The British Astronomical Association

VARIABLE STAR SECTION

CIRCULAR 56

1983

DECEMBER

Head Office: Burlington House, Piccadilly, London W1V 0NL. Telephone 01-734 4145

VARIABLE STAR SECTION

CIRCULAR 56

CONTENTS

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SECTION PROGRAMMES 1984

Main Programme

The listing on pages 2 and 3 gives full details of the Main Programme stars. Objects may be added to the programme, or deleted as appropriate. These may be novae, supernovae or other objects, for example, for which observations may be requested by professional astronomers, or as a result of suggestions from observers, provided sound reasons are given to the VSS Committee.

Observers will have noticed that replacement charts in a new style are being drawn by John Toone; the reaction to these is very favourable. If observers have any comments to make about these charts, please send them to the Director for consideration by the Officers' Committee.

Binocular Programme

Melvyn Taylor, John Toone and John Parkinson are preparing a new booklet containing a complete set of binocular charts. A new binocular programme list is being delayed until this publication becomes available in the near future. Our thanks go to John Parkinson for this new idea.

Eclipsing Binary Programme

Full details of this programme were given by John Isles in VSSC 55, 1983 Sept.-Oct.

Nova/Supernova Search Programme

Guy Hurst has recently published a main chart catalogue for *The Astronomer*. This contains a list of novae and supernovae. Details can be obtained by writing to Guy at his address given inside the front cover.

Notes to the Main Programme list overleaf

This list includes Harvard designations (second column) giving approximate 1900.0 positions in RA (first 4 digits) and Dec (last 2 digits). The latter are underlined to indicate southern declinations. Please note the chart numbers and to ensure that you use the last revision. Where chart numbers contain the letters 'TA' the Chart Secretary may, in some cases, re-direct enquiries to Guy Hurst, the Nova/Supernova Search Secretary.

Range, type, period and Spectrum (Sp.) are approximate only.

* Stars underobserved in 1982 are marked by an asterisk.

BRITISH ASTRONOMICAL ASSOCIATION

Main Programme 1984

Star	Desig.	Mean Range	Type	Period	Sp.	Chart
R And	001838	6.9- 14.3	M	409	S6	053.01
* W And	021143a	7.4- 13.7	M	396	S7	035.01
*RW And	004132	8.7- 14.8	M	430	M8	022.01
RX And	005840	10.3- 14.0	Z Cam	(14.3)	Pec.	001.02
DZ And	002725	9.7-(14.0	RCB?	-	K0	055.01
VY Aqr	210609	8.0- 16.6	UG?	-	-	TA/BAA
R Aql	190108	6.1- 11.5	M	291	M7	030.01
*UU Aql	195109	11.0- 16.8	UG	(56)	G	002.02
*UW Aql	185200	8.9- 9.5	Lc	-	M0	028.01
*V603 Aql	184300	-1.1- 12.0	Na	-	B	TA
SS Aur	060547	10.5- 15.0	UG	(56)	Pec.	003.02
* U Boo	144318	9.8- 13.0	SRb	201	M4	036.01
V Boo	142539	7.0- 12.0	SRa	258	M6	037.01
* V Cam	054974	9.9- 15.4	M	522	M7	027.01
X Cam	043274	8.1- 12.6	M	144	M3	038.01
Z Cam	081473	10.2- 14.5	Z Cam	(22)	Pec.	004.02
XX Cam	040053	7.3- 9.7	RCB	-	G1	DAP 74.11.09
* S Cas	011272	9.7- 14.8	M	612	S4	054.01
T Cas	001755	7.9- 11.9	M	445	M7	RGA 1961 Jan
UV Cas	225859	10.3- 15.6	RCB	-	F4	061.01
Gam Cas	005060	1.6- 3.0	Gam C	-	B0	064.01
Rho Cas	234956	4.1- 6.2	RCB?	-	G6	" "
*DM Cep	220672	7.2- 7.7	Lb	-	M4	
Omi Cet	021103	3.5- 9.1	M	332	M7	039.01
R CrB	154428	5.8- 14.8	RCB	-	F	041.01
S CrB	151731	7.3- 12.9	M	360	M7	043.01
T CrB	155526	2.0- 10.8	Nr	-	B	025.01
* V CrB	154539	7.5- 11.0	M	358	N2	057.01
* W CrB	161138	8.5- 13.5	M	238	M3	044.01
* R Cyg	193449	7.5- 13.9	M	426	S5	031.01
* S Cyg	200357	10.3- 16.0	M	323	S2	032.01
V Cyg	203847	9.1- 12.8	M	421	N	034.01
W Cyg	213244	5.0- 7.6	SRb	126	M5	062.01
SS Cyg	213843	8.2- 12.4	UG	(50)	Pec.	005.02
*BC Cyg	201737	9.6- 10.5	SRc	-	M4	065.01
*BI Cyg	201736	8.4- 9.9	Lc	-	M4	065.01
CI Cyg	194635	9.1- 11.5	Z And	-	B	006.01
*Chi Cyg	194632	5.2- 13.4	M	407	S8	045.01
"Honda" Cyg	213831	10.0-(14	-	-	-	TA/BAA
HR Del	203718	3.5- 12.4	Nb	-	Pec.	JEI 1972 Nov

