a recent accession of several new workers in the persons of Revs. J. T. Bird and L. A. Williams; Messrs. J. M. Field and A. E. Mitchell; and Prof. M. Moye of Montpellier, France. Their work, however, has been principally among the short-period or irregular stars. To keep *au courant* with the doings of the long-period variables each star needs to be watched as often as possible by at least *two* observers. A fairly reliable light-curve can then always be obtained. Several of the light-curves of the following stars depend on the observations of Mr. Corder and the Director. As, however, the former has recently been debarred from observing, we are much in need of further workers in this branch. One observer alone can never hope to get such an accurate result as

when the work of two observers is combined. Out of the large number of members of the Association the two or three workers required to follow the 26 long-period stars on the list ought surely to be forthcoming.

After the table of maxima and minima are given some notes touching upon each of the stars of the working list.

As some of the stars are also under regular and systematic observation at the Rousdon Observatory, it is of interest to compare the dates of maxima and minima. This is indicated by "R—V" in the notes, where R denotes the date observed at Rousdon by Mr. C. Grover (*see* "Journal," Vol. XV., p. 235), and V that obtained from the work of the Section.

It will be noted that we have observed 14 maxima and five minima, also that the total number of observations is 954.

The sign  $\pm$  denotes a certain amount of doubt; this often happens when the curve is flat either at maximum or minimum, that is, when the maximum or minimum is protracted. It should be remembered that the columns headed "Period from last observed maximum or minimum" are based entirely on the work of the Section. In the last column of the table is given the period assigned to the star by Prof. Chandler in his "Revision of "Elements of Third Catalogue of Variable Stars." (A.J., No. 553.)

*Maxima and Minima of Long-Period Variables observed in  
1904.*

Chandler's Number.	Star.	Maximum.		Minimum.		No. of Obser- vations.	Period, from last observed.		Chandler's Period.
		Date.	Mag.	Date.	Mag.		Max.	Min.	
112	<i>R Andromedæ</i>	Feb. 8	6·0	Oct. 17±	13½±	36	d. 402	d. 389	d. 410 ± 30
782	<i>R Arietis</i> -	Dec. 22	8·0±	Oct. 8±	11·1	30	185·5	—	187 ± 7
806	<i>o (Mira) Ceti</i>	{ Mar. 10 and 1905, Mar. 5	2·9	Oct. 24	9·4	76	360	337	332 ± 14
3825	<i>R Ursæ Majoris.</i>	June 22	7·7	—	—	48	288	—	302 ± 11
4511	<i>T Ursæ Majoris.</i>	June 5	7·8	—	—	46	257·5	—	257·2 ± 20
4557	<i>S Ursæ Majoris.</i>	June 5	7·6	Sept. 26±	12·3	44	238	231·5	226·5 ± 35
5677	<i>R Serpentis</i> -	July 24	6·5	—	—	46	360	—	357·2 ± 35
5955	<i>R Draconis</i> -	Mar. 15±	9·3	—	—	43	258	—	245·6
6044	<i>S Herculis</i> -	Sept. 6±	7·9	—	—	21	297·5	—	303·3 ± 35
6512	<i>T Herculis</i> -	Oct. 13±	8·0	Aug. 5±	10·5	21	165	166	165 ± 10
7045	<i>R Cygni</i> -	Dec. 21	6·4	—	—	37	399	—	425·9
7120	$\chi$ <i>Cygni</i> -	Dec. 10	4·2	—	—	118	406	—	406·02 ± 25
7609	<i>T Cephei</i> -	Mar. 12	5·75	Oct. 28	9·7	59	360	416	387
8290	<i>R Pegasi</i> -	Aug. 9	8·0	—	—	29	363·3	—	377·5 ± 60

(112) *R Andromedæ*.—The maximum is pretty plainly indicated. Just after maximum occurs a sudden drop of  $0^m\cdot5$ , and then, perhaps, a slight "delay." The observations of Br. and Co. show it to have been distinctly on the decline from  $9^m\cdot75$  on July 5 to  $13^m$  on September 3. After this it continued at  $13^m\cdot25$  from September 18 to November 7. Precise date of minimum difficult to fix; if we assume it at middle point of stationary magnitude of  $13\cdot25$  we get October 17.

