British Astronomical Association

VARIABLE STAR SECTION CIRCULAR

No 110, December 2001

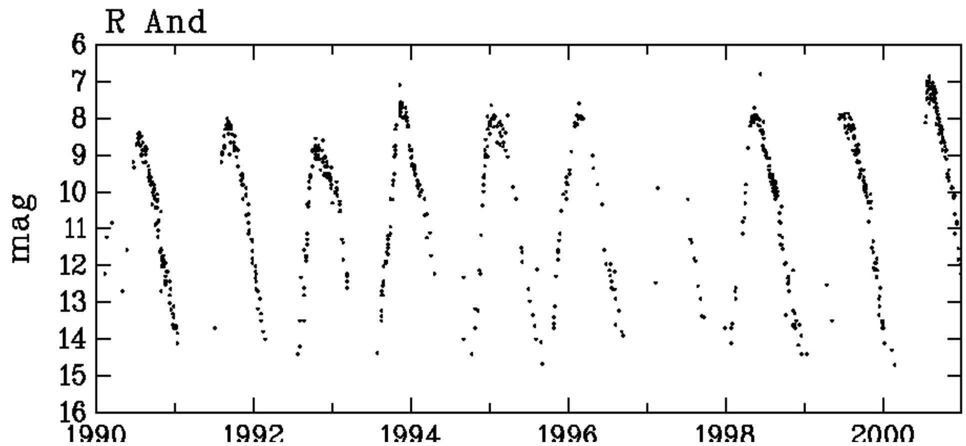
Contents

ISSN 0267-9272

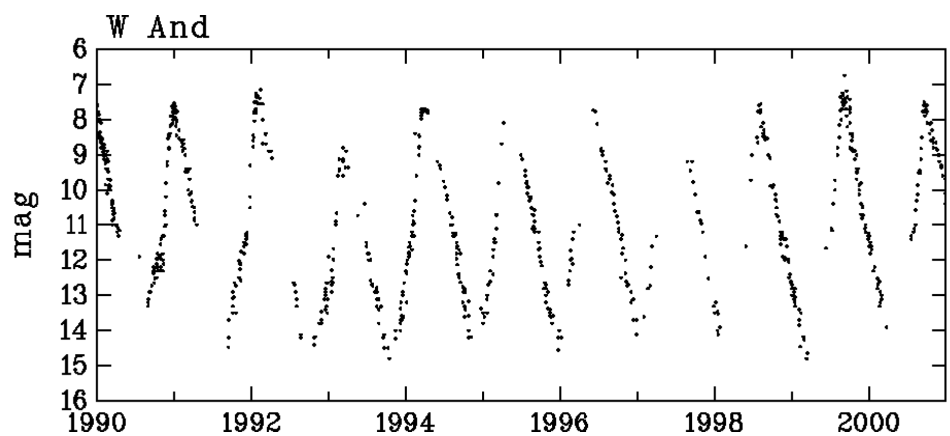
Office: Burlington House, Piccadilly, London, W1V 9AG

LIGHT CURVES

JOHN SAXTON



Observers were: G Stephanopoulos, S W Albrighton, A J Johnston, A R Baransky, B H Granslo, R C Dryden, G A V Coady, M J Gainsford, G S Hawkins, M A Adamson, M Gill, I A Middlemist, E Metson, M J Nicholls, J J Howarth, R D Pickard, R A H Paterson, T Markham, R E Kelly, R J Bouma, R Billington, J D Shanklin, J Toone, M D Taylor, E J W West.



Observers were: A D Godden, S W Albrighton, B H Granslo, C P Jones, R C Dryden, D Stott, G A V Coady, M J Gainsford, M A Adamson, I A Middlemist, M J Nicholls, J J Howarth, R D Pickard, R A H Paterson, T Markham, R J Bouma, J Toone, G Poyner.

The deadline for contributions to the 111th issue of VSSC will be Feb 7, 2002. All articles should be sent to the editor (details are given on the back of this issue).

Printed by RAMPrint 01604 233677

FROM THE DIRECTOR

ROGER PICKARD

Danie Overbeek

Firstly, it is with sadness, that I report that the great South African observer Danie Overbeek passed away on July 19th, 2001 at the age of 81. A full obituary, written by Brian Fraser, can be found in the December Journal. As a southern hemisphere observer, only those observations of Danie's that were jointly on the RASNZ and the VSS programmes came our way, most of them being reported to the AAVSO. However, I felt that his observational work was put into true perspective following the AAVSO Meeting in Sion, Switzerland in 1997 (*see VSSC 94*). Upon his return from this meeting, Dick Chambers told me, that he was sitting next to Albert Jones when Danie was being presented with an award from the AAVSO, and Albert told him that he thought that Danie was the greatest observer ever! What greater accolade could you wish for?

VSS Meeting in Preston

My thanks to all the lecturers, and those leading the workshop sessions, for making this meeting so memorable, and particularly to Denis Buczynski for organising it. The venue of Alston Hall was also superb, and if you get the chance to go there, I can heartily recommend it. From the comments and feedback that I've received, it seems to have met, not just with general approval, but with some acclaim! The format of a weekend meeting was excellent, and so we will be repeating it in the future. However, before then we will probably have a one-day meeting, sometime next year. Watch this space.

For those unable to attend, I'm pleased to advise that the whole of the meeting was recorded on video and if any member wishes to borrow the videos (6 in all!) please contact the Director (they are available for the cost of the return postage only).

The first report of the Preston meeting, compiled by Karen Holland, can be found on page 12 of this Circular.

WZ Sagittae

Many members will be aware that this cataclysmic variable went into outburst, reaching magnitude 7 - 8, only 23 years after the preceding outburst (the previous known outbursts had been at 33 year intervals).

The Director received an email from Dr Danny Steeghs, of the University of Southampton who requested observations to complement the professional ones he was instigating, and we were able to supply a number of both visual and CCD (B, V and R) observations. A more detailed report can be found in the December Journal.

More recently, Dr Taichi Kato of Kyoto University and VSNET fame, requested ALL VSS data of this star due to its renewed historical interest. They are hoping to prepare a paper analysing the full light curve, not just of the current outburst for comparison between earlier ones, but also during quiescence; this data has now been supplied.

RAS/BAA PRO-AM Meeting on Variable Stars, at the Institute of Astronomy, Cambridge 26th January 2002.

Following the successful RAS Pro-Am Meeting at UCL in September 2000, there will be a follow-up meeting at Cambridge but specifically devoted to variable stars.

The meeting will represent an opportunity for professionals and amateurs to get together to discuss the main areas of interest to professional astronomers, and the ways in which amateur astronomers can most profitably assist them.

Unlike the previous meeting, which was by invitation only, due to space limitations, there will be no such limitations this time, and the meeting is open to all. There will be a nominal charge for admission of a few pounds.

The programme has yet to be finalised but will be along the following lines:-

10.30-11.00	Start
11.00	Three 20-30 minute talks
12.30	Lunch including tour of the facilities
14.30	Discussion session on charts and sequences
15.30	Tea break
16.00	Three more 20-30 minute talks
5.30-6.00	Finish

Organisers:
Margaret Penston: mjp@ast.cam.ac.uk
Nial Tanvir: nrt@ast.cam.ac.uk
Roger Pickard: rdp@star.ukc.ac.uk

Please advise either Margaret Penston or Roger Pickard if you intend to come, so that we can make the necessary catering arrangements.

Binocular Secretary E-mail Details
Please note that Melvyn Taylor, the binocular secretary, can now be contacted by e-mail. His e-mail address is on the back of this issue.

New Webmaster
Please note that Peter Moreton is now the Variable Star Section Webmaster (see back cover for contact details).

New Web page address
Please note the new web page address on the back of this circular

Erratum
Please note that the caption accompanying the spectrum on page 9 of VSSC 109 is incorrect. It should read 'The H-alpha emission line is easily recorded in 5 seconds exposure, and is elongated from mutual red and blue Doppler shifts through the nova's explosive expansion, and confirms a nova's identity.' The editor apologises for this mistake.

ECLIPSING DWARF NOVAE PROGRAMME: 2001 NOVEMBER UPDATE

BILL WORRAKER

Progress Since 2000 September

Progress in the last 14 months has been limited, not least because of attention being diverted to other projects, namely time-series photometry of **U Gem** during the winter (2001 January to April) when it was in the later stages of a long period of quiescence, and of **WZ Sge**, which in 2001 July underwent an impressive outburst lasting several weeks. Another high-priority target for time-series photometry, **IP Peg**, underwent prime-time outbursts in 2000 October and in 2001 October.

The only photometry undertaken and submitted for the EDNe project during this period has been on **CY Lyr** (2.5 hours by Graham Salmon, 2000 October and 1.5 hours by Roger Pickard, 2001 July); on **AR And** (4 hours by David Boyd, 2000 November); and on **V516 Cyg** (4.1 hours by Nick James, 2001 October). Although there is no sign of eclipses in any of these stars, further time-series photometry will be needed before we can be certain that these stars are not eclipsing systems.

