BRITISH ASTRONOMICAL ASSOCIATION

L I G H T - C U R V E

VARIABLE STAR SECTION CIRCULAR No. 51 1982 SEPT.

SECTION OFFICERS

Director D.R.B. Saw, 12 Taylor Road, Aylesbury, Bucks. HP21 8DR

Tel: Aylesbury (0296) 22564

Assistant Director S.R. Dunlop, 140 Stocks Lane, East Wittering, nr Chichester, West Sussex PO20 8NT

Tel: Bracklesham Bay (0243) 670354

Programme Secretaries

Main Secretary G.A.V. Coady, 15 Cedar Close, Market Deeping, Peterborough PE6 8BD

Tel: Market Deeping (0778) 345396

Binocular Secretary M.D. Taylor, 17 Cross Lane, Wakefield, West Yorkshire WF2 8DA

Tel: Wakefield (0924) 37641

Eclipsing Binary Secretary J.E. Isles, c/o Department of Transport, Room B246, Romney House, Marsham Street, London SW1

Tel: 01-212 0246

Nova/Supernova Search Secretary G.M. Hurst, 1 Whernside, Manor Park, Wellingborough, Northants. NN8 3QQ

Tel: Wellingborough (0933) 676444

Chart Secretary J. Parkinson, 28 Banks Road, Golcar, Huddersfield, West Yorkshire HD7 4LX

Tel: Huddersfield (0484) 642947

****

Contents:

Binocular Programme 1981 Report

Eclipsing Variables in need of study

CSV 927 Cephei

Chart Revisions

Determining variability

g Herculis

Epsilon Aurigae

Mira and RS Ophiuchi

Photoelectric Photometry News

****

Editorial We would like to thank all the contributors who have sent in material following the request in the last issue. This has very greatly helped with the preparation of this number and is one of the reasons why this Circular is more or less on time. Please continue to send in any comments upon items which we publish, short observational pieces, or any other material of relevance to variable star work.

It will be noticed that we are now trying the new method of production which was previously mentioned and which we hope we shall be able to use in future. If all goes well it will be much easier to reproduce light-curves, but if submitting any please try to draw them neatly in ink on white paper or tracing paper. It is also possible that we may be able to reproduce some photographs and we shall be experimenting with this later. We hope that this will encourage publication of details of equipment which can best be described by the use of photographs, as well as for the occasional star field. As always some detail will be lost on reproduction, so contrasty prints are acceptable, and desirable.

Binocular Programme - 1981 Report The observational total for 1981 was due to contributions from the 32 observers listed in Table I (overleaf), including those of two society variable star groups. A total of some 9400 light estimates of 155 programme stars was received, this being an increase of 9% on results for 1980. The most popular star in terms of the number of observers following it was UU Aurigae, with CH Cygni being observed most with 231 estimates. See Table II for the number of estimates per star. The leading observers, Albrighton, Fraser, Middlemist, Nartowicz and Taylor produced about 76% of the total number of estimates. Other valuable contributions - by virtue of particular stars being well covered were from Allen, Billington, Collinson, Espey, Hoste, Parkinson, Saw, Shanklin, Srinivasan, Steele, Toone and Young.

The following stars were underobserved in 1981:

SU And
BZ
CSV 101849 Aql
V Ari*
psi^{1} Aur
W Boo
RY Cam
VZ
+61°0668
RT Cnc
W CMa
DM Cep
FZ
CSV 927
Fl 33 Cet

V1351 Cyg
CSV 8232
CSV 8683
UX Dra
VW
AT
Fl 69
BQ Gem
DW
NQ
ST Her
SX
UW
V566*
U Hya
SX Lac*
RX Lep

SV Lyn
CSV 100869
S Mon
RV
SX*
W Ori
BL
CK
+14°1247
GO Peg*
SU Per
KK
PR
Z Psc*
S Sct*
TT Tau

CSV 6048 Tau
+22°0743
W Tri
TV UMa
RW Vir
RX
SS
SW
BK
RR UMi

* indicates Priority Star

Stars underlined are those for which we desperately need more observations. Please try to follow some of the stars on this list.