(782) *R Arietis*.—The ascent from minimum to maximum pretty uniform. Indication of delay in descending curve, after maximum.

(806)  $\circ$  (*Mira*) *Ceti*.—Omitting the work done in January, February, and March, which has been dealt with in a former report, the observations commence on September 10, when it was observed  $9^m$  by Co. It then declined slightly and reached a minimum of  $9^m\cdot4$  about October 24, with, I do not think, a larger probable error than  $5^d$  either way. About December 10 the light made a rapid rise. It reached  $3^m\cdot9$  about February 8 when there was possibly a slight delay; and a maximum on March 5,  $3^m\cdot7$ . This is one of the most reliable pieces of work done by the Section. The observations (139 in number for 1904 and 1905), when plotted on squared paper in the usual way, indicate the curve quite plainly to the eye; although to get the precise points of minimum and maximum, it is, of course, necessary to draw a most probable curve through them. Some observations made by Mr. Worssell in South Africa just before the star drew in towards the sun, enabled a maximum to be satisfactorily allocated to 1905, March 5. See Plate 1, which shows two maxima and the minimum.

(1855) *R Aurigæ*.—A maximum probably occurred in March; but observations are not sufficient in number to admit of the precise date being fixed. From this it steadily declined until November, when it was below  $12^m$ . Here again the observations are too few and vague to enable any date being fixed. Thirty-one observations by Co. and Ma. January was the only month in which no observations were made.

(2100) *U Orionis*.—There was a minimum,  $<12^m$  somewhere about 1903, December 11, but observations not sufficient to enable it to be fixed with accuracy. A rise commenced soon after this date, and the star was about  $6^m\cdot5$  on 1904 May 2, on which date two observations were made by Co. and Ma. Here, paucity of observations, combined with the approach of the star to the sun, prevents any deduction as to date; 25 observations by Co. and Ma.

(2213)  $\eta$  *Geminorum*.—Seven observations by Fd. and Ma. in December apparently indicate a decline from  $3^m\cdot2$  on December 2 to  $3^m\cdot9$  on December 16; but in the absence of more observations it cannot be stated with confidence that this change is real.

(3825) *R Ursæ Majoris*.—Was at minimum probably at the beginning or middle of March. There are indications of sub-

sidary maxima on July 14 and August 17, respectively 22<sup>d</sup> and 56<sup>d</sup> day after the principal one. Observations, on the whole, very accordant.  $R - V = - 3^d$ .

(4511) *T Ursæ Majoris*.—Minimum some time in March; about 13<sup>m</sup>. By the beginning of April it was rapidly increasing in light. Maximum clearly indicated. Observations accordant, and curve free from inflections.  $R - V = + 26^d$ .

(4557) *S Ursæ Majoris*.—A minimum probably occurred some time during the beginning of the year. Curve flat at maximum, and pointed at minimum; features previously deduced from the work of the Section on this star. There seems to have been a bend or "standstill" in the rising curve between November 13 and December 7; but, unfortunately, through a lack of observations, it is not possible to obtain details of this with much accuracy. Observations not so accordant as in the case of the previous variable.  $R - V = + 12^d$ .

(5504) *S Coronæ*.—The star was probably near maximum when first observed on March 21, 7<sup>m</sup>·0 (Co.): but observations do not go far back enough to enable exact date to be fixed. After this the light fell away. About the beginning of April there are indications of a delay; and again from about May 1 to June 4 there was a marked standstill, if not even a slight rise. Then it declined to 12<sup>m</sup> on October 7. No date can be fixed for minimum. 35 observations. N.B.—The identification of this object from F. Hagen's chart, when in its fainter stages, is exceedingly difficult for small telescopes.

(5677) *R Serpentis*.—Maximum fairly well determined; but the observations scatter a good deal about this phase. There is a distinct check in the descending branch, the middle of which may be put down at about August 26, or 33<sup>d</sup> after maximum.