However, sufficient time-series photometric data from previous years has been submitted by Tonny Vanmunster (CBA Belgium) to cover at least three orbits of the following systems, all of which have turned out to be non-eclipsers: **V1504 Cyg**, **V844 Her**, **QY Per** (from the ROP, or Recurrent Objects Programme), **RZ Sge**, **SW UMa** (formerly ROP) and **BC UMa** (ROP). These have all, therefore, been dropped from the programme.

No new stars are being added to the programme at this point, but suggestions for new additions will be welcome. They must be stars which have not previously been covered in the programme; they must not be on the Recurrent Objects Programme (since dwarf novae on the ROP are automatically regarded as targets for this programme); they should be relatively poorly observed to date; and should be expected to reach magnitude 15 visual when in outburst.

The information given in this article will appear in due course on the BAAVSS web pages **http://www.britastro.org/vss**, which will also carry updates on the project from time to time.

How You Can Participate in the Programme even without a Telescope!

When this programme was set up two years ago, an initial target list of dwarf novae was published, the idea being to alert interested observers when stars on the list were detected in outburst, thus giving them the opportunity of doing time-series photometry in order to check for the occurrence of eclipses (*see Variable Star Circular 102, December 1999, pp.11-14*). In most cases the stars on the target list were selected as not being the brightest, most familiar dwarf novae, and not already being known to exhibit eclipses, yet expected to reach visual magnitude 15 or brighter during outbursts. The thinking behind this choice was that, in the case of the better-known systems, published photometry probably already existed which was sufficient to show whether or not they underwent eclipses.

Since the long-term aim of this project is to check every possible dwarf nova down to the magnitude 15 limit, it is important to be able to give a defensible answer as to whether or not eclipses occur, even for the better-known systems. Instead of adding these systems to the list of observing targets, I propose to make use of published photometry as follows:

- If you are interested in contributing to the programme through literature searching, contact me to register your interest.
- I will suggest a particular dwarf nova in the 'brighter, better-known' category, e.g. **SS Cyg, Z Cam, RU Peg, VW Hyi.**
- You should then search for a suitable paper or papers of professional standard, which contain sufficient information to decide whether the star of interest undergoes eclipses. I envisage two ways whereby this question will normally be settled, viz (i) a clear statement by the author or authors to the effect that, from the data presented, there is either no sign of eclipses in the orbital light curve, or that there is a clear eclipse signature; (ii) a light curve or curves from which it is evident (just by looking) whether eclipses are occurring or not. If you are relying on light curves it is important to allow for the occurrence of superhumps, which are frequently seen in SU UMa stars in outburst, and which are distinct in origin from eclipses. Please also remember that the policy in this programme is to require three orbits' worth of photometric data on a star before deciding finally whether it exhibits eclipses.
- Once an appropriate paper has been found, send me details of the reference and of the text and/or figures relevant to the eclipsing/non-eclipsing question. It is also worth noting whether the star was in outburst or in quiescence at the time of the reported observations. I can then add your dwarf nova to the list of objects assessed for the occurrence of eclipses. If you are interested in looking up further objects, I can then assign you another, and so on. Everyone participating in this way can expect to be recognised in resulting publications in the same way as observers who submit photometric data.

The obvious next question is how to go about searching the literature. If you have no relevant books or papers to hand, a good way to start is to log into the Harvard astrophysics database at **http://adswww.harvard.edu.** Abstracts of papers in most recognised astronomical and astrophysical publications are listed here, and searches can be made using either keywords or an object name. Users should beware, however, that searches often produce misleadingly generous results, i.e. many of the abstracts listed only have a tenuous link to the subject of interest.

Having selected an abstract of real interest, the problem is then to extract the information required, viz. photometric light curves or statements about the eclipsing or non-eclipsing status of the star under investigation. Normally such information is not found in abstracts, and the full paper has to be consulted. Recent papers (up to about 5 years old) published in the major journals (e.g. Monthly Notices of the Royal Astronomical Society, Astronomy and Astrophysics etc) are not generally available online, so if you do not have access to a suitable university library it may be necessary to request an offprint from the main author (a technique I have not found very useful in practice). A possible alternative is to download preprints from a site such as http://xxx.soton.ac.uk/archive/astro-ph, which I understand carries preprints of about 50% of the papers appearing in the refereed literature. Older papers are generally easier to obtain - either from one of the authors, through a local university library or astrophysics group, or even through a public library.

I am confident that if only a small number of people are willing to participate in this way, we can soon establish the eclipsing/non-eclipsing status of many dwarf novae without telescopes or clear skies. This will neatly complement the efforts of observers doing time-series photometry of more obscure stars, and move the programme rapidly forward.

Please get in touch!

My contact details are:
Bill Worraker
65 Wantage Road
Didcot
Oxon.
OX11 0AE
UK
Tel. 01235 211315 (up to 10:30 pm daily)
e-mail: bill.worraker@hyprotech.com, or w.worraker@ntlworld.com

SUMMARY OF PHOTOMETRIC OBSERVATIONS RECEIVED TO DATE

Notes: (1) All observations are unfiltered CCD.
(2) Observations by LT Jensen are supplied courtesy of CBA, Denmark.
(3) Observations by T Vanmunster are supplied courtesy of CBA, Belgium

Star	**Observer(s)**	**Date, Time(hours)**	**Conclusions/Comments**
AR And	D R Boyd	2000 Oct, 4.0	Practically flat light curve
TT Boo	D R Boyd	2000 Jly, 2.0	Small variation, pattern not clear.
GX Cas	L T Jensen	1996 Oct, 1.9	Incomplete orbital cycle, no eclipses
	N D James	2000 Aug, 5.5	Clear superhumps, no eclipses
V516 Cyg	N D James	2001 Oct, 4.1	Flat light curve
V1504 Cyg	T Vanmunster	1998 Aug, 5.6+5.1+5.9	Superhumps, dip on 3rd night, no eclipses
V844 Her	L T Jensen	1997 Jun, 2.3+1.3	Noisy data, superhumps visible, no eclipses
	G Salmon	2000 Jly, 2.2+1.5+0.9	No eclipses; hump on 3rd night
	G Salmon	2000 Jly, 1.8+1.9	Superhumps visible (both nights), no eclipses
	D R Boyd	2000 Jly, 1.8	Superhumps visible, no eclipses
	R D Pickard	2000 Jly, 0.6	Possible superhump and noise
	T Vanmunster	1997 May, 4.1+4.9 +4.6+3.2	Superhumps visible, no eclipses
	T Vanmunster	1997 Jun, 4.4	Linear fade, no eclipses
T Leo	L T Jensen	1997 Feb, 1.4+3.6	Superhumps visible, no eclipses
	L T Jensen	1997 Mar, 2.6	Superhumps visible, no eclipses
RZ LMi	L T Jensen	1996 Dec, 2.8	Possible(??) eclipses ~0.15mag deep
	L T Jensen	1997 Jan, 5.2	Possible(??) eclipses ~0.15mag deep
	T Vanmunster	1998 Feb, 7.6	5 clear superhump cycles, no eclipses
	L T Jensen	1998 Feb, 3.1	Possible(??) eclipses ~0.1mag deep

	LT Jensen	1998 Feb, 4.7	High data scatter
	LT Jensen	1998 Mar, 4.6	High data scatter
	LT Jensen	1998 Mar, 6.2	High data scatter, eclipses just(??) possible
SX LMi	LT Jensen	1997 Apr, 4.5+1.1	No evidence of eclipses
AY Lyr	LT Jensen	1996 Apr, 0.8+2.7	Superhumps visible, no eclipses
	LT Jensen	1997 Sep, 4.2	Superhumps visible, no eclipses
CY Lyr	G Salmon	2000 Oct, 2.6hrs	Scatter <0.05mag RMS, getting worse. No eclipses
	RD Pickard	2001 Jly, 1.5	A lot of scatter. No eclipses
V426 Oph	G Salmon	2000 Aug, 1.3	Some variation, pattern not clear.
TZ Per	ND James	1999 Nov, 5.8	No eclipses, some variation seen
	ND James	2000 Jan, 5.0	No eclipses
QY Per	ND James	2000 Jan, 4.3	Superhumps visible, no eclipses
	T Vanmunster	2000 Jan, 9.1	4 superhump cycles, no eclipses
RZ Sge	T Vanmunster	1996 Aug, 5.5+1	Superhumps visible, no eclipses
SW UMa	T Vanmunster	2000 Feb+Mar, Total 24.1	Superhumps visible, no eclipses Irregular light curves near end of outburst
BC UMa	ND James	2000 Apr, Total 6.0	Superhumps visible, no eclipses
	T Vanmunster	2000 Apr, Total 17.7	Superhumps visible, no eclipses

Stars Now Removed From the Programme (including ROP and former ROP objects)

