British Astronomical Association

VARIABLE STAR SECTION CIRCULAR

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Contents

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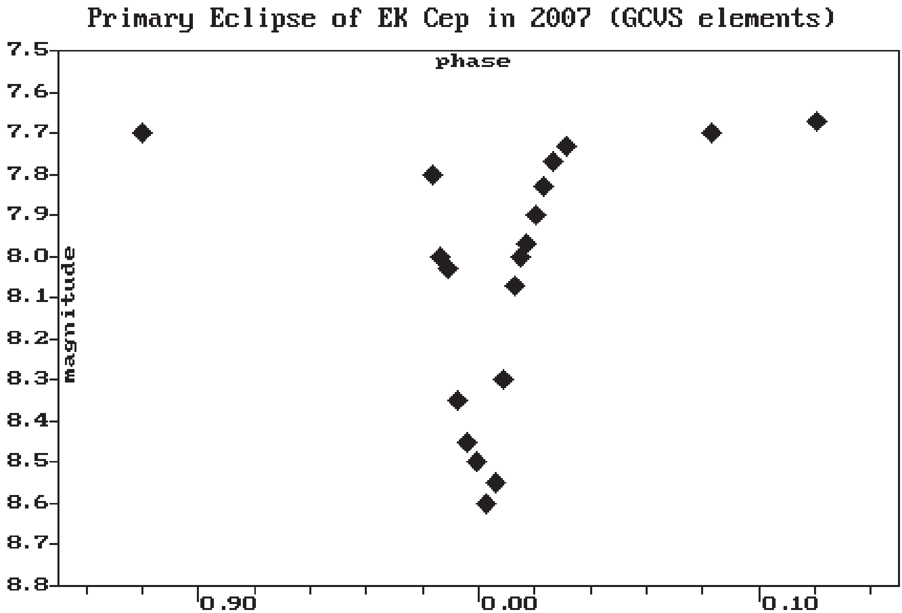
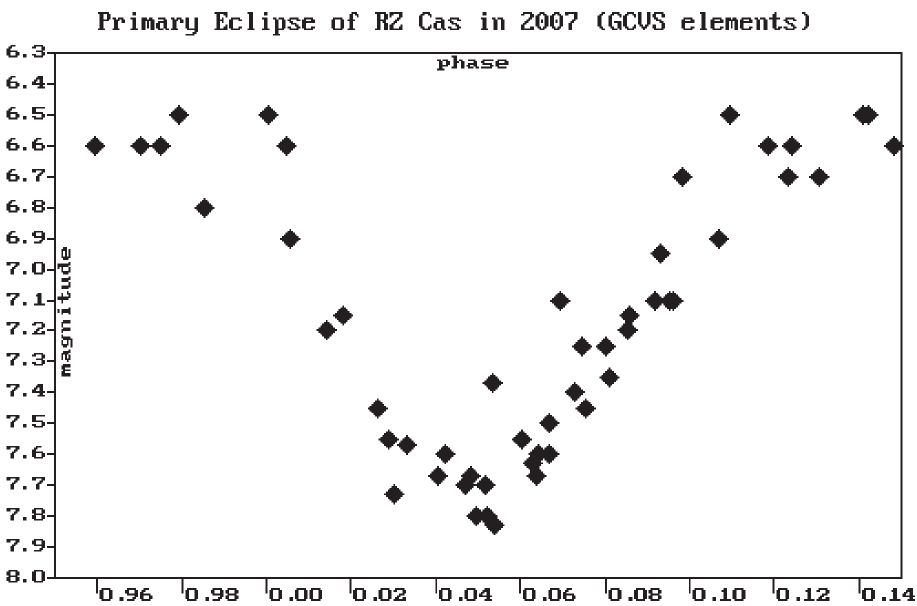
ECLIPSING BINARY LIGHT CURVES

TONY MARKHAM



Both sets of observations were made by Tony Markham using 11x80 binoculars. They show the combined results of all his observations of the primary eclipses of EK Cephei, and RZ Cassiopeiae, in 2007.



FROM THE PRESIDENT

ROGER PICKARD

Joint Meeting of the AAVSO and the BAA 10 - 13 April 2008

Further to my note in the last Circular, I can now fill in the missing details regarding speakers and the titles of their talks.
This is a prestigious International Meeting with delegates from all over the world. (We already have bookings not just from the UK and the USA but from France, Belgium and Finland).

This is only the third time the AAVSO have ventured outside mainland North America, and the first time they have come to the UK. It is quite a feather in our cap!

Their first meeting was in Brussels in 1990 and from that the book "Variable Star Research: An international perspective" was produced.

Their second meeting was in Sion, Switzerland in 1997. Sadly, I don't think more than a handful of Brits attended the first meeting, and for certain only one (Dick Chambers) attended the second. I'd dearly like us to rectify that situation at our home meeting!

You'll note that during the AAVSO/VSS Meeting on the Friday some time has been left for short presentations. I suspect that by the time you read this, they will have all been filled, but in case not, and you've decided you wish to make a short presentation, do contact me to verify if there is any time left.

Also, don't forget there is plenty of room at New Hall for poster papers.

Thursday 10th April

PM Suggested trip to the American Military Cemetery for those arriving early (Make own arrangements by bus or walk).
19.00 Dinner
20.00 Visit to Cambridge Institute of Astronomy old telescopes – no charge

Friday 11th April

AAVSO/BAA VSS Meeting on Variable Stars

09.20 - 09.30 Welcome, BAA President, Roger Pickard, and AAVSO Director, Dr Arne Henden
09.30 - 10.00 Dr Paula Szkody, Washington University, "HST Campaigns and the Amateur."
10.00 - 10.30 Des Loughney, VSS, "Eclipsing Binaries - Observational Challenges."
10.30 - 11.15 Short Presentations and poster papers - 1
11.15 - 11.45 Tea/coffee break
11.45 - 12.45 Short Presentations and poster papers - 2
12.45 - 14.00 Lunch

14.00 - 14.45 John Toone, VSS, “British Variable Star Associations 1848-1908”
14.45- 15.30 Robin Leadbeater, VSS, Chasing Rainbows - “The European amateur spectroscopy scene.”
15.30 - 16.00 Tea/coffee break
16.00 - 16.45 Dr Tom Lloyd-Evans, VSS, “Long term monitoring and the Carbo Miras”
16.45 -17.30 Dr Boris Gaensicke, Warwick University, “Cataclysmic variables from large surveys - a silent revolution.”
17.30 Close

19.00 Dinner
20.00 Informal lecture: Prof Mike Bode, Liverpool John Moores University, “The Explosions of the Recurrent Nova RS Ophiuchi.”

Saturday 12th April

BAA Out of London Meeting
in conjunction with the AAVSO & BAA Variable Star and Solar Sections.

10.00 - 10.25 Registration Tea/coffee available
10.25 - 10.30 Official Welcome, BAA President, Roger Pickard and AAVSO Director, Dr Arne Henden
10.30 - 11.15 Dr. Rene Oudmaijer, Leeds University, Star Formation
11.15 - 12.00 Dr. Arne Henden, AAVSO, The MJUO/AAVSO Collaboration
12.00 - 13.30 Lunch
13.30 - 14.15 Mr Guy Hurst, “BAA Novae and Supernovae: from visual to remote robotic observations.”
14.15 - 15.00 Lee MacDonald, BAA, “Observing the Sun with Small Telescopes.”
15.00 - 15.45 Tea
15.45 - 16.30 Dr. Giulio Del Zanna, Mullard Space Science Laboratory, “Changes in the solar corona during the last cycle.”
16.30 - 17.30 TBA
17.30 - Close

19.00 - 19.30 Assemble for Banquet (smart casual attire will suffice)
19.30 - 21.00 Banquet and awards
21.00 - 22.00 After Dinner lecture, Prof John Brown, Astronomer Royal for Scotland, “Some Musings on 50 Years in Astronomy and Magic.”

