

BRITISH ASTRONOMICAL ASSOCIATION

L I G H T - C U R V E

VARIABLE STAR SECTION CIRCULAR No. 50 1982 JUNE

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) 374651

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 Yorksshire HD7 4IX

Tel: Huddersfield (0484) 642947

\*\*\*\*\*



## Change of Address

R.J. Stuart 67 Ullswater Road, Handforth, nr Wilmslow, Cheshire

## New Members

L. Baker, 4 Ailsa Drive, Greenock, Glasgow

N.M. Bone, Dept of Molecular Biology, Univ. Edinburgh, Mayfield Road,  
Edinburgh EH9 3JR

D. Couzin, 40 Hillhead Drive, Ellon, Aberdeenshire AB4 9WB

S.J. Evans, 79 Beechwood Rise, Watford, Herts. WD2 5SQ

J.A. Harcourt, 16 Tippet Green, Rowley Regis, Warley, W. Midlands  
B65 9AA

E. Spooner, 57 Ripley Road, Heage, Derbyshire DE5 2HU

A. Thomson, Coullie Cottage, Udney Green, Ellon, Aberdeenshire AB4 0RT

W. Vollmann, Fr. Hillegeiststr. 2/25, 1020 WIEN, Austria

A. Watkins, 1 Rayleigh Road, Kent Elms Corner, Leigh-on-Sea, Southend,  
Essex

## CIRCULARS

Please note:

All material for these Circulars (and payment) should be sent  
to Storm Dunlop at the address given overleaf.

Charges: United Kingdom £2 for Circulars and light-curves  
Other countries £3 " " " " " " " " " "

(Circulars only £1 and £1.50 respectively)

Payable annually - you will be informed when renewal is  
due.

## CHART ENQUIRIES AND ORDERS

All information and orders should be sent to John Parkinson -  
address overleaf.

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

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

NOTE - All charges (Circulars, Charts, Etc.) are payable to the  
BAA, please do not make payment to individuals.

Editorial Once again we must apologise for the delay in issuing this (and the previous) Circular. It is our intention to publish quarterly, but for various reasons it is difficult to adhere to a rigid schedule. We are investigating the possibility of another form of production, which would enable preparation to be faster. If costs permit this alternative method of publication will be introduced with Circular 51 or 52.

Contributions As we have previously said we are always interested in receiving contributions from members and subscribers. This time we have several from Aare Kellomaki, while one from Dietmar Böhme on the behaviour of  $\gamma$  Herculis, as shown by extensive observations by German observers, has been translated, but may have to await Circular 51 in order that the light-curve may be reproduced.

1981 Light-curves of Main Programme Stars Reproductions of the light-curves of all BAA Main Programme stars are included with this Circular (for subscribers). Binocular stars should be covered by curves issued with the next Circular. Members are reminded that they may receive all light-curves by payment of £1. A few extra copies of the Main Programme light-curves are available, but if a large number of members suddenly wake up to the fact that they have not subscribed, and request copies, there may be some delay while further stocks are obtained.

Past Issues of Circulars A considerable quantity of copies of past issues still exists, but this stock has to be reduced. If any back issues are required, please contact Storm Dunlop. The cost of postage will be appreciated. Photocopies of any past issues of the current series (from 12 - 1972) are available at cost. [Copies can also be made of the original series 1 - 11, 1922 - 1933.] Send all requests to Storm Dunlop.

In addition an index is being prepared including all items in Circulars 35 - 50.

Submission of Observations Members are reminded that the various Secretaries would like to receive observations for the period 1982 January to June as soon as possible.

'Observer' Report Forms A copy of the long-awaited 'observer' report forms is enclosed with this Circular, and may be returned with your Jan - Jun observations. Apart from your name, initials and the year, completion is as follows:

For each instrument enter:

Code letter (R = Reflector, G (OG) = Refractor, B = Binoculars)  
[If you insist upon other forms of telescope, C = Catadioptric,  
M = Maksutov, S = Schmidt.]