Star	Conclusion	Basis
V503 Cyg	Non-eclipsing	Advice from F Ringwald
AQ Eri	Non-eclipsing	Advice from J Thorstensen
T Leo	Non-eclipsing	Observations by LT Jensen, CBA Denmark
RZ LMi	Non-eclipsing	Observations/advice from T Vanmunster, CBA Belgium
AY Lyr	Non-eclipsing	Observations by LT Jensen, CBA Denmark/IBVS
FY Per	Non-eclipsing	Advice from J Thorstensen
KT Per	Non-eclipsing	Advice from J Thorstensen
TY Psc	Non-eclipsing	Advice from J Thorstensen
CY UMa	Non-eclipsing	Advice from J Thorstensen

Removed since 2000 September

Star	Conclusion	Basis
V1504 Cyg	Non-eclipsing	Observations by T Vanmunster, CBA Belgium
V844 Her	Non-eclipsing	Observations by DR Boyd, G Salmon, LT Jensen, CBA Denmark and T Vanmunster, CBA Belgium
QY Per	Non-eclipsing	Observations by ND James and T Vanmunster, CBA Belgium
RZ Sge	Non-eclipsing	Observations by T Vanmunster, CBA Belgium
SW UMa	Non-eclipsing	Observations by T Vanmunster, CBA Belgium
BC UMa	Non-eclipsing	Observations by ND James and T Vanmunster, CBA Belgium

Eclipsing Dwarf Novae Programme

Object Name Altern.Name	Coordinates (J2000)	Type	Min	Max	T1 T2	P_orb(h) P_shu(h).
AR And (DS2)	01 45 03.27 +37 56 33.3	UG?	16.9	11.0	25	3.91
FO And	01 15 32.1 +37 37 36	SU	17.5	13.5	15-23	1.7186 1.779
KV And	02 17 13.8 +40 41 31	SU	22.5:	14.6 14.1	18-55 270:	1.733* 1.783
TT Boo	14 57 44.7 +40 43 41	SU	19.2	12.7	45	1.85: 1.875
AT Cnc Ton 323	08 28 37.0 +25 20 02	ZC	15.0B 16.2B	12.7B	14	5.72858
CC Cnc	08 36 19.1 +21 21 06	SU	17.4 18.8	13.1B	??	1.764 1.826
GX Cas	00 49 01.5 +56 52 44	SU	18.5	13.3	??	2.14* 2.23
KU Cas (DS)	01 31 02.6 +57 54 12.3	UG	18p	13.3p	??	??
SV CMi	07 31 08.5 +05 58 47	ZC	16.3	13.0	16	3.74
V516 Cyg (DS)	20 47 09.9 +41 55 26.0	UG	16.8p	13.8p	??	??
V1060 Cyg (DS)	21 07 42.3 +37 14 08.3	UG	18p	13.5p	??	??
ES Dra (DS2) PG 1524+622	15 25 31.8 +62 01 0.1	DN?	16.3p	13.9p	??	4.238
AW Gem	07 22 40.6 +28 30 16 1	SU	18.8 19.4	13.8 13.1	98 410	1.84416?* 1.9063?
SX LMi CBS 31	10 54 30.5 +30 06 09	NL?	16.B			1.50:
CY Lyr (DS2)	18 52 41.41 +26 45 29.9	UG?	17.0	13.2	??	3.82

LL Lyr (DS2)	18 35 12.91 +38 20 4.3	UG?	17.1	12.8	??	??
V344 Lyr	18 44 39.0 +43 22 27	SU	>20	14.5 13.8	13-19 240:	2.10* 2.1948
V426 Oph	18 07 51.8 +05 51 48	ZC	13.4	11.5	17-55	6.847
HX Peg PG 2337+123	23 40 23.8 +12 37 41	ZC	16.6	12.9		4.819
TZ Per	02 13 50.8 +58 22 53	ZC	14.7 15.6	12.3 13.3	10-20	6.252
PY Per	02 50 00.2 +37 39 22	ZC	19.8	13.8		3.715
CI UMa	10 18 13.0 +71 55 44	SU	18.8	13.8	34 140	1.44 1.500
HS Vir PG 1341-079	13 43 38.5 -08 14 04	ER	16.6	14.6	8	1.85: 1.9385
VW Vul	20 57 45.0 +25 30 27	UG	15.6	13.6	14-23	4.05
FY Vul (DS)	19 41 40.0 +21 45 59.0	ZC	15.3B	13.4B	??	??

Explanation of Symbols

DS Data taken from Downes and Shara, PASP 105, 127 (1993)
DS2 Data taken from Downes, Webbink and Shara, PASP 109, 345 (1997)
W Data (not position data) taken from Warner, ‘Cataclysmic Variable Stars’, CUP (1995)
B Johnson B-band magnitude
p photographic magnitude
T1 Normal outburst interval (days)
T2 Superoutburst interval (days)
DN Dwarf Nova
UG Dwarf Nova, U Gem type
ZC Dwarf Nova, Z Cam type
SU Dwarf Nova, SU UMa type
ER Dwarf Nova, ER UMa type
NL Novalike variable
* Asterisks after the orbital period indicate that this figure has been estimated from a measured superhump period.

A CCD-CONTROLLED DRIVE FOR A NORMAN WALKER FILTER BOX

Graham Salmon

Introduction

Last winter I joined Bill Worraker's project, which was set up to plot the light curves of around 400 dwarf novae, for the purpose of determining which are eclipsing systems (*see VSSC 102 p11, and this VSSC p3*). The orbital periods of these systems are typically between 1.5 and 6 hours, and images are required every minute, for a time rather longer than this. This can be done by setting the CCD running in continuous mode. The images must be taken using filters. I have one of Norman Walker's filter boxes in which the filters are mounted on a wheel with six positions: there is one position for each of B, V, R, I, an unfiltered position, and a diagonal for visual work. The wheel is rotated manually by a knob.

It occurred to me that the results might be made more useful, if more than one filter was used. This could be done by cooperation with another observer (difficult to arrange) or piggy-backing another telescope on my LX200 (expensive). Alternatively, I could turn the filter after each exposure, but the difficulty of doing so without missing once, over the course of several hours, was considerable. If the filter-change mechanism could be brought under the control of the CCD it might work reliably. Richard White of Sussex University had designed a means of remotely controlling the filter wheel from the computer, using a Basic program, logic chips and a stepper motor.

I considered the possibility of writing a program to control it from the computer, but I decided that the difficulties of linking up with the CCD software were too risky. Instead, I checked the waveforms on the pins of the 25 way plug connecting the CCD to the parallel port of the computer, and found one whose voltage went up to +5V during the exposure, and returned to 0V at the end as the readout began. This negative edge was all that was required to start the filter change while the CCD readout was proceeding. The selection of which filter positions it should stop at, could then be determined by toggle switches. The electronics would then have to deliver an appropriate number of pulses to the driver board for the stepper motor to enable it to rotate the filter wheel to the next required position.

The System

The electronics are based around a ring of six flip-flops, one of which is set at a time to keep pace with the rotation of the filter wheel, once the initial positions have been synchronised. Refering to Fig 1:

Switches D, I, R, V, B, and U select the filter positions required
Lights D, I, R, V, B, and U indicate which flip-flop is set
Switch 1, (push switch) delivers a manual pulse
Switch 2 selects between a manual pulse and a CCD pulse
Switch 3 sets D flip-flop
Switch 4 de-energises the stepper motor so that it can be turned manually

In operation, after switching on, Switches 3 and 4 are pressed, the D light comes on and the filter is turned manually to the Diagonal position. When the exposure run is to begin, and the required DIRBVU switches have been set, Switch 2 is set to Manual, and Switch 1 is pushed so that the filter advances to the start position. The exposure run can than be started. At the end of each exposure, a pulse from the CCD triggers the clock in the filter drive to deliver 200 pulses to the stepper motor to rotate the filter wheel to the next position, and one pulse to the flip-flop chain to advance it one position, and this is repeated until the next selected stopping position is reached.

