British Astronomical Association

VARIABLE STAR SECTION CIRCULAR

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Contents

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THE SPEAKERS AT THE VARIABLE STAR SECTION MEETING, CARDIFF UNIVERSITY. **SATURDAY, 13TH JUNE 2009**

Vanessa Stroud, Fraser Lewis, Stan Waterman, Dr. Danny Steeghs, Tony Markham, Jeremy Shears, Gary Poyner, Roger Pickard, Clive Beech, and David Boyd.

photograph courtesy Rob Januszewski

FROM THE DIRECTOR

ROGER PICKARD

John Toone

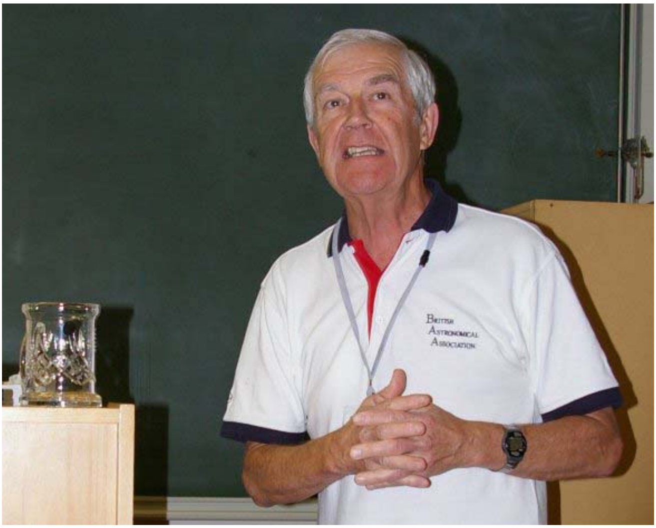
I'm delighted to advise, that at 00:12 BST on 8th August 2009, Miranda Irene was born to John and Irene and as a sister to Alexander. (John added that he celebrated by undertaking a visual observation of Mira when he returned home!)

We wish Miranda a long and happy life.

VSS Meeting, Cardiff

You will see the first report of this excellent meeting in this circular, which hopefully will be followed by more in future circulars.

I was somewhat overwhelmed when, after the lunch break, John Toone made a presentation to me, on behalf of all the Officers, for becoming the longest serving VSS Director of modern times.



Roger with presentation engraved glass tankard, for thelongest servingVSS Director of modern times.

photograph courtesy Rob Januszewski

Apparently, I am the fifth person to have completed 10 years as Director after Markwick, Brook, DeRoy & Lindley. Technically, of course, John Isles almost completed 10 years, but in two stints. It's notable that, for the first 68 years there were only 5 Directors (average 13 years), whereas in the subsequent 41 years there have been 8 Directors (average 5 years). I'm also the thirteenth separate VS Director and if I serve for another 3 years will have completed 13 years! Perhaps that will signify the time to stand down?!

I'm not sure I've been totally successful in combining Presidential duties with those as VSS Director over the last two years, as I know I have had to let some VSS responsibilities slip. However, the Presidency is soon coming to an end and as I find running the VSS very rewarding, I have no immediate plans to step down.

Minor Changes to Program stars

The Officers, with input from Tony Markham (who instigated it anyway) are investigating some relatively minor changes to the VSS Binocular/Telescopic Program to include some more "interesting" stars for binocular observers. If anyone has any particular suggestions I'd be please to hear them.

Light Pollution

And finally, for those of you who are thinking light pollution is killing visual variable star observing, take a look at the graph for Z Ursae Majoris on the VS web site. It's been compiled from observations by four observers, with three of them living in the centre of Edinburgh!

Tom Boles

It is with great pleasure that we announce that Tom Boles is now the leading discoverer of supernovae worldwide, with a total of 125 discoveries. This includes all individuals, whether professional or amateur, who have personally searched for these objects, but excludes all those discovered via automated surveys.

Tom reached this milestone on 21st Aug 2009, with the discovery of SN2009ij. This was his third discovery that evening, and is the sixth time he has achieved this remarkable feat, (another possible record, but one which is difficult to check). This brought Tom's total to 124, thus surpassing Fritz Zwicky who discovered 123, (including one with P. Wild). Zwicky's first was on 1921 April 6th with 1921B, and his final discovery was on 1973 April 26th with 1973K. Sadly he died the following year. Zwicky used a 16" Schmidt in his early days, and the 48" Oschin Schmidt later.

Tom made his first discovery on 29th Oct 1997 with SN1997dn and so overtook Zwicky in less than 12 years, but there again, Tom now uses three 14" telescopes!

But this was not enough for Tom, and another discovery followed with supernova 2009io in UGC 11666, although this was actually discovered earlier, on August 13.932.

We are grateful to Professor Ian Howarth (a former VSS Director) for initially bringing Tom's record to our attention.

Roger Pickard; and Stewart Moore, Deep Sky Section Director

EPSILON AURIGAE – EVOLUTION OF THE KI 7699 ABSORPTION LINE PRE FIRST CONTACT

ROBIN LEADBEATER

The start of the eclipse of the 27.1 year period binary, epsilon Aurigae, was predicted to start mid August, and as I write, photometric evidence of first contact is eagerly awaited by those hoping to learn more about this enigmatic system. The intrinsic variability of the system outside eclipse is a problem when trying to isolate brightness changes due the eclipsing object. Spectroscopically however, there are features that only appear during eclipse, which potentially can be used to track the progress. The KI absorption line at 7699A is such a feature. Outside eclipse an absorption line (either due to the primary star or from interstellar material) is seen centred close to the KI rest wavelength. During the last eclipse however (1982-84) an additional component was detected, which appeared at ingress and swept from red to blue (+20km/s to -40km/s radial velocity) across the stationary component, as the eclipse progressed through to egress. This behaviour is consistent with the eclipsing body being a rotating disc of material. The KI absorption is considered to come from a semi-transparent extended envelope, surrounding an opaque disc (responsible for the reduction in brightness) and rotating with it.[ref 1]

In the hope that monitoring this line might provide an early indication of the impending eclipse, I have been recording the KI 7699 line at a resolution of 0.3A using a modified LHIRES III spectrograph.[fig 1] The period covering the approach to ingress coincided with the solar conjunction of epsilon Aurigae, which meant at times measuring in bright twilight conditions at air masses over 6. (Some judicious pruning of trees was also required!) Contamination of the spectra due to the atmosphere, was removed by dividing by the spectrum of a hot star (line free in this region) measured at similar air mass.

The additional redshifted component is clearly seen in spectra taken 19/21st July onwards[fig 1] which led to the issue of CBET 1885[ref 2] announcing the probable spectroscopic detection of ingress. There are however early signs of this component in the line profile as far back as the end of May.

By subtracting the out of eclipse component from the KI 7669 line, it is possible to estimate the magnitude (EW) of the absorption solely due to the eclipsing body.[fig 2] The increased frequency of observation, compared with previous eclipses, allows a detailed study of this absorption with time. There are signs that the increase in absorption on the approach to photometric first contact may not be progressing smoothly. Changes in brightness seen in the I band also correlate with the later variations.[ref 3] This could be an indication of inhomogeneity in the extended outer regions of the eclipsing body, perhaps part of a multi-ring structure similar to that proposed by Ferluga for the opaque inner region of the disc.[ref4] Further measurements at egress may clarify this.

This feature is continuing to evolve, and it is hoped that continuous monitoring throughout the eclipse may shed more light on the structure and dynamics of the mysterious eclipsing object.

This article is based on a poster paper presented at the BAA meeting, Leeds, England 5th September 2009 which can be accessed here:
http://www.threehillsobservatory.co.uk/astro/spectra_40a.htm

(1) Epsilon Aurigae in eclipse. II - Optical absorption lines from the secondary Lambert, D. L.; Sawyer, S. R Astronomical Society of the Pacific, Publications, vol. 98, April 1986, p. 389-402
http://adsabs.harvard.edu/abs/1986PASP...98..389L

(2) *http://www.cfa.harvard.edu/iau/cbet/001800/CBET001885.txt*
or here without subscription
http://www.citizensky.org/forum/first-publication-cbet-1885

(3) Miles, R. Golden Hill Observatory

(4) Epsilon Aurigae I - Multi-ring structure of the eclipsing body. S Ferluga, Astron. Astrophys. 238, 270-278 (1990)
http://adsabs.harvard.edu/abs/1990A%26A...238..270F

Figure 1: Evolution of the KI 7699 absorption line from 18th March - 28th August 2009, showing the additional redshifted component from 19/21 July.

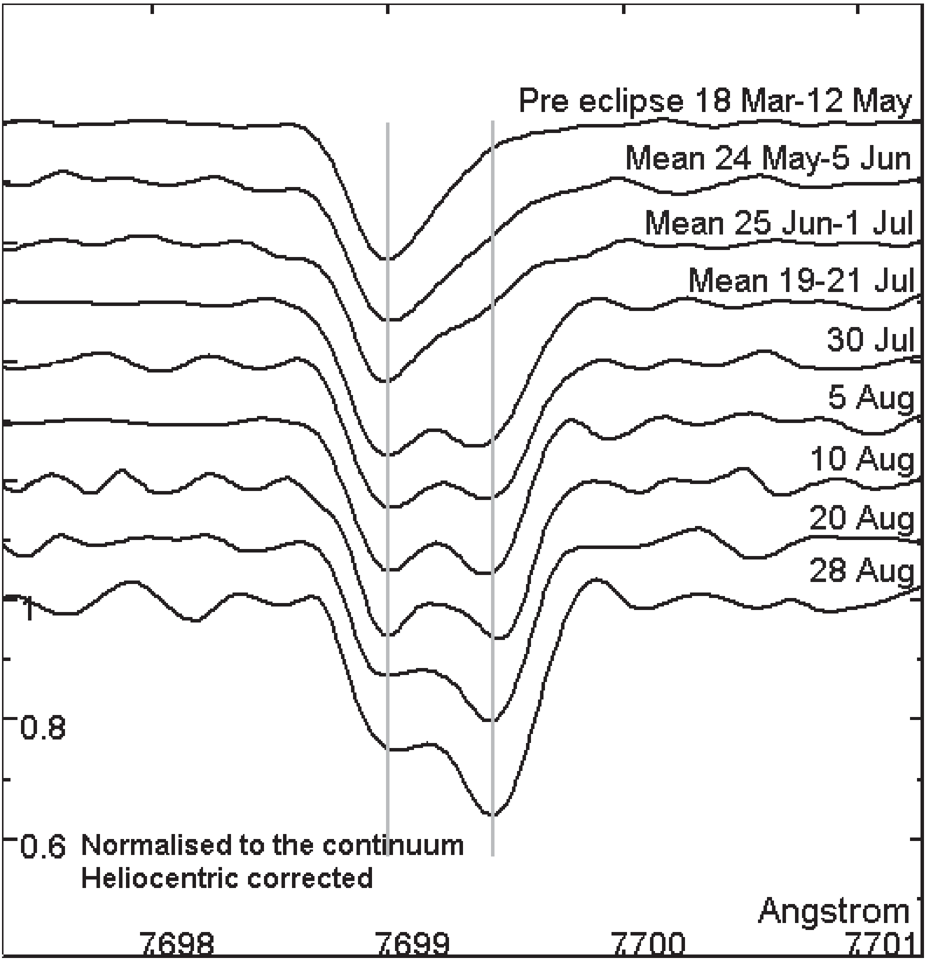
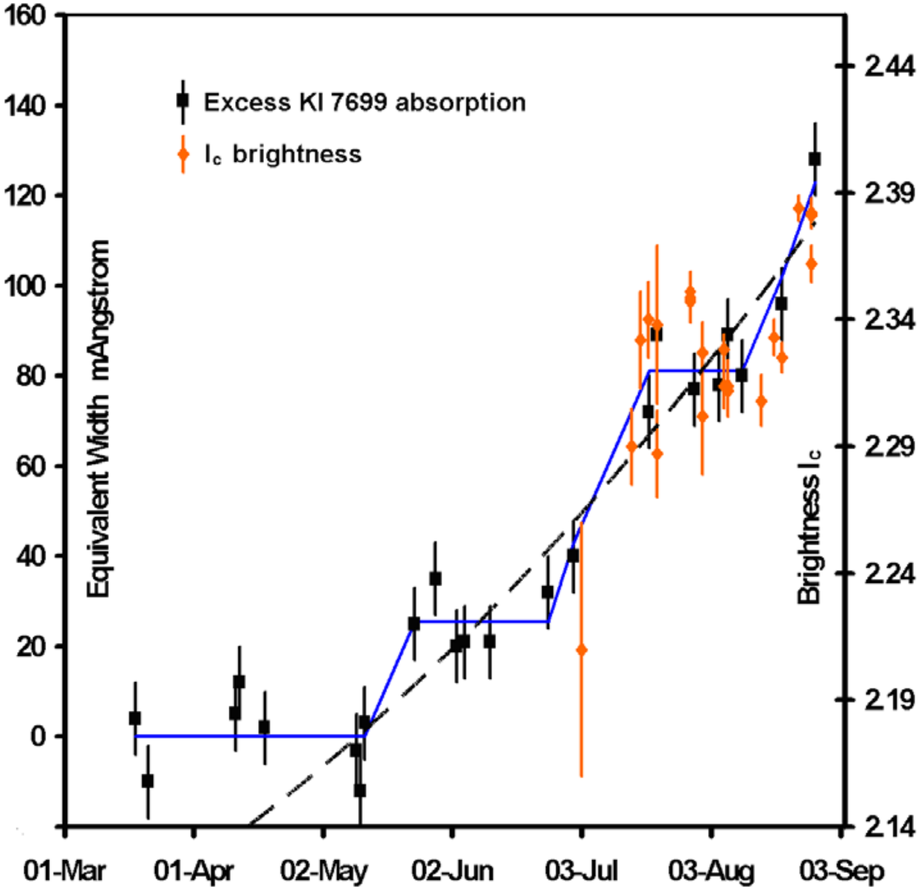


Figure 2: Time dependent variations in the KI 7699 line intensity.



robin_astro@hotmail.com

ECLIPSING BINARY NEWS.

DES LOUGHNEY

Epsilon Aurigae*

It has been difficult to make reliable estimates of the system between the middle of May and the middle of July because the system has been too low down. Estimates were easier after the beginning of July. By that time Epsilon was a pre-dawn object which required setting the alarm at 3.00 am BST.

The estimates that were made suggest that Epsilon hovered around 3V magnitudes during all of this period. It occasionally brightened by about 0.1 magnitude. At the time of writing (17th August 2009) Epsilon's magnitude remains at 3. The official predicted start of the eclipse was the 8th August. It has not happened yet but is expected at any time. Making an accurate prediction of this eclipse is difficult given the period of over 27 years and the likely eclipsing body - an uneven cloud of dust and gas.

No doubt the eclipse will start soon. All observations are welcome so that we can monitor the fade to totality in December 2009. The BAAVSS website will be regularly updated with news of the eclipse.

We are still in the process of preparing a PowerPoint presentation on the eclipse for local societies and schools. It should be ready in the next couple of weeks. Get in touch if you would like a copy.

Delta Librae

I reported in the last Eclipsing Binary News, that we had agreed with our colleagues in New Zealand, to undertake joint observing projects. We would observe Eclipsing Binaries within twenty degrees of the equator. The first agreed project, is a campaign to look at the Delta Librae system. It appears that this system has not been studied for some time. All observations are called for – visual, CCD, and DSLR. Observations should be sent to the BAA in the normal way, but I would be grateful for a copy.

Delta Librae is classified as an EA/SD system. The Krakow elements for the system are 2452500.526 + E2.327336. Up dated predictions, based on these elements, are published on the Krakow website <*http://www.as.up.krakow.pl/minicalc/LIBDELTA.HTM*>. These elements may be out of date - they were determined around eight years ago. One of the purposes of the project is to determine the current elements.

In the primary eclipse Delta Librae fades from 4.91 to 5.90 magnitudes so is easily followed with binoculars. The secondary eclipse has a fade of 0.1 magnitude which can be picked up by CCD and DSLR photometry.

The Delta Librae system is called a semi detached system. The two stars are close together. The light curve outside of eclipses, may not be flat, due to distortions in the shape of the stars, and star spots. A purpose of the project is to determine the whole light curve and not just the eclipses. Out of eclipse observations are welcome.

The system has been on the BAA VSS Observing list for some time. A chart was prepared in the 1980's. It is not available on line but I am happy to forward a paper copy or a scanned PDF version.

The season for observing the system has drawn to a close. I hope that our observers can have a look at it next year. This appeal is directed at our more southern members as it is difficult to observe from Scotland. It does not rise high enough.

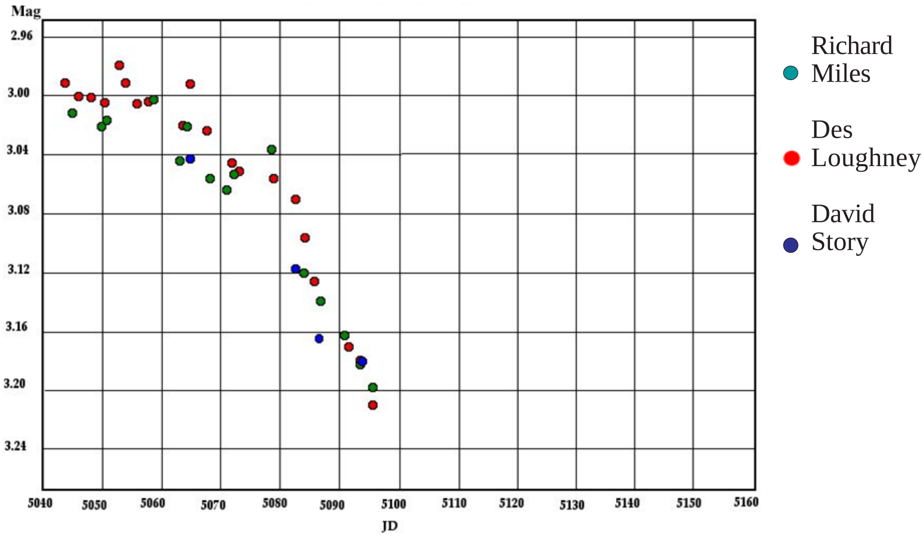
During a recent holiday on La Palma, in the Canaries, I made some intensive observations of Delta Librae. I hope to have results written up for the next Newsletter.

***Epsilon Aurigae Update, 12th September 2009**

The system has started to fade within the last couple of weeks. It seems that the eclipse has started, as the magnitude is now below the normal out of eclipse variation.

If it is the eclipse fade then the shape of the recent light curve suggests that the fade started around the middle of August which is only about a week later than predicted. The prediction was quite accurate given the long period (27.1 years) of the system.

Epsilon Aurigae Update, 23rd September 2009



Epsilon Aurigae: August - September 2009: a diagram illustrating the V photometry estimates since 1st August.

The eclipse is now underway. Recent V photometry indicates that epsilon is around 3.22V.

continued page 16

OBSERVING VARIABLE STARS NEAR THE HORIZON: PHOTOMETRY AT HIGH AIRMASS.

RICHARD MILES

Abstract: In this article, I discuss the need to allow for the effects of atmospheric absorption, when tackling CCD-V photometry of stars which happen to be located low in the sky. Visual estimates are equally affected by the atmosphere, and when stars are relatively close to the horizon, some adjustment to the magnitude will be required to maximise accuracy.

Atmospheric Extinction

Strictly speaking, photometry of all stars should be adjusted to allow for the fact that the light from each one passes through a different thickness of atmosphere, before it reaches your eye or CCD camera. If a star is directly overhead, then its light traverses *exactly* a single layer of the atmosphere, referred to as having an airmass of *exactly* 1. In reality stars are distributed across the sky, and so are seen through various thicknesses of atmosphere, all having different airmasses greater than 1. If you do the geometry and approximate the atmosphere to a plane, parallel layer, then stars which are exactly 30° degrees altitude above the horizon, will be seen through an airmass of exactly 2. So, if you are determining the brightness of a variable, relative to that of a nearby comparison star, you should really allow for the difference in airmass, otherwise your result will be slightly in error, the size of the error depending on the difference in airmass of the two stars, as well as on the fraction of light which the atmosphere absorbs. The latter is termed 'atmospheric extinction' and this will vary depending on; (a) how clear the air is, and (b) the height of the observatory. As a ballpark figure, if the sky is properly transparent and you are less than say 500 meters above sea level, you can expect the stars at the zenith to have lost close on 0.20 magnitudes in intensity, compared to the brightness they would have had were there to be no intervening atmosphere. That does not sound like much, but it is an important factor if two stars are seen through slightly different path lengths when they are close to the horizon. We call this effect, 'differential extinction' - a rather intimidating term in my opinion!