Diameter in mm

For Binoculars only, Magnification preceded by 'X'

Examples: B50X7 = 50 mm, x 7 Binoculars (note this reverses usual order in which details are specified)

R300 = 300 mm Reflector

G75 = 75 mm Refractor

Please then enter the instrument number in the appropriate column (57) on the 'Estimate' forms. We suggest that you keep a prominent note of the instrument code numbers.

The second and following lines on this 'observer' form are for long comments - give a 2-digit code in cols. 26 & 27. 'X' followed by this 2-digit code in cols. 68-70 of 'estimate' form will provide the appropriate cross-reference.



SUAA.VSS in the winter of 1980-81

Aarre Kellomäki (Director of SUAA.VSS)

The VSS of the Scandinavian Union of Amateur Astronomers was inaugurated in 1972. The activity of the Section has increased gradually, especially during the last three years. The observing year from July 1 1980 to June 30 1981 was again successful; the Section received 25,118 observations from 45 observers in the four northern countries of Finland, Sweden, Norway and Denmark (the majority of observers being in Finland). There were 12,852 binocular and 12,264 telescopic observations. The most active observer was Harry Lehto with 2,917 observations; nine other observers exceeded 1,000 observations.

Our observing programme contains about 65 binocular and 160 telescopic stars. Although the distribution of the observations amongst the variables was more even than in earlier years, once again there were a large number of observations of some popular stars; for instance SS Cyg 640, Gamma Cas 508, Alpha Cas 488 and Mu Cep 443.

Great difficulties were encountered in trying to publish the results but by using microcomputers for tabulating binocular observations, we were able to solve the problem up to the beginning of 1982 and can now return to our usual time table. Besides the original observations we also published (when reasonable) 10-day means of variables and other analyses of our observational data.

Main Programme Report for 1981 Because of Greg Coady's absence in the USA until May of this year, this report is compiled by the Director.

In addition to the stars covered by the programme listed in the December 1981 Circular (no. 48), observations were also received of:- SN in NGC 6946 (Cep), SN in NGC 4536 (Vir) and Nova Aql (1982).

A total of 16,577 observations (an increase of over 7% compared with 1981) were received from 66 observers. Promising results came from new observers J. Lashley, Terry Laban, John Rock and Garry Foyner and Ian Nartowicz. Unfortunately we are losing the observations of Henk Feijth because the Netherlands group are to send their observations to the AAVSO; we thank Henk for his excellent services to us. We must also thank Tony Tanti and Frank Ventura in Malta for extending the coverage of some of our difficult low declination stars. Special mention is given to our most prolific observer Dave Stott who made over 2,000 observations (I know from past experience how difficult this is to achieve) also to Shaun Albrighton and Karl Lewis, both of whom well exceeded 1,000 observations and Len Brundle and Mike Gainsford with over 900 each. Steve Kay topped the 700 mark.

The observer totals (minimum 30 observations) for 1981 were:

S.W. Albrighton	1220	S. Hoste	115	R.A.H. Paterson	357
C.M. Allen	251	M.B. Houchen	64	R.D. Pickard	393
M.R. Bell	94	G.M. Hurst	178	G. Poyner	415
R. Billibgton	91	S.J. Kay	718	J.W. Rock	269
T. Brelstaff	215	N.S. Kiernan	325	A.J. Rogers	30
L.K. Brundle	916	N.F.H. Knight	504	D.R.B. Saw	356
R.H. Chambers	69	A. Kocsis	77	J.D. Shanklin	190
G.A.V. Coady	263	J. Lashley	45	H.W.S. Smith	193
E.H. Collinson	150	K. Lewis	1397	R. Steele	32
J.W. Ells	128	R.J. Livesey	36	D. Stott	2005
B. Espey	33	R.L. Lyon	236	R.J. Stuart	59
H. Feijth	392	I.A. Middlemist	517	T. Tanti	252
R.B.I. Fraser	34	R. Miles	115	M.D. Taylor	302
M.J. Gainsford	965	C.R. Munford	499	F. Ventura	77
R.J. Godden	168	I.P. Nartowicz	234	P.J. Wheeler	374
L.J. Higgins	73	M.J. Nicholls	57	P.B. Withers	475
A.J. Hollis	276	J. Parkinson	55	Photographic	91
		15 other observers	197	TOTAL	<u>16,577</u>