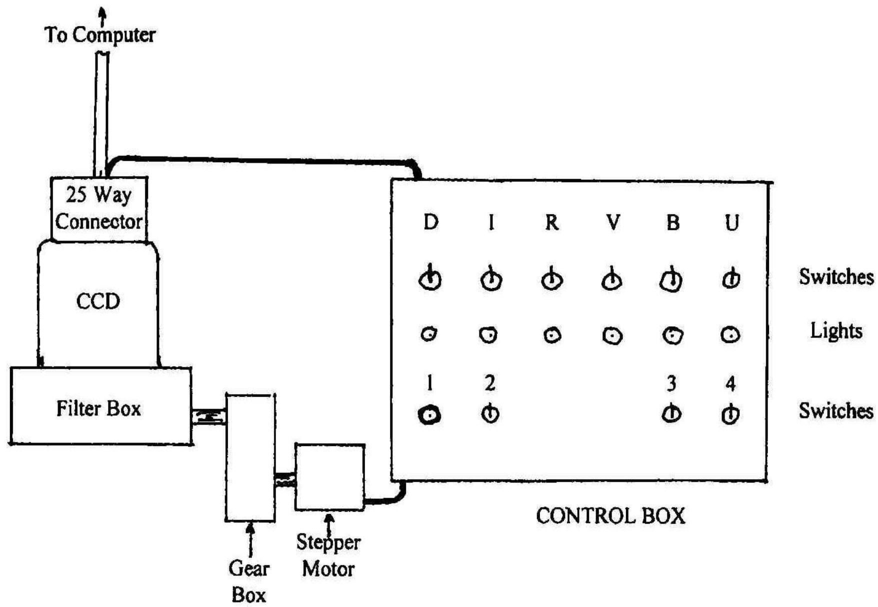


Figure 1

A few design points

The stepper motor (from RS) has enough power to rotate the filter wheel in the available time, but is short on torque. It is therefore geared down 1:6, but this enables it to position the wheel to 0.3°. (The motor has 200 steps per revolution, ie. 1.8° per step). The motor rotates the filter wheel in the opposite direction to the normal sequence, as the design of the detent in the box makes the torque required slightly less in this direction. The accurate positioning of the filter wheel is critical to ensure that the process of flat-fielding eliminates all variations in the transparency of the filter. A test run demonstrated that it maintained perfect alignment for 3½ hours. At the moment it only rotates in one direction, and takes about 1 second per position, ie a maximum of 5 secs for 5 positions. This is less than most available CCD readout times but can be reduced by increasing the clock frequency if required.

Although the D and U positions would not be used normally with the B, V, R and I filters, the

D position could be used to obtain dark frames during the course of the exposure run.

Conclusions

I have used it while following the current outburst of WZ Sge and one of the light curves is shown in Fig 2. My SXL8 CCD is not sensitive enough and my readout time of 40 secs is not

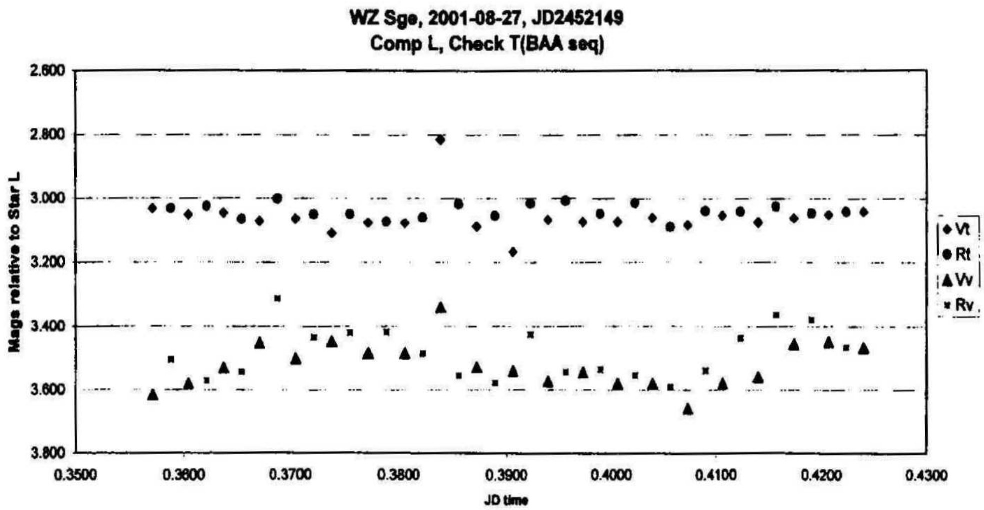


Figure 2

fast enough to achieve the data rate that is required at the desired accuracy for one filter, let alone two. That means upgrading the CCD and probably the computer - it is 7 years old!

When I have gained more experience with it I am hoping to make various improvements, particularly to remove the power from the stepper motor each time it stops so that the detent can do the final positioning of the filter wheel, and enable the system to reverse when going backwards and forwards between two filters which would reduce wear. I hope that this design will be suitable for use with any CCD so I would be glad to hear from anyone interested in building their own. The eight integrated circuit chips and sundry other components are mounted on strip board, and the soldering of these and drilling of the box is not too difficult. I made my own simple gear box, but Norman may well consider producing one to go with the filter box.

Acknowledgements.

To Norman Walker for discussions about the mechanical aspects of the design, to Richard White, Sussex University, for the information about his remote control of the filter box and for help with the logic circuits and to my neighbour Bob Barrett, ex-BBC engineer, for assistance with the electronic problems and the loan of his oscilloscope.

REPORT ON THE VARIABLE STAR SECTION MEETING AT ALSTON HALL, PRESTON

Karen Holland

The follows a summary of the above meeting. It is stressed that this summary is extremely condensed, and **a full version of this report**, together with figures,appears on the VSS web pages at **http://www.britastro.org/vss.** The whole meeting was recorded on video; the six videos are available for loan, for the price of the return postage - please contact the Variable Star Section director for further information.

This year BAA members were given a real treat, in the form of a weekend meeting of the Variable Star Section, held at Alston Hall in Preston. This was ably organised by Denis Buczynski and Roger Pickard, and got off to a lively start on the Friday evening, with **Dr Allan Chapman's talk on 'A History of Variable Star Astronomy.**

Dr Chapman took us on a whistlestop tour of the eminent figures in astronomy, describing Halley's discovery of the first Aurora in 1716; Goodricke's careful measurement of the orbital cycle of Algol in 1782 (that was to within a minute or two of current day measurements) and Herschel's publication of the first list of double stars in 1782 - at this time 'variable' meant something that changed, and so included binaries. By 1840, numerous astronomers were measuring variable stars. This took a long time for many stars, and could only be done by professionals with big telescopes, or rich amateurs. In the1830s, Bessel suggested that those stars with the greatest proper motions might be the nearest to Earth. So if you could find a binary pair that had a big proper motion, then you might be able to measure them more easily; this provided a selelction criterion. With this increasing amount of data, Bessel noticed the wobble of Sirius, and in 1844, he suggested that Sirius might have a dark companion. This was discovered by Alvin Clark in Boston in 1861, by using an obscuring bar, in conjunction with a large refractor.

By 1840 lots of variable stars were known, and it was John Herschel, who first devised a way of shutting down the moon's light, until it was exactly the same brightness as a first magnitude star. He then calculated that a first magnitude star was the same brightness as a certain fraction of the moon's diameter; it gave him a standard to measure the brightness of stars by. He went on to develop this technique further.

Once glass making techniques improved, Pritchard invented the graduated wedge. This comprised a wedge of glass, which was dyed uniformly throughout. The wedge was then used to see where along the glass, the star's light first disapppears.

By the 1900s, the concept of photographic magnitude was begining to be developed, after Pickering started to develop the first nomenclature for stellar brightness.

Dr Chapman described how, in 1865 ,the first spectral classification was published by Secchi, and by 1880 it was thought that all stars might be variable given enough time. He discussed Henrietta Leavitt's discovery of the period-luminosity relationship for Cepheid stars, and the impact that this had on astronomy of the time.

He finished by concluding that variable stars had been at the heart of our attempts to discover what the universe is like.

The first session on the Saturday morning was a **presentation of Poster papers**, in which those members who had brought poster papers for display, were given a brief opportunity to discuss their work.

Melvyn Taylor began the session by discussing his attempts to follow **WZ Sge** in outburst, visually; **Graham Salmon** discussed the clear sky detector that Richard Miles had presented at a meeting some time ago, and described how he was inspired to make one; **Tom Lloyd Evans** discussed his idea that there might be the possibility of sending out experienced observers to the South African Observatory to extend sequences, using surplus time; **Denis Buczynsk**i mentioned his poster, which described his work to develop equipment that will produce measurements, that will be useful to other people, and **Roger Pickard** mentioned the Jack Ells automatic photoelectric telescope, which was built around 1988.

Roger Pickard also mentioned that Dave McAdam, had had to step down as computer secretary, but that John Saxton had now taken over, and Peter Moreton was the new Variable Star Section webmaster. The BAA had decided to move to a new web provider (their new web page address was **http://www.britastro.org**), and so the Variable Star section had also moved their web page; the new address was **http://www.britastro.org/vss.**

The first main talk of the Saturday was titled **Inconstant Mira Variables, by Dr Albert Zijlstra.** Albert began by describing the properties of miras: they generally had periods of 200-600 days; visual amplitudes of >2.5 magnitudes; the periods were stable, but the amplitude could vary, and they had strong stellar winds. Semi-regular variables, on the other hand, were very much like miras, but had short periods of 50-100 days; amplitudes of <2.5 magnitudes (SRas had regular light curves, SRbs had irregular light curves) and they all had weaker winds. Albert was particularly interested in how miras changed with time. He showed a Hubble image of **NGC7027**, and showed that you could just about pick out rings around the planetary nebula. These rings showed that the wind of the mira, which formed the planetary nebula, must have changed with time.

