British Astronomical Association

VARIABLE STAR SECTION CIRCULAR

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Contents

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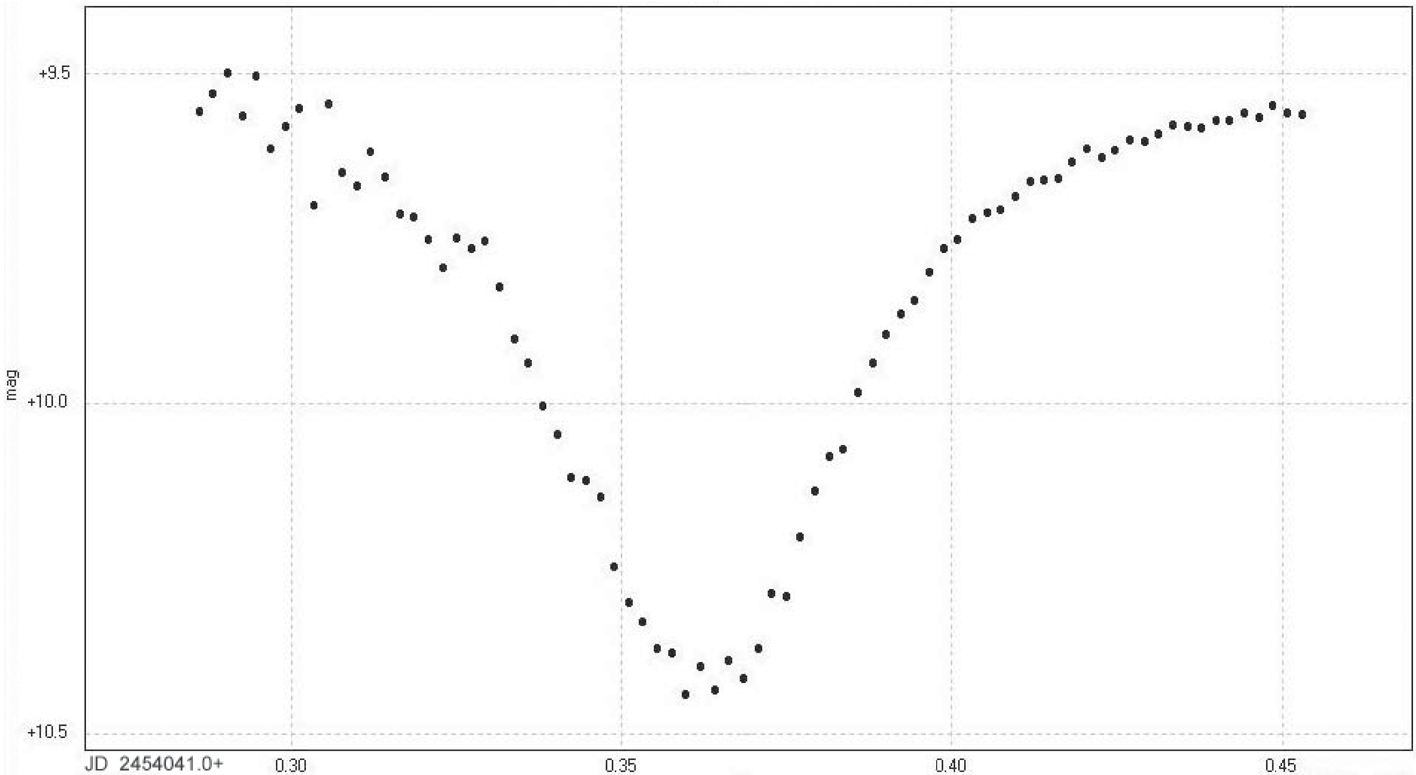
AB ANDROMEDAE PRIMARY MINIMA 1st November 2006

IAN MEGSON



Light curve constructed using Peranso software from the observations of Ian Megson with a V filtered Starlight Xpress MX916 CCD camera. The midpoint of the eclipse was determined to be 20.37 UT on 1/11/07 which corresponds to a HJD of 54041.3623. The eclipse was late by 0.086 days which fits in well with the Krakow O/C diagram: http://www.as.ap.krakow.pl/o-c/diagram_html/and_ab_small.html

FROM THE DIRECTOR

Roger Pickard

President of the BAA: Well, not just Director of the VSS but now President of the BAA as well! I'm honoured to take up this position and will endeavour to fulfil both positions to the best of my ability. However, please bear with me if, on occasion, any replies relating to VSS business are a little delayed as I feel the greater demands of the Presidency must come first.

Richard Miles, VSS CCD Advisor, hands over the Presidency of the BAA to VSS Director, Roger Pickard - who will be next!

Visual Observing - again: There have been a number of emails of late, stemming from an article in an American publication stating that the era of visual observing is just about dead, due to the large number of professional surveys being undertaken nowadays. From the flood of email that followed, this is obviously not the case.

As with the AAVSO, the number of visual observations reported to the VSS over the last several years has not dwindled. More people may be using CCDs and the like but they are very much in the minority. CCD observers also tend to concentrate on fainter objects than the visual observer and on objects requiring time-series observations. In addition, it quite often happens that a visual observer will confirm a CCD observation and vice versa. Therefore, the visual observer should not feel despondent but encouraged that their observations are being backed up, not just by CCD observations, but by some very large surveys as well!

Regarding surveys; they may make one observation per night, but for example, they will not cover a rise to maximum . In addition, there is the other extreme where a star may be too bright for them. As John Greaves pointed out recently, this is the case for CE Lyncis, and hence most of the stars on the Binocular Programme.

SRb stars and the like may not be the flavour of the month with professional astronomers right now, but when the time comes for a full analysis they are going to want as a long a time span coverage as possible.

Eclipsing Dwarf Novae Programme: Observations made of stars on this programme, (see VSSC 132 for June 2007) should be sent to the Director, and not Bill Worraker who has stepped down from co-ordinating the project.

There has been a concerted effort this year by both Ian Miller and myself to observe the outstanding stars, with some success, and it is hoped to publish our results in due course. In the meantime, if any other observers have time-series observations on any of the programme stars, I shall be pleased to receive them.

Melvyn Taylor: And finally a note, not to use Melvyn's email address until further notice, as very few messages seem to be getting through to him. He is trying to sort this out but his Internet provider seems to be having great difficulty since they "streamlined" their activity some months ago.

Joint Meeting with the AAVSO, 10th -13th April 2008: I am delighted to advise that the BAA VSS will be holding a joint meeting with the AAVSO on the above dates in Cambridge (England!). The precise venue has not been confirmed at the time of writing but should be by the time you read this. Further details will be posted on the web site when known, but for those members without Internet access, please feel free to call me for further information.

We do have a number of speakers provisionally booked, but I do not wish to include them here yet until further details of the meeting have been finalised. I have not allowed for too much informal discussion during the actual lecture periods as I am hoping that most members will be staying over both Friday and Saturday nights which will allow plenty of time for chatting with friends and colleagues.

(Very) Provisional Programme

Thursday 10th April

PM Possible trip to local astronomical attraction for those arriving early.

19:00 Dinner (Own arrangements)
20:00 Informal lecture?

Friday 11th April

AAVSO/BAA VSS Meeting on Variable Stars

10:00 Welcome
10:05 Talk 1 AAVSO
10:50 Talk 2 BAA
11:30 Tea/coffee break
12:00 Talk 3
12:30 Talk 4
13:00 Lunch
14:15 Talk 5 John Toone
15:00 Talk 6
15:30 Tea/coffee break
16:00 Talk 7
16:40 Talk 8
17:30 Close

19:00 Dinner (Own arrangements)
20:00 Informal talk?

Saturday 12th April

BAA Out of Town Meeting
in conjunction with the AAVSO, BAA VSS and BAA Solar Section

10:00 Registration
10:25 Official Welcome, BAA President
10:30 Dr Lucie Green - Space weather
11:20 Speaker 2 - ??
12:15 Lunch
14:00 Speaker 3 - AAVSO?
14:45 Speaker 4 - VS?
15:30 Tea
16:00 Lee MacDonald (BAA Solar Section)
16:30 Prof Douglas Gough, The Sun as a Variable Star
17:30 Close

19:00 Assemble for Banquet
19:30 Banquet
21:00 After Dinner lecture, Prof John Brown, Astronomer Royal for Scotland, Giant Snowballs in Hell.
22:00 Close

Sunday 13th April

AM Possible trip to local astronomical attraction?

RECURRENT OBJECTS PROGRAMME, AND LONG TERM POLAR PROGRAMME NEWS.

Gary Poyner

DK Cas is to be dropped from the ROP forthwith. Excellent CCD coverage from Jeremy Shears and Ian Miller have revealed that the star has frequent, faint and short duration outbursts, peaking in the mid to low 16's. Three outbursts have been detected in 2007 alone (March, August and October). Although dropped from the programme, observers are advised to continue monitoring.

SDSSpJ015543.4+002807 has now been designated FL Cet, and is now catalogued as an eclipsing AM star with a well defined Porb (0.06051621d). Recent CCD observations from Miller & Shears show that this object has entered a recent high state (Sep/Oct) of 15.0C-16C. With this in mind, and with the need to keep this object in a relatively high profile status, it has been decided to move it from the ROP to the Long Term Polar Monitoring Programme (LTPMP). Interested observers are asked to continue regular monitoring in order that the current (October) high state is covered, as well as any future activity.

Likewise EUVE J0854+390 will also be dropped from the ROP and moved over to the LTPMP. This is now a well established AM star, where both high and low states have been detected by Shears and Miller, in addition to orbital humps revealed from time series photometry.

Four stars are to be added to the ROP, unfortunately with these absurd SDSS & RX designations...

SDSS081321.91+452809.4 Type UG (long period)
SDSS081610.84+453010.2 Type UGWZ:
Both of these objects have existing Henden & Simonsen charts/sequences.

RXJ1715.6+6856 & RXJ1831.7+6511

Taichi Kato comments on VSnet-chat 7370...

"Two CVs of potential interest: RX J1715.6+6856 Porb=1.64 hr. very likely an SU UMa-type dwarf nova. V=18 in quiescence. We can expect outbursts of mag ~13 or even brighter. RX J1831.7 + 6511 Porb=4.01 hr. Bright CV (dwarf nova?)> V about 14-16."

Unfortunately charts for these two objects do not yet exist, but preliminary ones are available upon request. This will enable coverage to begin at least!

Apart from the above two ROP stars which are moving over to the LTPMP, one other addition to this programme will be made. WX LMi is a low accretion rate Polar. Boris Gaensicke comments on his HQS web pages [1] "This is the first member of the so-called Low Accretion Rate Polars, characterized by an almost pure cyclotron emission spectrum. This object has not been seen in the X-rays, indicating a very low mass transfer rate. More recently, people started to wonder whether this is a polar, or rather a pre-polar in which the white dwarf is accreting not through Roche-lobe overflow, but from the wind of the still detached donor star. Monitoring is extremely important, as the detection of a real high state would clearly rule out that second possibility."

Details of both ROP and LTPMP can be seen at...

http://www.garypoyner.pwp.blueyonder.co.uk/rop.html

http://www.garypoyner.pwp.blueyonder.co.uk/vsspolar.html

1: http://deneb.astro.warwick.ac.uk/phsdaj/HQS_Public/HQS_Public.html

ECLIPSING BINARY NEWS

DES LOUGHNEY

As announced in the last circular, I paid a visit to La Palma in September.
The observations of delta Cephei are reported elsewhere in this Circular. The visit was very successful. My accommodation was situated around 4200 feet which was above the trade winds zone. While conditions were not as good as the Observatory level (8000 feet) they were still first class. In fact the skies were clear for 21 nights in a row. The only factor that hindered observations was the moon.

A sequence of 21 clear nights allowed a good series of observations of Beta Lyrae to be made. These will be reported in a subsequent Circular. A study was made of the unusual Cepheid TU Cas which will again be reported later. Two eclipsing binaries in edition to Beta Lyrae were studied. These were W Serpentis and TV Cas.

All observations were made using the methodology described in the VSSC 132 (Differential Photometry with a DSLR).

W Serpentis

Some comments were made on this eclipsing binary in VSSC 131. It is a bit low down as seen from the UK. However, it was at a good height as seen from La Palma. Photometry was done on the 21 nights and a preliminary light curve was constructed. The light curve was similar to the one presented in J S Glasby's book 'Variable Stars' which was published in 1968. This light curve has three minima of which the deepest is attributed to the eclipse.

I was able to observe the deep minimum on Sunday 16th September 2007 - JD 2454360.3958. This is actually 7 days later than the midpoint predicted by the Krakow elements (2419321.68 + 14.15996d) and perhaps more surprisingly 4.76 days later compared with the latest elements quoted on the Krakow site (2452514.1394+14.165346d). It would seem that the period of this system is changing very fast. It certainly deserves to be studied in detail and up to date elements worked out. I have not been able to find any recent source of elements for W Serpentis.

TV Cas

I was able to observe three eclipses of this eclipsing binary from La Palma (7/9/07, 8/9/07, 17-18/9/07 and a subsequent eclipse from Edinburgh on 16 - 17/10/07. Below is the light curve of the eclipse on 7/9/07. Compared with the latest Krakow elements the eclipses were late by 3 minutes, 4 minutes, 4 minutes and 6 minutes respectively. This suggests that the period continues to slowly decrease.

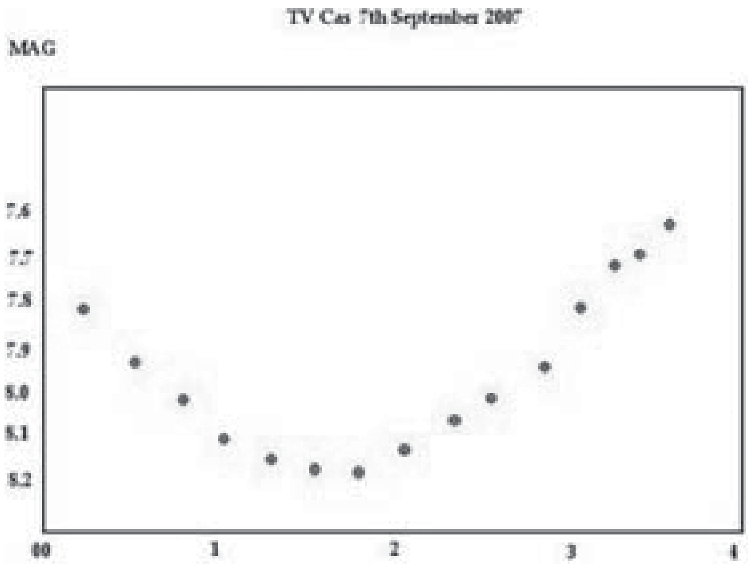


Fig 1: Light curve of an eclipse of TV Cassiopeiae from DSLR photometry, in La Palma.

V Filters

In my article on DSLR photometry in the last edition I mentioned that magnitude estimates would be more useful if they could be done using a V filter which could be attached to the camera. V filters for a DSLR are not available commercially. They can be custom made. This can be done most efficiently - and cheaply - in sets of four. I would like to get a filter that will fit a 85 mm and a 200 mm lens and would welcome three other observers also wanting V filters to minimise costs. Anyone interested should contact me.

desloughney@blueyonder.co.uk

John and Irene Toone at their wedding

(as promised in September's 'From the Director')

CHART NEWS

John Toone

The following new charts are now posted to the VSS web site and are available in paper form from the Chart Secretary:

Telescopic Stars

078.02 **TX CVn**

A new 3 degree field chart replaces chart 078.01. Comparison stars D, E, G & J have been dropped and Tycho is adopted for the sequence.

212.02 **R Com**

New 9 degree and 1 degree field charts replace chart 212.01. All the previous comparison stars are retained but are amended to V measurements from Tycho and Pickard. The previous sequence used was poorly calibrated below magnitude 9.

008.04 **U Gem**

New 3 degree, 1 degree & 20 minute field charts replace chart 008.03. Comparison stars C, D, M (variable), N, Q, Y & AA have been dropped and comparison star 1 has been added. The new sequence is a combination of V measurements taken from Tycho, ASAS 3, Henden & Pickard.

010.02 **X Leo**

A new 25 minute field chart replaces chart 010.01. Comparison stars B & K are dropped and the sequence now adopts V measurements from Bailey & Misselt.

014.03 **RU Peg**

A new 30 minute field chart replaces chart 014.02. Comparison stars A, C, D, E & K are dropped and comparison stars R, S, M & N have been added. The new sequence consists of V measurements from Tycho and Henden.

130.03 **GK Per**

A new 30 minute field chart replaces chart IDH 1977 Aug. Comparison stars H & L have been dropped and comparison stars N & P have been added. The new sequence is drawn from V measurements by Tycho, Pickard & Henden. An intermediate chart referenced 130.02 was briefly posted to the BAA VSS web site which had slightly different values for comparison stars B and C.

Binocular Stars

026.04 **V Aql, R & S Sct**

This 8 degree field chart replaces chart 026.03. The V Aql sequence is extended to include comparison star 7 and the magnitudes are amended to Tycho. Comparison stars A, B (too bright), L, N (close double) on the R Sct sequence are dropped and comparison star P is added. The R Sct sequence is converted to Tycho with the exception of the red comparison star F for which the Harvard measurement is retained. A lettered sequence replaces the numbered sequence for S Sct. Tycho is adopted for the new S Sct sequence which drops old comparison star 10 and adds new comparison star Z.

311.01 **RT Cnc**

This 6 degree field chart replaces chart MDT 1972 Jul 29. Comparison stars C, F & G are dropped and comparison star N is added. The new sequence consists of V measurements from Tycho and Miles. The previous sequence used was poorly calibrated below magnitude 7.5.

