The British Astronomical Association

VARIABLE STAR SECTION

JANUARY

CIRCULAR 68

1989

ISSN 0267-9272
Office: Burlington House, Piccadilly, London, W1V 9AG

SECTION OFFICERS

Director	J.E. Isles, PO Box 6322, Limassol, Cyprus Tel: Limassol (010 357 51) 25587 Email: Telecom Gold 72:MAG60293 Eclipsing binary charts are available from, and bulky material should be sent to: Mrs Elizabeth Isles, 20 Berkeley Square, London W1X 6DT NB: for routine enquiries contact D.R.B. Saw
Deputy Director	D.R.B. Saw, 'Upanova', 18 Dollicott, Haddenham, Aylesbury, Bucks. HP17 8JG Tel: Haddenham (0844) 292065
Assistant Director & Circulars Editor	S.R. Dunlop, 140 Stocks Lane, East Wittering, nr Chichester, West Sussex PO20 8NT Tel: Bracklesham Bay (0243) 670354 Email: Telecom Gold 72:MAG100665
Secretary	M.D. Taylor, 17 Cross Lane, Wakefield, West Yorkshire WF2 8DA Tel: Wakefield (0924) 374651
Chart Secretary	J. Toone, 2 Hilton Crescent, Boothstown, Worsley, Manchester M28 4FY Tel: 061 702 8619
Nova/Supernova Secretary	G.M Hurst, 16 Westminster Close, Kempshott Rise, Basingstoke, Hants. RG22 4PP Tel: Basingstoke (0256) 471074 Email: Telecom Gold 72:MAG60138
Prof./Am. Liason Comm. Secretary	Roger Pickard, 28 Appletons, Hadlow, Kent TN11 0DT Tel: Tonbridge (0732) 850663 Email: Telecom Gold 72:MAG70304

Telephone Alert Numbers

The following numbers may be called at any time up to 23:00 UT (or BST when in operation) to report variable-star activity, or at any time for possible novae only:

Guy Hurst	0256 471074
Alan Young	0435 882102
Graham Keitch	0934 862924
Denis Buczynski	0524 68530

For subcription rates and charges for charts and other publications see inside back cover.

Editorial

As readers will have gathered, the production of the *Circulars* is becoming more and more sophisticated - some might say 'more and more complicated'. Thanks are due to John Isles, who submitted a lot of material on disk, sent to Guy Hurst; to Guy Hurst, who then patiently made some changes necessary to send the material to Storm Dunlop by e-mail, and also sent material of his own. Jean Felles deserves thanks for typing the report on the Professional-Amateur Meeting, and the PALC-VS *Newsletter*, both of which were again forwarded by e-mail, together with material prepared by Roger Pickard. John Toone provided charts, and Melvyn Taylor material and light-curves. Initial editing and layout was made on an Olivetti M290 with Microsoft Word software, the files then being passed to a Macintosh SE for final layout with Pagemaker 3.0 software, the masters for printing being produced on a laser printer.

VSSC Index

Peter Wheeler has now completed his mammoth task of indexing all VSS *Circulars* from No.12 to date. As the index includes all mentions of individual stars, as well as more general items, it is a extremely useful indeed. The Section officers are most grateful to Peter for this very valuable piece of work. A decision will be taken shortly regarding publication of the index. In the meantime, anyone (professional or amateur) requiring details of particular stars or subjects is invited to contact Storm Dunlop.

VSS Papers on Variable Stars

Readers are reminded that reprints (or photocopies) of all papers and letters on variable stars that have appeared in the BAA *Journal* since 1971 are available from Storm Dunlop. (A check-list of the 80-odd items is available on request.) Although the service is primarily intended for professional astronomers, requests from amateurs carrying out research on particular stars will also be considered. If a large amount of photocopying is required, it may be necessary to ask for a contribution towards this cost.

VSSC 67 - Errata

The most important error that occurred in *VSSC* 67 was that the report on Eclipsing Binaries, 1986 (2) - Cyg to Ori, which began on page 7, was omitted from the Contents List. We apologize for this and also for several small errors that crept in during last-minute editing.

Project on Unusual Carbon Stars

John Isles

BAA Circular 679 announced a new VSS project on unusual carbon stars, in collaboration with astronomers at University College, London. Charts have already been distributed to the observers who have so far expressed interest, but more observers are needed, so copies of the charts are also given here. Members are also invited to take part in an interesting experiment involving the use of filters for visual estimates of two stars in the project. The four stars to be observed are:

	VX And,	type SRA,	visual range	7.8 - 9.3,	period 369 days;
FEW ✓	EU And,	type SR,	photographic range	12.9 - 14.1,	period unknown;
FEW ✓	V778 Cyg,	type LB,	photographic range	11.6 - 13.5;	and
NONE!	BM Gem,	type SRB,	photographic range	11.5 - 12.1,	period 286 days?

Carbon stars are very red and consequently they are much brighter visually than might be suggested by the photographic ranges (estimated from blue-sensitive plates). My visual estimates in 1988 May-Oct range as follows:

VX And	8.3 - 9.3,	EU And	10.9 - 11.8,
V778 Cyg	10.5 - 11.5,	BM Gem	8.3 - 8.8

Thus all four variables are within the range of small instruments.

In the article that follows this, Ian Griffin of UCL explains why these stars are of particular interest. The initial aim of the VSS project is to provide visual light curves for the period during which observations are being made at different wavelengths, using different telescopes on different dates, so that it can be seen whether each star was visually bright or faint at the time of each observation. Any of the stars that turn out to vary enough will be retained on the telescopic programme, so that the period and amplitude of variation can be estimated when we have a long enough run of data.

Visual observations can be made in the usual way every 5-10 days, using the "v" magnitudes given with each chart. They should be reported as soon as possible after the end of each three-month period to me, and also half-yearly to Melvyn Taylor.

Filter experiment

Visual magnitude estimates of red stars are notoriously difficult to make. The work of a single observer may show considerable internal scatter, and furthermore when the work of several observers is compared it is not uncommon to find that one is systematically brighter than another by as much as a magnitude. This effect is fairly well understood, though impossible to correct; it is due to the varying use of direct or averted vision, and the "Purkinje effect" whereby in a larger telescope red stars appear brighter (relative to the comparison stars, which usually are not red). Moonlight, haze and some light pollution introduce further systematic errors.

In principle, these problems can be avoided by using a filter to isolate light of a particular colour. The use of filters introduces other problems, though; particularly the loss of light, greatest in the narrow-passband filters that would be most useful; and the need to determine a new set of comparison star magnitudes as seen through the filter. Nevertheless, these problems may be less troublesome than the one we wish to solve, and it seems well worth making the experiment.

Readers of *Sky & Telescope* (1988 April issue, page 375) will be aware of one way that filters suitable for astronomical use can be obtained free of charge. Certain theatre supply companies sell plastic filters for stage lighting, and distribute books of samples on request. These samples are usually several square inches in size, and can be held between eye and eyepiece or cut up and mounted. Not all these filters are of optical quality, and the spectral transmittance characteristics of a filter must be known if any scientific use is to be made of observations made with it. Also, of course, all observers must use the same filter or set of filters if their work is to be combined.

Of the three firms that agreed to honour requests from *S&T* readers, only one did so in my case: Roscolab Limited, whose UK address is Blanchard Works, Kangley Bridge Road, Sydenham, London, SE26 5AQ. *S&T* gave the USA address, Rosco Laboratories, Inc., 36 Bush Ave., Port Chester, N.Y. 10573. If you are an *S&T* reader, or can get one to write for you, or just happen to have a convenient interest in stage lighting, ask them for their sample books of Rosco colour filters. Any member having difficulty can get a SMALL piece of each recommended filter by writing to me, or probably by asking around at your local astronomical society; but please first try to get them yourself.

Two Rosco filters seem particularly suitable, and I have been using them for several months now. They are Supergel filters numbers 15 (deep straw, which I shall call yellow) and 67 (light sky blue). Transmittance graphs are given in the booklet, according to which the yellow filter cuts out virtually all light shorter than 4800Å and lets through around 90 percent of light longer than 5700Å. The blue filter lets through 75 percent at 4600Å, dropping to near zero at 5800Å; there is a red leak at wavelengths longer than 6600Å but this is probably irrelevant if the filter is used for visual observation of stars.

Assuming estimates are made using scotopic vision - that is, with the cells in the retina called rods which are responsible for night vision - I have calculated the following results. The yellow filter (Rosco 15) has an equivalent wavelength of 5370Å, and transmission of 22 percent. Visual estimates made with it will approximate closely to the V magnitude scale: more closely, in fact, than estimates made without a filter. The blue filter (Rosco 67) has equivalent wavelength 4630Å, and transmission of 44 percent. For stars of a wide range of colours, provided their spectra approximate to black-body curves, visual estimates made with it will be about 76 percent of the way from V to B magnitudes.

The light loss is about 1.6 magnitudes with the yellow filter and 0.9 magnitude with the blue. A very red star, though, will appear much fainter with the blue filter, so that blue estimates of EU And or V778 Cyg would require quite a large telescope. Also, as it happens, B magnitudes are not available for faint stars near these two variables, so it is not so easy to set up a sequence. For our experiment, therefore, it is suggested that observers should on each occasion make three estimates of VX And and BM Gem: one without any filter, one with the Rosco 15 filter and one with Rosco 67. The "v" magnitudes for comparison stars may be used for both non-filter observations and Rosco 15, and the "b" magnitudes have been calculated for use with Rosco 67.

If the experiment is successful, we should find that the observations of several observers made with a particular filter are in closer agreement, so that minor fluctuations of the star are more clearly defined. There is also a possibility of detecting change in the colour of each star. Pulsating variables are generally redder at minimum brightness, so the amplitude in blue light may be greater than in yellow or with no filter.

Filter observations of the two stars should be written up on the same report form as estimates made with no filter, and the remarks column should indicate clearly which observations were made with each filter and which with none. A decision whether to introduce filters in regular VSS work, and what filters might be used, will be made in the light of this experiment. In the meantime, filter observations of other stars are not required.

Please note that ordinary visual observations of these stars are needed NOW. Don't wait until you have got your filters.

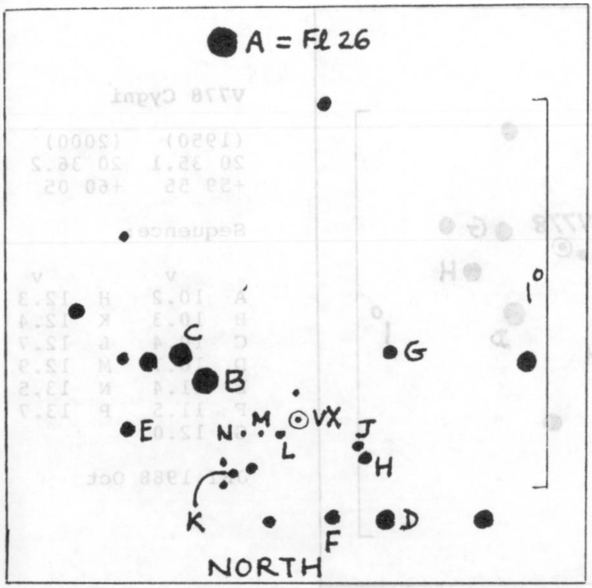
Notes on charts and sequences

VX And: Chart and v mags from AAVSO (bc) chart, 1974 July. (Photovisual sequence from H.A. 108.) b mags are 0.24 V + 0.76 B, using values from CSI. The AAVSO sequence has been preferred to the CSI V mags as it appears more satisfactory. Comments on the b sequence, and estimates of the stars for which b mags are not available, will be welcomed.

EU And: Field sketch from Papadopoulos Atlas and preliminary sequence from visual estimates by J.I.

V778 Cyg: Chart from JBAA 1986 Feb page 102, with amendments. (The three brightest stars on the original chart have been deleted as they do not exist!) Sequence measured by Dr R. Wood, Royal Greenwich Observatory, for SN 1980K in NGC 6946.

BM Gem: Chart adapted from one generated from CSI database by Ian Griffin, University College, London. v and b mags from CSI (v=V, b=0.24 V + 0.76 B); comments invited on both.



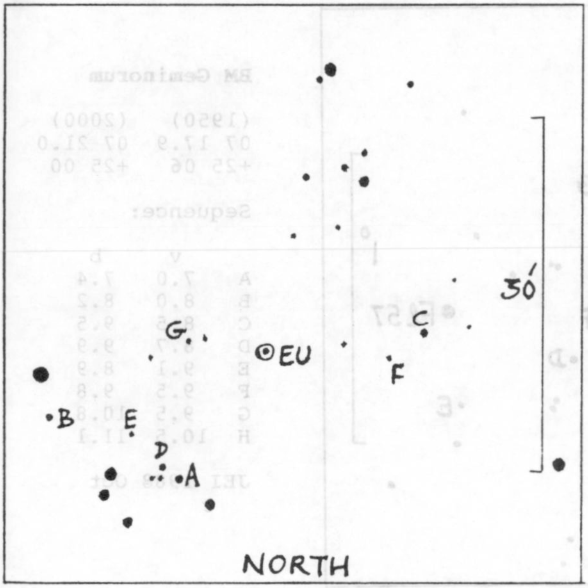
VX Andromedae

(1950)	(2000)
00 17.2	00 19.2
+44 26	+44 43

Sequence:

	v	b
A	6.0	6.0
B	7.0	7.2
C	7.5	8.3
D	7.6	8.5
E	7.8	9.3
F	8.6	9.3
G	9.4	9.7
H	9.6	9.7
J	9.9	-
K	10.4	-
L	11.0	11.3
M	11.8	-
N	11.9	-

JEI 1988 Oct



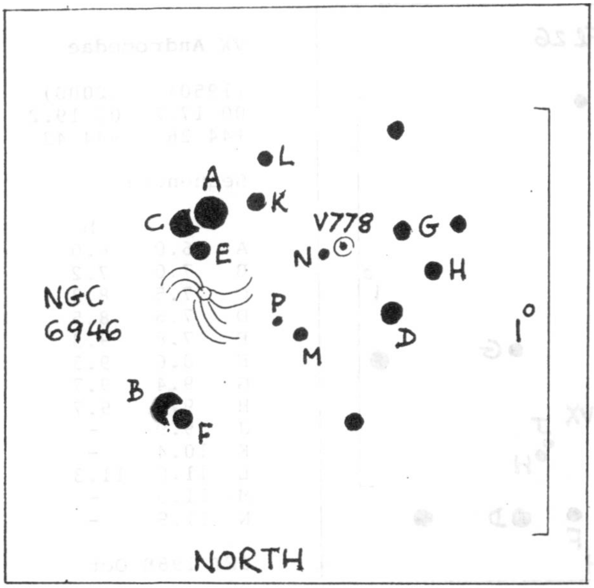
EU Andromedae

(1950)	(2000)
23 17.7	23 20.0
+46 58	+47 14

Sequence:

	v
A	10.3
B	10.5
C	10.8
D	11.1
E	11.3
F	11.5
G	12.1

JEI 1988 Oct



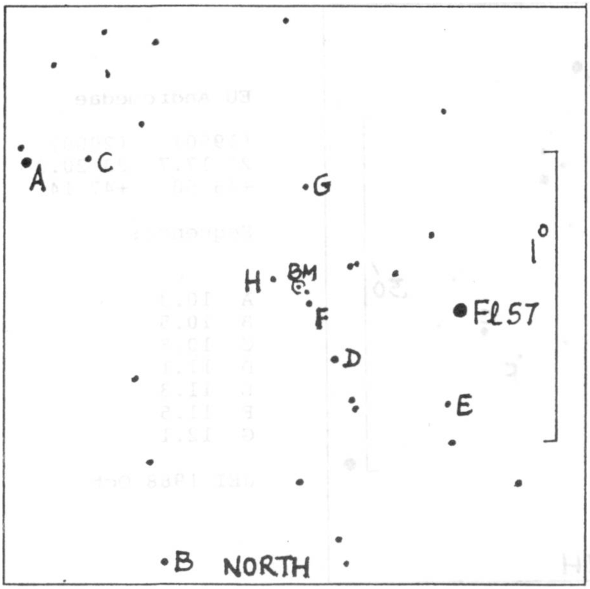
V778 Cygni

(1950)	(2000)
20 35.1	20 36.2
+59 55	+60 05

Sequence:

	v		v
A	10.2	H	12.3
B	10.3	K	12.4
C	10.4	L	12.7
D	10.7	M	12.9
E	11.4	N	13.5
F	11.5	P	13.7
G	12.0		

JEI 1988 Oct



BM Geminorum

(1950)	(2000)
07 17.9	07 21.0
+25 06	+25 00

Sequence:

	v	b
A	7.0	7.4
B	8.0	8.2
C	8.5	9.5
D	8.7	9.9
E	9.1	8.9
F	9.5	9.8
G	9.5	10.8
H	10.5	11.1

JEI 1988 Oct

Four Important Peculiar Red Giants

Ian Griffin, University College, London

[The preceding article presented details of a project on unusual carbon stars. In this article, Ian Griffin explains why visual estimates of these stars will be particularly useful.]