(5758) *X Herculis*.—34 observations, of which 12 are by Mr. T. W. Backhouse, F.R.A.S., and the remainder by Ma. The observations by Backhouse have been very carefully made; he has used six different comparison stars, for which the P.D.M. magnitudes are adopted. They have been reduced according to the "step-value" assigned by him. The whole of the observations should, therefore, be comparable, and they have been plotted in the usual way on squared paper. An inspection of the diagram shows:—(1.) That our observations indicate no such period as 93<sup>d</sup>·5, which is that given by Chandler; (2.) That the variation, if any, is confined within the extreme limits of 6<sup>m</sup>·2 and 7<sup>m</sup>·4. On April 6 the light was 7<sup>m</sup>·4, from which it seems to have risen to 6<sup>m</sup>·2 on May 10. Then there is a decline to 6<sup>m</sup>·8 on May 18. From this date to the end of the year, the light-curve fluctuates very slowly and irregularly, touching 7<sup>m</sup>·1 on July 20. Then it rose to 6<sup>m</sup>·5 near end of August, near which brightness it remained until December; (3) That these results are in line with what has been previously deduced from the observations of the Section. (See "Journal," Vol. XII., page 273, and Memoirs, "Variable Star Section," December 1903, page 167); (4.) That it still remains for someone to prove clearly the variation of this

star, and to disentangle it, if it exists, from possible variation of the comparison stars.

(5955) *R Draconis*.—The date of maximum given is subject to a probable error of at least  $10^d$  either way, owing to the paucity of observations about that phase. A slight halt in the descending curve is apparent about the middle of April. The minimum ( $< 13^m \cdot 2$ ) must have occurred somewhere between July 2 and August 28. After this the light rose rapidly, and a maximum was reached about October 29,  $8^m \cdot 1$ . But here again paucity of observations prevents the precise date being arrived at.  $R - V = - 4^d$ .

(6044) *S Herculis*.—Exact date of maximum not attainable. The observations scatter rather curiously near that phase, possibly owing to the effect on the light observations of the bright star 49 Herculis, which is situated close to the Variable. A distinct pause in the ascending curve is indicated for the period July 16–August 17. I have often noted the beautiful character of the telescopic field when this Variable is in its bright stages.  $R - V = + 16^d$ .

(6512) *T Herculis*.—The curve is flat both at maximum and minimum. Observations all fairly accordant. The periods given in the table are one-seventh of the interval from the phases last observed by the Section, seven periods having elapsed in the interval, both for maximum and minimum.

(6849) *R Aquilæ*.—Neither a maximum nor a minimum can be deduced, as the curve starts probably just after the former and ends just before the latter. There is a steady descent all through, with perhaps indications of a slight delay, the middle of which occurs about August 8. Fall from  $6^m \cdot 7$  to  $11^m \cdot 1$  in  $202^d$ . Rate  $1^m$  in  $46^d$ . 26 observations. The character of the curve is very similar to what we observed in 1902.

(7045) *R Cygni*.—In July, August, and September the star was below  $13^m$ , and invisible in a  $6\frac{1}{2}$ -in. reflector. On October 3 it had begun to rise, and attained its maximum somewhere about the date shown in the table. More observations are wanted to fix it with accuracy. This is a difficult star to observe owing to the proximity of the bright star  $\theta$  Cygni.  $R - V = - 3^d$ .

(7120)  $\chi$  *Cygni*.—This wonderful star has been through the greater part of its extraordinary periodical fluctuations in the year 1904. At the beginning it was near  $7^m$  and falling rapidly. Co. observed it  $10^m \cdot 5$  on April 6. The date of minimum it has been impossible to fix. The variable was probably very faint during May and June; and it was observed  $13^m \cdot 5$  by Co. on July 5. After this a rise set in. From August 14  $\pm$  to October 13 there was a considerable slackening down of the rate of increase of light, resulting in a large "hump" on the curve. But after this a very rapid rise set in. In the three days, October 3–6, the light increased  $1^m \cdot 7$ , or more than  $\frac{1}{2}^m$  per diem; in fact, the light-curve is then nearly perpendicular; see Plate 2. The date of maximum is determined with, I consider, about as great



accuracy as is possible, owing to the large number of observations. Would that all the long-period stars on our list were given so much attention and such excellent work! There is a slight secondary maximum indicated on December 30, or 20<sup>d</sup> after the primary one. One hundred and eighteen observations were made in 1904; but as the maximum occurred towards the end of the year, 26 other observations made in 1905, January and February, have been made use of, so as to thoroughly deduce the light-curve about this time. The observations, on the whole, are very accordant.  $R-V = +30^d$ . There is little doubt that the star was well past its principal maximum on the date given in the Rousdon report, viz, 1905 January 9.