Have a look at *Norton's Star Atlas*. In particular look at the very last part of the section entitled 'Variable Stars', where in my copy of the 12th edition (page 130), there is a short table (Table 57), entitled 'Atmospheric extinction'. Take for example the cases of two stars at altitudes above the horizon of 10° and 11°. The difference of just 1 degree is enough to introduce an apparent brightness difference of 0.1 magnitude – that's in a properly clear and transparent sky. Sometimes the sky will appear perfectly clear, but because of dust and atmospheric aerosols it can absorb more light than usual, so this 1 degree difference in altitude could equate to say twice the expected light loss, i.e. a 0.2 magnitude error. Here are a few selected values to chew over taken from Norton's:

Atmospheric Extinction (transparent sky)

Altitude (degrees)	**Extinction** (magnitude)
43	0.1
21	0.4
15	0.7
11	0.9
10	1.0
6	1.5
4	2.0

In the UK we rarely experience very transparent skies, especially in the summer when extinction is often some 50% greater than you would expect from the figures quoted in the table! So, whether you are observing visually or with a CCD camera, you should be concerned about the dreaded 'differential extinction' especially if the region of the sky you are observing is less than say 20 degrees altitude.

What does this mean in practice? People have tended to ignore making allowances for extinction, probably because; (a) the fields of view of CCD cameras have been small when used in conjunction with an astronomical telescope, and (b) it has never been very obvious how you can make the extinction correction. However, the use of DSLR cameras for photometry is highlighting this as an issue, because they inherently possess larger FOVs, especially when used with photographic lenses, and so stars are seen through relatively larger differences in airmass.

Airmass

Let's look at how you can determine the airmass of your variable and comparison star(s). One way is to use a planetarium program to determine altitude above the horizon. Here you will need to put in your geographic latitude and longitude as well as the time of the observation and then change the settings to show altitude and azimuth (sometimes referred to as 'Alt/Az' coordinates). Once you know the altitude, **h**, you can calculate airmass, **X**, from the relationship:

$$\textbf{Airmass} = \mathbf{X} = \mathbf{1 / SIN(h)} \qquad \textbf{... (1)}$$

This formula is also referred to as '**sec(z)**', i.e. the secant of **z**, the zenith distance (**90° minus h**). So for an altitude of 30°, **sec(z)** gives **X** = 2.000. Note that if you use an Excel spreadsheet to do this calculation, the altitude has to be converted to an angle expressed in radians to give the correct result, i.e. the value in degrees, must be divided by 57.29 (the number of degrees in one radian, approx.). This expression is good up to an airmass of 5 or 6, i.e. down to about 10° altitude.

A convenient way to determine **X** is to use an online facility such as that provided by the AAVSO at: *http://www.aavso.org/observing/programs/ccd/airmass.shtml* from which the following screenshot was taken:

Figure 1: Airmass and Scintillation Calculator. This calculator will give you an approximation for airmass and scintillation (for small and modest aperture telescopes).

Date of Observation	2455062.4421	JD or yyyy/mm/dd/hh/mm/ss (UT)
Observer Latitude	50.931	dd.ddd. North is positive, South is negative
Observer Longitude	-2.405	dd.ddd or dd mm ss. West is - or W, East is + or E (12.123E or +12.123)
Target RA	76.706	degrees or hh:mm:ss or hh mm ss
Target Dec.	43.175	degrees or dd:mm:ss or dd mm ss
Aperture	6	cm (optional - only required for scintillation)
Integration Time	380	seconds (optional - only required for scintillation)

Calculate

The corresponding output was as follows:

AAVSO Air Mass & Scintillation Calculator Results

RA	76.706
Dec.	43.175
Lat.	50.931
Long.	-2.405
Date	2455062.4421
Aperture	6
Integration	380
LAST	94.58025
HA	227.4634 (15.1642 h)
Scintillation	0.0141
Airmass	**4.5288**

Figure 2.

Alternatively, you might wish to write a spreadsheet to derive **X**. Here's an example of a cell entry taken from a spreadsheet I wrote a few years ago.

```
=1/(((SIN(($F$2)*$F$1))*(SIN((F$7)*$F$1)))+((COS(($F$2)*$F$1))*(COS((F$7)*$F$
1))*(COS((360*((((24*(((6.60069/24)+(($C13-3004.5)*1.00273791))-
INT((6.60069/24)+(($C13-3004.5)*1.00273791))))-($F$3/15)-(F$6/15))/24)-
INT(((24*(((6.60069/24)+(($C13-3004.5)*1.00273791))-INT((6.60069/24)+(($C13-
3004.5)*1.00273791))))-($F$3/15)-(F$6/15))/24)))*$F$1))))
```

Where:
$F$1 = 0.01745 (conversion factor, degrees to radians)
$F$2 = Latitude (deg)
$F$3 = Longitude (deg, West positive)
F$6 = Target R.A. (deg)
F$7 = Target Dec. (deg)
$C13 = JD – 2450000

Clearly this is a more complicated alternative, but once you have a working spreadsheet the calculations are done virtually instantaneously, and your spreadsheet can be tailored to suit your data input. In my case, I use AIP4WIN to perform the image analysis, and then cut and paste a block of data into a specially-written spreadsheet, to obtain the result not just of airmass, but also the finished magnitude fully reduced to allow for differential extinction (as well as transformations for colour).

Another approach is to use freeware available on the Web, such as Airmass Calc 1.5b by Laurent Corp available at:
http://www.astrosurf.com/lcorp/airmasscalc.html
which will handle files in BAA VSS and AAVSO formats. It is also able to automatically search the GCVS catalogue, to obtain celestial coordinates for variables of interest.

Extinction Coefficients and Exo-atmospheric Zeropoint

The main uncertainty when correcting for extinction, is in knowing the so-called atmospheric extinction coefficient, **k**, for the filter passband used. The present paper is limited to a discussion of visual estimates, and CCD images taken using a V filter, or some other equivalent green filter. Using such a filter simplifies the analysis, unlike some other filters (e.g., those for the B and I passbands) which have second-order terms dependent on other factors, such as relative star colour.

If you plot the instrumental magnitude, **v**, that is **(-2.5*LOG(adu counts/exposure time))** versus **X**, you should get a straight line, the slope of which is the extinction coefficient (expressed in magnitudes per equivalent atmosphere), and which should typically be in the range, 0.17-0.35 mag/atm for a clear night not too far above sea level. For observatories on the tops of mountains there is less of the atmosphere overhead, and the extinction coefficients are consequently lower than at sea level. Cold winter nights tend to be more transparent than warm summer nights. So you could wait and follow a star as it rises or sets, and see by how much it brightened or faded, so as to get a handle on the V-band extinction coefficient, **kv**. In practice it is a lot better to spend say 10 or 15 minutes imaging 3 or 4 stars, which are essentially non-variable, of fairly similar colour or spectral type, and which are located at widely spaced altitudes. In this approach, you plot the instrumental magnitude corrected for the known V magnitude, **v-V**, versus **X** and you should end up with a straight-line plot, the slope of which has the value, **kv**, and the intercept at **X**=0 is known as the exo-atmospheric zeropoint, or **Zv**.

Figure 3.

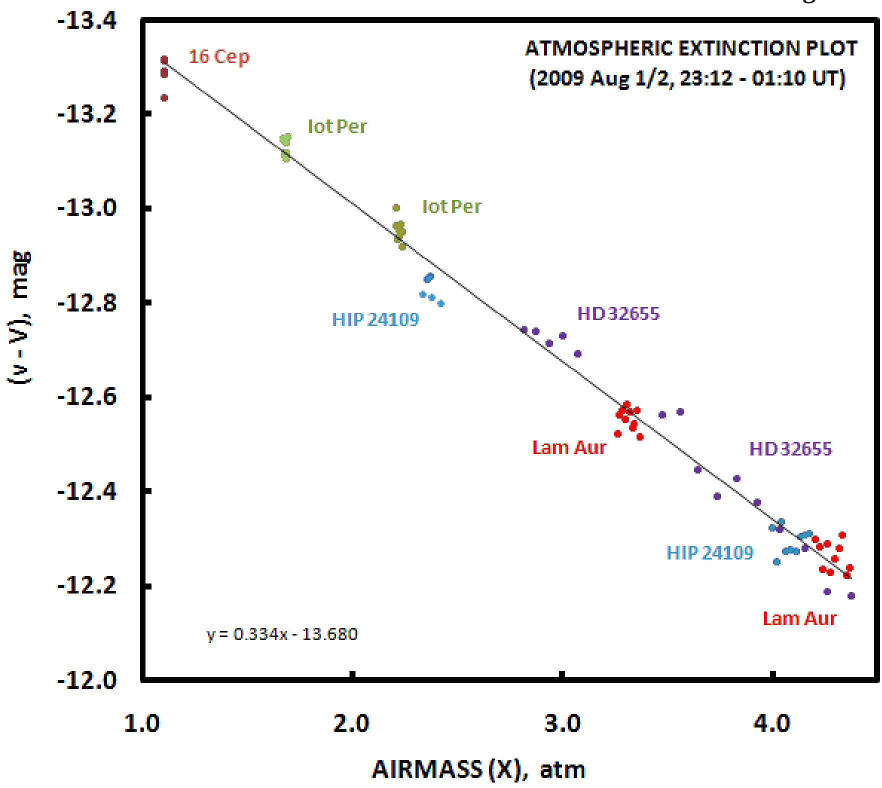
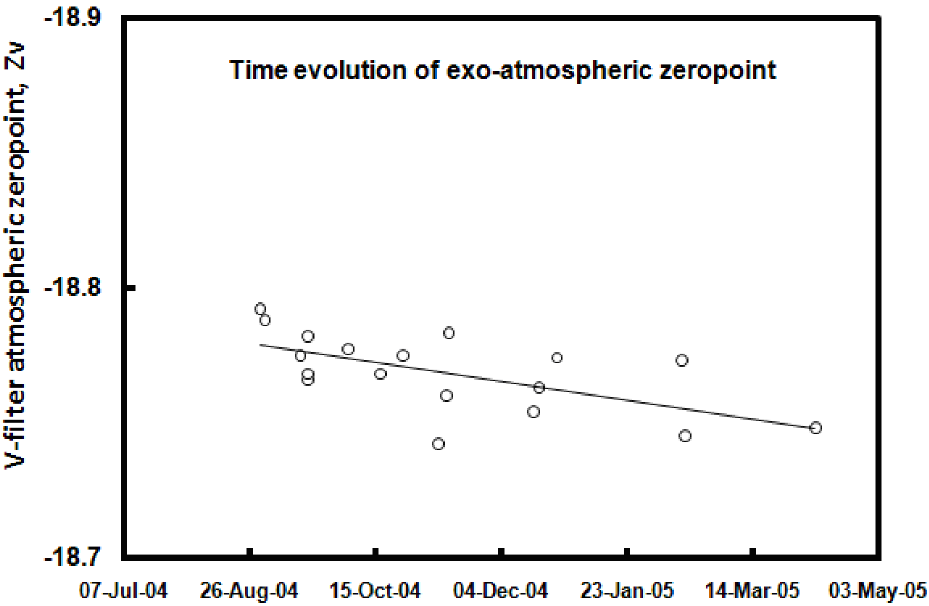


Figure 3, *page 11*, is an example of an extinction plot, using data obtained whilst the sky transparency remained constant for more than 3 hours. You can see how points for the same star, taken a couple of hours apart, lie close to the best-fit straight line. On this occasion, **kv** = 0.334 and **Zv** = -13.86.

In some ways, Zv is the holy grail when it comes to wanting to do accurate V photometry at high airmass - knowing your transformation coefficient is also important, but that subject is not discussed here. The reason it is so important, is that once you have determined Zv with good accuracy on a properly clear night, when conditions were photometric, you can calculate a very accurate extinction coefficient on subsequent nights, from knowing the intensity of a single comparison star of known brightness. However to do this, you need to leave the optical setup unchanged – no dismantling, no cleaning of the optics – since any change in the proportion of light reaching the detector will affect Zv. The most common problems afflicting this approach, is allowing condensation to form on the optics as the night progresses, permitting a dewcap to flop and vignette some of the light transmitted to the detector, or allowing serious amounts of dust to gradually contaminate the optics. Here's an example of the way in which Zv evolved from new for a Takahashi 6-cm aperture refractor, which being a sealed system gathered only a small amount of dust on its front element during its first 8 month's use.

Figure 4.



So if you know the value of **Zv**, then the extinction coefficient is simply given by:

$$Kv = [(v-V) – Zv] / X \qquad \text{... (2)}$$

So if you are working at an airmass of say 4, then even if you know **Zv** only approximately to say +/-0.05 mag, you will be able to calculate **kv** to an accuracy of +/-5% or so.

Photometry of objects at altitudes ranging from 4° - 10° (5<X<13)

Assuming that you have a good clear night, scintillation will be the main factor limiting precision whilst working with fairly bright stars at low altitude. The battle against scintillation can be a difficult one to overcome, because of a double whammy working against you. The first problem is that scintillation is very much worse at low altitudes, since it increases at the 3/2 power of X. So at an airmass of 10 for example, stars twinkle exhibiting a variation which is about 30 times greater than when they are high in the sky. Although scintillation affects stars equally, independent of their magnitude, if you try to image bright stars, then you may be forced to use very short exposures to avoid saturating the detector pixels. In so doing, you will increase the degree of scintillation further, possibly to unacceptably high levels. Likewise, if you try stopping down the working aperture of a DSLR camera to avoid saturation, then scintillation will increase very significantly – in other words you can't win that way either. Your main weapon in this particular war is to take lots of images, stack them and measure the stars in the stacked frames. I suggest you make stacks from a time-series of an odd number of frames, so that the 'middle' frame provides a value for the mid-time of the stacked exposure. If you use software such as Astrometrica or AIP4WIN for stacking, this will give an accurate mid-time value in the FITS header, as well as enable you to dark-subtract, and flat-field the images during the same operation. You might consider stacking from say 9 up to 99 individual frames in order to generate a single image for which accurate photometry is possible. Another approach is to use a neutral density filter to attenuate the light by say up to 90-99% thereby permitting longer duration exposures without saturating pixels.

In the calculation of airmass, at altitudes below about 10°, the simple plane, parallel model of the atmosphere begins to break down such that the effective airmass becomes increasingly less than that predicted by the **sec(z)** formula. A better approximation valid down to about 4° altitude, is that of Hardie (1962) who used Bemporad's values to derive a formula, which can be simplified to give:

X = 1 +0.99818*A - 0.00287*A2 – 0.000808*A3 where **A = sec(z) – 1** **... (3)**

If you wish, you can utilise this formula to calculate airmass for any altitude between 4° and 90°.

At very low altitudes, the airmass changes rapidly as stars rise or set, and so it is also possible to derive an empirical measure of extinction, based on the apparent change in instrumental magnitude versus sec(z) over a period of say thirty minutes, as shown in ***Figure 5***, ***page 14***.

In this case there is no need to modify the airmass parameter to take account of the non-ideal atmospheric model which sec(z) represents.

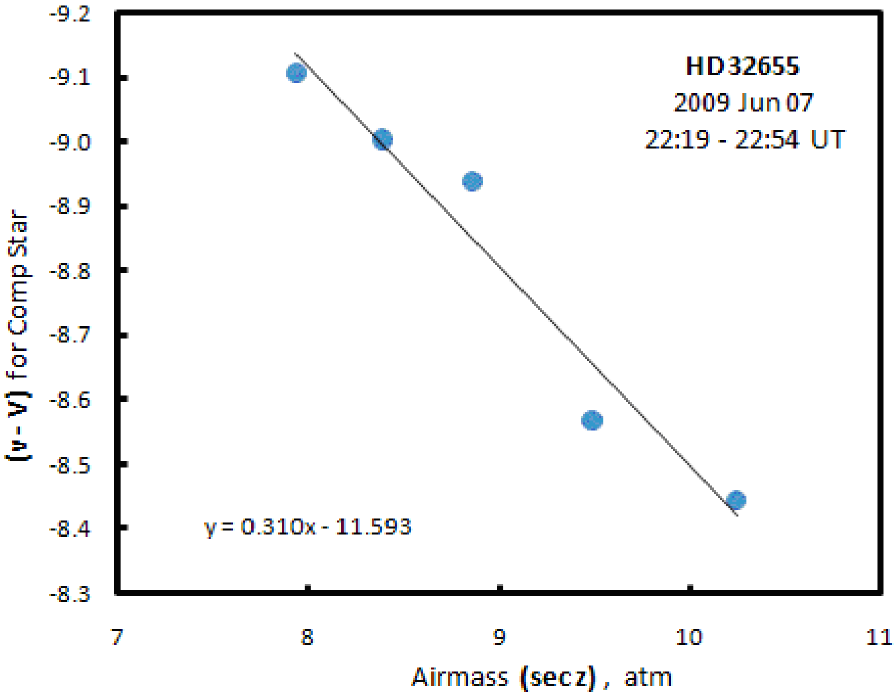


Figure 5.

Photometry of Epsilon Aurigæ during 2009 May-August

Trying to follow epsilon Aurigæ through the summer period is a good case where accurate photometry at high airmass is required. The reason is that the star is located some 21° from the Ecliptic, such that it is generally unobservable during the month of June unless you live at geographic latitudes north of about 50°, when it becomes circumpolar and in principle it can be observed through the summer months as it tracks low above the northern horizon. Most UK-based observers are well-placed to follow this variable. However one difficulty is that it is not possible to use lambda Aurigæ or eta Aurigæ as comparison stars since their declination is too far south. Although rather faint, the best alternative is HD 32655 (V=6.20) which is located about 1.1° from the variable, and is fairly similar in colour. Although the two stars are in relatively close proximity, the differential magnitude will change significantly if no correction is made for changing airmass of both the variable and comparison, as shown in ***Figure 6***, ***page 15***, where the differential extinction increases with time, HD 32655 being the lower star.

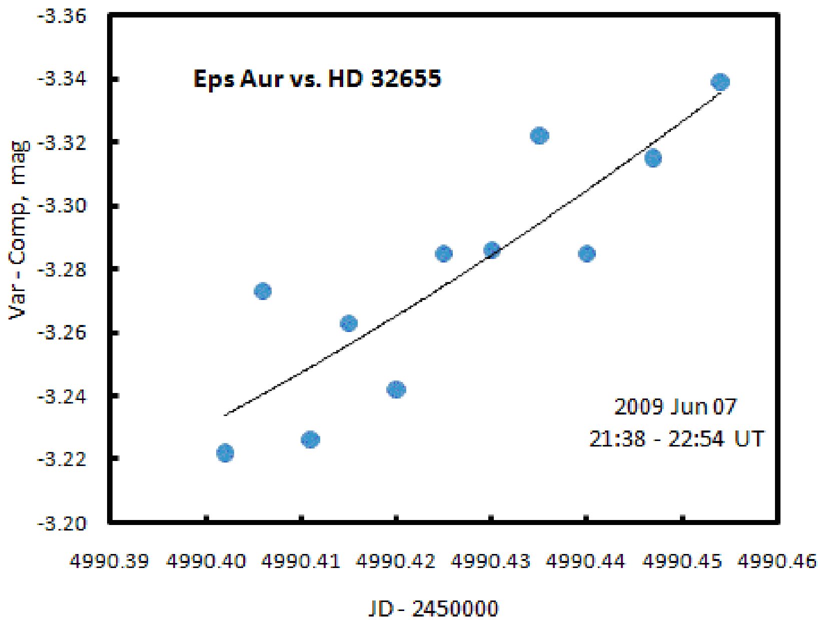


Figure 6.

If corrections are made for extinction, it is clear from the resultant light curve (*Figure 7, below*) that the variable is constant in brightness, the scatter in the data points being affected by both scintillation and the relative faintness of HD 32655.