Star	Desig.	Mean Range	Type	Period	Sp.	Chart
T Dra	175458	9.6- 12.3	M	421	NO	046.01
*AB Dra	195277	12.0- 15.8	Z Cam	(13)	Pec.	007.03
U Gem	074922	8.2- 14.9	UG	(103)	B	008.02
IR Gem	064128	10.7-(14.5	UG	(75)	-	042.01
*RU Her	160625	8.0- 13.7	M	485	M8	060.01
SS Her	162807a	9.2- 12.4	M	107	M2	047.01
AC Her	182621	7.0- 8.4	RVa	75	G3	048.02
AH Her	164025	10.2- 14.7	Z Cam	(20)	Pec.	009.03
* R Hya	132422	4.5- 9.5	M	390	M7	049.01
*SU Lac	221955b	11 - 15	M	319	M5	IDH 1978 Mar
* X Leo	094512	11.1- 15.5	UG	(17)	Pec.	010.01
AY Lyr	184137	12.6- 17.0	UG	(24)	G?	011.01
U Mon	072609	5.9- 7.8	RVb	92	G4	029.02
RS Oph	174406	5.3- 12.3	Nr	-	O	024.01
U Ori	054920	6.3- 12.0	M	372	M8	059.01
*CN Ori	054705	11.5- 14.8	Z Cam	(18)	Pec.	012.02
*CZ Ori	061015	11.8- 16.2	UG	(27)	-	013.02
RU Peg	220912	9.0- 13.1	UG	(68)	B	014.02
S Per	021558	7.9- 11.5	SRc	825?	M4	050.01
*RS Per	021556	7.9- 10.2	SRc	152?	M4	063.01
TZ Per	020657	12.3- 15.6	Z Cam	(17)	Pec.	015.02
*UV Per	020356	11.9- 17.5	UG	(360)	-	016.03
*BU Per	021156	7.9- 9.8	SRc	365?	M4	063.01
*GK Per	032443	0.2- 14.0	Na	-	B	TA/BAA
*WZ Sge	200317	7.0- 15.5	Nr	-	Pec.	023.01
R Sct	184205	4.5- 8.2	RVa	140	G5	026.02
Branchett's object in Scutum(Nova Sct 81)		8 - ?	-	-	-	TA/BAA
* R Ser	154615	6.9- 13.4	M	356	M7	033.01
RV Tau	044025	8.3- 11.4	RVb	79	K2	056.01
SU Tau	054319	9.1- 16.0	RCB	-	C0	017.02
T UMa	123160	7.7- 12.9	M	257	M5	JEI 1974 Jun
SU UMa	080362	11.0- 14.5	UG	(18)	Pec.	018.02
SW UMa	082953	10.8- 16	UG	(459)	Pec.	019.02
CH UMa	095968	10.7- 15.9	UG	(204)	Pec.	020.02
V Vul	203226	8.1- 9.4	RVa	76	G8	058.01
PU Vul	201621	8.4-(14	-	-	-	052.01
3C 273	122402	12.2- 13.0	Quasar	-	-	1981 May
NGC 4151	120539	10.8- 11.6	"Seyfert"	-	-	1980 May
Mark.421	110138?	13	BL Lac	-	-	81.07.26 TA

ECLIPSING BINARY PREDICTIONS - corrections

Members using the elements published in VSSC 55 to compile their own eclipsing binary predictions should note the following points affecting objects with non-linear terms:

1 The period given on line 2 is preceded by a minus sign for these objects. This is a signal to the program that a further record follows with the arguments of non-linear terms. The positive value of the period should be used in calculating predicted times of minima.

2 Arguments C and D are in degrees. If your computer prefers radians, multiply them by $\pi/180$ (or ATN(1)/45 if it has never heard of π).

Apologies to any members who have had trouble producing predictions because these points were not explained.

PHOTOELECTRIC PHOTOMETRY

IAPPP Meeting at Royal Greenwich Observatory, Herstmonceux

The third European meeting of the IAPPP will be held at the Royal Greenwich Observatory, Herstmonceux Castle during the last week in August or the first week in September. the meeting is being sponsored by the BAA (and the VSS) and aims to encourage amateur and professional workers to discuss techniques, present results, and start specific collaborative projects.

The final date has yet to be decided, pending the response to a questionnaire sent to a large number of persons interested. Provisional dates are August 29-30-31, September 5-6-7, or September 6-7-8. There will be a registration fee, but the amount of this is still uncertain. It has been pointed out to that the figure initially proposed (£30 - £50) is high for most amateurs; it is hoped that they will be offered a lower rate in order that they may participate. Accommodation can be arranged and this will cost about £10 per night (bed and breakfast) at local farms or inns, £20 per night at local hotels.

Anyone who feels that they may be interested is invited to contact:

Dr Norman Walker
Royal Greenwich Observatory
Herstmonceux Castle
Hailsham
East Sussex
BN27 1RP

as soon as possible. This is without obligation to attend. A copy of the questionnaire is enclosed, and we would invite members to complete this to help with planning the meeting. Full details will be sent by the end of June to anyone expressing an interest.

Recent photoelectric work - Richard Miles

Since March 1982 I have been carrying out photoelectric photometry (PEP) observations of a number of variable stars and asteroids - weather permitting. Recently, I received a comprehensive set of eclipsing binary predictions produced by John Isles and Dr Peter Owen. This list proved very useful and I observed photoelectrically the primary minimum of the Algol-type eclipsing binary, AR Aurigae, during the night of October 21/22. I made 96 30-second 'integrations' of the variable star over a period of 4 hours, using an uncooled Hamamatsu IP21 photomultiplier, together with a V-band filter. I used 17 Aurigae as the comparison star (V mag = 5.41) and with the appropriate (minor) corrections have plotted [Fig. 1] the resultant differential light-curve against the normalized V magnitude, which at primary minimum is only about ±0.005 magnitudes! [The circuit used in these observations is described in the next item.]

I hope that this brief note may serve to whet the appetite of VSS members, by giving some impression of what is possible using PEP. I used a 280-mm aperture Schmidt-Cassegrain. The observations were somewhat impaired by the presence of the Full Moon some 30 - 40 distant from the variable. The sky background at the time was thus comparable in brightness to that experienced by many city dwellers.

A number of other amateurs in the UK are now also operational, or are about to go 'photoelectric' shortly. I hope to have more to say about this in future issues of the VSS Circulars. A circulation list is being compiled of names, addresses and telephone numbers of anyone who is either very interested in the topic, planning to undertake PEP, or is already an active PEP observer. I therefore ask members who would like to be included on this circulation list to get in touch with me as soon as possible.

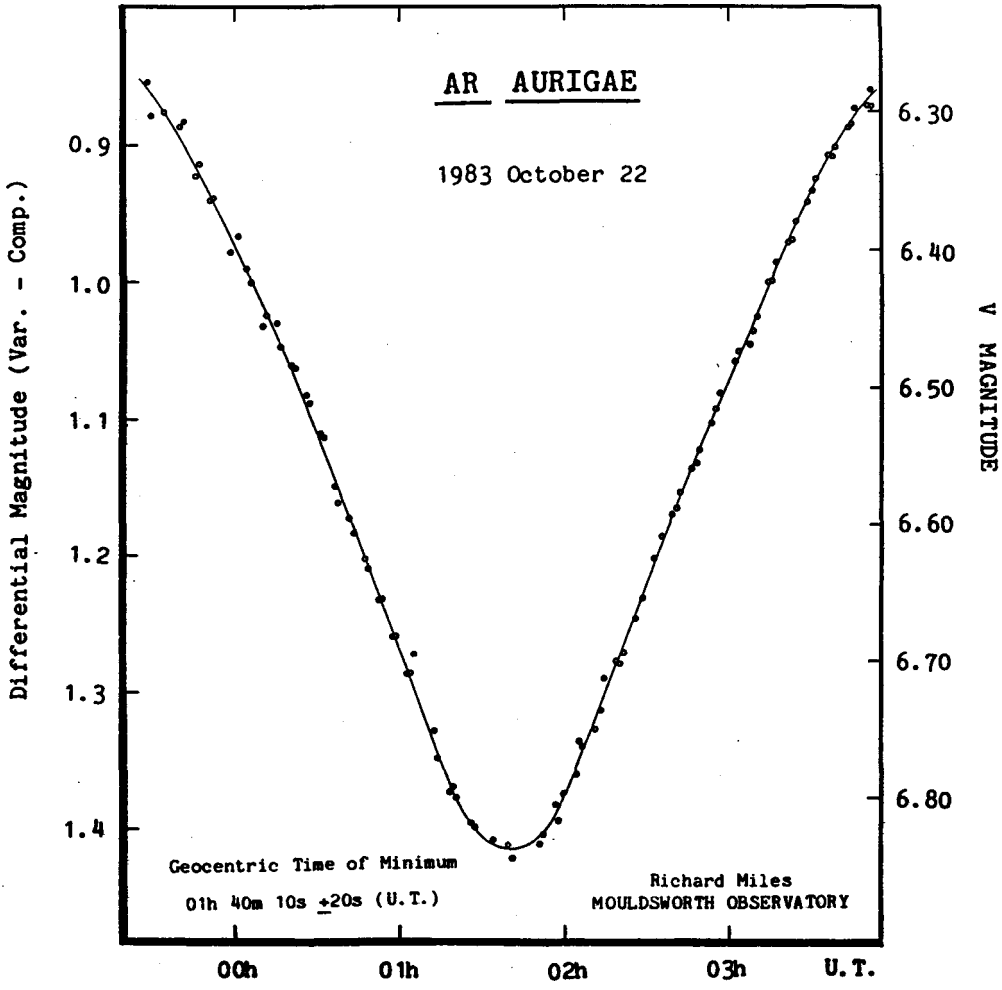
Richard Miles, Dove Cottage, Station Road, Mouldsworth, Cheshire CH3 8AJ (Tel: Manley 371)