We thank the following observers, either for their invaluable early morning observations or for their good series for particular stars: Shaun Albrighton, Tristram Brelstaff, Len Brundle, Greg Coady, Henk Feijth, Mike Gainsford, Ron Godden, Les Higgins, Steve Kay, Norman Kiernan, Frank Knight, J. Lashley, Karl Lewis, Ian Middlemist, Colin Munford, Roger Pickard, John Rock, Jonathan Shanklin, H.W.S. Smith, Dave Stott, Tony Tanti, Melvyn Taylor, Frank Ventura, Peter Wheeler and Philip Withers.

The number of observations received for each star was:

*R And 108	XX Cam 288	SS Cyg 963	*X Leo 138	*RV Tau 141
*W And 152	*S Cas 148	*BC Cyg 130	*AY Lyr 154	SU Tau 167
*RW And 152	T Cas 283	*BI Cyg 142	U Mon 271	T UMa 218
RX And 437	UV Cas 303	CI Cyg 347	RS Oph 190	*SU UMa 222
DZ And 148	Gam Cas 378	Chi Cyg 166	U Ori 219	*SW UMa 216
R Aql 220	Rho Cas 258	HR Del 179	*CN Ori 142	CH UMa 347
*UU Aql 91	DM Cep 0	*T Dra 212	*CZ Ori 105	*V Vul 186
*UW Aql 94	o Cet 202	*AB Dra 66	RU Peg 242	PU Vul 325
V603 Aql 3	R CrB 512	U Gem 276	S Per 148	Honda Cyg 25
(RW Aur 79)	S CrB 240	IR Gem 83	*RS Per 181	3C 273 2
SS Aur 469	*T CrB 157	*RU Her 96	TZ Per 322	NGC 4151 0
(SU Aur 178)	*V CrB 173	SS Her 177	*UV Per 105	Mark. 421 0
*U Boo 103	*W CrB 111	AC Her 404	*BU Per 162	Branch. Sct 52
*V Boo 209	*R Cyg 169	AH Her 261	*GK Per 193	SN NGC6946 30
*V Cam 131	*S Cyg 146	*R Hya 77	*WZ Sge 144	SN NGC4536 12
X Cam 212	V Cyg 242	*SU Lac 120	R Sct 506	N.Aql1982 3
Z Cam 480	W Cyg 399	DK Lac 0	*R Ser 173	(T Tau 120)

In addition, a further 62 observations were received of the following stars; V1330 Cyg, V1500 Cyg, V1668 Cyg, HM Sge, HS Sge, NQ Vul. The bracketed stars RW Aur, SU Aur and T Tau are no longer on the programme. The stars marked \* need more observations.

#### Discussion of the Main Programme

On the assumption that about 200 observations of a star are needed in order to plot a reasonable light curve, then the present programme is about the right size as we have about 16,000 observations of about 80 stars. However, this assumption is true only for M stars and then only if there are, say, 5 observers each making 40 observations spread evenly throughout the year to cover minima and difficult times of observing. Unfortunately this rarely happens; there are very few stars that are observed adequately. More often the apparently good totals for many stars are achieved only because of the dedication of 2 or 3 of our top dozen or so observers. Stars in this category are: R And, RW And, DZ And, R Aql, V Boo, V Cam, UV Cas, T CrB, R Cyg, S Cyg, BC Cyg, BI Cyg, Chi Cyg, T Dra, SS Her, SU Lac, CN Ori, RS Per, BU Per, GK Per, RV Tau, CH UMa and V Vul. We hope the observers of these stars will keep up their good work and we would be very grateful if other observers feel that they can add some of these stars to their present programme.

A few stars are receiving very good coverage: RX And, SS Aur, Z Cam, R CrB, SS Cyg, CI Cyg, U Gem, AC Her, R Sct, CH UMa (see above) and PU Vul. However even here these stars are not covered during their "difficult" times of the year. For instance, despite the splendid efforts of two observers, the start of the "standstill" of RX And was missed. Again, in the case of SS Cyg, which is notoriously over observed in the late summer and early Autumn and which leads to many redundant observations, only 2 observers covered it during March. It would be very helpful if observers of this star were to add some of the other Cyg stars such as BC and BI to their programme (or even made negative observations of R and S Cyg).