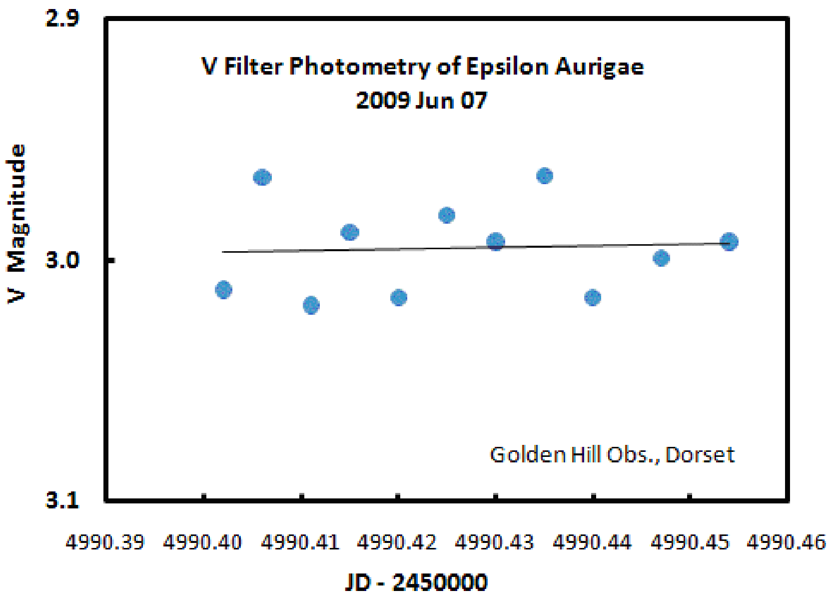


Figure 7.

These observations were made using a 6-cm, 355-mm focal length refractor stopped down to 4.4 cm, with a 5x5 cm neutral density glass filter having a 2% transmission, fixed in front of the main objective lens together with a Starlight Xpress SXV-H9 CCD camera. Having a 1.5 degrees FOV, it was possible to simultaneously image the variable and comparison stars without the need to move the telescope between exposures. The variable has been followed in this way throughout the summer months, weather permitting, and the results obtained, are depicted highlighted as grey squares, in the light curve shown in ***Figure 8, page 17***.

The most demanding time was imaging the 6th magnitude comparison star when it was just 4° above the horizon. Note that a clear, photometric sky is essential for good results when working close to the horizon. Further details including copies of spreadsheets can be obtained by contacting the undersigned.

Richard Miles, Variable Star Section CCD Adviser, *rmiles@baa.u-net.com*
Grange Cottage, Stourton Caundle, Dorset DT10 2JP

Epsilon Aurigae, 21st August, 2009, R. M.

I have obtained another set of accurate photometry of Epsilon Aurigae tonight - I now have V and Ic data on 11 nights starting July 15/16 and ending August 20/21.
Although Robin Leadbeater sees spectroscopic evidence of changes by July 19, these do not seem to be manifested as systematic changes in V or Ic magnitude. The system did fade about 0.2 mag in V very quickly during the first two months of July but this is probably unrelated to the eclipse phenomenon especially since Epsilon Aurigae has brightened a little since July 21st.

Looking at the entire dataset, what strikes me as possibly unusual, is the constancy of the Ic magnitudes in particular (extreme range of 2.308-2.355 over 10 nights) with no evidence of a fade starting. Also, since Aug 01/02, the V-Ic colour index has been especially constant (6 nights with an extreme range of just 0.695-0.711) although this is likely just through random chance. Whether this damping down of the usual magnitude fluctuations is linked to the start of the ingress I am not sure but it is unlikely.

The V mag has wandered about between about 3.00 and 3.07 showing no sign of any systematic fading of late.

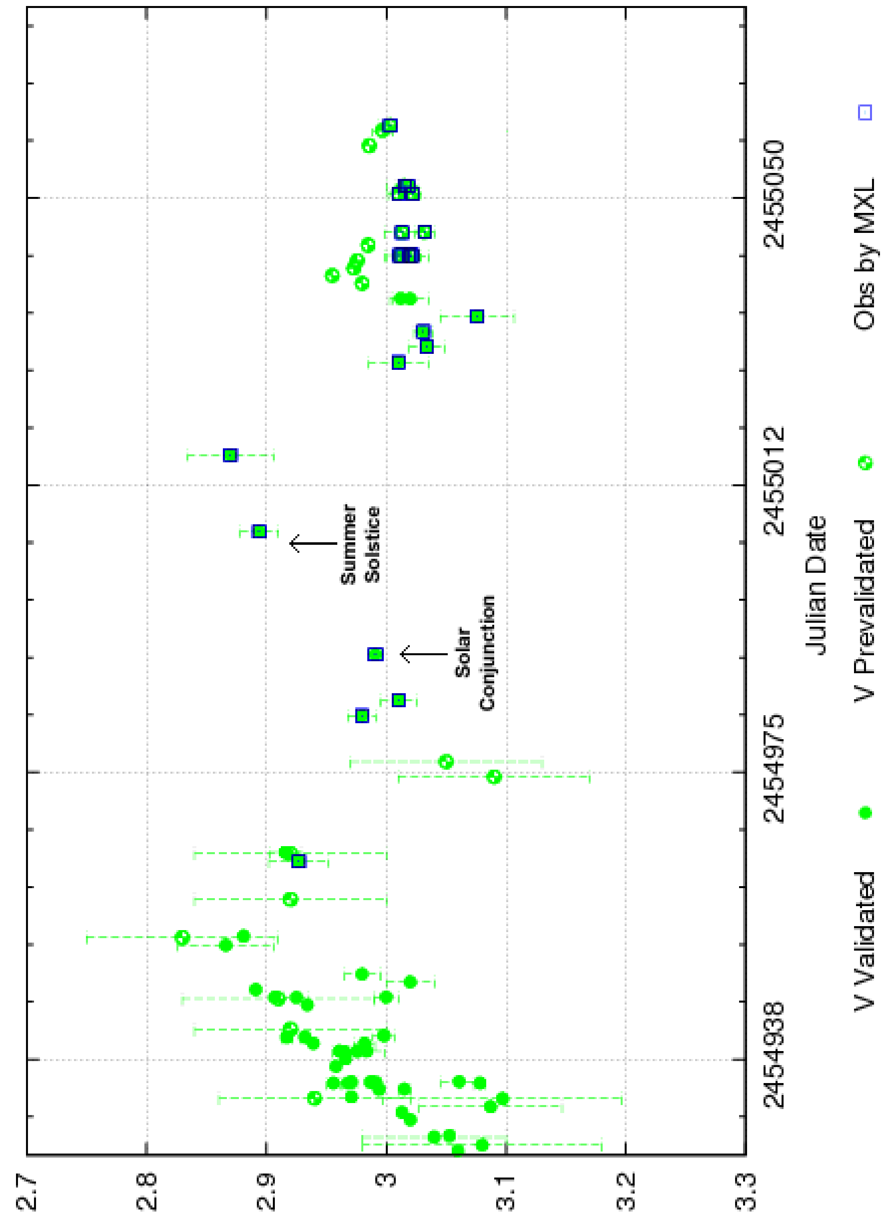
All in all rather perplexing. Looks like the duration of this eclipse may be even shorter than that of 1982-84.

Epsilon Aurigae Update, 23rd September 2009, D. L. ***continued from page 7.***

It seems to be on target to reach maximum eclipse in the middle of December at around 3.8. It is possible that there will be bumps/ humps/ shoulders on the downward trend due to the unevenness in the eclipsing cloud of dust and gas and because of the intrinsic variability of epsilon itself.

Visual observers should now be able to pick up that epsilon has faded below eta Aurigae (magnitude 3.2).

All observations are welcome as unexpected developments may happen!



AAVSO DATA FOR EPS AUR - WWW.AAVSO.ORG
Magnitude
2.7
2.8
2.9
3
3.1
3.2
3.3
Julian Date
2454938
2454975
2455012
2455050
Summer Solstice
Solar Conjunction
V Validated
V Prevalidated
Obs by MXL

Figure 8.

VARIABLE STAR SECTION MEETING, CARDIFF UNIVERSITY.

SATURDAY, 13TH JUNE 2009

photograph courtesy Rob Januszewski

MONITORING LOW MASS X-RAY BINARIES WITH THE FAULKES TELESCOPES.

FRASER LEWIS (Las Cumbres Observatory Global Telescope, Faulkes Telescope Project, Open University)

DAVID M. RUSSELL (University of Amsterdam)

1. Introduction

The Faulkes Telescope (FT) Project, is an educational and research arm of the Las Cumbres Observatory Global Telescope (LCOGT). In addition to the production of spectacular images of galaxies, nebulae, supernovae remnants, star clusters, etc., the FT team is involved in several projects pursuing scientific goals. Many of these projects also incorporate data, collected and analysed, by schools and amateur astronomers.

The Project currently has two 2-metre robotic telescopes, located at Haleakala on Maui (FT North), and Siding Spring in Australia (FT South). It is planned for these telescopes to be complemented by a research network of twelve to eighteen 1-metre telescopes, along with an educational network of twenty-eight 0.4-metre telescopes, providing 24 hour coverage of both northern and southern hemispheres.

FT North and FT South feature u’ g’ r’ i’ (Sloan), z y (Pan-Starrs), and BVRI (Bessel) broad-band filters as well as Hα, Hβ and O III narrow-band. They feature Merope cameras with a 4.6′ x 4.6′ field of view.

2. X-ray Binaries

X-ray Binaries (XRBs) consist of a pair of stars orbiting each other, however unlike ‘normal’ binary stars, one of the components is a compact object. This compact object is either a neutron star or a black hole.

There are 300 of these objects known in the Milky Way, split into two main categories, based on the mass of the companion star. They are known as High-Mass and Low-Mass X-ray Binaries (HMXBs and LMXBs). LMXBs form around 50% of the overall population of XRBs, and usually feature faint K and M dwarf stars as their companion stars.

The faintness of the donor, provides us with a useful opportunity to study the accretion variability of the system more easily than in HMXBs, where the system’s brightness is usually dominated by the intrinsic brightness of the O and B type stars.

XRBs possess discs of matter at millions of degrees Centigrade, ripped from the relatively normal star, towards the compact object. Often they have jets, of as yet unknown content, travelling at close to the speed of light (making them the fastest known objects in our Galaxy [1, 2]). In addition to the supernovae that form them, XRBs are also closely linked with extreme phenomena such as Gamma Ray Bursts (GRBs), and are considered to be likely sources of gravitational waves.

XRBs are usually first detected at X-ray wavelengths (by satellites such as Swift, INTEGRAL, RXTE), a signature of their extreme temperatures, but can also be seen at other wavelengths, such as the optical regime that the FTs operate at. They can often increase in optical brightness, by factors of 1000 or more, in a matter of days (known as outbursts), and sometimes display variability on the order of seconds [3, 4].

3. The Monitoring Program

Since 2006, we have been monitoring LMXBs using FT North. The addition of FT South, in 2008, allowed us to extend this to a total of 30 LMXBs. New cameras have allowed us to improve our monitoring, particularly the ability to observe in Pan-Starrs y filter, which moves us closer to the infrared regime. The addition of spectrographs, will allow us to perform rapid spectroscopic follow-up to new outbursts, which has rarely been possible until now.

The aims of the project are:

1. We wish to observe these transient sources as they go into outburst. LMXBs are known to brighten in the optical/near-infrared (OIR) for up to a month before X-ray detection.

This behaviour is poorly understood, particularly for black hole X-ray binaries. Catching outbursts from quiescence will allow us to examine this behaviour, and alert the astronomical community to initiate multi-wavelength follow-up observations on the early rises of outbursts, via Astronomers Telegrams (ATels).

It is also worth noting that often as these sources go into outburst, they remain below the threshold of instruments such as the All Sky Monitor (ASM) aboard the Rossi X-ray Timing Explorer (RXTE), and are detected first in the optical regime [e.g. 5].

2. To study the variability in quiescence. Recent results have suggested that many processes may contribute to the quiescent optical emission, including emission from the jets in black hole systems [6]. By monitoring the long-term variability of quiescent LMXBs, we aim to provide constraints on the emission processes, and the mass functions. Studying the systems that do not exhibit outburst behaviour, provides lower limits on their duty cycles.

Initial studies suggest that our sources divide into five main types:

- Those that show little or no variability in quiescence.
- Those that show some non-periodic variability in quiescence.
- Those that show periodic variability in quiescence.
- Those that undergo outbursts.
- Those that are persistently active.

4. The Outbursting Black Hole System, GX339-4

One target for FT South is the transient black hole binary GX 339-4, which went into outburst in early 2007, followed by a steady decline in the following months (see Fig.1). The outburst was detected at X-ray [7], optical/IR [8] and radio [9] wavelengths. Our observations show that the source continues to decline in V, R and i' bands until ~ MJD 54585 when the source increased in brightness to its previous brightest level [10].

Our ATel triggered multi-wavelength follow-up campaigns with the South African Large Telescope (SALT), the Very Large Telescope (VLT) and the Swift X-ray/gamma-ray and RXTE X-ray satellites.

We also note rapid flaring in i' and V band with jumps of ~ 0.3 – 0.4 magnitudes in periods of ~ 140 seconds, a high level of variability for an LMXB.

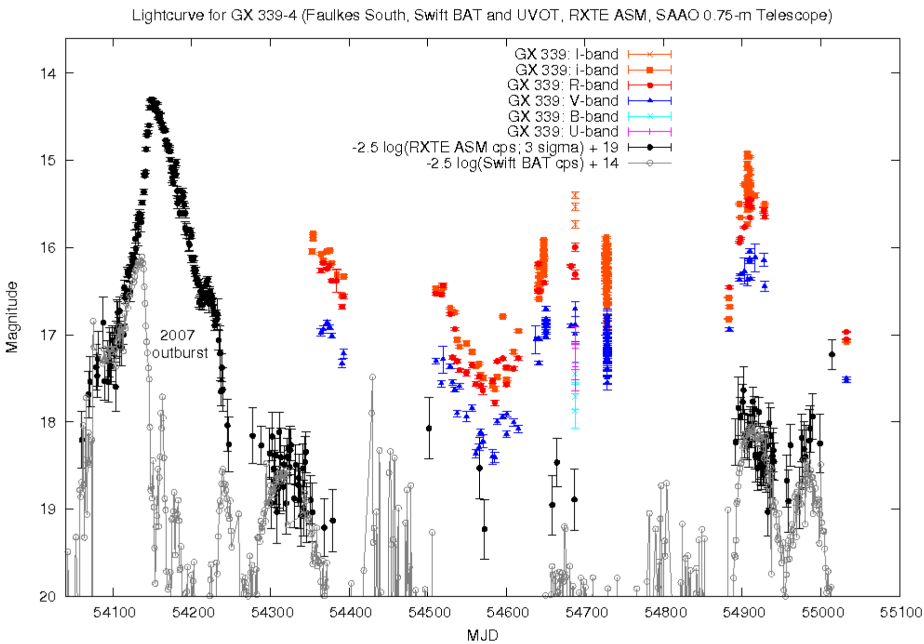


Fig. 1 FT multi-wavelength data, combined with RXTE X-ray observations showing the system's 2007 and 2008 outbursts.

5. Conclusions

We now have 4 years worth of data for several of our northern targets, and are collecting our second season's data for the southern ones. So far, we have produced 9 ATels and have contributed to one MNRAS paper. We have several papers on individual sources in preparation, as well as a couple of papers examining overall behaviour of our sample of XRBs. Much of the data discussed in this article is also intended for one author's (FL) PhD thesis.

6. Acknowledgements

FL would like to acknowledge support from the Dill Faulkes Educational Trust. DMR acknowledges support from a Netherlands Organization for Scientific Research (NWO) Veni Fellowship. ASM/RXTE data are provided by the ASM/RXTE team.

7. References

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4. Hynes (2008) High Time Resolution Optical, UV, and IR Observations of X-ray Binaries, AIP Conference Proceedings - HIGH TIME RESOLUTION ASTROPHYSICS: The Universe at Sub-Second Timescales, **984**, pp 3 - 14.

5. Lewis et al. (2008) Renewed optical and X-ray activity in IGR J00291+5934, *ATel*, **1726**.

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10. Russell et al. (2008) Unusual optical and X-ray flaring activity in GX 339-4, *ATel*, **1586**

The following article was presented as a POSTER PAPER at the Variable Star Section meeting .

A NOVEL PHOTOMETRIC ANALYSIS OF AN ECLIPSING BINARY, RZ CASSIOPEIAE.

JOHN HOWARTH

Eclipsing binaries such as RZ Cassiopeiae (EA/SD, HD17138, Period 1.195247dy*, F=0.17) have been observed by members of the BAA VSS for some decades, and estimates have been made of the times of eclipse minima. The challenge for analysis is to detect subtle changes in period, and in the shape of the light-curve, from one eclipse to another. Small changes in period, typically of the order of a few seconds, can be due to mass transfer between the components of the binary system, and the light-curve itself can be distorted from time to time by the fleeting presence of bright or faint spots on either component. Traditionally, such analysis has involved finding a *minimum* by curve-fitting or bisection. However the *minimum* can be hard to define, particularly in eclipses with wide 'bathtub' light-curves, asymmetric eclipses, or eclipses whose shape varies with time. The method employed here is novel, in that it makes no assumptions regarding the shape of the light-curve: it is based entirely on correlative techniques between eclipses. It employs the entire set of observations – from first drop to final rise – with equal weight, not just the few data around the supposed *minimum*. This is important since, other things being equal, the observations made at times of steepest descent or ascent will contribute most to the accuracy with which phase can be determined. However, for the method to work, it is not necessary to observe an entire eclipse – any reasonable subset will do (just as well, bearing in mind weather and light conditions!).

The analysis begins, by arranging the original observational estimates into strict chronological order, both within the eclipses themselves and in the order in which the eclipses occurred; then the heliocentric time is calculated for each estimate. Visual, CCD or PEP estimates may be used, provided julian date and V-magnitude are available.

Preliminary Iterative Process

For convenience a trial period is adopted, which for RZ Cassiopeiae is the Krakow 2004 period of 1.195248dy, though this can be revised later in the process, if it prove to be greatly inaccurate. The observations are plotted in Figure 1 (after heliocentric adjustment) in phase relative to the adopted period. All of the observations were kindly provided by Janet Simpson except for those marked in the legend, IG (Ian Megson) or JH (the author). From inspection, it would appear that the eclipses overlay well, and that the light-curve exhibits uniform properties over time; however further analysis is needed if more subtle variations are to be revealed. A *tentative* light-curve is firstly obtained by selecting just one eclipse's observations, ideally a set with as long a span of data as possible. For RZ Cassiopeiae this would be of duration 4-5 hours (only the primary eclipse is relevant for RZ Cas).

Next the data from each eclipse is considered in turn, and the offset (as a fraction of the adopted period) is found that gives the best correlative fit against the *tentative* light-curve. The data in the current *tentative* light-curve is now augmented by melding it, successively, with the data from each eclipse with its offset applied. When all eclipses have been done, a *best-estimate* light-curve is generated, which can be smoothed for use in the Main Iterative Process to follow.

Main Iterative Process

This proceeds in a similar way to the Preliminary Iterative Process already described, except that the *best-estimate* light-curve replaces the *tentative* light-curve used before, and the observations from each eclipse, with the new calculated offsets applied, are melded in turn into a *revised best-estimate* light-curve. When all eclipses have been done this *revised best-estimate* light-curve is smoothed and becomes the new *best-estimate* light-curve. The Main Iterative Process can now be repeated, typically 10 times in total, and at each stage a successively improved *best-estimate light* curve will be generated.

The final *best-estimate* light-curve for RZ Cassiopeiae is shown after 10 iterations in Figure 2. The innovative principle of this method is that the light-curve is derived *a posteriori* from the analysis, rather than assumed *a priori*, as often happens (taken to be a quadratic, for example). At the same time, the final phase offsets for each eclipse have been calculated and are plotted against the time of the eclipse, in calendar years, in Figure 3. The more positive the phase offset (vertical axis), the earlier the eclipse occurs. The phase difference is thus in the *opposite* sense to the familiar 'observed minus calculated' (O-C) value. A phase difference of 0.001 corresponds to a difference in time of about 1min 43sec. The symbols employed are identical to those used in Figure 1.

Discussion

The phase offsets in Figure 3 are referred to an arbitrary datum, in that it is strictly only meaningful, to compare the phase offset for one eclipse against the phase offset for another. The simple reason for this, is that published eclipse elements traditionally give epochs for the perceived *minimum* light, whereas the method described here has no perception of *minimum*, being based entirely on correlation. However it is quite feasible to interpolate the data of Figure 2, to find a value for *minimum* relative to the ordinate of phase – this quantity turns out to be about 0.0025. Hence the same value corresponds in Figure 3 to the *minimum* of the light-curve (horizontal line).