I should be extremely grateful if VSS members would consider putting some of these stars (VX And, EU And, V778 Cyg, BM Gem) on their observing lists. The first priority should be to start a long-term monitoring programme in order to study the temporal variations in magnitude, to define any periodicities present, and also to define the amplitude of any fluctuations in brightness.

I am planning to observe these objects at optical, radio and infra-red wavelengths on various dates over the coming months, and it would be useful to me if when reducing my data I knew whether the observations were obtained when each star was bright or faint in the visual region. This is where I feel that VSS members' work would prove particularly useful since I hope their observations would provide a record of the stars' optical behaviour before, after, and (best of all) during the observing time that I obtain.

Now, to tell your members the reason for requesting that you consider adding these stars to your observing list. Here goes....

All of the above stars have been classified as carbon stars from their optical spectra. This means that the ratio of carbon to oxygen in their photospheres is greater than one, and they can be described as 'carbon-rich'. Because all stars of this type lose mass via stellar winds, one would expect any circumstellar material to reflect the same carbon-rich character found in the photosphere.

Current theories about circumstellar material tell us that in carbon-rich environments one would expect dust of a certain type to condense preferentially. This dust, composed of silicon carbide (SiC) and amorphous carbon, has a characteristic emission feature in the infra-red at 11.3 microns, and this was in fact observed around many carbon stars by the low-resolution spectrometer (LRS) aboard the Infra-red Astronomy Satellite (IRAS) during 1983.

Strangely, however, none of the four stars of interest showed this 11.3-micron SiC feature (and neither did two southern carbon stars not included in the VSS project and not known to be variable). Instead, their LRS spectra exhibited a strong emission feature at 9.7 microns, which is characteristically found in oxygen-rich environments (such as around M stars like Betelgeuse) and is due to silicate dust.

Thus we have a slight problem. The photospheres of these stars are apparently carbon-rich, yet the dust shells around them appear to be oxygen-rich. Further evidence that the dust shells of at least some of these stars are oxygen-rich comes from the fact that, within the last year or so, water maser emission has been detected from at least three of them (EU And, V778 Cyg and BM Gem); water masers are normally found in the circumstellar dust shells of oxygen-rich stars.

Two possible solutions have been suggested to explain the observations. One is that we are actually observing the transition from an oxygen-rich M star to a carbon star, and the observed dust shell is just a fossil remnant of the oxygen-rich material from an M star that has recently evolved into a C-type star.

The other possible explanation is that we are observing a binary system with an M star and a C star in orbit around each other. The M star would have to have such a thick dust shell around it that it is totally obscured in the optical, where only the carbon star is observed. This dust shell would also have to be so thick that in the infra-red region it totally dwarfs any emission from a circumstellar shell around the C star. Hence only silicate emission from the optically obscured M giant is seen.

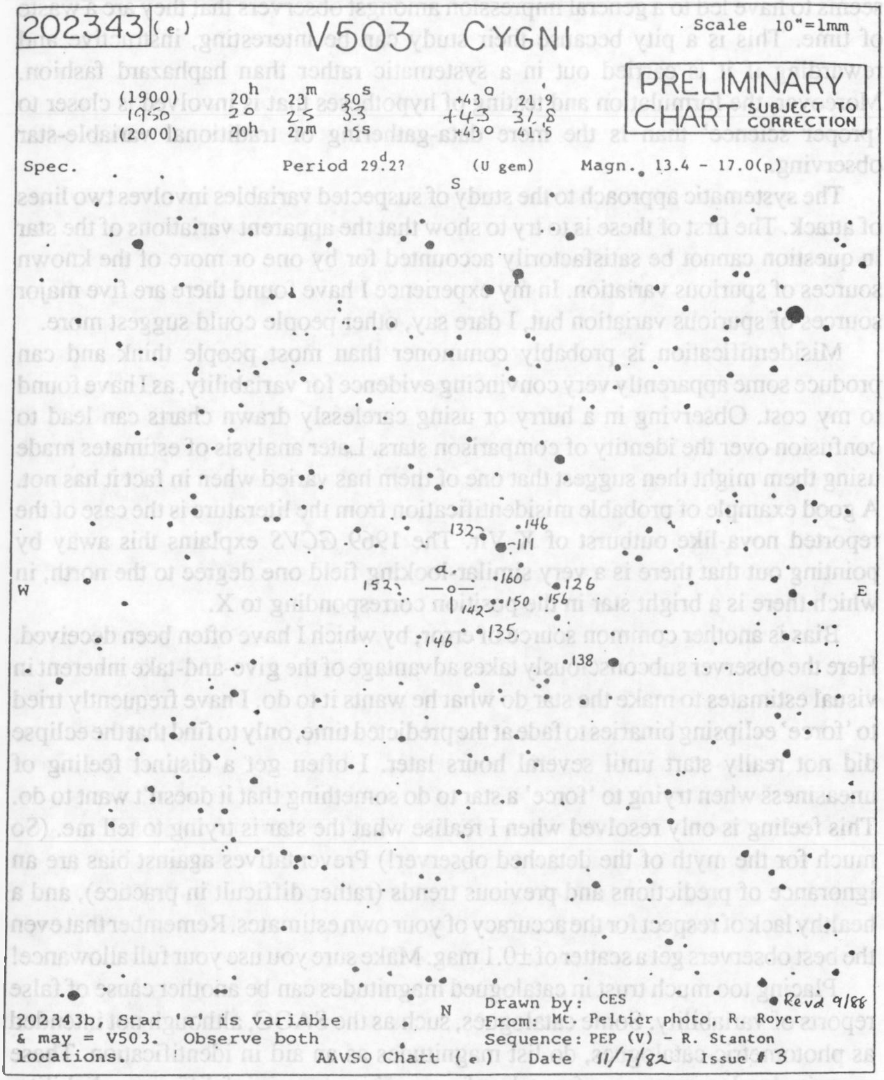
It is this problem that your observations, in conjunction with those I hope to obtain at optical, radio and infra-red wavelengths, would greatly help to resolve. ANY observations of these objects would greatly assist in my research and I shall give due credit to the BAA VSS in any publications that result from this work.

Where is V503 Cygni?

In a recent *AAVSO Circular*, Janet Mattei asked for observations that might clarify the position of the cataclysmic variableV503 Cygni (catalogued as a dwarf nova of the SS-Cygni sub-type). Guy Hurst was able to make the following observations (where x = the star at the originally plotted position; a = star at position 'a' on the chart shown *opposite*):

UT	x	a
Oct 10.83	[15.2	14.8
30.82	[15.2	[15.2
Nov 4.80	[15.0	[15.0
12.81	[16.0	13.4
13.81	[14.6	13.9
14.77	[15.0	13.9

As Guy remarks, this definitely shows a variable at 'a' and possibly identifies it with V503 Cyg. Observers are invited to check this area using this AAVSO preliminary chart. Details should be reported to Guy, who will pass the results on to Janet Mattei. (Readers are reminded that, as always, both magnitudes and positions on preliminary charts are subject to a certain degree of uncertainty.



202343 (e)
V503 CYGNI
Scale 10"=1mm
PRELIMINARY CHART SUBJECT TO CORRECTION
(1900) 20h 23m 50s +43° 24'.9
1950 20 25 33 +43 31.8
(2000) 20h 27m 15s +43° 41'.5
Spec.
Period 29d.2?
(U gem)
Magn. 13.4 - 17.0(p)
S
W
E
N
a
132
146
111
152
160
126
142
150
156
146
135
138
Drawn by: CES
Rev'd 9/88
202343b, Star 'a' is variable & may = V503. Observe both locations.
From: Mt. Peltier photo, R. Royer
Sequence: PEP (V) - R. Stanton
AAVSO Chart (e)
Date 11/7/82
Issue # 3

Observing Suspected Variable Stars

Tristram Brelstaff

In the past, suspected variables have been rather neglected by the VSS and this seems to have led to a general impression amongst observers that they are a waste of time. This is a pity because their study can be interesting, instructive and rewarding if it is carried out in a systematic rather than haphazard fashion. Moreover, the formulation and testing of hypotheses that is involved is closer to 'proper science' than is the mere data-gathering of traditional variable-star observing.

The systematic approach to the study of suspected variables involves two lines of attack. The first of these is to try to show that the apparent variations of the star in question cannot be satisfactorily accounted for by one or more of the known sources of spurious variation. In my experience I have found there are five major sources of spurious variation but, I dare say, other people could suggest more.

Misidentification is probably commoner than most people think and can produce some apparently very convincing evidence for variability, as I have found to my cost. Observing in a hurry or using carelessly drawn charts can lead to confusion over the identity of comparison stars. Later analysis of estimates made using them might then suggest that one of them has varied when in fact it has not. A good example of probable misidentification from the literature is the case of the reported nova-like outburst of X Vir. The 1969 *GCVS* explains this away by pointing out that there is a very similar-looking field one degree to the north, in which there is a bright star in the position corresponding to X.

Bias is another common source of error, by which I have often been deceived. Here the observer subconsciously takes advantage of the give-and-take inherent in visual estimates to make the star do what he wants it to do. I have frequently tried to 'force' eclipsing binaries to fade at the predicted time, only to find that the eclipse did not really start until several hours later. I often get a distinct feeling of uneasiness when trying to 'force' a star to do something that it doesn't want to do. This feeling is only resolved when I realise what the star is trying to tell me. (So much for the myth of the detached observer!) Preventatives against bias are an ignorance of predictions and previous trends (rather difficult in practice), and a healthy lack of respect for the accuracy of your own estimates. Remember that even the best observers get a scatter of ±0.1 mag. Make sure you use your full allowance!

Placing too much trust in catalogued magnitudes can be another cause of false reports of variability. Some catalogues, such as the SAOC, although not intended as photometric catalogues, do list magnitudes as an aid in identification. These magnitudes, however, are often taken from various sources of differing reliability. The result of this is that discrepancies of over half a magnitude might be noticed if these are used without checking as comparison-star magnitudes. Nor are photoelectric catalogues infallible sources for comparison-star magnitudes. There are systematic differences between visual and photoelectric V-magnitudes that depend on the spectral type. These can rise to 0.2 mag for M-type stars. It is, however, possible to correct for these. In addition, I have found occasional anomalies such as Xi and Lambda Gem which differ by a quarter of a magnitude on the V-scale, but which I see as almost equal in brightness.

Observer differences are another potential source of spurious variation. These can arise from inherent differences between the observers' eyes or from differences in technique or instrumentation. By technique I mean whether the observer uses averted or direct vision, or whether he takes a quick glance or has a long stare when making an estimate. The importance of this was brought home to me a few years ago when I found that I could make the red star UX Dra brighter by over half a magnitude just by staring straight at it for a few tens of seconds! As an illustration of the effect of different instruments on the estimated magnitude, I regularly used to notice a jump of one or two tenths of a magnitude in the light-curve of Mira when I switched from using binoculars to the naked eye as the star rose above mag.5. It is best for observers to try to minimize these sorts of problems by being as consistent as possible in their observing technique and in the instruments they use. If this is done, then it should be possible to correct for any remaining differences between the observers, at least in those cases where they have made enough observations to establish reliably any systematic deviations from the norm.

The position-angle effect is the last of my main sources of spurious variation. It is a systematic error in the estimated magnitude, which varies with the orientation of the field in the sky. It frequently shows up in the light-curves of circumpolar stars as a wave with an amplitude of one or two tenths of a magnitude and a period of one year. I have occasionally come across a similar effect in non-circumpolar stars, but in these cases it might be a consequence of some of the estimates being made in twilight, rather than the true position-angle effect. Variations due to the position-angle effect should show a coherent light-curve when folded on the sidereal day (which, incidentally, is a good reason for recording the time, as well as the date, when observing slow variables). However, bias might well confuse things a bit.

The second line of attack in the study of suspected variables is to try to show that all the available information on the star in question is consistent with it being a member of a known class of variable star. Preferably it should be a fairly typical member of one of the more common classes. For example, if you think that you have found the first-ever W UMa star with a B-type spectrum, or if you claim to have discovered a new RCB star (these are very rare) then you have almost certainly made a mistake somewhere.

The spectral type is a key piece of information in determining variability. Knowing it can save an awful lot of wasted effort. For instance, a red-giant star is unlikely to show rapid variations within a single evening, and you would probably be wasting your time in looking for them. On the other hand, an A-type suspected variable could well be an eclipsing binary or an RR Lyrae star, and it would certainly be worthwhile to look for rapid variations. Actually, it would be very useful to have some statistics on the frequency of the various classes of variable star within each of the spectral types so, for example, we could say that x% of all A-type stars brighter than mag.12 are eclipsing binaries, while y% are RR Lyrae stars.

The position of the star in the sky can also give useful clues to the type of variability. For example, a couple of years ago I started observing a 12th magnitude suspected Cepheid in Canes Venatici. It was only when I realised that a Cepheid of that brightness in that part of the sky would be unusually far from the plane of the Galaxy that I started looking for RR-Lyrae-type variations, and almost immediately found them. Similarly, near the Orion Nebula you should consider the possibility of a star being an irregular nebular variable, although how you should go about demonstrating this is another problem, which will be discussed below.

Finally, getting round to the magnitude estimates themselves, the first thing to do is to look at their distribution over the magnitude range. Eclipsing binaries tend to show a preference for maximum, while pulsating stars often show a slight preference for minimum.

