

BRITISH ASTRONOMICAL ASSOCIATION: VARIABLE STAR SECTION

CIRCULAR No. 12

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Introduction: We deeply regret the delay since the last Circular. A few copies of Circulars 1 - 11, issued by Dr Felix de Roy between 1922 and 1935, are still available to members who send a stamped addressed envelope of at least 26cm x 16cm to the Acting Director. Only the first few applicants will receive complete sets.

These Circulars will be issued at irregular intervals and will deal with Sectional matters unsuitable for publication in the BAA Circulars or Journal. It is hoped that it will also prove possible to use them for the rapid distribution of charts for novae within a few days of their discovery. Members are invited to submit notes on observational problems and unusual activity in stars they are following, or to suggest topics for discussion.

The Programme: Several members have requested a list of stars currently under observation, many stars having been added since that published in the Handbook for 1962. However, it does not seem advisable to publish a list immediately, since many of the stars on the programme are hardly observed at all or completely unobserved, and probably should be dropped. The Secretary's tabular statements will indicate which stars may reasonably be considered to be under observation, and a list drawn up from them will be published in the next Circular. It is therefore particularly important that observers who have not yet submitted their 1970 or 1971 reports do so without further delay. Mean while, observers should continue working on the stars allocated to them, and may rest assured that, regardless of any future changes in the programme, we intend to publish every observation.

Binocular Group: Mrs Margaret Penston of the Royal Greenwich Observatory has advised the Section that observations of the bright semiregular variables, originally undertaken at the request of Sir Richard Woolley, are no longer required. Brian Morell and the Acting Director have therefore worked out the following new programme for binocular observers.

- (1) Timing the minima of 37 eclipsing binaries 8.0m or brighter at maximum, the results to be published in IAU Information Bulletins on Variable Stars.
- (2) Observation of bright, or normally bright, stars already on the main programme (Rho Cas, R CrB, W Cyg, U Mon, R Sct) or to be added (XX Cam, Gamma Cas).
- (3) Observation near maximum of long period variables already on the main programme reaching 7.0m or brighter at an average maximum.
- (4) A nova patrol. This will include regular checks on recurrent novae (T CrB, RS Oph, V529 Ori, WZ Sge).

(3) and (4) will be discussed in later Circulars, and details of (1) are enclosed. Charts will be distributed by Brian Morell, to whom estimates should be submitted. Not all the charts have been printed at the time of writing, but requests for specific charts will be met as far as possible. Possession of a telescope does not prohibit additional participation in the activities of the Binocular Group, whose results will be given equal priority with those of telescopic observers when the question of publication arises. Moreover, several of the eclipsing binaries can be more satisfactorily observed telescopically.

We are indebted to Messrs Peter Owen and W F A Ridler of the Computing Section for preparing the enclosed predictions.

R CrB stars. The current minimum of R Coronae Borealis was first reported to the Section by Peter Hornby of Leeds, who telephoned to say that he had observed the star at 6.5m on Mar 4. As the report came after a fortnight's cloud cover, the Acting Director imagined that AAVSO observers would already have spotted the fall and notified the IAU telegram bureau at the Smithsonian Astrophysical Observatory. In the event, it was a further five days before an AAVSO observer reported it. Following this episode, the Acting Director met Dr Brian Marsden, who edits the IAU circulars, at the March meeting of the Association, and Dr. Marsden asked for a telegram to be sent to him whenever

the onset of a minimum of an R CrB star is observed by the VSS. Would observers therefore in future please telephone the Acting Director whenever a drop of 0.4m or more below normal is observed in either R CrB or SU Tau, now on the programme, or XX Cam, for which we hope to announce the availability of charts in the next Circular.

Variable comparisons. Would all observers please delete the following stars, now known to be variable, from their sequence lists:

<u>Sequence</u>	<u>Star</u>	<u>Identity</u>	<u>Type</u>	<u>Amplitude</u>
Chi Cyg	6	CSV 8307	SR	0.7m
R CrB	20	TT CrB	Lb	0.8
R Set	b	Delta Sct	Delta Sct	0.2
R UMa	b	VY UMa	Lb	0.6
	M	VW UMa	SR	0.7

The current sequences for R CrB and R Sct do not include the comparisons mentioned above, but some observers are using out-of-date lists in which they appear.