As well as BC and BI Cyg, other semi-regular stars needing better coverage are RS and BU Per. They may not be the most exciting of stars, but then for most of the time neither is R CrB, another star which is over-observed during the Summer, but which is observed by only a handful of observers during December and January.

The other type of star which is suffering badly is the UG/Z type; in particular many more observations are needed of AB Dra, X Leo, AY Lyr, CN Ori, CZ Ori, UV Per, SU UMa and SW UMa. Observers with apertures of 250mm (10") are asked to give these stars first priority.

Finally, thank you to all observers. The VSS is now its strongest ever; keep up the good work and also add a few under-observed stars to your programme. Good weather and good observing. Doug Saw.

SX PhoenicisJohn Toone

SX Phe and AI Vel (both southern stars) are the only two stars of a rare type (RRs) of dwarf cepheid brighter than  $10^m$ . When discovered by Eggen in 1952 it held the record for the shortest period (79 min) pulsating variable star. The range varies, this modulation being caused by pulsation in both the fundamental and first harmonic modes.

In September 1981 I visited Puerto Rico, Gran Canaria ( $27^{\circ}47'N.$ ,  $15^{\circ}43'W.$ ) from where SX Phe (Dec.  $-42^{\circ}$ ) could be observed nightly for nearly five hours. On Sep. 25 I checked the comparison star sequence and found that at least one visual magnitude estimate would have to be made every five minutes in order to produce a meaningful light curve.

On Sep. 27, between 10.32 and 15.18 (286 minutes), I made 65 estimates of the star with 12 X 50 binoculars. From 13.21 to 13.43 I had to make an estimate every two minutes to follow each  $0^m.1$  increase in brightness.

The light curve is shown below. Four maxima were observed; at 10.56 ( $7^m.1$ ), 12.34 ( $7^m.0$ ), 13.43 ( $6^m.7$ ) and 15.02 ( $7^m.0$ ) giving a mean period of  $82 \pm 12$  minutes. Near minimum the star apparently fluctuated about  $0^m.1$  but photometry would be necessary to show if this is a real effect. The minima were all  $7^m.43$  giving an extreme range of  $0^m.7$ ; this is  $0^m.4$  greater than that given in G.C.V.S. (1969 edition). Colin Henshaw at Gatooma, Zimbabwe (Latitude  $14^{\circ}S.$ ) has recorded a range from  $6^m.8$  to  $7^m.5$  with a period of 80 minutes.

It is unfortunate that SX Phe is not visible from the British Isles as this star is a rewarding one to observe because of its short period and modulated range. The light curve shows the amount of information which can be obtained from observing for a few hours during a single night.

[The light-curve which John mentions is actually reproduced at the end of this Circular. We apologise to John for the delay in printing his item. Unfortunately we have not yet had the other observations which we were promised of a similar star, CY Aqr.]

Binocular Programme Stars

With the exception of the suspect 'variables', the following stars have items of uncertainty shown in the GCVS, and its supplements. It will be seen that in some cases even the type of variation is uncertain. Many of these stars can be very adequately covered by amateurs, so that we can certainly hope to improve knowledge of the stars' characteristics by reasonably comprehensive coverage. We urge members to try to follow any of these stars consistently so that the long observational runs, so essential to determining

behaviour, may be available.

LIST 1:

(Star name, type, uncertainty. Figure is GCVS period in days.)