As it stands, Figure 3 provides an easy way of comparing the phase of one eclipse with another, and shows a general trend upwards, suggesting a period slightly shorter than the adopted one. The usual techniques of regression may be applied to the data in Figure 3 to calculate an improved period, or, if there is sufficient data over a long enough time-span, a rate of change of period. As with all processes of measurement it is important to be able to assess the accuracy of the derived statistics – in this case, the phase estimates. These will, of course, affect the confidence of any derived period, via the regression process.

The probable error in each phase estimate in Figure 3 can be shown to depend on:

- - the number of observations made of the eclipse (n)

and is given by $(F\Delta\sqrt{2}) \,/\, (\pi A\sqrt{n})$.** Taking n=15 (average value), A=1.6mag, F=0.17, Δ=0.1mag (for visual observations) gives 0.00123, or 2.13 minutes.

- - the depth of the eclipse (A)
- - the duration of the eclipse divided by the period (F)
- - the supposed accuracy of each observation (Δ)

The wider spread in phase in the spring of 2008, suggests a transient variation in brightness around the discs of one or both components of the system at that time. Likewise in 2005, though here the presence of only three eclipse runs, and the probable error above, mean the variation is less significant.

Acknowledgement

It is a pleasure to acknowledge the help given by Janet Simpson, both in the form of timely observations and in helpful discussion.

Future Work

I expect soon to receive further observations from the visual archives of the BAA VSS. This should enable the range of Figure 3 to be much extended, and to show clearly the long-term trends in phase behaviour for RZ Cassiopeiae and other eclipsing binaries.

* Sky Catalogue 2000.0, Volume 2, eds. Alan Hirshfeld and Roger W Sinnott, Cambridge University Press, 1985.

**This formula is based on a sinusoidal-type light curve (i.e. it flattens out towards the top) – an analogous formula based on a quadratic-type curve (i.e. one that drops suddenly and levels out suddenly at the top) gives a probable error of about 2/3 of this value.

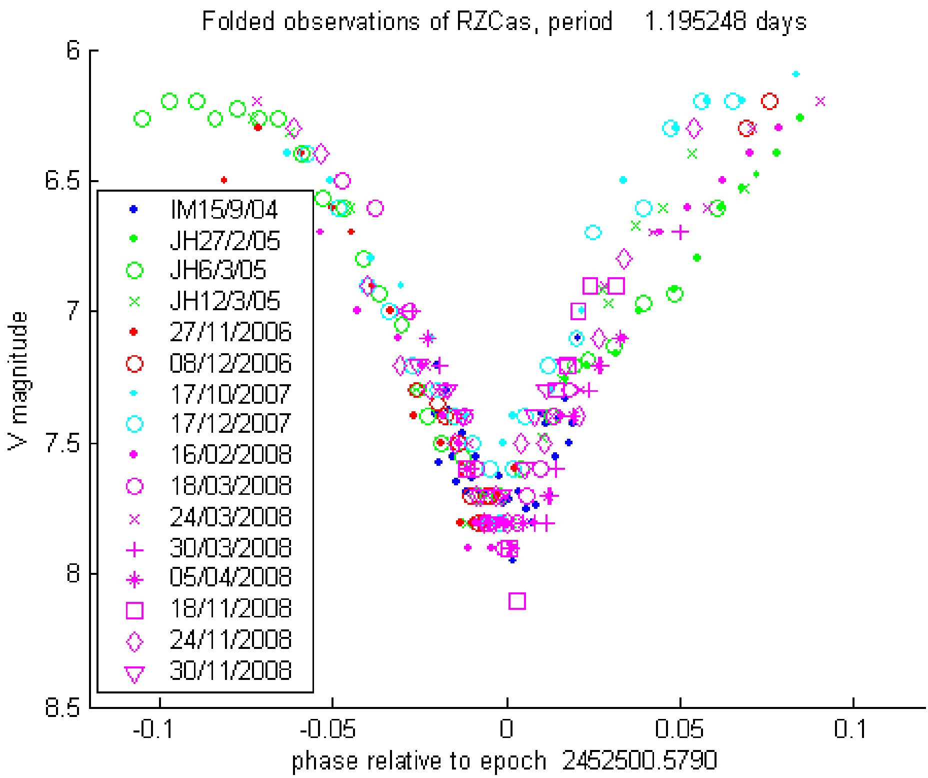


Figure 1: Folded Light Curve for RZCassiopeiae (observations by Janet Simpson unless otherwise stated in legend)

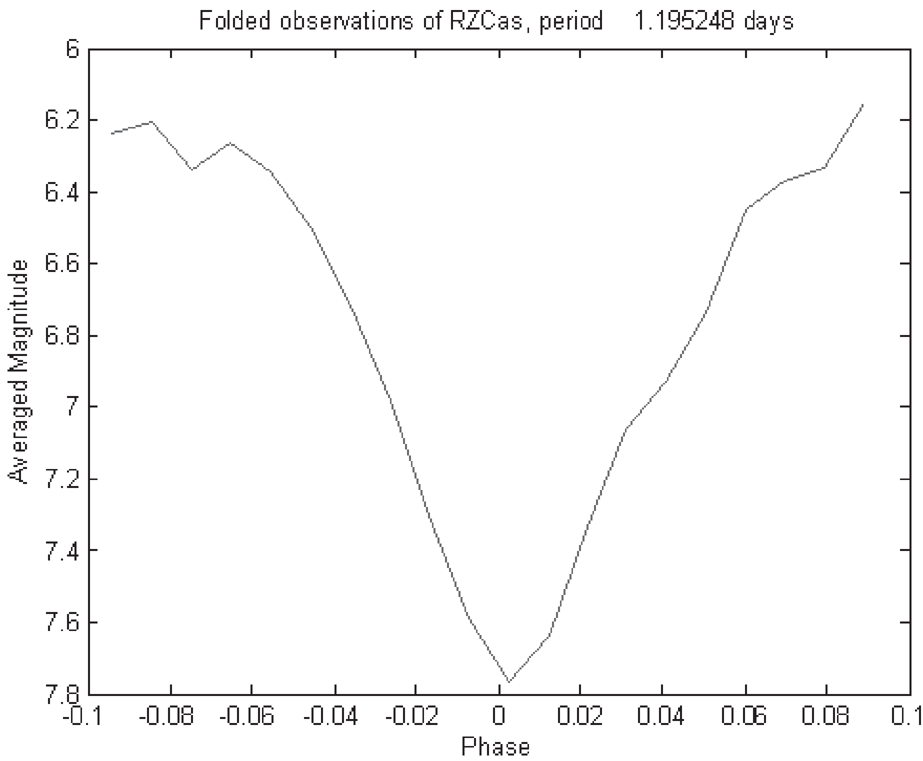
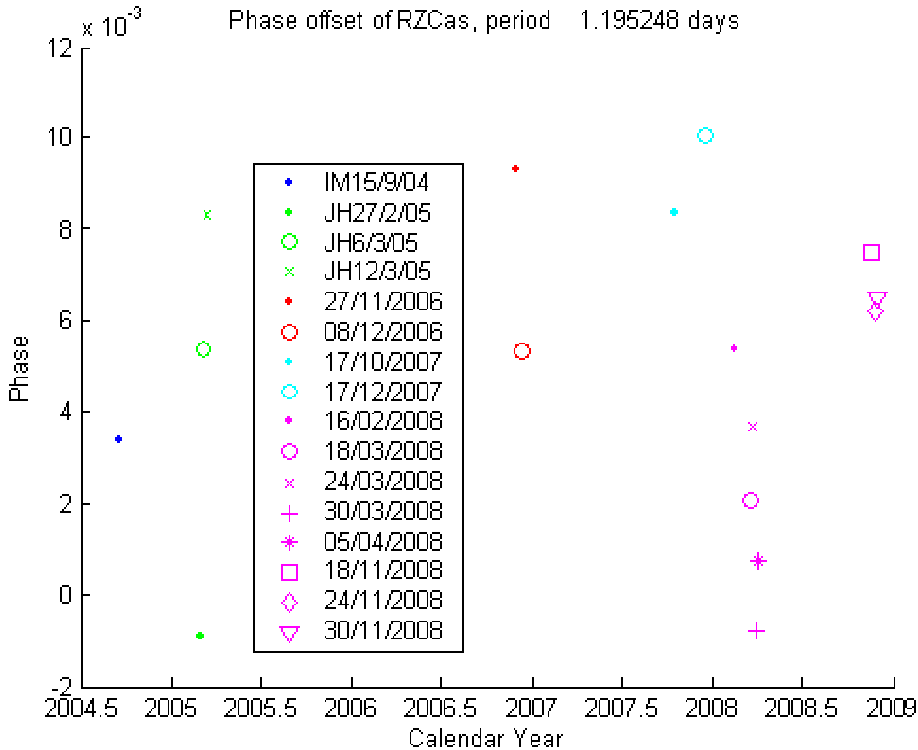


Figure 2: Best-Fit Light Curve based on all data.

Figure 3: Phase Offsets for the Various Eclipses.



Johnhowart@aol.com

A NON-TELESCOPIC 100,000.

TONY MARKHAM

Much of the content of Tony's talk was covered in his article "A Variable Star Observing History - an Observer Profile" p.7, VSSC 117 (2003 Sep).

Additional content included running top 10's:

over 9000 estimates by mid 1984, top star rho Cassiopeiae,
over 27000 by end 1989, top star CH Cygni,
over 57000 by end 1999, top star TV Cassiopeiae,
over 101000 by end 2008, top star TV Cassiopeiae,

and six things he wished someone had told him when he first started observing:-

1. The magnitude ranges listed for stars are often extreme ranges … R Lyrae doesn't vary between 3.9 and 5.0 in each cycle.

2. The magnitude ranges listed are not absolute …. V566 Herculis is listed as 7.1-7.8, but Tony's first estimate was mag 8.0… rather off-putting, but he wasn't doing anything wrong – it was magnitude 8.0.

3. Different observers see different magnitude ranges. Some observers are more sensitive to red light than others. Tony seems to be at the less sensitive end of the range, which can make a big difference for very red variables …TX Piscium is listed as magnitude 4.8-5.2, but Tony usually sees 5.8-6.2, and for W Canis Majoris he seems to be nearly 2 magnitudes fainter than some observers.

4. Most semiregular periods are not readily visible, so don't be surprised if they are not obvious in your results. Some published periods are spurious; others only show up in statistical analyses.

5. Not all comparison star magnitudes are reliable. Things are improving, but some still don't 'look' right. Fortunately there are usually more comparisons than you need on a chart, and you can pick the ones you are happy with and stick to using those.

6. Be wary of non-variable star authors, and of variable star observers, who make statements about stars they do not personally observe. These are the people who have never observed R Lyrae, but will quote information from variable star listings, and tell you that R Lyrae is a good star for beginners because it varies between magnitude 3.9 and 5.0 every 50 days …. No it does not !

A paper about the observing campaign described in **David Boyd**'s talk "**Results from the international CCD photometry campaign on DW UMa**" is being written up for the MNRAS. A brief summary of his talk will appear in VSSC 142.

Jeremy Shears also, has written his presentation "**Precursor to a superoutburst**" on HS0417 as a paper for publication, so it can not appear here.

A NOTE ON THE VARIABILITY OF CD-62 466 CARINAE.

Peter Williams

Situated between the brilliant Theta Carinae open cluster IC2602, and the Eta Carinae Nebula complex NGC3372, is the carbon star CD-62 466. With such prominent and spectacular neighbours, it is easy to understand why CD-62 466 has been overlooked by most casual observers, despite its rich red hue in fine contrast to two adjacent white coloured field stars of magnitude 9 to either side.

CD-62 466 is located at 10h 34m 17.8s, -62° 42' 38.8" (2000) and the Simbad database lists alternative designations including SAO 251015, CCCS1705, CGCS2792, IRAS 10325-6227 and TYC 8961-1219-1.

This star appears to have been first noted as star 312 in the Birmingham and Espin Catalogue of Red Stars from 1890. A subsequent investigation reported on by Lourens [(1)], indicated no variation greater than visual magnitude 0.5 was detected in this very red star.

My attention was first directed to CD-62 466 during a group discussion with John Toone [(2)] at the 1999 Ilford (NSW) star party, where a chart by Colin Henshaw was produced. Colin had noted this star as a possible variable during his time in Africa, but he had been unable to follow up on it due to his relocation further northward.

With such as strong colouring, CD-62 466 is a difficult star to estimate through the telescope. It is, however, well suited to observation with the 20x80mm binoculars, and has been under regular observation during the 11 years 1999 through 2009. Observations have been primarily provided by Albert Jones of Nelson, New Zealand, and Peter Williams of Heathcote, NSW. Although technically circumpolar, the usual observing season is typically January through August, and a seasonal gap is therefore evident in the data.

Following on from the amalgamation of the VSS RASNZ database into the AAVSO International Database, all observations are now available from a single location. These are plotted by the AAVSO Light Curve Generator, and shown here as Figure 1.

The light curve indicates CD-62 466 shows distinct variations in some years, and a reduced activity at other times. Perhaps this explains the little or no variation, reported by Lourens. A number of maxima and minima are evident, in what appears to be a long period semi regular cycle.

Details of the observed maxima and minima are listed here in Table 1. This gives the dates of maximum, and the interval in days to the following maximum, plus the dates of minimum, and interval to the following minimum. All dates have been measured directly from the light curve. A colon (:) after the date indicates some uncertainty in the actual date, usually due to the poorly defined light curve during times of reduced activity.

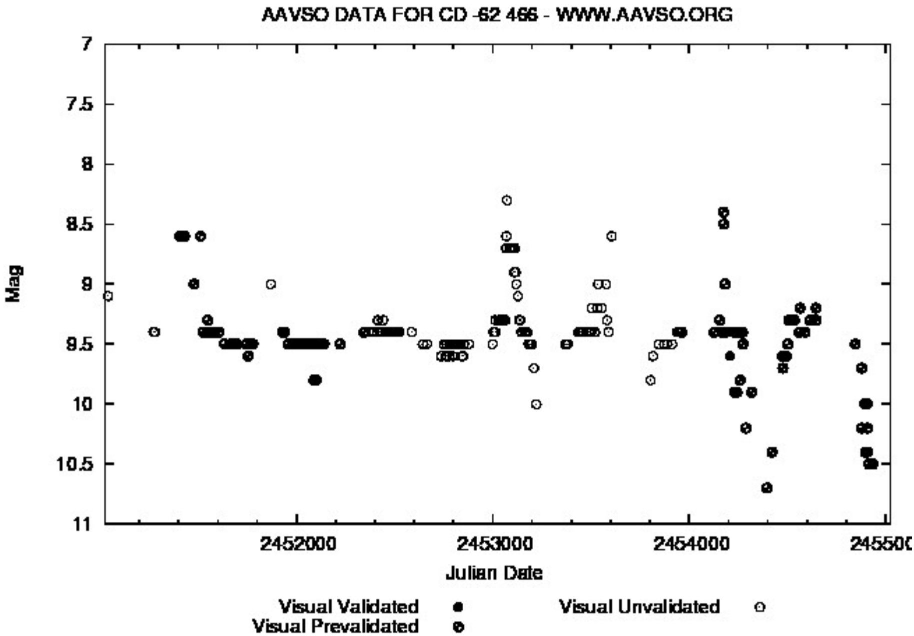
A mean period of 553.0 days is found from the 7 observed maxima, while a mean of 549.8 days is evident from the 7 minima. The average of these two values, 551.4 days, is used here in the following preliminary elements for determining the dates of maximum brightness, relative to the well-observed maximum of 2007:

JD 2454171 +/- 551.4 days (+/- 10 days)

An extreme brightness range of 8.4 to 10.7mag is evident from the visual light curve.

The available data discussed here, covers a relatively short time for what is clearly a variable star of rather long cycle. Continued observation is therefore desirable to refine these preliminary results.

Figure 1. Light curve of CD -62 466 based on visual observations by Albert Jones and Peter Williams, courtesy of the AAVSO.



References

1 Lourens, J.V.B., MNRAS, 108, 503-504 (1948)
2 Toone, J., BAA VSSC, 101 & 102 (1999)

Table 1. Observed maxima and minima of CD -62 466

MAX	INT (M)	MIN	INT (m)
51412	540	51663:	482
51952:	483	52146:	637
52435:	655	52782	540
53090	521	53322	444
53611	560	53766:	617
54171	559	54383	579
54730	-	54962-	

Days	Mean (M)	Days	Mean (m)
3318	553.0	3299	549.8

Mean maximum + minimum = 551.4 days

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VSS RASNZ

CPD-62 1643 THE COMPANION TO CD-62 466.

JOHN TOONE

Whilst in Australia in April 1986, I took some photographs of the Eta Carinae region, using fujichrome film which had red sensitive emulsion. A very red star was recorded between Eta Carinae and Theta Carinae, which is immersed within the bright open cluster IC2602. No variable star appeared to be catalogued in that position which coincided with SAO 251015, listed as a magnitude 8.6 star with a spectral class of F0. I mentioned this star to Colin Henshaw, who had also noted its red colour independently whilst he was stationed in Botswana in the mid 1980's. Unfortunately Colin had not had sufficient time to monitor the star for variability. Consequently this star was on my list of objects to investigate visually, on my next visit to Australia in March 1999.

In mid March 1999, I made visual magnitude estimates of SAO 251015 with 12x50 binoculars on 7 nights, where it appeared to be constant at magnitude 9.6. I recall discussing the star with Peter Williams at the Wiruna Star Party, and Peter informed me he had previously corresponded with Colin Henshaw on this very same star. On the final night (24 March 1999) I examined the star with the C8 telescope, just to admire the deep red colour, and found that it had a magnitude 12 companion closely south-preceding. Having a declination of 62 degrees south, and me not being resident in the southern hemisphere, I was unable to monitor SAO 251015 any further to establish its variability.

Fortunately both Albert Jones and Peter Williams have monitored SAO 251015 visually since 1999, and they have been able to establish its variability and calculate preliminary elements (see separate article by Peter Williams in this Circular).

SAO 251015, is listed in Simbad as CD-62 466, was earlier catalogued as CoD -62 466, and is equivalent to GSC 8961 12191, and was recorded by Tycho in 1989-1993 to be magnitude 8.25, with a B-V of +4. The companion that I noted in 1999, is CPD -62 1643 which is equivalent to GSC 8960 1845, listed with a GSC magnitude of 11.6. In the Lourens paper of 1948 on CoD -62 466, the companion star CPD -62 1643 is mentioned and was measured as 11.8pg at the Radcliffe Observatory, Pretoria in 1946. The Lourens paper also clarified that the spectral class of F0 applies to the companion CPD -62 1643, and not the brighter red star CoD -62 466 which is clearly a carbon star. If the spectral class of F0 is accurate then the visual magnitude (mv) of CPD -62 1643 is likely to be in the region of 11.0-11.5, which means that it can be contributing light to visual magnitude estimates being made of CoD -62 466. The impact of the companion on the magnitude estimates of CD-62 466 can be calculated by applying the following formula:

$$m = m1-2.5 \log \{1 + \text{antilog} [-0.4 (m2-m1)]\}$$

Where m1 and m2 are the respective magnitudes of the two individual stars and m is their combined magnitude.

The following tables derive the individual magnitude of CD-62 466 from the observed combined magnitude of the two stars between magnitudes 8.0 and 11.0 (covering the full visual range seen by Albert Jones and Peter Williams). In table 1, a magnitude of 11.5 is assumed for CPD -62 1643, whereas Table 2 assumes a magnitude of 11.0.

Table 1

Combined Magnitude	CPD -62 1643	CD -62 466
8.0	11.5	8.0
8.5	11.5	8.6
9.0	11.5	9.1
9.5	11.5	9.7
10.0	11.5	10.3
10.5	11.5	11.2
10.7	11.5	11.3
11.0	11.5	12.1

Table 2

Combined Magnitude	CPD -62 1643	CD -62 466
8.0	11.0	8.1
8.5	11.0	8.6
9.0	11.0	9.2
9.5	11.0	9.8
10.0	11.0	10.5
10.5	11.0	11.6
10.7	11.0	12.2
11.0	11.0	14.3

The effect of the companion CPD -62 1643 on total magnitude estimates of CD-62 466 is obviously more serious if its actual brightness is 11.0 rather than 11.5, but in either case the impact is clearly visible, especially once the combined light of both stars dips below magnitude 10.0. It would be most useful if we had an accurate V measurement for CPD -62 1643, so that its impact on the visual data accrued by Albert Jones and Peter Williams can be ascertained. Then we would have a much clearer picture of the actual minimum magnitude of this neglected carbon star. Perhaps someone within the recently activated Variable Stars South organisation, might wish to undertake such a measurement.