Eta Geminorum. According to van Schewick (1950), this well known semiregular variable is also an eclipsing binary with a period of about eight years. The most recent minimum was centred on 1971 December, and analysis of its light-curve in conjunction with published radial velocity measures may enable estimates to be made of the mass and radius of the giant M3 component, and throw light on the nature of its unseen companion. VSS members who have observed it during the recent apparition are urged to communicate their results to Paul Sutherland, "Woodlands", Fair Street, Broadstairs, Kent, who is collecting them for a proposed analysis in "The Observatory". Observers are asked to reduce their estimates according to the following sequence of photoelectric V magnitudes:

Mu Gem	2.86	Lambda Gem	3.59
Epsilon Gem	2.98	Nu Gem	4.14
Zeta Tau	3.03	Fl 1 Gem	4.15
Xi Gem	3.34		

Magnitudes of any additional comparisons used will be supplied on request.

AAVSO Circulars. The monthly Circulars issued by the AAVSO, under the editorship of John E Bortle, Gold Road, Stormville, N.Y.12582, U.S.A., are not intended as a publication for AAVSO members only, but as a means of communication between all amateurs, regardless of organizational affiliation, and the professional community. VSS observers are invited to contribute details of observed maxima of dwarf novae and estimates of novae and other eruptive or unusual variables. The low subscription of \$2.00 per year, to be made payable to John Bortle, includes airmail postage. Members contributing reports should indicate to which body the observations will eventually be submitted. The Acting Director has a few spare copies of the Circulars for observers who may be interested.

Telescopic meteors. Dr. Keith Hindley, Director of the Meteor Section, has asked VSS Members to record details of all telescopic meteors they may see in the course of their routine work. Despite the apparent coarseness of such data, computer analysis can yield valuable information on the activity of telescopic radiants and distribution of sporadic meteors. The details to be noted are:

**Instrument**, including aperture, magnification and field diameter.

**Universal Time**

**Magnitude**, to nearest whole number.

**Type**, using one of the following codes:

00 = entered and left field

a0 = began in field and left field

0a = entered field and ended in field

aa = began and ended in field

**Direction of motion**, position angle to the nearest 10°, measured anticlockwise from the north point

**Speed**, very swift/swift/average/slow/very slow

**Field limiting magnitude**

**Field centre**, to lm in RA and 1° in Dec, for 1950. The position of the variable, even if not at the field centre, will be sufficiently accurate

If the co-ordinates recorded for the field centre are those of a particular star, it would be useful also to record its identity, so that the position can be checked. With the next Circular we hope to distribute report forms and instructions on the submission of these observations, but observers are asked to start recording telescopic meteors immediately.

Submission of observations. Observers are asked to submit all outstanding observations for 1970 to the Section Secretary immediately. 1971 results should be sent to either Brian Morell or the Secretary, as appropriate, to arrive no later than the end of May.

The Secretary notes that most observers when completing their reports are not following the guidance given in the booklet "The Methods of the Variable Star Section". All Section members are asked to re-read this booklet. Copies are available for anyone without one. The Secretary further asks all observers to note the instruments used on the top left-hand corner of the first sheet for each star, as he is compiling a card index of this information.

The Acting Director would like to add two further pleas:

1. Do not forget to give your name and the year on each sheet. Failure to observe this point can cause considerable trouble.
2. Do not send us your observations if they are also being submitted to the AAVSO, BSS or any other group. Users of published reports will naturally assume them to be independent, and your estimates as published by, say, the AAVSO, may be taken as confirmation of the same estimates as published by the BAA.

You too can help. We have a considerable backlog of unpublished or undiscussed observations, and every effort will be made to bring the Section's publications up to date. The form which the eventual publication of these analyses and estimates will take is at present under consideration. Whatever means is adopted, it is certain that it will not be possible to clear the backlog without a great deal of help from members checking reductions, listing results in chronological order and typing them out ready for publication. At the moment, the greatest need is for volunteers to check deduced magnitudes, and willing members should contact the Secretary. The Acting Director would also be grateful if any members with access to duplicating equipment, or with a typewriter suitable for cutting stencils, or who could simply stuff, address and stamp about 150 envelopes every 2 - 3 months, would offer assistance in the production of these Circulars.