V Aql	SRb	353?	BQ Gem	SRb	50?
V450	SRb	40?	BU	Lc?	type
			IS	SRd	47?
V Ari	SRb	77?	NQ	SR?	type
UU Aur	SRb	235?	X Her	SRb	95?
psi <sup>1</sup>	Lc?	type	V566	SR?	type, 400?
			g	SRb	70?
RX Boo	SRb	340?	U Hya	SRb	450?
U Cam	SRb	400?	SV Lyn	SRb	76?
UV	SR?	type, 294?	δ <sup>2</sup> Lyr	SRc?	type
X Cnc	SRb	170?	S Mon	Ia?	type
RS	SRc?	type	SX	SR	100?
RT	SRd	90? or 140?	W Ori	SRb	212?
Y CVn	SRb	large	CK	SR?	type, 120?
		irregularities			
TU	SRb?	50? type	AD Per	SRc	330?
SS Cep	SRb	90?	ST UMa	SRb	81?
T Cyg	Lb?	type	V UMi	SRb	72?
RV	SRb	300?			
V973	SRb	40?	RX Vir	SR?	type, 200?
RY Dra	SRb	172.5?	SW	SRb	150?
TX	SRb	78?	BK	SRb	150?
UW	Lb?	type			
VW	SRd	170?			

According to the 'Amateur's Variable Star Directory' published by the IUA, the following stars are probably unique to the BAA programme. A ? indicates a star suspected of variability.

LIST 2

AQ And	SR	RX Cep	L
BZ	Lb	CSV927	?
		+59 2383	?
V450 Aql	SRb	+60 2216	?
V1293	SRb	+84 0536	?
CSV101849	?	F1 33 Cet	?
V Ari	SRb	V973 Cyg	SRb
NO Aur	Lc	CSV8307	?
+31 1048	flare?	CSV8683	?
		F1 28	?
+61 0668 (Cam)	?	+47 2801	?
V377 Cas	Isb	+19 4450 (Del)	?
CSV171	N1?	F1 69 Dra	?
+49 4329	?	DW Gem	Lb
Wr 162	?	NQ	SR?



V566 Her	SR?	GO Peg	Lb
SX Lac	SRd	PR Per	Lc
delta <sup>2</sup>	SRc	Z Psc	SRb
SX Mon	SR	+22 0743 (Tau)	?
V2048 Oph	γC	TV UMa	SRb

Changes to the binocular programme will probably be introduced in 1983 and it is likely that this will involve some of the suspects and objects from List 1. Observers with particular 'favourite' stars which appear above, or those who wish to make proposals or comments should contact the Binocular Secretary.

#### Co-operation between SUAA.VSS and BAA.VSS

I think that it is a worthwhile idea to try to make some combined effort between the national (or regional) organizations in general, and between SUAA and BAA in particular. I am willing to take part in the data analysis, and since I work close to a computer centre it will be no problem for me to handle the amounts of data which will be gathered. There are some practical problems:

- 1 Data transfer. Ways have to be found to record the observations on some medium for transportation between Great Britain and Sweden/Finland. My personal choice would be to use magnetic tape.
- 2 Methods of analysis and presentation. My present method for analysing the SUAA.VSS data is to make least squares approximations with a third-degree polynomial to derive computed maxima for Mira stars. If SUAA were to handle part of the data and the BAA the other part, the same method should be used for analysis and presentation.

If these problems can be solved, it will both benefit the better usage of the observations, and also be proof of the possibility of international co-operation between amateur organisations.

With best wishes,

Gunnar Rynefors  
P1 4320  
S-440 06 GRÄBO  
Sweden

#### Availability of a computer program for tabulating variable star observations

My son Pertti Kellomäki has made a microcomputer program for processing variable star observations. This program 'COMTAB' (compute and tabulate) is in BASIC language (essentially standard Microsoft BASIC) and contains 260 lines. It is interactive and can also be used by persons with just knowledge of computers alone. In the present form the program handles observations for half a year. It forms 19 'boxes' of 10-day periods in the memory of the computer beginning from the starting J.D.

The observations are written in by two INPUT commands in the form: TIME, MAGNITUDE and OBSERVER. If the observer is the same as the earlier one it can be written by pressing RETURN, which greatly facilitates the input. Correcting the written value is possible too. In this input phase the computer stores the data in two tables T and M and in string variables O in proper 10-day boxes. When the input has been finished the computer

first sorts the tables and string variables in chronological order. Then it computes 10-day means with S.D.'s within every 10-day box.