A circuit for a stable DC photometer - A.J. Hollis

Photoelectric photometry is a comparatively new field for the amateur observer in the UK. Recent advances in silicon chip technology make the construction of sophisticated equipment relatively straightforward and suitable for the home workshop.

The accuracy of photoelectric observation is limited by the stability and performance of the electronics and by the atmospheric conditions.

The DC amplifier and voltage-to-frequency converter described here was developed by the writer from a much larger circuit discussed by David DuPuy in the Publications of the Astronomical Society of the Pacific in 1983. It was designed to achieve the performance desired and has proved very successful. It has also been adopted by Richard Miles, who is carrying out such high


AR AURIGAE
1983 October 22
Differential Magnitude (Var. - Comp.)
0.9
1.0
1.1
1.2
1.3
1.4
6.30
6.40
6.50
6.60
6.70
6.80
V MAGNITUDE
Geocentric Time of Minimum
01h 40m 10s ±20s (U.T.)
Richard Miles
MOULDSWORTH OBSERVATORY
00h
01h
02h
03h
U.T.

quality work at his observatory. [See the preceding item in this Circular.]

The circuit [Fig. 2 overleaf] uses an ICL 7650 chopper stabilized operational amplifier. This device has an internal chopper which nulifies any internal noise and counteracts any drift. Its response is linear and purely dependent on the input. The DC amplifier is carried within the photometer head, fitiing on the eyepiece mount without any additional bracing. Naturally, all other components must also be of high quality so that they contribute minimal noise. Range-selection resistors must be chosen to match the telescope/photomultiplier tube combination, and typical values are shown. The amplifier section fits on a board layout of 40 mm by 30 mm.

The voltage-to-frequency convertor is a 9400CT IC. This chip has a linearity of ±0.05%. This part of the circuit is built into a box containing both the +5 V and -5 V power supplies, plus a frequency counter based on the ICL 7226A IC. The zero volt input is set to give an output frequency of 100 counts per second in case there is any tendency for the amplifier to drift to negative voltages. Although this has been a problem in the USA with other designs, this version seems to be free from it.

The voltage-to-frequency convertor can easily be made to interface with a computer. Richard Miles counts the frequency with an HP41, which then reduces the data to instrumental magnitudes. The writer has interfaced his system to a ZX Spectrum using a Z80A-P10 and a specially-written machine-code routine to log the data, although data reduction will soon be undertaken.

The frequency counter and computer are made to count the pulses for 10 seconds. Integrating readings for this period allows random effects in the atmosphere and electronics to be averaged out. At least two counts are taken and used to form an average. This approach, and the stability of the electronics, contribute greatly to the accuracy of the system, and which is borne out by the results being obtained by its two users.

Components' lists and printed-circuit board layouts are available from the writer, who can also provide diagrams of the other components and information about sources of supply.

A.J. Hollis, Ormada, 85 Forest Road, Cuddington, Northwich, Cheshire CH8 2ED

[A light-curve obtained with this equipment, also of AR Aur is to be published in the April issue of the BAA *Journal*.]

FROM THE LITERATURE: *Monthly Notices* of the RAS

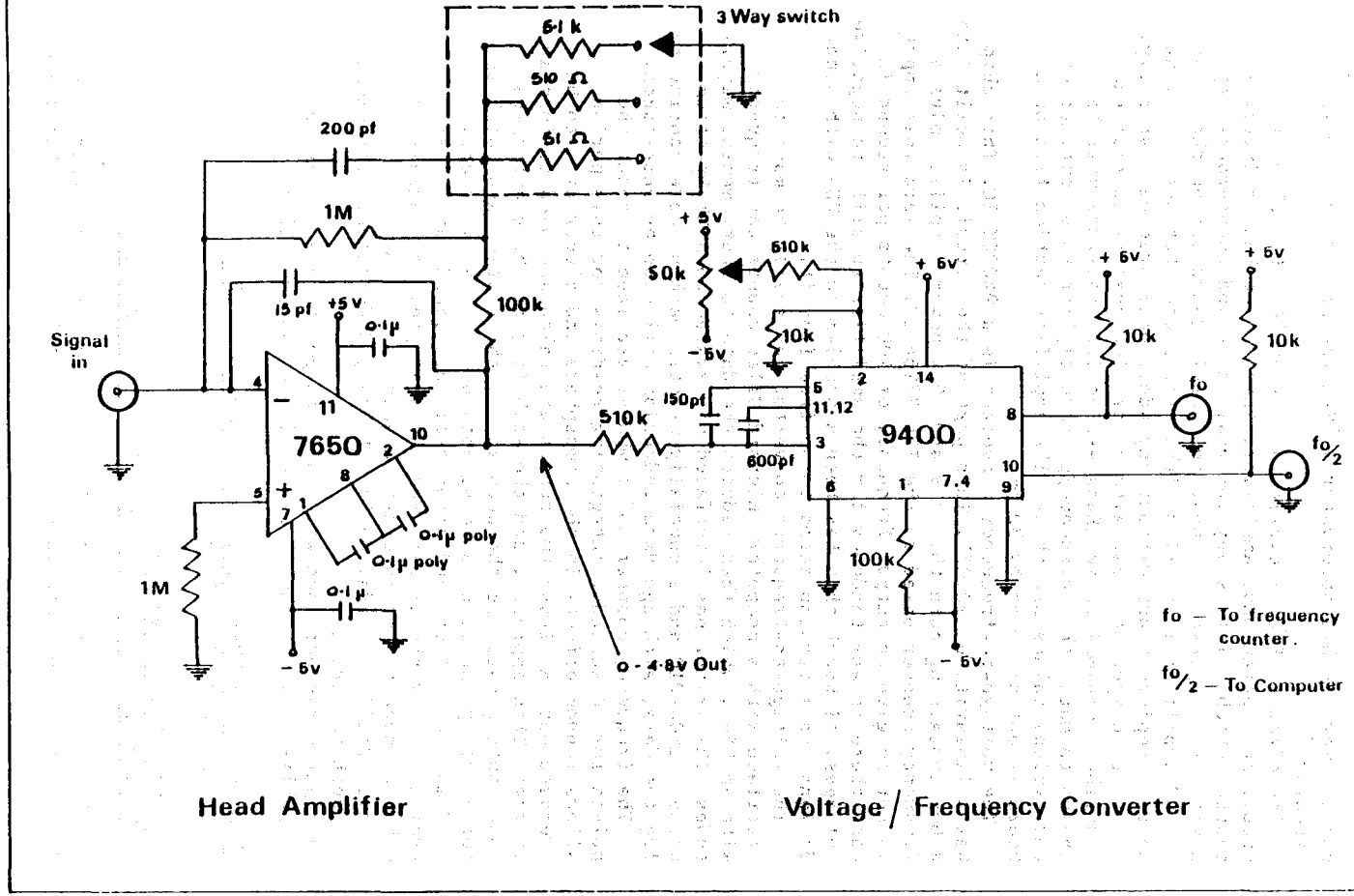
(Compiled by J.E. Isles)