The main use for the magnitude estimates, however, is to demonstrate a reasonably coherent light-curve, characteristic of the proposed class of variable star. If you can't do this then you need to get more estimates! A very powerful weapon in demonstrating a coherent light-curve, and hence in demonstrating variability, is the assumption that the variations are periodic. This allows, once a suitable value for the period has been identified, the combination of estimates made on different cycles to form a coherent light-curve for a single cycle. The problem of identifying the period is a fascinating one. It is, however, quite technical and full of traps for the unwary, and is probably best left to people who are familiar with the subject, such as John Isles. I won't go into it here.

The power of the periodicity assumption in demonstrating a coherent light-curve is paid for in its fragility. That is to say, if either the assumption itself, or the selected value of the period is wrong, then it is very easy for estimates made on different cycles to contradict each other. Because of this easy refutability, a proposal of periodic variability can reasonably be based on the observations of only a single observer. Indeed, if the amplitude is small, then including estimates by other observers might well lead to observer differences swamping any true variation. An example of a refutation of a proposal of periodic variability is provided by the case of RR Ari. This was alleged to be an eclipsing binary with a period of 47.9 days and an amplitude of 0.42 mag. However, when I folded a set of estimates I had made on the given period, I found no sign of any eclipses, although the estimates were well enough distributed over the cycle to have shown any had they been there. I concluded that the original estimates must have contained some errors.

A proposal of irregular variability can be much harder to refute. Even if all later observations show the star to be constant, you really have to go back to the original estimates and show that they do not support the original claim of variability. This can be quite difficult, especially if the original estimates have not been published.

There is another problem associated with irregular variability. Unless you put some constraint on the type of irregular variation that you are willing to accept, then you run the risk of being taken in by some of the spurious sources of variation mentioned above. I suspect that quite a lot of the rapid variability attributed to the nebular variables and to some alleged flare stars is of this type (not all, but a fair amount of it). The soundest basis for a proposal of irregular variability is two or more simultaneous runs of estimates made by independent observers that corroborate each other. Obtaining this type of observation requires careful coordination and is probably best done in fixed-duration campaigns rather than in the open-ended way that normal variable stars are observed. Above all, the investigation of suspected irregular variables is not really suitable for the lone observer.

I became interested in the problems of suspected variables more or less by accident when I found some of my eclipsing binaries were misbehaving. Indeed, the Section's Eclipsing Binary Programme Handbook lists quite a few suspected eclipsing binaries which might be suitable for further investigation. However, by far the best source of suitable suspects is the NSV. Not all of the stars listed in the NSV are good candidates for variability. You have to carefully examine the notes and look up the references, if possible, and weigh up the evidence before committing yourself to an intensive observing campaign. Good candidates for periodic variables are early-type stars suspected of rapid variations. Particularly promising are those stars which have been suspected independently by more than one observer. Surely something must be going on in these cases? You could be the one who works out what it is!

Professional-Amateur Meeting

(held at University College, London, on Saturday, 1988 May 07)

The meeting brought together 45 professional and amateur astronomers from all over the UK and sought to establish better communication between them in order to maximise the scientific value of work undertaken by amateurs on variable stars. The morning session was chaired by Dr John Mason and consisted of presentations by three amateurs and three professionals on aspects of variable-star observing.

The Amateur Scene

Guy Hurst (BAA VSS and editor of *The Astronomer*) described the work of the visual variable star observer. In 1986, for example, 45,000 visual observations had been reported to the BAA on a total of 211 stars.

Initially the section had placed emphasis on Mira type variables but nowadays this had shifted to eruptives as increasing light-grasp had resulted in stars of 15th magnitude and below being observed. Parallel with this was an increase in photographic photometry where, by using hypersensitised emulsions, 20th magnitude objects could be recorded. Programmes devoted to eclipsing binaries and to recurrent objects were also being actively pursued. The value of feedback from professionals was stressed in order that programmes could be updated as research priorities changed.

Records of the VSS go back to the last century but many observations, particularly of novae in the 1920's and 1930's, are still unpublished. The VSS does recognize the importance of rapid publication and produces preliminary light curves on an annual basis. The main organ for rapid publication, however, is *The Astronomer* magazine which is issued monthly.

One difficulty facing the amateur is the inaccuracy of many comparison star sequences, especially those fainter than 9th magnitude. Professional help in this area would greatly assist in improving the data. New variables are also discovered by amateur observers but they are not yet able to undertake the spectroscopy necessary to confirm their type and therefore the nature of the object often remains unknown. On occasions however analysis of the light-curve is sufficient to yield a correct identification as illustrated recently with the recurrent nova DO Dra.

The necessity for rapid communication between the amateur and the professional was discussed. It was pointed out that an increasing number of amateurs used an electronic mail service via Telecom Gold and were capable of communicating rapidly on a world-wide basis.

Summarising, Mr Hurst stressed the versatility and enthusiasm of the amateur and the value to the professional in his ability to conduct intensive observation programmes, often at extremely short notice.

Jack Ells (CMHAS) described the current state of photoelectric photometry (PEP) among amateurs in the UK, illustrating his talk with a number of slides from his own and other observatories. Due to the relatively poor atmospheric conditions only differential photometry is practical in the UK. All of the half-dozen or so amateur systems already built used a single-channel system based on a photomultiplier tube, and fed data into a microcomputer for storage and reduction. Another 4 to 5 systems should come on stream over the next year.

Currently, eclipsing binaries were favourite objects for observation where a typical observing session could last 3 to 4 hours and might involve 20 to 50 integrated observations per hour, each integration taking some 10 to 40 seconds. Light would be delivered through a pinhole of 60 to 120 arc-seconds diameter. Even with skies much affected by light pollution accuracies of 0.01 magnitude can be obtained on 10th magnitude stars. Thus, it is possible to detect quite subtle changes in phase and period of these variable stars. Observations of similar precision would determine rotation periods of minor planets.

Mr. Ells concluded by describing his new automatic telescope which, while tracking the stars, was capable of undertaking an observing sequence under computer control. In this way a complete observing cycle (variable, comparison, check and sky) could be accomplished in as little as 100 seconds.

Richard Miles (Assistant Director, BAA Asteroids and Remote Planets Section) then discussed the future of amateur variable-star observing with particular reference to PEP. He pointed out that by using PEP not only was higher-precision data produced but also, standard colorimetric measurement could be obtained by using the appropriate filters.

Although in the UK there is a growing demand for PEP equipment, few commercial companies marketed hardware suitable for amateurs and that available tends to be expensive. However, high-quality software is available and is freely exchanged between individual amateurs. This is in contrast with the professional experience in the USA where software is often the most expensive single item when equipping a telescope for PEP.

Dr Miles predicted that PEP would ultimately be replaced by CCDs although not for at least 5 years. Meanwhile, opportunities existed for such studies as polarimetry and spectroscopy. The difficulty of observing through unstable sky conditions could be mitigated by the use of dual (or even multiple) telescope systems an example of which was shown on a slide.

Having been successfully founded, amateur PEP must now be nurtured if it is to grow to maturity in the UK. Funding was needed for the purchase of PEP equipment which could be loaned under the auspices of the BAA to suitably qualified observers.

The Professional Scene

David Stickland (RAL) said that professionals are concerned with the mechanism whereby stars operate and evolve. Eclipsing binaries are particularly conducive to such studies as the absolute masses of the components can be derived. With these systems there are two kinds of photometric observation that are of value: light-curve derivation at various wavelengths, and determination of minima to obtain a measurement of O-C (Fig.1). With this latter observation a gradual change in period could be evidence for apsidal motion or for the gravitational influence of a third body. As well as interacting dynamically, binaries can interact by an interchange of material. These causes may be distinguished by a long term study of the orbital period.

An example of a system currently under study is the Wolf-Rayet eclipsing binary CQ Cep. Earlier photographic work has suggested changes in period but recent observations showed no significant variation (Fig.2). It was particularly pleasing that Jack Ells had also observed this star and his results had been incorporated in a paper which had been submitted for publication. Regular PEP measurements of this object would continue to be worthwhile.

Dr. Stickland pointed out that although the modern professional astronomer observes over a wide range of wavelengths often with complex equipment located on remote mountain peaks or in orbit, nevertheless contributions from amateurs are of considerable value in giving a broader data base which the researcher can use to derive theories of stellar behaviour.

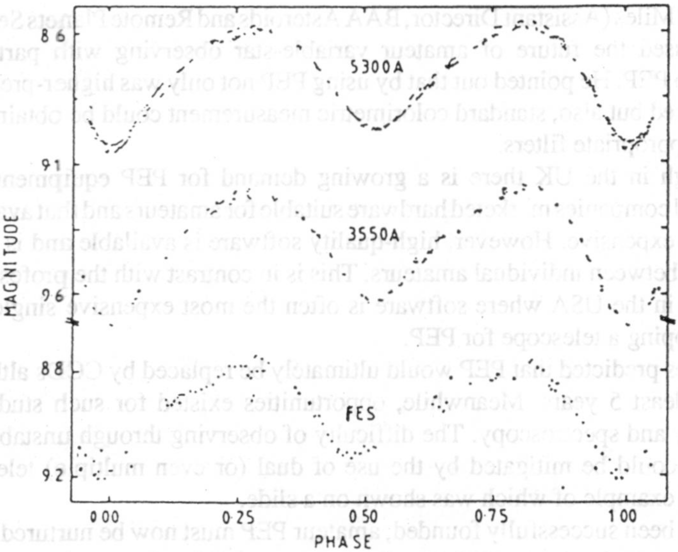


Fig.1 CQ Cep: Hiltner's observations and data from IUE Fine Error Sensor

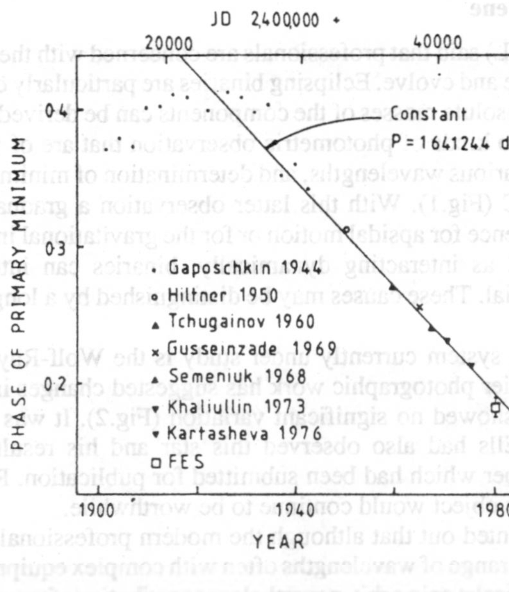
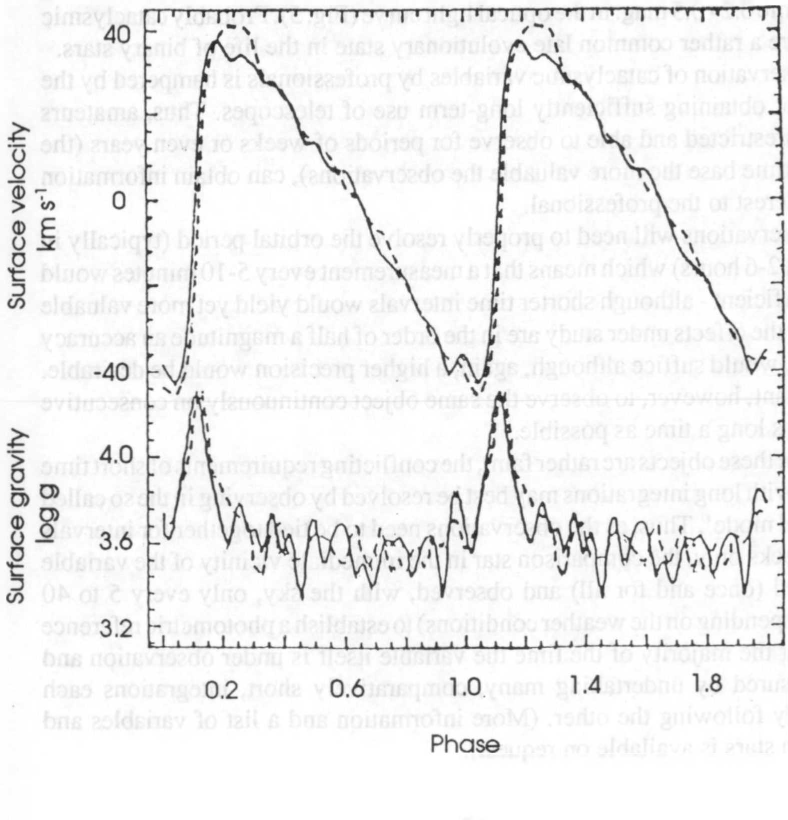


Fig.2 CQ Cep: measured phase of primary minimum

Phil Hill (St. Andrews University) spoke on current work on pulsating variables. These objects contain within them the cause of their variability and are important because they give insight into stellar structure and evolution. Also, they may be used as 'standard candles' to derive galactic structure and cosmological distances. Absolute brightness may be derived from period-luminosity (PL) or period-luminosity-colour (PLC) relationships. New techniques, such as CCD and precise IR photometry facilitate this work. Opportunities for amateurs exist in the study of the more unusual pulsating stars. Thus, continuous and accurate observations would help in the understanding of such objects as: a) R CrB stars (H poor, C rich) which may all exhibit Cepheid-type pulsations of around 40 days b) PV Tel stars (excess He) which pulsate at very low amplitudes, and c) V652 Her (BD + 130 3224) which is a unique object similar to PV Tel but exhibiting very regular 2-1/2 hour pulsations (Fig.3). In particular, period changes have been discovered in V652 Her and some R CrB stars, thereby demonstrating the need for regular monitoring.