Note:
The above formula and tables is only a guide to indicate what the effect would be on the mean visual observer. The actual effect could be very different because we are dealing with a combination of vastly different coloured stars, and it would really depend upon how the individual observers colour response would react in this situation.

STUDYING SOUTHERN VARIABLES COLLOQUIUM – PART 1.

CARL KNIGHT

Introduction.

The Colloquium was attended by 32 on a miserable day in Wellington.

Grant Christie kicked off proceedings with a brief welcome to the attendees. His introduction was upbeat and encouraging. He noted that variable star observing is "one of the elite occupations of the Amateur World in terms of it's contribution to science," and that "there is room for everybody," the CCD equipped and the visual observer.

He further made the case for Amateur Variable Star observing, "Funding is an issue for all sky surveys...we can't rely exclusively on these. They're all very well while they're running." Suggesting that once the funding is gone, there is a gap to be filled by the amateur.

As a visual observer I found Grant's point that "there's a role for visual astronomers detecting outbursts, novae and dwarf novae" still, quite heartening.

He touched on Brian Warner's vision for all sky surveys to > Mag 20, with amateur astronomers doing the data mining. "What about amateurs publishing?... We want to see the results and not just add more data", he remarked.

Grant concluded the introduction by thanking Pauline Loader for stepping into the breach and running the RASNZ Variable Star section until a replacement Director could be found; And we all look forward to the VSS under Tom Richards.

Stan Walker spoke next on the "Changing periods in Mira and similar stars."

Stan Walker – Changing periods in Mira and similar stars.

The stars in question are cool red giants before the helium flash, and Asymptotic Giant Branch (AGB) where the Miras are located.

Stan began with a key question, "Long Period Variables (LPV), why do we look at them?" In summary, there can be enormous differences between successive maxima, despite the internal energy production remaining the same; When we measure their spectral class or pulsation period, we are measuring something about their evolution; Furthermore their pulsation tells us something about their physics.

There is a long history of observation of cool red giants. The first observations were made some 413 years ago. Observations of Mira itself dates back to the 1500s.

Stan moved on to examine and compare the following in more detail:

- Miras
- Semi-regular (SR) stars of various kinds – SRa, b, c, d.
- Semi-regular stars of short period
- Small Amplitude Red Variables (SARV).
- Long Period Variables

The Mira, RR Sagittarii has a well defined period of 334 days. The semi-regular SRc, CL Carinae has a period of around 513 days, and is more regular than LPVs. θ Apodis is semi-regular with more frequent pulsations of lower amplitude. β Gru is lower amplitude pulsations again. Finally the SARV HR8889 varies by a tenth of a magnitude.

Red Variables.

Discussing Miras, Stan noted that according to current theories, Miras should evolve through the AGB in around 60k years. Based upon those theories, we should see one Mira leaving the AGB every 5 years – but we don't. The theories are wrong! Good news for all, there's work to be done!

We know little about the nature of the departure of Miras from the AGB according to Stan. We don't know if the departure is abrupt or gradual, or how the departure changes the star and it's light curve.

The O-C diagram and period changes.

The Observed – Calculated (O-C) diagram is used to detect changes in period.

Examining R Aquilae, in 1870 there was a big change in period. O-C reveals that we see maxima earlier and earlier. Clearly it is evolving in some way. Which colour is pivotal in tracking evolution, Stan pointed out that we lack colour in old observations.

Mira, with roughly 400 years of maxima data, shows changes in period around 1700, though we can be less certain of this, and definitely around 1940 when it changed period by two days.

RR Sagittarii switches between two periods, this according to Stan is quite unexpected.

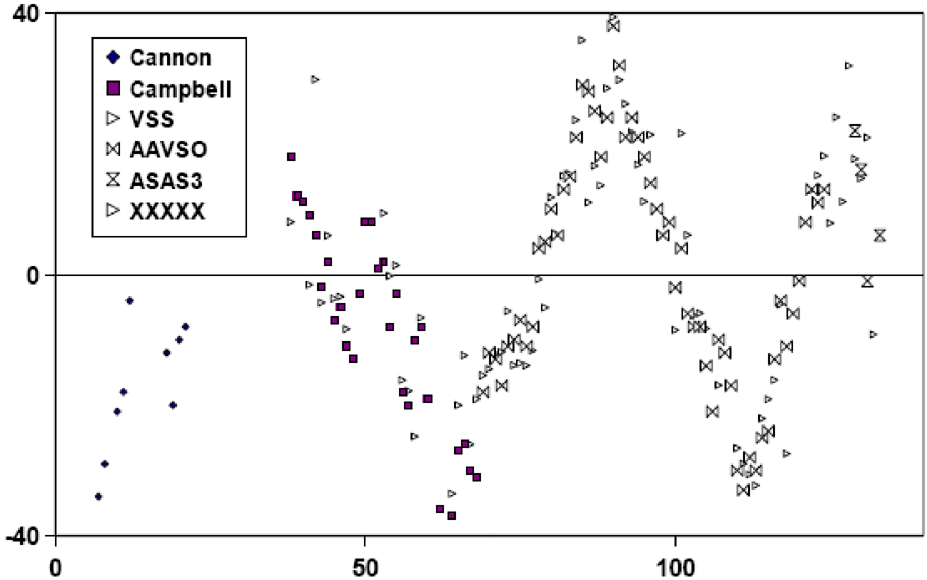


Figure 1: O-C Diagram of RR Sagittarii based on the elements of maximum epoch JD 2410052 + 334 days

T Eridani shows similar behaviour. Other stars show evidence of alternating periods, among them R Pictoris and T Centauri.

Others we can be less sure of. We lack data, and there is too much variance in the data we have, to make a determination.

Accuracy of Epoch determinations.

While the driving mechanism for Miras is the same as that of Cepheids, that is, driven by ionisation and recombination, and the subsequent impact of each on stellar opacity, a Mira is a star that began at <10 solar masses, that has expanded enormously, from a few solar radii to 300-1000 solar radii. The Mira's atmosphere is extremely tenuous, and it is further surrounded by a shell of gas, and a shell of dust, each of which has their own radiation signature. With the resulting jitta in the maxima and minima data being in the order of 5%, according to Stan, achieving accuracy of <0.1 magnitudes is largely wasted effort; and that visual observation is adequate, and indeed that visual observers are doing a good job.

Other aspects of red variable stars.

There is evidence according to Stan, that the period of red variables affects their behaviour.

- <100 days, small amplitude variables - semi-regular with one or more periods, SARVs.
- 100-200 days, multiple periods are present.
- 200-400 days, regular single period.
- >400 days yields erratic light curves with dual maxima and changing periods.

Composition is also very important, especially the role of TiO – it increases the temperature sensitivity of a star. Generally where red variables are concerned, the hotter the less opaque they are, and with cooling they become more opaque.

Models of red variables focus on a single fundamental frequency. Yet they are observed, according to Stan to pulsate in multiple modes, a fundamental based upon size (diameter) and density, and then overtones.

Period changes in detail.

Stan next moved on to examine the period changes of R Hydrae in detail. It has been observed from 1666 and has exhibited a decreasing period for much of that time. Then in the last 150 years it moved slowly from decreasing to alternating periods.

R Aquilae also maybe showing signs of a change from a decreasing to an alternating period.

Bright, 7^{th} magnitude BH Crucis begs the question, "Why was it not found until 1969", according to Stan. "Was it previously too faint?" BH Cru is an SC and like only a handful of others it exhibits a double maxima. During the past 40 years it's light curve has changed dramatically as has it's period from 421 to 525 days. Furthermore, colour changes in BH Cru indicate a change in surface temperature – it has become steadily redder – it appears to have maintained the same brightness, so therefore it must have expanded in order to produce the same brightness with a cooler surface temperature.

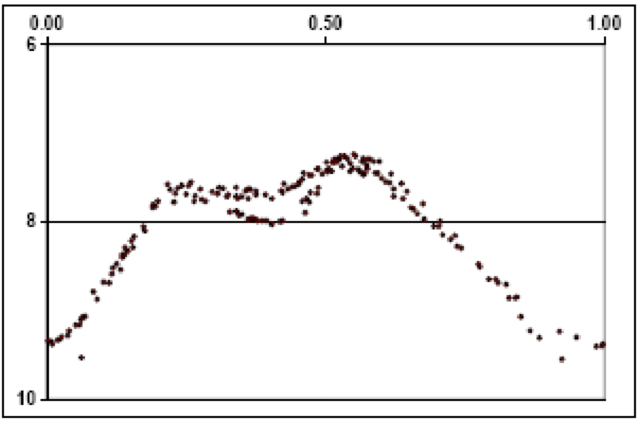


Figure 2: BH Crucis 1970 - 1976 V-Band.

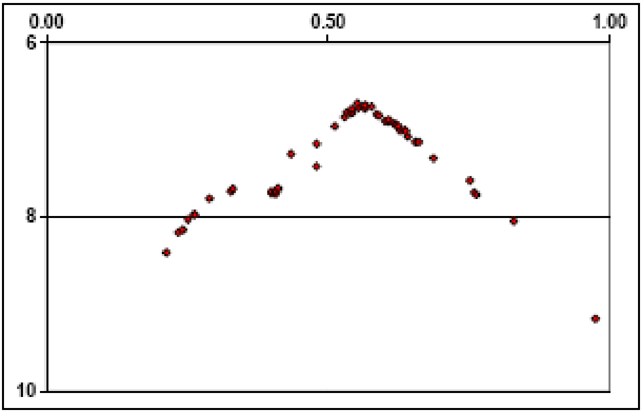


Figure 3: BH Crucis 1990 - 1994 V-Band

What period changes tell us.

In the case of R Hydrae and R Aquilae, shortening periods of pulsation implies they are becoming smaller and hotter.

In the case of BH Cru, it has been cooling, and its largely steady brightness, and lengthening period of pulsation, implies considerable expansion. Currently there are no models that predict any changes in internal energy production, so what then is causing the observed behaviour? Some suggest that chemical opacities have a role in altering the energy flow within the star and hence influence pulsation.

Semi-regular stars.

SRs are a mixed group. Those with a longer period resemble Miras and LPVs, but differ in that they exhibit lower amplitudes and less regular pulsations. At the shorter period end, they exhibit far more variety of behaviour. Some exhibit several periods at once, and the stronger these periods are, the more erratic the light curves become.

Stan drew attention to the transition typically shown on the HR diagram between Red giant, Helium flash, Horizontal branch, and Asymptotic Giant Branch, and the need to firmly establish where the stars we are observing fit. Stan notes, “It’s not as simple as it looks here – judging by the examples I’ve shown. Or is the evolution similar to that of binary stars where we see them at different stages but don’t recognise them at others, e.g., the 2-3 hour dwarf nova period gap.”

What is needed according to Stan, is measurements of SR stars with low amplitudes and also those with short or unknown periods.

In offering clarification to this article, Stan recently communicated to me, “We cannot understand red variables by studying Miras alone. SR, SARVs, LPVs and Miras are all part of the same interesting puzzle, but too little is being done to study the non-Mira stars.”

Dennis Sullivan – Southern variable White Dwarfs over an extended period.

Dennis Sullivan gave the next presentation, detailing work done at Mt John University Observatory to study southern White Dwarfs (WD). His work has been one of evolution and refinement, as lessons were learnt over time, and technology advances, especially the application of the same, enabled the quality of the data to be greatly increased.

One of the issues Dennis highlighted in his work at Mt John was that when attempting to track the pulsations of WD, variations in transparency and cloud can mimic the phenomena that the project is attempting to capture. Using Fourier Transforms, the coherent (WD) phenomena can be distinguished from the incoherent (transparency, clouds, etc.) and useful data obtained.

To achieve this, multiple apertures are required on a photometer monitoring:

1. The sky.
2. A suitable comparison star.
3. The WD target.

Initially the time series photometry work was performed with a photometer. This required a very accurate time source.

The next phase was a CCD system developed at the University of Texas. This uses a frame transfer CCD. It has the advantage of allowing more data to be captured. It takes milliseconds to transfer data to the buffer side of the CCD chip, and then the data can be read at a more leisurely pace whilst the exposed side of the CCD is continuing to capture more data from the target. The system also offers integration time in the order of 10 seconds. However, the CCD system is not as good as the three channel photometer yet.

Dennis touched on the cooling mechanism for WD cores. Due to the extreme density and opacity of the WD core, the core cannot cool by radiative means. Instead the WD core cools by neutrino emission. During the morning tea break, I was able to get Dennis to explain in more detail:

The mean free path of a photon, is such that very little in the way of energy is able to escape by photon emission. Instead it requires the far more exotic process of neutrino cooling. This is a rare reaction where the collision of two gamma rays in the dense core yield a virtual electron-positron pair. Instead of recombining and annihilating, the electron-positron pair further decay into a pair of neutrinos. The mean free path of neutrinos is enormous – measured in light years of lead – and so the energy associated with the original gamma rays is emitted from the core, by means of the neutrinos produced by the decay of the virtual electron-positron pair.

Dennis gave an example of how the three channel photometer is used to discriminate the WD pulsation period from the noise. To obtain the data necessary, the effects of the sky are removed from the raw data in the following manner:

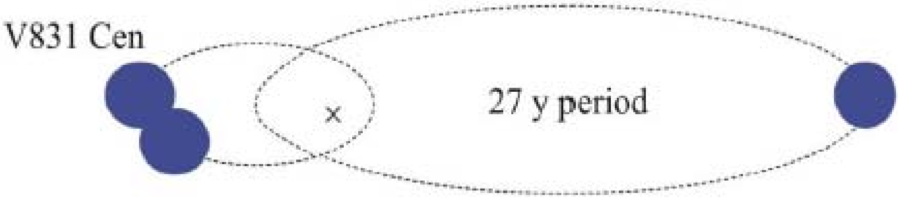
K x (WD – Sky) / (Cmp – Sky)

Then Fourier analysis is used to reveal the WD pulsation period(s).

Roland Idaczyk – Absolute parameters of young stars: V831 Centauri.

Roland presented a work in progress, involving himself and a number of collaborators. They have been working on a complex multiple system. V831 Centauri is an ECB, part of the 27 year period multiple, See 170 (Fig. 4 page 38). See 170 is itself part of the larger multiple I 424 (Fig. 5, page 38) with a 1500 year period.

There is evidence of asymmetries in the light curve of V831 Centauri when Hipparcos data V -Band photometry is fitted to the V-Band photometry of Waelkens & Bartholdi (1982)[1]. Roland remarked that this might be due to the influence of a third unseen component in V831 Cen. Spectra of V831 Centauri also indicates a third component.



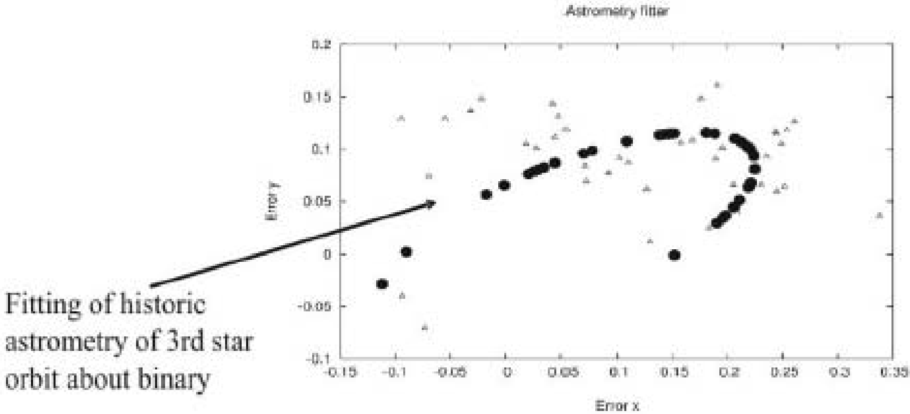
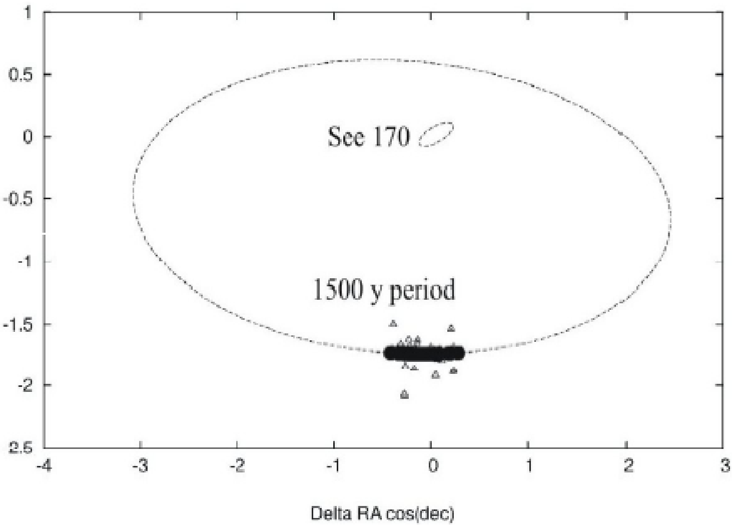


Figure 4: See 170

Figure 5: I 424



1 The author is unsure as to which work of Waelkens & Bartholdi is being quoted. However, V0831 Cen is HR 4975 so the most likely candidate is Waelkens, C. & Bartholdi, P. (1982). HR 4975 - a possible early - type contact system with unequal components. Astronomy and Astrophysics, 108(1), 51-54.

The team has experienced considerable difficulties gathering data from its Wellington region based observatory:

- No photometric nights.
- Always some atmospheric cloud – even if it's not visible.
- Noisy data.

The team is now attempting to complement the existing multi-band photometry of V831 Centauri with I-Band photometry. According to Roland, I-Band photometry of the system has not been done yet. As of the time of the VSS Colloquium, they had insufficient data from I-Band photometry done between January and April 2009. The project is very much a work in progress, but the team is hoping that I-Band will produce new information.

Roland further discussed issues that the team has experienced with sky noise and saturation. There were a number of possible solutions suggested from the Colloquium attendees.

Aims for the project in the future include:

- Better data on the ECB minima.
- More information about the third component in V831 Centauri.

Preliminary findings regarding the third component of V831 Centauri.

The third component's contribution to the spectra of V831 Cen, shows rare earth elements, Chromium (Cr I), Europium (Eu I), Gadolinium (Gd II), Manganese (Mn I), Samarium (Sm II) and possibly Neodymium (Nd II). This suggests that the third component is peculiar, "a Bp or Ap type star" according to Roland.

Finally Roland concluded with a plea to "watch this space," as it's early days for this project and much more data needs to be gathered yet.

Tom Richards – Bad Contacts: An attempt to classify some little-studied southern eclipsing contact binary variables that aren't.

Tom Richards has been investigating little studied southern eclipsing contact binary (EW of the W UMa class) variables as part of a US based project with 12 members. He has been using his own 16" RCOS – other members have been trying to use a Global Rent-a-Scope instrument at Moorook, South Australia with limited success.

What is expected of the stars in the study, if they are genuine EWs is:

- A period of < 1d.
- The components share an atmosphere – so the light curve varies continuously with no flat portion.
- Minima about equal.
- Amplitude of variability of between 0.1 and 1.0 magnitudes.

In the EWs that Tom has looked at to date, there are problems. One very notable issue is that if these stars have a common envelope, that envelope should have the same temperature, yet their minima varies – why?

Whilst the GCVS says these are EW stars, Tom points out that the photometric data were not that good when the classification was decided.

First Suspect: V0687 Arae.

Tom subtitled this, “Or Why I’m glad I’m not a professional astronomer”.

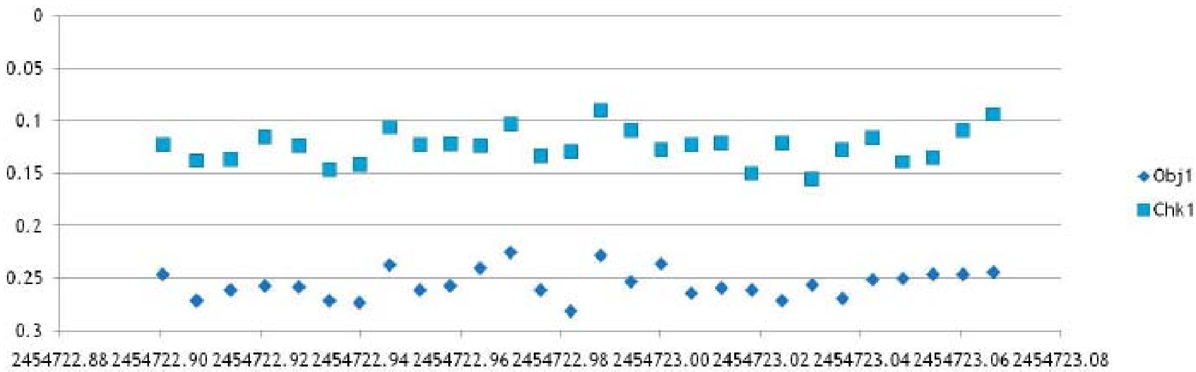


Figure 6: V0687 Arae flat line.