312.01 **W & RW Cep**

This 6 degree field chart replaces chart MDT 1983 Oct 01. Comparison stars C, F, J, K & L have been dropped and comparison star P has been added. Tycho is adopted for the sequences of both stars.

315.01 **SS Cep**

This 6 degree field chart replaces chart MDT 1972 Nov 04. Comparison stars A, C, F & G have been dropped and comparison stars H, K, L & M have been added. Tycho is adopted for the sequence.

108.03 **SV & CE Lyn**

This 9 degree field chart replaces chart 108.02. The only change to the previous chart is that the sequence for CE Lyn is extended at the faint end to include comparison star W.

094.02 **AG Peg**

This 6 degree field chart replaces chart 094.01. Comparison stars B, C, E, F & I are dropped and Tycho is adopted for the sequence.

102.02 **ST UMa**

This 9 degree field chart replaces chart 102.01. Comparison stars D, E, G (variable), H & K are dropped and comparison star N is added. Tycho is adopted for the sequence.

Polars

314.01 **V884 Her**

No BAA VSS chart previously existed for this star. A 10 minute field chart has been drawn which includes a V sequence from Pickard.

313.01 **V2301 Oph**

No BAA VSS chart previously existed for this star. A 15 minute field chart has been drawn which includes a V sequence from Pickard.

Active Galactic Nuclei

309.01 **3C 66A**

This 20 minute field chart supercedes TA chart TA931105. The sequence is extended at both the bright and faint ends and now adopts V measurements by Henden.

310.01 **S5 0716+71**

No BAA VSS chart previously existed for this bright circumpolar blazar. A 15 minute field chart has been drawn which includes a V sequence from Villata and Perugia.

Thanks are due to Roger Pickard who drew the charts for V884 Her and V2301 Oph.

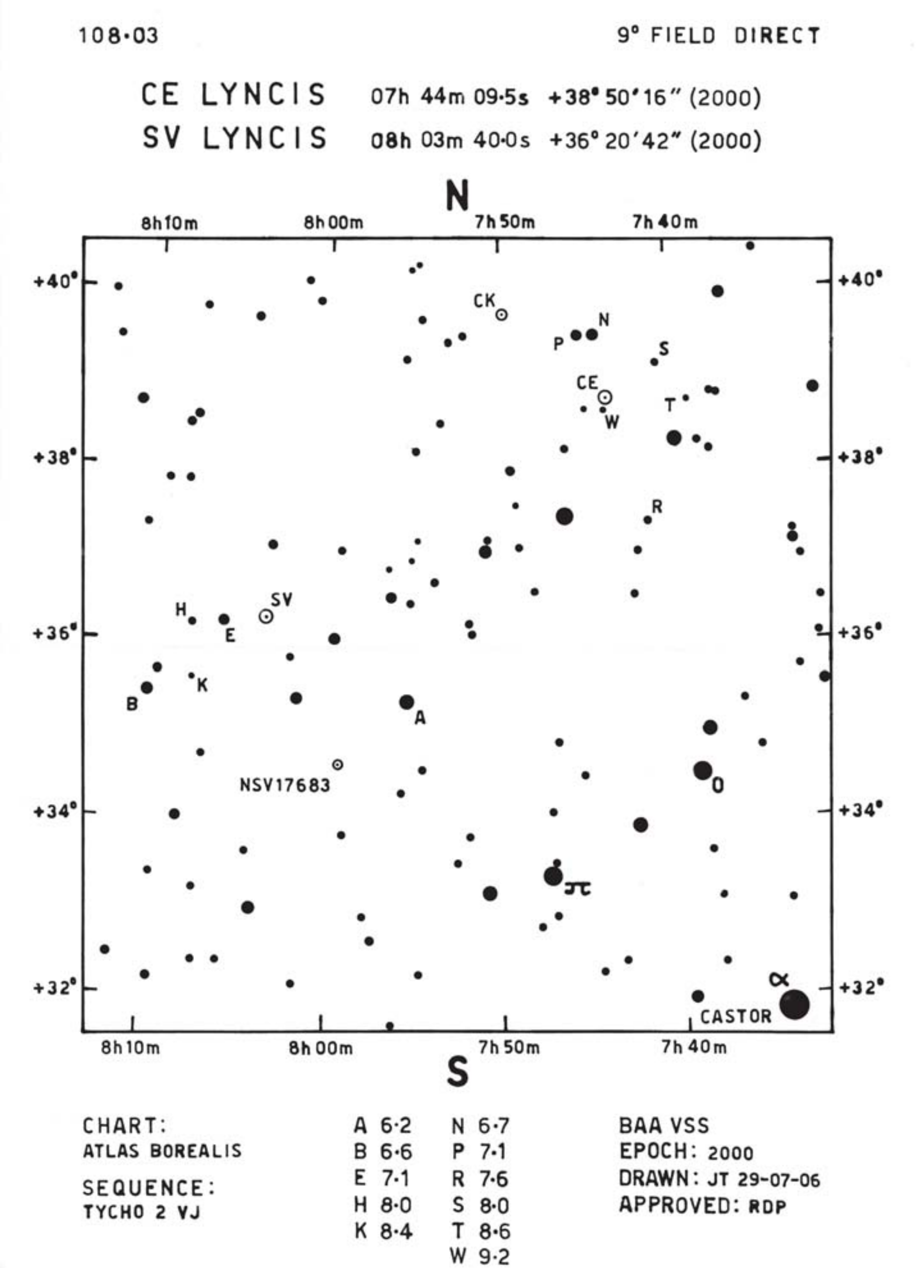
CE LYNCIS

JOHN TOONE

CE Lyncis is a bright red giant variable star classified as type SRb in the GCVS. It was added to the Binocular Programme in 2006 (see VSSC 127, page 2) on the basis that its range according to Hipparcos was greater than many other red stars on the existing Binocular Programme. A Tycho sequence was prepared and added to the updated SV Lyn chart (see VSSC 130, page 7). I began regular monitoring in November 2006 and the star declined marginally from mag 7.8 to mag 8.0 by June 2007. Following solar conjunction it has further declined from mag 8.4 in September 2007 to mag 8.7 in November 2007. The faintest star on the initial sequence was T at mag 8.6 so the sequence has now been extended at the faint end to include W at mag 9.2. The slow but steady decline of nearly a magnitude in 12 months indicates that if the SRb classification is correct then it is likely to have a rather long period. Those binocular observers who have not yet taken up this star are urged to do so.

NEW CHART

John Toone



SV LYNCIS LIGHT CURVES 1971 - 2007

MELVYN TAYLOR

SV Lyn: Observer list

Albrighton, Allen, Barry, Clayton, Coady, Currie, Day, Evans, Fraser, Gardner, Gavine, Good, Gough, Henshaw, Hoenig, Hornby, Horton, Hufton, Isles, Jobson, Johnston, Keenan, Livesey, Markham, McCalman, Middlemist, Munden, Nartowicz, Pickup, Pointer, Poxon, Quadt, Ramsey, Robinson, Saunders, Spooner, Taylor, Toone, West, Young, Young, Yusuf,

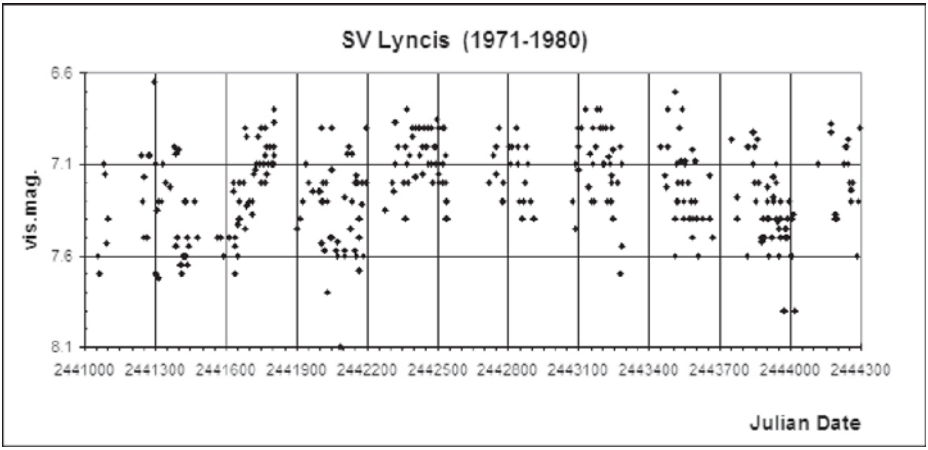


Figure 1

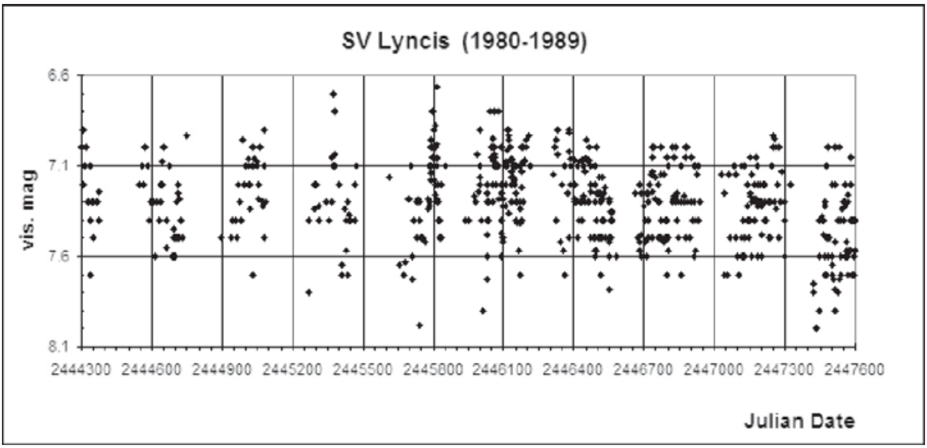


Figure 2

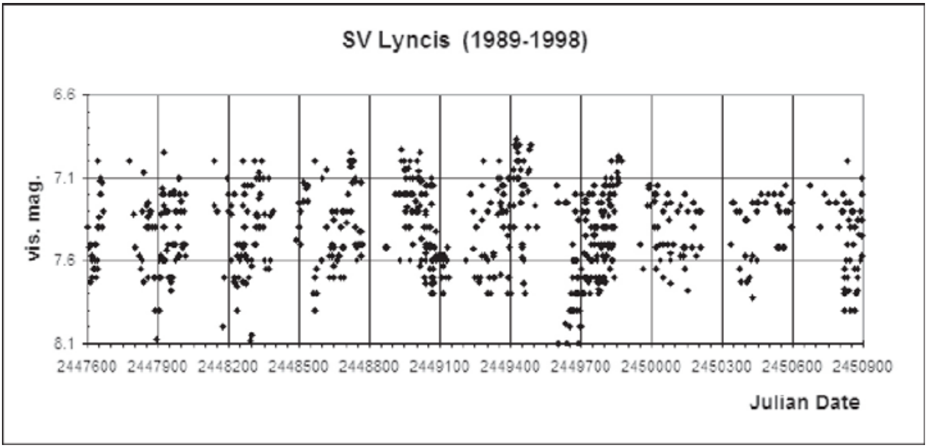


Figure 3

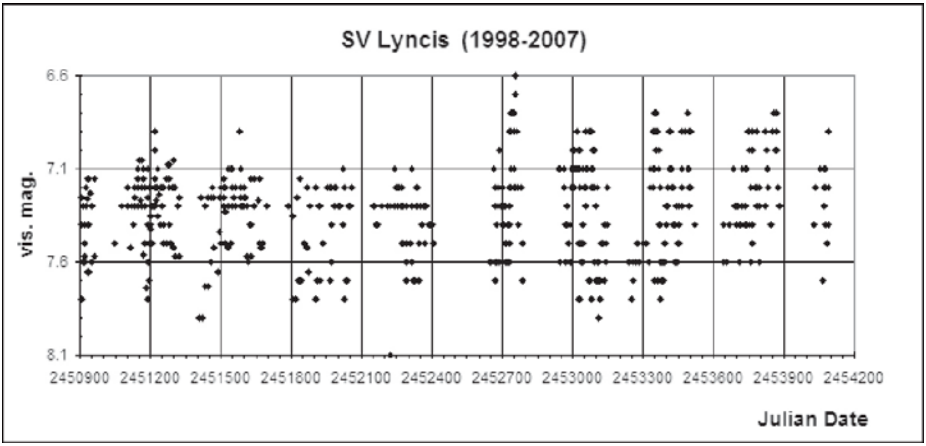


Figure 4

RUTHERFORD APPLETON LABORATORY VSS MEETING 2006

We have to thank David Boyd, Dr Peter M Allan, and Dr Chris Lloyd, speakers at our 2006 BAA Variable Star Section meeting, for supplying the following summaries of their talks.

AN INTRODUCTION TO MEASURING VARIABLE STARS USING A CCD CAMERA

DAVID BOYD

This is a short summary of a talk I gave at the VSS meeting at the Rutherford Appleton Laboratory on the 3rd June 2006. If you are interested in exploring this subject further, much more information can be found in the "Beginner's Guide to Measuring Variable Stars Using a CCD Camera" which is published by the VSS and available from BAA sales.

Using a CCD camera for variable star photometry can offer some advantages over visual observing. These include the ability to achieve greater precision (0.01 mag is possible with care), to observe fainter stars, and to produce a permanent and objective record of the observation. However the process of recording images and analysing them takes longer than making a visual estimate so the number of stars observable in a given time will tend to be smaller. Also, an inclination towards using equipment and computers is required which may not be to everyone's taste.

The focus of the talk was primarily on using a cooled CCD camera attached to a telescope, although much of what follows also applies to the use of digital SLR cameras. Cooled cameras generate less noise in the image as noise decreases with temperature. DSLRs have become popular recently as they offer large CCDs and, when coupled with a good lens, can produce stunning wide-field images of excellent quality which are capable of yielding good measurements of the brighter stars.

Besides a camera and telescope, the single most important contributory factor to achieving good results is a stable, driven equatorial mount. A dew heater is essential with SCTs because of the exposed glass at their upper end. A means of setting the clock of the computer controlling your camera to an accuracy of a second or better is also necessary, as this clock is used to obtain the time of each exposure which is recorded in the FITS header for the image. Inexpensive radio controlled alarm clocks, or net-based time sources if an internet connection is available, are convenient for this. FITS is an international standard for recording astronomical data and is used by both amateurs and professionals. Each image recorded is stored in a FITS file, with relevant information about the image stored in the file header. A motorised focuser is helpful for quickly reaching a good focus while watching a sequence of partial images downloading on the computer screen. Most cameras support this focusing method. It is important to monitor focus during an observing session, as falling temperatures slightly change the position of the focal plane of most telescopes causing images to drift out of focus. The use of photometric filters (which are different from those used for colour photography) is recommended to enable magnitude measurements to be brought onto a standard scale. This enables your results to be combined with others to build up a comprehensive picture of a variable star's behaviour.

Unfiltered observations are also useful for certain purposes, such as detecting when cataclysmic variable outbursts occur and measuring eclipse timings for eclipsing variables. In these cases it is less important to know the magnitude quite so accurately. Avoid colour CCD cameras if you are specifically buying a camera for photometry as these have built-in colour filters, which are not the same as proper photometric filters.

A CCD camera is basically a rectangular matrix of pixels in which each pixel collects the photons which reach it and converts these into a digital readout called an ADU (Analogue to Digital Unit) count. An ADU count is therefore, a measure of the amount of light from a star reaching a given pixel in the camera. Various sources of background noise and loss occur in the process, which need to be corrected for to obtain accurate measurements. However if care is taken this is not difficult, and good results can be obtained. A major advantage of CCD cameras over film for measuring star brightness is that CCDs are linear over a large part of their range and therefore the ADU counts they produce are directly proportional to the number of photons collected from the star. However, this linear behaviour tends to break down at the upper end of their range because of the way pixels work. It is therefore good practice to set the exposure length such that the maximum ADU count in any of the pixels within the image of a star you want to measure, is about 50% of the full digital range of the camera. For a 16-bit camera this means keeping the maximum ADU count for the brightest stars below about 35,000. This should also be monitored throughout a long run as improving sky transparency can cause ADU counts to drift upwards.

For best results you should try to match the pixel size of your CCD camera with the focal length of your telescope, in order to achieve good sampling of star images by the CCD pixel matrix. The relevant formula for pixel size is:

Pixel size (in arcsec) = 206 * pixel size (in microns) / focal length (in mm)

Given that stars on CCD images taken in the UK are usually about 3-5 arcsec across, you should aim for a pixel size of about 1-1.5 arcsec, so that enough CCD pixels are included in a star's image, to give an accurate measurement of the total ADU count for the star.

The simplest kind of photometry is called differential photometry. This involves measuring the brightness of both the variable you are interested in, and another star in the image which has a known magnitude. Brightness is measured by adding up the ADU counts for all the pixels involved in the image of each star, and then subtracting the brightness of the sky background which is present in every pixel. This process is called aperture photometry. The total ADU count for each star can be changed into what is called an instrumental magnitude using the formula:

Instrumental magnitude = -2.5 * log10(total ADU count)

The difference between the instrumental magnitudes of the variable and comparison stars is the same as the difference in their real magnitudes. Since you know the real magnitude of the comparison star you can work out the real magnitude of the variable. If you do this for each image you record, and take a series of images, you can produce a plot showing how the magnitude of the variable changes over time. It is very satisfying to do this for the first time with say, an eclipsing binary and see a light curve emerge with a well-defined dip at the predicted time of eclipse, or possibly to detect a deviation from the predicted time indicating that there may have been a physical change in the binary system.