Sunday 13th April

09.00 - 18.30 Visit to Stonehenge and Avebury Stone Circles

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Melvyn Taylor

Re: the note, page 2 of December’s circular; Melvyn has now changed his email address,and can be contacted on:

melvyndtaylor@tiscali.co.uk

Erratum

The Cepheid 'Zeta' Aquilae, page 34, of December's VSSC, No 134, was of course Eta Aquilae!

ECLIPSING BINARY NEWS

DES LOUGHNEY

Contact Eclipsing Binaries

In the last few months I have been reading about contact eclipsing binaries. These are classified as the EW class of eclipsing binaries after the prototype which is W Ursae Majoris. It is interesting what can be learnt from a study of their light curves. As a start to observing such stars I have been looking at W Usae Majoris itself. It is fascinating to observe a system which is continually eclipsing and only has a period of around eight hours. The only drawback is that because of the particular time of the period, the time of primary eclipse only changes by a minute every night, and the most suitable primary eclipse is around 03:00 at the time of writing. So far a partial light curve has been constructed which does seem to suggest that the maxima are 'asymmetric'. Brightness at maxima, when the two stars are visible, ought to be the same. A difference of 0.1 magnitude, which seems to be quite common in EW systems, indicates that one star has a large star spot or group of star spots. These large star spots or groups are apparently driven by the complex interaction of the magnetic fields of the two contact stars.

W Ursae Majoris varies between 7.8 and 8.5 and is thus a binocular object. It is also a good object for DSLR photometry. Another EW system that is worth looking at is VW Cephei which varies between 7.2 and 7.7 with a period of 0.2783 days. I have reported on this system elsewhere in the Circular.

Eclipsing Binary Systems as stellar distance indicators

I was reading in the 'Introduction to Astronomical Photometry' (1) pp 65- 67 that photometry of eclipsing binary stars can allow the estimation of absolute stellar magnitudes, and thus the distance of the system. It seems that estimation of distances by the eclipse method could have an accuracy surpassing that of the Hipparcos programme if care is taken about the selection of suitable binaries.

U Cephei

U Cephei is on the BAA VSS EB list. It is often seen as a good starter EA type of eclipsing binary to look at. It varies between 6.8 and 9.4 magnitudes; is circumpolar, and is a binocular object. However, it can be a bit awkward to observe a full eclipse as it is a totally eclipsing binary. Totality lasts over two hours. To construct a light curve of one eclipse means systematic observations over a period of six hours. It can be hard observing one star over such a long period - and, of course, you have to count yourself as being very lucky to have that length of time to observe any eclipsing binary in UK conditions!

I wondered how U Cephei made it onto the BAA VSS list. Was it because it was a binocular object or was there something else that was unusual about the system? From reading various papers and IBVS bulletins it seems that U Cephei undergoes outbursts now and then. By outbursts is meant a high level of mass transfer which results in hot spots or dark spots in an accretion disk.

In the 1980s these spots in an accretion disk led to disturbances within the totality phase which was not flat bottomed. It seems that these particular disturbances could result in variations of up to 0.1 magnitude within totality. These would be difficult to pick up visually but might be a good target for CCD observers.

Another effect of the spotty accretion disk was seen outside the totality period. This was observed after the period of totality. On the rise the light curve dipped briefly by up to 0. 6 magnitude. Such an effect can, of course, be picked up visually. It seems entirely possible that U Cephei could undergo outbursts, phases of intensive mass transfer, at any time.

It is my intention to carry out an observing campaign of U Cephei in the first half of 2008 using DSLR differential photometry. Supporting visual and CCD observations would be welcome. Of particular interest would be instrumental observations throughout the full period of totality. Predictions of U Cephei are now included in this Circular.

AAVSO Variable Star of the Season 2008 - Epsilon Aurigae

The star that has been chosen is the enigmatic long period EB Epsilon Aurigae. It varies between 3.0 and 3.8m. It's period is 27.12 years. Opportunities to observe the eclipse are rare. The eclipse actually takes place in 2009 but observations are needed, starting now, through to 2010.

For more details see the AAVSO's webpages:
http://www. aavso.org/vstar/vsots/eps_aur.shtml.

Reference:
1. 'Introduction to Astronomical Photometry' by E. Budding and O. Demircan, 2007, Cambridge University Press.

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CLOSE COMPANIONS TO VARIABLE STARS

John Toone

A most essential element of making good quality visual observations is the correct identification of the variable star, but sometimes this can be made difficult when there is a close companion star to the variable. Problems in the past have included observers estimating the combined magnitude of the variable and companion star, and also estimating the companion alone, when the variable has faded below the companion and beyond the limit of the optics being employed. Improvements in the quality of the VSS charts and the inclusion of all known close companions to the variable down to 2.0 magnitudes below the faintest recorded level of the variable has certainly helped to reduce the risk of misidentification. Also, where the companion is of an acceptable colour and within the brightness range of the variable, it is used as a comparison star thus further drawing the observers attention to it. In spite of these improvements there are still a few isolated cases of misidentification occurring and I would like to highlight the following popular stars with close companions that should be handled with care by visual observers:

key: N = North, S = South, P = Preceding, F = Following.

RX And
Comparison star P at mag 14.3 is 0.5' NP the variable. For many years the minimum of RX And was thought to be mag 14 but this was probably due to observers estimating comparison P by mistake. RX And can fade well below mag 15 on occasions so observers with 20cm telescopes need to take great care when estimating RX And at minimum.

R Aql
Comparison star W at mag 11.7 is 1.4' NP the variable and is a risk to observers equipped with small (10cm) telescopes.

SS Aur
Comparison star Y at mag 16.3 is 0.5' SP the variable. For many years it was thought that the minimum of SS Aur was around mag 15.0 but some recent CCD observations have revealed that it can fade to mag 17.0. Therefore visual observers equipped with 40cm telescopes straining to see SS Aur at minimum need to ensure they have clearly identified comparison Y.

U Cam
Comparison star H at mag 9.5 is 3.3' N of the variable. U Cam rarely fades below mag 9 but when it does observers with small and average sized binoculars are at risk.

X Cam
Comparison star P at mag 13.6 is 1' F the variable and comparison star T at mag 13.9 is 0.8' SF the variable. This is a close knit triangle of similar brightness stars when X Cam is undergoing a faint minimum. Observers with 20cm telescopes need to take care once X Cam dips below mag 13.0.

Omicron Cet
Comparison star Z at mag 9.2 is 2' F the variable. Being the brightest and most famous of the LPV's, means that observers generally only use binoculars when it fades below naked eye visibility. When approaching minimum binoculars are not usually sufficient to separate comparison Z from the variable and the variable can go fainter than Z at times. It is recommended therefore that a small telescope is employed at this time.

Chi Cyg
The second most famous LPV can also be troublesome at minimum. Comparison star KK at mag 14.5 is 0.3' NP the variable. The minimum of Chi Cyg is often close to KK but it can go slightly fainter at times so observers with telescope apertures less than 30cm need to take care.

CH Cyg
Comparison star J at mag 9.4 is 2.7' P the variable. In 1996 CH Cyg faded below mag 10.0 for the first time and was off the lower limit of the then sequence which ended with comparison J. Since mag 9.0 is the limit for average sized binoculars and the quoted

range for CH Cyg was 5.4 – 9.6 a few binocular observers were reporting CH Cyg at mag 9.4 when in reality it was a magnitude fainter. The advice is that when CH Cyg is faint and both CH Cyg and comparison J cannot be clearly seen with binoculars then the observer should switch to a small telescope.

AB Dra
Comparison star P at mag 15.0 is 0.7' S of the variable. The average minimum for AB Dra is just a little fainter than comparison P so the observer must employ a telescope with sufficient aperture (>30cm) to render both stars visible.

AH Her
Comparison star K at mag 14.1 is 0.4' SF the variable. The minima of AH Her can range from mag 13.5 to 15.0 so it is important to clearly identify and use comparison K when undertaking minima estimates.