There is lots of data but no meaningful light curve, so Tom set about doing his own photometry over a number of nights, which yielded pretty much a flat curve – what Tom described as “boring”. The curve was flat enough that any variability at all was all within the “error bars” so to speak. It seems very unlikely that V0687 Ara is an EW (Fig. 6 above) at all.

Then Tom finally observed something genuine, a decline and then a climb. Eventually Tom had enough “scraps” – including the flat line data – as he called them to estimate a minimum, extrapolate another, and arrive at a possible period of 1.616d. The extrapolated light curve (Fig. 7 page 41) now looks like an EA detached binary, not an EW.

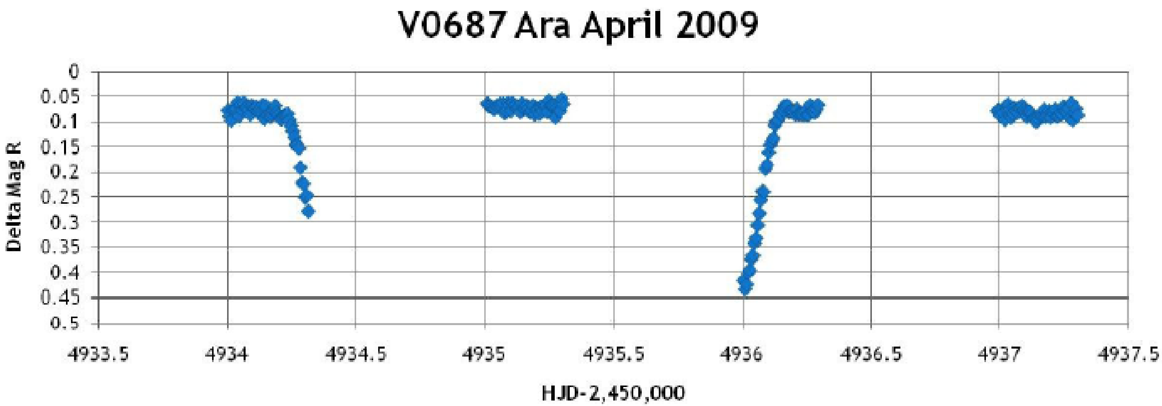


Figure 7: V0687 Arae light curve.

Now Tom had an ephemeris to test with some predictions for full eclipses of the system, and just needed some cloudless nights to prove it. Alas, by the time of the Colloquium the much needed cloudless nights had not occurred. Tom has subsequently informed me that later work was confirming his hunches until two months of solid cloud set in. (BAA VSS members will be pleased to note that "cloud" is not just a UK phenomenon.)

So in concluding the case of V0687 Ara:

- It may be an EA, not an EW, with a period of around 1.61 days.
- It's nothing at all like the GCVS classification.
- More data is needed to get an a thorough coverage of the orbit. Is it elliptical? What is its inclination?
- An accurate ephemeris for times of minima is needed.
- Light curves in different colours, to see if there are two separate stars of different temperatures.

SW Reticuli – a star with many disguises.

The next case Tom examined is that of SW Reticuli.

- The original GCVS in 1953 classifies the system as an EW with a period of 0.52774d.
- The ASAS-3 survey says it is an RRC which is a variant of RR Lyrae with an amplitude of variation of <1 magnitude, and a period of 0.2 to 0.5 days.
- To further muddy the waters, Szczygiel & Fabrycky (Mon. Not. R. Astron. Soc., 377, 1263-1274 (2007)) offer the opinion that SW Ret is an RRD. They worked at very limits of the ASAS-3 data, and concluded that SW Ret has two periods, an overtone of 0.3548111d, and a fundamental of 0.4766242d.

To quote Tom, "Who is right?"

Tom did his own photometry. On the first night, the light curve clearly indicated the system was not any sort of eclipsing binary (Fig. 8 below).

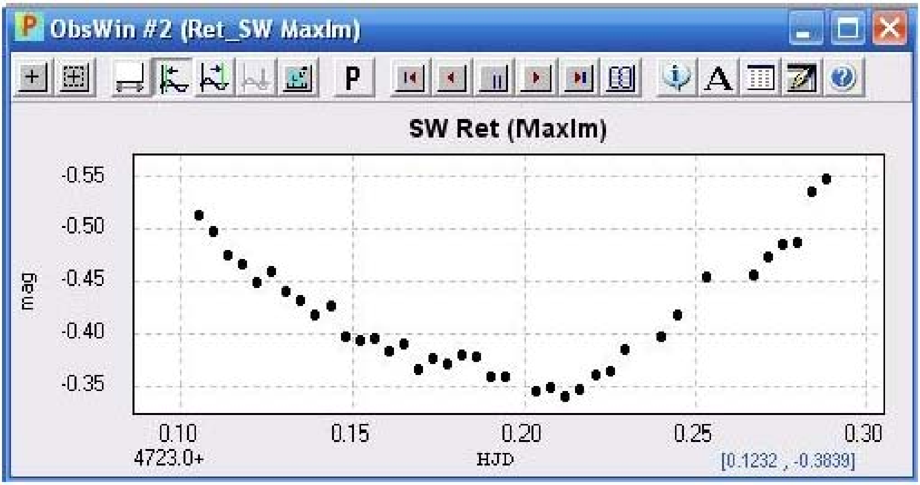


Figure 8: SW Reticuli not an EB.

Tom obtained twelve nights data between September and November 2008. From the resulting data, he was able to reach the following conclusions:

- SW Ret is definitely an RRD – probably a double mode RRD.
- The dominant period is 0.37487d. The ASAS-3 says 0.3548111d.
- Tom folded his data about the dominant period and discrepancies appeared. He removed the previous dominant period and its aliases from a period plot, to reveal a second period of 0.476518d. Szczygiel & Fabrycky had 0.4766242d.

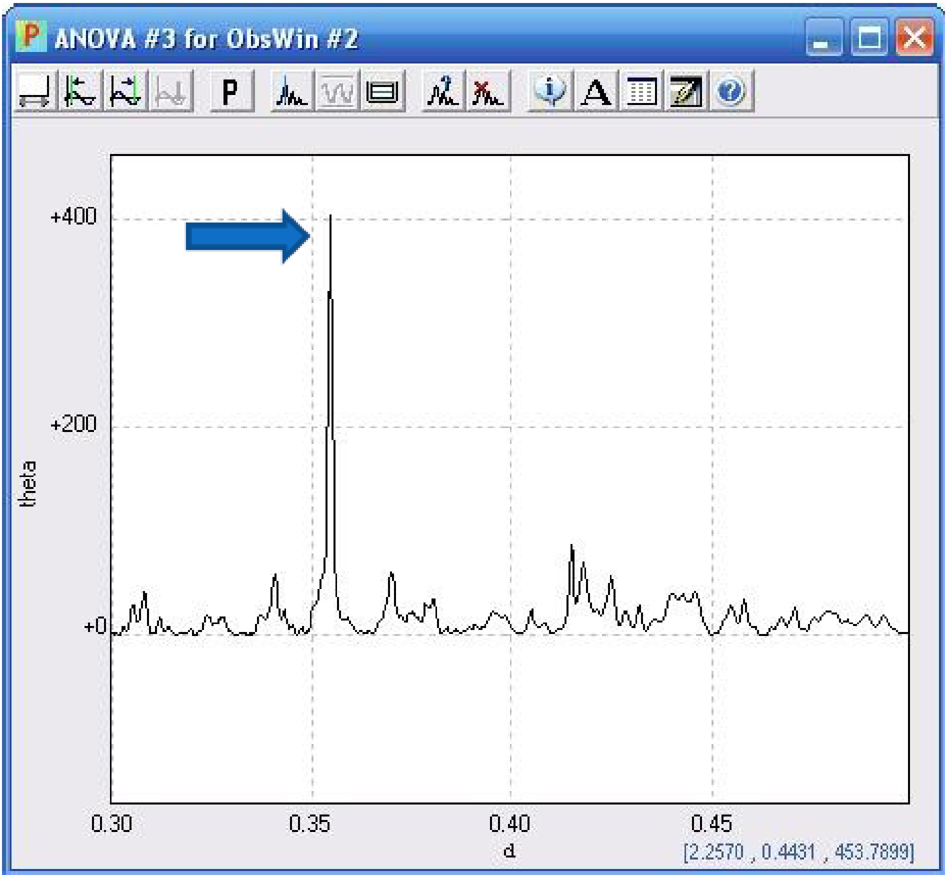


Figure 9: SW Reticuli dominant period.

Further work.

Still to do, UX Horologii, V0805 Arae; Refine V0687 Arae and SW Reticuli; And would really like some spectroscopy.

Lunch.

Lunch was a great time for lively conversation with like minded people – with two notable exceptions. I had a couple of burning questions which Dr. Tom Richards very kindly offered to attempt to answer. He suggested we seat ourselves in the couches by the fire. So with full bellies, comfortable seats, an open fire on a rainy Wellington afternoon, we sat down to discuss the growth of the electron degenerate core of WDs and the propagation of the cooling wave through the accretion disk of a CV as it comes out of outburst – now I can't speak for Tom, but I'm guessing that the combination of food, comfort, and open fire made us both anything but "lively".

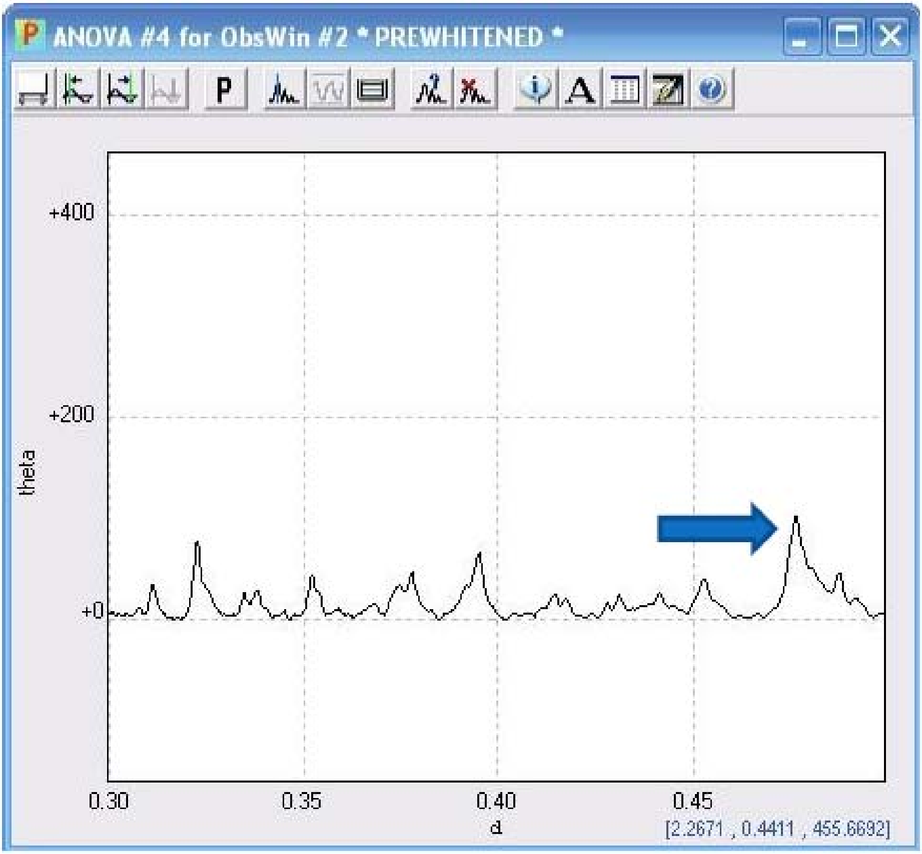


Figure 10: SW Reticuli overtone.

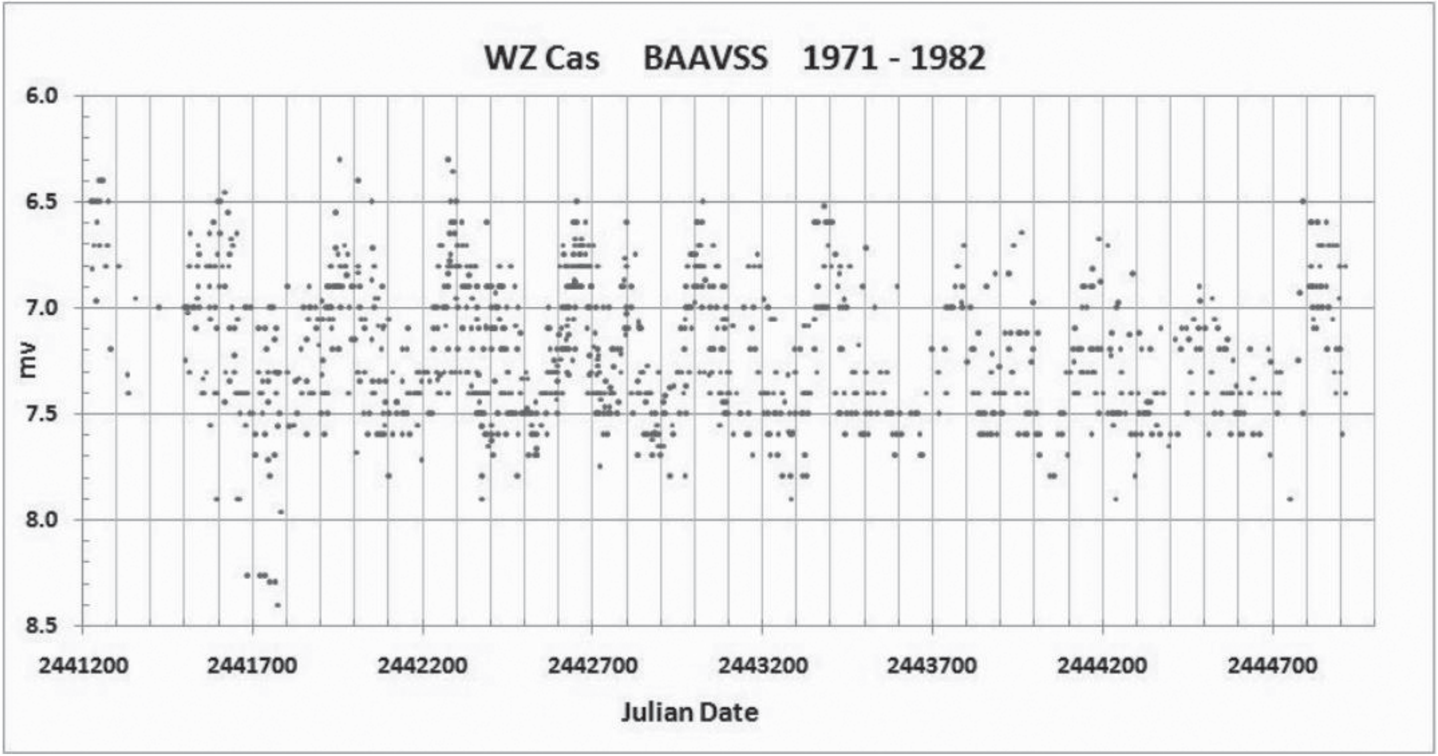
sleepless.knight@paradise.net.nz

WZ CASSIOPEIAE
RA 00h 01m, DEC.+60° 21' (2000), SRB.

MELVYN TAYLOR

The light curve of this very red semi-regular variable, that is within a few degrees of beta Cassiopeiae, has been extracted from the CD database for the years 1971 to 1982. Mean variation is from magnitude 6.3 to 8.2 with all estimates averaging 7.20 (s.d. 0.31) for this interval. The considerable scatter is at times not easy to interpret, with a (long) mean period of about 255 days, that is in contrast to the GCVS data of 186d.

The existing chart is being considered for amendment, its sequence no. is a date of 1982 Aug 16. It also includes the eclipsing binary TV Cassiopeiae, and V377 Cassiopeiae, a delta Scuti type suitable for instrumental photometry since its amplitude is small.



The VSS observers in the data-set are: Albrighton, Allen, Baker, Beesley, Bingham, Blair, Brelstaff, Britton, Broadbent, Bullivant, Chaplin, Chapman, Clayton, Currie, Day, Dryden, Evans, Fleet, Fraser, Freeman, Gardner, Geddes, Good, Goodger, Gough, Granslo, Hather, Hollis, Hornby, Hufton, Hunt, Hurst, Hutchings, Isles, Jobson, Johnston, Kendall, Kennedy, Koushiappas, Livesey, Lloyd, Lubek, Maris, Markham, Matthews, McAdam, McNaught, Middlemist, Miller, Minty, Mormyl, Nartowicz, Nicholls, O'Halloran, O'Neill, Parkinson, Pezzarossa, Pickup, Pointer, Pointer, Porter, Pratt, Price, Quadt, Ramsey, Rothery, Saunders, Saville, Smeaton, Smith, Spooner, Stephanopoulos, Swain, Taylor, Thorpe, Volodymir, West, Wilson, Wise, Woodbridge, Yates, Young, Yusuf.

RECURRENT OBJECTS PROGRAMME - UPDATE!

Gary Poyner

Following a review of the ROP during the Summer months, it has been decided to drop three stars and add two. Those stars which have been dropped are…

V1316 Cyg: Observations have shown this to be a remarkable dwarf nova, exhibiting frequent short period outbursts, and being shown to be a UGSU star after many years of attempting to observe superhumps. For more detailed studies of V1316 Cyg, see "Brief Outbursts in the Dwarf Nova V1316 Cyg". Shears, Boyd, Poyner. JBAA Vol. 116, No.5 2006 or *http://arxiv.org/pdf/astro-ph/0605284* and "Superhumps and flickering in V1316 Cygni", Boyd et al *http://arxiv.org/pdf/0710.1653*

KV Dra: Jeremy Shears has looked at previous normal and Superoutbursts of this object dating back to 2000, and successfully predicted a Superoutburst occurring in May of this year. His analysis has been published in JAAVSO Vol 37, 2009 (The Superoutburst Period of KV Draconis) and is available on-line at *http://www.aavso.org/publications/ejaavso/ej95.pdf*

With the above analysis accomplished on both stars, and the fact that both objects are 'frequent' outbursting DNe, we have decided to retire them from the ROP, although continued monitoring is to be encouraged.

EX Hya: This eclipsing IP has remained virtually anonymous on the ROP for years, and at -29 degrees declination, it's not hard to see why. Even though outbursts are short and quite rare, we do know a great deal about EX Hya (see AAVSO Variable Star of the Season, April 2009 *http://www.aavso.org/vstar/vsots/* . For these reasons, we have decided to replace it with an object of a more suitable location in the sky.