Differential photometry has the advantage that many sources of background and loss cancel out because they are the same for all the stars in an image. However, there are some issues that still need to be considered carefully to get accurate results. These involve removing the background noise generated by the electronics of the camera which is slightly different for each pixel; and correcting for unequal efficiencies of each pixel, for shadowing of some pixels by dust particles, and for any vignetting which occurs towards the edge of each image caused by obstructions in the light path inside the telescope. These effects are corrected by making special images called dark frames and flat-field frames, and using these to calibrate each star image before it is measured. Information on how to make these special images is given in the report mentioned above and in most books on CCD photometry.

We are fortunate in that there are many software packages which the amateur photometrist can use to calibrate and measure their CCD images. Examples include AIP4WIN, AstroArt and MaximDL (type these names into Google for more information). The VSS has created a spreadsheet which takes the output from such packages and produces light curve plots and generates the files you need to report your results to various astronomical organisations such as the BAAVSS and the AAVSO. This spreadsheet is available on the VSS part of the members section of the BAA website at http://www.britastro.org.

My talk concluded with examples of results obtained using CCD photometry, several of which have now been published in the BAA Journal. Figure 1 shows the light curve of the intermediate polar 1RXS J002258.3+614111 which reveals the regular 9.4 min modulation caused by the rapidly spinning magnetic white dwarf primary star. The same period has also been detected in the X-ray emission from this object.

The take-home message from the talk was that using a CCD camera to measure variable stars is fun and, with care, is capable of producing results of real scientific value.

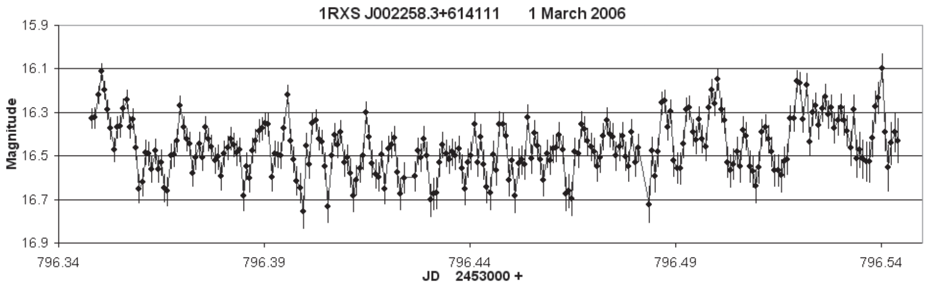


Figure 1: Light curve of the intermediate polar 1RXS J002258.3+614111 revealing the 9.4 min spin period of the magnetic white dwarf primary star.

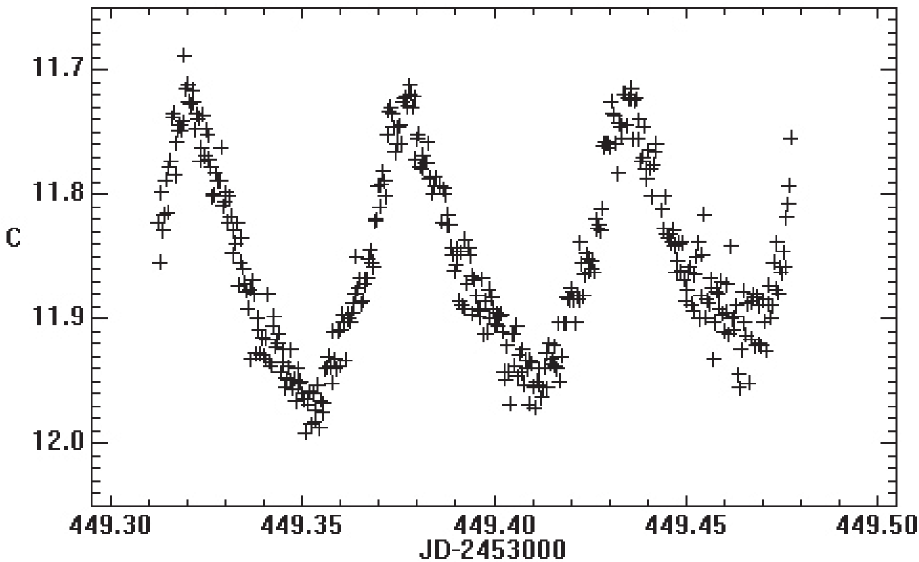
CATACLYSMIC VARIABLES - SOME RECENT EXPERIENCES

Dr Chris Lloyd

The main part of the talk covered two recently discovered dwarf novae, known initially as Bernhard 01 and 02, and included an intriguing item called 'Gary bares all'. The two new dwarf novae were discovered as part of a collaboration with Klaus Bernhard to identify X-ray sources with new variables in the ROTSE-1 database (1). Most of the variables discovered are active binaries like RS Canum Venaticorum or W Ursae Majoris systems, but two turned out to be very different dwarf novae.

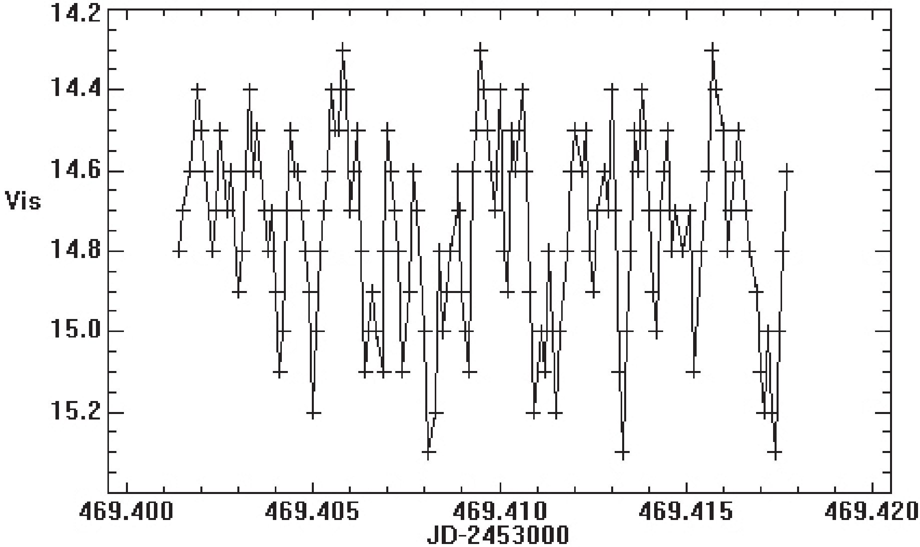
The first one, Bernhard 01 is more properly known by the name of the associated X-ray source, 1RXS J053234.9+624755. It showed three clear outbursts in about 300 days in the ROTSE data from below magnitude 15.5 to 13. Previous outbursts were identified in the Sonneberg Plate Archive and a regular outburst interval of 133 days was found, which allowed following outbursts to be predicted, to some extent. As the discovery paper was published the star went into a predicted outburst but it wasn't long before this became a superoutburst and the Bernhard 01 became a new UGSU system.

Figure 1: Observations of 1RXS J053234.9+624755 by Jeremy Shears near the maximum of the outburst showing strong superhumps.



Photometry by Gary Poyner and Jeremy Shears during the maximum of the outburst showed clear superhumps with a period 0.0561 days but as the system faded a much less regular structure appeared in the light curve. This is known as flickering and is a feature of accretion processes. In dwarf novae it is associated with 'lumpy accretion' onto the hot spot or material leaving the inner edge of the accretion disc. Flickering is an amalgam of lots of little 'flares' occurring on time scales from sub-second to some minutes. They are not periodic or predictable and they do not make the light curve random, but they do leave an imprint on the light curve that allows some global properties to be extracted.

Figure 2: Visual observations of 1RXS J053234.9+624755 by Gary Poyner showing flickering towards the end of the outburst.

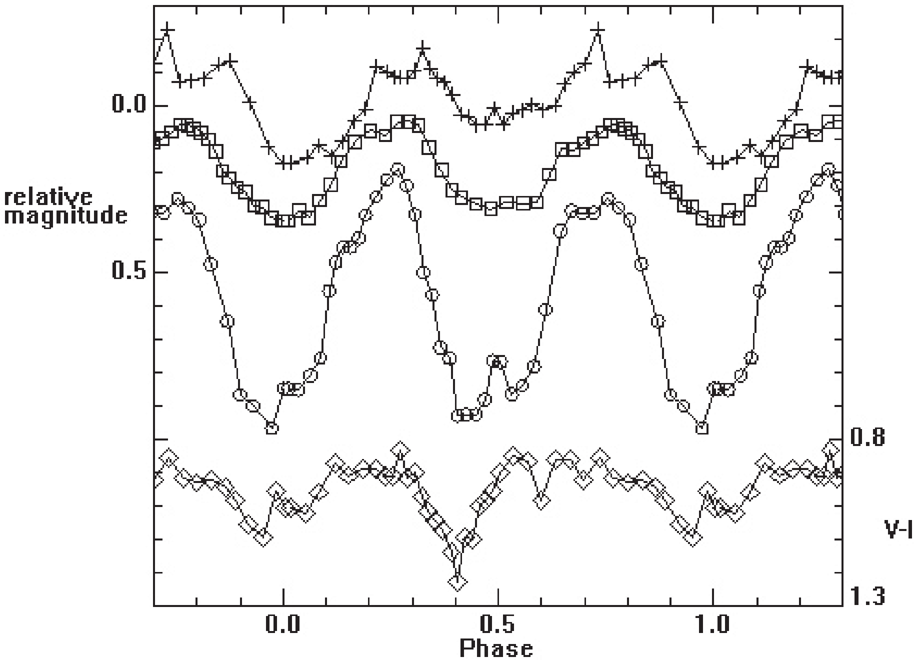


Different classes of dwarf novae tend to have different flickering properties so in some situations it can be used as a diagnostic. Typically flickering is strongest during the late stages of an outburst or during quiescence. In good quality photometry the ‘flickering spectrum’ can be extracted by constructing the wavelet transform of the light curve, which can show the ‘power’ in the light curve associated with different time scales. To see flickering in visual observations requires a strong flickering signature and a high level of skill and concentration on the part of the observer. During the later stages of the outburst Gary Poyner reported seeing flickering in a run of observations made every 10 seconds for 24 minutes. The observations showed a full range of 1 magnitude with a lot of structure, but was it flickering? Quite remarkably the analysis showed a typical flickering spectrum at short time scales and although this broke down at longer time scales, probably due to observer fatigue, it is still an incredible achievement.

The second new dwarf nova Bernhard 02 aka 1RXS J224342.3+305526 is a very different object and shows very repeatable cyclic variations between magnitude 16 and 13 every 16 days or so. Alternate cycles have different shapes being broad/narrow and bright/faint like a number of Z Camelopardalis systems. Superimposed on this variation is a large orbital hump which has an amplitude of 0.8 magnitudes at outburst minimum reducing to only 0.04 magnitudes at maximum. This variation can be explained by the orbital variation being diluted as the system brightens during the outbursts.

It seems most likely that the system is unusual in showing an orbital double hump with a period of 0.422 days, which means that the cool star makes a significant contribution to the total light of the system at minimum. The system also shows large changes in colour becoming much bluer as it brightens, which is as the hot spot dominates the light curve. The large orbital variation also suggests that this is a high-inclination system although there are no signs of eclipses.

Figure 3: The orbital variation of 1RXS J224342.3+305526 showing (from the top) the light curve at the peak of the outburst (amplitude multiplied by 4), at the mid level, and at the minimum of the outburst cycle. The bottom plot show the orbital variation in V-I at outburst minimum, which is dominated by the ellipsoidal variation of the cool star. Observations provided by Klaus Bernhard, David Boyd, Jim Jones and Jochen Pietz.



Two other known but poorly observed and potentially interesting systems were briefly mentioned. V1316 Cygni has become known for its low-amplitude brief outbursts, which seem to be a common feature of the system. Since the talk it has been shown to be a UGSU system. The other curious dwarf nova mentioned was V1363 Cygni which doesn't seem to show any outbursts at all, but seems to waft up and down in brightness with a casual disregard for what a dwarf nova is supposed to do.

1. ROTSE-1 Telescope of the Robotic Optical Transient Search Experiment.

THE UK VIRTUAL OBSERVATORY

Dr Peter M Allan
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Abstract

Modern astronomical observatories, whether on the ground or in space, are currently delivering unprecedented amounts of data. It is already a challenge to deal with all the

data we currently have and the rates are only set to increase in the future. The solution that is being adopted across the world is to build a virtual observatory that will provide easy access to astronomical data archives from your desktop computer. Within the UK, we are building AstroGrid. This is the infrastructure for a UK virtual observatory that links into similar systems around the world. AstroGrid has set out to tackle some of the most demanding, yet most necessary, tasks that are needed in order to help astronomers extract the maximum science from the data.

What is the problem?

Traditionally, things change fairly slowly in astronomy. However, it is becoming more important to be able to respond rapidly to sudden events. Discovering supernovae in distant galaxies and then measuring their spectrum while they are bright enough to do so is a now a standard method of measuring the expansion of the universe. It has led to the discovery of dark energy that is making the expansion accelerate rather than slow down, as was previously expected.

Gamma ray burst sources are a relatively recent discovery which need immediate follow-up observations in order to understand their nature. The ability to connect data sources from around the world in a coherent manner via the virtual observatory enables follow-up observations to be organised much more rapidly than in the past. Furthermore, it has been true for some time that astronomy is largely a multi-wavelength enterprise. Whilst an individual astronomer may concentrate on observations made in a given wavelength regime, it is generally necessary to use observations from many wavelength regimes in order to understand the physics of the objects. Any one astronomer is likely to be much more familiar with data from some wavelengths than others, and so will be able to locate and use data from some sources more readily than others. AstroGrid is designed to help with the process of finding data sources with which an astronomer was previously unfamiliar, and to ease the process of obtaining and using those data.

These two situations are illustrated by the two figures.

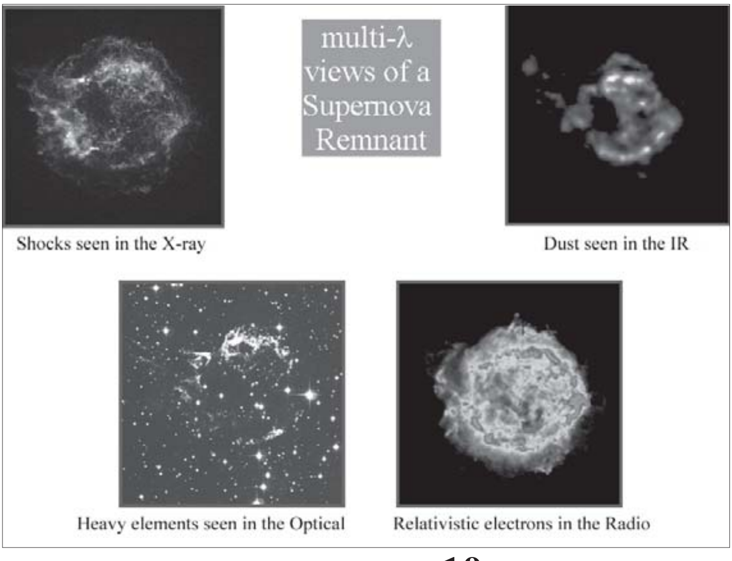
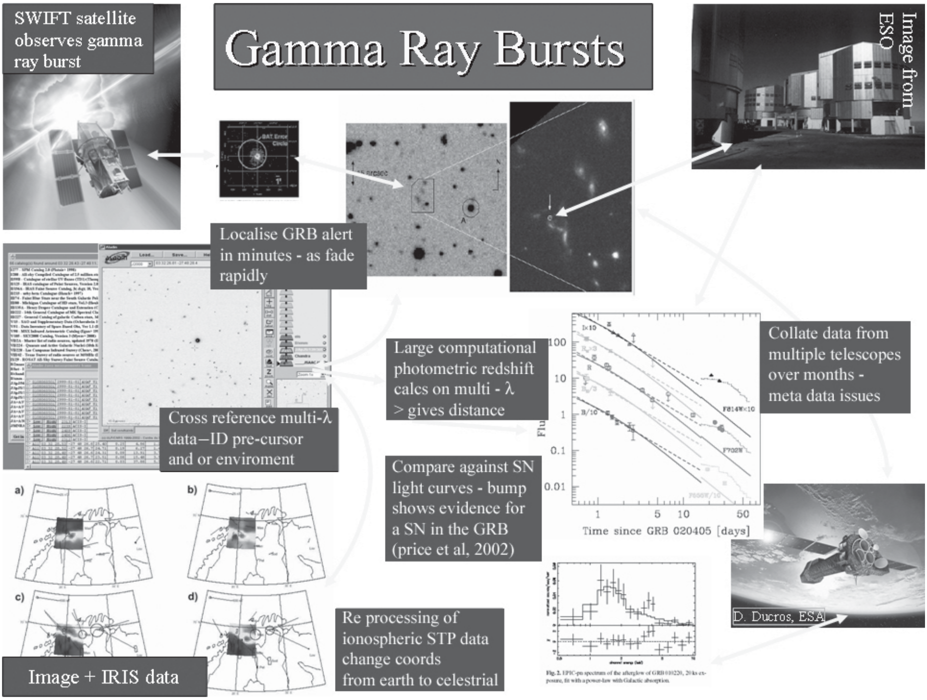


Figure 1:

Supernova remnant seen in different wavelengths

Figure 2



What do we need?