## ECLIPSING BINARY PROJECT.

Eclipsing binaries have been neglected in the past in this country, although they are the subject of intensive investigation by several overseas groups. Visual observation is an inefficient method of studying the details of the light-curves of these stars, but it is satisfactory for following their period changes, which may be due to the ejection of material from the system, mass exchange between the components, apsidal motion, or the presence of additional distant components. Their periods repeat with extreme regularity, rendering very small changes in the periods obvious by their cumulative effect, which frequently amounts to a difference of several hours between the observed and predicted times of a minimum. All the well-observed eclipsing binaries have variable periods, and there are about 4,000 neglected systems, including a number of bright ones, nearly all of which may be expected to show period changes also. These stars cannot be followed continuously by professional observatories, and the support of Commission 27 of the IAU for amateur work in this field is well demonstrated by its willingness to publish amateur results in the Information Bulletins on Variable stars (IBVS).

Details of the stars in the eclipsing binary programme are given in the table overleaf. This contains all stars 8.0m or brighter at maximum whose eclipses are readily observed visually from the latitude of the British Isles.

Heliocentric times of minima and the difference O-C between observed and calculated times will be derived and published in the IBVS. Reprints of these reports will be communicated to the observers concerned. Observers may be interested in reducing their observations themselves, but how this is done is being left for possible later publication. The following notes relate purely to observing methods.

Predicted times of minima (rounded to the nearest half-hour to reduce the risk of bias) will be distributed with the Circulars. Frequently more minima occur in a night than one observer can cover. On the whole, priority should be given to stars with longer periods, but the circulars will draw attention to stars in particular need of observation. Only experienced observers should attempt  $\mu$  Her and the secondary minima of VW Cep. Estimates should be made about every 30 minutes for as much as possible of the interval  $(t - \frac{1}{2}D)$  to  $(t + \frac{1}{2}D)$ , where  $t$  is the predicted time, and  $D$  the length of the eclipse, given in the table. More frequent estimation introduces a danger of bias.

Many of the comparison star sequences are tentative, so observers who can are urged to use the Pogson or Argelander step methods, so that the results can be reduced independently of the comparison magnitudes.

It is not essential for the star to be visible at mid-eclipse in the instrument used. Thus although 5cm aperture is required to see RW Tau at its faintest, minima can be timed with binoculars by obtaining estimates on the falling and rising branches. However, single estimates and short runs on only one branch are completely useless.

Observations should be submitted as soon as possible after the end of each month, so that the results can be published while they are still 'hot'. Since several of these stars are not on the programme of any of the overseas groups, we hope many observers will give this project their support.

Star	Max	Min		Type	Period d	D h	Remarks
		I	II				
V822 Aql	7.0	7.4	-	EA	2.65	?	
WW Aur	6.0	6.5	-	EA	2.53	6	P
AR Aur	5.8	6.5	6.4	EA	4.13	7	
IM Aur	7.9	8.5	8.3	EA	1.25	?	see below
ZZ Boo	6.6	7.4	7.3	EA	4.99	7	
RS CVn	8.0	9.5	-	EA	4.80	13	P
RZ Cas	6.4	7.8	-	EA	1.20	5	P
TV Cas	7.3	8.4	-	EA	1.81	8	
U Cep	6.7	9.0	-	EA	2.49	10	P
VW Cep	6.9	7.3	7.2	EW	0.28	(3)	P
EI Cep	7.6	8.1	8.0	EA	8.44	12	
GK Cep	6.9	7.5	7.5	EB	0.94	(11)	
Y Cyg	7.0	7.6	7.6	EA	3.00	7	P
V477 Cyg	8.0	8.9	-	EA	2.35	4	
TW Dra	7.3	8.9	-	EA	2.81	10	P
AI Dra	7.1	8.1	-	EA	1.20	4	
BH Dra	8.0	8.6	-	EA	1.82	7	
S Equ	8.0	10.0	-	EA	3.44	10	
Z Her	6.8	7.6	-	EA	3.99	11	

RX Her	7.0	7.6	-	EA	1.78	6	
u Her	4.6	5.3	-	EB	2.05	(24)	
AR Lac	5.9	6.7	-	EA	1.98	8	P
U Oph	5.9	6.6	6.5	EA	1.68	7	P
V451 Oph	7.9	8.5	8.3	EA	2.20	6	
V566 Oph	7.0	7.6	7.5	EW	0.41	(5)	
EE Peg	6.9	7.6	-	EA	2.63	6	P
DM Per	7.6	8.4	-	EA	2.73	10	
IZ Per	7.7	8.9	8.2	EA	3.69	11	
Beta Per	2.1	3.3	-	EA	2.87	10	P
SZ Psc	7.0	7.6	-	EA	3.97	10	P?
U Sge	6.3	9.9	-	EA	3.38	11	P
RW Tau	8.0	11.1	-	EA	2.77	9	P
CD Tau	6.6	7.2	?	EA	3.44	7	see below
HU Tau	6.0	6.8	-	EA	2.06	8	
W UMa	7.7	8.4	8.3	EW	0.33	(4)	P
TX UMa	6.9	8.5	-	EA	3.06	10	P
Z Vul	7.6	9.4	-	EA	2.45	11	