U Ori
UW Ori (suspected EB variable) at mag 10.4 is 0.8' F the variable. Because U and UW Ori appear roughly at the same position angle to bright comparison star L, observers with small telescopes can mistake UW Ori for U Ori as it fades to minimum. It is particularly tricky as UW Ori is swamped by the light of U Ori when bright and the rate of change of U Ori is usually quite rapid in the 10th – 11th mag range. The advice is when U Ori dips below mag 10.0 a 20cm telescope is employed to ensure U and UW Ori are clearly separated and positively identified.

RU Peg
Comparison star H at mag 12.6 is 0.3' SF the variable RU Peg is one of the brightest dwarf novae with a minimum on average equal to comparison star H. 20cm telescopes will certainly show RU Peg and comparison H but will not easily separate them. Therefore it is recommended that a larger telescope is employed when RU Peg is at or near minimum to ensure an effective estimate is made that includes a clearly separated comparison H.

TZ Per
Comparison star T at mag 14.4 is 0.5' NF the variable. An average minimum for TZ Per is mag 15.0 and the danger is comparison T is a similar position angle with respect to comparisons L and R. Therefore a minimum aperture of 30cm should be employed. A further complication is a 15th mag star on the opposite side of comparison T from TZ Per (shown on 10' chart 015.03). Care must be taken when TZ is at minimum not to mistake the 15th mag star for T and T for TZ.

SV Sge
Comparison star N at mag 14.8 is 0.3' NF the variable. This is a real challenge for visual observers when SV Sge is undergoing a faint minimum due to the Milky Way background and close proximity of comparison N. The only remedy is a high power on a large (40cm) telescope once SV Sge dips below 14th mag.

SW UMa
There is a mag 16 star 0.7' F the variable (shown on 15' chart 019.03). Visual observers straining to see SW UMa at minimum need to clearly identify this star to ensure a safe estimate is secured. A good avoidance strategy is to remember that the star forms an equilateral triangle with comparison stars H and P whereas SW UMa forms a right angled triangle.

An understanding of the combined brightness of two stars is useful when dealing with a variable star and a close companion. If the companion is not clearly visible and the variable is less than 2.0 magnitudes brighter than the companion then there is a brightening effect by the unseen companion on the estimate of the variable. This brightening effect is summarized below for a difference range of 0.0 to 2.0 magnitudes between the variable and companion:

Mag Difference	**Brightening Effect**
0.0	0.75
0.5	0.53
1.0	0.36
1.5	0.24
2.0	0.16

For example, if a variable is only 0.5 mag brighter than its unseen companion then the observer's estimate of the variable is likely to be 0.5 mag too bright. If the variable is equal in brightness to the companion but the observer is unable to resolve them then an estimate of the pair would be 0.8 mag brighter than for each individual star. This illustrates the importance of clearly eliminating the companion from the estimate of the variable.

The summary message is that if there is any doubt whatsoever about the identification of a variable with a close companion of similar brightness; please do use a larger power or aperture. If uncertainty remains with the maximum power on the largest aperture available, then it is best to record a negative estimate using the faintest comparison clearly visible with a note stating that the variable was not distinguishable from its close companion.

VSX J074727.6+065050: A NEWLY DISCOVERED DWARF NOVA IN CANIS MINOR

Jeremy Shears
bunburyobservatory@hotmail.com

VSX J074727.6+065050 (hereafter "J0747") was originally announced as an Optical Transient in Canis Minor on the CBAT Unconfirmed Observations Page. Spectroscopy by H. Naito and S. Narusawa (Nishi-Harima Astronomical Observatory, Japan) suggested it was a dwarf nova in outburst. A check of astronomical databases revealed a blue object with B~19.5 at the same co-ordinates, which is presumed to be the precursor [1]. The position of J0747 is:

RA: 07 47 27.64 , Dec: +06 50 50.0 (J2000)

An image of J0747 in outburst is shown in Figure 1.

Figure 1: VSX J074727.6+065050 in outburst on 2008 January 24 at 13.1C
Field 24 x 19 min. Takahashi FS102 0.1 m apochromatic refractor, unfiltered Starlight Xpress CCD camera, 60 s integration.

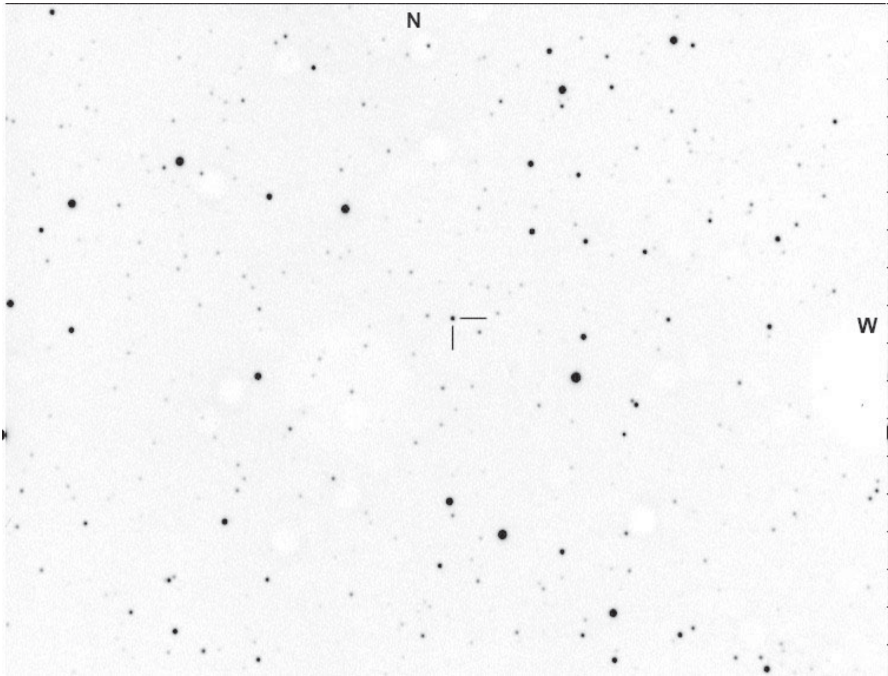


Figure 2 shows the light curve of the outburst based on observations in the AAVSO International Database and others reported on vsnet. J0747 was at it's brightest, ~12.4V, on Jan 20.37 (JD 2454485.87), following which there was a slow decline of 0.15 mag/day over a period of 7 days. This was followed by an abrupt and very rapid decline at 1.36 mag/d. Note that two visual observations helped to define the time of onset of the decline, showing the importance of regular observations of such outbursts irrespective of the method of observation. The decline stopped when the star reached mag 16.1 to 16.8, still ~3 magnitudes above minimum, where it remained for 3 to 4 days. Then on Feb 3.45, a rebrightening to 13.17V was reported by the Kanata team at Hiroshima University (vsnet-alert 9879). However, this was immediately followed by a fade at 1.1 mag/d (vsnet-alert 9880).

Superhumps were detected in J0747 shortly after the outburst was reported, confirming J0747 to be a member of the UGSU class of dwarf novae. Moreover, the large outburst amplitude, ~7 magnitudes, and the rebrightening after an initial rapid decline, are consistent with it being a member of the UGWZ sub-class. I was able to conduct several times series photometry runs at the Bunbury Observatory. A ~4 hour between Jan 24.81 and 24.98 also showed superhumps with peak-to-peak amplitude of ~0.1 mag. Period analysis using the DCDFT algorithm in Peranso yielded a superhump period Psh = 0.0572 d (82.4 min) and a phase diagram obtained by folding the data on this period is shown in Figure 3. Many observers worldwide carried out time series photometry during the outburst and it will be interesting to see how the period, ephemeris and amplitude of the superhumps varied through the outburst and subsequent rebrightening. Initial reports from H. Maehara state that no superhumps were detected during the rebrightening (vsnet-alert 9880).