The professional astronomer needs access to large amounts of diverse data. Data from all major observatories are archived for later use and the data are accessible via the internet. Astronomers need to be able to find the data, to select the data that are of interest to them and to access the data in the archives. They then need to process the data using sophisticated algorithms and to have the result presented on their desktop computer in order to extract the best science.

Much of this was possible before the virtual observatory. However, it could be very tedious and time consuming to obtain all the data that are necessary to answer a particular scientific problem. The effort of undertaking a serious research project meant that it was only practical to do projects that had clearly defined goals with clear results expected. A key requirement is to be able to automate the entire chain of obtaining data, processing the data, and presenting the results, so that the computer can be left to get on with the task. By greatly improving the access to all sorts of data, the virtual observatory will make possible investigations that were previously impractical. The goal is to be able to get results to scientific questions in minutes, not months.

So how does this work?

The key concept behind making the virtual observatory work is the development of international standards for how astronomical data centres should make their data available to the outside world and software that conforms to these standards. Observatories generate data that are archived in data centres using standard data formats. The existence of these data is published by the data centres in well known on-line registries of data collections. The individual virtual observatories provide means of locating the data that you want – a bit like finding a book using Amazon. Once you have found the data that you want, you can download it to your own on-line storage in your virtual observatory.

Can I try it?

The AstroGrid software is available from *www.astrogrid.org*, along with a more detailed description of the project and some tools to use for analysing data. The software for individual astronomers to use can be downloaded to your own computer, or even tried out on-line as Java applications so you can try them before installing them. In addition, there is the software that is used to provide access to data. This comes as various components, allowing you to create a data source of varying degree of sophistication, depending on your needs. Using these, you can make your own data part of the virtual observatory. While it would be unwieldy for lots of individuals to set up data sources, it is perfectly sensible for a community of like minded individuals to set up a shared data repository.

Towards a virtual sky

The concept of a virtual observatory is an excellent way of locating data on objects that have already been observed. There are several all-sky surveys that will be easily accessible via the virtual observatory. The Sloan Digital Sky Survey (*www.sdss.org*) is systematically mapping a quarter of the entire sky. The Large Synoptic Survey Telescope (*www.lsst.org*) will survey all of the sky visible to it once every three nights. This will be an excellent source of data on variable objects. Yet despite these great advances in surveys, there will always be observations that are needed that are not in the archives.

While astronomers will continue to have observing campaigns at telescopes, the virtual observatory opens up the possibility of integrating robotic telescopes with the data archives. Recent experiments with robotic telescopes have shown the value of such systems. The Liverpool Telescope (*telescope.livjm.ac.uk*) is an example of a robotic telescope requiring no operator to be present. These telescopes are operated autonomously with pre-programmed observing sequences delivering their results via the internet. The technology now exists for an astronomer to say "I would like this sort of data on these objects". If the data are available from the archives, then they are extracted and returned. If the data are not available, the necessary observations can be scheduled automatically on the most appropriate telescope. The problems with achieving this are largely organisational (should person X be allowed to use telescope Y) rather than technical.

The virtual observatory holds out the enticing prospect of being able to obtain all of the data that an astronomer needs without having to leave their office. However, those who have been to observatories on the Canary Islands, or Hawaii, or in Australia are not completely convinced this is a good thing!

A NEW INFRARED VARIABLE IN SCUTUM

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This new variable lies ~30 arcsec SE of the Recurrent Objects Programme star EU Scuti (Nova Sct 1949). Early confirmation of variability was found in archived unfiltered CCD images, created to monitor EU Scuti for outbursts after JD2453901.

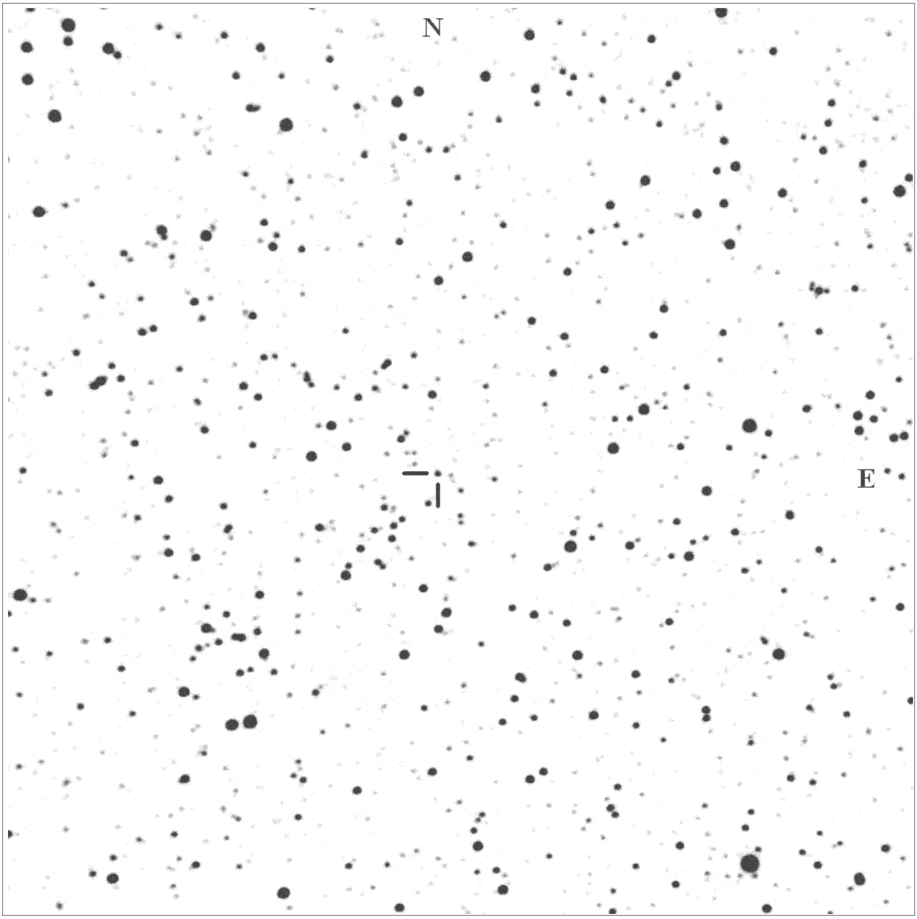

Figure 1: The New Variable at Magnitude 15.52C on October 9, 2007 at 1940 UT. Exposure 450s (Binned 2x2). Field 11.8'x11.8'

The object's position was accurately determined as RA 18:56:14.79 Dec - 04:12:49.0 (J2000) and identified as USNO-B1.0 0857-0425370 = NOMAD1 0857-0480702 = CMC14 185614.8-041249 = DENIS J185614.8-041249. It is also likely to be the infrared source IRAS 18535-0416 = MSX6C G029.7261-02.9881, with catalogued positions 7.5 and 1.8 arcsec distant respectively from the position found. No bibliography was found in SIMBAD and no matching object was found in the principal catalogues for variable stars. The object appears to be an unknown variable which radiates most strongly in the infrared.

Rs and Is band observations were begun during the second unfiltered minimum around JD2454325, and V band observations were carried out on JD2454404 and JD2454410, but no attempt was made to put these measurements on the standard system due to the redness of the star. Instead, comparison star 140 (13.958V+/-0.000) on the AAVSO 041128 (f) chart for EU Sct = DENIS J185629.3-041307 (13.5R+/-0.26 and 12.685I+/-0.02) was chosen as the comparison star for differential photometry. The resulting unfiltered (C), V, Rs and Is estimates have typical errors of 0.03, 0.12, 0.33 and 0.05 magnitudes respectively.

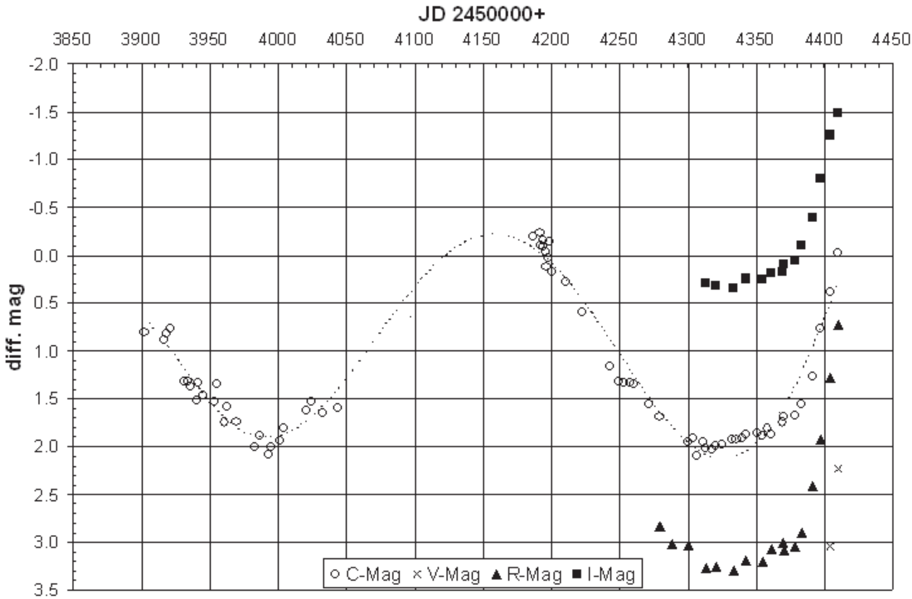

Figure 2: C, V, Rs and Is Band Observations of the New Variable.

This object could not be observed while it passed behind the Sun, from mid November 2006 until mid March 2007, so a trend line for the unfiltered observations was plotted to bridge that gap. The trend line displays a range of ~2.3 unfiltered CCD magnitudes and a period of ~335 days before the second unfiltered minimum.

More observations over a longer time frame are needed to fully establish the nature of this object, but the colour of the star and the amplitude and period of its light variations indicate that it is most likely to be a Mira-type. The largest Mira stars can be so heavily obscured by gas and dust that they are sometimes almost invisible in the optical part of the spectrum, but very conspicuous in the infrared. If this is a Mira-type its variations in V will be much greater than those in the near infrared. (Percy, J. R.)

Stumbling across an "invisible" variable has been a powerful reminder that unfiltered CCD photometry can be very misleading.

Equipment used: 0.35m SCT, SXV-M9 CCD prior to JD2454045, SXVF-H16 CCD after JD2454185 and Schuler VRsIs filters.

Acknowledgements

The author is grateful to Gary Poyner and Roger Pickard for carrying out independent searches which showed that this object was unlikely to be a known variable. This research also used the SIMBAD database, operated by the CDS at Strasbourg, France.

Reference

Percy, J. R., Understanding Variable Stars, 216, 211.

THE LIFE AND TIMES OF CHARLES FREDERICK BUTTERWOTH, F.R.A.S.

Gary Kewin

It was Melvyn Taylor and Glyn Marsh who informed me that Charles Butterworth had lived on the Isle of Man so I thought I would investigate the background to this outstanding but often forgotten astronomer. I have been reliably informed that the person in the picture below taken at Stoneyhurst College, Lancashire in 1922, is Charles Butterworth.

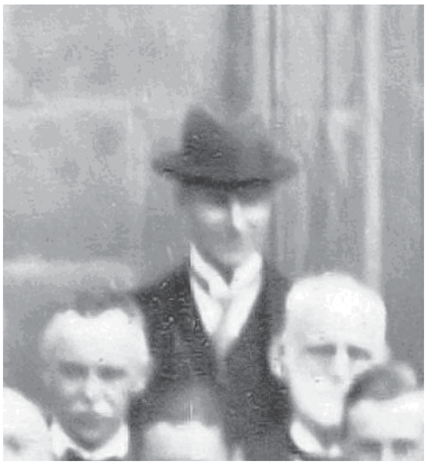

Figure 1:

Photo of Charles Frederick Butterworth

reproduced with permission from Manchester Astronomical Society

Charles Frederick Butterworth was born on the 29th November 1870 in Barton Upon Irwell, a district of Manchester. His parents, Francis Joseph & Jessie Butterworth, were in the cotton industry. His father was a grey cloth agent, cotton is naturally grey before it is bleached white hence a grey cloth salesman. Francis Joseph Butterworth was doing very well out of the business. So much so, he was able to employ a cook from the Isle of Man called Mrs Watterson, whilst they had a house called Mayfield Mansions in the Whalley Range district of Manchester. Charles had one younger brother (by two years) called Josepth Francis, who went on to become a warehouseman working for their father.

When Charles Butterworth left school he wanted to study chemistry, but owing to his father wishes he entered the cotton trade at fifteen years of age, to learn the business, from the factory floor. He later went on from a grey cloth salesman to become a cotton manufacturer in later life.

His Interest in Astronomy started because he suffered chronic insomnia so he would often go for long bicycle rides at night where he spotted many shooting stars. His only regret was that he had not started 20 years earlier in astronomy.

In 1887 at the age of seventeen he was a founder member of the Societe Astronomique de France but it was not until 1910 that he joined the British Astronomical Association. In 1911 he joined the Manchester Philosophical & Literary Society and in 1918 he was elected a Fellow of the Royal Astronomical Society. During 1913 to 1920 he was a member of the BAA Spectroscopic Section where he contributed several papers on work that he had done with a prismatic camera on Gamma Cassiopeiae, Mira Ceti and Comet Delavan (1913f). His most productive work however, was as a variable star observer spending long hours studying and reporting observations to the BAA Variable Star Section.

In 1897 he built an observatory (12 feet in circumference) at Waterloo in Poynton, Cheshire. The principle telescope that he used was an equatorially mounted 6 inch Grubb refractor but he also used 10 inch and 15 inch reflectors from time to time but never after 1927.

This is all that remains of his observatory in Poynton today, a circular patch of nettles.

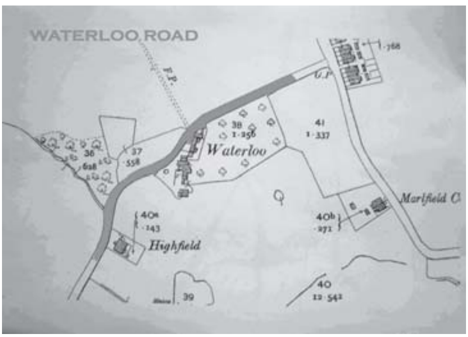

Figure 2:

Author's map showing Waterloo where Charles built an observatory.

Figure 3:

Circular bed of nettles where Charles's observatory stood. Photo taken by the author.

An example of Butterworth's work for the BAA VSS is shown below. S Persei is a semi-regular type variable in the Sword Handle. Its catalogued extreme magnitude limits are 7.9 to 12.0 with an average period of 822 days. The SRc status certainly shows in the variations and the double maxima are particularly interesting.

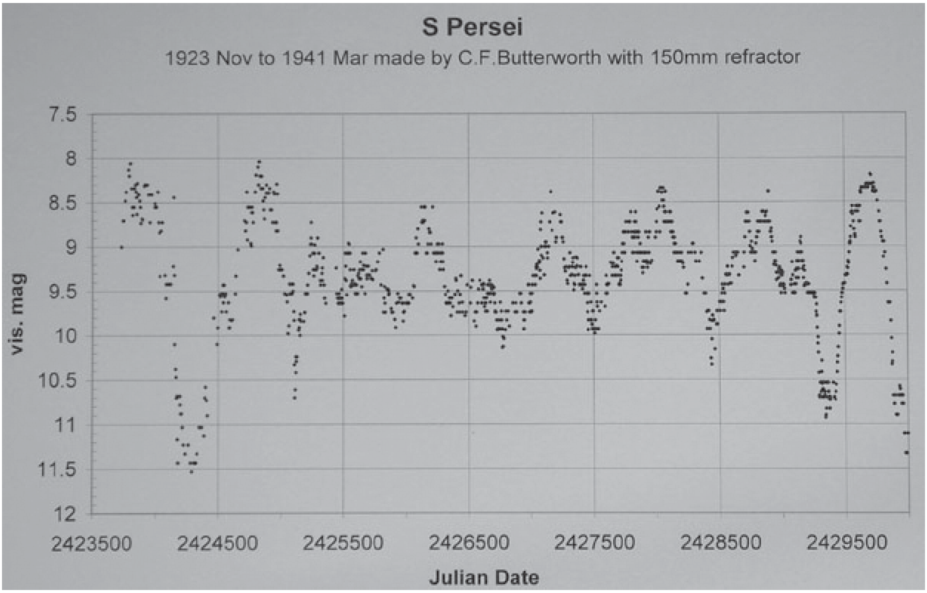

Figure 4: S Persei light curve made from observations by C. F. Butterworth from November 1923 to March 1941.
Observations are from the BAA VSS database

His observations of long period and irregular variable stars were sent to the BAA Variable Star Section and during the years 1911 to 1941amounted to just under 80,000. Some 30,000 observations of other variable stars not on the BAA VSS programme were submitted to the AFOEV. It is believed that overall Butterworth's total number of variable star observations was 105,000 when he ceased observing in 1941. This is a staggering amount of observational work sustained over a thirty year period and was a record figure for the time.

In 1927 Butterworth was awarded the Abbot Silver Medal from the University of Lyons. In 1928 he was awarded the Palmes d'officier dei'Academie, from the president of France. In 1941 he was the second person to be awarded the Walter Goodacre Medal and Gift from the BAA.