The two stars which are to be added to the ROP are…

V1108 Her: Formerly Var Her 04, discovered by Yuji Nakamura on 2004 June 13.632 at 11.5pg. This object was later shown to be a rare UGWZ type star, although the 2004 outburst did not show echo outbursts, normally associated with UGWZ type stars. Harvard archive plates (1929-1950) reveal four (possibly five) previous outbursts in April 1932, October 1934, August 1939 and August 1941 (the uncertain one occurred during August 1940) [1]

SDSSJ103533.02+055158.3: is a (totally) eclipsing dwarf nova with an orbital period very close to the period minimum (82.1m). The short P_orb and spectrum indicate a UGWZ type star, and analysis of eclipse profiles suggest a highly evolved CV with a brown dwarf donor star. In his CVnet interview, Dr. Boris Gaensicke suggests an outburst study and measure of it's superhump period would be "fantastic". [2]

A chart for V1108 her can be obtained from the AAVSO chart plotter. A preliminary chart for SDSS1035 is available from the ROP web pages.(*http://www.britastro.org/vss/*)

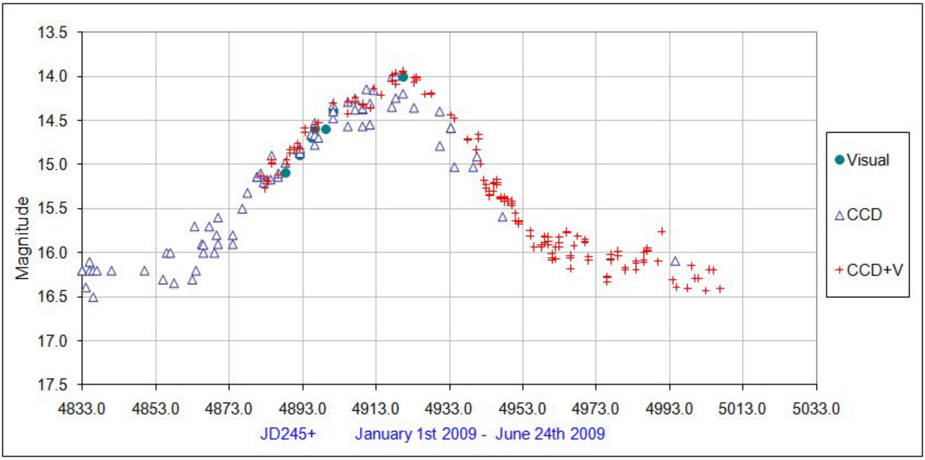
1: A New Cataclysmic in Hercules. Price et al, *arXiv:astro-ph/0411158v2*

2 : An interview with Boris Gaensicke.
CVnet *https:*//sites.google.com/siteaavsocvsection/interviews

V630 Cas

By far the most interesting outburst to occur this year was that of V630 Cas. Only two previous outbursts had been reported (1950 and 1992) of this long period UG star (P_orb 2.56d), and both were unusually slow outbursts, lasting between two and three months respectively. Usually found between magnitude 16.0 and 17.0 at quiescence, by early February 2009 several CCD observers had noted an increase in brightness suggesting that V630 Cas was becoming active again. The outburst took a long time to reach maximum (52d) and peaked at 13.94V on March 29th. The decline was also protracted, but faster than the rise (38d). The two previous outbursts were similar in profile. A paper is currently being prepared for the BAAJ.

V630 Cassiopeiae Light Curve



From observations by…

Visual: G. Poyner

CCD: R. Januszewski, H. McGee (GRAS001), I. Miller, M. Mobberley, R. Pickard, J. Shears (including data from BRT).

CCD+V: D. Boyd, I. Miller, M. Mobberley, M. Nicholson, G. Poyner (SRO)

(G. Poyner acknowledges the AAVSO Sonoita Research Observatory for his V-band data).

IBVS 5869-5890

Gary Poyner

5821 Detection of Increase in the Optical Light of Be/X-ray Binary System GRO J2058+42. (Kiziloglu et al, 2008)

5822 Photometric Sequences and Astrometric Positions of Nova Vul 2007 N.2 and Nova Cyg 2008. (Henden & Munari, 2008)

5823 The GEOS RR Lyr survey. (Le Borgne et al, 2008)
5824 Photometric Analysis of a New W UMa System in Vulpecula. (Capezzali et al, 2008)
5825 BN UMa and CF Del: Two New Galactic Field Double Mode RR Lyr Stars. (McClusky, 2008)
5826 Discovery of Short-periodic Pulsating Component in the Eclipsing Binary Y Leonis. (Turcu et al, 2008)
5827 The Unconfirmed Eclipsing Nature of V348 And and Detection of Variability of HD 1438. (Zasche & Svoboda, 2008)
5828 Optical Spectroscopy SN 2007gr of Type 1c. (Tarasova, 2008)
5829 New Outburst of V1118 Ori (2007-2008). (Garcia & Parsamian, 2008)
5830 BAV Results of observations – Photoelectric Minima of Selected Eclipsing Binaries and Maxima of Pulsating Stars. (Hubscher, 2008)
5831 BVRcIc Photometric Observations of V733 Cep (Persson's star) (Semkov & Peneva, 2008)
5832 Recent CCD Photometry of AB Dor, and a Comment on the Long-term Activity Cycle. (Innis et al, 2008)
5833 On the Accretion State Switching in EX Dra. (Halevin & Henden, 2008)
5834 Photometric Sequences and Astrometric Positions of Nova Cyg 2008 N.2 and Nova Sgr 2008. (Henden & Munari, 2008)
5835 New and Archive Times of Minima of Eclipsing Binary Systems. (Borkovits et al, 2008)
5836 UX Ari: New Photometry and Longitudinal Asymmetry in Spot Activity in Orbital Reference Frame. (Rosario, et al, 2008)
5837 166. List of Timings of Minima Eclipsing Binaries by BBSAG Observers. (Diethelm, 2008)
5838 Observations of the Active Southern RS CVn Binary V841 Cen in 2007 and 2008 – a Large, Long-lived Spot Wave. (Innis & Coates, 2008)
5839 Plate archive photometry of the progenitors of Nova Cyg 2008 N.2 and Nova Sgr 2008. (Rajka & Ulisse, 2008)
5840 Confirmation of the RRd nature of V458 Her. (Hambsch & Wils, 2008)
5841 Evidence for short term variations in two O-type stars. (Becker et al, 2008)
5842 Short period oscillations found in the Algol type system GSC 4550-1408. (Dimitrov et al, 2008)
5843 Times of minima observed by "Pi of the sky". (Ogloza et al, 2008)
5844 Multicolour CCD Photometry of Three RRab Stars. (Jurcsik et al, 2008)
5845 V965 Cygni, an A and F Type Very High Fill-out Binary with Strong Magnetic Activity? (Samec et al, 2008)
5846 Multicolour CCD Photometry of Four RRab Stars. (Jurcsik et al, 200)
5847 Elements for 8 eclipsing binaries. (Haussler et al, 2008)
5848 V772 Cas: An intrinsically variable BpSi star in an eclipsing binary. (Gandet, 2008)
5849 The cool dwarf interacting eclipsing binary, HH95-79. (Samec et al, 2008)
5850 Early spectroscopy and photometry of the new outburst of V1647 Ori. (Kun, 2008)
5851 The longitudinal magnetic field of the ROSAP star HD 99563. (Elkin et al, 2008)
5852 The new contact binary GSC 2414-0797. (Robb et al, 2008)
5853 The GEOS RR Lyr survey. (Le Borgne et al, 2008)
5854 Maxima of RR Lyr stars from AAVSO international database. (Le Borgne et al, 2008)
5855 Long term BVRcIc photometry of carbon and symbiotic stars in the Draco dwarf galaxy. (Munari et al, 2008)

5856 Short period oscillations in the Algol type systems II: Newly discovered variable GSC 3889-0202. (Dimitrov et al, 2008)
5857 Variable Stars in the field of the open cluster King 7. (Bukowiecki & Maciejewski, 2008)
5858 Elements for 10 RR Lyrae stars. (Haussler et al, 2008)
5859 Multicolour CCD photometry of three RRab stars. (Kun et al, 2008)
5860 BVRcIc photometry of the eccentric eclipsing binary HD350731. (Kleidis et al, 2008)
5861 Eclipse mapping of RW Tri in the low luminosity state. (Halevin & Henden, 2008)
5862 Dwarf Nova Trianguli 2008 as a WZ Sge type object. (Shugarov et al, 2008)
5863 The 79th name list of variable stars. (Kazarovets et al, 2008)
5864 Variable Stars in the field of the open cluster NGC 457. (Macijewski et al, 2008)
5865 Long term optical observations of the BE/X-ray binary system V0332+53. (Kiziloglu et al, 2008)
5866 The 2008/2009 eclipse of EE Cep will soon begin. (Galan et al, 2008)
5867 A multicolour photometric study of CN Orionis. (Spogli et al, 2008)
5868 Tow pairs of interacting EB's towards the LMC in the OGLE database. (Ofir, 2008)
5869 ROTSE III observations of Nova M31 2008-08D. (Yuan et al, 2009)
5870 Photoelectric minima of selected eclipsing binaries in 2008. (Dvorak, 2009)
5871 Timings of minima of eclipsing binaries. (Diethelm, 2009)
5872 CCD photometry of new variable stars and BX Dra. (Kim et al, 2009)
5873 Double mode RR Lyrae stars in SDSS stripe 82. (Wils, 2009)
5874 BAV – Results of observations – photoelectric minima of selected eclipsing binaries and maxima of pulsating stars. (Hubscher et al, 2009)
5875 CCD minima for selected eclipsing binaries in 2008. (Nelson, 2009)
5876 Updated spin ephemeris for the Cataclysmic Variable EX Hydrae. (Mauche et al, 2009)
5877 The GEOS RR Lyr survey. (Le Borgne et al, 2009)
5878 Photometric observations of high amplitude delta Scuti stars. (Wils et al, 2009)
5879 New photometry of blue stragglers in four galactic open clusters. (Tas et al, 2009)
5880 MW UMa, a detached binary: Observations and analysis. (Nelson, 2009)
5881 HD 190336 A new beta Cep star. (Jurcisk et al, 2009)
5882 Three new galactic double mode pulsating stars. (Hajdu et al, 2009)
5883 Short period oscillations in the Algol type systems III: Newly Discovered variable GSC 4588-0883. (Dimitrov et al, 2009)
5884 V364 Cas – an evolved detached eclipsing binary. (Nelson, 2009)
5885 Plate archive photometry of candidate variable stars in Cepheus OB3 association. (Munari, 2009)
5886 ASAS J071829-0336.7: Short-Period End for Contact Binaries Redefined. (Pribulla et al, 2009)
5887 New Times of Minima of Some Eclipsing Binary Stars and Maxima of Pulsating Stars. (Yilmaz et al, 2009)
5888 Elements for 10 RR Lyrae stars. (Haussler et al, 2009)
5889 BAV – Results of observations – photoelectric minima of selected eclipsing binaries and maxima of pulsating stars. (Hubscher et al, 2009)
5890 NSV 11154 – A possible new R CrB star. (Haussler et al, 2009)

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*

BINOCULAR PRIORITY LIST

MELVYN TAYLOR

(Includes *XX Cam*, *Mira*, *R CrB*, and *R Hya* which are also on the telescopic programme)

Variable		RA (2000) Dec	Range	Type	Period	Chart	Prog
AQ	***And***	00 28 +35 35	8.0-8.9	SR	346d	303.01	
EG	***And***	00 45 +40 41	7.1-7.8	ZAnd		072.01	
V	***Aql***	19 04 -05 41	6.6-8.4	SRb	353d	026.04	
UU	***Aur***	06 37 +38 27	5.1-6.8	SRb	234d	230.01	
AB	***Aur***	04 56 +30 33	6.7-8.4	Ina		301.01	
V	***Boo***	14 30 +38 52	7-12	Sra	258d	037.01	
RW	***Boo***	14 41 +31 34	7.4-8.9	SRb	209d	104.01	
RX	***Boo***	14 24 +25 42	6.9-9.1	SRb	160d	219.01	
ST	***Cam***	04 51 +68 10	6.0-8.0	SRb	300d?	111.01	
XX	***Cam***	04 09 +53 22	7.3-9.7	RCB		068.01	T/B
X	***Cnc***	08 55 +17 04	5.6-7.5	SRb	195d	231.01	
RS	***Cnc***	09 11 +30 58	5.1-7.0	SRc	120d?	269.01	
V	***CVn***	13 20 +45 32	6.5-8.6	SRa	192d	214.02	
WZ	***Cas***	00 01 +60 21	6.9-8.5	SRb	186d	1982Aug16	
V465	***Cas***	01 18 +57 48	6.2-7.8	SRb	60d	233.01	
γ	***Cas***	00 57 +60 43	1.6-3.0	GCAS		064.01	
Rho	***Cas***	23 54 +57 29	4.1-6.2	SRd	320d	064.01	
W	***Cep***	22 37 +58 26	7.0-9.2	SRc		312.01	
AR	***Cep***	22 52 +85 03	7.0-7.9	SRb		1985May06	
Mu	***Cep***	21 44 +58 47	3.4-5.1	SRc	730d	112.01	
O	***Cet***	02 19 -02 59	2.0-10.1	M	332d	039.02	T/B
R	***CrB***	15 48 +28 09	5.7-14.8	RCB		041.03	T/B
W	***Cyg***	21 36 +45 22	5.0-7.6	SRb	131d	062.03	
AF	***Cyg***	19 30 +46 09	6.4-8.4	SRb	92d	232.01	
CH	***Cyg***	19 25 +50 15	5.6-10.5	ZAnd+SR	97	089.02	
U	***Del***	20 46 +18 06	5.6-7.9	SRb	110d?	228.01	
EU	***Del***	20 38 +18 16	5.8-6.9	SRb	60d	228.01	
TX	***Dra***	16 35 +60 28	6.6-8.4	SRb	78d?	106.02	
AH	***Dra***	16 48 +57 49	7.0-8.7	SRb	158d	106.02	
NQ	***Gem***	07 32 +24 30	7.4-8.0	SR+ZAnd	70d?	077.01	
X	***Her***	16 03 +47 14	6.1-7.5	SRb	95d	223.01	
SX	***Her***	16 08 +24 55	8.0-9.2	SRd	103d	113.01	
UW	***Her***	17 14 +36 22	7.0-8.8	SRb	104d	107.01	
AC	***Her***	18 30 +21 52	6.8-9.0	RVA	75d	048.03	
IQ	***Her***	18 18 +17 59	7.0-7.5	SRb	75d	048.03	
OP	***Her***	17 57 +45 21	5.9-7.2	SRb	120d	1984Apr12	
R	***Hya***	13 30 -23 17	3.5-10.9	M	389d	049.02	T/B
RX	***Lep***	05 11 -11 51	5.0-7.4	SRb	60d?	110.01	
Y	***Lyn***	07 28 +45 59	6.5-8.4	SRc	110d	229.01	
SV	***Lyn***	08 84 +36 21	6.6-7.9	SRb	70d?	108.03	
U	***Mon***	07 31 -09 47	5.9-7.9	RVB	91d	029.03	
X	***Oph***	18 38 +08 50	5.9-9.2	M	328d	099.01	
BQ	***Ori***	05 57 +22 50	6.9-8.9	SR	110d	295.01	

Variable		RA (2000) Dec	Range	Type	Period	Chart	Prog
AG	*Peg*	21 51 +12 38	6.0-9.4	Nc		094.02	
X	*Per*	03 55 +31 03	6.0-7.0	GCas+Xp		277.01	
R	*Sct*	18 48 -05 42	4.2-8.6	RVA	146d	026.04	
Y	*Tau*	05 46 +20 42	6.5-9.2	SRb	242d	295.01	
W	*Tri*	02 42 +34 31	7.5-8.8	SRc	108d	114.01	
Z	*UMa*	11 57 +57 52	6.2-9.4	SRb	196d	217.02	
ST	*UMa*	11 28 +45 11	6.0-7.6	SRb	110d?	102.02	
VY	*UMa*	10 45 +67 25	5.9-7.0	Lb		226.01	
V	*UMi*	13 39 +74 19	7.2-9.1	SRb	72d	101.01	
SS	*Vir*	12 25 +00 48	6.9-9.6	SRa	364d	097.01	
SW	*Vir*	13 14 -02 48	6.4-8.5	SRb	150d?	098.01	

* *

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/time.

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	AI Dra	7.2 - 8.2	U Sge	6.45 - 9.28V
TV Cas	7.2 - 8.2V	Z Vul	7.25 - 8.90V	RW Tau	7.98 - 11.59V
U Cep	6.8 - 9.4	Z Dra	10.8 - 14.1p	HU Tau	5.92 - 6.70V
U CrB	7.7 - 8.8V	TW Dra	8.0 - 10.5v	X Tri	8.88 - 11.27V
SW Cyg	9.24 - 11.83V	S Equ	8.0 - 10.08V	TX Uma	7.06 - 8.80V
V367 Cyg	6.7 - 7.6V	Z Per	9.7 - 12.4p	Del Lib	4.9 - 5.9
Y Psc	10.1 - 13.1	SS Cet	9.4 - 13.0	RZ Cas	6.3 - 7.9

Note that predictions for 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.

OCTOBER

2009 Oct 1 Thu
RS CVn.....L04(04)05D
Z Dra..........04(07)05D
Z Per...........D19(14)19
Y Psc...........D19(15)20
RZ Cas........D19(17)20
TV Cas........D19(22)27
X Tri.............19(21)24
RW Tau........L20(19)24

2009 Oct 2 Fri
SW Cyg.......00(06)05D
Z Vul...........01(06)02L
U Cep.........D18(20)25
X Tri...........D18(21)23
RZ Cas..........20(22)24
S Equ...........23(28)25L

2009 Oct 3 Sat
TV Cas........D18(18)22
U Sge...........D18(19)24
TW Dra.......D18(19)24
X Tri...........D18(20)22
AI Dra............20(21)22
SS Cet.........21(26)29D
Z Dra.............22(24)26

2009 Oct 4 Sun
RZ Cas........00(03)05D
Z Per...........D18(16)20
Z Vul...........D18(17)22
X Tri...........D18(19)22

2009 Oct 5 Mon
AI Dra............00(02)03
U Cep.........03(08)05D
RZ Cas........05(07)05D
TX UMa.....D18(14)19
X Tri...........D18(19)21
RS CVn.....D18(23)21L

2009 Oct 6 Tue
RS CVn....L04(<<)05D
TW Dra.......D18(14)20
S Equ...........D18(15)20
Z Dra.........D18(17)20
X Tri...........D18(18)20
SW Cyg.......D18(20)26
SS Cet.......L21(25)29D
U Sge...........22(28)25L
Z Vul...........23(28)25L

2009 Oct 7 Wed
RW Tau.......03(08)05D
TV Cas.......05(09)05D
RZ Cas.......D18(17)19
Z Per...........D18(17)22
X Tri...........D18(17)20
U Cep.........D18(20)24
U CrB.......D18(21)22L
V367Cyg..D18(62)29L
Z Dra.............23(26)28

2009 Oct 8 Thu
TX UMa..D18(16)20L
X Tri...........D18(17)19
V367Cyg..D18(38)29L
RZ Cas..........19(21)24
Y Psc...........24(28)28L

2009 Oct 9 Fri
TV Cas.......00(04)05D
TW Dra......05(10)05D
V367Cyg..D18(14)28L
Z Vul...........D18(15)20
X Tri...........D18(16)18
AI Dra...........19(21)22
S Equ...........20(25)25L
SS Cet..........L20(24)29
HU Tau........L21(18)21
RW Tau.......22(27)29D
RZ Cas..........24(26)28

2009 Oct 10 Sat
U Cep.........03(07)05D
V367Cyg.D18(<<)28L
U Sge..........D18(13)19
RS CVn....D18(18)20L
Z Per...........D18(18)23
Z Dra..........D18(19)21
TV Cas..........20(24)28

2009 Oct 11 Sun
AI Dra...........00(01)03
SW Cyg......04(10)05D
RZ Cas.......04(07)05D
TX UMa..D18(17)20L
HU Tau.......L20(19)23
Z Vul...........20(26)25L

2009 Oct 12 Mon
TW Dra......00(05)05D
Z Dra..........01(04)05D
AI Dra........05(06)05D
U Cep.........D18(19)24
TV Cas.......D18(19)24
Y Psc..........D18(23)27
RW Tau.......L19(21)26
SS Cet.....L20(24)28

2009 Oct 13 Tue
RZ Cas.......D18(16)19
Z Per..........D18(20)24
U Sge.......D18(22)24L
HU Tau.......L20(20)24

2009 Oct 14 Wed
Z Vul..........D18(13)18
TV Cas.......D18(15)19
U CrB......D18(19)22L
TX UMa..D18(19)20L
Z Dra............18(21)23
RZ Cas..........18(21)23
TW Dra......20(25)29D
TX UMa....L22(19)24

2009 Oct 15 Thu
U Cep........02(07)05D
RS CVn......D18(13)20
SW Cyg...D18(24)29D
RW Tau.......L19(16)20
AI Dra...........19(21)22
SS Cet.........L20(23)28
HU Tau.......L20(22)25
RZ Cas..........23(26)28

2009 Oct 16 Fri
Z Dra.........03(05)05D
Y Psc..........D18(17)21
Z Per..........D18(21)26
S Equ.......D18(22)24L
Z Vul..........18(24)25L

2009 Oct 17 Sat
AI Dra...........00(01)03
RZ Cas.......04(06)05D
U Cep........D18(19)24
TW Dra......D18(20)25
TX UMa..D18(20)20L
HU Tau.......L20(23)27
TX UMa....L22(20)25