Table I - BAA VSS Binocular Observations 1981 - Observer Totals

Observer	Abbrev.	no.observations	no.stars
S. Albrighton	AG	1422	87
C. Allen	AX	387	57
S. Allmand	AQ	12	12
Mrs. M. Beach	UC	30	7
R. Billington	RL	213	29
E.H. Collinson	CO	127	9
H. Colquhoun	QC	22	6
C. Devoy	DQ	18	5
D.J. Ells	EL	27	14
B. Espey	EP	137	21
Miss R.B.I. Fraser	FB	553	112
A. Gardner	GE	17	12
M.A. Hapgood	HP	31	5
P. Heppenstall	QH	12	3
S. Hoste	OT	53	4
M.B. Houchen	NH	23	7
G.M. Hurst	HF	142	29
J. Lashley	LJ	20	5
T. Markham	QM	31	7
I.A. Middlemist	MM	2614	118
I.P. Nartowicz	NZ	898	71
J. Parkinson	JR	163	14
R.D. Pickard	PI	3	3
A.J. Rogers	RZ	41	10
T.G. Saville	VS	18	14
D.R.B. Saw	SW	47	9
J. Shanklin	SK	188	12
S.R. Srinivasan	VN	72	7
R. Steele	US	191	14
M.D. Taylor	TY	1641	102
J. Toone	TJ	167	2
D. Young	YD	99	17
32 observers	Total	9419	

For observers with larger than average binoculars, say greater than 50 mm in aperture, the stars which were underobserved, and which are in the magnitude range between 8 - 9 may be ideal candidates for your observational programme. A binocular of 70 to 80 mm aperture will allow greater resolving power on some of the more difficult variables on the programme. However, it should be borne in mind that stars of magnitude 10 to 11 will be evident, and in Milky Way areas identification of the variable could prove daunting at first. Variables in the range between magnitudes 8 and 9 are 'optimum' candidates for the 'large-binocular' owner. At present nobody in the binocular programme is using the even larger, military binoculars and these would be advantageous, not only for the keen variable star observer, but also for the comet, meteor and nova/supernova specialist. Anyone with, or having access to, such large equipment could provide very useful coverage of some of the fainter objects.

There are many variables on our programmes (not forgetting the eclipsing binaries) which can be observed with large binoculars, and some of these are listed in Table III.

Table II - BAA VSS Binocular Variable Programme - 1981 Totals

RS And	35	CSV 927 Cep	23	CSV 102195 Lac	53
SU	11	+59°2383	53	RX Lep	28
TZ	37	+60°2217	55	Y Lyn	68
AQ	30	+84°0536	70	SV	36
BZ	23	F1 33 Cet	22	CSV 100869	17
V Aql	50	RR CrB	60	R Lyr	89
V450	52	SW	60	XY	71
V1293	50	T Cyg	72	δ^2	71
CSV 101849	29	RU	46	S Mon	18
V Ari	7	RV	45	RV	25
UU Aur	142	TT	55	SX	6
AB	142	AF	148	X Oph	61
AE	177	CH	231	V2048	135
CO	64	V460	66	W Ori	35
NO	52	V973	110	BL	11
Psi^1	27	V1351	12	BQ	86
+31°1048	345	P	108	CK	34
W Boo	14	F1 28	50	+14°1247	11
RV	73	CSV 8232	20	AG Peg	56
RW	75	CSV 8307	50	GO	19
RX	69	CSV 8683	25	X Per	137
UV	46	+47°2801	66	SU	35
U Cam	44	U Del	115	AD	51
RY	26	EU	137	KK	25
ST	81	+19°4450	49	PR	28
UV	38	RY Dra	167	Z Psc	21
VZ	23	TX	189	TV	46
ZZ	38	UW	43	TX	40
+61°0668	11	UX	36	S Sct	29
X Cnc	44	VW	32	Y Tau	82
RS	73	AH	65	TT	30
RT	29	AT	31	BU	105
V CVn	150	F1 69	16	CE	42
Y	149	TU Gem	46	CSV 6048	45
TU	144	TV	86	+22°0743	17
W CMa	6	WY	81	W Tri	31
WZ Cas	93	BN	65	Z UMa	168
V377	107	BQ	35	RY	134
V391	69	BU	89	ST	50
V393	67	DW	21	TV	25
V465	112	IS	66	VW	97
CSV 171	111	NQ	18	VY	98
+49°4329	35	X Her	73	V UMi	62
Wr 162	46	ST	23	RR	62
W Cep	97	SX	2	RW	3
RU	46	UW	38	RX	3
RW	92	IQ	38	SS	10
RX	59	OP	95	SW	8
SS	98	V566	29	BK	3
AR	96	g	100		
DM	17	U Hya	16		
FZ	11	SX Lac	24		
Mu	109	CSV 8775	54		