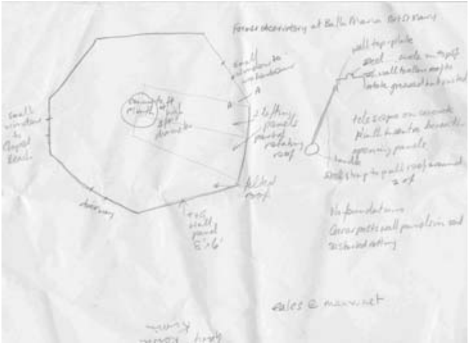

Figure 4:
Plan of observatory given to the author

Figure 5:
Butterworth's observatory in Port St Mary

In 1927 he decided to retire to Port St Mary on the Isle of Man where he purchased a house for £900 and called it Beach Villa. A short time later he established an observatory that may have been transferred from Poynton. A photograph and the plans for the observatory can be seen above. This observatory enabled him to continue his variable star work for an additional fourteen years into his retirement. In addition to his astronomy he bought a yacht which he sailed from Port St Mary. Also he was also a keen ornithologist, a musician (he had a fine set of Italian instruments) and was adept at growing roses. The account of the award made at the 1941 BAA meeting (Journal 52 (1) indicates that Harold Thomson received it for him because Butterworth himself could not take the three day journey to London. The report also advises that his first wife Margaret had died recently and Butterworth himself had a bad leg and could not easily travel. Erika Johana Henrietta Fruhling, a German nurse who had been interned in a women's camp in Port St Mary, had been released so that she could nurse Margaret Butterworth in her final days. A year later in February 1942 Butterworth married Erika Fruhling in Brentford but could not move back into Beach Villa because it was within a wartime protected zone. They spent the remaining war years living in a friend's house named Avondale in nearby Colby. Happily Charles Butterworth returned to Beach Villa in 1946 where he died aged 75 on 22 September and was buried alongside his first wife Margaret.

I wish to thank the following persons who have assisted me in my research into Charles Butterworth:

Melvyn Taylor and Glyn Marsh for telling me about John Toone's talk at the BAA VSS meeting in 2004.
Tony Cross from the Manchester Astronomical Society
Emile Schweitzer of the AFOEV

Without the willing support of the above persons I would not have progressed as far as I have.

A HARD DAY'S NIGHT: DAY-TO-DAY PHOTOMETRY OF VEGA AND BETA LYRAE

RICHARD MILES

In the December issue of the Journal (Observers' Forum, p.278) I gave an account of an initial sortie into the world of 'daytime' observation of stars and planets having been provoked into trying this by the bad run of weather during May-July. There I alluded to photometry of the variables, Betelgeuse, ε Aurigae and β Lyrae, including a couple of images of the latter taken at 18:25 UT and at 04:44 UT, i.e. *before* sunset and *after* sunrise. I also wrote a short letter which appeared in the last VSSC issue (No.133, p.4) highlighting the possibility of daytime photometry and promising to undertake this at the next opportunity. Well, here is a summary of how I got on.

The hardware used to observe in daylight comprised a Takahashi FS60C refractor (60mm aperture) in front of which is placed a 50mm x 50mm glass neutral density filter having a transmission of 2% to cut down the excess light when imaging the blue sky. The filter was fitted to a 'modified' tin can reducing the aperture to 44 mm as shown in the photograph (Fig.1). A Starlight Xpress SXV-H9 camera fitted behind a V filter served to image the sky.

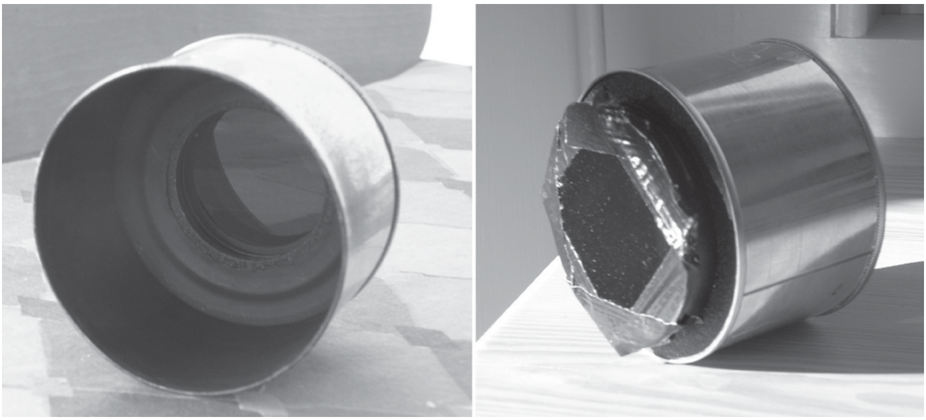

Figure 1: Two views of neutral density filter attached to a 'modified' tin can

The project undertaken was to measure the V magnitude of both β Lyrae and α Lyrae (Vega). In particular, there has been some dispute as to whether Vega is variable or not in the visible. Fernie at the David Dunlap Observatory reported variability of up to 0.04 magnitude (Ref.1). In contrast, Ruban states that Vega's monochromatic magnitudes have remained constant to ±0.01 mag over a period of 16 years (Ref.2).

Carrying out photometry of Vega is difficult, especially using a CCD camera as there is no suitable comparison star in the same field of view unless you use a short focal length camera lens. Vega is also so bright that it is difficult to take an image which avoids saturating Vega whilst underexposing the comparison stars. The best 'nearby' comparison star is γ Lyrae, which lies some 7.6 degrees away and has V = 3.25 and a B-V colour index of -0.05, i.e. similar to Vega and β Lyrae at B-V = 0.00.

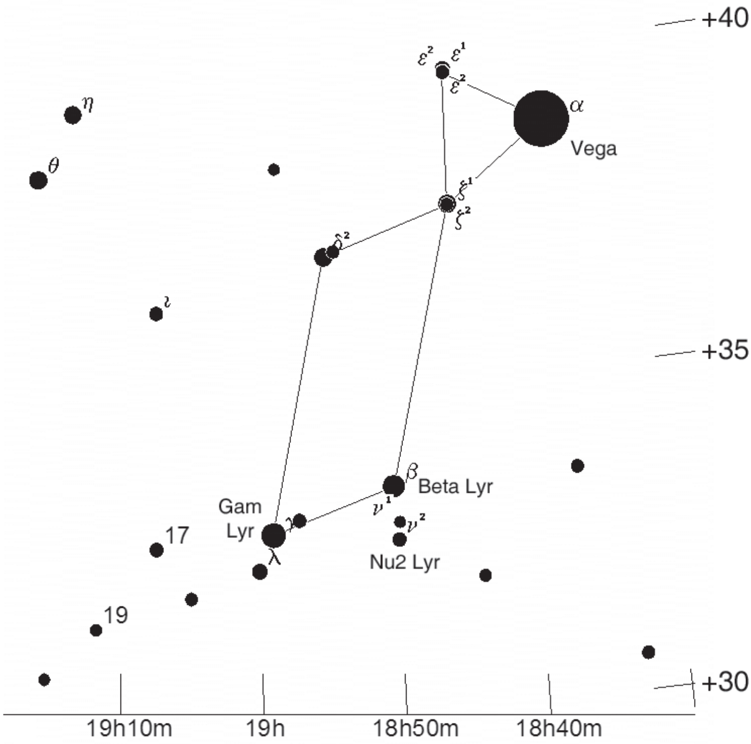

Figure 2: Finder chart

The solution to the problem is to use the CCD to take individual frames of each star in turn - rather like during the old days using single-channel PMT photometers. ν^2 (Nu2) Lyrae was also selected as a check star it having V = 5.22 and B-V = 0.10 (see Fig.2).

To image stars during the daylight hours, the CCD is windowed down to as little as 1/8 x 1/10 of the normal frame size so that the file size is small and the readout time is short (about 0.5 sec per frame saving to the harddisk). Many frames are taken and co-added so that the signal from the star can be maximized. For Vega, 50 x 0.4 sec exposures sufficed whereas the 3rd magnitude β Lyrae required 900 x 0.5 sec exposures. Short exposures are needed to avoid saturating the CCD. As the sun set and the sky darkened fewer, longer exposures were used. After sunset, all 4 stars were imaged in the order; γ Lyrae (Comp.) - β Lyrae - ν^2 Lyrae (Check) - Vega - γ Lyrae … etc. For each star, 10 frames were taken and averaged for each V magnitude measurement. Once dark, exposure times of 10, 12, 20 and 0.5 seconds respectively were used for imaging the four stars.

Weather conditions during the day and soon after sunset were very clear and the air was transparent. Atmospheric extinction (measured in magnitudes per airmass) was initially about 0.2 mag/atm but this increased as the night wore on, as shown in Fig.3. (N.B. Monitoring the extinction coefficient through the observing run involves determining the exo-atmosphere zeropoint value as explained in the Appendix to this note.)

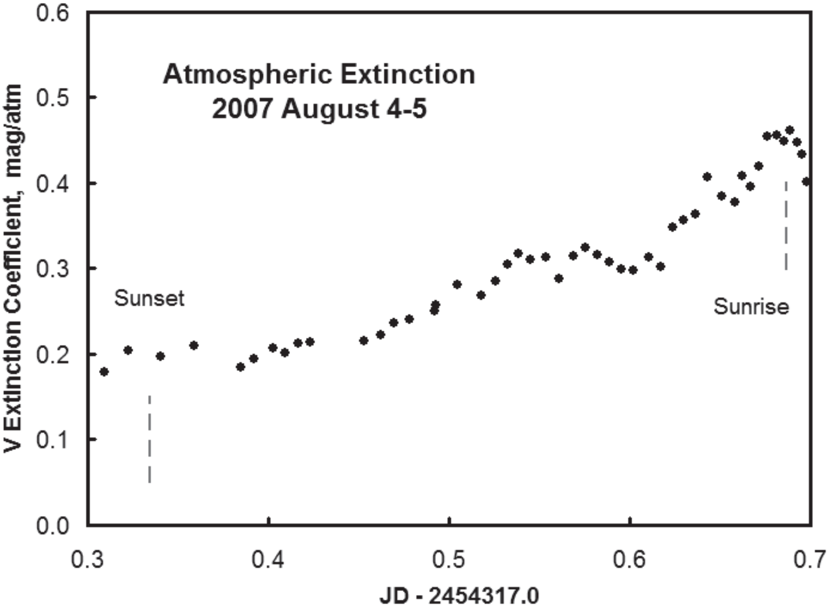

Figure 3: Change in atmospheric transparency during the course of the night

The air became increasingly misty towards dawn with the mist beginning to clear once the sun had risen again. Although conditions were not ideal, a satisfactory lightcurve was obtained of β Lyrae spanning some 9 hours as shown in Fig.4.

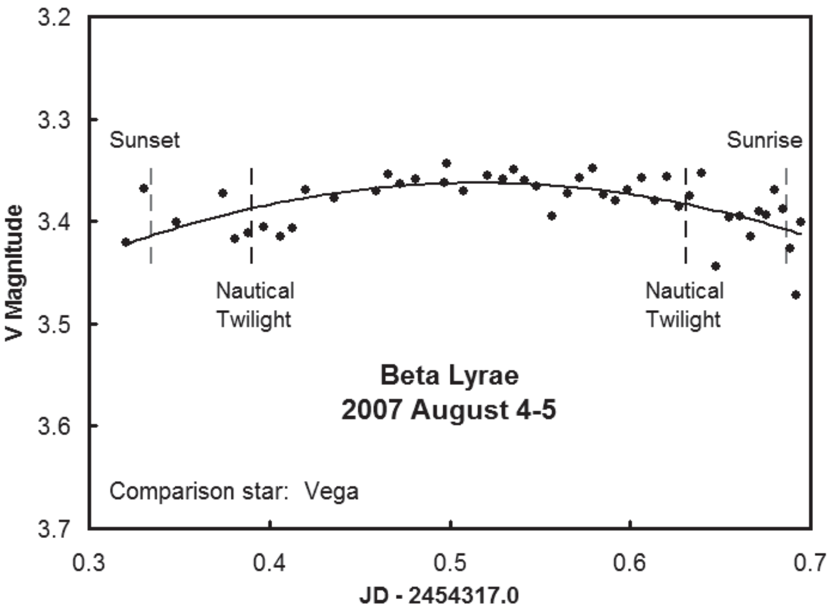

Figure 4: Lightcurve of Beta Lyrae measured relative to Vega (V=0.036)

Here the measures were corrected for airmass differences, which at the start amounted to about 0.03 atm but by the end of the observing session had grown to 0.24 atm as the stars' altitude declined. At the time of observation β Lyrae was near maximum. Note that this star is an eclipsing binary system with a period of about 12.9 days and possesses some unusual features as described by Dirk Terrell in VSSC #132 (Ref.3).

The brightness of Vega itself could be compared to that of the comparison and check stars, γ Lyrae and ν^2 Lyrae. The observed trend was found to be constant (Fig.5) with individual measures exhibiting a standard deviation of 0.012 mag and a mean magnitude for Vega of:

$$V = 0.036 \pm 0.002 \text{ (st. error) at JD } 2454317.5$$

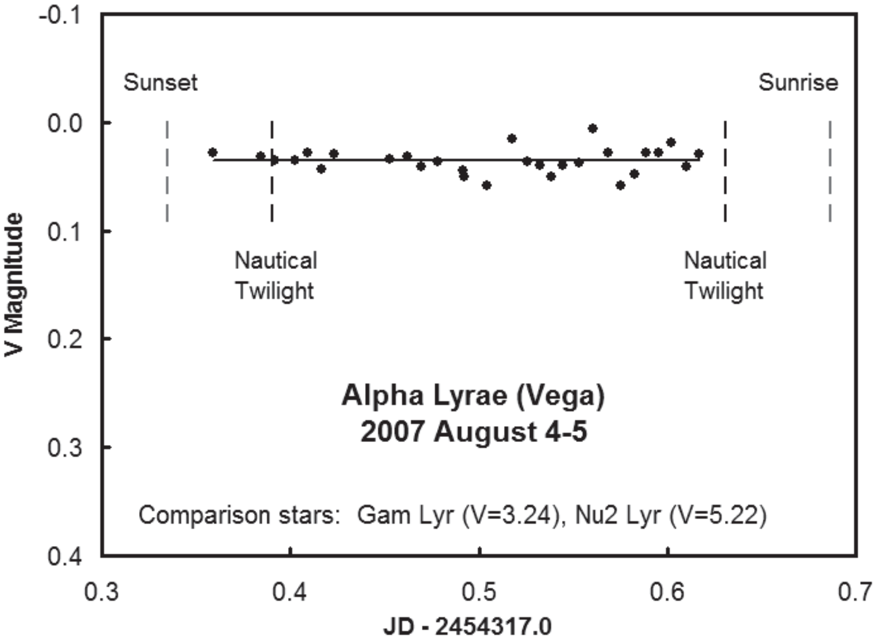

Figure 5: Lightcurve of Vega

The observed difference between the comparison and check star magnitudes was found to be 1.983 ± 0.002 mag.

This type of observation is termed 'absolute photometry' as corrections have to be made to allow for both colour differences between stars (using the transformation coefficient) and for differences in airmass (using the extinction coefficient, which can vary through the night as shown here). Now then, where did I put my sunglasses ....

2007 November 17

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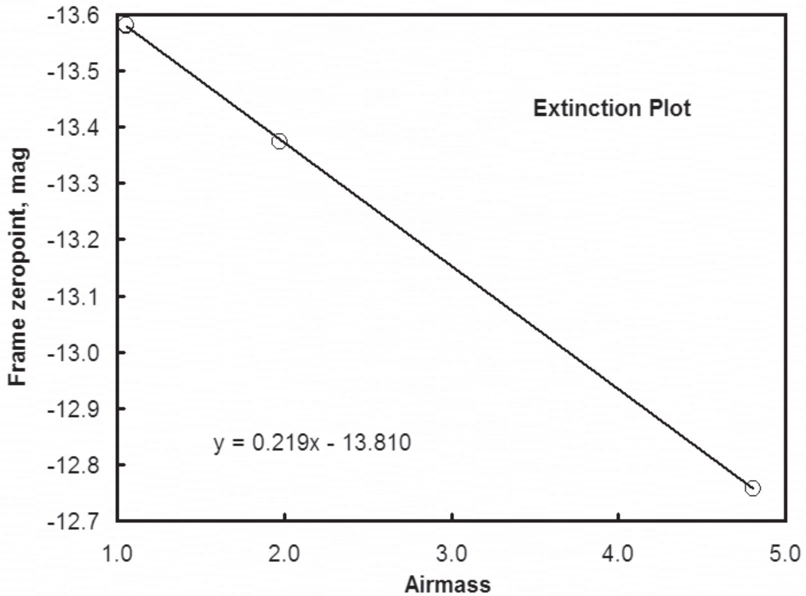
1. Fernie, J.D., Publ. Astron. Soc. Pacific, 93, 333-337 (1981)
2. Ruban, E.V., Astron. Tsirk., 1532, 29-30 (1988)
3. AAVSO Variable Star of the Season Summer 2005 reproduced in VSS Circular No.132, 6-11 (June 2007)

APPENDIX

Figure 6: Measuring the Extinction Coefficient and the Exo-atmosphere Zeropoint, Z_0

Star	V	MJD-2454517	v	v-V-kv*(V-I)	Alt (deg)	Airmass
Gamma Lyr	3.25	0.43421	-10.333	-13.580	71.8	1.053
Nu2 Lyr	5.22	0.43844	-8.356	-13.582	71.5	1.054
Theta Peg	3.52	0.43186	-9.850	-13.374	30.4	1.976
Phi Sgr	3.17	0.42810	-9.592	-12.758	12.0	4.809



The above table and plot summarises the data used to derive extinction coefficient through the observing run. The V magnitudes of reference stars in this study are taken from the Johnson V magnitudes for Hipparcos stars as listed in the planetarium program, GUIDE 8.0.