(7609) *T Cephei*.—The light-curve is flat at both maximum and minimum, but especially at the latter, hence the determination of date of minimum is difficult. The mean of the periods, deduced from the last observed maximum and minimum, is 388<sup>d</sup>, or within 1<sup>d</sup> of Chandler's period. Indications of a standstill or subsidiary maximum about May 18. The observations are fairly accordant, with the exception of four by Oa. on April, 6, 8 and 9 and May 2, which, for some reason or other, differ by more than a magnitude from the mean curve. The comparison star used on those days is DM + 67° 1329. The magnitude in the P.D.M. is 7.52, which is that adopted; while it is 6.8 in the DM. Is it possible that that star is variable to a slight extent?  $R-V$  for maximum = + 44<sup>d</sup>, for minimum = - 14<sup>d</sup>.

(7754) *W Cygni*.—There are only eight observations by the Section in 1904, and nothing can be inferred from them as to the nature of the light-curve, &c. Our previous work on this star does not bring out the variation clearly, and it is, perhaps, significant that Chandler does not give any ephemeris for this star in *A.J.*, XXIV., No. 8, although it is included in the "Revision of Elements of Third Catalogue."

(8290) *R Pegasi*.—The assigned date of maximum is probably not far out, although the observations for the season begin only at about that phase. A fairly gradual slope is indicated by the light-curve, from 8<sup>m</sup> to 10<sup>m</sup>, period August 2 to 1905, January 7. At the latter date there are indications of a more rapid descent setting in, and this is a repetition of what was observed by the Section before. "A marked feature is the sharp descent from about 10<sup>m</sup> to 12<sup>m</sup>.5." ("Memoirs," British Astronomical Association, Vol. XI., Pt. IV., p. 168.)

(8600) *R Cassiopeiæ*.—The observations are not sufficiently numerous to admit of the date of maximum being determined accurately. At the beginning of the year the star was rising, and it was observed, though "doubtfully," 5<sup>m</sup>.75 by Co. on February 13, after which it apparently declined until it reached 11<sup>m</sup>.0 on October 3. In December it was brighter than 9<sup>m</sup>. Twenty-six observations.

### The late Director of the Meteoric Section.

It is with great regret that we record the death, on June 29, of Mr. Walter Ernest Besley. Mr. Besley joined our Association on November 25, 1896. He soon became an active Member of the Meteoric Section and in 1900, on the resignation of Mr. W. F. Denning through ill-health, was appointed its Director. His own resignation from the same cause was announced in the "Journal," No. 7. He took a keen interest in that particular branch of astronomy and regularly published in our "Memoirs" his annual report, besides contributing various interim reports to the "Journal" of the Association. Even these, full as they were, do not represent all the observations that he so diligently got together, financial exigencies on the part of the Association enforcing the adoption of brevity. Mr. Besley was also a member of the Variable Star Section, the Director of which bears testimony to the value of his observations in that Section. He was elected a Fellow of the Royal Astronomical Society in 1902.

## Papers communicated to the Association.

### The Zodiacal Light and the Gegenschein.

By W. MORTON SYKES.

The display was on Friday morning, 14th April. Noticing a very fine definition of the Zodiacal Light at about 4 a.m., I went out to some higher ground to get a better observation, and if possible to get a glimpse of the Gegenschein. I was not disappointed, for at the opposite point of the sky there was an unmistakable dome of faint light, extending up about half as high as, or more than, the Zodiacal Light, which reached to about 45° or 50°. There could be no possible mistake. The line joining the two lay at a fairly broad angle to the Milky Way, and the dark interval between it and the Gegenschein was very clearly marked. There is no town or suburb out west in that direction from which the light could have arisen. I verified the appearance over and over again, and am sure of the fact. There was a conspicuous star near the apex of each, and I am very sorry I did not more clearly observe at the time what stars they were. I write these particulars in the hope that some other member may have seen the display and be able to confirm my impressions.

Croydon, Sydney, N.S.W.,  
17th April 1905.