In reality, Albert said, the part of the Mira definition that stated that miras had stable periods was wrong. Some miras showed small variations of about 1-2%, but some changed by much larger amounts. **R Aql** was discovered in 1850, and by 1900, it was noticed that its period was slowly decreasing. If all the exisiting data was used, the period appeared to have changed from 360 days to around 275 days. The period was due to a sound wave that travelled through a star; if the sound wave took less time to get out (i.e. the period decreased), then it must be because the radius was decreasing.

R Hya was the third brightest mira at 5th magnitude, and had a period of around 400 days. Its period evolution, discovered in the 19th century, was described in 1981 by Wood and Zarro. There appeared to have been a continuous decline in the period since at least 1850. Since 1950, the period had been constant at 385 days. To detect the start of the decline required historical data, and Albert had found records of all the observations of maxima since 1850, and records of older observations dating back to 1662. It looked like the period was constant many years ago, and that the period started declining around 1770 (to around 400 now, from 500 in the 1700s). He also had IRAS data which showed the dust shell around the star. It seemed to have had episodes of wind and no wind, and it also looked like when R Hya's period started to drop, its wind ceased at the same time. We know that the wind must have varied with the period changes, and if the behaviour of R Hya was periodic then perhaps the star could blow multiple rings. The rings that were seen around planetary nebulae suggested that changes in behaviour might take place every 200-400 years. Albert had tried to model this behaviour.

In summary, perhaps 10% of bright miras had period variations larger than 5%. They had fluctuating periods; sudden, rapid changes over decades, and slow, continuous changes over hundreds of years. Miras were obviously not quite as stable as previously assumed, so it was important to keep on observing them for a few more centuries! So what caused these changes? There seemed to be two possibilities. The first was that the helium 'ash' which formed in these stars (due to the burning of hydrogen) might ignite. This could cause rapid changes in the star. The second was that miras might resemble so-called 'non-linear' pulsators, where the pulsation itself caused a change in the star.

The next lecture was given by **Dr Keith Robinson, on Symbiotic Stars,** who described his PhD project to model symbiotic star spectra. Keith explained that a canonical model for symbiotic stars did not exist, only what might be called the 'symbiotic phenomenon', which was most apparent in the spectra of many symbiotic stars, which showed lots of absorbtion bands due to TiO etc; a weak blue continuum which was probably caused by a hot star in the system; and pronounced emission lines, which indicated the presence of a hot ionizing source such as the hot star mentioned above. Symbiotic stars exhibited a kind of double identity, in which they showed semiregular/mira type activity, with occasional dwarf novae type outbursts.

A survey conducted by Mike Bode's Manchester-based team, together with another survey, had produced high resolution spectra of about eighty stars. Examining these spectra, they found that the forbidden [OIII] lines often displayed a complicated structure which was possibly indicative of earlier outburst phases for the stars concerned; the HeII lines were invariably single peaked and relatively narrow - these should have been generated near to the hot source; the H alpha line was single-peaked and narrow in some cases, but in most cases it was very broad and double peaked. The blue peak was usually lower in amplitude than the red peak but not always. **CH Cyg** showed the reverse effect, in which the blue peak was higher than the red peak.

Mike suggested modelling the H alpha lines, on the assumption that they originated in an accretion disc, even though there was still a lot of doubt as to whether accretion discs existed in symbiotic systems. Keith's analysis thus took the form of an investigation, the results of which, could not be expected to prove or disprove the theory at this time.

Double-peaked lines were produced by an accretion disc, primarily as a consequence of the orbital motion of the disc material. A high inclination system, would produce the deepest central reversals. Conversely, a disc seen face on would produce a narrow single peaked emission line. Horne and Marsh (1986) developed a new profile model which was able to produce more realistic looking model line profiles, and Keith consequently adopted this model for his investigation into symbiotic stars.

Keith began to model real spectra, but was beginning to have doubts that symbiotic systems were simply scaled up versions of cataclysmic variables. An accretion disc could certainly provide the high velocity material which was needed to produce the broad wings seen in the line profiles, but an explanation was needed for the unequal emission peak heights. Keith considered the effect of lines produced by an accretion disc suffering subsequent absorption in the outflowing wind of the red giant. A very simple absorbing wind model was developed, which assumed a spherically symmetric radially outflowing wind. This was incorporated into the Horne and Marsh model to produce line profile model fits, which were very good, despite the rudimentary nature of the model. The model favoured a lower blue emission peak, though in exceptional situations it could produce a model line profile with a lower red peak. This was exactly what appeared to be observed.

This disc, plus absorbing wind model, would be strengthened if it could be shown that an accretion disc could form in a binary system as a result of accretion of wind material, as opposed to Roche lobe overflow. Work in the mid 80s by Livio and Warner (1984) in this area, was not encouraging. However, very recent work by Ed Sion et al 2001)at Villa Nova University in the U.S.A., in relation to the companion to **Mira**, lent support to the idea that accretion discs could, after all, form via wind accretion. This, in conjunction with results such as the model line profile fits discussed above, could help in the longer term to strengthen the case for accretion discs in symbiotic stars.

Dr Maurizio Salaris then spoke on **Dating the universe with RR Lyrae and Eclipsing Variables.** He started his talk by briefly discussing the connection between the Hubble constant and the age of the universe. The determination of the Hubble constant measured by the HST extragalactic distance scale key project, was based on the use of the cepheid Period-Luminosity relationship, established for cepheids in the Large Magellanic Cloud (LMC), and its zero point was determined assuming a LMC distance. However, this distance itself, was not yet precisely known. The value determined by the HST group was around 70 Km/Mpc/s, but the current uncertainty on the LMC distance caused an error of about 20% on this value.

An independent way to put limits on the value of the Hubble constant was through the determination of the ages of the oldest stars that populate our galaxy, such as those in globular clusters. These ages provided a firm lower limit to the age of the universe, and therefore an upper limit to the value of the Hubble constant, and could be determined using stellar evolution calculations, by fitting theoretical isochrones to the observed magnitude and colour information on the Hertzsprung-Russel diagram. One difficulty that still remained, was that the distance to the cluster was required, in order to get the turn-off absolute brightness. It looked like the problem of the distance scale could not be avoided.

One possibility was to try to determine an empirical calibration of the RR Lyrae stars' (which populated the horizontal branch of many globular clusters) brightness from local RR Lyrae with parallax distances, and use them as distance indicators, but unfortunately, precise parallaxes for RR Lyrae stars still did not exist.

A very promising way to eliminate these uncertainties, was to use well-detached eclipsing binary systems; the main idea was to derive the masses of the stars in the turn-off region of a globular cluster, provided some turn-off stars were in eclipsing binary systems. The masses, and the distance to the system could be derived from a knowledge of the radial velocity and light curve of the system. The cluster age could be calculated from the turn-off mass-age relationship and luminosity-age relationship.

Moreover, if eclipsing binaries were observed and analysed in a large sample of clusters of different metallicities, then the absolute brightness of their RR Lyrae stars could be determined with precision when the clusters' distances from the binary systems was known. This would provide a solid calibration for the distance indicator, that could then be applied , for example, to observations of RR Lyrae stars in the LMC.

Many eclipsing binary systems had been observed in other globular clusters (like **47 Tuc**), in the galaxies M31, M33, the LMC and the SMC. They appeared to be probably the best tool to finally resolve the problem of the age and the value of the expansion rate of the universe.

Variable Star Data Analysis, by **Chris Lloyd**, was the next talk of the day, and Chris began by stating that he was hoping to cover the analysis of visual, CCD and photoelectric observations. He was going to spend most time on period-finding, as that was the sort of analysis that most people tried, and he would have a brief look at O-C diagrams.

Many methods of period-finding had been used, but the most popular included Phase Dispersion Minimisation (PDM), Discrete Fourier Transform (DFT) and Least Squares methods, in various forms. Autocorrelation was a related technique that could provide additional information.

In the PDM methods, the folded light curve was divided into a number of bins, and at the best period the dispersion in any particular phase bin should be the lowest. There were several different methods of calculating this statistic, and software was freely available.

The Discrete Fourier Transform method tried to determine the amplitude of the fourier component at every trial frequency, and was quick and easy to program, although sensitive to sinusoidal variation. This method did suffer from aliasing, and spurious answers.

The Least Squares sine periodogram method was an honest method, if a bit slow, and sensitive to sinusoidal variation and aliasing problems. It folded the data with a certain period, fitted a sine curve, and told you the residuals from this fit. Where the residuals were minimised, was deemed to be the best period.

Other methods such as wavelet analysis, the Lomb-Scargle method, *Clean* and neural networks were also discussed briefly.

Aliasing was an effect that commonly produced spurious features in the periodogram, and was purely due to the data spacing of the observations.