Decline rates of dwarf novae

V.J. Mantle and G.T. Bath (202, 151, 1983 Jan)

In 1975 Jeremy Bailey (*BAAJ* 86, 30) discovered that there was close correlation between the rate of decline from outburst and

HEAD AMPLIFIER & VOLTAGE - FREQUENCY CONVERTER



orbital period; objects with longer periods having slower declines. He suggested that rate of decline might be determined by the size of the disk, which is limited by the size (and hence period) of the orbit. This is confirmed by theoretical work in the present paper. Theoretical light-curves of the outburst show the same dependence on orbital period as is observed, provided the mass-transfer which triggers the outburst decays fast enough.

Theoretical light-curves of novae
Sun Kwok (202, 1149, 1983 Mar)

This paper fits theoretical light-curves to optical and radio observations of the novae HR Del, FH Ser and V 1500 Cyg. The author concludes that nova ejection can be visualized as having two phases: a relatively rapid ejection during the early weeks after the outburst and a sustained, wind-like ejection over a period of several years. The rate of decrease of the mass-loss rate determines the initial rate of decline of the light-curve.

Southern R CrB stars
David Kilkenny and Claire Flanagan (203, 19, 1983 Apr)

The authors examine the small-amplitude variations which occur in S Aps and UW Cen near maximum: the period of S Aps decreased progressively from 132 days in 1923 to 110 days in 1956. UW Cen, however, showed little variation from a period of 43 days.

A second paper by Kilkenny (205, 907, 1983 Dec) examines more recent observations of S Aps. Some time about 1970 the period suddenly changed to about 40 days, and it has shown little change since then. He suggests that S Aps has switched from pulsating in the fundamental mode to the first overtone. Assuming this to be the case, the mass (0.6 solar masses) and luminosity (5000 Suns) can be derived. This work shows that R CrB stars at maximum also require careful, unbiased estimates.

V 388 Cyg
L. Milano and G. Russo (203, 235, 1983 Apr)

These authors discuss the ß Lyrae-type eclipsing binary V 388 Cyg, on list B of the BAA programme (see VSSC 55). This appears to be a semi-detached system in the rapid phase of mass-exchange: the primary fills its Roche lobe and as it evolves it loses mass to the secondary, leading to a progressive reduction in the length of the orbital period. The star has not been well-observed but if the authors are correct is should be eclipsing three or four hours earlier than predicted.

Observations are urgently required. Revised predictions may be obtained from the following elements:

Min = 2 433 584.543 + 0.85904784 E - $5.1055 \times 10^{-10} E^2$

These give minima on 1984 Jan 1, 07.30 GMAT and at intervals of $20^h\ 37^m$ thereafter. V 388 Cyg is at $20^h\ 27.2^m$, $+31^o\ 13'$ (1950.0), range 9.7 - 10.3. It is plotted on chart 50 of the AAVSO Variable Star Atlas.

Establishing the period of a variable star
M.M. Dwortsky (203, 917, 1983 Jun)