References:

1. *http://www.aavso.org/publications/specialnotice/92.shtml*

Figure 2: Light curve of the outburst of VSX J074727.6+065050

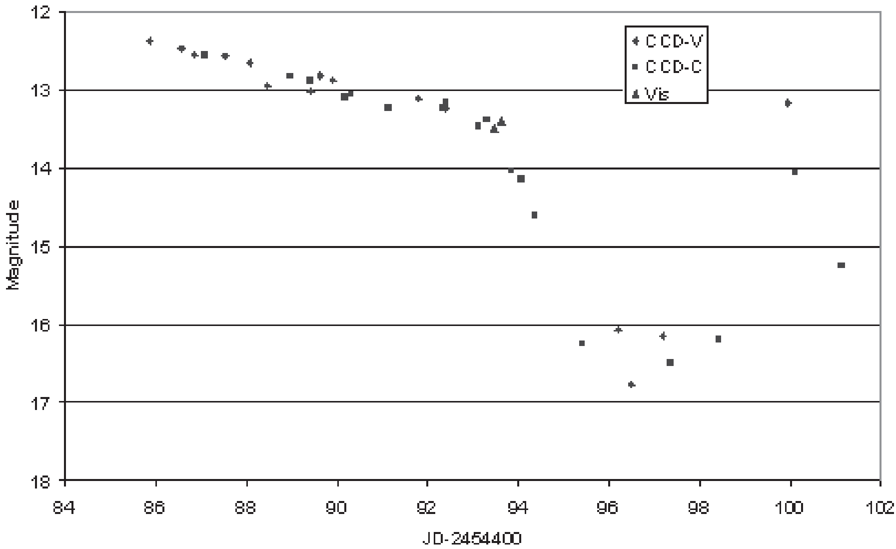
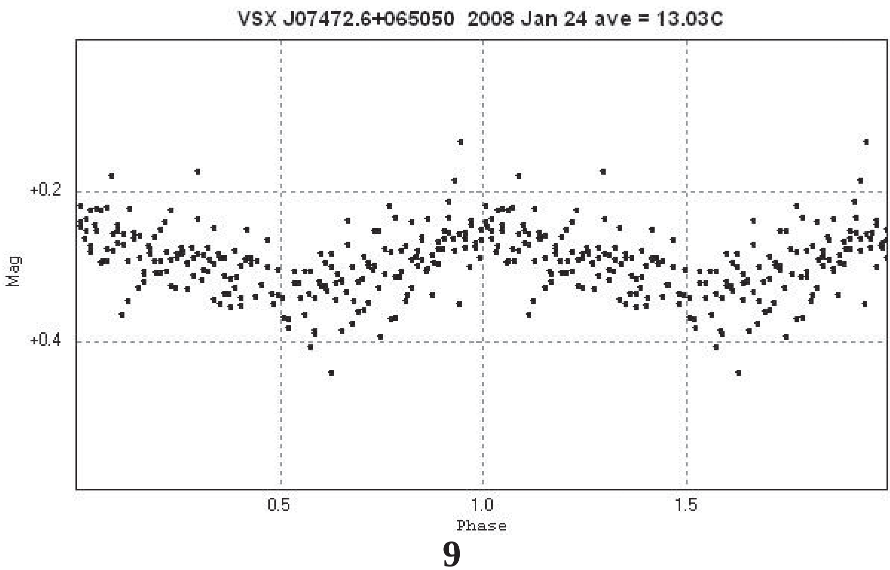


Figure 3: Phase diagram of data from 2008 Jan 24 folded on Psh = 0.0572 d



OUTBURST OF HT CASSIOPEIAE IN JANUARY 2008

Jeremy Shears

HT Cassiopeiae is a rarely outbursting dwarf nova of the UGSU family located at:

RA 01:10:13.12   Dec + +60:04:35.7 (J2000.0)

and has a magnitude range of 10.8 to 18.4 vis [1]. Since it has such a high declination, it can be monitored all year round. I have been following the star for the past 3 years via CCD imaging and found that it is typically around magnitude 17C at quiescence. However, even at quiescence there is considerable activity as the star can reach almost magnitude 16 and at other times fade to the low 17s. This is consistent with the study performed by Robertson and Honeycutt between 1991 and 1995 during which they found ~1.8 magnitude long time scale variations (high states and low states) between 15.9 and 17.7 [2].

According to the AAVSO Special Notice number 89 [3], all but one outburst from 1979 to date have been brief outbursts, lasting only 2-3 days, and where the maximum brightness is between magnitudes 12.3 and 13.3. Such outbursts have been seen in January 1979, March 1980, August 1985, February 1987, November 1989, November 1995, March 1997, March 1998, July 1999, April 2001 (possible outburst), February 2002, and April 2003 (single observation). By contrast a long, bright outburst was seen in 1985 between January 12th and January 24th, reaching visual magnitude 10.7.

The 2008 outburst was detected visually by Glenn Chaple (USA) who found it at 13.6 on January 10.0076 UT. This was confirmed by M. Uemura and colleagues (Hiroshima University, Japan) on January 10.5278 when they observed it at 14.02V.

The overall lightcurve of the outburst is shown in Figure 1, based on observations from the AAVSO International Database and VSNET. This shows that the star faded rapidly (~1.1 mag/d) following detection and after only 2 days it was already below magnitude 16, confirming this to be a short outburst.

One of the most interesting things about HT Cassiopeiae is that it shows deep eclipses with a period of 1 hour 46 minutes. I was able to conduct 3 hours 45 minutes of unfiltered CCD photometry during a rare clear spell on the evening of January 10th, i.e. the evening following the detection of the outburst. The resulting light curve in Figure 2 shows two eclipses with a depth of ~2.5 magnitudes. No other structure was seen in the light curve outside eclipse, although the underlying fading trend is apparent. Measuring the eclipse times, I found them to be within 30 seconds of the eclipse ephemeris given in the AAVSO Special Notice, which was based on a 2005 paper by Feline et al. Sadly this was the only time-series photometry I was able to conduct during the outburst. Figure 3 shows the star outside and during eclipse.

References.

1. Downes R. et al., A catalogue and atlas of cataclysmic variables – archival edition *http://archive.stsci.edu/prepds/cvcat/index.html*
2. Robertson J.W. and Honeycutt, R.K. (1996) AJ, 112, 2248
3. Waagen E.O. (2008) *http://www.aavso.org/publications/specialnotice/89.shtml*

Figure 1: Light curve of the 2008 outburst

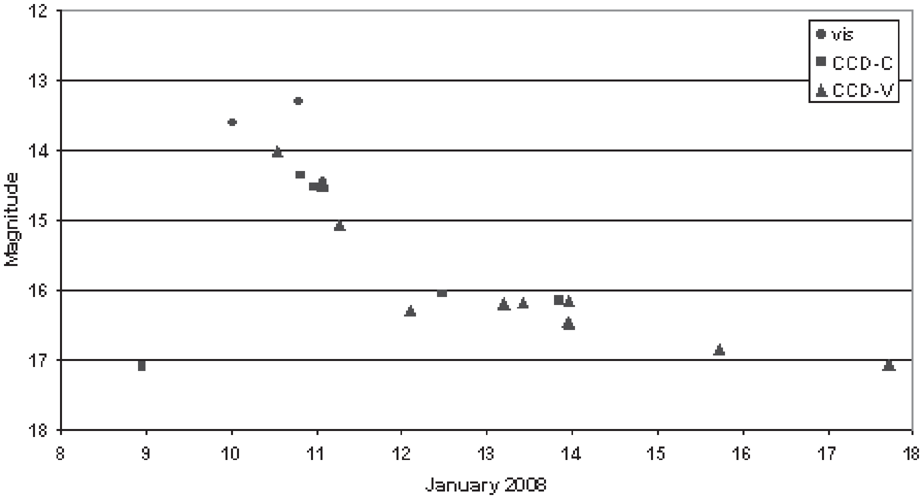
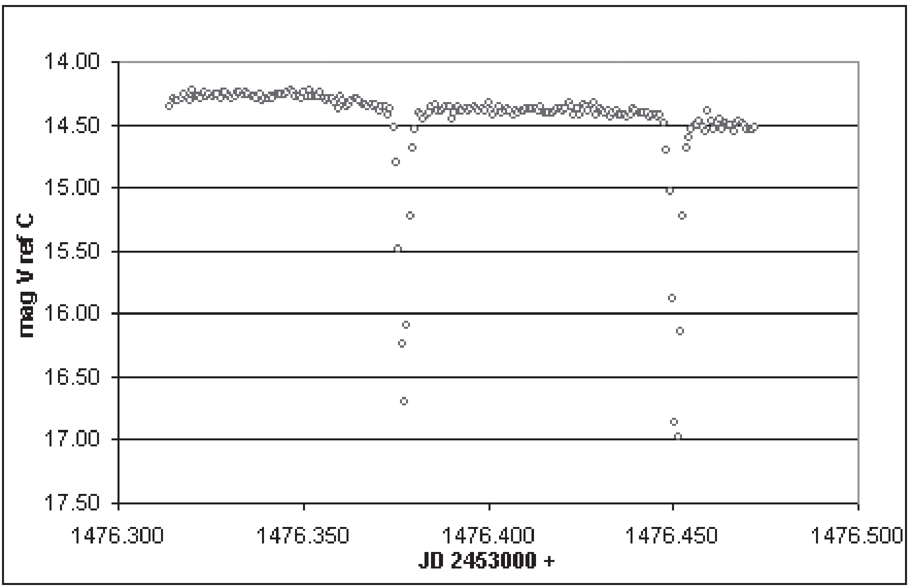