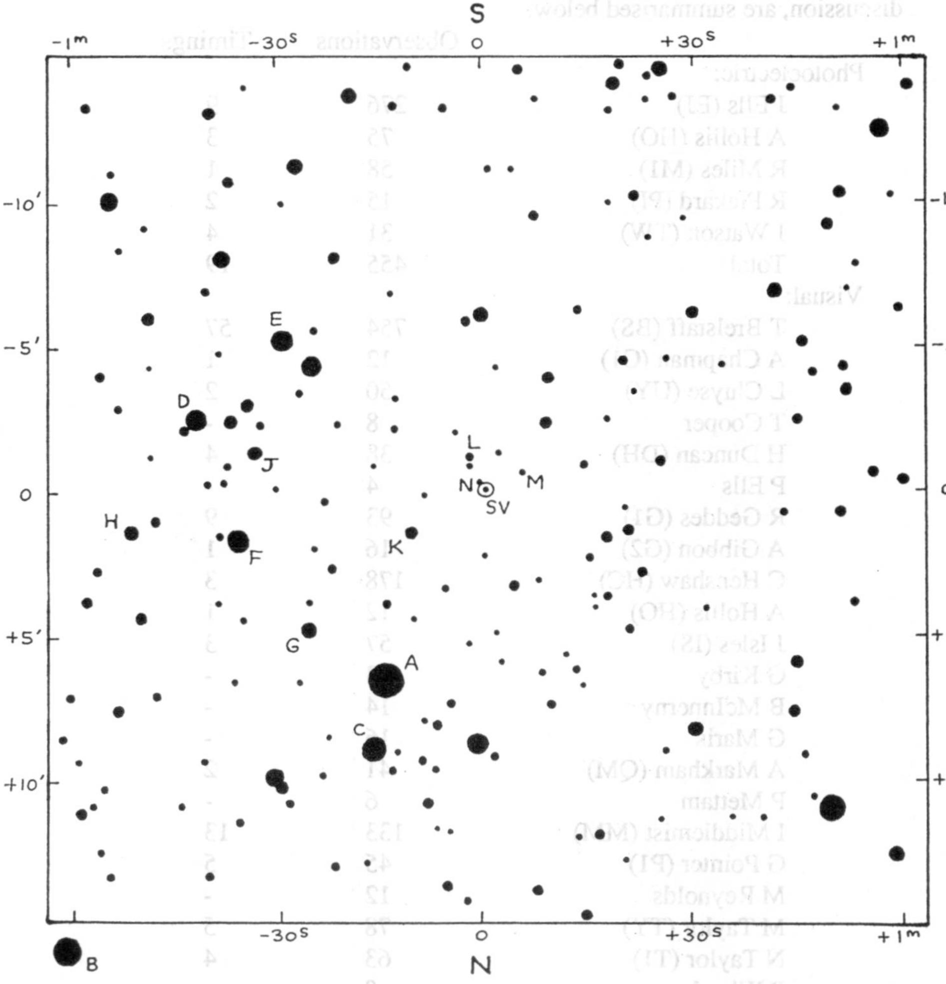
Fig.3 V652 Her: $P = 2.59^h$ (after Jeffery 1986)



071·01 **30′ FIELD INVERTED**

SV SAGITTAE $19^h\ 05^m\ 58^s$ $+17°\ 32.9′$ (1950)

$19^h\ 08^m\ 12^s$ $+17°\ 37.6′$ (2000)



SEQUENCE: A & B SAO CATALOGUE; OTHERS AAVSO.
CHART: AAVSO ADAPTED.

A 8·1	F 11·5	L 13·4
B 9·0	G 11·8	M 14·0
C 10·2	H 12·1	N 14·9
D 10·7	J 12·3	
E 10·9	K 13·0	

BAA VSS

DRAWN: JT 3-7-88

APPROVED: JEI 1988

Dr Hill gave two further examples of opportunities available to amateurs. The Be stars, many of which are bright enough for amateurs to observe, are the object of study by an international network of observers and a newsletter, specially dealing with these stars, is published. The flare stars, also, were subjected from time to time to multi-wavelength campaigns. A recent exercise on YY Gem involved, among others, GINGA (Japanese X-ray Satellite), UKIRT, IUE and many optical telescopes. Both Be stars and flare stars would benefit from 24-hour, multi-site surveillance and such observing programmes, which would require to be co-ordinated on an international basis, would be helped by amateur involvement.

Constanze la Dous (University of Cambridge) discussed the cataclysmic variables. These objects exhibit a wide variety of variability in time scales ranging from seconds to years with associated brightness changes of fractions of a magnitude to several magnitudes (Fig. 4).

The various sub-types can all be accounted for by a single model whereby in a semi-detached binary system a white dwarf draws material from its main sequence companion and creates an accretion disc with a hot spot at the point where the gas from the cooler star impinges onto the disc. In many objects short time-resolution observations reveal the presence of the hot spot as a periodically recurring hump of some 0.2 - 0.5 mag. in the optical light curve (Fig. 5). Probably cataclysmic variables are a rather common late evolutionary state in the life of binary stars.

The observation of cataclysmic variables by professionals is hampered by the difficulty of obtaining sufficiently long-term use of telescopes. Thus, amateurs who are unrestricted and able to observe for periods of weeks or even years (the longer the time base the more valuable the observations), can obtain information of great interest to the professional.

The observations will need to properly resolve the orbital period (typically in the order of 2-6 hours) which means that a measurement every 5-10 minutes would be quite sufficient - although shorter time intervals would yield yet more valuable data. Since the effects under study are in the order of half a magnitude an accuracy of 0.1 mag. would suffice although, again, a higher precision would be desirable. It is important, however, to observe the same object continuously on consecutive nights for as long a time as possible.

Because these objects are rather faint, the conflicting requirements of short time resolution with long integrations may best be resolved by observing in the so called 'high-speed mode'. Thus, as the observations need to be tied together for intervals of a few weeks only, the comparison star in the immediate vicinity of the variable is calibrated (once and for all) and observed, with the sky, only every 5 to 40 minutes (depending on the weather conditions) to establish a photometric reference system. For the majority of the time the variable itself is under observation and being measured by undertaking many, comparatively short, integrations each immediately following the other. (More information and a list of variables and comparison stars is available on request).

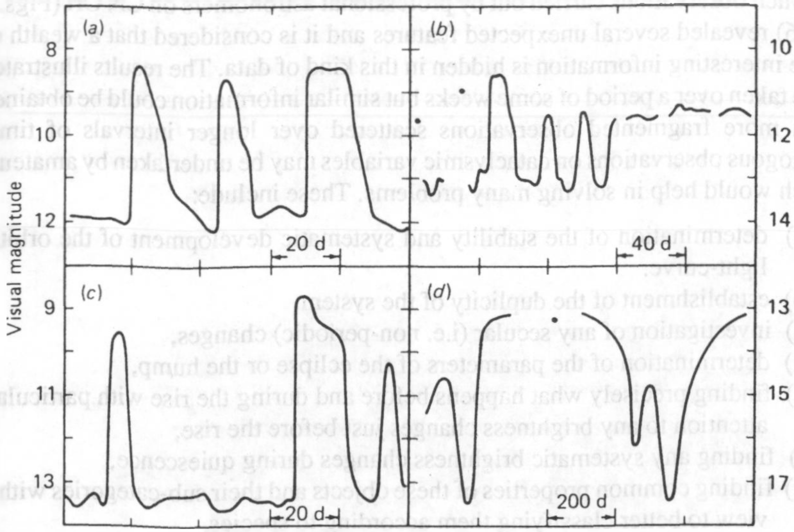


Fig.4 (a) SS Cyg in 1975; (b) Z Cam: (c) SU UMa-type star VW Hyi; (d) novalikeVY Scl (after Wade, R.A. & Ward, M.J. "Cataclysmic variables: observtional overview", in *Interacting binary stars*, ed. Pringle & Wade, R.A., CUP, 1985

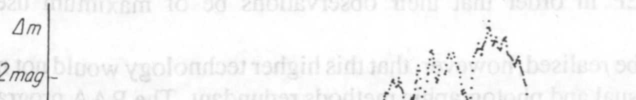


Fig.5 Orbital light-curve of U Gem, showing bright spot and eclipse (after Nather, R.E., *Vistas Astron.*, 15, 91, 1973)

Such observations carried out by professional astronomers on CN Ori (Figs. 5 and 6) revealed several unexpected features and it is considered that a wealth of more interesting information is hidden in this kind of data. The results illustrated were taken over a period of some weeks but similar information could be obtained from more fragmented observations scattered over longer intervals of time. Analogous observations on cataclysmic variables may be undertaken by amateurs which would help in solving many problems. These include:

a) determination of the stability and systematic development of the orbital light-curve.
b) establishment of the duplicity of the system,
c) investigation of any secular (i.e. non-periodic) changes,
d) determination of the parameters of the eclipse or the hump,
e) finding precisely what happens before and during the rise with particular attention to any brightness changes just before the rise,
f) finding any systematic brightness changes during quiescence,
g) finding common properties of these objects and their sub-categories with a view to better classifying them according to species.

The Organisation of Professional-Amateur Co-operation

The afternoon session was chaired by Dr. Ian Howarth (UCL).

Richard Chambers (CMHAS) reminded the audience that the meeting was being held at this time primarily because PEP had just become an established activity among amateurs and observations of an accuracy and reliability which was acceptable to professionals were now being produced. Thus, it was opportune to review the objectives and procedures of those amateurs who were undertaking or about to undertake PEP in order that their observations be of maximum use to the researcher.

It should be realised, however, that this higher technology would not make the traditional visual and photographic methods redundant. The BAA programme of visual variable-star observation would continue to be improved and extended. Professionals should not hesitate, therefore, to influence the content of the programmes to ensure they reflect current research interests. It should also be remembered that the BAA variable-star section is the oldest such body in the world and has records of high-class observations reaching back into the last century. It is regrettable, therefore, to hear of British researchers approaching other organisations for historical data without, apparently, contacting the BAA first.

Unfortunately, BAA data are not organised in a form which can be easily processed by automatic means. Steps are being taken to rectify this situation and the interest of professionals will help to speed up this process. In contrast, with the advent of PEP, instead of just amassing data for possible future use, observations are undertaken for specific purposes and the information is normally already in a form suitable for easy processing.

PRO-AM LIAISON COMMITTEE (PALC-VS)
NEWSLETTER No.1

A professional-amateur meeting was held at University College London on 1988 May 07 to explore areas of potential collaboration in the study of variable stars. A full report of the meeting will be found in the accompanying VSS *Circular*.

The outcome of the meeting was the formation of a committee which has subsequently been re-formulated within the BAA VSS as the Professional-Amateur Liasion Committee (PALC-VS) with the following broad objectives:

1) Foster communication and collaboration between professional and amateur astronomers concerned with the study of variable stars.

2) Promote the use of advanced techniques by amateurs, especially photoelectric photometry and to encourage 'technology transfer' between professionals and amateurs.

3) Publish a newsletter containing advice and information on professional-amateur co-operation in the study of variable stars.

One of the first steps the Committee will take is to circulate a questionnaire amongst professionals and amateurs in order to establish the level of support for co-operation. Should the response be favourable it is intended to compile a register of interested persons.

Brief details of the committee members are given below for the information of anyone who is interested.

Dr Constanze la Dous was educated at the University of Munich and is currently a post-Doctorate Research Associate at the University of Cambridge. Her interests include classical and high-speed photometry, spectroscopy, and the general observation of stars, particularly cataclysmic variables and RR Lyrae stars and the theory of stellar spectra.

Guy Hurst is Editor of *The Astronomer* and co-ordinator of the UK Nova/Supernova Patrol. He also acts as a 'filter' for potential European amateur discoveries and alerts in conjunction with Brian Marsden at the central bureau. He has co-ordinated various collaborative PRO-AM projects over the last five years and most recently has pioneered the use of the electronic mail system for rapid communications between amateurs in Europe, Australia and Cyprus. His main interests are visual observation of novae, supernovae and eruptive variables for which he uses a 40-cm telescope. Guy is professionally employed as a Bank Manager.

John Isles, who directs the Variable Star Sections of the BAA and JAS, is an ex-officio member of the Committee. He studied astronomy at Edinburgh University and statistics at LSE, before becoming a statistician in the UK Government Statistical Service. In 1987 he moved to Cyprus to concentrate on observing and writing about variable stars. He is planning to build an observatory there with instruments up to 80 cm aperture, equipped for photoelectric photometry and spectroscopy.

Dr Richard Miles is employed as a research physical chemist, and has been a member of the BAA since 1966 and of the IAPPP since 1980. He is currently serving on the BAA

Council. His main interest is in the introduction of modern techniques to enhance the scientific value of amateur observations and in particular wishes to promote the use of photometry for the study of a wide range of astronomical objects. He uses telescopes of 35 cm and 28 cm diameter both of which are equipped with photometers.

Roger Pickard has been a member of the Crayford Manor House Astronomical Society for over 22 years and is its variable star section director. He is a charter member of the IAPPP, obtaining his first PEP observations in 1983 and has since been involved in the promotion of the technique helping to organise several meetings. He uses a 40-cm telescope for observations of most types of variable stars. Roger is professionally employed as a services engineer.

Dr Robert Smith is a lecturer in Astronomy at University of Sussex. He is currently a council member of the RAS and Associate Editor of the *Quarterly Journal*. His research interests include stellar rotation and internal motions of close and interacting binaries. Currently, he spends most time on near-infrared, CCD, spectroscopic observation of cataclysmics. He is also Honorary President of Brighton Astronomical Society and faculty liaison officer with Sussex University Astronomical Society.

Dr David Stickland is a Senior Scientific Officer in the Space Science Department of the Rutherford Appleton Laboratory and is responsible for the UK-ESA interface for operation of the IUE satellite and use of its data archive. His interests lie in the field of stellar astrophysics with particular concern for massive stars, binaries and variable stars. He is also an editor of the *Observatory*.

Observing Programmes

As part of the programme to give guidance on the type of object that professional astromoners would like amateurs to observe David Stickland has written the following article:

Photometry of Bright Massive Binaries

It has been known for many years that the most massive stars are the brightest, and indeed, the mass-luminosity relationship shows that the total energy radiated into space goes roughly as the fourth power of the mass. This means that the most massive hot stars are pouring out enough radiation to drive off their tenuous outer layers in winds gusting up to a few thousand km/s and that in the space of one year (very short on the timescale of stellar evolution), perhaps a millionth of a solar mass or more may be lost. This is enough to show up strongly in the ultraviolet spectra of such stars and mass-loss rates have been determined for many such objects. However, these rates are dependent on theoretical models of the winds and confirmation of these rates is most desirable.

One means available to check on the changing mass of a star is to monitor the period of such an object in a binary system, since the period depends both on the total mass of the stars involved and on the mass ratio of the two components. The effect of increasing period is well known in Algol systems where an evolved giant star has thrown off most of its mass, much of which has been captured by the companion thus making it the more massive of the two. The same concordance with theory has not been widely observed for the massive hot O-type and Wolf-Rayet stars despite their prodigious mass-loss rates and so a programme is required to keep a close check on their periods.

Several brightish stars are worthy of observation and my colleagues and I are interest in hearing from any amateurs who might be able to make accurate photoelectric measurements (0.01 - 0.02 mag). Examples are CQ Cep (9th mag, $P = 40$ hrs, ampl. approx. 0.6 mag), AO Cas (6th mag, $P = 3.5^d$, ampl. 0.15 mag), V444 Cyg (8th mag, $P = 4.2^d$, 0.4 mag). Observations are best carried out using a standard filter (such as B or V) and reductions made against approved standard stars so that the results can be tied in with data from elsewhere. This is particularly important for complex systems such as GP Cep (9th mag, two periods due to two binaries in a quadruple system: 6.7^d and 3.5^d, ampl. 0.1 mag).

Contact: D.J. Stickland, Rutherford Appleton Lab.,
Chilton, Didcot, OX11 OQX

Resources of the BAA VSS

John Isles

The BAA VSS is a group of (mainly) amateur astronomers who observe variable stars for pleasure and in the hope of doing something of scientific value. Its main resources, which may be useful to professional astronomers, are its observer network and its database of observations.

The observer network

Some 3000 amateurs can be contacted through BAA publications. At present about 60 of these are active in variable star work, most of these being in the UK. Most observers can only make visual magnitude estimates, with internal errors of about 0.2 mag, or more for red variables. The annual number of estimates reported is over 50,000, and rising. A few observers use photography, and a very few photo-electric photometry.

Statistics on the equipment in use are not available (so all VSS members are urged to complete the accompanying questionnaire), but visual monitoring of variable stars brighter than mag. 14 is routinely carried out, and several observers can reach mag. 16; one photographic observer can reach mag. 20.