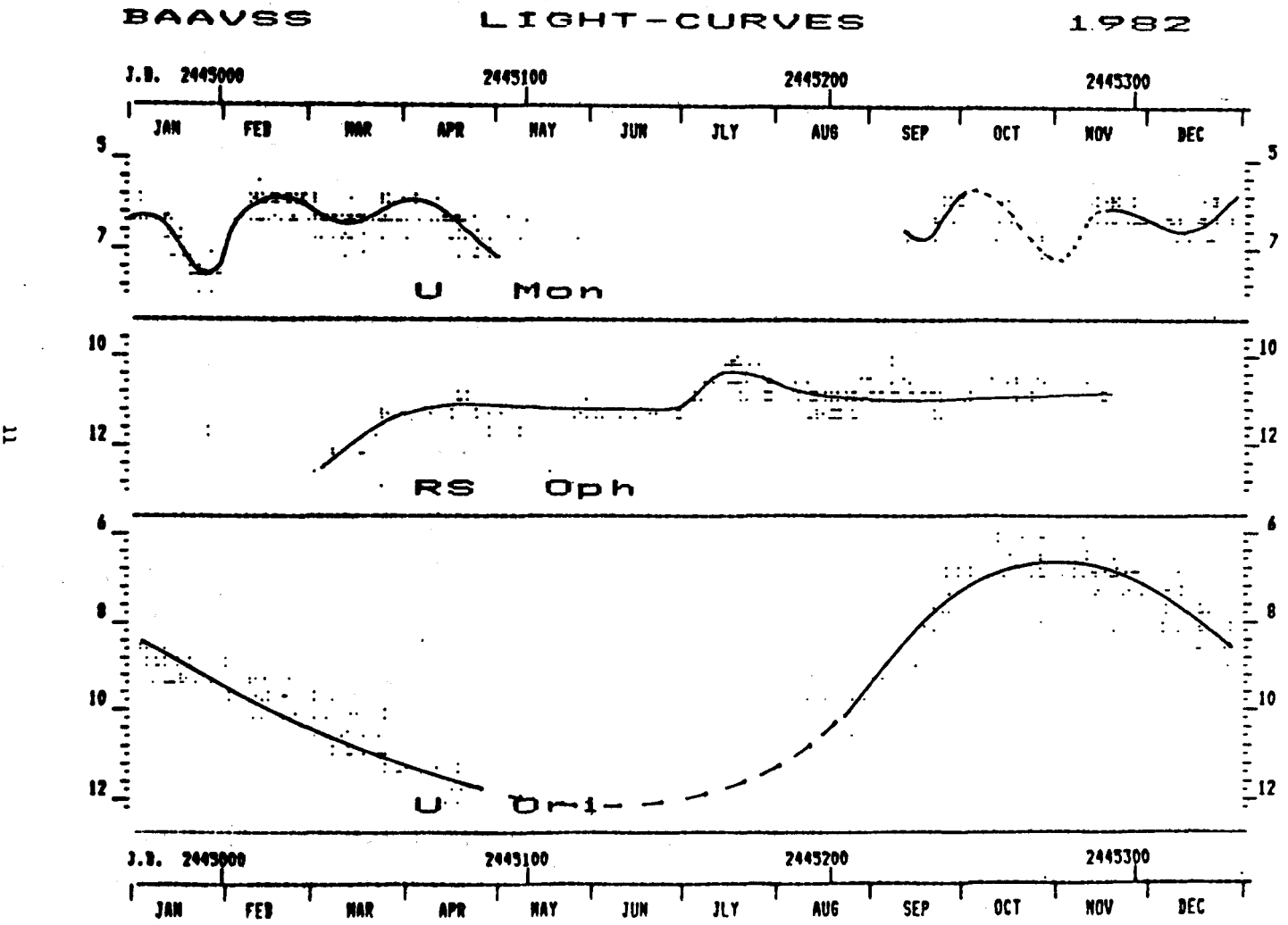
'How long is a piece of string?', describes a computer method (eminently programmable on a micro) for establishing the period of a variable star from a relatively small number of randomly spaced observations over a long span of time. Criteria for establishing the validity of indicated periods are discussed.

'Humps and superhumps'
G.T. Bath, A.C. Edwards and V.J. Mantle (205, 171, 1983 Oct)

In another mainly theoretical paper the authors discuss 'humps' and 'superhumps'. The 'hump' is a shoulder in the light-curve which precedes the eclipse of a dwarf nova of suitable orbital inclination. During 'supermaxima' - the unusually bright, long outbursts of certain objects such as SU UMa and VW Hya - 'superhumps' appear as well. In VW Hya the normal hump period is 0.074271 days, but during supermaxima a 'superhump' period of 0.074676 days is found. It is suggested that 'humps' arise from the periodic appearance of the bright spot on the disk as the system rotates in its orbital period, but that 'superhumps' are due to a bright feature on the red component, which rotates non-synchronously with a period of 2.2 days in the rotating frame of the binary. RASNZ visual observations are presented that appear to show variations in the supermaximum light-curve with period 2.2 days and amplitude a few tenths of a magnitude, suggesting perhaps that the rate of mass-transfer varies as the bright feature passes the inner Lagrangian point. BAAVSS observations of SU UMa are being examined to see if they show anything similar. The need for accurate and unbiased observations of dwarf novae is clearly underlined; it is not just a matter of saying whether the star is 'up' or 'down' tonight!

Nova Aql 1982
L. Rosino, T. Ijima and S. Ortolani (205, 1069, 1983 Dec)

These authors discuss optical (mainly visual) and spectroscopic observations of Nova Aql 1982. This appears to have been a rather exceptional nova: large amplitude (over 13 mags, but maximum was unobserved in twilight), steep decline, rapid brightness fluctuations, some spectral features resembling fast novae such as V 476 Cyg, CP Pup and V 1500 Cyg, but others resembling recurrent novae like T CrB.


BAAVSS
LIGHT-CURVES
1982
J.D. 2445000
2445100
2445200
2445300
JAN
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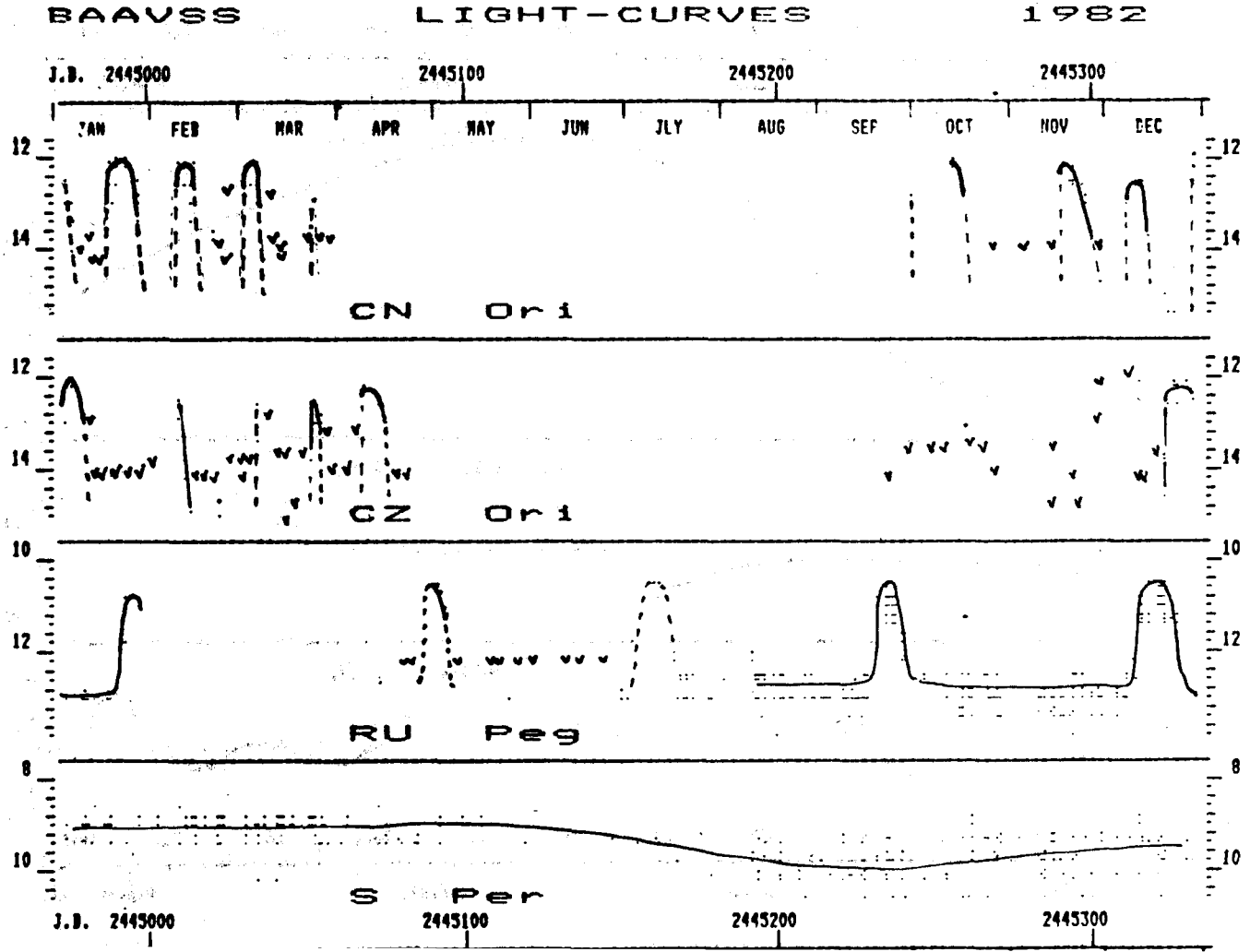
U Ori