Figure 2: Time resolved photometry of HT Cassiopeiae on the evening of Jan 10 2008
Takahashi FS102, 0.1 m apochromatic refractor, unfiltered Starlight Xpress CCD camera



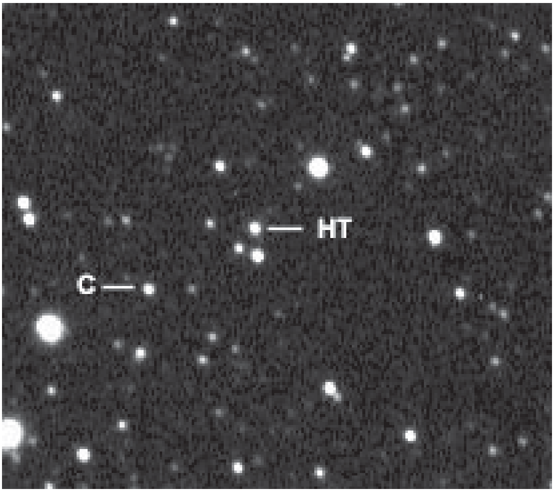
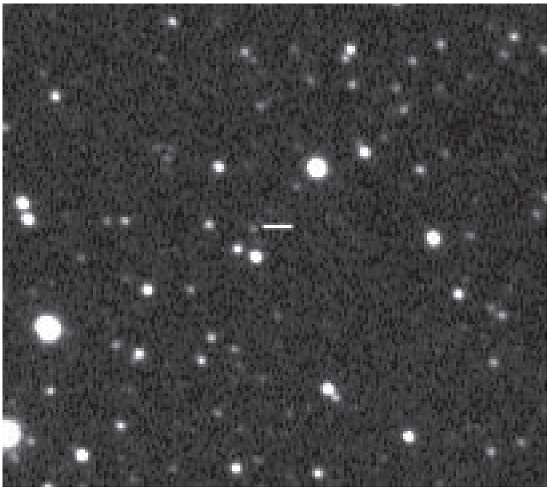


Figure 3: CCD images of HT Cassiopeiae outside eclipse (left; January 10.817, 14.30C)

and in eclipse (right; January 10.951, 16.98C)



The star marked C is star C2 on the AAVSO CCD chart 12/00 which has V=14.51. Instrumentation as in Figure 2; 60 sec exposure. N is up and the field is ~6.5 x 6 arcmin.

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VW CEPHEI

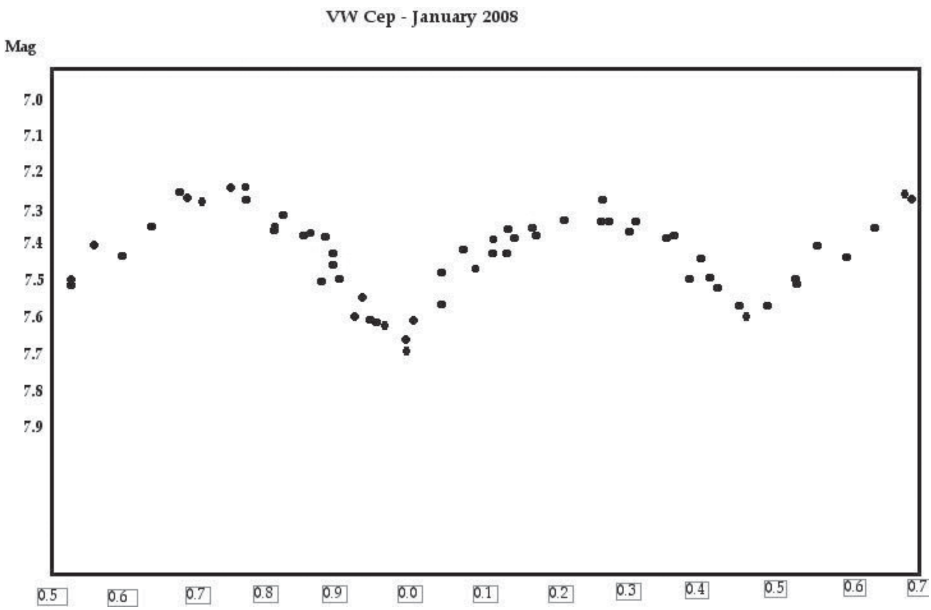
DES LOUGHNEY

VW Cephei is an EW class, Eclipsing Binary system. It is on the BAA VSS Eclipsing Binary list. It is a circumpolar binocular object which varies from 7.2 to 7.7 with a typically EW short period of 0.278311 days (1). As an EW class system, it is a contact binary and eclipses are continuous. All such systems are interesting to observe and it should be attractive to visual observers. However, despite being a ‘bright’ system, a variation of only 0.5 magnitude makes it a challenging target.

I decided to study the system in January 2008 and carried out DSLR differential photometry. The camera used was a Canon 350D with a 200 mm lens. The settings were ISO 800, exposure 2.5 seconds and f stop 3.2. Each magnitude estimate was based on ten images analysed using the AIP4WIN software. The 55 estimates have been plotted on a phase diagram (figure 1) which has been constructed using the latest Krakow elements (1). The nearby comparison star used is selected from Starry Night Pro with the classification HIP 102970. The assumed magnitude of the comparison to two places is that specified by Starry Night which is 7.78.

It can be seen that, viewed broadly, the light curve that results from plotting estimates is the classic light curve of an EW system.

Figure 1: Phase diagram of VW Cep, January 2008.



Light Time Effects

The estimates of a primary eclipse on 21/1/08 indicated that the midpoint of the eclipse was 12 minutes earlier than the time predicted using the Krakow elements. This estimate suggested a period of 0.278310 days. This is only a slight decrease and may not be related to any continuing mass transfer. The period of this system changes due to light time effects (2) and (5). The eclipsing binary is part of a three or four body system.

Asymmetric Maxima and Minima

Other research (3) describes variable light curves of VW Cep. Light curves are asymmetrical in both the maxima and minima. The asymmetry of the minima can be seen on figure (1) and this is related to the difference in brightness of the binary system which is composed of G5V and G8V stars. The variation in maxima have been ascribed to circumstellar clouds of absorbing material, hot spots produced by a gas stream impacting on a circumstellar disc around the hotter star, or star spots (4).

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References:

1. J M Kreiner, 2004, Acta Astronomica, vol. 54, pp 207-210.
2. T Pribulla, D Chochol, J Tremko, S Parimucha, M Vanko, J M Kreiner: 'Period study of the contact system VW Cep' Contrib. Astron. Obs. Skalnate Pleso 30 (2000)117 -139.
3. P G Niarchos: 'Photoelectric light curves and elements of V W Cephei' Astron. Astrophys.Suppl. Ser. 58, 261 —271 (1984).
4. Pribulla, Parimucha & Venko 'New Photoelectric Light Curves of VW Cephei' (2000) IBVS 4847.
5. C LLoyd, J Watson, R D Pickard: 'A Major Period Change of VW Cephei' (1992) IBVS 3704.