This phase takes about 4-6 minutes for 300 observations, but my computer is a little slow. In the output phase the computer writes tables of original individual observations and 10-day means with a teletype or matrix printer. Soon the program will be extended to print light-curves as 10-day points. From the tables the binocular report of the SUAA.VSS has been compiled by a 'cut and paste' method.

My experience with the program are favourable. At best I have been able to write in as many as 240 observations per hour, and the net result was then about 180 observations tabulated per hour. As I believe that microcomputers might be useful for other associations as well, I offer this program for use without any charge. Please write for further information.

Aarre Kellomäki  
SF-36280 Pirkkolinna  
Finland

[Slow progress is being made with the VSS computing project. As there was such interest in astronomical computing shown by the response to the VSS enquiry letter published in the BAA Journal, the BAA itself is promoting a 'Microcomputer Users' Group' and everyone - mostly from outside the VSS - will be contacted in due course.]

#### Another Editorial Note

It has been suggested since we started preparation of this Circular - incidentally we apologise for the changes in typewriter - that perhaps some members are shy of contributing anything. Don't be shy! Any comments, in more or less any form, are welcome. Please let us have them. All the officers of the VSS are exceptionally busy, and it is not always easy for them to find the 'extra' time to compile notes for these Circulars, and then to produce the final version. With a greater amount of material it would also be easier to achieve regular publication. [Strange, but true.] We are very grateful to Rossie Atwell for a lot of help with preparation and mailing of both this, and Circular 49. We know that members have various schemes - for example photometers - so please let us have some details.