Table III - Stars suitable for large binoculars - Ranges

RS And	7.0-9.1	W Cep	7.0-8.9	RV Mon	6.3-7.9
SU	8.0-8.5	RU	8.2-9.4	SX	7.8-8.9
TZ	7.6-9.0				
AQ	8.0-8.9	T CrB	2.0-10.5	X Oph	5.9-9.2
BZ	7.5-8.4	RR	7.1-8.6	RS	4.6-12.3
		SW	7.6-8.3		
UW Aql	8.9-9.5			R Sct	5.8-8.4
		RU Cyg	8.0-9.4		
V Ari	7.8-8.8	CSV 8307	7.5-8.2	TT Tau	8.1-8.8
V Boo	7.6-10.4	DW Gem	8.0-10.4	W Tri	7.5-8.8
RX	6.9-9.1				
UV	8.0-8.7	SX Her	8.0-9.2	Z UMa	6.6-9.1
		UW	7.8-8.7	VW	6.9-7.7
XX Cam	7.3-9.7	AC	7.0-8.4		
RY	7.3-9.4	IQ	7.3-8.2	V UMi	7.4-8.8
V393 Cas	6.8-7.9	SX Lac	7.7-8.7	V Vul	8.1-9.7

Chart Revisions

002235 AQ Andromedae 8.0-8.9 SR The star is near R And, the long period variable, and a sequence change is now shown on the chart dated 1982 Aug.16.

	1972 Nov.11	1982 Aug.16
A	6.4	no change
B	6.8	"
C	7.37	D = 7.4
D	7.67	E = 7.6
E	7.80	C = 7.7
F	7.97	no change
G	8.04	"
H	8.46	"
K	8.69	"

003245 BZ Andromedae 7.5-8.4 Lb M5 This well-placed irregular (within 5° of Messier 31) needs an instrument capable of resolving it from nearby magnitude 8-9 stars. The sequence is now numbered and amended as follows:

A (6.0), B (6.6) are dropped. C = 2 = 7.7. D (7.8) is dropped. E = 1 = 7.4. F is dropped. Two new comparisons 3 (8.4) and 4 (8.7) are added. 1982 Aug.16 is latest date.

114036 TV Ursae Majoris 6.5-7.6 SRb M5 It is clear that the magnitude of some comparisons is far too bright and from estimates produced by Albrighton, Fraser, Markham, Middlemist and Saw the variation is between 6.9 and 7.4. There are too few observations to be able to derive a period, but the 0.9 magnitude amplitude given in the Catalogue is certainly not seen. Comparisons A and B are now dropped with the sequence:

C = 6.6, D = 6.7, E = 7.4, F = 7.7. 1982 Aug.16

235659 WZ Cassiopeiae 6.9-8.5 186^d SRb Comparison star 66 about 20' arc nf WZ Cas as marked on the chart dated 1972 Nov.11 is now dropped due to independent observers reporting inconsistent estimates of it. Indeed one observer, T. Brelstaff, noted in VSSC no.47 a small amplitude from magnitude 6.7 to 7.1 and with a possible period of 140^d. Observers I.A. Middlemist and D.A. Rothery have also noted the star as being fainter than its quoted magnitude. I.P. Nartowicz has suspected a range of about 0.6 magnitudes with a 12x 50 binocular.

The star is HD 224980 = SAO 21020 and it is at RA $23^h\ 59^m\ 43^s$, Dec $+60^o$ 25.5' (1950); V = 6.73, B-V +1.82; spectrum K8 III. It is not shown in the Catalogue of Suspected Variables and so could be the subject for future assessment and a possible paper.

Observers of WZ should delete 66 (nf WZ Cas) from their chart; a revision dated 1982 Aug.16 is due for issue. All the above charts are obtainable from the Chart Secretary.

Preliminary Totals - Binocular Observations - 1982 Jan. to Jun.