CHI CYGNI: MY FAVOURITE STAR

Chris Allen

On the evening of July 4th 2005 I did something I hadn't done for twenty years - I observed a variable star. Through the Scandinavian twilight and traces of noctilucent clouds, the cross of Cygnus was emerging and I pointed my newly acquired binoculars in the direction of eta Cygni. Fittingly, the first target after my twenty year astronomical hibernation was the extraordinary Mira star Chi Cygni, my favourite variable and the subject of this short article. It is amazing how certain variable star fields remain imprinted on the mind of the observer even after two decades in the doldrums. Despite my being totally out of practice, Chi eventually revealed itself, forming the left wing of an unmistakable, kite-like asterism.

I had been introduced to variable stars by Melvyn Taylor during a coffee break at the 1980 TA meeting. Melvyn convinced me that variable stars had something to offer the binocular observer and throughout the autumn of that year I set about the mainly semi-regular and irregular red variables of the VSS binocular programme. Like many newcomers I struggled to recognize the variables and comparison stars in their respective fields. The most difficult problems I found however were the slow and subtle light variations of many of these stars, not to mention the difficulties in gauging the Purkinje effect for red objects.

Chi Cygni is one star with variations which are anything but subtle. Alerted by the VS pages in TA, I set out to observe Chi as it began its rise to maximum in the autumn of 1980.

After checking and re-checking with the comparisons, I eventually picked up the star which I made magnitude 8.0. Before heading out to the sixth form disco three weeks later I was astonished to see Chi positively glowing like a tiny ruby against the Cygnus star clouds at magnitude 6.0. Here at last was a variable beyond any shadow of a doubt!

Chi Cygni belongs to a select group of variable stars whose light variations have been charted for more than 300 years following its discovery by Gottfried Kirch in 1686. The official data for the star, lists mean variations in brightness between magnitudes 5.2 and 13.4 over its 408 day pulsation cycle (AAVSO), and a S6 2e-S10 spectrum. However as many observers noted recently, Chi does on occasion break these extremes. In the summer of 2006 for example, the star briefly became brighter than the 4th magnitude comparison eta Cygni; this would appear to have been the brightest maximum for nearly 150 years. Other maxima brighter than magnitude 4.0 were noted for the years 1702, 1845, 1847, 1858 and 1864. The twist of unpredictability superimposed on the otherwise relatively regular cycles is what has always fascinated me about Mira stars.

Coming back to the variable star scene after so many years, I have been struck by the extent to which the pendulum of observational priorities (both amateur and professional) seems to have moved since the 1980s, away from the Mira variables and alike in favour of the ‘sexier’ Cataclysmic variables. The chance of catching one of the recurrent object programme CVs in rare outburst or a polar in a high state is certainly what sustains many observers’ interest in the subject. Nevertheless it is still important to keep an eye on what Mike Simonsen has referred to as ‘legacy variables’ like Chi Cygni as well as the importance of including them in a ‘mixed diet’ along with CVs, AGNs, and other objects. As John Percy stresses, long visual datasets of Miras and other red variables help to shed light on secular variations in light curves. Such data in turn demonstrate the far from satisfactory state of astrophysical theory with regards to the underlying mechanisms of convection and pulsation at work in these stars.

There will always be a place for Chi Cygni on my observing programme!

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ENSEMBLE PHOTOMETRY – WHAT IS IT AND WHY USE IT?

David Boyd

The most popular method of variable star photometry, known as differential photometry, involves measuring the brightness of two stars, one of which is variable and the other, called the comparison star, which is believed to be constant and has a known magnitude. Once the difference in magnitude between them is known, the magnitude of the variable can be found.

The difference in magnitude between the two stars is given by the difference in their instrumental magnitudes. These instrumental magnitudes are found using aperture photometry software (such as AIP4WIN (1)) to measure a CCD image containing both stars. The photons from a star collected by each pixel in the CCD are turned into a number called an ADU (Analogue to Digital Unit) count by the electronics of the CCD camera. A circle is drawn round each star in the image and the ADU counts from all the pixels within this circle are added together. This total ADU count is a measure of the brightness of each star. Given this ADU count for each star, its instrumental magnitude m is given by the formula:

$$m = -2.5 * \log10 \text{ (ADU count)}$$

If the instrumental magnitudes of the variable and comparison stars are respectively mv and mc, and the magnitude of the comparison star given on a variable star chart is Mc, then the magnitude of the variable is found from:

$$Mv = Mc + mv - mc$$

While this technique is simple to use, the magnitude value which it produces is subject to several sources of uncertainty. These include errors in measuring the instrumental magnitudes of the variable and comparison stars due to statistical and other effects, any error there might be in the chart magnitude of the comparison star, and possible variation of the comparison star not previously known. To address the last of these a check star is normally also measured and compared with the comparison star. Any variation in the difference between these two stars indicates that one of them is likely to be variable, but it doesn’t tell you which one.

The error in Mv, the measured magnitude of the variable star, is a combination of the errors in Mc, mv and mc. While the error in mv, the instrumental magnitude of the variable, is determined by the parameters of the observation and therefore has to be accepted for what it is, the contribution from the errors in Mc and mc can be significantly reduced using the technique called ensemble photometry. The basic principle of ensemble photometry is to measure several comparison stars in the field of the variable, not just one, and to use all of them to calculate an “ensemble comparison star” to compare with the variable. By using multiple comparison stars in this way, the random measurement errors in each of these stars partially cancel out so that the error in the ensemble comparison star magnitude is smaller than if a single comparison star is used. If the chart magnitude of any of the comparison stars is inaccurate, this tends to show up as an inconsistency when deriving the ensemble comparison star magnitude. If any of the comparison stars is variable, this shows up in its light curve. In either case, the problem comparison star can be dropped from the ensemble. Incidentally, detecting variability in this way not infrequently leads to the discovery of a new low amplitude variable star.

However, while ensemble photometry is a good idea in principle, in practice it is complicated to implement. There are several ways of calculating the ensemble comparison star magnitude from the measurements of the individual comparison stars. The simplest way is to take an average of the measured instrumental magnitudes of all of the comparison stars and similarly to average the chart magnitudes of the same stars. These average values are then used in place of mc and Mc in the formula above for a single comparison star. A variant of this averages the intensities of the stars (i.e. their ADU counts) rather than their magnitudes.

This simple approach works well if all the chosen comparison stars have similar magnitudes and similar uncertainties in their chart magnitudes. In practice, however, it is often necessary to use comparison stars with a range of magnitudes, some fainter than others. In that case, the errors in measuring the instrumental magnitudes of the fainter stars are likely to be larger than for the brighter stars. The fainter stars may also have larger errors on their chart magnitudes. Fainter stars should therefore make a smaller contribution to the ensemble than brighter ones to reflect these larger errors. Simply taking an average gives them all the same contribution.

A better approach is to adjust, or weight, the contribution of each star to the ensemble in inverse proportion to its error, thereby achieving the correct balance between the brighter and fainter stars. This is the method implemented in the BAA VSS CCD photometry spreadsheet version B2.0 (2) which is designed for use with AIP4WIN v2. AIP4WIN v2 allows you to measure multiple comparison stars in the same image as required for ensemble photometry. It can also be used to measure a series of images of the same field taken sequentially so you can monitor how a variable behaves over an extended period.

Figure 1: Aperture photometry using multiple comparison stars with AIP4WIN v2.