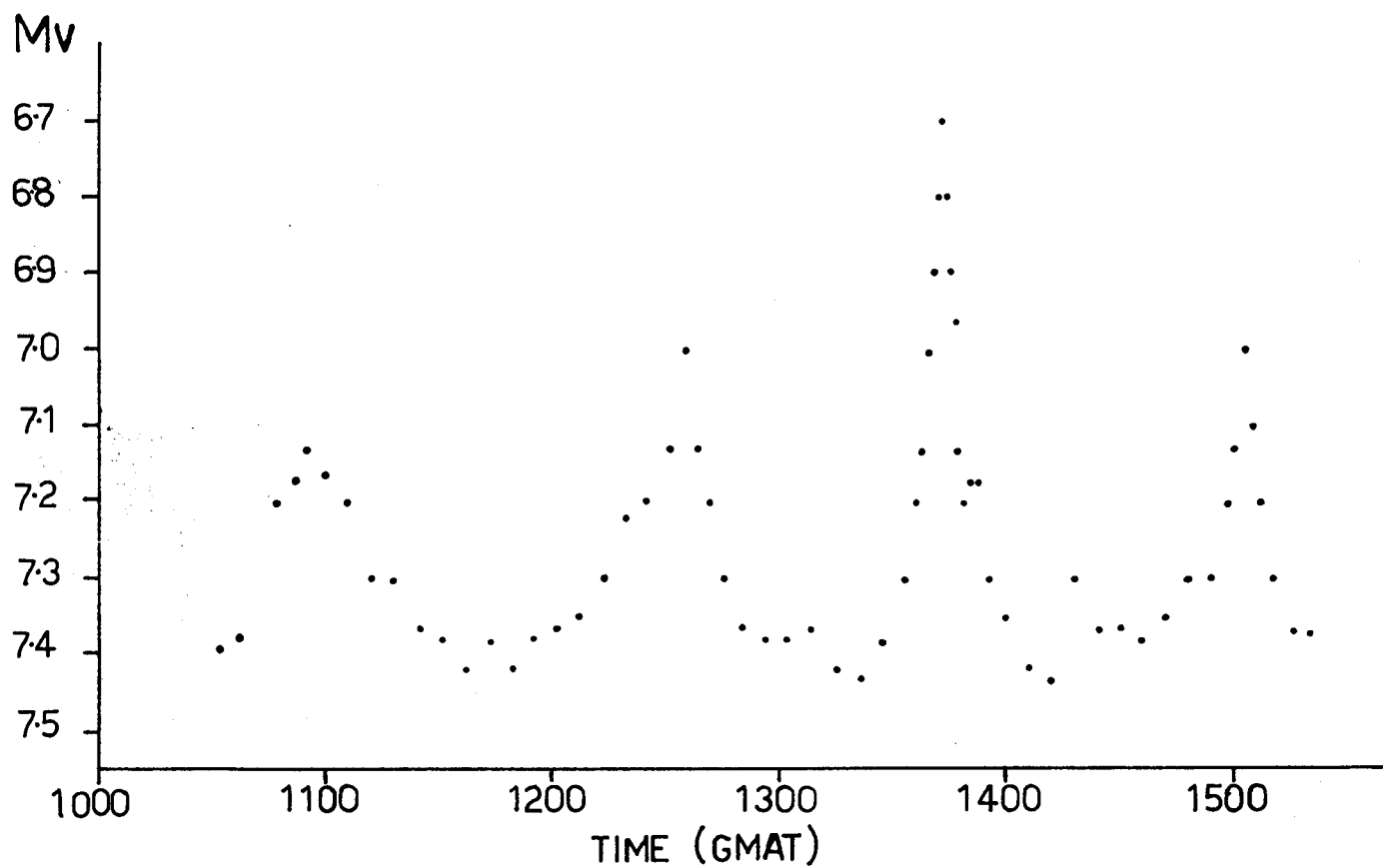
#### The Report Forms

For the benefit of those who feel that all (2) of the VSS Report Forms are vastly complicated, a comprehensive set of instructions is being prepared, so they may take heart. We would remind members that report forms may be obtained from any of the Secretaries.

#### U and EU Delphini

A chart for these variables is attached to this Circular, together with fairly recent light-curves for both. As a glance at the curves shows the variations are not well-defined when only a few observations are available, as is to be expected with any fairly red stars. Observers who have not observed these objects might like to try, whilst those who have observed in the past are urged to continue to keep them on their programmes.

