BRITISH ASTRONOMICAL ASSOCIATION

VARIABLE STAR SECTION

CIRCULAR No. 32 1977 SEPTEMBER

OFFICERS OF THE V.S.S.

Director: I.D. Howarth, 67 Lichfield Road, Portsmouth, Hants. PO3 6DF

Assistant to Director: J.E. Isles, 118 Liverpool Road, Watford, Herts. WD1 8DN (Tel: (0923) 48128)

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

Chart Curator: R.L. Lyon, Gwel-an-Meneth, Nancegollan, Helston, Cornwall. TR13 0AH

Circulars: S.R. Dunlop, 140 Stocks Lane, East Wittering, Nr. Chichester, W. Sussex. PO20 8NT
Tel: Bracklesham Bay (0243) 670354

BINOCULAR GROUP

Co-ordinator: A.L. Smith, 62B Hayter Road, London SW2

Recorder: A.E.J. Forno, 92 Crockford Park Road, Addlestone, Surrey. KT15 2LR
Tel: Weybridge (0932) 44668

Chart & Sequence Notes: M.D. Taylor, 17 Cross Lane, Wakefield, Yorks. WF2 8DA

ECLIPSING BINARY PROGRAMME

Co-ordinator: P.W. Hornby, 79 Redcliffe Gardens, London SW10

Predictions: J.C. Smith, 18 St. James' Close, Hanslope, Bucks.

NOVA SEARCH PROGRAMME

Co-ordinator: G.M. Hurst, 12 Clare Close, Earls Barton, Northampton. NN6 0PP
Tel: Northampton (0604) 811030

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Walter Pennell died of a heart attack on July 11, aged 67. His skill as a photographer and his courtesy as a gentleman will long be remembered. He was active in amateur astronomy to the very end; his notes elsewhere in this Circular were written only two days before his death.

An obituary notice will be published in the Journal.

T Coronae Borealis

In VSSC 29 (1977 March) Jeremy Bailey summarised R.F. Webbink's model of T CrB, which interprets the outbursts as accretion rather than thermonuclear events. Dr. Webbink has undertaken to produce a compilation of all visual observations of recurrent novae, and VSS records are making important additions to these compilations. The following is an extract from a recent letter from Dr. Webbink to the Director.

"In fact there are a number of additional features of T CrB which support the interpretation I gave in the Nature article, but which I omitted at that time for the sake of brevity, or have only since demonstrated to my own satisfaction. The most important ones are: (1) The hydrogen emission lines from the accretion disc at minimum are very narrow by cataclysmic variable standards. We know from the variability at minimum that the orbital plane of this system is not highly inclined to the line of sight. Direct estimates of M/R for the accreting star are possible from the total width of the emission lines, and these indicate $M/R \sim 0.7\ M_\odot/R_\odot$, i.e., the accreting star is main sequence and not a white dwarf. (2) The 260 day interval from minimum to principal outburst is just the time it would take a blob of gas to expand, at thermal velocity to fill its orbit. (In fact, I got 262^d the first crude calculation I made like this.)

(3) The spectroscopic properties of the principal outburst are very peculiar by the standards of classical novae. The emission lines are first seen at huge velocities (~5000 km/s), and quickly decrease within a few days to a few hundred km/s. Normal novae show a gentle rise from 0 to around a steady 1000 km/s in the outflow velocities. Furthermore, the spectrum of T CrB features many prominent extremely high excitation forbidden lines ([Fe XIV], for example), which are scarcely noticeable, if present at all, in classical novae. All of this suggest a high-velocity shock wave plowing through circumstellar material. In fact, I find that the density difference between the expanded blob transferred from the giant and the stellar wind from that giant is sufficient to accelerate a shock wave by a factor of about 40, from the initial collision velocity of the stream with itself (about 135 km/s) up to observed velocities (5200 km/s).

(4) The light curve at minimum shows no significant humps or asymmetries characteristic of a hot spot in the disk. This suggests that the disk is not continuously being fed with matter, at least to any great extent.

I had not noticed, before your calling my attention to it, that T CrB's recurrence interval is commensurate (or at least very nearly so) with its orbital period. It turns out that J.F. Julius Schmidt, director of the Athens Observatory, observed this star for 13 years following its first outburst in 1866, and remarked at the time on its apparently periodic variability at minimum. Coupling Kraft's & Sanford's radial velocity curves with Schmidt's apparent maxima & minima, I obtained a binary period of 227.494 ± 0.012 days. The

difference between recurrence interval and 128 orbital periods is then only 7 ± 2 days. It is not clear whether the difference is significant."