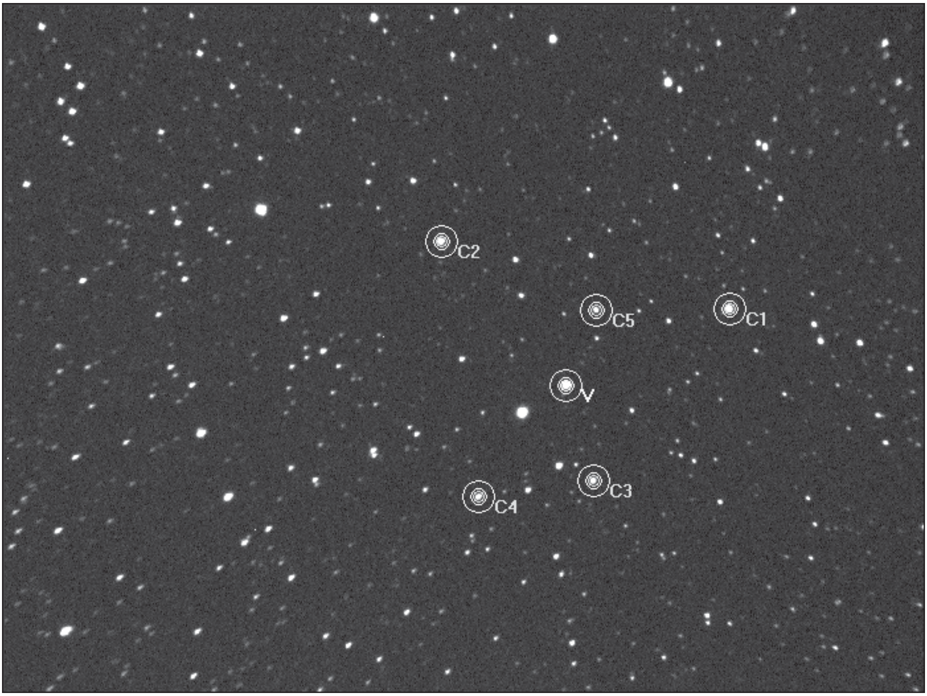


Figure 1 is a screen image from AIP4WIN v2 showing the field of Nova Cygni 2006 (V2362 Cyg). The nova and several comparison stars are surrounded by the circular apertures used to measure their ADU counts. This is one image from a long run of 1800 images recorded over a 6 hour period. AIP4WIN v2 calculates instrumental magnitudes for the variable and for each of the comparison stars, along with estimates of their errors, for each image in the run. The AIP4WIN v2 photometry results can be written out to a file which is then read into the CCD photometry spreadsheet. This will produce light curves showing

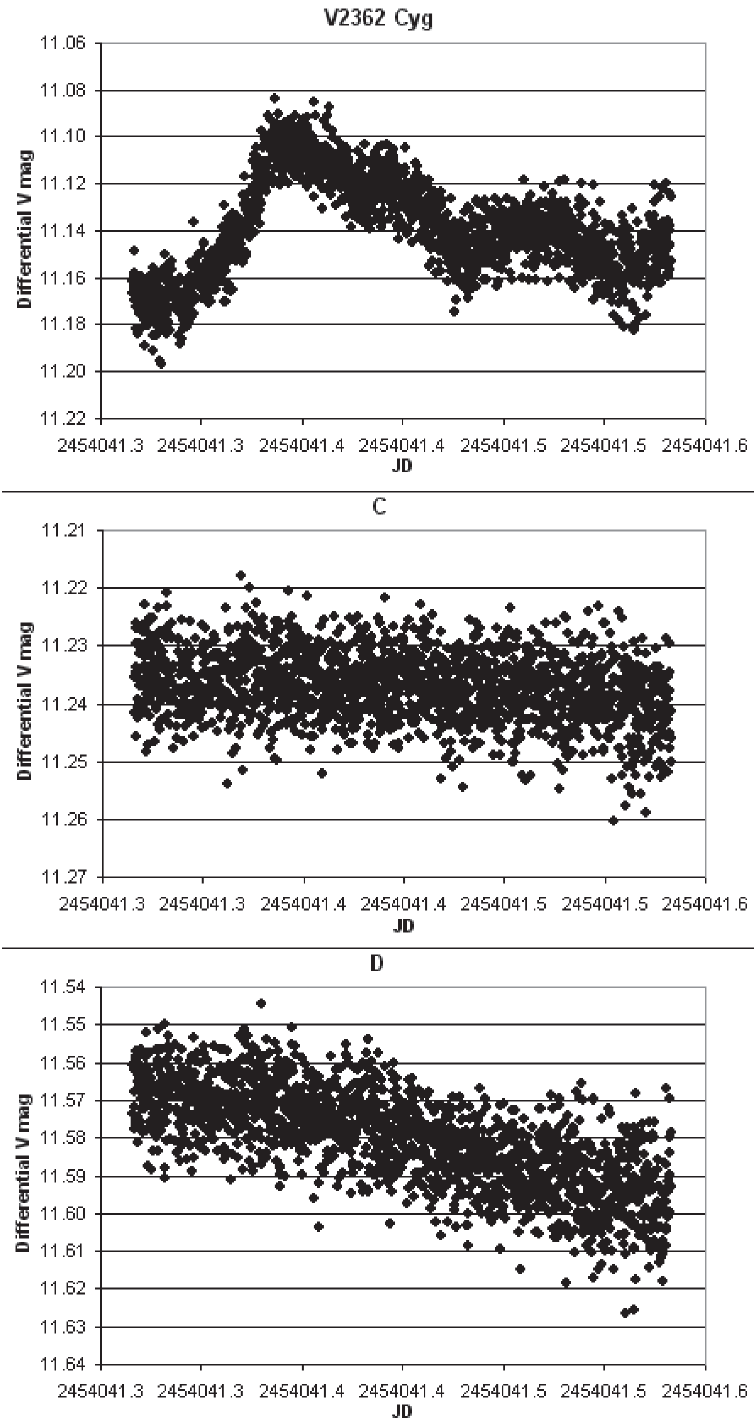
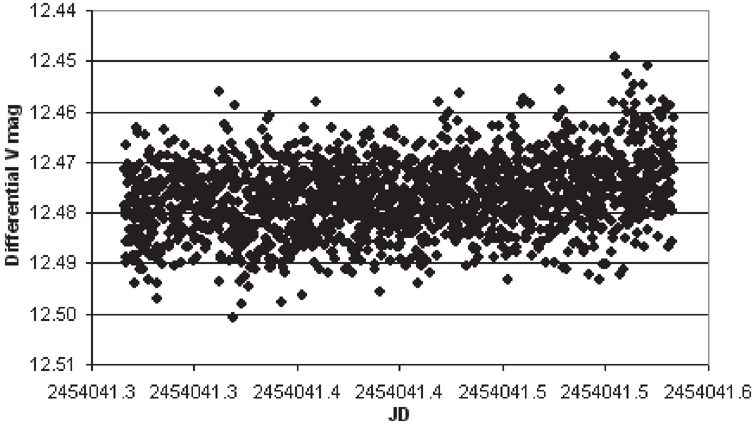
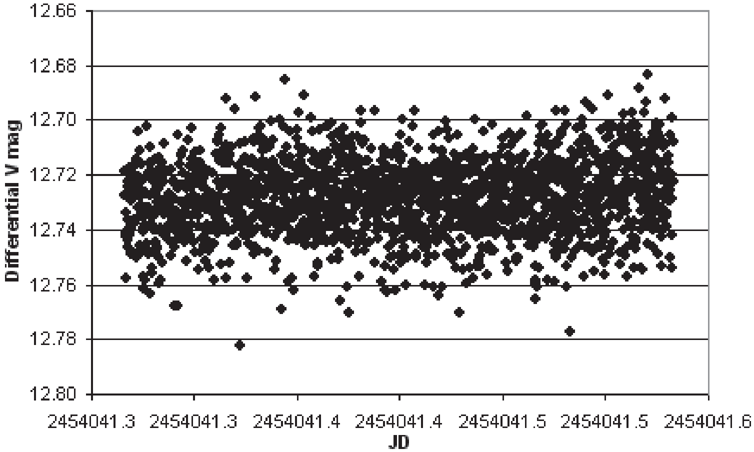


Figure 2: Light curves of the variable and comparison stars marked in Figure1.