Min I and II denote primary and secondary minima respectively.  
 Min II is only given where it is deep enough to be observable visually.

Type EA = Algol, EB = Beta Lyrae, EW = W Ursae Majoris.

D is the duration of the eclipse in hours; for types EB and EW, in which it is not possible to define the beginning and end points of the eclipse, the figure given in brackets is half the period.

Remarks: P = period known to vary. (Probably they all vary.)

IM Aur: The 1969 General Catalogue of Variable Stars gives an alternative period of 0.68 days, but recent observations indicate that the period given above is correct.

CD Tau: The GCVS gives Min II as 7.5, which is clearly incorrect.

MINIMA OF ECLIPSING BINARIES: 1972 May-June

The following predictions are computed from the 1969 GCVS elements, including trigonometric terms. However, VW Cep and W UMa are apparently performing 1½ hours early and GK Cep 1 hour early, while several others are half an hour out. Future predictions will be corrected in accordance with recent observations. II denotes secondary minimum.

MAY 1972

DAY	GMAT	STAR	DAY	GMAT	STAR	DAY	GMAT	STAR
01	11	VW Cep	11	11	EI Cep II	21	10	TV Cas
	11	AI Dra		11½	VW Cep		10½	RX Her II
	11½	TV Cas		13	W UMa		12	VW Cep
	12	V451 Oph II		13½	V566 Oph		13	W UMa
	12½	V566 Oph II	12	11	RZ Cas	22	11½	VW Cep II
	12½	W UMa		11	VW Cep II		11½	u Her
	13½	GK Cep		11½	V451 Oph II		13	W UMa
02	10	IM Aur II		13	RX Her II	23	10½	V566 Oph
	10½	VW Cep II		13	W UMa		11	VW Cep
	12	GK Cep		14	V566 Oph II		11	V451 Oph II
	13	V588 Oph		14	U Sge		13	W UMa
	13	W UMa	13	10½	VW Cep		13½	GK Cep II
	14	VW Cep		10½	AI Dra	24	10	RZ Cas
03	10	VW Cep		10½	RX Her		10	VW Cep II
	10½	GK Cep		11	RS CVn		11	V566 Oph II
	13	VW Cep II		13	W UMa		12	GK Cep II
	13	W UMa		13½	VW Cep II		12½	u Her
	13½	V566 Oph II	14	10	Z Vul		13½	W UMa
04	11	U Oph		10	V566 Oph		13½	VW Cep
	12½	VW Cep		12½	U Oph		14	U Oph
	13	RX Her		13	VW Cep	25	10½	GK Cep II
	13	W UMa		13	W UMa		10½	AI Dra
	14	V566 Oph	15	10½	V566 Oph II		11,½	V566 Oph
	14½	Z Vul		12½	VW Cep II		13	VW Cep II
05	12	VW Cep II		13	W UMa		13½	W UMa
	13	W UMa		13½	BH Dra	26	10	V477 Cyg
06	11½	RZ Cas	16	11½	V566 Oph		11	BH Dra
	11½	VW Cep		12	VW Cep		12	V566 Oph II
	11½	BH Dra		13	GK Cep		12½	VW Cep
	13	TW Dra		13	W UMa		13½	W UMa
	13	W UMa	17	11	VW Cep II		14	u Her
07	10	IM Aur II		11½	GK Cep	27	11½	VW Cep II
	10½	VW Cep II		12	V566 Oph II		13	V566 Oph
	11	AI Dra		13	W UMa		13½	W UMa
	11	V566 Oph	18	10	GK Cep	28	11	VW Cep
	13	W UMa		10½	RZ Cas		13	RX Her II
	14	VW Cep		10½	VW Cep		13½	V566 Oph II
08	10	VW Cep		12½	V566 Oph		13½	W UMa
	11½	V566 Oph II		13	W UMa	29	10½	VW Cep II
	13	W UMa		14	VW Cep II		10½	RX Her
	13½	VW Cep II	19	10	VW Cep II		11½	U Sge
	14	GK Cep II		10½	AI Dra		13½	W UMa
09	11½	U Oph		13	V566 Oph II		14	V566 Oph
	12	V566 Oph		13	U Oph		14	VW Cep
	12	Z Vul		13	W UMa	30	10½	U Oph II
	12½	GK Cep II		13½	VW Cep		11½	TV Cas
	13	VW Cep	20	10	u Her		13	VW Cep II
	13	W UMa		12½	VW Cep II		13½	W UMa
10	11	GK Cep II		13	RX Her	31	10	AI Dra
	12	VW Cep II		13	W UMa		12½	VW Cep
	12½	V566 Oph II		13½	V566 Oph		12½	GK Cep
	13	TV Cas		14	TW Dra		13½	W UMa
	13	W UMa		14	EE Peg			
	14	IZ Per II						