Dr. Webbink also supplied a preprint of a paper, "Recurrent Novae, Symbiotic Variables, and Binary Evolution", submitted to Publ. RAS NZ VSS, in which the present evolutionary status of T CrB, as a prototypical recurrent nova, is discussed. It is suggested that this system is a relatively young object of this type, having undergone perhaps ten nova-like outbursts so far. The frequency of outbursts is expected to increase, culminating in the gradual transformation of this binary into a symbiotic variable. The anticipated rate of evolution is sufficiently high that secular changes in the behaviour of a recurrent nova or symbiotic variable should be observable in some systems within a human lifetime!

Canterbury & Hatfield Programmes

As mentioned in VSSC 31, the Canterbury programme comes to a close in September. Observations of the 'H_2O' (R Aql, RX Boo, S CrB, U Her, R LMi, S Per, RS Vir, RT Vir) made in June - Sept 1977 inclusive should be communicated to the Director in the first week of October, thereafter observations of U Her, R LMi, RS Vir and RT Vir are no longer required. Observations of RX Boo 1976 Aug - 1977 Feb inclusive would also be appreciated, the original records having been lost in transit. Dr. Parker, head of the Canterbury group, writes that our optical observations, combined with his H_2O data, are sufficient to cast doubt on a simple infrared radiative pumping mechanism for the H_2O maser in RX Boo.

V Coronae Borealis (Mira, P 358^d, mean range 7.5 - 11.0) is being added to the Hatfield programme (see VSSC 30). Charts are available from the Curator. R. Lyon reports that so far there has been a very poor response from members to the new charts issued for this programme, and observers are strongly urged to take up observation of the stars concerned.

Gamma Cassiopeiae

A Section Report is being prepared on this star. Records prior to 1970 are completely lacking, and members are asked to forward copies of any observations which they may have made prior to 1970 Jan to the Director.

V Camelopardalis

R. Lyon reports V Cam as being $8^m.6$ on Aug 16, after rising $3^m.5$ in 32^d. D. Saw observed it at $8^m.0$ on Aug 27 and R. Lyon at $7^m.9$ on Sep 02. The GCVS extreme magnitude is 8.5.

Charts and Sequences

Members should note the new magnitudes assigned to comparison stars in the CN Ori field:

E	12.6	K	14.0
F	13.2	L	14.2
G	13.5	M	14.5
H	13.8	N	14.8

Observers are reminded that if they consider any sequences to be significantly in error, then the Director would be glad to hear of suggested revisions at the end of each year.

Charts for GK Persei have been prepared and are available from the Curator.

G. Kirby's photographs of the Orion Nebula region (VSSC 31) were shown to the late Walter Pennell, and his comments invited. He replied as follows:

"I have had a coreful look at Geoff Kirby's slides, and I would confirm what I believe you also think, that the variability of the image density of 'G' is not due to any change in the star.

I think there are several factors -

1/ the star is at the threshold of the technique used, and for

objects of low altitude this accentuates atmospheric variations particularly with short exposures and too wide apertures.
2/ There are obvious guidance errors in some of the exposures, but it is the less obvious errors that I have found can cause anomalies when the spread is not so obvious. A look at nearby V372 will show what I mean.
3/ Small scale and grain effects in the film.

I first came on this problem some years ago with DO Cep, which is a flare star, and John Isles spotted an enlargement of the B component on one of a pair of overlapping prints, which caused quite a stir. I did all sorts of checks and came to the conclusion that this sort of effect could be reproduced on perhaps 10% of similar exposures - in this case definitely grain effect with high quality small images."

1976 Light-Curves

The following notes on 1976 light-curves have been supplied by the Secretary; data are provisional.

R And: Fell from 8.6 on Jan 3 to 11.3 on Mar 18. Lost until July 30 (13.7). On Sep 26, 13.5; rose quickly through Oct to 9.3 on Nov 3. Slower rise to max. 7.8 about Dec 18. Under-observed when faint.