Chris moved on to show the results of his analysis of some real data using photoelectric photometry of **XY Lyr**, which had errors of the order of a few hundredths of a magnitude, explaining some of the difficulties in doing so, and then moved on to demonstrate the method of the auto correlation technique as applied to **mu Cephei** data. O-C diagrams were discussed, as they were particularly useful in examining changes in a star's period.

Chris closed his talk, by reiterating that visual observations were a very valuable resource, and could be corrected to improve the data by removing personal bias. He felt that if observers wished to perform photoelectric or CCD photometry then the use of a filter was very important to data analysis. He felt that it was important to have data analysis and observations feeding each other. If a quick analysis was performed early on in the observing history of a star, then it was possible to predict when observations would need to be made, and this might enable results to be obtained much more quickly.

John Howarth then talked about his **analysis of RR UMi data** using the AMPSCAN program. For working out periods, this used a discrete Fourier analysis approach, which took the magnitudes and sometimes binned them up by averaging 10 or 20 nights' observations. This sometimes reduced the aliasing that you could get by having too much data in one or two places.

John said that the analysis began by estimating a trial frequency ω, working out a sine and a cosine for that frequency, and then combining them to get a half peak to peak amplitude, a, also called the semi-amplitude. The quantity a was then maximised as a function of ω. Having got the frequency it was possible to work out the period and phase at that frequency, and then an idealised light curve could be obtained. It was also possible to obtain error bounds for the frequency, phase and amplitude, assuming the errors were gaussian in form.

John went on to describe his examination of some **UU Aur** data; this had many gaps and it was difficult to tell by eye, from 30 years worth of observations, if there was any pattern to the data. John said that he had put the data into bins so he had 10 day means; the gaps were still there, but they were less conspicuous, and some kind of periodicity was already evident. A semi-amplitude spectrum analysis for UU Aur using this data, showed periods that agreed with the AAVSO analysis.

John said that he had been working with Kevin West on **RR Umi.** He had first analysed his own data (obtaining a period of 33.56 days); then he analysed Kevin's data (*see VSS Circular, 101, p8*), and he got a good period of the same value (33.56 days); finally he obtained all the BAA results (digitised thanks to the efforts of Terry Miles), and these showed the same period. John said that he hoped that it would be possible to produce a paper together with Kevin West showing the analysis of this data.

In summary, it seemed that AMPSCAN gave consistent and accurate results. John wanted to stress that visual observations were still very valuable and worthwhile, particularly when done regularly over a long span of time, and that observers should continue to contribute their observations to the database.

In the next session there was a **Charts and sequences discussion** lead by **John Toone**. John proposed that four areas be covered during the discussion; these were international standardisation of sequences, CCD charts, sequence selection and coloured comparison stars.

The first part of the discussion concentrated on the **international standardisation of sequences**, and John pointed out that the problems stemed from the fact that amateur variable star observers around the world today were fragmented into around half a dozen groups, that had developed their own individual sequences. This meant that several sequences could exist for the same stars being observed and this caused problems when analyzing data derived from the different groups. Recognising this as a worldwide problem, the BAAVSS and AAVSO had begun a dialogue with a view to standardising sequences internationally. The main aim was to ensure that the sequences which were used, did not differ significantly for the same variable star, and of the 1,000 AAVSO charts and 400 BAAVSS charts that had been compared, only 141 had been found to be covering common variable stars. Of these, 59 were found to have significant differences that required investigation (significant differences meant 0.2

magnitudes or more). These were currently being investigated, and a report with recommendations for eliminating these significant differences would be presented to the BAAVSS and AAVSO shortly for their consideration and hopefully rapid implementation.

John then moved on to the next item, asking if it was considered necessary to produce **charts for CCD observers**, and if so, how should they be produced? The general feeling seemed to be that, in addition to the comparison star identifier; a cross-reference to a lettered sequence chart, where available and the position of the comparison star; photometry in B,V, R and I bands, together with an estimated measurement error was required, in order that the calibration of the CCD camera could be checked. This information would be required for a number of stars in the variable's field. GSC or DSS images could be downloaded for identification of the variable, avoiding the need for a chart.

The point of major concern regarding **sequence selection** issues, was that of the selection of comparison stars to be used in the future. This had been discussed with the AAVSO. Future charts would use Tycho2 (Vj) for stars down to magnitude 11, and CCD V measures for fainter stars. It was intended that magnitudes would be listed to 1 decimal place in future, rather than two as previously. The use of microvariables and the use of the Howarth and Bailey formula was also discussed (see web report for further details).

There was a discussion regarding the use of **coloured comparison stars**, in which John explained that whilst the AAVSO still advocated the use of comparison stars that matched the colour of the variable), providing the B-V of the comparison did not exceed +1.5, the BAA took the view that the colour range of comparison stars should be limited to a B-V of 0-1 wherever, possible, only using stars of B-V up to 1.5 in extreme cases. This was because stars with a B-V of greater than +1.5 had a very high risk of being variable themselves.

Chris Jones expressed his concern that there was a huge backlog of charts to be looked at, and asked if there would be a delay in the issue of new charts due to both a lack of time, and the need for CCD measures of magnitude 11 and fainter stars. John suggested that if people were willing to help produce charts in the right format, then this would assist, and it was later agreed that Chris would help with the production of charts where this was appropriate.

There followed a fascinating **trip to the observatories**. There were a number of domes on site, but I know no one who went on the visit, who failed to be stunned by the sight of the ‘multiple mirror telescope’ which consisted of 7x16" schmidt cassegrain telescopes, all on the same equatorial mount! This was currently unfinished, but it was hoped that the telescopes might see first light some time this winter, and then the mirrors would be sent away for re-aluminising before the telescope began its work proper. The plan was that fibre optic cables would take the light from the telescopes to a spectrometer. It was to be used by Gordon Bromage to back up XMM observations of flare stars, and for final year undergraduate use.

...........to be continued in the next issue.

ECLIPSING BINARY PREDICTIONS

TONY MARKHAM

The following predictions, based on the latest Krakow elements, should be usable for observers throughout the British Isles. The times of mid-eclipse appear in parentheses, with the start and end times of visibility on either side. The times are hours GMAT (UT-12h). D indicates that the eclipse starts/ends in daylight, and L indicates low altitude at the start/end of the visibility period. Thus, for example, the eclipse of SS Cet on Jan 2 starts in daylight, but can be observed between 05h and 10h GMAT (17h and 22h UT), with mid eclipse at about 6h GMAT (18h UT). Please contact the EB secretary (details on the back of this circular) if you require any further explanation of the format. Note that predictions for **RZ Cas, Beta Per, Lambda Tau** and **HU Tau** can be found in the BAA Handbook. The variables (charts available on BAAVSS web page) covered by these predictions are :

Star	Mag Range	Star	Mag Range	Star	Mag Range
TV Cas	7.2 - 8.2 V	S Equ	8.0 - 10.08 V	U Sge	6.45 - 9.28 V
U Cep	6.75 - 9.24 V	RW Gem	9.53 - 11.76 V	RW Tau	7.98 - 11.59 V
SS Cet	9.4 - 13.0 v	V640 Ori	11.2 - 13.5 p	X Tri	8.88 - 11.27 V
SW Cyg	9.24 - 11.83 V	Z Per	9.7 - 12.4 p	TX UMa	7.06 - 8.80 V
Z Dra	10.8 - 14.1 p	ST Per	9.52 - 11.40 V	Z Vul	7.25 - 8.90 V
TW Dra	8.0 - 10.5 v	Y Psc	9.44 - 12.23 V		

2002 Jan 1 Tue
Z Per D05(00)05
SW Cyg D05(02)08
TW Dra D05(04)09
Z Vul D05(05)08L
S Equ D05(07)07L
X Tri 05(08)10
TX UMa 10(14)19D
RW Tau 11(15)17L

2002 Jan 2 Wed
SS Cet D05(06)10
X Tri D05(07)10
V640 Ori L07(05)08
U Cep 10(15)19D

2002 Jan 3 Thu
Y Psc D05(01)05
Z Dra D05(06)09
X Tri D05(07)09
TV Cas 15(19)19D
RW Gem 15(21)18L
Z Vul L17(16)19D
U Sge L18(17)19D
TW Dra 19(24)19D

2002 Jan 4 Fri
Z Per D05(02)06
X Tri D05(06)08
RW Tau 05(10)15
V640 Ori L07(06)08
TX UMa 11(16)19D
Z Dra 13(15)17

2002 Jan 5 Sat
U Cep D05(03)08
X Tri D05(05)08
SS Cet D05(05)10
ST Per 09(13)17
SW Cyg 09(15)12L
TV Cas 10(15)19
SW Cyg L14(15)19D

2002 Jan 6 Sun
Z Vul D05(03)07L
X Tri D05(04)07
V640 Ori L07(06)09
RW Gem 12(17)18L
TW Dra 14(19)19D

2002 Jan 7 Mon
U Sge D05(02)07L
Z Per D05(03)08
X Tri D05(04)06
RW Tau D05(04)09
Z Dra 06(08)11
TV Cas 06(10)14
U Cep 10(15)19D
TX UMa 13(17)19D