At 22:14 - 22:23 UT, the telescope was moved to image the stars θ Pegasi and φ Sagittarii and a set of 10 x 20-sec exposures were averaged for each in turn. These stars were selected for constancy and to be at a suitable altitude above the horizon so that change in brightness versus airmass could be calculated. Note that the instrumental magnitude 'v' is calculated from:

$$V = -2.5 * \log (\text{counts for star} / \text{exposure time in sec})$$

The slope of the plot is the extinction coefficient at about 22:19 UT that night. The exo-atmosphere zeropoint, Z_0 is the value of the extrapolated frame zeropoint at an airmass of zero, i.e. as though there was no atmosphere between the CCD camera and the star in question - the next best thing to putting your observatory in orbit! A value for Z_0 = -13.810 was determined. The extinction at any time during the observing run can be calculated by taking the measured value for the instrumental magnitude, v, of a standard star, say Vega, and plugging this into the equation:

$$kv = (v - 13.810) / X$$

Note that from my experience using a small refractor, provided the same hardware setup is utilised, this same coefficient can be employed for several weeks at a time to calculate the extinction coefficient at any particular time by measuring a suitable reference star, night or day.

DELTA CEPHEI, 2007

DES LOUGHNEY

In the last Circular I described a way of doing differential photometry with a DSLR. To explore the effectiveness of this methodology I studied Delta Cephei on a visit to La Palma, the Canaries, in September 2007. On twenty one consecutive clear nights Delta Cephei was imaged twice on each night. The settings for each image with a Canon 350D SLR and an 85 mm lens were an exposure of 1 second, f stop 4 and ISO 800.

Delta Cephei was chosen as an object to study because its light curve is invariable and, as a result, it would indicate the errors involved in the methodology.

The results are recorded on the figure. Each point on the figure represents the average of 10 images using AIP4WIN. As the observations were spread over 21 days three cycles of Delta Cephei (period 5.366 days) were observed.

The magnitudes were estimated using the AIP4WIN photometry tools and the comparison star Zeta Cephei at an assumed magnitude of 3.6.

The observations describe the classical profile of this class of Cepheid although I have not been able to find , in a trawl through the Internet, an instrumental light curve with which the current observations can be compared. The light curve can be compared with the one constructed from visual observations presented on the AAVSO website: < http://www.aavso.org/vstar/vsots/0900.shtml>.

It is suggested that the best way to examine the accuracy of the methodology is to look at the spread of results as the star declines from maximum. This was done by drawing a line through the uppermost observations and a line through the lower and comparing the difference which seems to be about 0.06 magnitude, a deviation of up to 0.03 magnitude either side of a central line.

It is hoped to do similar observations of other Cepheids including Zeta Aquilae and ones with apparently more complex light curves such as Z Lacertae and RW Cassiopeiae. The latter are easily followed all the year round from the UK.

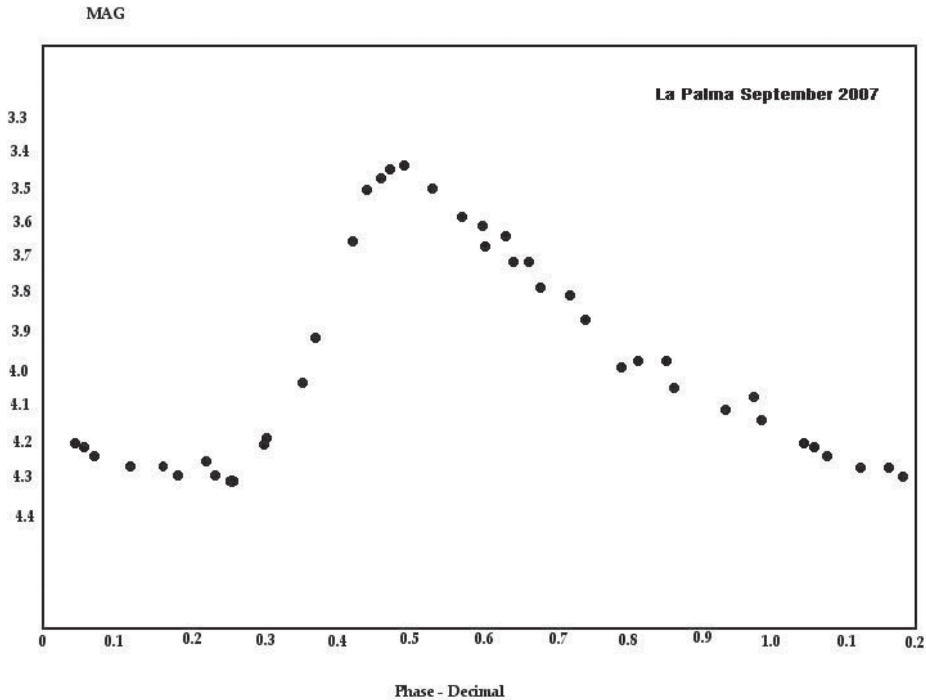


Figure 1: DSLR Differential Photometry of three cycles of Delta Cephei

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THE 2007 AUGUST OUTBURST OF AW SAGITTAE

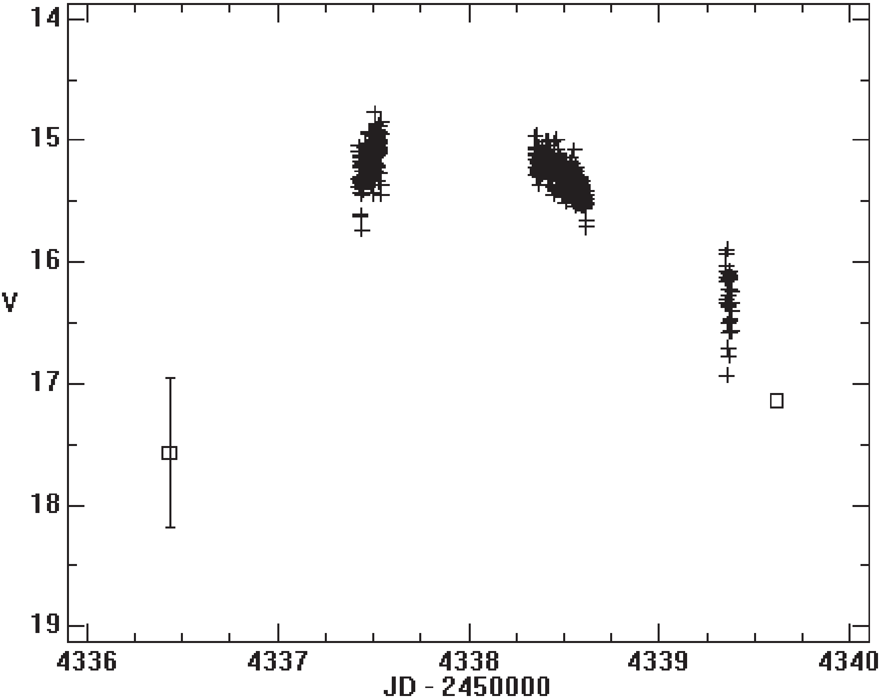
C. Lloyd and R.D. Pickard

AW Sagittae is a faint and poorly observed dwarf nova and is considered to have rare outbursts. In recent times these have occurred every two years but as they reach only magnitude 14.5 it is likely that some have been missed. Apart from the 2006 November superoutburst (Shears et al. 2008) very little has been published on this star and most of the analysis, comments and observations are scattered through sources on the internet, some of which are no longer accessible.

Wolf & Wolf (1906) first reported AW Sagittae as a variable and found it visible at magnitude 13 and 15 in 1901 and 1905, but below the plate limit on five other occasions. The first recognisable outburst was reported by Meinunger (1965) from Sonneberg plates in 1961 October, but this event seems to have passed largely unnoticed. AW Sagittae was first suspected of being a CV by Vogt and Bateson (1982) and was then included in subsequent catalogues. Systematic visual observations did not begin until the early 1990s and the first outburst in recent times was discovered in 1996 by Pietz at around magnitude 15, and this is towards the fainter end of the discovery magnitudes. Since then the star has been seen in outburst in 2000, 2002, 2004 and 2006 (see Shears et al. 2008 for details). The 2000 outburst showed superhumps for the first time establishing AW Sagittae as a UGSU system (Masi and Tosti 2000) and the best-observed outburst to date, in 2006, was also a superoutburst (Shears et al. 2008). On the basis of the timings of the recent outbursts Lloyd (2007) suggested that the outbursts were more frequent than previously thought with an interval near 284 days. An outburst was predicted during July or August 2007 and this was subsequently discovered on August 27 by Pickard (2007).

The observations were made using a Meade LX200 30-cm telescope and a Starlight Xpress SXV-H9 CCD camera from Shobdon Observatory, Herefordshire using V and R filters. On the night before the outburst the star was seen near quiescence with R ~ 17.6. During the outburst the star was caught on the rise at V = 15.3 and brightened to V = 15.1 over the following 3 hours. During this run there is a marginal periodic variation with a period of 0.054(5) days, but this is much shorter that the superhump period and if real, difficult to interpret. The magnitude at maximum was probably V ~ 14.5, similar to previous values. During a longer run on the following night the star faded from V = 15.1 to 15.5, and a short run on the third night found the star at V = 16.3. An unfiltered observation a few hours later put the star at 17.1C (Poyner 2007). The average decline rate was 1.15 mag/day, which is slightly steeper than that seen in previous normal outbursts. Overall the outburst lasted scarcely more than 2 days; it was brighter than magnitude 16.0 for about 1.5 days and brighter than 15.0 for no more than 18 hours. Clearly, these outbursts are very brief and easily missed. According to the ephemeris the next outburst is expected to occur within a month of 2008 May 18.

Figure 1: Light curve of the 2007 August outburst of AW Sge showing the mean of the R observations near quiescence, the steep rise prior to maximum and the subsequent fade, with Poyner's unfiltered observation (open square)



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CY AQUARII 1981-1982

John Howarth

Recently I chanced upon some old observations of the variable CY Aquarii, that I made by eye using an 8 inch reflector back in 1981-1982. CY Aqr was then (and still is) one of the shortest known period RR Lyrae objects, with a period of approximately 88 minutes. The period in days is often given to 10 (!) decimal places which, if nothing else, suggests that it is thought to be remarkably constant. During the autumn of 1981, I made 6 rather scattered obervations, but as a newcomer to variable star observing, I was not very confident about them.

The next year, I remember, Jack Ells of Crayford Manor House A. S. organised a more systemstic observing of the object by several observers independently, with a view to finding out whether we were all actually seeing the same thing, and not just seeing what we thought we should see! I made 100 or so observations during the autumn of 1982, over 6 different nights. Whilst making the observations I was not conscious of any definite periodicity, as I recall, though there was certainly variation. I believe they were eventually submitted along with those of the other observers, but until I stumbled on my own observations the other day, they were just gathering dust!

Anyhow, I decided to analyse them, just to see what they were like, and was encouraged to find that they showed a self-consistent pattern (I don't have the other observers' data to hand). When I made the heliocentric correction, they clustered noticeably better. I finally folded them according to a period of Fu, J.N., 2000ASPC-203-475F, who believed the period was actually increasing by about 0.21 x 10^-8 dy/yr. The folded light curve is shown in Figure 1.

Partly as a result of this exercise, I believe, Jack decided to design and build his Automated Photometric Telescope, which is still in use and producing valuable results.

2007

I observed CY Aqr again a few weeks ago, and despite seeing conditions and my eyesight doubtless having deteriorated over the intervening 25 years, I obtained a shape similar to the Figure and was able to find a clear maximum. The phase was about 0.2 in advance of the 1982 value, but bearing in mind the span of time, this sort of variation would surely be expected. I would wish to observe at least one more maximum before submitting this as a definitive value!

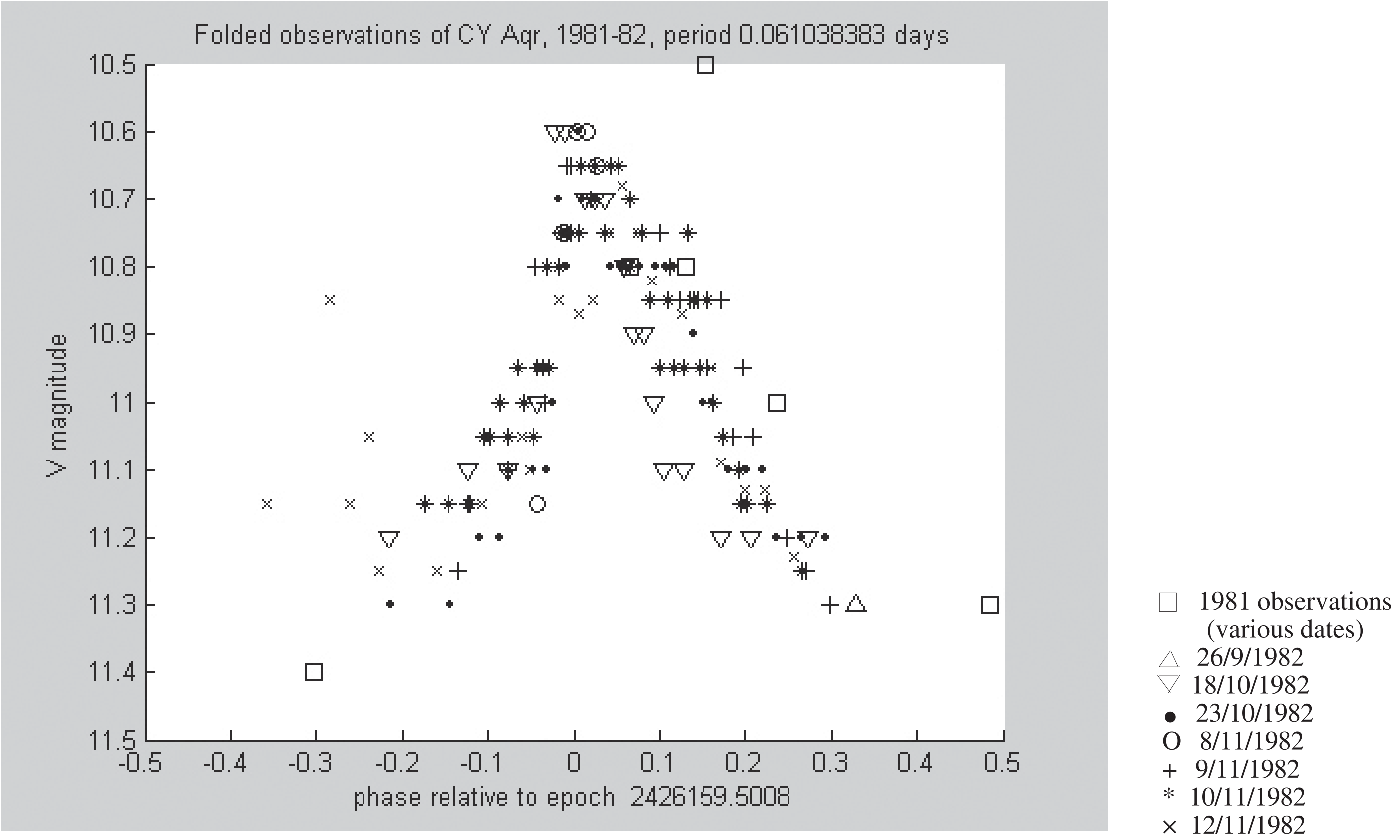


Figure1: Phase Diagram of CY Aquarii from visual observations made during 1981 - 1982 by John Howarth

NEW CHART

JOHN TOONE

310·01 15′ FIELD INVERTED

S5 0716+71 07h 21m 53·4s +71° 20′ 36″ (2000)