RX And: Max (11^m) about the following dates: Jan 6, 17, Feb 12, 25, Mar 19, Apr 1; gap until Jun 4, 29, Jul 11, 24, Aug 7, 19, Sep 4, 20, Oct 2, 11, 23, Nov 2. Decline to 11.8 on Nov 6, then unusual oscillations between 11.5 and 12.0 until Dec 4, followed by decline to min on Dec 7. Further normal max. Dec 11, 24.

R Aql: Thanks to Beesley, Brelstaff, Shanklin and Stott for early morning observations. Rose from 9.8 on Feb 8 to max (6.0) about Apr 13. Fell to min (11.6) about Sep 27 before rising to 7.3 by the end of Dec.

UU Aql: Maxima (12^m) July 13, Sep 3. Some observations at min, 14.8 - 15.3. Underobserved.

UW Aql: Thanks to Chesterfield and Griffin for early morning observations. Max, 8.7, about Jul 10; min, 9.6, about Oct 4. Period ca. 86 days. More observations needed March - June.

RW Aur: Irregular variations 9.6 - 11.0. But for the excellent work of Beesley this star would have been unobserved.

SS Aur: Maxima occurred (type, period in days) about the following dates: Jan 31 (L, 67), Apr (S, 53), May 30 (L?, 54), July 23 (S, 52), Sep 13 (S, 47), Oct 30 (L, 58), Dec 27 (S). Thanks to one set of summer observations it is unlikely that any maxima were missed.

SU Aur: Irregular variations 8.7 - 9.6. Nearly all observations due to B.J. Beesley.

U Boo: Thanks to Broadbent, Griffin for early morning observations. Rose from 11.4 early in the year to max (10.7) in mid-March, then fell to min (12.7) during the last week of June. Fast rise to 11.1 during July, followed by slow rise to max in early Sept (10.6). Fall to about 11.0 by mid Oct, after which no further observations.

V Boo: Thanks to Beesley, Griffin for a.m. observations. From 8.8 in Jan, fell to min of 9.6 about Apr 20. Rise to max (7.7) about Jul 1. Fall to 8.5 mid Aug, then slower fall to 9.0 at end of year (thanks to Bullivant for an a.m. observation).

V Cam: Rose from 13.9 early in Jan to 12.0 at end of Feb. Sharp

rise to max of 9.1 about Apr 18. Slow decline to 14.2 by end of year.

X Cam: Rose from 8.9 on Jan 3 to max of 8.2 about Jan 25. Fall to shallow min (12.3) about Apr 24, followed immediately by rise to bright max of 7.8 about Jun 25. Fall to min of 13.0 Sep 7, rise to faint max of 8.6 about Nov 11. Fall to 10.2 at end of year.

Z Cam: Max at end of 1975, 10.4 on Jan 3. Further max Jan 27 (10.8), long max (10.5) Apr 3 to Apr 11, May 4 (10.9?), May 24 (11.0). On Jun 12 the mag was 11.6; probably the star was rising to a max on Jun 13. The next observation was 11.6 on Jun 20, by which time standstill had certainly started; it continued (11.3 - 11.6) to the end of the year.

XX Cam: Possible fluctuations 7.35 - 7.55 with slight fall to 7.7 mid-Jun. However observer variation ranged from 6.7 to 8.1, mean 7.45.

S Cas: Fell from 13.1 early in Jan to below 14 mid-Feb. Near minimum for the rest of the year with three positive observations, 14.7 ±.

UV Cas: Variations 10.7 to 11.1. Two observers only, but in good agreement to give apparent periodicity 60 - 70 days. Badly underobserved.

Gamma Cas: Constant 2.25 - 2.4 until mid-Nov. Possible rise to 2.2 from late Nov to mid-Dec. Mag 2.3 at end of year.

Rho Cas: Constant 5.0 ± 0.05 until end of June. Rise to 4.8/4.9 early Jul till mid-Sept, fall to 5.0 mid-Oct, then 4.95 ± 0.05 to end of Dec.

Mira Cet: Rise from 7.7 on Jan 3 to max (4.9) about Feb 16. Unobservered Mar 25 - Jul 28 (8.8). Min about Sep 12 (9.2). Through Nov rose from 8.4 to 5.1. Max (4.2) very late Dec.

R CrB: 8.5 on Jan 2. Rose irregularly from 8.1 at end Jan, to 7.0 at end Feb, to 6.4 at end Mar, attaining 6.1 about May 10. Remained at max (6.1) till end of year, except possibly 6.2 - 6.3 in mid-June.