2002 Jan 8 Tue
X Tri D05(03)06
S Equ D05(04)07L
ST Per D05(04)08
SS Cet D05(05)09
V640 Ori L07(07)09
Z Dra 14(17)19D
Z Vul L17(14)19D

2002 Jan 9 Wed
TV Cas D05(06)10
RW Gem 09(14)18L
TW Dra 09(14)19D

2002 Jan 10 Thu
U Cep D05(03)08
Z Per D05(04)09
SW Cyg D05(05)11
U Sge D05(11)06L
V640 Ori L06(07)10
Y Psc 09(13)10L
TX UMa 14(19)19D
ST Per 16(20)16L

2002 Jan 11 Fri
TV Cas D05(01)05
Z Vul D05(01)06
SS Cet D05(04)09
Z Dra 08(10)12

2002 Jan 12 Sat
TW Dra D05(10)15
RW Gem 06(11)16
V640 Ori L06(08)10
U Cep 10(15)19D
RW Tau 12(17)16L
Z Dra 16(19)19D
TV Cas 17(21)19D

2002 Jan 13 Sun
Z Per D05(06)10
Z Vul 07(12)07L
ST Per 07(11)15
TX UMa 16(21)19D
Z Vul L16(12)17
U Sge L17(20)19D

2002 Jan 14 Mon
Z Dra D05(03)05
SS Cet D05(03)08
Y Psc D05(08)09L
V640 Ori L06(08)11
TV Cas 12(16)19D
SW Cyg L13(19)19D

2002 Jan 15 Tue
S Equ D05(01)06
U Cep D05(02)07
TW Dra D05(05)10
RW Gem D05(08)13
RW Tau 07(12)16L
Z Dra 09(12)14

Z Vul 18(23)19D
2002 Jan 16 Wed
ST Per D05(03)07
Z Per D05(07)12
V640 Ori L06(09)11
TV Cas 08(12)16
TX UMa 17(22)19D
Z Dra 18(20)19D
2002 Jan 17 Thu
SS Cet D05(03)07
U Sge D05(05)06L
U Cep 09(14)19D
2002 Jan 18 Fri
TW Dra D05(00)06
Y Psc D05(02)07
RW Gem D05(04)10
Z Dra D05(05)07
RW Tau D05(06)11
TV Cas D05(07)11
Z Vul D05(10)07L
S Equ 06(12)06L
V640 Ori 06(09)12
ST Per 14(19)16L
2002 Jan 19 Sat
Z Per D05(08)13
SW Cyg D05(09)11L
Z Dra 11(13)16
SW Cyg L13(09)15
2002 Jan 20 Sun
SS Cet D05(02)07
U Cep D05(02)07
TV Cas D05(03)07
V640 Ori 07(10)12
TW Dra 15(20)19D
Z Vul L16(21)19D
U Sge L17(14)19D
2002 Jan 21 Mon
RW Gem D05(01)06
ST Per 06(10)14
TV Cas 18(22)19D
2002 Jan 22 Tue
Z Dra D05(07)09
Z Per D05(10)14
V640 Ori 07(10)13
U Cep 09(14)19D
2002 Jan 23 Wed
TX UMa D05(01)06
SS Cet D05(01)06
Z Vul D05(08)06L
TW Dra 10(15)19D
Z Dra 13(15)18
TV Cas 14(18)19D
RW Tau 14(19)15L
SW Cyg 16(22)19D
U Sge 18(23)19D
2002 Jan 24 Thu
ST Per D05(02)06
V640 Ori 08(11)13
X Tri 13(15)13L
2002 Jan 25 Fri
U Cep D05(02)07
S Equ D05(08)06L
Z Per 06(11)16L
TV Cas 09(13)17
X Tri 12(15)13L
Z Vul L16(19)19D
2002 Jan 26 Sat
TX UMa D06(03)07
TW Dra 06(11)16
Z Dra 06(08)11
V640 Ori 08(11)13L
RW Tau 09(13)15L
X Tri 12(14)13L
ST Per 13(17)15L
RW Gem 14(19)16L
2002 Jan 27 Sun
TV Cas D06(09)13
U Cep 09(14)18
X Tri 11(13)13L
Z Dra 14(17)19D
2002 Jan 28 Mon
Z Vul D06(06)06L
SW Cyg 06(12)11L
Z Per 08(12)16L
V640 Ori 09(12)13L
X Tri 10(13)13L
SW Cyg L12(12)18
2002 Jan 29 Tue
TX UMa D06(04)09
TV Cas D06(04)08
TW Dra D06(06)11
RW Tau D06(08)13
ST Per D06(09)13
Y Psc D06(09)08L
X Tri 10(12)13L
RW Gem 10(15)16L
2002 Jan 30 Wed
U Cep D06(01)06
Z Dra 08(10)12
X Tri 09(11)13L
V640 Ori 09(12)13L
Z Vul L15(16)19D
U Sge L16(18)19D
2002 Jan 31 Thu
X Tri 08(11)13L
Z Per 09(14)15L
Z Dra 16(19)19D
2002 Feb 1 Fri
TW Dra D06(01)06
RW Tau D06(02)07
TX UMa D06(06)10
RW Gem 07(12)16L
X Tri 07(10)12
U Cep 08(13)18
V640 Ori 10(13)13L
TV Cas 15(19)19D
2002 Feb 2 Sat
SW Cyg D06(02)08
Y Psc D06(04)08L
X Tri 07(09)12
2002 Feb 3 Sun
X Tri 06(09)11
Z Dra 09(12)14
Z Per 10(15)15L
V640 Ori 10(13)13L
TV Cas 11(15)18D
ST Per 12(16)15L
TW Dra 16(21)18D
2002 Feb 4 Mon
U Cep D06(01)06
TX UMa D06(07)12
X Tri D06(08)10
RW Gem D06(09)14
Z Vul L15(14)18D
Z Dra 18(20)18D
2002 Feb 5 Tue
X Tri D06(07)10
TV Cas 06(10)14
V640 Ori 11(14)13L
2002 Feb 6 Wed
Z Dra D06(05)07
X Tri D06(07)09
ST Per D06(07)12
U Cep 08(13)18
SW Cyg 10(16)10L
RW Tau 11(15)14L
TW Dra 11(16)18D
Z Per 12(16)15L
SW Cyg L12(16)18D
U Sge L15(12)18
2002 Feb 7 Thu
TV Cas D06(06)10
RW Gem D06(06)11
X Tri D06(06)08
TX UMa D06(09)13
Z Dra 11(13)16
V640 Ori 11(14)13L
2002 Feb 8 Fri
X Tri D06(05)08
2002 Feb 9 Sat
X Tri D06(05)07
RW Tau D06(10)14L
TW Dra 06(11)16
V640 Ori 12(15)12L
Z Per 13(18)15L
Z Vul L15(12)17
U Sge 15(21)18D
2002 Feb 10 Sun
RW Gem D06(03)08
X Tri D06(04)06
Z Dra D06(07)09
TX UMa D06(10)15
TV Cas 17(21)18D
2002 Feb 11 Mon
SW Cyg D06(05)10L
U Cep 08(13)17
ST Per 10(15)14L
Z Dra 13(15)18
Z Vul 18(23)18D
S Equ L18(13)18
2002 Feb 12 Tue
RW Tau D06(04)09
TW Dra D06(07)12
TV Cas 12(16)18D
Z Per 14(19)15L
2002 Feb 13 Wed
Y Psc 06(11)07L
TX UMa 07(12)16
2002 Feb 14 Thu
ST Per D06(06)10
Z Dra D06(08)11
TV Cas 08(12)16
Z Vul L14(10)15
S Equ 18(23)18D
2002 Feb 15 Fri
TW Dra D06(02)07
SW Cyg 13(19)18D
Z Dra 15(17)18D
RW Gem 15(20)15L
2002 Feb 16 Sat
TV Cas D06(07)11
U Cep 07(12)17
TX UMa 09(13)18
U Sge L15(15)18D