The VSS has a close working relationship with the magazine *The Astronomer* (*TA*), through whose system of telephone alerts and electronic mail circulars, many active observers in the UK and several other countries can be contacted very quickly. When required, observers can within minutes be set to work on a given star, and observations can be collected and forwarded to interested astronomers monthly, weekly or even daily.

The database of observations

The BAA VSS is the world's oldest variable star organisation, having been formed in 1891, and it has continuous records for nearly a century on some stars. The database of some 2 million magnitude estimates is independent of data available from other organisations, e.g. AAVSO.

The stars currently observed were listed in recent VSS *Circulars* (*VSSC*), copies of which may be obtained from Storm Dunlop. Most are in the northern hemisphere. In 1988, the main programme of binocular and telescopic variables comprised:

122	semiregular and red irregular variables
34	Mira stars
21	dwarf novae (plus 46 further long-period dwarf novae on a separate programme of recurrent objects)
11	novae and recurrent novae (plus 3 on recurrents' programme)
5	Gamma Cas stars
5	RV Tauri stars
4	R Coronae Borealis stars
4	symbiotic stars
3	active galaxies/quasars
2	others (GCVS types INA, SDOR)

Most of these objects have been observed for at least 20 years. Records are also available on many stars formerly under observation. There are additional programmes on eclipsing binaries and nova/supernova search.

Most of the data are not yet computerised, but given adequate notice, extracts can be made available on application to me. Urgent requests should be addressed to Guy Hurst, who will be able to draw on monthly reports to *TA* for recent years, covering all these variables and many others. (See inside front cover of *VSSC* for addresses.)

The VSS is always pleased to consider adding stars to its programme temporarily or permanently, if observations are required by professionals. See, for example, the notes on unusual carbon stars in the accompanying VSSC.

NZ PEP Meeting

The third New Zealand Photoelectric Photometry Meeting will take place in Blenhein, 1989 March 9-12. Further details may be obtained from Roger Pickard.

Further Co-operation

All interested parties are invited to write to the committee with comments and suggestions. It would be appreciated if professionals could give some details of their research interests and simiarly, if amateurs could state their own interests and capabilities. Correspondence should be addressed to the editor at the address given below (see questionnaire enclosed).

Mr R. D. Pickard, Secretary PALC-VS
28 Appletons, Hadlow, Kent TN11 ODT

(Following the meeting Guy Hurst was able to supply Mr Griffin with visual observations of these stars taken over the last few years which has enabled a better modelling for the stars to be achieved).

David Dewhirst (University of Cambridge) reminded the meeting that professional library resources could be made available to amateurs and, for example, literature searches could be undertaken provided the project was intelligently conceived.

Phil Hill described briefly the twin telescope in operation at St. Andrews for photometric observations. He stated that the observatory would welcome organised visits by parties of amateur astronomers. Ian Howarth mentioned that there existed a fund, designed to assist amateurs who need to travel for training. John Mason stated that amateurs should be encouraged to visit professionals and see them at work. Joint workshops could be arranged. Richard Chambers thought that on occasions the visit of professionals to see the amateur at work would be beneficial.

Robert Smith (University of Sussex) recommended that when observing cataclysmic variables it would be more valuable to undertake extended observations on a few stars rather than observing many stars in an attempt to cover the start of any outburst.

A long and useful discussion ensued covering the points raised. It was agreed that the professional-amateur co-ordinating committee (PACC-VS) be formed with the following members:

Professional: Dr Constanze la Dous (Cambridge)
Dr Robert Smith (Sussex)
Dr David Stickland (RAL)

Amateur: Mr Guy Hurst
Dr Richard Miles
Mr Roger Pickard

Mr. Pickard would act as editor of the newsletter. The first priority was to work out means whereby contact between the amateur and the professional could be achieved and to this end the committee would meet as soon as possible to consider the publication of the first newsletter (the committee, in fact, met on Wednesday 25th May).

Finally, it was felt that the meeting had been a very rewarding one. Thanks were due to David Stickland for organising the professional contribution and to CMHAS for arranging the amateur side. Ian Howarth had overseen the excellent arrangements at UCL.

A special tribute was paid to Mrs Jean Felles (CMHAS) who single-handedly arranged the catering facilities including morning coffee and afternoon tea as well as a buffet lunch.

(This report prepared by Hugh Duncan and John Howarth - CMHAS.)

A major difficulty facing amateurs was the building of the PEP equipment, particularly the photometer head. This required considerable expertise which few individuals possess. Perhaps means could be found to pool the skills of individuals, possible through local astronomical societies. The help of other institutions, such as local technical colleges, might also be sought.

More subtle problems concerned the training of amateurs in the optimum use of the apparatus and the compilation of charts and comparison sequences. It was also a vexed question as to how (and whether) one should persuade amateurs to undertake particular professionally-inspired observing programmes. There was also the problem of co-ordinating the various amateur observers, perhaps internationally, and the administration required to put professionals in touch with those amateurs who are capable and likewise to put enthusiastic amateurs in touch with professionals who are willing to advise them.

Mr. Chambers proposed the founding of a joint advisory committee which would carry out these functions. The committee should be voluntary but carefully chosen to ensure wide representation. The committee should not itself organise meetings and undertake tasks but should identify problems, suggest remedies and encourage others to act. It was suggested that three professionals and three amateurs should comprise the committee and one of its duties would be the production of a newsletter for inclusion in the BAA VSS *Circular*. The possibility of issuing an annual report on professional-amateur co-operation for wider dissemination among professional and amateur journals should also be considered. The committee should concern itself strictly with variable stars. It was possible that similar committees would be formed at a later date to cover other areas of professional-amateur interest.

David Stickland reminded the meeting that the emphasis among professionals was on cosmology, space experiments and huge telescopes and consequently there was virtually no serious professional observing undertaken in the UK today, with the exception of St. Andrews University. Even La Palma had serious limitations with the instruments being heavily over booked. Thus, amateur contributions were potentially very valuable. To promote amateur participation he considered that the names of the contributing amateurs should appear with the professionals on publications. In addition, the professional should be prepared to play a much bigger role in public education by, for instance, visiting and addressing local societies and encouraging observation.

Under certain circumstances the professional should be prepared to loan items of equipment for amateur use and qualified individuals should be connected directly to STARLINK, the professional data transmission service, notwithstanding the practical and security difficulties this might involve.

Ian Griffin (UCL) spoke briefly on two stars: V778 Cyg and BM Gem, of which he and his fellow workers urgently required PEP measurements. He invited amateurs to contact him if able to help.

Eclipsing Binary Programme News

John Isles

The list of minima observed for eclipsing binaries in constellations Peg to Vul in 1985-86, included in this *Circular*, shows the programme to have been in a healthy state. Unfortunately it has since gone into a sad decline. 1987 saw a serious drop in the number of eclipse timings. For that year we are therefore reverting from the listing in constellation groups over three issues, back to a single annual list, which will be given in the next *Circular*. Judging from the few reports so far received, 1988 will see a further drop in observations.

The problem is that, although many members observe eclipsing binaries from time to time, this programme has always depended heavily on one or two observers who have specialised in these objects. In recent years the specialists have been Tristram Brelstaff on the visual side, and Jack Ells for photoelectric photometry. Tristram has had to discontinue his observations (temporarily, we hope), and Jack has been concentrating on development of his automatic photoelectric photometer (of which we have great hopes). Harder to explain is the fact that, after making a promising start, the other photoelectric observers all seem to have dropped out.

Some members have said they are not interested in observing eclipsing binaries on the grounds that they are not "real" variable stars. This is not strictly true, because many of them show physical variations as well as eclipses, and the period changes they show have a physical cause. The reasons why eclipsing binaries really are interesting, and why amateur observations of them, including visual estimates, are useful, should be clear to anyone who has read these *Circulars*, the *Journal* or the *Eclipsing Binary Handbook*, and do not need to be repeated. The field is now open for new eclipsing binary specialists to make their mark in a field where results are published promptly in VSS *Circulars* and discussed regularly in the *Journal*.

As there are currently no really active observers working on this programme, the labour of producing an *Eclipsing Binary Handbook* every year does not seem to be justified. The 1988 *Handbook* will remain available from Storm Dunlop and the BAA office (see inside back cover). This gives a full account of the programme, and for a large number of systems it lists elements that for several years yet will generally remain valid for purposes of prediction. Observers who have microcomputers can easily compile their own predictions from the information given, but I can supply predictions for particular stars on request, to any member who does not have a micro. When revised elements are available for enough systems to justify a new edition of the *Handbook*, the predictions will be given in a different form, for selected systems over several years.

I shall close with one example of the scope for useful work. According to the 1988 Kracow *Yearbook*, no eclipse timings of Lambda Tauri have been published anywhere since 1978. Well, three results are listed in this *Circular*, and they have been reported by members of the Junior Astronomical Society. They show that in

1986 the eclipses were occurring about 50 minutes later than predicted. Lambda Tau is an important object because it is triple, the third component having the shortest known period among triple stars (33 days). Has the orbital period of the close pair changed? Further observations of this system are needed. Predictions will be found in the main BAA *Handbook*.

VSS Programme and Chart Development

John Isles

VSSC **66** listed several possible additions to the binocular and telescopic programmes. These were examples of the kinds of variable star currently being considered for inclusion, rather than ones we would definitely be taking on; though in fact VSS charts for two of them, drawn by John Toone, are now available and are reproduced here - V1294 Aql and SV Sge.

Our programmes are already large, and many of our stars are not well observed. Also, the task of analysing the stars we now have under observation is already mountainous. This means we must think carefully before adding new ones. I shall be very pleased to hear from members who have views on how the programme should be developed, and so will Storm Dunlop if you would like your views to be considered for publication. To start the discussion, here are my thoughts. In what follows I mainly have visual observation in mind, since our capacity for photoelectric work is small as yet, and is fully taken up by the Eclipsing Binary Programme.

Amateur visual observers are usually the people in the best position to detect unusual events such as the outbursts of recurrent novae, long-period dwarf novae and symbiotic stars, and the fades of R CrB stars. Guy Hurst has kindly sent me his analysis of variable stars mentioned in *IAU Circulars* over recent years, and it is clear that, together with novae and supernovae, these classes of variable star account for the majority of reports. Monitoring these stars is so important that in my view it is unthinkable that the VSS should neglect it.

We now have a separate programme on recurrent novae and long-period dwarf novae, run by Guy as part of the UK Nova/Supernova Search Programme (see *VSSC* **66**), so those objects are largely covered, though there are several I should like to see added. The symbiotic stars and R CrB stars should be added to the main programme of binocular and telescopic variables. There are only a handful of R CrB stars that might be considered for inclusion, but there are several dozen symbiotic stars we might do - more if we include those that are not yet known to be optically variable. These are all worth monitoring for outbursts, as is illustrated by the case of AS 296 in Serpens (see *BAA Circular* **679**).

Another class frequently mentioned in *IAU Circulars* is the nova-like variables. These are a mixed bag of objects that have spectra resembling novae at some stage of their development. Many of them are indistinguishable from old novae, but some may in fact be pre-novae that could produce an outburst in the near future.

Old novae themselves are also of great interest, and any of them could turn out to be recurrent novae. To monitor all ex-novae for future outbursts would be an enormous task, but most of these objects are very faint, and we could give priority to those that are accessible in fairly small instruments. They often show semi-regular or irregular variation, or minor outbursts resembling those of dwarf novae.

Among the above types of variable, I think we should eventually take on as many as possible. Variable stars of most other classes are probably less important to add to the programme.

We have a reasonable sample of Mira stars and plenty of semiregular variables, and should add more only if the stars are of exceptional importance (as in the case of the unusual carbon stars discussed elsewhere in this *Circular*).

'Ordinary' dwarf novae, that is ones that have frequent outbursts, are very demanding of the observer and difficult to follow in the UK climate, so we should try to improve coverage of the ones we have rather than take many more on; but there are objects (e.g. TT Ari, IP Peg, some further SU UMa stars) that are of interest for reasons I hope to discuss later, and which I think we should take on.

There are some classes that are under- or un-represented in our present list, such as the X-ray sources and FU Ori stars. We could take some of these on, if only to ensure that our eggs are distributed among many baskets so that some of our observations will turn out to be useful. I am less sure about T-Tauri stars and nebular variables, as visual observations of these objects are difficult to interpret, and in the case of variables in nebulosity they are notoriously inaccurate. A visual programme on Cepheids and RR Lyrae stars could in principle be productive, but there is so much else that seems more important to get going.

If all these possible developments in our programme are to be pursued, it will mean a large increase in the number of reports that ought to be written for the Journal. Priority should therefore be given to adding stars it will be useful to observe even if no reports on them ever get written; that is, stars that are most likely to produce outbursts, fades or other unusual activity that would get reported in *IAU Circulars*, thus enabling other astronomers to make important observations.

The lists in *VSSC* 66 included several stars south of the equator, and members have queried this. The reason is not that I have moved to Cyprus! Stars south of the equator but north of the ecliptic can be followed through a greater part of the year by northern observers than they can from the southern hemisphere, so I think observers who can do so should be prepared to observe down to the southern ecliptic limit (-23°), otherwise we could be missing something important. If that point is conceded, then I think it also follows that we should try to observe not just down to the ecliptic but down to at least -23° at all hours of RA, at least in the case of stars monitored for outbursts or fades rather than particularly to get a continuous light curve. There are many important variables this would bring in, particularly in the region of the galactic centre. Of course, we shall not be able to tackle stars so faint at low declinations.

We already have an arrangement with the Variable Star Section of the Royal Astronomical Society of New Zealand, whereby the BAA passes estimates of several telescopic programme variables south of the equator to the RASNZ for combined analysis, and the RASNZ similarly sends us observations of stars north of the equator that are on the BAA programme. Our work on further southern variables could be included in this arrangement, so that, even if our results are fragmentary, they would go into a larger pool of data and thus none would be wasted. It makes sense for northern and southern observers to combine efforts on stars in the equatorial zone, rather than to erect a mental barrier at the equator.

Expansion of the programme will be limited by the rate at which charts can be drawn up and checked, given also the need to revise many of our existing charts. The last Circular referred to work in hand on chart improvement. I am compiling a list of known faults in VSS charts and sequences, and would appreciate a note from any member who detects one - whether a sequence query, error in the star detail, or other problem - preferably with specific suggestions for improvement.