JUNE 1972

DAY	GMAT	STAR	DAY	GMAT	STAR	DAY	GMAT	STAR
01	11	GK Cep	09 cont	12	V477 Cyg	19	10½	VW Cep
	11	V566 Oph		12½	U Oph II		11½	V566 Oph
	12	VW Cep II		12½	DM Per	20	11	TW Dra
	13½	EI Cep		13½	VW Cep II		12	V566 Oph II
	13½	W UMa		13½	W UMa		13½	VW Cep
02	11	V477 Cyg	10	11	V566 Oph	21	12½	V566 Oph
	11½	VW Cep		11½	V822 Aql		13	VW Cep II
	11½	V566 Oph II		13	VW Cep		13½	RX Her
	13	V822 Aql		13½	W UMa		13½	AR Lac
	13½	W UMa	11	11½	V566 Oph II	22	11	RX Her II
03	10½	VW Cep II		12½	VW Cep II		12	VW Cep
	11	V451 Oph II		13½	W UMa		12½	GK Cep II
	12	V566 Oph	12	11½	VW Cep		13	V566 Oph II
	13½	IZ Per		12	V566 Oph	23	11	GK Cep II
	13½	W UMa		13	RZ Cas		11½	VW Cep II
04	11½	U Oph II		13½	W UMa		13	AR Lac
	12½	V566 Oph II	13	11	VW Cep II		13½	V566 Oph
	13	BH Dra		12½	V566 Oph II		13½	U Cep
	13½	VW Cep II		13½	RX Her II	24	11	VW Cep
	13½	V451 Oph		13½	W UMa		12	RZ Cas
	13½	W UMa	14	10½	VW Cep		13	BH Dra
05	12	Z Vul		10½	RX Her		14	V566 Oph II
	13	V566 Oph		10½	V451 Oph II	25	10½	VW Cep II
	13	VW Cep		13	U Oph II		10½	U Oph
	13½	RX Her		13½	V566 Oph		12½	U Sge
	13½	W UMa		13½	GK Cep		13	AR Lac
06	10	TX UMa		13½	W UMa		13½	VW Cep
	10½	RX Her II	15	11	BH Dra	26	10½	V566 Oph
	11	RS CVn		12	GK Cep		13	VW Cep II
	12	VW Cep II		13	VW Cep		13	V451 Oph
	13½	V566 Oph II		13	V451 Oph	27	11	V566 Oph II
	13½	RZ Cas		14	V566 Oph II		12½	VW Cep
	13½	W UMa		14	W UMa		12½	AR Lac
07	11½	VW Cep	16	10½	GK Cep		12½	IZ Per II
	13	GK Cep II		11	IZ Per II	28	11½	TV Cas
	13½	W UMa		12½	11W Cep II		12	VW Cep II
	14	V566 Oph		13	V477 Cyg		13½	U Cep
08	11	VW Cep II	17	12	VW Cep	29	11	VW Cep
	11½	GK Cep II	18	10½	V822 Aql		12	V566 Oph
	13	TV Cas		10½	EI Cep		12	AR Lac
	13½	W UMa		10½	V566 Oph II		13	GK Cep
09	10½	VW Cep		11½	VW Cep II		13½	RX Her II
	10½	V566 Oph II		12	EE Peg	30	10½	VW Cep II
	11½	TX UMa		12½	RZ Cas		10½	u Her