S CrB: Thanks to the following for a.m. observations: Beesley, Brelstaff, Broadbent, Bullivant, Godden, Griffin, Hapgood, Hufton, Lewis, McLeod, Spalding, Stott. Rose to max (8.0) about Feb 14. Fall (slight shoulder in May) to min (12.4) about Aug 22. Rising to very bright max (6.0?) at end of year.

T CrB: At minimum, range 9.8 - 10.05. Minima about JD 2,442,855, ...2985, ...3070; maxima about ...2805, ...2920, ...3025.

W CrB: Max (8.5) Jan 2, min (13.4) May 3, max (8.4) Aug 12. Last observed falling (12.3) Nov 13. Underobserved when faint.

R Cyg: Rose from 12.6 on Jan 25 to max (9.1) about Apr 26. Fell to 14.1 on Dec 10.

S Cyg: Rose from 12.2 on Jan 3 to max (10.3) about Feb 8, lost after May 20 at 14.5 until Sep 21 at 14.2. Rose to 10.9 at end of Dec.

W Cyg: Rose from 6.8 on Jan 3 to max (6.1) Feb 9, 67^d to min (6.9) Apr 16, 73^d to max (5.8) Jun 24, 45^d to min (6.8) Aug 9, 60^d to max (6.1) Oct 8, 75^d to min (7.1) Dec 22. Large scatter between observations on the same night, e.g. 5.5 - 6.9, 6.0 - 7.4. Observers tend to fall into two groups, either faint or bright, with very few 'average'.

SS Cyg: Thanks to Brian Beesley and Colin Munford for filling the

spring gap. Maxima (magnitude, type) about Jan 23 (8.5, S); Mar 21 (8.3, L); May 22 (8.4, S); Jun 30 (8.5, L); Aug 27 (8.5, L); Oct 18 (8.5, S); Nov 17 (8.4, S); Dec 20 (8.4, L). The minimum until Jan 23 was 11.6 to 11.8; all subsequent minima steady at 11.8 to 12.0.

BC Cyg: Thanks to Griffin for a.m. observations. Rose from 10.2 on Jan 3 to 9.5 at end of May. Steady till end of July, then further rise to max (8.9) about Aug 19. Slow irregular fall to 9.4 early in Nov, then steady fall to 9.9 at end of year. As with W Cyg, observations on the same night were very scattered, e.g. 8.7 to 9.9. Underobserved.

BI Cyg: Steady 9.4 to 9.6 till early Sep. Fell to min (9.8) about Oct 18, rise to 9.5 by Nov 7, then steady till end of year. Underobserved.

CI Cyg: 9.7 on Jan 3. From May 24 to Aug 21, variations 9.3 - 9.9. From Sep 26 to Nov 25, variations 10.0 - 10.5. Three observers only; not observed except during periods given; badly underobserved.

V1500 Cyg: Thanks to Griffin, Rothery and Shanklin for a.m. observations. Slow decline throughout year form 9.8 to 11.6.

Chi Cyg: Observations during early part of the year due to B.J. Beesley and Shanklin. Rose from 13.9 early in Jan to 10.0 in mid-May. Rapid rise to max of 5.4 about July 3. Slow decline to 11.4 at end of year.

(To be continued)

Changes of Address:

PATERSON, Dr. R. St. John's Hospital, Stone, Aylesbury, Bucks. HP17 8PP

SINGH, Lt. Col. J.E.S. Controllerate of Inspection (Heavy Vehicles) Avadi : Madras-600 054 India

New Members & New Recipients:

KEARNS, M.J., 48 Ludford Park, Ballinteer Dundrum, Dublin 16, Eire.

MEZŐSI, Csaba, H-7625 Pécs Vak Bottyan u.50 Hungary

POTTS, A., Oak Tree Cottage, 5 Sugar Pit Lane, Knutsford, Cheshire WA16 ONH

RAMPONI, L., Grupo Astrofili Vill. Sereno 25100 Brescia Italy

Last SAE Reminder:

D.E. Beesley, R.H. Chambers, A. Cosgrove, R.W. Cripps, M.J. Currie, C. Henchaw, A. McWilliam, L.R. Matthews I. Miller, D.A. Rothery, P.J. Wheeler, H. Williams, P.B. Withers.