Observer	no.obs.	Observer	no.obs
C.M. Allen	847	I.A. Middlemist	958
S. Allmand	61	I.P. Nartowicz	585
N.M Bone	42	J. Parkinson	104
E.H. Collinson	82	R.D. Pickard	14
H. Colquhoun	15	K. Robinson	15
R.C. Dryden	21	T.G. Saville	361
B. Espey	34	D.R.B. Saw	48
M.A. Hapgood	74	J.D. Shanklin	44
S.E. Hart	5	H.W.S. Smith	7
P. Heppenstall	18	E. Spooner	20
A. Horton	24	S.R. Srinivasan	86
S. Hoste	22	M.D. Taylor	502
M.B. Houchen	27	A.J. Thomson	5
G.M. Hurst	60	W.J. Worraker	93
S.A. Jefferys	8	R. Young	48
J. Lashley	37		

Total 31 observers 4267 estimates

Contributors who have not yet sent in their binocular reports are urgently requested to do so. Bearing in mind the generally better observing conditions of the last third of the year, our total for 1982 could reach 10,000 - this has not happened in recent years.

(MDT)

Comments upon some eclipsing binaries (From Tristram Brelstaff)

The following list (overleaf) is of eclipsing binaries for which my observations disagree with the entries in the GCVS or the Krakow Yearbook [an 'International Supplement' - Ephemerides of Eclipsing Binaries - published by the Jagiellonian University, Krakow]. The epochs of minima are abbreviated by removal of the initial digits 244. This information is not meant to be completely accurate, but it should be of use to anyone who wants to observe any of these stars. Most of them are between mag. 10 and 12, and I use a 200 mm reflector to observe them. However, I dare say that some of them could be followed with a 100 mm aperture. I am willing to supply copies of my charts to interested observers, in return for an SAE.

Eclipsing binaries

DS And Out of phase. Use the epoch 4977.375. (One of my comparison stars seems to be variable!) In NGC 752.

AM Aur There has been some confusion over this star's period, but these elements seem to be OK:
JD 2 439 732.60 + 13.618216 x E

XZ Cam Duration of minimum seems to be less than 24 hours.

AN Cam Out of phase. Use the epoch 5023.42.

V466 Cyg Out of phase. Use the epoch 5104.41.

V748 Cyg Possibly about 10 hours early.

V450 Her Out of phase. Use the epoch 4869.28.

WZ Leo Either constant or misidentified.

HP Lyr Out of phase. Minima seen on about 4891 and 5101.

AB Per Out of phase. Use the epoch 4932.81.

EL Sge Constant. Exhibits a PA effect which could give the false impression of variability.

BV Tau Period is wrong. Possibly $13^{d}.0$, but even this does not explain all my observations.

GR Tau Period seems to be wrong. I have seen several complete minima, but still I cannot find a satisfactory period.

RT UMi Out of phase. Use the epoch 4813.417.

Tristram Brelstaff
7 Thweng Way, Guisborough,
Cleveland TS14 8BW

[John Isles comments 'I am unable to discuss any of these stars in detail at present, as they are all fainter than 10.0 at maximum, according to the GCVS, and so not covered by my index. I would like to say that as I regret that I am not able to anything on the Eclipsing Binary Programme, due to the problems over my moving house, I am most grateful to Tristram for 'keeping the flag flying'. Observations of these, and any other systems will be most welcome, and will be used in the Eclipsing Binary Programme reports in the Journal.]

News from photoelectric variable star observers

(From Russell Genet)

Two British amateur variable star observers now have fully functioning photoelectric capability. They are R. Miles, Dove Cottage, Station Road, Mouldsworth, Cheshire CH3 8AJ, and R. Pickard, 28 Appletons, Hadlow, Kent TN11 0DT. R. Miles is currently observing eclipsing binary stars.

This has been a good year for those interested in the photometry of variable stars. Three books aimed at smaller observatories were published this year. They were: 'Photoelectric Photometry of Variable Stars - A Practical Guide for the Smaller Observatory' by Hall and Genet; 'Astronomical Photometry' by Hendon and Kaitchuk; and 'Software for Photoelectric Astronomy' by Ghedini.

Commercial makers of stellar photoelectric photometers have come

out with much-improved and lower-cost models. EMI Gencom's Starlight-2 is a complete pulse-counting photometer for only $775 US, the solid state Optec photometer which goes into the near-IR is $595 US, and HPO Kits start at $250 US. New designs for those that wish to build their own equipment were also unveiled in the first book mentioned above.

While staying at Lowell Observatory for one year, English student Martin Watt devised one of the best photometry reduction programs yet, for that clever British invention, the Sinclair ZX81 microcomputer (now spread world-wide). The complete program will appear in the quarterly journal IAPPP Communications. Those interested in the International Amateur-Professional Photoelectric Photometry (IAPPP) association whould contact R.C. Wolpert, Belmont Observatory, 144 Neptune Ave., N. Babylon, NY 11704, USA.