BAAVSS LIGHT-CURVES 1982
J.D. 2445000
2445100
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JAN FEB MAR APR MAY JUN JLY AUG SEP OCT NOV DEC
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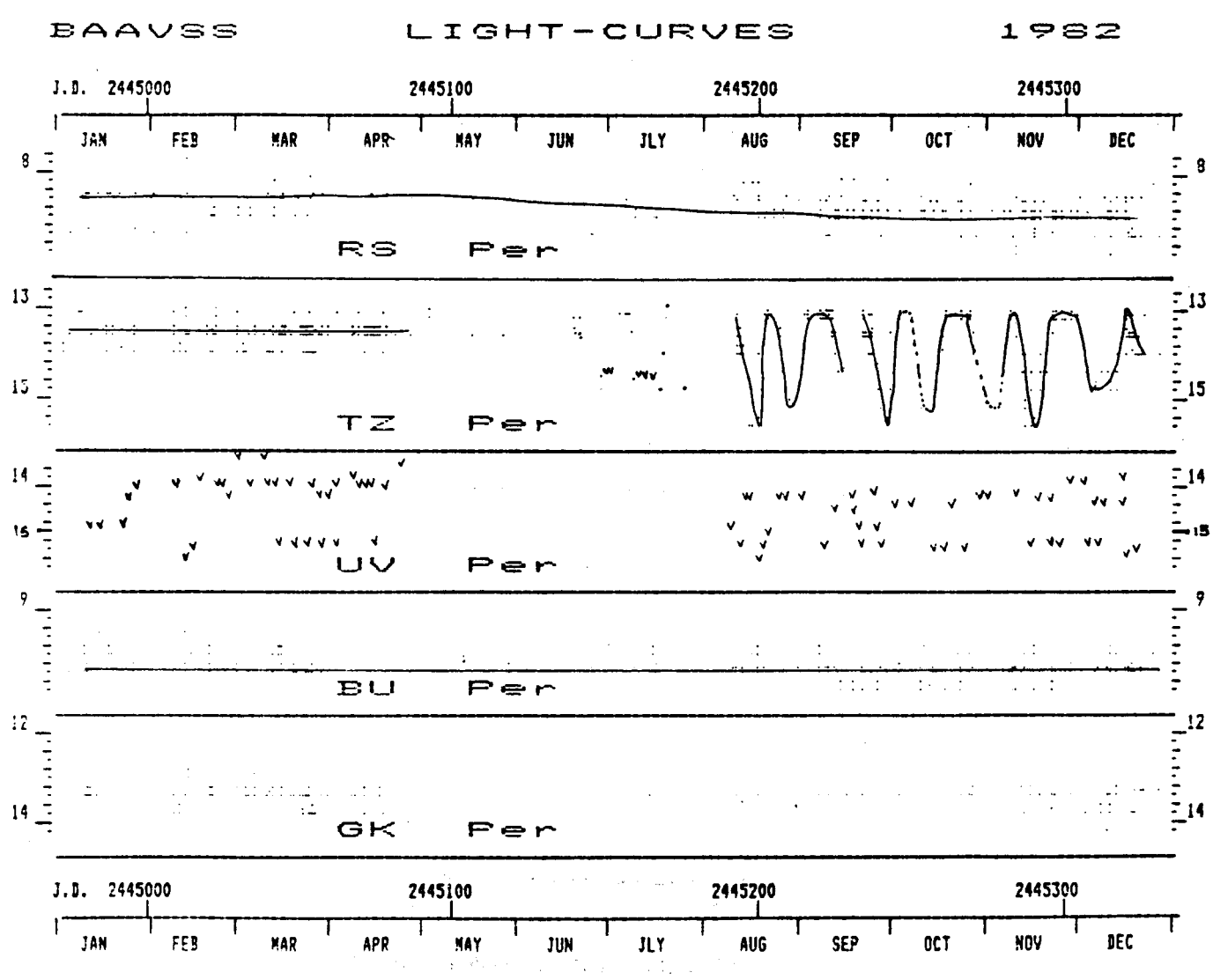
CN Ori
CZ Ori
10
RU Peg
8
S Per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TZ Per
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UV Per