2009 Oct 18 Sun
TV Cas.......02(06)05D
AI Dra........05(06)05D
RW Tau......05(10)05D
SS Cet.........L20(23)27
Z Dra............20(22)25

2009 Oct 19 Mon
RZ Cas.......D18(16)18
Z Per..........D18(22)27
HU Tau.........21(24)28
TV Cas.......21(26)29D

2009 Oct 20 Tue
U Cep.......02(07)05D
RS CVn...L03(08)05D
Z Dra........05(07)05D
SW Cyg.....D18(13)19
TW Dra.....D18(15)20
U Sge.........D18(16)22
TX UMa.D18(22)19L
RZ Cas.........18(20)23
TX UMa...L22(22)27
RW Tau.....24(28)29D

2009 Oct 21 Wed
X Tri.........05(08)05D
Z Dra........D18(16)18
U CrB.....D18(17)21L
TV Cas......D18(21)25
Z Vul......D18(21)24L
AI Dra..........19(20)22
SS Cet........L20(22)27
HU Tau.....22(26)30D
RZ Cas.........23(25)27

2009 Oct 22 Thu
X Tri.........04(07)06D
U Cep.......D18(19)23
Z Per............19(24)29
Z Dra...........22(24)27
AI Dra..........24(25)26

2009 Oct 23 Fri
RZ Cas......03(06)06D
X Tri.........04(06)06D
TV Cas......D18(17)21
S Equ......D18(19)24L
RW Tau......L18(23)28
TX UMa..19(24)19L
U Sge.........20(25)24L
TX UMa...L22(24)28
HU Tau.....23(27)30D

2009 Oct 24 Sat
Y Psc.........01(06)03L
X Tri.........03(06)06D
AI Dra.......05(06)06D
SS Cet........L19(21)26
SW Cyg.....21(27)29L

2009 Oct 25 Sun
U Cep 02(06)06D
RS CVn...L02(04)06D
X Tri.........02(05)06D
U CrB.....L05(03)06D
Z Dra.......D18(17)20
Z Per.........20(25)30D

2009 Oct 26 Mon
HU Tau.......01(04)06D
TW Dra......01(06)06D
X Tri...........02(04)06D
Z Vul........D18(19)24L
RZ Cas.......D18(20)22
V367Cyg..D18(53)27L
RW Tau.......L18(17)22
TX UMa..L22(25)30D
Z Dra.............23(26)28
2009 Oct 27 Tue
X Tri...........01(04)06D
TV Cas.......03(08)06D
U Cep.........D18(18)23
V367Cyg..D18(29)27L
AI Dra...........19(20)22
SS Cet..........L19(21)25
Y Psc...........20(24)27L
RZ Cas..........22(24)27
2009 Oct 28 Wed
X Tri..............00(03)05
HU Tau.......02(06)06D
V367Cyg..D18(05)27L
U CrB.........D18(14)20
TW Dra......20(25)30D
Z Per...........22(26)30D
TV Cas.......23(27)30D
X Tri..............24(26)29
AI Dra...........24(25)26
2009 Oct 29 Thu
RZ Cas.......03(05)06D
V367 Cyg...D17(<<)25
SW Cyg......D17(17)23
Z Dra..........D17(19)21
RS CVn....D17(23)19L
TX UMa....22(27)30D
X Tri..............23(26)28
2009 Oct 30 Fri
U Cep.........01(06)06D
RS CVn......L02(<<)05
HU Tau.......03(07)06D
AI Dra........05(06)06D
S Equ...........D17(16)21
U Sge........D17(20)23L
TV Cas..........18(23)27
SS Cet..........L19(20)25
X Tri..............22(25)27

2009 Oct 31 Sat
Z Dra.......01(04)06D
Z Vul........D17(17)22
Y Psc........D17(18)23
TW Dra....D17(21)26
U CrB.......19(25)20L
X Tri...........22(24)27
Z Per........23(28)30D

November

2009 Nov 1 Sun
RW Tau....01(06)06D
U CrB....L05(01)06D
HU Tau....05(08)06D
U Cep......D17(18)23
TV Cas.....D17(18)22
RZ Cas.....D17(19)22
X Tri...........21(23)26
TX UMa..23(28)30D
2009 Nov 2 Mon
Z Dra..........18(21)23
SS Cet.......L19(19)24
AI Dra.........19(20)21
X Tri...........20(23)25
S Equ........21(26)23L
RZ Cas........21(24)26
Z Vul.........23(28)24L
2009 Nov 3 Tue
SW Cyg....00(07)04L
TV Cas.....D17(14)18
TW Dra....D17(16)21
RS CVn..D17(18)19L
X Tri...........20(22)25
RW Tau.......20(25)29
AI Dra.........24(25)26
2009 Nov 4 Wed
Z Per........00(05)06D
U Cep......01(06)06D
RZ Cas.....02(04)06D
Z Dra.......03(05)06D
U CrB......D17(12)18
X Tri...........19(21)24
2009 Nov 5 Thu
TX UMa..01(06)06D
AI Dra......04(06)06D
TV Cas.....05(09)06D
Z Vul........D17(15)20
X Tri...........18(21)23
SS Cet.......L19(19)23

2009 Nov 6 Fri
S Equ........D17(13)18
U Sge........D17(14)20
U Cep......D17(18)22
RW Tau....L17(19)24
X Tri...........18(20)23
Z Dra..........20(22)25
2009 Nov 7 Sat
TV Cas.....00(05)06D
Z Per........02(06)06D
RZ Cas.....D17(19)21
X Tri........D17(19)22
SW Cyg....D17(20)26
U CrB....D17(23)20L
Z Vul........21(26)23L
2009 Nov 8 Sun
TX UMa..02(07)06D
U CrB......L04(<<)05
Z Dra.......05(07)06D
RS CVn.D17(13)18L
X Tri........D17(19)21
SS Cet.......L18(18)23
AI Dra.........19(20)21
TV Cas........20(24)28
RZ Cas........21(23)26
2009 Nov 9 Mon
U Cep......01(05)06D
TW Dra....02(07)06D
RW Tau....D17(14)18
Z Dra.......D17(16)18
X Tri........D17(18)20
U Sge........17(23)23L
S Equ........18(23)23L
AI Dra.........23(25)26
2009 Nov 10 Tue
RZ Cas.....02(04)06D
Z Per........03(08)06D
Z Vul........D17(13)18
X Tri........D17(17)20
TV Cas....D17(20)24
Z Dra..........22(24)27
2009 Nov 11 Wed
TX UMa..04(09)06D
U CrB....L04(10)06D
AI Dra......04(06)06D
X Tri........D17(17)19
U Cep......D17(17)22
SS Cet.......L18(18)22
HU Tau.....L18(15)19
Y Psc........21(26)26L
TW Dra....21(26)30D

2009 Nov 12 Thu
RW Tau.......03(08)06D
SW Cyg.....L06(10)06D
TV Cas........D17(15)19
X Tri...........D17(16)18
Z Vul............18(24)23L
2009 Nov 13 Fri
RS CVn.......02(08)06D
Z Per............04(09)06D
X Tri...........D17(15)18
Z Dra...........D17(17)20
RZ Cas........D17(18)20
HU Tau........L18(17)20
V367 Cyg....22(67)26L
2009 Nov 14 Sat
U Cep..........00(05)06D
TX UMa.....05(10)06D
U CrB.......D17(20)20L
TW Dra.......D17(22)27
V367 Cyg..D17(43)26L
SS Cet..........L18(17)22
AI Dra............19(20)21
RZ Cas...........20(23)25
RW Tau.......22(26)30D
Z Dra..............24(26)28
2009 Nov 15 Sun
V367 Cyg..D17(19)26L
Y Psc...........D17(20)24
HU Tau........L18(18)22
AI Dra............23(25)26
2009 Nov 16 Mon
RZ Cas...........01(03)06
TV Cas........02(06)06D
Z Per............06(11)06D
V367Cyg..D17(<<)26L
U Cep..........D17(17)22
U Sge........D17(17)22L
S Equ........D17(20)22L
SW Cyg.......18(24)27L
2009 Nov 17 Tue
AI Dra.........04(05)06D
SW Cyg........L05(00)06
RZ Cas........06(08)06D
TW Dra.......D17(17)22
Z Dra...........D17(19)22
RW Tau.......D17(21)26
Z Vul.........D17(22)23L
SS Cet...........L18(16)21
HU Tau........L18(19)23
TV Cas...........21(26)30

2009 Nov 18 Wed
RS CVn...L01(03)06D
U CrB......L03(07)06D
2009 Nov 19 Thu
U Cep........00(05)06D
Z Dra............01(04)06
Y Psc.........D17(14)19
RZ Cas......D17(17)20
TV Cas......D17(21)25
HU Tau......L18(21)24
U Sge..........21(27)22L
2009 Nov 20 Fri
TW Dra.....D17(12)17
TX UMa.D17(13)17L
RW Tau......D17(15)20
SS Cet.........L18(16)20
AI Dra...........18(20)21
RZ Cas.........20(22)24
2009 Nov 21 Sat
SW Cyg.....D17(14)20
TV Cas.......D17(17)21
U Cep........D17(17)21
U CrB.....D17(18)19L
HU Tau.........18(22)26
Z Dra............18(21)23
AI Dra..........23(25)26
2009 Nov 22 Sun
RZ Cas.........00(03)05
Z Per..........D17(13)18
Z Vul.......D17(19)22L
RS CVn...D17(22)17L
2009 Nov 23 Mon
RS CVn......L00(<<)05
TW Dra.....03(08)06D
Z Dra.........03(05)06D
AI Dra.......04(05)06D
RZ Cas......05(07)06D
RW Tau......05(10)06D
U Sge.........D17(12)17
TX UMa.D17(15)17L
S Equ.......D17(17)22L
SS Cet.........L17(15)20
HU Tau.........19(23)27
U Cep........24(28)30D

2009 Nov 25 Wed
U CrB......L03(05)06D
TV Cas......03(08)06D
X Tri..........05(07)05L
Z Per..........D17(15)19
RZ Cas......D17(17)19
Z Dra............20(23)25
HU Tau.........21(25)29
SW Cyg......21(27)27L
TW Dra.....22(27)30D
RW Tau......24(28)30D
2009 Nov 26 Thu
X Tri..........04(06)05L
SW Cyg...L05(03)06D
TX UMa.D17(16)17L
U Cep........D17(16)21
U Sge.......D17(21)21L
SS Cet.........L17(14)19
AI Dra...........18(20)21
RZ Cas.........19(22)24
TX UMa....L20(16)21
Y Psc..........23(27)25L
TV Cas......23(27)30D
2009 Nov 27 Fri
X Tri..........03(06)05L
Z Dra.........05(07)06D
del Lib.....L06(03)06D
Z Vul.......D17(17)22L
RS CVn...D17(18)17L
HU Tau.........22(26)30
AI Dra..........23(24)26
RZ Cas.........24(26)29
2009 Nov 28 Sat
X Tri..........02(05)05L
Z Dra.........D17(16)18
U CrB......D17(16)19L
Z Per..........D17(16)21
TW Dra........17(22)27
RW Tau.........18(23)27
TV Cas.........18(23)27
U Cep........23(28)31D
2009 Nov 29 Sun
X Tri..........02(04)05L
AI Dra..........04(05)06
RZ Cas......04(07)07D
del Lib.....L06(11)07D
SS Cet.........L17(14)18
TX UMa....L19(18)22
Z Dra............22(24)27
HU Tau......24(27)31D

2009 Nov 30 Mon
X Tri..........01(04)05L
S Equ.........D17(14)19
SW Cyg.....D17(17)23
TV Cas......D17(18)22
Y Psc..........17(21)24L

December

2009 Dec 1 Tue
X Tri..........00(03)05L
Z Dra.........07(09)07D
U Cep........D17(16)21
RZ Cas......D17(16)19
RW Tau.....D17(17)22
Z Per..........D17(17)22
TW Dra.....D17(18)23
X Tri..........24(26)29L
2009 Dec 2 Wed
HU Tau......01(05)07L
U CrB.....L03(03)07D
RS CVn.....06(13)07D
TV Cas......D17(14)18
Z Vul.........D17(15)20
Z Dra.........D17(17)20
V367Cyg.D17(57)25L
SS Cet........L17(13)18
AI Dra..........18(19)21
RZ Cas.........19(21)23
TX UMa...L19(19)24
X Tri...........23(26)28
2009 Dec 3 Thu
U Sge.........D17(15)21
V367Cyg.D17(33)25L
S Equ.........19(25)21L
X Tri...........22(25)27
AI Dra..........23(24)26
U Cep........23(28)31D
RZ Cas.........23(26)28
Z Dra............24(26)28
2009 Dec 4 Fri
HU Tau......02(06)06L
TV Cas......05(09)07D
del Lib.....L06(03)07D
V367Cyg.D17(09)25L
TW Dra.....D17(13)18
Y Psc.........D17(16)20
Z Per..........D17(19)23
Z Vul..........21(26)22L
X Tri...........22(24)27

2009 Dec 5 Sat
SW Cyg......01(07)02L
AI Dra..........04(05)06
RZ Cas......04(06)07D
SW Cyg...L04(07)07D
V367Cyg.D17(<<)25L
SS Cet........D17(13)17
U CrB.....D17(14)18L
TX UMa....L19(21)25
X Tri............21(24)26
2009 Dec 6 Sun
TV Cas......00(05)07D
HU Tau......04(07)06L
del Lib.....L06(11)07D
U Cep........D17(16)20
Z Dra.........D17(19)22
U Sge..........18(24)21L
X Tri............20(23)25
2009 Dec 7 Mon
RW Tau......01(06)06L
RS CVn......02(08)07D
TW Dra.....03(09)07D
Z Vul..........D17(13)18
RZ Cas......D17(16)18
Z Per..........D17(20)25
X Tri............20(22)25
TV Cas.........20(24)28
2009 Dec 8 Tue
Z Dra............01(04)06
HU Tau......05(09)06L
RZ Cas.........18(20)23
AI Dra...........18(19)21
TX UMa....L19(22)27
X Tri...........19(21)24
U Cep........23(27)31D
2009 Dec 9 Wed
U CrB.........L02(00)06
TV Cas......D17(20)24
SW Cyg...D17(21)26L
X Tri............18(21)23
Z Vul..........19(24)21L
RW Tau.........20(25)29
RZ Cas.........23(25)27
AI Dra..........23(24)25
TW Dra.....23(28)31D
2009 Dec 10 Thu
Z Per..........D17(21)26
S Equ.......D17(21)21L
X Tri............18(20)23
Z Dra............19(21)23

2009 Dec 11 Fri
RZ Cas.....03(06)07D
AI Dra.........04(05)06
del Lib....L06(02)07D
TV Cas.....D17(15)19
U Cep.......D17(15)20
X Tri...........17(19)22
TX UMa.....19(24)29
RS CVn..L23(27)31D

2009 Dec 12 Sat
Z Dra........03(06)07D
U CrB.......06(11)07D
Z Vul......L07(11)07D
U CrB.......D17(11)17
X Tri.........D17(19)21
RW Tau... D17(19)24
TW Dra...... 18(23)28

2009 Dec 13 Sun
del Lib....L05(10)07D
TV Cas.....06(11)07D
RZ Cas.....D17(15)18
X Tri.........D17(18)21
U Sge.....D17(18)20L
Z Per............18(23)27
U Cep.......22(27)31D

2009 Dec 14 Mon
SW Cyg....04(10)07D
X Tri........D17(17)20
Z Vul......D17(22)21L
RZ Cas........17(20)22
AI Dra.........18(19)20
Z Dra...........20(23)25
TX UMa.....21(25)30

2009 Dec 15 Tue
TV Cas.....02(06)07D
RW Tau....D17(13)18
X Tri.......D17(17)19
TW Dra....D17(19)24
U CrB....D17(22)17L
Y Psc.........18(23)23L
RZ Cas........22(24)27
AI Dra.........23(24)25

2009 Dec 16 Wed
U CrB......L02(<<)04
Z Dra.......05(07)07D
HU Tau....D17(14)18
U Cep......D17(15)20
X Tri........D17(16)19
Z Per...........19(24)29
TV Cas........21(26)30
RS CVn.....L23(22)28

2009 Dec 17 Thu
RZ Cas.....03(05)07D
AI Dra.........03(05)06
Z Vul......L06(09)07D
X Tri........D17(15)18
Z Dra.......D17(16)18
S Equ.....D17(18)20L
TX UMa..22(27)31D

2009 Dec 18 Fri
RW Tau....03(08)06L
del Lib....L05(02)07D
TW Dra....D17(14)19
X Tri........D17(15)17
HU Tau....D17(16)19
TV Cas........17(21)25
SW Cyg....18(24)25L
U Cep......22(27)31D
Z Dra..........22(24)27

2009 Dec 19 Sat
SW Cyg....L03(00)06
U CrB......03(09)07D
RZ Cas.....D17(15)17
Y Psc........D17(17)22
Z Vul.....D17(19)21L
Z Per...........21(25)30

2009 Dec 20 Sun
del Lib....L05(10)07D
Z Dra.......07(09)07D
U Sge........D17(13)18
TV Cas.....D17(17)21
HU Tau....D17(17)21
RZ Cas.....D17(19)22
AI Dra.........18(19)20
RW Tau....22(26)29L
TX UMa..24(28)31D

2009 Dec 21 Mon
TW Dra.......04(09)07D
V367 Cyg..L06(48)07D
U Cep..........D17(15)19
Z Dra...........D17(18)20
V367 Cyg..D17(48)24L
RZ Cas...........22(24)26
AI Dra............22(24)25
RS CVn........L23(17)24

2009 Dec 22 Tue
V367 Cyg..L06(24)07D
Z Vul.........L06(06)07D
HU Tau........D17(18)22
U CrB.......D17(20)17L
V367 Cyg..D17(24)24L
Z Per............22(27)30L
Z Dra.............24(26)29

2009 Dec 23 Wed
U CrB..........L01(<<)02
RZ Cas........02(05)07D
AI Dra............03(05)06
V367Cyg..L06(00)07D
V367 Cyg..D17(00)24L
SW Cyg.......D17(14)20
RW Tau........D17(21)25
U Sge.........D17(22)20L
U Cep..........22(26)31D
TW Dra.......24(29)31D

2009 Dec 24 Thu
TX UMa.....01(06)07D
TV Cas........03(08)07D
V367 Cyg.L05(<<)07D
RZ Cas........07(09)07D
V367 Cyg....D17(<<)20
S Equ.........D17(15)20L
Z Vul.........D17(17)20L
HU Tau........D17(20)23

2009 Dec 25 Fri
del Lib.......L05(01)07D
Z Dra.............17(19)22
TV Cas........23(27)31D
Z Per...........23(28)30L

2009 Dec 26 Sat
U CrB.....L01(07)07D
RS CVn.....06(12)07D
U Cep.......D17(14)19
RW Tau.....D17(15)20
RZ Cas......D17(19)21
HU Tau........17(21)25
AI Dra.........18(19)20
TW Dra.......19(24)29

2009 Dec 27 Sun
Z Dra...........01(04)06
TX UMa..03(07)07D
del Lib....L04(09)07D
Z Vul......L06(04)07D
U Sge......L06(07)07D
TV Cas........18(23)27
RZ Cas........21(23)26
SW Cyg.....22(28)25L
AI Dra.........22(24)25

2009 Dec 28 Mon
SW Cyg..L03(04)07D
HU Tau........18(22)26
U Cep.......21(26)31D

2009 Dec 29 Tue
Z Per.........01(05)06L
RZ Cas........02(04)06
AI Dra.........03(04)06
Z Vul......D17(15)20L
TV Cas.....D17(18)22
TW Dra....D17(19)24
Z Dra..........19(21)23

2009 Dec 30 Wed
TX UMa..04(09)07D
RZ Cas.....06(09)07D
U Sge......D17(16)19L
HU Tau........20(24)28
Y Psc.........20(24)22L

2009 Dec 31 Thu
RS CVn.....01(08)07D
Z Dra........03(06)07D
S Equ........D17(12)18
TV Cas.....D17(14)18
U Cep.......D17(14)19
RW Tau.....23(28)29L

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The **deadline for contributions** to the next issue of VSSC (number 142) will be 7th November, 2009. All articles should be sent to the editor (details are given on the back of this issue).

Whilst every effort is made to ensure that information in this circular is correct, the Editor and Officers of the BAA cannot be held responsible for errors that may occur.

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Variable Star Alerts Telephone Gary Poyner (see above for number)