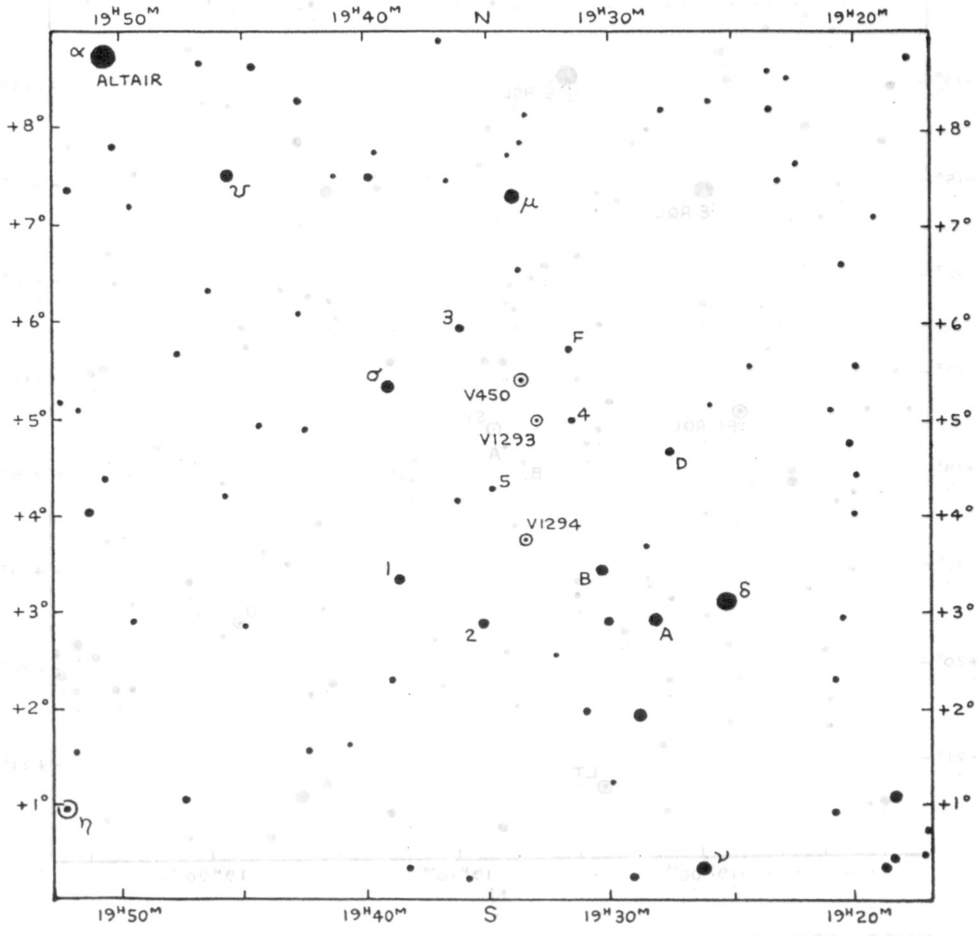
The Section officers have now drawn up a list of guidelines for new and revised VSS charts, which have been followed in preparing up the accompanying charts. The guidelines aim to include the best features of previous practice, so the new charts should not look unusual to anybody. The most obvious difference is that the six-figure Harvard designation that is given in the top left-hand corner on older charts has been replaced by the serial number of the chart, which should be quoted on report forms.

In the revised binocular chart for the semiregular variables V450 and V1293 Aquilae, the opportunity has been taken to add the Gamma Cas (GCAS) star V1294 Aql, which is an addition to the binocular programme. This has a catalogue range of only 6.82-7.23; my estimates in 1987-8 indicate a slightly brighter range of 6.5-7.0. Any GCAS star is liable to undergo shell episodes when it may fade, or it may brighten as Gamma Cas itself did in the 1930s; so observers should promptly report any obvious movement outside the variable's normal range. Observations need not be particularly frequent, and the star can conveniently be checked at the same time as V450 and V1293, every ten days or so.

SV Sge is an R Coronae Borealis (RCB) star with photographic range 11.5-16.2. Its normal visual magnitude is about 10.5. Observations should be made every few days, and any fade below 11.0 should be promptly reported (see telephone numbers on inside front cover). The most recent minimum ended in 1983 January. As with all RCB stars, it is important not just to detect the fades but to obtain good light curves of the whole of the minima, as these can be used to model the size, shape and movement of the cloud of carbon dust causing the obscuration. It is not known whether this star shows pulsational changes with a period of a few weeks, such as have been found in several other RCB stars; so estimates should be made with care even when the star is obviously near maximum.

070·01 9° FIELD ERECT

V1293 AQUILAE	19H 30M 39S	+ 04° 55·2′	(1950)
	19H 33M 08S	+ 05° 01·7′	(2000)
V1294 AQUILAE	19H 31M 07S	+ 03° 39·1′	(1950)
	19H 33M 37S	+ 03° 45·7′	(2000)
V450 AQUILAE	19H 31M 18S	+ 05° 21·4′	(1950)
	19H 33M 46S	+ 05° 27·9′	(2000)



SEQUENCE: A, B, 1, 2 PUBLN USNO XXI; OTHERS VISUAL ESTIMATES DAP & JEI.
CHART: FROM ECLIPTICALIS.

A 5·84	3 6·6
B 6·03	F 7·0
1 6·33	4 7·2
2 6·37	5 7·6
D 6·5	

BAA VSS
EPOCH 2000
DRAWN: JT 20-8-88
APPROVED: JEI 1988

071·01 9° FIELD INVERTED

SV SAGITTAE 19ᴴ 05ᴹ 58ˢ + 17° 32·9′ (1950)
19ᴴ 08ᴹ 12ˢ + 17° 37·6′ (2000)

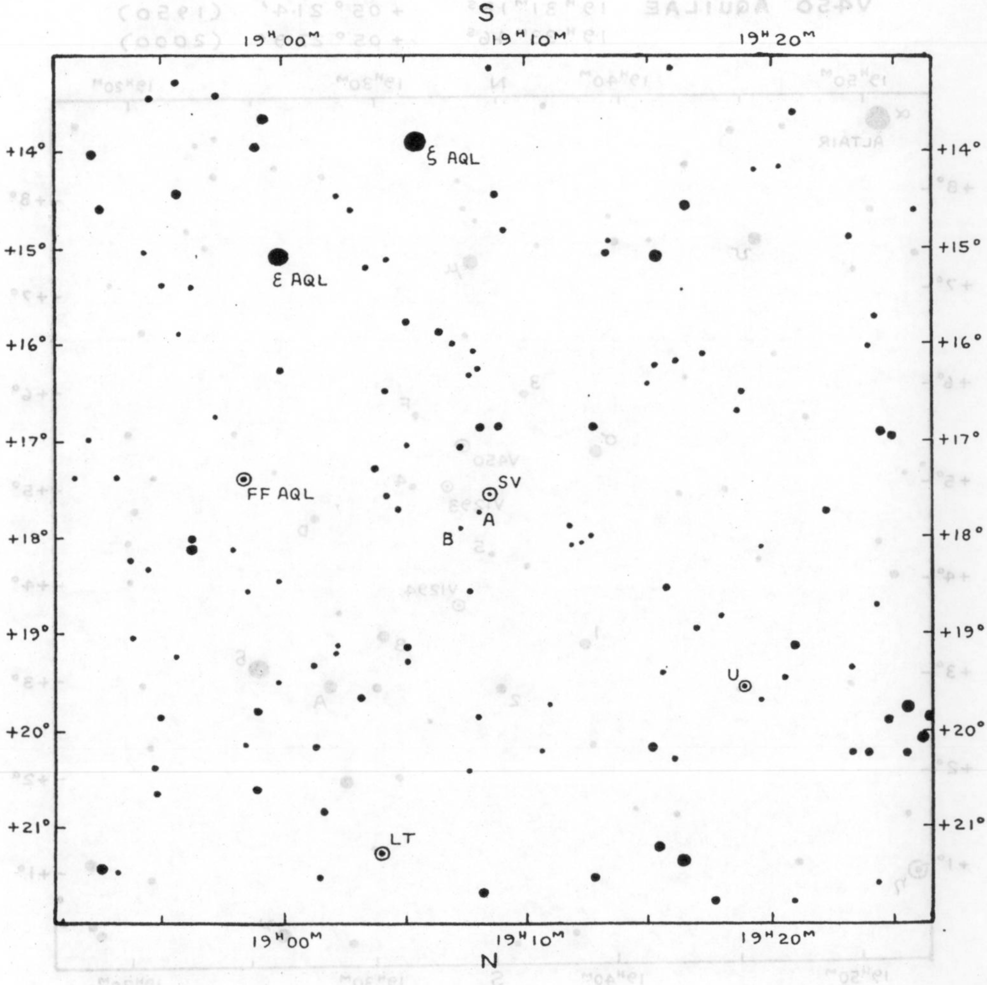


CHART : FROM ECLIPTICALIS

BAA VSS
EPOCH 2000
DRAWN : JT 21-8-88
APPROVED : JEI 1988

MINIMA OF ECLIPSING BINARIES,

1985-86 - (3) Peg to Vul - John Isles

The total numbers of observations received for known and suspected eclipsing variables in constellations Peg-Vul, including estimates reserved for separate discussion, are summarised below.

	Observations	Timings
Photoelectric:		
J Ells (EJ)	276	9
A Hollis (HO)	75	3
R Miles (M1)	58	1
R Pickard (PI)	15	2
J Watson (TW)	31	4
Total	455	19
Visual:		
T Brelstaff (BS)	754	57
A Chapman (C1)	12	1
L Cluyse (UY)	50	2
T Cooper	8	-
H Duncan (DH)	38	4
P Ells	4	-
R Geddes (G1)	93	9
A Gibbon (G2)	16	1
C Henshaw (HC)	178	3
A Hollis (HO)	12	1
J Isles (IS)	57	3
G Kirby	3	-
B McInnerny	14	-
G Maris	16	-
A Markham (QM)	41	2
P Mettam	6	-
I Middlemist (MM)	133	13
G Pointer (P1)	45	5
M Reynolds	12	-
M Taylor (TY)	78	5
N Taylor (T1)	63	4
P Wheeler	8	-
Total	1641	110
Grand total	2096	129

The observer codes C1, G1, G2, M1, P1, T1 are temporary, pending the allocation of final VSS codes to these observers by the Deputy Director.

In the accompanying list of observed minima, photoelectric determinations are underlined, and were made using a V filter unless noted below. The symbol ":" distinguishes timings that are uncertain because the observations were discordant, or one branch of the light curve was inadequately observed, or there were long gaps in the estimates; it has exactly the same meaning as "?" in previous lists. For further explanations, see *VSSC* **58**.

In addition to the timings in 1985-86, we repeat three earlier minima of W UMa by observer EJ, which as previously published were affected by an error in the light-time corrections. An asterisk draws attention to further information in the following notes.

AB Per The large O-C of -0.64d in 1985 confirms the similar O-C of -0.63d in 1982 (*VSSC* **60**).

LS Per The large O-C of -0.21d in 1985 confirms similar O-Cs of -0.23d: in 1983 (*VSSC* **60**) and -0.22d: in 1984 (*VSSC* **61**).

Beta Per As usual, epoch and O-C are calculated from the elements of the 1985-87 *GCVS*. However, the *GCVS* quotes an erroneous epoch of minimum from *IBVS* **2520**, in which the calculated times of three minima (from Ashbrook's 1976 elements) have evidently been listed instead of the observed times. (This was pointed out to the writer by Dr T. Saemundsson, University of Iceland.) The mean O-C of our timings against the *GCVS* elements, which are used in the *Eclipsing Binary Handbook* and (from 1989) in the BAA *Handbook*, is +0.002d in 1985 and +0.011d in 1986. Four visual timings in 1986 published in *BBSAG Bulletin* **82** give a similar mean O-C of +0.010d.

SU Psc Observations 6094-6411 folded onto a single cycle in order to derive the timing.

V861 Sco Observations 6616-6740 folded onto a single cycle in order to derive the timings.

RZ Sct Observations 6663-6665.

BL Tel The timing for this long-period eclipsing binary (P = 778.6d) is based on observations by HC 6333-6400. Estimates by Cooper 6372-6406 covering the rise are in close agreement.

W UMa The first photoelectric timing by HO on 6135 was made using B filter. Observations by QM on 6434-6792 have been folded onto a single cycle in order to derive the last two timings.

The numbers of estimates given against certain timings include estimates of other eclipses that were also used in deriving the time of minimum. These were as follows.

Star	Date	No	Other dates
Z Per	6319	7	6380-6411
AB Per	6114	17	6121-6372
AY Per	6383	6	6136-6218
IU Per	6457	4	6666
LS Per	6136	9	6387
Beta Per	6143	3	6094-6123
	6418	6	6381
	6487 (G1)	3	6550
	6530 (G1)	5	6490
	6659 (TY)	3	6441-6510
	6682	2	6679-6702
	6702	2	6719
	6728 (T1)	4	6550
	6728 (TY)	5	6745-6771
SY Sge	6351	3	6677
	6659	10	6383-6684
RS Sct	6615	2	6643
CF Tau	6351	7	6387
	6442	6	6456
Lambda Tau	6746 (G1)	6	6766
	6746 (C1)	4	6730-6762
	6762	5	6746-6750
TX UMa	6171	5	6180
RT UMi	6121	9	6292
BP Vul	6647	4	6684
GP Vul	6641	2	6675

Observed minima

Star	Epoch	Helio JD 244...	O - C	No	Observer
U Peg	26097.5	6292.522	-0.004	8	BS
	26254.5	6351.345	-0.022	7	BS
	26332	6380.403	-0.010	7	BS
	26340	6383.377	-0.034	8	BS
	26340	6383.3906	-0.0207	20	EJ
AT Peg	1304	6714.348	+0.008	5	MM
BG Peg	590	6684.440	-0.183	6	BS

Star	Epoch	Helio JD 244...	O - C	No	Observer	
BX Peg	7496	6297.414	+0.002	6	BS	
	7688.5	6351.400	+0.007	6	BS	
	7691.5	6352.286	+0.053	5	BS	
	7791.5	6380.278	+0.002	6	BS	
	8723	6641.487	0.000	6	BS	
BX Peg	8787	6659.435	0.000	9	BS	
	8815.5	6667.423	-0.004	6	BS	
	8890.5	6688.458:	0.000:	7	BS	
EE Peg	300	6352.386	+0.031	9	MM	
	440	6720.307	+0.002	7	TY	
Z Per	216	6319.374	-0.033	11	BS	*
ST Per	1388	6112.451:	+0.002:	10	MM	
	1456	6292.539	+0.004	10	BS	
AB Per	3230	6114.300	-0.639	26	BS	*
AY Per	1633	6383.437	-0.066	12	BS	*
DM Per	1653	6429.4131	+0.0001	37	EJ	
IQ Per	1045	6112.376	-0.0001	58	M1	
	1045	6112.401	+0.024	10	MM	
	1263	6492.4809	+0.0058	27	EJ	
	1396	6724.370:	0.000:	5	TY	
IU Per	581	6109.381	+0.013	9	BS	
	595	6121.359	-0.007	8	BS	
	987	6457.310	-0.010	9	BS	*
	1252	6684.438	+0.006	8	BS	
LS Per	2312	6136.389	-0.213	16	BS	*
LX Per	2416.5	6457.4018	-0.0454	23	EJ	
Beta Per	152	6077.352	+0.009	8	BS	*
	167	6120.368	+0.015	8	DH	*
	167	6120.368	+0.015	11	G2	*
	175	6143.299	+0.007	7	DH	*
	226	6289.506	-0.018	5	G1	*
	271	6418.538	-0.015	9	G1	*
	295	6487.368	0.000	8	G1	*