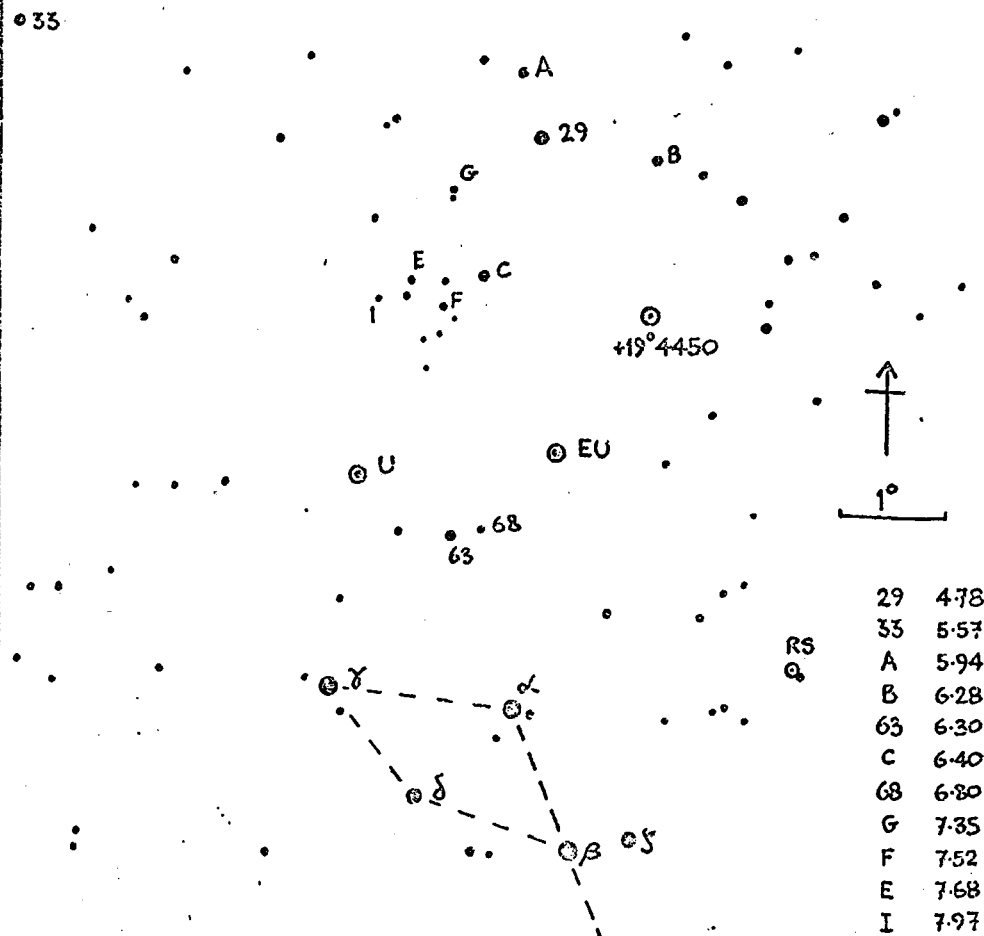
-----\*\*\*-----  
\*\*\*



Light-curve of SX Phe from observations on JD 2 444 875. Maxima occur at 10.56 (7.1 mag), 12.34 (7.0), 13.43 (6.7) and 15.02 (7.0).



202919	+19°44'50 Delphini	7.3 - 7.8	var?	M 8
203317	EU Delphini	5.8 - 6.9	SRb	59 <sup>d</sup> .5 M6II
204017	U Delphini	5.6 - 7.5	SRb	110 <sup>d</sup> M5III

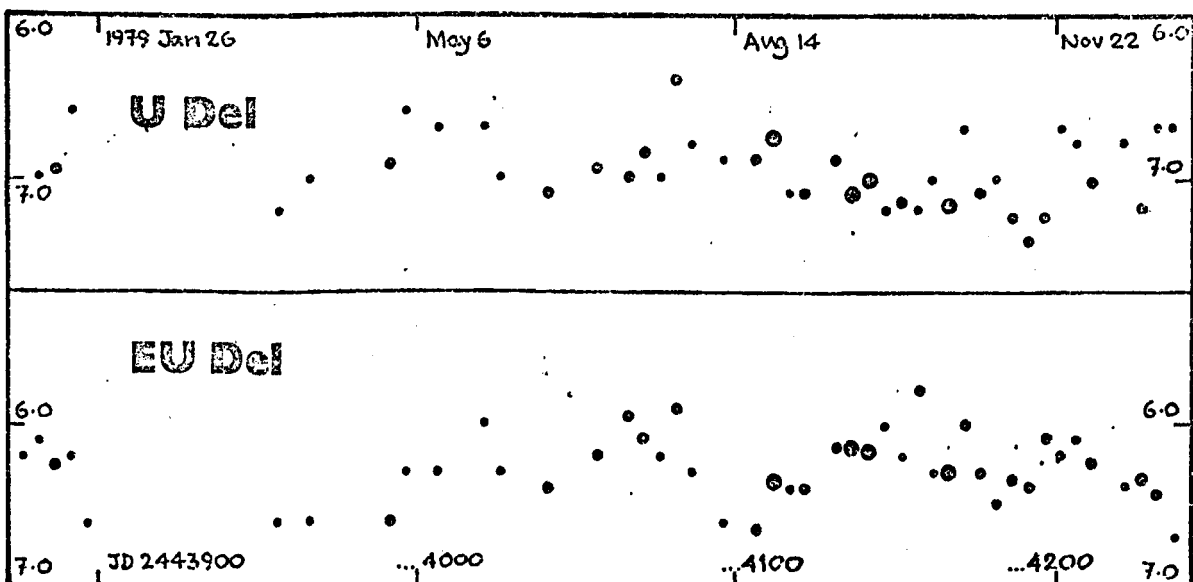


63, 68 by JEI  
others BAA VSS-  
HR Del.

BAA VSS

RS Del  
7.5-8.5 60<sup>d</sup>

JEI 23 Jan 1971  
Redrawn MDT



5-d mean mags. Observers: U Del - Haggood, Fraser, Taylor, Hufton, Middlemist, Hurst & Blair. EU Del - Fraser, Taylor, Hufton, Middlemist, Blair, Hurst. • 1 est. • 2-4 ests. • >4 ests