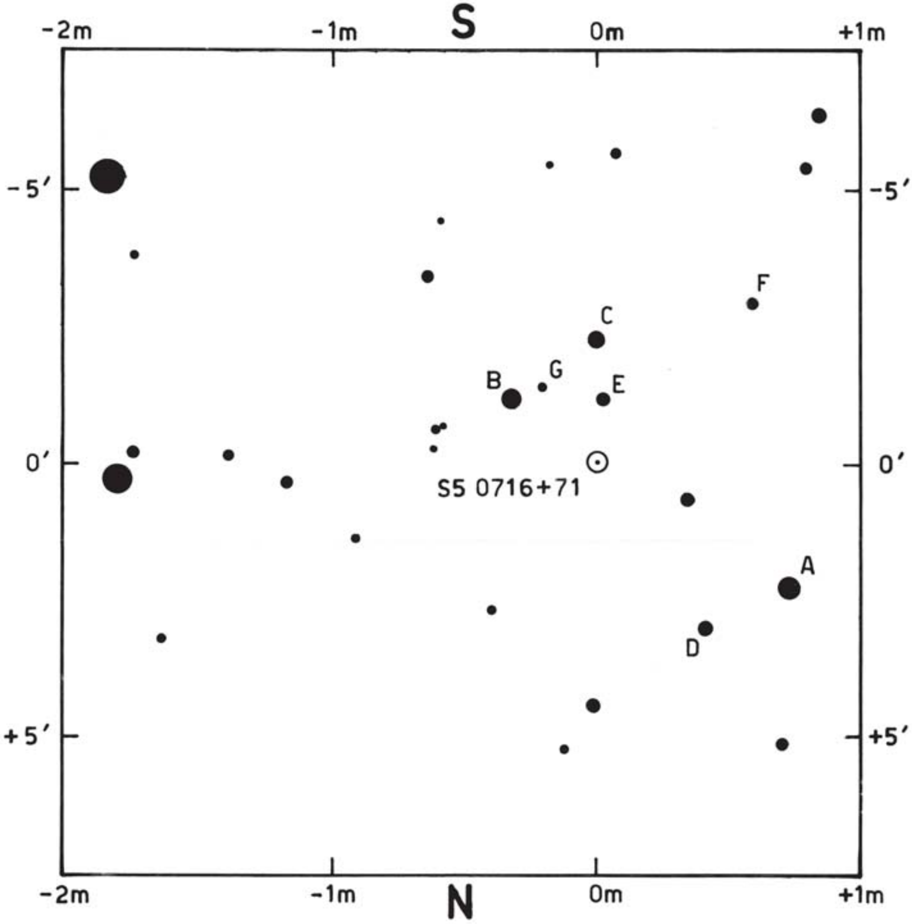


CHART:
GUIDE 8

SEQUENCE:
A–F VILLATA ET AL
G PERUGIA

A 10·99
B 11·46
C 12·43
D 13·19
E 13·55
F 14·10
G 15·02

BAA VSS
EPOCH: 2000
DRAWN: JT 18-09-07
APPROVED: RDP

S5 0716+71 – A MOST ACTIVE AGN

GARY POYNER

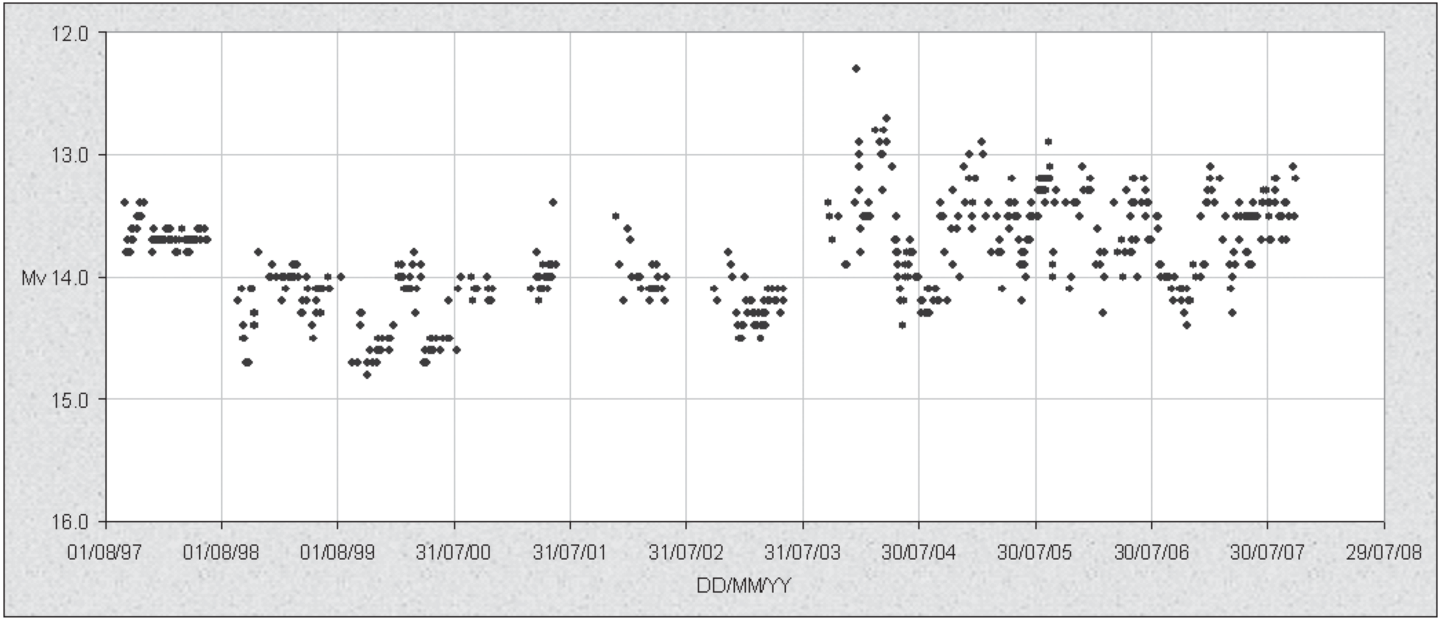
Active Galactic Nuclei (AGN) are some of the most remarkable objects to be observed in the Universe, and a small number of these are favourite targets for amateur Variable Star observers. Amongst the brightest and most active of this group is S50716+71, a Blazar located 5.6 degrees east of the 5th magnitude star TYC 4345 2051 in a rather barren part of the constellation Camelopardalis at RA 07h 21m 53'.5 +71 20 36 (2000.0). It's classification was first noted in the fifth 5-GHz strong source surveys (S5). This survey covers the area between declination 70 and 90 deg. [1] It's redshift is assumed to be as >0.3 [2], although no precise measurement has yet been obtained.

S50716 is classified as a BL Lac object (or Blazar), a subgroup of the AGN which are radio and gamma ray loud, high energy objects, and display the largest amplitudes of all AGN. Blazars generally show featureless spectra, probably due to the high relativistic beaming found in these objects. It's thought that this increased beaming, and associated 'shock waves' occurring in the jet are the cause of the high variability we see in these objects, and with S50716 in particular!

This high variability proves fascinating to observe both visually and with CCD's. S50716 is rarely inactive, and undergoes both 'low states'and outbursts. During March 2004, an historical high magnitude of 12.0 was reached (which began three months earlier in January), triggering many satellite TOO's, especially in the X-ray [3]. Quite apart from periods in outburst, S50716 also shows easy to detect variations in the order of around one magnitude over the course of several days. This phenomenon has also been observed in BL Lac and W Com, but it would appear to be more pronounced in S50716, presumably because of the higher relativistic beaming phenomenon, which is consistent with the 'shock wave jet' model. Since the 2004 outburst, S50716 has proved to be more erratic than ever, with the light curve showing just how much this object has been varying from one night to the next [fig.1]. It would appear that the 'jet' is almost in a constant state of activity!

As with all Blazars, S50716 shows a high level of IDV (IntraDay Variations, first detected in 1986) in both optical and radio. These small amplitude, rapid optical variations can be detected with amateur instruments (in V, R and I), particularly when the object is bright. Less common are reports of optical 'flickering', but this phenomenon has been detected by experienced visual observers [4].

S50716 is an object which will reveal a high degree of variation to both visual and CCD astronomers. It's circumpolar from the UK, and can therefore be observed all year round. The extreme amplitude varies between 12.0-15.0, but more usually 13.0-14.0, and is therefore quite an easy object for 20-30cm telescopes. It's variations will keep the observer very much on his/her toes, and is guaranteed to spring a surprise on anyone who observers it for even a short while.



S50716+71

Ten year visual light curve showing the historically bright 2004 outburst, and the apparent increased activity since that time.

Gary Poyner

1: The 5-GHz strong source surveys. V Survey of the area between declinations 70 and 80 degrees. Kuhr et al, AJ, Vol 86 No.6, June 1981.

2: Optical-IUE observations of the gamma-ray loud BL Lacertae object S5 0716+713: data and interpretation. Ghisellini et al, A&A, 327, 61-71 (1997)

3: http://www.lsw.uni-heidelberg.de/users/lostorer/0716/0716-nov2003.html

3: BAAVSS Circular 121, September 2004, Pg 12

IBVS 5757 - 5779

Gary Poyner

5757 FR Scuti: A tripe VV Cephei-type system of particular interest. (Pigulski & Michalska, 2007)
5758 Elements for 7 pulsating variables. (Haussler et al, 2007)
5759 Eleven more eclipsing systems with apsidal motion in the LMC. (Michalska, 2007)
5760 CCD minimum for selected eclipsing binaries in 2007. (Nelson, 2007)
5761 Photoelectric minima of selected eclipsing binaries and maxima of pulsating stars. (Hubscher & Walter, 2007)
5762 Rapid changes in the light curve of the active, late type subgiant CF Octanis. (Innis et al, 2007)
5763 SDSSJ102146.44+234926.3: New WZ Sge type dwarf nova. (Golovin et al, 2007)
5764 New times of minima of some eclipsing variables. (Lacy, 2007)
5765 A sudden period change in the RRc variable GSC 6199-0755. (Wils et al, 2007)
5766 A lesson of Y Scorpii. (Samus & Watson, 2007)
5767 The GEOS RR Lyr survey. (Le Borgne et al, 2007)
5768 13 new eclipsing binaries with additional variability in the ASAS catalogue. (Pilecki & Szczygiel, 2007)
5679 Photometric sequences and astrometric positions for Nova Cyg 2007 and Nova Oph 2007. (Henden & Munari, 2007)
5770 Elements for 10 RR Lyrae stars. (Haussler et al, 2007)
5771 Photometric sequences and astrometric positions of Nova Sco 2007 N.1 and N.2 (Henden & Munari, 2007)
5772 GSC 3377-0296 is a new short period eclipsing RS CVn variable. (Lloyd et al, 2007)
5773 Long term spectroscopic variability of two Oe stars. (Rauw et al, 2007)
5774 AD CMi. (Hurta et al, 2007)
5775 The ultra compact binary candidate KUV 23182+1007 is a bright Quasar. (Southworth et al, 2007)
5776 Ha observations of the galactic microquasar LSI+61.303. (Zamanov et al, 2007)
5777 New minima times of selected eclipsing binaries. (Parimucha et al, 2007)
5778 Ha observations of the binary system HR 2142. (Pollmann, 2007)
5779 V2467 Cyg – A Nova with extremely strong OI8446A emission. (Tomov et al, 2007)

The Information Bulletin on Variable Stars (IBVS) can be accessed through the WWW in HTML format at the following URL…. *http://www.konkoly.hu/IBVS/IBVS.html*

NEW CHART

JOHN TOONE

026·04 — 8° FIELD DIRECT

V AQUILAE	19h 04m 24·2s	-05° 41′ 05″	(2000)
R SCUTI	18h 47m 29·0s	-05° 42′ 18″	(2000)
S SCUTI	18h 50m 20·0s	-07° 54′ 27″	(2000)

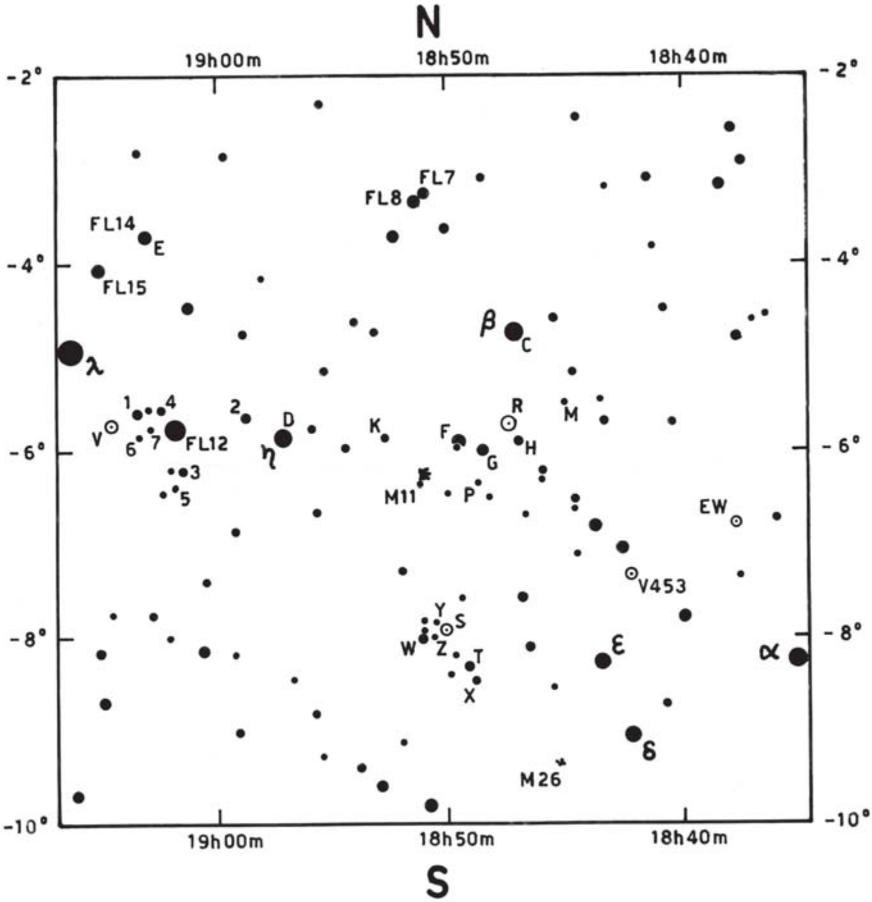


CHART:
ECLIPTICALIS

SEQUENCE:
F HARVARD OTHERS
TYCHO 2 VJ

C 4·2	M 8·4	1 6·9
D 4·8	P 8·8	2 7·3
E 5·4	T 7·1	3 7·7
F 6·2	W 7·3	4 7·8
G 6·5	X 7·8	5 8·1
H 7·0	Y 8·2	6 8·2
K 7·9	Z 9·0	7 8·9

BAA VSS
EPOCH: 2000
DRAWN: JT 21-09-07
APPROVED: RDP

BINOCULAR PRIORITY LIST

MELVYN TAYLOR

Variable	Range	Type	Period	Chart
AQ And	8.0-8.9	SRC	346d	303.01
EG And	7.1-7.8	ZA		072.01
V Aql	6.6-8.4	SRB	353d	026.03
UU Aur	5.1-6.8	SRB	234d	230.01
AB Aur	7.2-8.4	INA		301.01
V Boo	7-12	SRA	258d	037.01
RW Boo	6.4-7.9	SRB	209d	104.01
RX Boo	6.9-9.1	SRB	160d	219.01
ST Cam	6.0-8.0	SRB	300d?	111.01
XX Cam	7.3-9.7?	RCB?		068.01
X Cnc	5.6-7.5	SRB	195d	231.01
RS Cnc	5.1-7.0	SRC	120d?	269.01
V CVn	6.5-8.6	SRA	192d	214.02
WZ Cas	6.9-8.5	SRB	186d	82/08/16
V465 Cas	6.2-7.2	SRB	60d	233.01
γ Cas	1.6-3.0	GC		064.01
rho Cas	4.1-6.2	SRD	320d	064.01
W Cep	7.0-9.2	SRC		312.01
AR Cep	7.0-7.9	SRB		85/05/06
mu Cep	3.4-5.1	SRC	730d	112.01
O Cet	2.0-10.1	M	332d	039.02
R CrB	5.7-14.8	RCB		041.03
W Cyg	5.0-7.6	SRB	131d	062.03
AF Cyg	6.4-8.4	SRB	92d	232.01
CH Cyg	5.6-10.0	ZA+SR		089.02
U Del	5.6-7.5	SRB	110d?	228.01
EU Del	5.8-6.9	SRB	60d?	228.01
TX Dra	6.8-8.3	SRB	78d?	106.02
AH Dra	7.1-7.9	SRB	158d?	106.01
NQ Gem	7.4-8.0	SR+ZA	70d?	077.01
X Her	6.3-7.4	SRB	95d?	223.01
SX Her	8.0-9.2	SRD	103d	113.01
UW Her	7.8-8.7	SRB	104d	107.01
AC Her	6.8-9.0	RVA	75d	048.03
IQ Her	7.0-7.5	SRB	75d	048.03
OP Her	5.9-6.7	SRB	120d	84/04/12
R Hya	3.5-10.9	M	389d	049.02
RX Lep	5.0-7.4	SRB	60d?	110.01
SS Lep	4.8-5.1	ZA		075.01
Y Lyn	6.9-8.0	SRC	110d	229.01
SV Lyn	6.6-7.5	SRB	70d?	108.03
U Mon	5.9-7.8	RVB	91d	029.03
X Oph	5.9-9.2	M	328d	099.01
BQ Ori	6.9-8.9	SR	110d	295.01
AG Peg	6.0-9.4	NC		094.02
X Per	6.0-7.0	GC+XP		277.01
R Sct	4.2-8.6	RVA	146d	026.04
Y Tau	6.5-9.2	SRB	242d	295.01
W Tri	7.5-8.8	SRC	108d	114.01
Z UMa	6.2-9.4	SRB	196d	217.02
ST UMa	6.0-7.6	SRB	110d?	102.02
VY UMa	5.9-7.0	LB		226.01
V UMi	7.2-9.1	SRB	72d	101.01
SS Vir	6.9-9.6	SRA	364d	097.01
SW Vir	6.4-7.9	SRB	150d?	098.01

Please Note:

Some of the chart reference numbers have been updated to the latest sequence comparisons.

ECLIPSING BINARY PREDICTIONS

DES LOUGHNEY

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 UT, with a value greater than 24 indicating a time after midnight. D indicates that the eclipse starts/ ends in daylight; L indicates low altitude at the start/end of the visibility and << indicates that mid eclipse occurred on an earlier date.

Please contact the EB secretary if you require any further explanation of the format.

The variables covered by these predictions are :

RS CVn 7.9-9.1V	Z Dra 10.8-14.1p	RW Tau 7.98-11.59V
TV Cas 7.2-8.2V	TW Dra 8.0-10.5v	HU Tau 5.92-6.70V
U CrB 7.7-8.8V	S Equ 8.0-10.08V	X Tri 8.88-11.27V
SW Cyg 9.24-11.83V	Z Per 9.7-12.4p	TX Uma 7.06-8.80V
V367 Cyg 6.7-7.6V	U Sge 6.45-9.28V	W Ser 8.4-10.2
Z Vul 7.25-8.90V		

Note that predictions for RZ Cas, Beta Per and Lambda Tau can be found in the BAA Handbook.

For information on other eclipsing binaries see the website < *http://www.as.ap.krakow.pl/o-c/index.php3*>. Again please contact the EB secretary if you have any queries about the information on this site and how it should be interpreted.