Star	Epoch	Helio JD 244...	O - C	No	Observer	
Beta Per	295	6487.384	+0.015	7	T1	*
	303	6510.334	+0.027	3	P1	*
	310	6530.400	+0.022	8	G1	*
	310	6530.404	+0.027	5	T1	*
	355	6659.390:	-0.017:	6	G1	*
	355	6659.420	+0.013	10	TY	*
	362	6679.460	-0.018	7	G1	*
	363	6682.354	+0.009	5	TY	*
	370	6702.431	+0.015	5	P1	*
	379	6728.237	+0.015	14	T1	*
	379	6728.249	+0.027	12	TY	*
	394	6771.240:	+0.009:	12	T1	*
	394	6771.244:	+0.013:	12	G1	*
	394	6771.278:	+0.046:	5	P1	*
	401	6791.296	-0.007	7	P1	*
	401	6791.306	+0.004	12	G1	*
RV Psc	39657.5	6351.384	-0.012	6	BS	
	39722.5	6387.387	-0.019	6	BS	
SU Psc	7568	6297.014	-0.234	13	BS	*
V Sge	16351	6297.520	+0.002	11	BS	
	17055	6659.510:	-0.002:	5	BS	
SY Sge	3761	6351.631	+0.127	6	BS	*
	3848	6659.484	+0.067	15	BS	*
TU Sge	3795	6649.465	-0.240	5	UY	
V861 Sco	378	6671.02	+0.17	32	HC	*
	378.5	6674.41	-0.36	44	HC	*
RS Sct	3279.5	6615.564:	+0.028:	10	IS	*
RZ Sct	1804	6664.41	+0.18	4	DH	*
RW Tau	155	6113.370	-0.003	8	MM	
	155	6113.373	0.000	12	BS	
	272	6437.334	+0.007	8	MM	
	285	6473.328	+0.006	6	MM	
	289	6484.390	-0.008	8	MM	
BV Tau	61	6109.393	+0.006	9	BS	
	89	6135.440	+0.001	9	BS	
	90	6136.374	+0.004	9	BS	
	421	6444.370:	+0.024:	4	BS	

Star	Epoch	Helio JD 244...	O - C	No	Observer	
CD Tau	1411	6466.397	+0.011	10	MM	
CF Tau	5697	6351.462	-0.074	12	BS	*
	5730	6442.408	-0.072	13	BS	*
GR Tau	3574	6109.392	-0.008	9	BS	
HU Tau	2364	6136.412	-0.002	9	MM	
	2364	6136.4136	-0.0008:	18	HO	
V781 Tau	7467	6450.3895	-0.0075	30	EJ	
	7481.5	6455.3925	-0.0057	34	EJ	
	7536.5	6474.3655	-0.0028	8	PI	
Lambda Tau	6385	6746.454	+0.032	13	G1	*
	6385	6746.464	+0.042	9	C1	*
	6389	6762.260	+0.026	8	P1	*
BL Tel	15	6369.3	-2.3	21	HC	*
X Tri	3906	6297.536	-0.001	13	BS	
	3983	6372.346	0.000	6	BS	
	4054	6441.328	+0.003	11	BS	
	4055	6442.292	-0.004	14	BS	
W UMa	829	6042.3192:	-0.0048:	28	EJ	
	838	6045.3262	-0.0005	40	EJ	
	838.5	6045.4927	-0.0008	43	EJ	
	967	6088.3644:	-0.0016:	29	EJ	
	1096	6131.4006	-0.0046	16	EJ	
	1108	6135.4134	+0.0046	30	HO	*
	1108	6135.4144	+0.0056	21	HO	
	1111	6136.4090	0.0007	30	EJ	
	2271	6523.4265	-0.0027	11	TW	
	2280	6526.4270	-0.0050	7	PI	
	2394	6564.4670:	-0.0003:	3	TW	
	2403	6567.4651	-0.0043	8	TW	
	2436	6578.4754	-0.0040	9	TW	
	2909	6736.294	+0.004	24	QM	*
	2909.5	6736.456	-0.001	15	QM	*
TX UMa	367	6122.372	+0.016	6	HO	
	383	6171.395	+0.027	9	DH	*
	512	6566.535	+0.009	21	UY	

Star	Epoch	Helio JD 244...	O - C	No	Observer	
VV UMa	588	6219.507	-0.009	9	BS	
	822	6380.363	+0.001	8	BS	
	1228	6659.440	+0.001	8	BS	
XY UMa	22971	6219.510	+0.024	10	BS	
	23313	6383.336	+0.035	9	BS	
ZZ UMa	4668	6684.412	-0.017	8	BS	
W UMi	7308	6114.341	-0.042	8	BS	
	7321	6136.442	-0.056	8	MM	
RT UMi	2614	6121.264	+0.085	17	BS	*
RU UMi	8605	6113.319	-0.007	8	BS	
	8607	6114.359	-0.017	9	BS	
	9693	6684.445	-0.001	9	BS	
AG Vir	1060	6113.630:	+0.005:	3	IS	
BH Vir	3654	6215.459	+0.001	5	IS	
BP Vul	332	6647.448	+0.004	10	BS	*
	367	6715.356	0.000	9	MM	
DR Vul	2845	6704.379	+0.001	8	MM	
GP Vul	11323	6292.496	-0.002	11	BS	
	11349	6319.372	+0.028	7	BS	
	11661	6641.484	0.000	9	BS	*

Miscellaneous 'Binocular' Variables - 1987

Melvyn Taylor

RS And (7.0 - 9.1, SRb, 130d, M7)
Apparently brightening during Jan. to Mar. about 8.5; Jun. 8.5, fading to 8.8 in Oct. then 8.6 in Dec. No observations during April and May. 67 estimates by: Fraser, Isles, Markham, Middlemist & Taylor.

TZ And (7.6 - 9.0, SRb, M6)
Apart from Apr. and May when no estimates were made of this star, little variation was recorded during the year: 8.7/8.6. 71 estimates by: Fraser, Isles, Markham, Middlemist & Taylor.

AQ And (8.0 - 8.9, SR, C5)
Brightening during Jan. to Mar., 8.6 to 8.3; no estimates in Apr. and May; minimum, 9.0 in Jly; brightening to maximum 8.6 in Oct. and 8.8 in Dec. 80 estimates by: Fraser, Isles, Markham, Ramsay, Taylor & Toone.

V Aql (6.7 - 8.2, SRb, 353d, N6)
Magnitude 7.5 in Jan., falling to 8.0 in Mar., then maximum 7.3 in Jly, falling to 7.7 in Nov., possibly rising in Dec. (much scatter). See light-curve. 138 estimates by: Bone, Fraser, Isles, Markham, Middlemist, Srinivasan, Swain, Tanti, Taylor, Toone & Worraker.

V450 Aql (6.7 - 7.4, SRb, 64d, M5-M8)
Mean variation from Mar. to Dec., 6.7 to 6.5 130 estimates by: Fraser, Isles, Markham, Munden, Smeaton, Smith, Taylor & Toone.

V1293 Aql (6.7 - 7.4, SRb, M5)
March 7.0 rising to 6.7 in August, then 6.7/6.9 to Dec. 112 estimates by: Bone, Fraser, Isles, Markham, Munden, Smeaton, Smith & Taylor.

V Ari (7.8 - 8.8, SRb, 77d , C4)
No estimates Apr. and May; mean variation during year is a decline from magnitude 8.3 to 8.6. Requires more observations. 69 estimates by: Fraser, Isles, Markham, Ramsay, Swain, Taylor.

RW Boo (6.4 - 7.9, SRb, 209d, M5)
Falling from 7.9 in Jan. to minimum, 8.2 in Apr., rising (smoothly) to 7.6 in Dec. 112 estimates by: Fraser, Hutchings, Isles, Markham, Munden, Ramsay, Taylor & Toone.

U Cam (7.7 - 8.7, SRb, N5)
Magnitude 8.5 in Jan., rising to maximum 8.1 in May, then 8.5 in Jly, rising to 8.1 in Nov. and probably fading to 8.3 in Dec. 82 estimates by: Fraser, Isles, Markham, Smeaton, Taylor, Toone & Worraker.

RY Cam (7.3 - 9.4, SRb, 135d, M3)
Magnitude 8.3 to 8.7 from Jan. to May, then 8.3/8.5 all year. The light-curve shows much scatter between individual observers, which is strange for a star of this brightness. The proximity of faint stars, very close to the variable may well be producing discordant estimates and all observers should take great care when estimating this variable. 101 estimates by: Fraser, Isles, Markham, Mettam, Middlemist, Ramsay & Swain.

ST Cam (6 - 8, SRb, $300^{d}\pm$, C5)
Magnitude 7.4 in Jan., with minimum about 7.5 in Mar., rising to 7.1 maximum during Jun./Jly, falling to minimum of 7.6 in Oct./Nov., then 7.4. See light-curve. 159 estimates by: Fraser, Howarth, Isles, Markham, Middlemist, Shanklin, Swain & Toone.

UV Cam (7.5 - 8.1, SRb, $294^{d}\pm$, C5)
Between mean magnitudes 7.9 and 8.2 all year. 110 estimates by: Fraser, Isles, Markham, Mettam, Ramsay & Swain.

ZZ Cam (7.1 - 7.9, Lb, M0-M5)
Much scatter between observers, probably caused by: similar reasons to RY Cam. The mean magnitude Jan. to Apr. was about 7.7; then from Jun. to end of year 7.4/7.6. More estimates are required. 90 estimates by: Isles, Markham, Ramsay & Swain.

RT Cnc (7.1 - 8.6, SRb, $60^{d}\pm$, M5)
From Jan. to Jun. 7.9/7.8; brighter from Sep. to Dec. between 7.3 and 7.7. 76 estimates by: Fraser, Hutchings, Isles, Markham, Munden, Ramsay & Toone.

Y CVn (5.2 - 6.6, SRb, 157^{d}, C5)
Magnitude 5.7 Jan./Feb., then 6.0 Mar./Apr., rising to 5.6 in Jly, falling to 6.0 in Sep., rising to 5.7 in December. 203 estimates by: Fraser, Geddes, Hutchings, Isles, Kendall, Markham, Pointer, Price, Privett, Ramsay, Swain, Taylor & Toone.

W CMa (6.4 - 7.9, Lb, C6)
About 7.5/7.4 from Jan. to Apr.; Sep. to Dec. falling 7.1 to 7.4. 66 estimates by: Fraser, Isles, Kendall, Markham, Swain, Toone & Worraker.

V391 Cas (7.6 - 8.4, Lb, M4)
Mean magnitude 7.4/7.6. 192 estimates by: Beveridge, Fraser, Hutchings, Isles, Kendall, Markham, Ramsay, & Taylor.

V393 Cas (7.0 - 8.0, SRa, 393^{d}, M0)
Magnitude 7.7 in Jan. rising to 7.5 in Apr., 7.8 in Jun. rising slowly to 7.6 in Nov./Dec. 193 estimates by: Beveridge, Fraser, Hurst, Isles, Kendall, Markham, Middlemist, Ramsay & Taylor.

W Cep (7.0 - 9.2, SRc, K0-M2)
From Jan. to Apr. 8.2/8.3, rising to 7.8, Jly, falling to 8.2, Nov., then 8.0 in Dec. 185 estimates by: Beveridge, Fraser, Gavine, Geddes, Isles, Markham, Middlemist, Price, Smith, Swain, Taylor, Toone & Worraker.

RW Cep (6.2 - 7.6, SRd, 346ᵈ±, K0)
Jan. to May 7.2 to 7.1, then slow fade to 7.5 in Dec. 274 estimates by: Bone, Fraser, Gavine, Geddes, Hutchings, Isles, Kendall, Markham, Price, Privett, Ramsay, Smith, Swain, Taylor, Toone & Worraker.

SS Cep (6.7 - 7.8, SRb, 90ᵈ, M5)
Magnitude 7.4/7.5, Jan./Feb.; 7.9 in Jly; 7.3 in Aug./Sep. and 7.5 in Dec. Maxima: 7.4 Jan./Feb., 7.6 in May, 7.3 in Aug./Sep. and 7.4 in late Nov. 182 estimates by: Fraser, Isles, Kendall, Markham, Munden, Smith, Swain, & Toone.

DM Cep (7.0 - 8.2, Lb, M4)
Mostly 7.4/7.6 but possibly fainter in August. 178 estimates by: Fraser, Isles, Kiernan, Markham, Nicholls, Ramsay & Scott.

FZ Cep (7.0 - 7.6, SR, M5)
Mostly 7.4/7.6. 94 estimates by: Fraser, Isles, Kendall, Markham, Middlemist & Taylor.

RU Cyg (8.0 - 9.4, SRa, 234ᵈ, M6)
Magnitude 8.5 in December 1987, falling to minimum of 9.1 in May, rising to maximum, 8.6 during Sep.; 8.9 in late Dec. See light-curve. 52 estimates by: Fraser, Isles, Markham, Middlemist, & Taylor.

TT Cyg (7.4 - 8.7, SRb, 118ᵈ, C5)
Falling from Jan. 8.1 to 8.5 minimum Jly/Aug., rising to 8.2 in Sep., then about 8.4. More observations required. 67 estimates by: Fraser, Markham, Smeaton & Toone.

V460 Cyg (5.6 - 7.0, SRb, 180ᵈ±, C6)
Rising 6.7 to 6.3 in May, minimum 6.6 Jly/Aug., maximum 6.2 in Oct., falling to 6.7 in Dec. 67 estimates by: Fraser, Markham, Smeaton & Toone.

UW Dra (7.0 - 8.2, Lb?, K5)
Mainly 7.6/7.7 all year. 83 estimates by: Fraser, Kendall, Markham & Toone.

AH Dra (7.1 - 7.9, SRb, 158ᵈ, M7)
Rising from magnitude 7.9 to maximum 7.3 Mar./Apr., then deep minimum 8.7 Jun./Jly; maximum 7.4 in Sep. and 7.9 in Dec. See light-curve. 169 estimates by: Fraser, Hutchings, Isles, Kendall, Markham, Middlemist, Smith, Swain & Toone.

AT Dra (5.3 - 6.0, Lb, M4)
Much scatter. The mean magnitude was 5.9/6.0. 183 estimates by: Fraser, Hutchings, Isles, Kendall, Markham, Ramsay, Smith, Swain & Toone.

TU Gem (7.4 - 8.3, SRb, 230^d, C6)
During Jan. to may 7.1/7.2; possibly 6.9 in Jly (1 estimate), then Aug. to Dec. 6.9/7.0. Possibly star detail causes some observers concern. 77 estimates by: Isles, Markham, Ramsay, Srinivasan & Toone.

BQ Gem (5.1 - 5.5, SRb, 50^d, M4)
Apart for Jun. and Jly, magnitude 5.4/5.6. 68 estimates by: Fraser, Isles, Markham, Munden & Ramsay.

DW Gem (8.0± - 10.4, Lb, M3-M7)
Positive estimates only: main variation between 9.4 and 9.8 apart from Jun. and Jly. 47 estimates by: Fraser, Hutchings, Isles, Middlemist & Taylor.

SX Her (8.0 - 9.2, SRd, 102^d, G3-K0)
Good coverage, three maxima recorded. Magnitude 8.4 in Jan.; minima 8.7 Feb./Mar., 8.6 in Jun., 8.7 in Sep. Maxima: 8.2 in Apr., 8.2 end of Jly, 8.3 in Nov. See light-curve. 69 estimates by: Fraser, Isles, Markham, Taylor & Toone.