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BU Per
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GK Per
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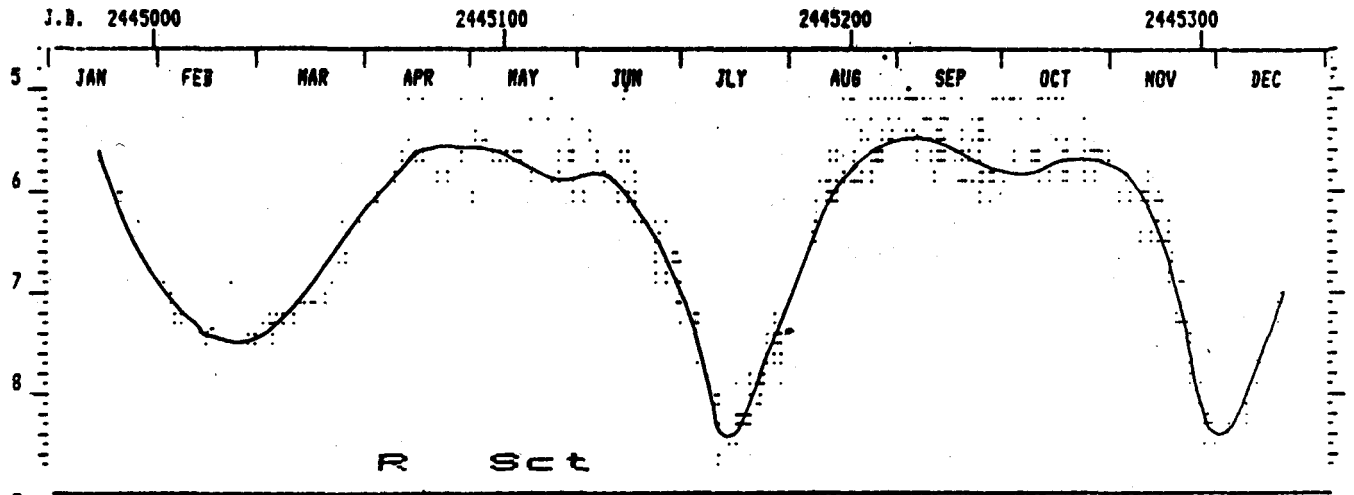
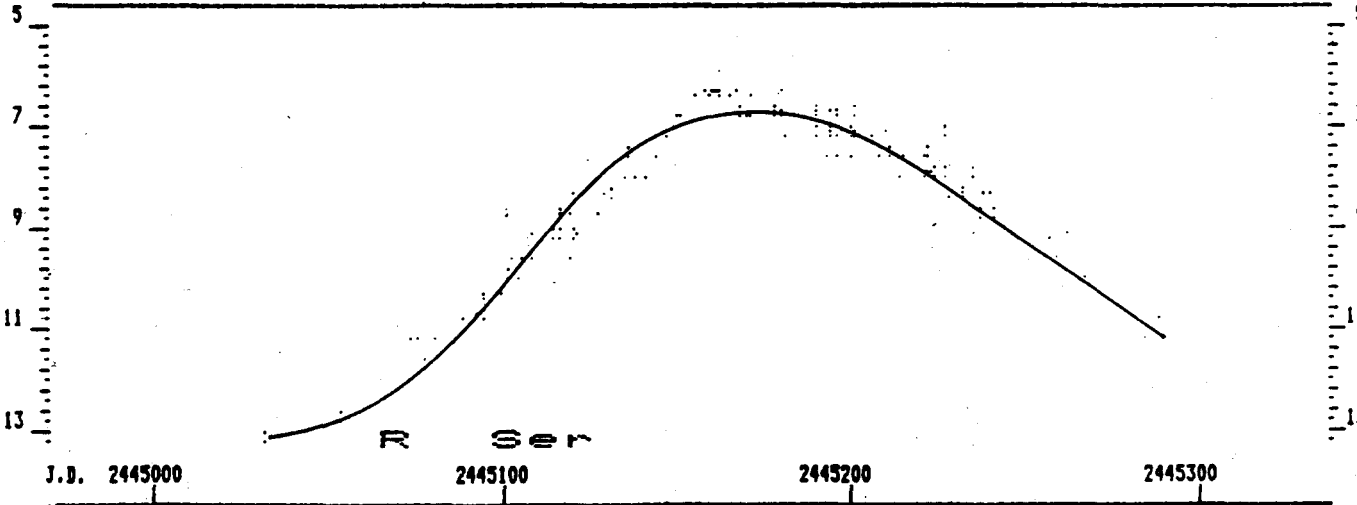
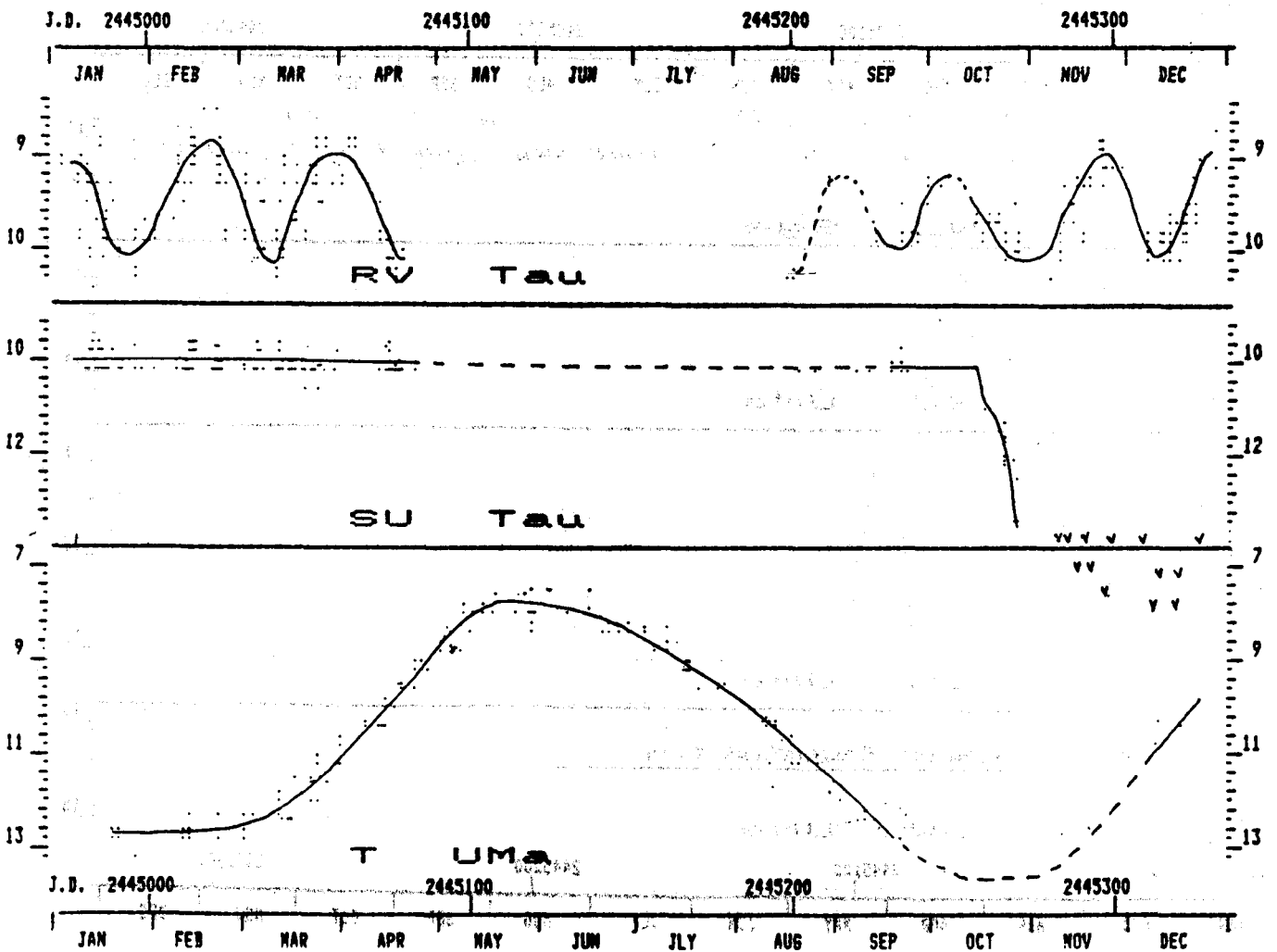
JAN FEB MAR APR MAY JUN JLY AUG SEP OCT NOV DEC