January

2008 Jan 1 Tue

RW Tau	01(05)05L
U CrB	02(08)07D
SW Cyg	L02(01)07D
TX UMa	03(07)07D
del Lib	L04(06)07D
X Tri	D17(15)17
Z Per	D17(20)25
RS CVn	L22(25)31D

2008 Jan 2 Wed

Z Dra	05(07)07D
TW Dra	D17(20)25
TV Cas	18(22)26
Z Vul	18(23)20L
HU Tau	21(25)28L

2008 Jan 3 Thu

Z Dra	D17(16)18
SS Cet	D17(16)21
U Sge	D17(20)19L
RW Tau	19(24)28

2008 Jan 4 Fri

TX UMa	04(09)07D
TV Cas	D17(17)21
Z Per	D17(21)26
Z Dra	22(24)27
HU Tau	23(27)28L

2008 Jan 5 Sat

Z Vul	L05(10)07D
SW Cyg	D17(15)21
TW Dra	D17(15)20

2008 Jan 6 Sun

del Lib	L04(<<)04
Z Dra	06(09)07D
SS Cet	D17(15)20
RW Tau	D17(18)23
RS CVn	L22(20)27

2008 Jan 7 Mon

HU Tau	00(04)04L
U Sge	L05(05)07D
TX UMa	06(10)07D
Z Dra	D17(17)20
Z Vul	D17(21)19L
Z Per	18(23)28
Y Psc	19(24)22L

2008 Jan 8 Tue

U CrB	L00(05)07D
del Lib	L04(06)07D
TV Cas	04(08)07D
TW Dra	06(11)07D
Z Dra	24(26)28

2008 Jan 9 Wed

HU Tau	02(05)04L
RW Tau	D17(13)17
SS Cet	D17(15)19
S Equ	D17(22)19L
SW Cyg	22(28)24L
TV Cas	24(28)31D

2008 Jan 10 Thu

SW Cyg	L02(04)07D
Z Vul	L05(08)07D
U Sge	D17(14)19L
Z Per	19(24)29L

2008 Jan 11 Fri

TW Dra	01(06)07D
HU Tau	03(07)04L
Y Psc	D17(18)22L
Z Dra	D17(19)22
TV Cas	19(23)27
RS CVn	L21(16)22

2008 Jan 12 Sat

RW Tau	02(07)04L
SS Cet	D17(14)19
Z Vul	D17(19)19L

2008 Jan 13 Sun
Z Dra 01(04)06
del Lib L03(<<)04
TX UMa D17(13)18
TV Cas D17(19)23
U Sge 18(24)18L
TW Dra 20(25)31
Z Per 21(26)29L

2008 Jan 14 Mon
U Sge L05(00)05
SW Cyg D17(18)23L
V367Cyg D17(55)22L
RW Tau 21(26)28L
U CrB L24(27)31D

2008 Jan 15 Tue
del Lib L03(05)07D
V367 Cyg L04(31)07D
Z Vul L04(06)07D
SS Cet D17(13)18
TV Cas D17(14)18
V367Cyg D17(31)22L
Z Dra 18(21)23

2008 Jan 16 Wed
V367Cyg L04(07)07D
RS CVn 04(11)07D
V367Cyg D17(07)22L
TX UMa D17(15)20
S Equ D17(19)18L
TW Dra D17(21)26
Z Per 22(27)28L

2008 Jan 17 Thu
X Tri 01(04)02L
Z Dra 03(05)07D
V367Cyg L04(<<)07D
U Sge L05(09)07D
TV Cas 06(10)07D
V367Cyg D17(<<)22L
Z Vul D17(17)19L
RW Tau D17(20)25

2008 Jan 18 Fri
X Tri 01(03)02L
SS Cet D17(13)18

2008 Jan 19 Sat
X Tri 00(03)02L
TV Cas 01(05)07D
SW Cyg 02(08)07D
TW Dra D17(16)21
TX UMa D17(17)21
Z Dra 20(23)25
X Tri 23(26)25L
Z Per 23(28)28L

2008 Jan 20 Sun
del Lib L03(<<)03
Z Vul L04(04)07D
RW Tau D17(14)19
U Sge D17(18)18L
TV Cas 21(25)29
X Tri 23(25)25L
RS CVn 24(30)31D

2008 Jan 21 Mon
Z Dra 05(07)07D
X Tri 22(25)25L
U CrB L23(25)30

2008 Jan 22 Tue
del Lib L03(05)07D
TW Dra 07(12)07D
Z Vul D17(15)18L
Z Dra D17(16)18
TX UMa D17(18)23
TV Cas D17(20)24
Y Psc 21(25)21L
X Tri 21(24)25L

2008 Jan 23 Wed
Z Per 01(06)04L
HU Tau D17(15)19
S Equ D17(16)18L
SW Cyg D17(22)23L
X Tri 21(23)25L
Z Dra 22(24)27

2008 Jan 24 Thu
SW Cyg L01(<<)04
U Sge L04(03)07D
del Lib 06(13)07D
TV Cas D17(16)20
X Tri 20(23)25

2008 Jan 25 Fri
TW Dra 02(07)07D
Z Vul L04(02)07D
U CrB 06(11)07D
Z Dra 07(09)07D
HU Tau D18(16)20
TX UMa D18(20)24
X Tri 19(22)24
RS CVn L20(25)31D
RW Tau 23(27)27L

2008 Jan 26 Sat
Z Per 02(07)04L
Z Dra D18(17)20
Y Psc D18(20)21L
X Tri 19(21)24

2008 Jan 27 Sun
del Lib L02(<<)03
U Sge 06(12)07D
Z Vul D18(13)18
HU Tau D18(18)21
X Tri 18(20)23
TW Dra 21(26)31D
Z Dra 24(26)28

2008 Jan 28 Mon
TV Cas 03(07)07D
SW Cyg 05(11)07D
X Tri D18(20)22
TX UMa D18(21)26
RW Tau D18(22)26
U CrB L23(22)28

2008 Jan 29 Tue
del Lib L02(04)07D
Z Per 03(08)04L
HU Tau D18(19)23
X Tri D18(19)22
TV Cas 22(26)30

2008 Jan 30 Wed
Z Vul L03(<<)05
Y Psc D18(14)19
X Tri D18(18)21
Z Dra D18(19)22
TW Dra D18(22)27
RS CVn L20(20)27

2008 Jan 31 Thu
del Lib 06(12)07D
RW Tau D18(16)21
X Tri D18(18)20
HU Tau D18(20)24
TV Cas D18(22)26
TX UMa 18(23)27

February

2008 Feb 1 Fri
Z Dra 01(04)06
U CrB 03(09)07D
Z Vul 05(10)07D
W Ser L06(42)07D
X Tri D18(17)20
SW Cyg 19(25)22L

2008 Feb 2 Sat
SW Cyg L00(01)07D
V367Cyg L03(45)07D
W Ser L06(18)07D
X Tri D18(16)19
TW Dra D18(17)22
TV Cas D18(17)21
HU Tau D18(22)25
V367Cyg D18(45)21L

2008 Feb 3 Sun
del Lib L02(<<)03
V367Cyg L03(21)07D
U Sge L04(06)07D
W Ser L06(<<)07D
X Tri D18(16)18
V367Cyg D18(21)21L
Z Dra 19(21)23
TX UMa 19(24)29

2008 Feb 4 Mon
V367Cyg L03(<<)06D
W Ser L06(<<)06D
V367Cyg D18(<<)21L
HU Tau 19(23)26L
RS CVn L20(15)22
U CrB L22(20)26

2008 Feb 5 Tue
del Lib L02(04)06D
V367Cyg L03(<<)06D
Z Dra 03(06)06D
V367 Cyg D18(<<)18

2008 Feb 6 Wed
RW Tau 00(05)02L
Z Vul L03(08)06D
TV Cas 04(08)06D
SW Cyg D18(15)21
HU Tau 20(24)26L
TX UMa 21(26)30

2008 Feb 7 Thu
del Lib 06(12)06D
Z Dra 20(23)25
TV Cas 24(28)30D

2008 Feb 8 Fri
U CrB 01(07)06D
TW Dra 03(08)06D
RW Tau 19(24)26L
HU Tau 22(26)26L

2008 Feb 9 Sat
RS CVn 04(11)06D
Z Dra 05(07)06D
TV Cas 19(23)27
TX UMa 22(27)30D

2008 Feb 10 Sun

del Lib L02(<<)02
U Sge L03(01)06
Z Per D18(14)18
Z Dra D18(16)18
Y Psc D18(21)20L
TW Dra 22(27)30D
HU Tau 23(27)26L
SW Cyg L24(29)30D

2008 Feb 11 Mon

Z Vul L03(06)06D
RW Tau D18(18)23
TV Cas D18(19)23
U CrB L22(18)24
Z Dra 22(24)27

2008 Feb 12 Tue

del Lib L01(04)06D
TX UMa 24(29)30D

2008 Feb 13 Wed

HU Tau 01(04)02L
U Sge 04(10)06D
S Equ L06(07)06D
TV Cas D18(14)18
Z Per D18(15)20
TW Dra D18(22)28
RS CVn 23(30)30D

2008 Feb 14 Thu

del Lib 05(11)06D
Y Psc D18(16)19L
Z Dra D18(18)20
U CrB 23(29)30D

2008 Feb 15 Fri

TV Cas 06(10)06D
SW Cyg D18(18)21L
SW Cyg L23(18)25
Z Dra 24(26)29

2008 Feb 16 Sat

TX UMa 02(06)06D
Z Vul L02(04)06D
W Ser L05(22)06D
Z Per D18(16)21
TW Dra D18(18)23

2008 Feb 17 Sun

del Lib L01(<<)02
TV Cas 01(05)06D
W Ser L05(<<)06D

2008 Feb 18 Mon

W Ser L05(<<)06D
Z Dra D18(19)22
RS CVn L19(25)30D
TV Cas 21(25)29

2008 Feb 19 Tue

del Lib L01(03)06D
TX UMa 03(08)06D
TW Dra D18(13)18
Z Per D18(18)23
RW Tau 21(25)25L

2008 Feb 20 Wed

Z Dra 02(04)06D
SW Cyg 02(08)06D
U Sge L03(04)06D
S Equ L06(04)06D
TV Cas D18(20)24
V367Cyg D18(60)20L

2008 Feb 21 Thu

V367Cyg L02(36)06D
Z Vul L02(02)06D
del Lib 05(11)06D
V367Cyg D18(36)20L
U CrB L21(26)30D

2008 Feb 22 Fri

V367Cyg L02(12)06D
TW Dra 04(09)06D
TX UMa 05(09)06D
V367Cyg D18(12)20L
TV Cas D18(16)20
Z Per D18(19)24
RW Tau D18(20)25
Z Dra 19(21)23

2008 Feb 23 Sat

V367Cyg L02(<<)06D
V367Cyg D18(<<)20L
RS CVn L18(20)26
X Tri 23(25)23L

2008 Feb 24 Sun

del Lib L01(<<)01
V367Cyg L01(<<)06D
Z Dra 03(06)06D
SW Cyg D18(22)21L
X Tri 22(25)23L
SW Cyg L23(22)28
TW Dra 23(28)30D

2008 Feb 25 Mon

RW Tau D18(14)19
Z Per D18(20)25
Y Psc D18(23)19L
X Tri 21(24)23L

2008 Feb 26 Tue

del Lib L01(03)06D
Z Vul L02(00)05
TV Cas 03(07)06D
Z Dra 20(23)25
X Tri 21(23)23L

2008 Feb 27 Wed

U Sge L02(<<)04
S Equ L05(01)06D
TW Dra D18(23)28
X Tri 20(23)23L
TV Cas 22(26)30D

2008 Feb 28 Thu

del Lib 04(11)06D
Z Dra 05(07)06D
Z Vul 05(10)06D
RS CVn D19(15)21
Z Per D19(22)26L
X Tri 19(22)23L
U CrB L21(24)30D

2008 Feb 29 Fri

SW Cyg 06(12)06D
HU Tau D19(15)19
TV Cas D19(22)26
X Tri 19(21)23L

March

2008 Mar 1 Sat

U Sge L02(07)06D
W Ser L04(26)06D
TW Dra D19(19)24
X Tri D19(21)23L
Z Dra 22(25)27
RW Tau 22(27)25L

2008 Mar 2 Sun

del Lib L00(<<)01
Z Vul L01(<<)03
W Ser L04(02)06D
HU Tau D19(16)20
TV Cas D19(17)21
X Tri D19(20)22
Z Per D19(23)25L

2008 Mar 3 Mon

W Ser L04(<<)06D
U CrB 05(11)06D
X Tri D19(19)22

2008 Mar 4 Tue

del Lib L00(02)06D
Z Vul 03(08)06D
RS CVn 04(10)06D
TW Dra D19(14)19
Z Dra D19(18)20
HU Tau D19(18)22
X Tri D19(19)21
RW Tau D19(22)25L
SW Cyg 19(25)20L
SW Cyg L22(25)30D

2008 Mar 5 Wed

TX UMa D19(15)20
X Tri D19(18)20
Z Per 20(24)25L
Z Dra 24(26)29

2008 Mar 6 Thu

del Lib 04(10)05D
TV Cas 04(08)05D
X Tri D19(17)20
HU Tau D19(19)23
U CrB L20(22)28

2008 Mar 7 Fri

TW Dra 04(09)05D
RW Tau D19(16)21
X Tri D19(16)19
TV Cas 24(28)29D

2008 Mar 8 Sat

U Sge L01(02)05D
S Equ L04(08)05D
TX UMa D19(17)22
Z Dra D19(19)22
HU Tau D19(21)24L
Z Per 21(26)25L
RS CVn 23(29)29D
del Lib L24(18)24

2008 Mar 9 Sun

Z Vul L01(06)05D
SW Cyg D19(15)20L
TV Cas 19(23)27
TW Dra 24(29)29D

2008 Mar 10 Mon

Z Dra 02(04)05D
U CrB 03(09)05D
V367 Cyg 05(50)05D
HU Tau D19(22)24L
del Lib L24(26)29D

2008 Mar 11 Tue

V367Cyg L00(26)05D
U Sge 05(11)05D
TX UMa D19(18)23
TV Cas D19(19)23
Z Per 22(27)25L

2008 Mar 12 Wed

V367Cyg L00(02)05D
Z Dra D19(21)24
TW Dra 19(24)29
HU Tau 19(23)24L

2008 Mar 13 Thu

V367Cyg L00(<<)05D
del Lib 03(10)05D
RS CVn D19(25)29D
U CrB L20(19)25
SW Cyg 23(29)29D

2008 Mar 14 Fri

Z Vul L01(04)05D
Z Dra 03(06)05D
TX UMa D19(20)25
HU Tau 21(25)24L
Z Per 24(29)25L

2008 Mar 15 Sat

U Sge L01(<<)02
W Ser L03(30)05D
S Equ L04(05)05D
TW Dra D19(19)25
RW Tau D19(23)24L
del Lib L23(18)24

2008 Mar 16 Sun

W Ser L03(06)05D
Z Dra 20(23)25
HU Tau 22(26)24L

2008 Mar 17 Mon

U CrB 00(06)05D
TV Cas 01(05)05D
W Ser L03(<<)05D
TX UMa D19(21)26
SS Cet 20(24)20L
del Lib L23(25)29D

2008 Mar 18 Tue

U Sge L01(05)05D
TW Dra D19(15)20
RW Tau D19(18)23
SW Cyg D19(19)19L
RS CVn D19(20)26
TV Cas 21(25)29
SW Cyg L21(19)25
HU Tau 23(27)23L

2008 Mar 19 Wed

Z Vul L00(02)05D

2008 Mar 20 Thu

del Lib 03(09)05D
TV Cas D19(20)24
TX UMa D19(23)28
SS Cet D19(24)20L
U CrB L19(17)23
Z Dra 22(25)27

2008 Mar 22 Sat

S Equ L04(02)05D
TV Cas D19(16)20
del Lib L23(17)24

2008 Mar 23 Sun

SW Cyg 02(08)05D
RS CVn D19(15)21
Z Dra D19(18)20
SS Cet D19(23)20L
TX UMa 20(24)29D
U CrB 22(28)29D
Z Vul L24(24)29D

2008 Mar 24 Mon

TW Dra 01(06)05D
del Lib L23(25)29D
Z Dra 24(26)29D

2008 Mar 25 Tue

U Sge L00(<<)05D

2008 Mar 26 Wed

TV Cas 03(07)05D
SS Cet D19(22)19L
TW Dra 20(25)29D
RW Tau 21(25)23L
TX UMa 21(26)29D

2008 Mar 27 Thu

del Lib 03(09)05D
U CrB D19(15)21
Z Dra D19(20)22
SW Cyg L21(22)28
TV Cas 22(26)29D

2008 Mar 28 Fri

U Sge 03(09)05D
RS CVn 04(10)05D
V367Cyg L23(64)29D
Z Vul L24(21)27

2008 Mar 29 Sat

Z Dra 02(04)05D
W Ser L02(34)05D
S Equ L03(<<)04
RW Tau D19(20)23L
TW Dra D19(20)25
TV Cas D19(22)26
del Lib L22(17)23
TX UMa 23(27)29D
V367Cyg L23(40)29D

2008 Mar 30 Sun

W Ser L02(10)05D
U CrB 20(26)28D
V367Cyg L23(16)28D

2008 Mar 31 Mon

W Ser L02(<<)04D
Z Vul 03(08)04D
TV Cas D19(17)21
Z Dra D19(21)24

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The **deadline for contributions** to the next issue of VSSC (number 135) will be 7th February, 2008. All articles should be sent to the editor (details are given on the back of this issue)

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