UW Her (7.8 - 8.7, SRb, 103^d, M5)
Rising 8.5 in Jan. to 8.2 in Apr., 8.5 in Jun. rising to 7.8 in Jly to 8.3 in Dec. with minor variations Jly-Dec. 114 estimates by: Fraser, Isles, Markham, Middlemist, Smith, Taylor & Toone.

IQ Her (6.99 - 7.47, SRb, 75^d, M4)
Magnitude 7.3 in Jan. rising to indistinct maximum; minimum 7.5 in May rising to 7.0 by month end. Minimum 7.6 in Jun., maximum 7.2 in Aug. Minimum 7.6 Aug./Sep.; maximum 7.1 in Oct., falling to 7.6 Nov./Dec., then rising. 59 estimates by: Fraser, Isles, Markham & Swain.

OP Her (5.85 - 6.73, SRb, 120.5^d, M5)
Magnitude 6.5 in Jan. falling slightly then 6.4 in March to Jly. Maximum of 6.2 in early Aug., falling to 6.5/6.6 in Sep. 6.2 in Oct., falling in Nov. with a magnitude of 6.4 in Dec. Houchen has four p.e. V measures as follows: May 01, 6.03; Aug.29, 5.32; Sep.12, 6.31; Oct.12, 6.02 There is a substantial amount of scatter between different observers. 247 estimates by: Bone, Fraser, Geddes, Hutchings, Markham, Middlemist, Price, Ramsay, Smeaton, Smith, Swain, Taylor, Toone & Worraker.

V566 Her (7.1 - 7.8, SRb, 137^d, M4)
Slow variations: magnitude 7.7 in Jan. (one estimate of 7.4 in Feb.), maximum of 7.4/7.5 in May, falling to 7.9 in Oct./Nov., then 7.8 in Dec. 143 estimates by: Hutchings, Isles, Price, Smeaton, Swain & Taylor.

U Hya (4.2 - 6.5, SRb, 450^d±, C6)
Magnitude 5.4 in Jan. and rising slightly (5.3) into Jun. No observations Jly to Sep. Oct. to Dec. 5.5/5.4. 64 estimates by: Fraser, Isles, Ramsay, Srinivasan, Taylor, Toone & Worraker.

SX Lac (7.7 - 8.7, SRd, 190^d, K2)
Few observations Jan. to Jun., about 8.6. Magnitude 8.4 in Jly falling to minimum of 8.9 in Oct. and rising to 8.6 in Dec. 75 estimates by: Fraser, Isles, Markham, Middlemist, Privett, Swain & Toone.

RX Lep (5.0 - 7.4, SRb, 60^d±, M6)
Falling from Jan., 6.4/6.5 to minimum 6.9 in early Feb. then rising to 6.5 in Apr. No observations May and Jun. One estimate of 6.0 in Jly falling to 6.3 in Dec. with minor variations. 102 estimates by: Fraser & Isles

RV Mon (6.8 - 8.3, SRb, 131^d, C4-C6)
Magnitude 7.5 in Jan. falling to 7.7 in Mar., then rising to 7.4 in May. No observations then until 7.0 (one estimate) in Aug., then falling to 7.5/7.6 in Nov. with a minor rise in Dec. 85 estimates by: Fraser, Isles, Markham, Mettam, Srinivasan, Taylor, Toone & Worraker.

SX Mon (7.3 - 8.5, SR, 100^d, M6)
Rising from 8.1 in Jan. to maximum of 7.7 in Feb./Mar., then 8.1/8.2 in May. Aug./Nov. 8.1/8.3, risiing to 7.9 in Dec. 83 estimates by: Fraser, Isles, Markham, Mettam, Srinivasan, Taylor, Toone & Worraker.

X Oph (5.9 - 9.2, M, 329^d, M5-M9)
Falling through Jan., 8.0 to minimum of 8.6 in Mar./Apr.; rising with halts in Jun. and Aug. to maximum 6.8 in Oct. Falling, 8.2 (one estimate) in Dec. 140 estimates by: Fraser, Isles, Markham, Mettam, Shanklin, Swain, Taylor, Toone & Worraker.

W Ori (5.9 - 7.7, SRb, 212d, C5)
Rising 7.1 in Jan. to 6.4 in Apr. Aug. to Dec. 6.6/6.7. 104 estimates by: Fraser, Isles, Kendall, Markham, Middlemist, Srinivasan, Swain, Taylor & Toone.

BL Ori (6.3 - 6.9, Lb, C6)
No observations Jun./Jly, main variations 6.6/6.8. 107 estimates by: Hutchings, Isles, Kendall, Markham, Mettam, Munden, Ramsay, Srinivasan, Taylor & Toone.

BQ Ori (6.9 - 8.9, SR, 110^d, M5-M8)
Falling from 8.2, Jan. to 8.4 minimum early Feb., then maximum 7.5 at end of Mar., falling to 8.2 mid-May, and end of observations. Magnitude 7.6 in late Jly, falling to 8.4 Sep./Oct., then rise to 8.0 Nov./Dec. 138 estimates by: Fraser, Gavine, Isles, Markham, Shanklin, Smeaton, Srinivasan, Swain, Taylor & Toone.

AK Ori (5.9 - 7.1, SR±, 120^d±, K2)
There appears to be little variation, 6.4/6.6 throughout the year. No observations May and Jun. 137 estimates by: Bone, Fraser, Isles, Kendall, Markham, Ramsay, Smeaton, Smith, Taylor & Toone.

GO Peg (7.1 - 7.8, Lb, M4)
Falling in Jan., 8.1 to 8.3, then 8.0 in Feb., and Apr./May, Jun. Rising to about 7.5

in Jly/Aug. then minor variations 8.0 in Sep., 7.8 in Nov. and about 7.5 in late Dec. 128 estimates by: Fraser, Isles, Markham, Middlemist, Ramsay, Taylor, Toone & Worraker.

SU Per (7.0 - 8.5, SRc, 533^d, M3)
Falling from 8.1 in Jan. to 8.3 in Mar., rising in Apr./May. Magnitude 8.1 in Jun. to 7.8 (maximum) Aug./Sep., with a steady fall to 8.3 in Dec. 74 estimates by: Isles, Markham, Middlemist, Swain, Thorpe & Worraker.

AD Per (7.7 - 8.4, SRc, 363^d, M2)
Magnitude 8.8/8.9 Jan./Feb., rising to about 8.3 in May. Magnitude 8.6/8.7 in Jly, then 8.4/8.7 for rest of year. 56 estimates by: Isles, Markham, Middlemist, Swain, Thorpe & Worraker.

KK Per (6.6 - 7.6, Lc, M1-M3)
Magnitude 8.3/8.0 during Jan. to Apr., then Jun. to Dec. 7.9/8.2. 48 estimates by: Isles, Markham, Swain, Thorpe & Worraker.

PR Per (7.6 - 8.3, Lc, M1)
At about 8.0/8.2 for the year. 44 estimates by: Beveridge, Isles, Markham, Swain & Thorpe.

TT Tau (8.1 - 8.8, SRb, 167^d, C4)
At magnitude 8.7/8.5 Jan. to Apr. At magnitude 8.4/8.7 Aug. to Dec. 70 estimates by: Fraser, Hutchings, Isles, Markham, Ramsay, Swain & Taylor.

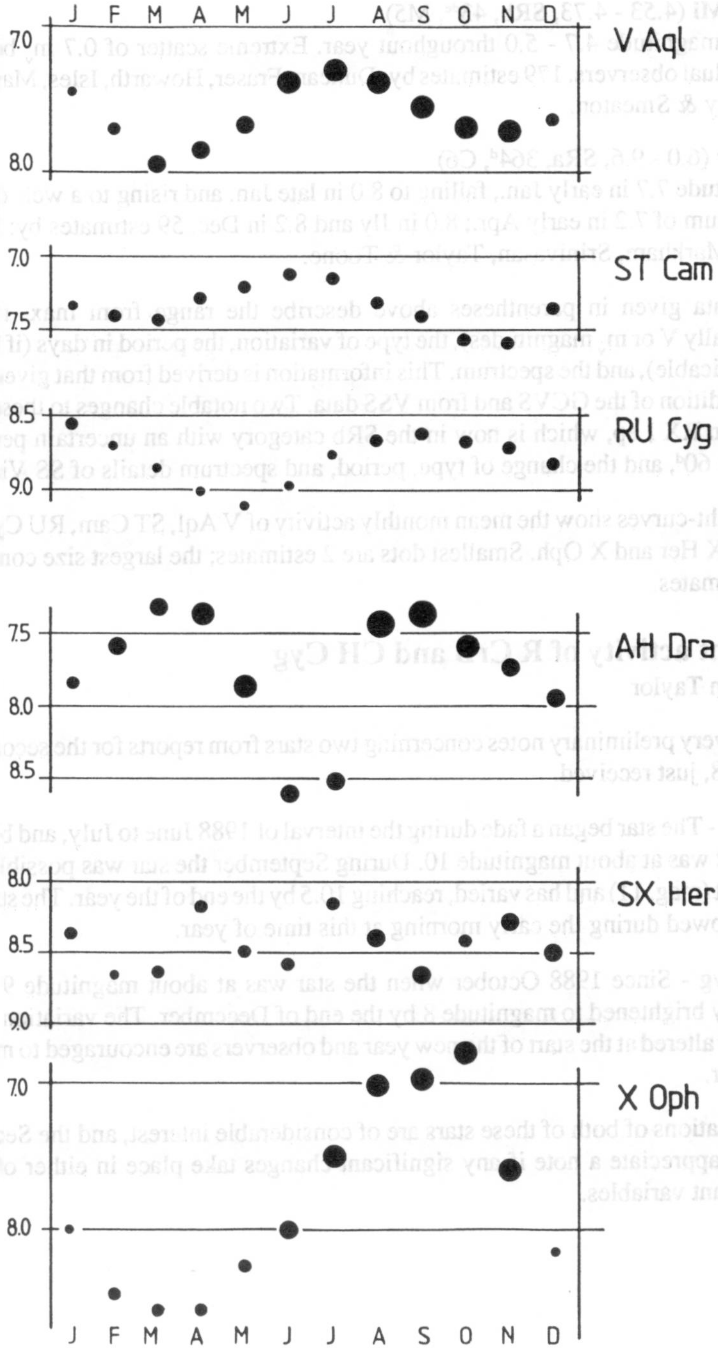
CE Tau (4.5 - 4.9, SRc, 165^d, M2)
Mean magnitude Jan. to Apr., and Aug. to Dec., 4.7/4.8. 70 estimates by: Fraser, Isles, Kendall, Markham, Middlemist & Ramsay.

W Tri (7.5 - 8.8, SRc, 108^d, M5)
Magnitude 8.0 to 8.2, Jan. to Mar. Jun. and Jly 8.0, falling to 8.8 in Oct./Nov., rising to 8.4 in Dec. 82 estimates by: Isles, Markham, Ramsay & Toone

VY UMa (5.9 - 6.5, Lb, C6)
Slow variations, 7.2 in Jan., rising to 6.9 in Aug. Oct. to Dec. 6.9 to 7.2. 205 estimates by: Bone, Fraser, Hutchings, Isles, Kendall, Markham, Taylor & Toone.

VW UMa (6.9 - 7.7, SR, M2)
Generally 7.2 to 7.5 throughout the year. 206 estimates by: Bone, Fraser, Geddes, Hutchings, Isles, Kendall, Markham, Middlemist, Price, Ramsay, Swain & Taylor.

V UMi (7.2 - 9.1, SRb, 72^d, M5)
Magnitude 8.3 in Jan.; 8.0 Feb./Mar.; 8.3 Mar./Apr.; 8.1 May then 8.1/7.9 to year end. 134 estimates by: Fraser, Isles, Ramsay, Smeaton, Swain, Taylor & Toone.


J F M A M J J A S O N D
V Aql
7.0
8.0
ST Cam
7.0
7.5
RU Cyg
8.5
9.0
AH Dra
7.5
8.0
8.5
SX Her
8.0
8.5
9.0
X Oph
7.0
8.0
J F M A M J J A S O N D

RR UMi (4.53 - 4.73, SRb, 43^{de}, M5)
Mean magnitude 4.7 - 5.0 throughout year. Extreme scatter of 0.7 m_v between individual observers. 179 estimates by: Duncan, Fraser, Howarth, Isles, Markham, Ramsay & Smeaton.

SS Vir (6.0 - 9.6, SRa, 364^d, C6)
Magnitude 7.7 in early Jan., falling to 8.0 in late Jan. and rising to a well-defined maximum of 7.2 in early Apr.; 8.0 in Jly and 8.2 in Dec. 59 estimates by: Fraser, Isles, Markham, Srinivasan, Taylor & Toone.

The data given in parentheses above describe the range from max. to min. (generally V or m_v magnitudes), the type of variation, the period in days (if known or applicable), and the spectrum. This information is derived from that given in the 1986 edition of the GCVS and from VSS data. Two notable changes to these notes concern RX Lep, which is now in the SRb category with an uncertain period of around 60^d, and the change of type, period, and spectrum details of SS Virginis.

The light-curves show the mean monthly activity of V Aql, ST Cam, RU Cyg, AH Dra, SX Her and X Oph. Smallest dots are 2 estimates; the largest size comprises 18 estimates.

Recent activity of R CrB and CH Cyg

Melvyn Taylor

Some very preliminary notes concerning two stars from reports for the second half of 1988, just received.

R CrB - The star began a fade during the interval of 1988 June to July, and by early August was at about magnitude 10. During September the star was possibly at its faintest (mag. 11) and has varied, reaching 10.5 by the end of the year. The star may be followed during the early morning at this time of year.

CH Cyg - Since 1988 October when the star was at about magnitude 9 is has steadily brightened to magnitude 8 by the end of December. The variation seems to have altered at the start of the new year and observers are encouraged to monitor this star.

Observations of both of these stars are of considerable interest, and the Secretary would appreciate a note if any significant changes take place in either of these important variables.

NEW MEMBERS

J. Fraser	23a Averon Road, Alness, Rossshire IV17 0SJ
Dr C. Gilbert	5 The Grove, Forest Hall, Newcastle-upon-Tyne NE12 9PE
C. Jones	92 Long Riding, Basildon, Essex SS14 1QZ
K. Marshall	33 Eastern Avenue, Haverhill, Suffolk CB9 9JD

CIRCULARS

Charges: U.K. & Eire - £4 for Circulars and light-curves (4 issues)
Other countries - £5

Payments (made out to the BAA) and material for inclusion should be sent to Storm Dunlop.

CHARTS: Eclipsing - Order from Mrs E. Isles
All others - John Toone

Charges: Telescopic - SAE plus 30p per star
Eclipsing - SAE plus 6p per star (1 sheet)
Binocular - SAE plus 8p per star (1 sheet)

NB: SAEs should preferably be A4 size

BOOKLETS

Direct sale prices apply to material collected from the Office at Burlington House or purchases at BAA Meetings.

Binocular Variable Star Charts: Vol.1

£1.25 (U.K) or £1.50 (Overseas) each, including postage (Direct sale price £1.00)

Eclipsing Binary Programme Handbook: 1988

£1.25 (U.K.) or £1.50 (Overseas) each, including postage (Direct sale price £1.00)

Available from Storm Dunlop or BAA Office at Burlington House

VARIABLE STAR SECTION
CIRCULAR 68

CONTENTS

Castle Printers of Wittering