Russell M. Genet
Fairborn Observatory
1247 Folk Road
Fairborn, Ohio 45324 USA

[It seems a little odd that we should receive news of British observers by way of contacts on the other side of the Atlantic. May we encourage any members to let us have details of their experiments and success with photoelectric and other photometers for publication - at least in summary form - in these Circulars.]

CSV 927 Cephei (From I.P. Nartowicz)

I decided to write this note after I read that CSV 927 Cep is probably unique to the BAA Binocular Programme, and happens to be almost unobserved (9 observations in 1980, 23 in 1981). Between May 1981 and July 1982 I made 45 Class 1 observations of this star and now believe it to be semi-regular, with a period of about 45 days. This assumes a small (<0.1 mag.) error in the observations, but a similar light-curve drawn from observations of VZ Cam, which uses the same comparisons, gives a period of 24 ± 1 day [i.e. close to the Catalogue value of 23.7 days].

With any luck the knowledge that this star does show some variation will encourage more people to observe it. It is bright and convenient, being only 3° from Polaris.

[We are not including the light-curve which Mr Nartowicz sent, partly because it would have to be redrawn to be suitable for reproduction, and also because although it does show the type of variation to which he refers, any light-curve based upon sparse coverage by a single observer must remain of doubtful validity. Mr Nartowicz has also sent a list of estimates - or rather deduced magnitudes - and these show an apparent range of 4.9 - 5.4. Certainly some sort of variation seems to be indicated. We would encourage other observers to follow this, and other similar stars to improve the density of coverage, and the conclusions which can be drawn. In this respect also the following item is of relevance.]

The determination of variation With all variable star observations, whether with one or many observers, there will be scatter in the deduced magnitudes. This will occur even with constant objects, and the problem is to determine real from apparent changes.

It is therefore usually necessary in any doubtful cases to apply a proper statistical test for variation. Less anyone shy away at the mention of statistics, it should be said that one is in effect adopting a simple statistical method in just using the Argelander method of making estimates, if it is properly applied. To detect variation the simple method described by John Isles some time ago in NWAVSO's 'Light-Curve' is highly recommended. John has offered to send a copy of this method to anyone interested in receiving details, if they send him an SAE.

It cannot be doubted that if such a test were applied more often there would be very many fewer false alarms of variability, and some of the many 'panics' of the last few years would have been avoided. More observations by more than one observer are the best insurance against such cases, but certainly individual observers can also help by adopting proper observational practices. Many cases of suspected variation rely upon estimates against a single comparison star. The use of single comparisons is always to be deplored - except in the very few cases of very difficult sequences - whatever actual method of estimation is used.

It should perhaps be mentioned that the method John Isles describes - known technically as the Spearman Rank Correlation Coefficient - is only a test for variation, not period. The latter is far more difficult to determine in low-amplitude, high-scatter observations.

g Herculis (From Dietmar Böhme)

Observations of the bright variable g Herculis made by the Variable Star Working Party of the DDR Cultural Organisation.

The semi-regular red giant variable g Her has been extensively observed in recent years by the members of the Variable Star Working Party. For this analysis 1890 estimates by 21 observers were available, which gave complete coverage for the years 1979 - 1981. In addition a series of observations by D. Böhme, consisting of 225 estimates for the years 1972 - 1979, was also evaluated.

The sequence of comparison stars, to which all estimates relate, is given in Table I.

Table I - Comparison stars used

Star	RA (1950)	Dec	m_{vis}	Spectrum
Sigma Her	$16^h32^m29^s$	$+42^o32'.4$	4.3	A0
SAO 046 210	16 37 23	+49 01.5	4.9	M0
SAO 065 233	16 18 12	+39 49.6	5.5	F2

The light variations show two components which may be definitely separated from one another. (See the light-curve reproduced opposite.) These two components are:

a) a rapid variation with the observed extremes shown in Table II.