Z Vul 16(21)18D
2002 Feb 17 Sun
Y Psc D06(05)07L
RW Tau 12(17)14L
TW Dra 16(22)18D
2002 Feb 18 Mon
TV Cas D06(03)07
Z Dra 08(10)13
RW Gem 12(17)15L
2002 Feb 19 Tue
ST Per 09(13)14L
TX UMa 10(15)18D
Z Dra 16(19)18D
2002 Feb 20 Wed
SW Cyg D06(09)09L
RW Tau 07(11)13L
SW Cyg L11(09)15
TW Dra 12(17)18D
2002 Feb 21 Thu
U Cep 07(12)17
RW Gem 08(14)15L
TV Cas 14(18)18D
Z Vul L14(19)18D
S Equ L17(20)18D
2002 Feb 22 Fri
ST Per D06(05)09
Z Dra 09(12)14
TX UMa 12(16)18D
2002 Feb 23 Sat
RW Tau D06(06)11
TW Dra 07(12)17
TV Cas 09(13)17
U Sge L14(10)15
2002 Feb 24 Sun
RW Gem D06(10)15L
SW Cyg 17(23)18D
2002 Feb 25 Mon
Z Dra D06(05)07
TV Cas D06(09)13
TX UMa 13(18)18D
2002 Feb 26 Tue
TW Dra D06(08)13
U Cep 07(12)16
Z Dra 11(14)16
Z Vul L14(17)18D
U Sge L14(19)18D
2002 Feb 27 Wed
TV Cas D06(04)08
RW Gem D06(07)12
ST Per 08(12)13L
2002 Feb 28 Thu
Z Per D06(02)07
TX UMa 15(19)18D
S Equ L17(17)18D
2002 Mar 1 Fri
TW Dra D07(03)08
Z Dra D07(07)09
SW Cyg D07(12)08L
SW Cyg L10(12)18D
2002 Mar 2 Sat
ST Per D07(03)08
RW Gem D07(04)09
Z Dra 13(15)18D
TV Cas 15(19)18D
2002 Mar 3 Sun
Z Per D07(03)08
U Cep D07(11)16
RW Tau 09(13)13L
X Tri 10(13)11L
Z Vul L13(14)18D
TX UMa 16(21)18D
TW Dra 17(22)18D
2002 Mar 4 Mon
X Tri 10(12)10L
TV Cas 11(15)18D
2002 Mar 5 Tue
Z Dra D07(08)11
X Tri 09(11)10L
U Sge L14(13)17D
2002 Mar 6 Wed
SW Cyg D07(02)08L
Z Per D07(05)09
RW Tau D07(08)12
TV Cas D07(10)14
X Tri 08(11)10L
TW Dra 13(18)17D
Z Dra 15(17)17D
2002 Mar 7 Thu
ST Per D07(11)13L
X Tri 08(10)10L
S Equ L16(14)17D
2002 Mar 8 Fri
TV Cas D07(06)10
U Cep D07(11)16
X Tri 07(09)10L
Z Vul L13(12)17D
U Sge 16(22)17D
2002 Mar 9 Sat
RW Tau D07(02)07
Z Per D07(06)11
X Tri D07(09)10L
Z Dra 08(10)13
TW Dra 08(13)17D
2002 Mar 10 Sun
X Tri D07(08)10L
SW Cyg 10(16)17D
RW Gem 13(18)14L
Z Dra 16(19)17D
2002 Mar 11 Mon
X Tri D07(07)10
TV Cas 17(21)17D
2002 Mar 12 Tue
X Tri D07(07)09
Z Per D07(07)12
TW Dra D07(08)13
2002 Mar 13 Wed
X Tri D07(06)08
U Cep D07(11)15
Z Dra 10(12)14
RW Gem 10(15)13L
TV Cas 12(16)17D
Z Vul L13(10)15
2002 Mar 14 Thu
X Tri D07(05)08
RW Tau 10(15)12L
S Equ L16(11)16
2002 Mar 15 Fri
TW Dra D07(04)09
X Tri D07(05)07
SW Cyg D07(06)07L
Z Per D07(09)13L
ST Per D07(09)12L
TV Cas 08(12)16
SW Cyg L09(06)12
U Sge L13(16)17D
Z Vul 16(21)17D
2002 Mar 16 Sat
TX UMa D07(03)08
Z Dra D07(05)07
RW Gem D07(12)13L
2002 Mar 17 Sun
TV Cas D07(07)11
RW Tau D07(10)12L
Z Dra 11(14)16
S Equ 16(22)17D
2002 Mar 18 Mon
Z Per D07(10)12L
U Cep D07(10)15
Z Vul L12(08)13
2002 Mar 19 Tue
TX UMa D07(04)09
RW Gem D07(09)13L
SW Cyg 13(19)17D
2002 Mar 20 Wed
RW Tau D07(04)09
Z Dra D07(07)09
TW Dra 13(19)17D
Z Vul 14(19)17D
2002 Mar 21 Thu
Z Per D07(11)12L
Z Dra 13(15)17D
2002 Mar 22 Fri
RW Gem D07(05)11
TX UMa D07(06)11
U Sge L13(11)16
TV Cas 14(18)17D
2002 Mar 23 Sat
ST Per D07(08)12L
U Cep D07(10)15
TW Dra 09(14)17D
2002 Mar 24 Sun
Z Dra D07(09)11
Z Per 08(13)12L
SW Cyg L09(09)15
TV Cas 09(13)17D
S Equ L15(18)17D
2002 Mar 25 Mon
RW Gem D07(02)07
TX UMa D07(07)12
Z Vul L12(17)17D
U Sge 14(20)17D
Z Dra 15(17)17D
2002 Mar 26 Tue
TV Cas D07(09)13
TW Dra D07(09)14
2002 Mar 27 Wed
Z Per 09(14)12L
Z Per L17(14)17D
2002 Mar 28 Thu
TV Cas D07(04)08
TX UMa D07(09)14
U Cep D07(10)14
RW Tau D07(11)11L
Z Dra 08(10)13
ST Per 11(15)11L
2002 Mar 29 Fri
TW Dra D07(05)10
Z Dra 16(19)17D
2002 Mar 30 Sat
Z Per 11(15)12L
Z Vul L11(15)16D
Z Per L16(15)16D
2002 Mar 31 Sun
RW Tau D07(06)10
ST Per D07(07)11
TX UMa D07(11)15
S Equ L15(15)16D
TV Cas 15(19)16D

SECTION OFFICERS

Director Roger D Pickard
28 Appletons, Hadlow, Kent TN11 0DT
T:01732 850663 E:rdp@star.ukc.ac.uk

Secretary John Saxton
11 Highfield Road, Lymm,
Cheshire, WA13 0DS
T:01925 758009 E:jsaxton@fs1.ge.man.ac.uk

Chart Secretary John Toone
Hillside View, 17 Ashdale Road,
Cressage, Shrewsbury, SY5 6DT.
T:01952 510794 E:john.toone@dial.pipex.com

Binocular Secretary Melvyn D. Taylor
17 Cross Lane, Wakefield, West Yorks,WF2 8DA
T:01924374651E:melvyn.taylor@breathemail.net

Nova/Supernova Secretary Guy M Hurst
16 Westminster Close, Basingstoke,
Hants, RG22 4PP .
T& F:01256 471074 E:Guy@tahq.demon.co.uk

Eclipsing Binary Secretary TonyMarkham
20 Hillside Drive, Leek, Staffs, ST13 8JQ
T: 01538 381174
E: tonymarkham@compuserve.com

Recurrent Objects Co-ordinator Gary Poyner
67 Ellerton Road, Kingstanding,
Birmingham, B44 0QE.
T:0121 6053716
E:gp@star.sr.bham.ac.uk

Pro-am Liaison Committee Secretary & Photoelectric Photometry Advisor -
as Director

CCD Advisor Richard Miles
1 Tall Trees Close, Northwich, Cheshire,
CW8 4YA
T:01606 784132
E:rmiles@baa.u-net.com

Circulars Editor Karen Holland
136 Northampton Lane North, Moulton,
Northampton, NN3 7QW
T: 01604 671373 Fax: 01604 671570
E: kho@star.le.ac.uk

Webmaster Peter Moreton
Engaynes Lodge, Manor Gardens, Pytchley,
Northants, NN14 1HB
E:Peter.Moreton@rockinghaminstruments.com

TELEPHONE ALERT NUMBERS

Nova and Supernova discoveries

First telephone the Nova/Supernova Secretary. If only answering machine response, leave a message and then try the following: Denis Buczynski 01524 68530, Glyn Marsh 01772 690502, or Martin Mobberley 01245 475297 (weekdays) 01284 828431 (weekends).

Variable Star Alerts

Telephone Gary Poyner (see above for number)

BAAVSS web pages:http://www.britastro.org/vss

Charges for Section Publications

The following charges are made for the Circulars. These cover one year (4 issues). Make cheques
out to the BAA. Send to the Circulars editor.

	UK	Europe	Rest of World
BAA Members	£3.00	£4.00	£6.50
Non-Members	£5.00	£6.00	£8.50

The charges for other publications are as follows. Make cheques out to the BAA and please enclose a large SAE with your order.

	Order From	Charge
Telescopic Charts	Chart Secretary	30p
Binocular Charts	Chart Secretary	10p
Eclipsing Binary Charts	Eclipsing Binary Secretary	10p
Observation Report Forms	Director or Binocular Secretary	Free
Guide to Making Visual Observations	Director or Binocular Secretary	40p
Chart Catalogue	Director	60p
Sample Charts for NE and Binoculars	Director or Binocular Secretary	40p
Sample Charts for Smaller Telescopes	Director or Binocular Secretary	40p
Sample Charts for Larger Telescopes	Director or Binocular Secretary	40p