BAAVSS LIGHT-CURVES 1982






BAAVSS LIGHT-CURVES 1982
J.D. 2445000
2445100
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2445300
JAN FEB MAR APR MAY JUN JLY AUG SEP OCT NOV DEC
9
10
RV Tau
10
12
SU Tau
7
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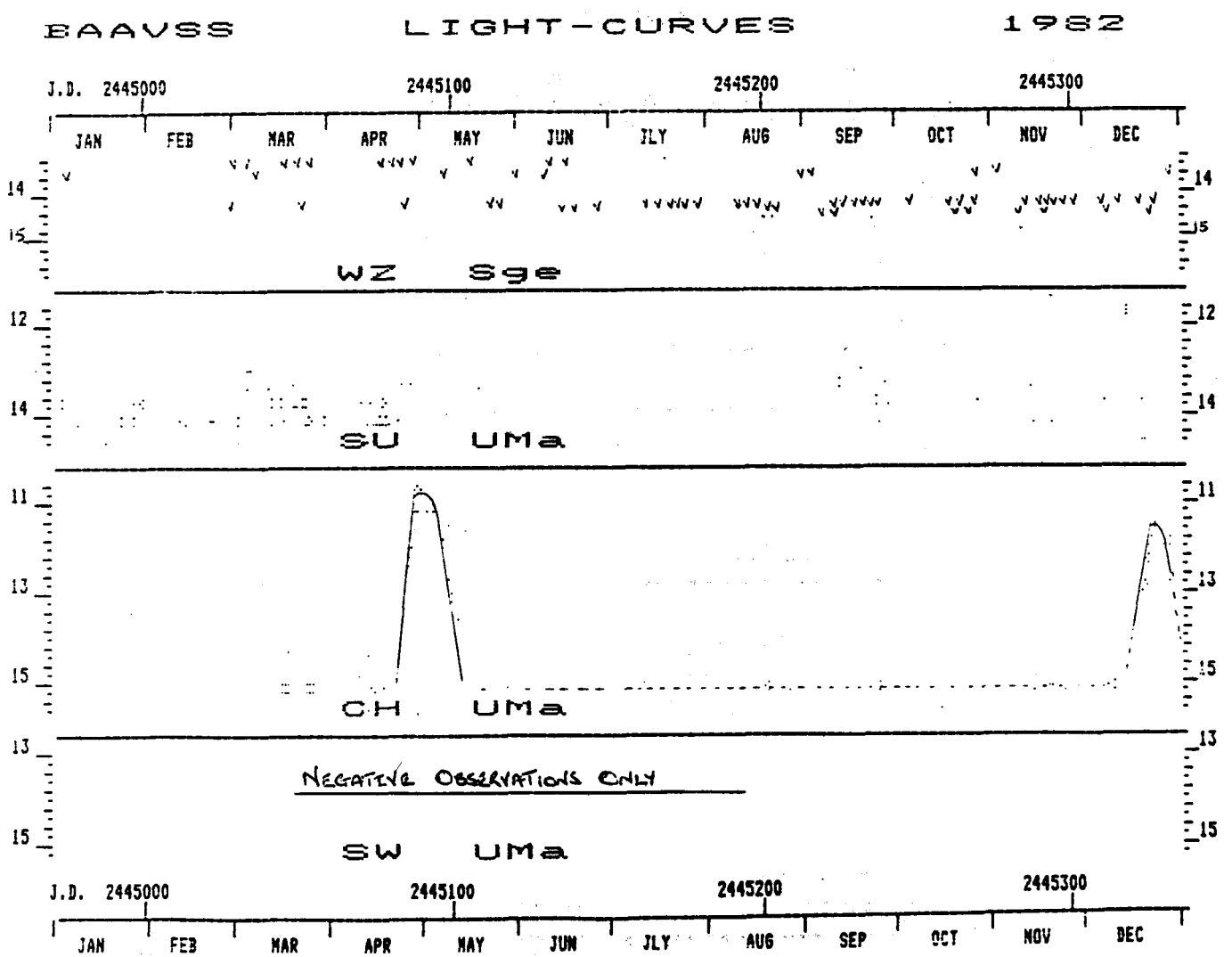
13
T UMa
J.D. 2445000
2445100
2445200
2445300
JAN FEB MAR APR MAY JUN JLY AUG SEP OCT NOV DEC


EAAVSS LIGHT-CURVES 1982
J.D. 2445000
2445100
2445200
2445300
JAN FEB MAR APR MAY JUN JLY AUG SEP OCT NOV DEC
WZ Sge
SU UMa
CH UMa
NEGATIVE OBSERVATIONS ONLY
SW UMa

CHANGES OF ADDRESS

S. Albrighton - now: 59 Salisbury Drive, Nuneaton, Warcs. CV10 9LU

D. Couzin - now: 6 Union Lane, Ellon, Aberdeenshire AB4 9AR

R.J. Stuart - now: 67 Ulswater Road, Handard, nr Wilmslow, Cheshire

NEW MEMBERS

M. Beveridge - 22 Faulds Gate, Kincorth, Aberdeen AB1 5QS

P.C. Burgess - 46 Skegness Road, Stevenage, Herts.

C. Enos - 66 Priory Avenue, Bridgend, Mid-Glamorgan CF31 3LR

G.R. Floodgate - 103 Stagsden, Orton Goldhay, Peterborough PE2 ORP

M. Harris - 315 Old Walsall Road, Great Barr, Birmingham B42 1HY

J. Higgs - 4 Chestnut Avenue, Kettering, Northants.

Mrs. M. Hoenig - 31 Maple Avenue, West Drayton, Mddx UX7 8LT

Dr R. Miles - Dove Cottage, Station Road, Mouldsworth, Cheshire CH3 8AJ

B.R.M. Munden - 67 Lilliesfield Avenue, Barnwood, Gloucester GL3 3AH

V. Polley - 25 Herbert Road, Gosport, Hants. PO12 3RZ

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SECTION OFFICERS:

Director	D.R.B. Saw, 'Uppanova', 18 Dollicott, Haddenham, Aylesbury, Bucks. HP17 8JG Tel: Haddenham (0844) 292065
Assistant Director	S.R. Dunlop, 140 Stocks Lane, East Wittering, nr Chichester, West Sussex PO20 8NT Tel: Bracklesham Bay (0243) 670354

Programme Secetaries:

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
Assistant Binocular Secretary	J. Toone, 2 Hilton Crescent, Boothstown, Worsley, Manchester M28 4FY Tel: 061 702 8619
Eclipsing Binary Secretary	J.E. Isles, Flat 5, 21 Bishops Bridge Road, London W2 6BA Tel: 01 724 2803
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

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