Examination of this variation by means of an autocorrelation procedure produced a mean period

$$\bar{P}_1 = 89^d.2 \pm 12^d.7$$

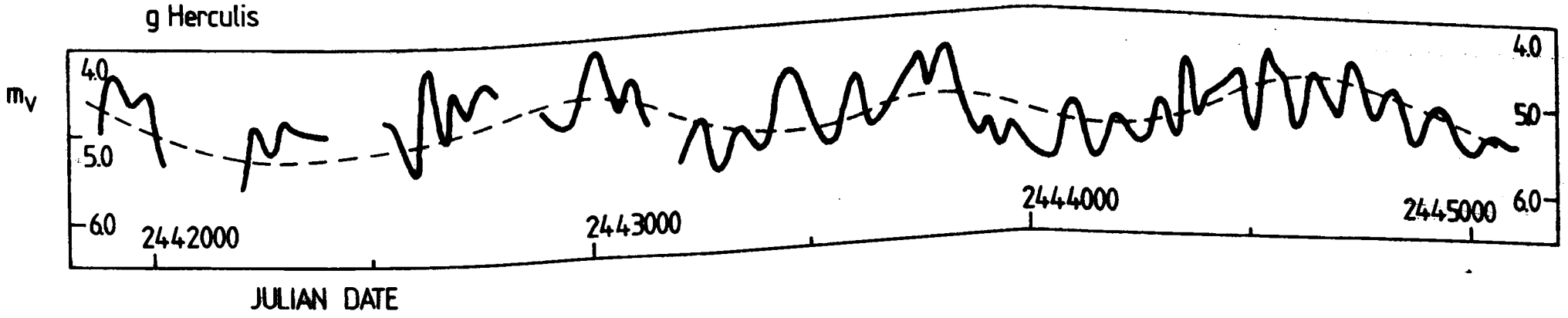


Table II

Rapid variation
Observed extremes (1979-81)

Phase	JD	m_{vis}	Phase	JD	m_{vis}
Max	2 444 020	5.3	Min	2 444 508	5.4
Min	4 068	6.0:	Max	4 552	4.7
Max	4 110	5.2	Min	4 602	5.35
Min	4 145	5.8	Max	4 648	4.6
Max	4 184	5.25	Min	4 699	5.2
Min	4 230:	5.5:	Max	4 715	4.65
Max	4 287	5.0	Min	4 773	5.3
Min	4 330	5.75	Max	4 810	4.8
Max	4 371	4.75	Min	4 872	5.5
Min	4 411	5.3	Max	4 912	5.15
Max	4 476	4.9			

Table III

Slow variation
Observed extremes (1972-81)

Phase	JD	m_{vis}
Min	2 442 300	5.3
Max	2 860	4.7
Min	3 300	5.3
Max	3 650	4.8
Min	4 100	5.4
Max	4 550	4.8
Min	5 100	5.4

g Her (cont.) For the rapid variation: Period range = 67^d - 105^d
Mean magnitude: $\bar{m}_{vis}$ = 4.96 Amplitude range, m_{vis} = 4.6 - 6.0

b) Slow variation (see Table III) The brightness is here taken to be the mean value of the superimposed, faster light variation.
The secondary period has a mean value $\bar{P}_2 = 875 \pm 70^d$, with an amplitude range m_{vis} = 4.8 - 5.5

In addition non-periodic brightness variations also occur, with characteristic durations of between 5 and 15 days, and an amplitude of up to 0.2^m.

[We are pleased to be able to include this report from Dietmar Böhme, who has also just submitted a paper on the eclipses of Eta Geminorum to the BAA Journal. He may be contacted at:
4851 NESSA 11 PF 93 DDR]

Epsilon Aurigae Just a reminder to our readers that Epsilon Aurigae has begun (about the end of July) its descent towards its minimum which it will reach in early January 1983. For those who do not remember the details, this star has the exceptionally long period of 9883 days (i.e. 27.06 years), and a range between magnitudes 3.0 and 3.8. The duration of the eclipse is 791^d, and that of minimum 366^d. There is still no general agreement about the nature of this system, one component of which (the one causing the eclipse) remains invisible. The most probable model is that in which the eclipse is caused by a shell ejected from, surrounding, and hiding a small hot component. Naked eye observations may be made using Eta (mag. 3.2) and Zeta (mag. 3.9) as comparisons. The latter star has a period of 2.66 years, but has recently undergone an eclipse.

Mira and RS Oph We are pleased to learn that members found our 'stop press' details of Mira and RS Oph accompanying the last Circular of interest, and thank them for the observations which have been sent in. In connection with Mira the information was circulated following a report from Frank Knight who observed on 1982 July 27 and said '... Mira Ceti is now unusually bright, $3^m.0$ (a very good observation that I was lucky enough to make this morning). This is brighter than I have ever seen it before, and that includes my big period of observing about 40 years ago.' Current reports put the star at about 3.3 - 3.4.

RS Oph appears to have reached mag. 10 - 10.1 (July 17) and subsequently fallen back to around 11.0. A report just this moment received suggests that it may be rising again.

SU Ursae Majoris We would just call members' attention to the report of the BAA Ordinary Meeting of April 28 (Journal **92** (5) 238) in which Dr M.F. Bode of Keele University discussed this star. It would now appear that the X-ray halo previously reported was a transient feature.

Errata: Circular 50 Page 5, last line: for 'observarional' read 'observational'. Page 7, last item, heading: for 'Availibity' read 'Availability'. We apologise to our readers overseas for such errors, knowing that at least one person searched (not surprisingly without success) for the second of these words.

-----*****-----

Change of Address

Associazione Astrofile Veneziani C.P. 433 - VENEZIA 30100 ITALY

A. Thomson, Ardbeck Lodge, North Deeside Road, Milltimber, Aberdeen

New members

R.W. Betts, 18 Hilda Street, Goole, North Humberside DN14 6DS

R. Flett, Halvard, 22 Dundas Crescent, Kirkwall, Orkney

J.A. Muston, 10 Whitmore Road, Chaddesden, Derby

****

Circulars: All material (and payments) to Storm Dunlop. Monies to be payable to BAA.

Charges: United Kingdom £2 for Circulars and light-curves

Other countries £3 " " " "

(Circulars only £1 and £1.50 respectively)

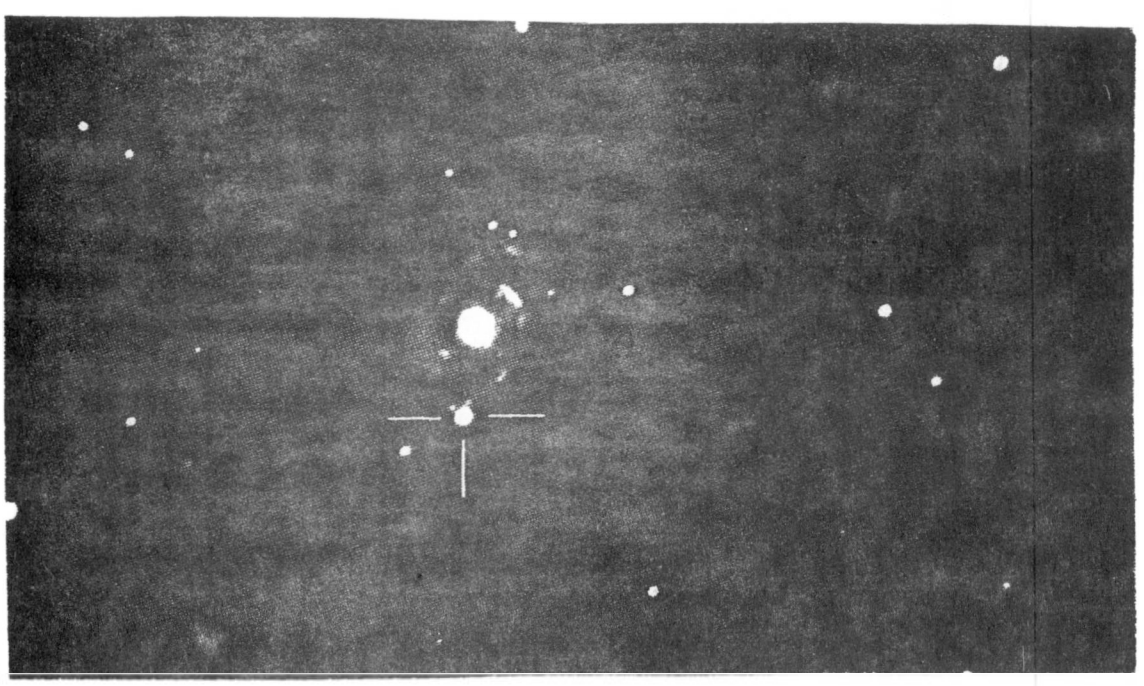
Charts: John Parkinson

Charges: Main programme SAE plus 20p per star (4 sheets)

All other programmes SAE plus 5p per star (1 sheet)

Note: All payments should be made to the BAA, please.

****



SN in M100, 1979 Apr
(by Ben Mayer, California)

[Testing method of reproduction]