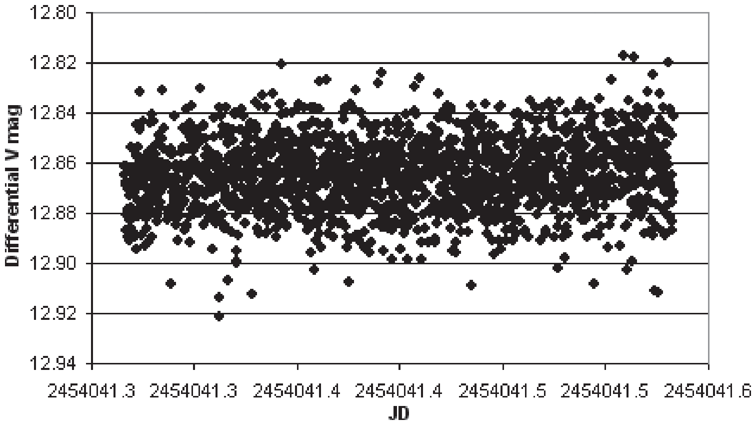
E


12.44
12.45
12.46
12.47
12.48
12.49
12.50
12.51
Differential V mag
2454041.3
2454041.3
2454041.4
2454041.4
2454041.5
2454041.5
2454041.6
JD

F


12.66
12.68
12.70
12.72
12.74
12.76
12.78
12.80
Differential V mag
2454041.3
2454041.3
2454041.4
2454041.4
2454041.5
2454041.5
2454041.6
JD

G


12.80
12.82
12.84
12.86
12.88
12.90
12.92
12.94
Differential V mag
2454041.3
2454041.3
2454041.4
2454041.4
2454041.5
2454041.5
2454041.6
JD

how each star behaves over time. One of the benefits of ensemble photometry is that a magnitude can be calculated for each comparison star as well as for the variable in every image. Monitoring how these comparison star magnitudes vary over a run gives a good feel for whether any of them are intrinsically variable.

Figure 2 shows light curves plotted using Excel for V2362 Cyg and the other comparison stars which were circled in Figure 1 (C = C1, D = C2, etc). Star D varies by 0.03 mag over the run and was subsequently removed from the ensemble. In fact this turned out to be a new, previously unknown, variable with amplitude 0.05 magnitude. The other comparison stars varied by less than 0.01 magnitude over the run and were retained in the ensemble.

In this example using an ensemble of comparison stars improved the precision of magnitude measurements of the nova such that the estimated errors on its magnitude were reduced by about 50% compared to using a single comparison star. This result was borne out by examining the distribution of calculated magnitudes of the non-variable comparison stars over the 6 hour run. When these stars were included in the ensemble, the standard deviations of their magnitude distributions over the run were reduced by up to 50%.

So, if you are currently using a single comparison star and would like to investigate whether ensemble photometry has something to offer, try using AIP4WIN v2 to measure your images and the CCD photometry spreadsheet version B2.0 to analyse your results.

As background reading on ensemble photometry, Honeycutt (3) has written a fairly technical paper about ensemble photometry which describes the use of weighting when combining multiple comparison stars. I have written a paper which describes the analysis procedure embedded in the CCD photometry spreadsheet. It also explains how the method can be applied when more than one photometric filter is used and the results are transformed onto the standard magnitude scale. This paper can be found on-line in the proceedings of the 2007 Society for Astronomical Sciences Conference (4).

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A NEW VARIABLE STAR IN CYGNUS –TYC 3181 1907

DAVID BOYD

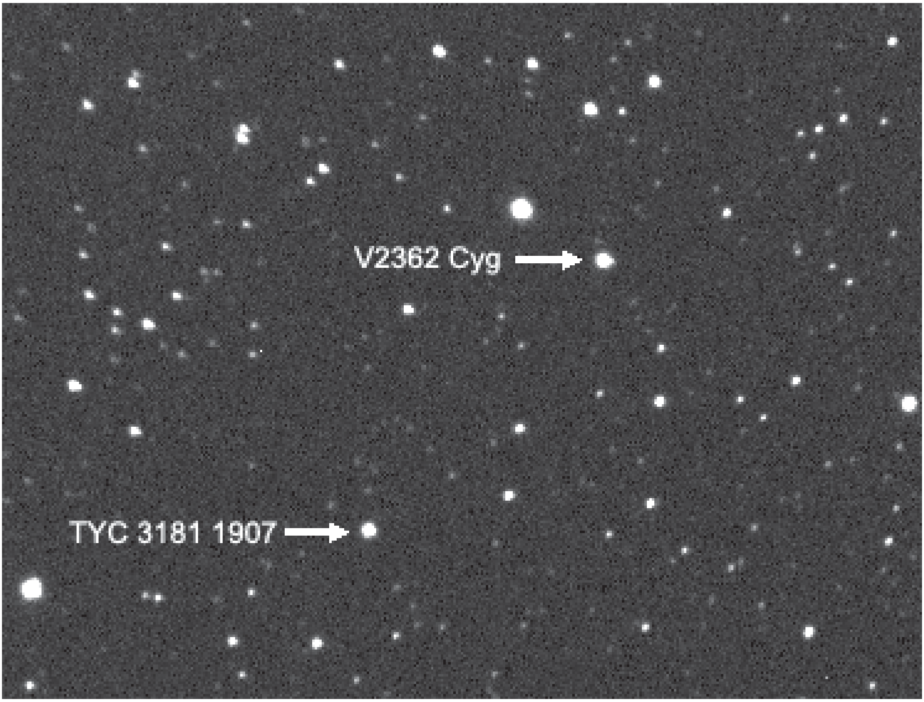

Figure 1: Location of TYC 3181 1907 near Nova Cygni 2006 (V2362 Cyg). North is up and the field is about 9 arcmin wide.

I discovered this star was variable in the course of using ensemble photometry to analyse images of Nova Cygni 2006 (V2362 Cyg). It is the star labelled D in Figure 2 in the article on ensemble photometry in this issue. It is also the comparison star labelled D on the TA chart for the nova dated 060807. Figure 1 shows the location of the variable close to the nova. Comparing its mean position measured with Astrometrica (1) and the UCAC2 catalogue, (J2000) RA 21h 11m 44.99s ±0.01s, Dec +44° 45' 30.4" ±0.2", with the Tycho-2 catalogue using VizieR (2) confirms that the variable is the star TYC 3181 1907. It is not currently listed as a variable in either the GCVS (3) or VSX (4).

Figure 2 shows V magnitude measurements of the variable on images taken of the nova between June and December 2006. These clearly show a wider spread than would be expected from the errors on the individual measurements. Its mean V-Ic colour index over this period was 0.49±0.02.

Frequency analysis of the data in Figure 2 using the Lomb-Scargle method in Peranso (5) shows prominent peaks corresponding to periods of 0.593 days and its 1 cycle/day alias at 1.457 days. There is also an indication that there may be other frequencies present.

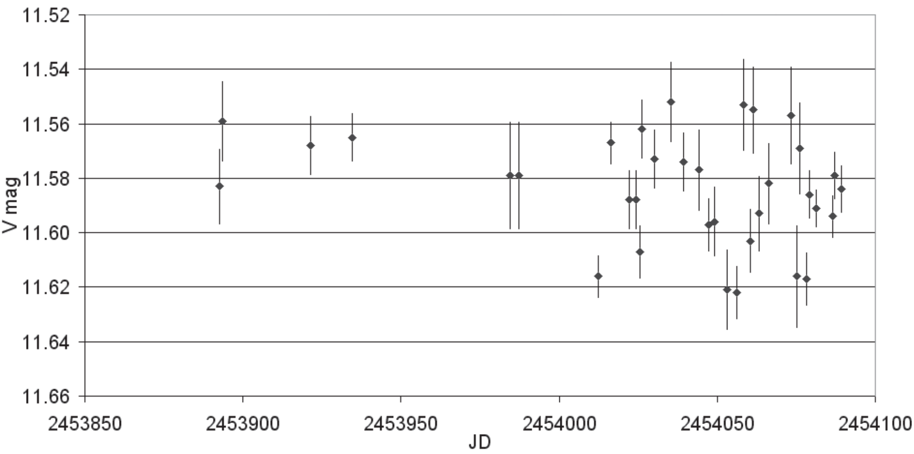

Figure 2: V magnitude measurements of TYC 3181 1907 between June and December 2006.

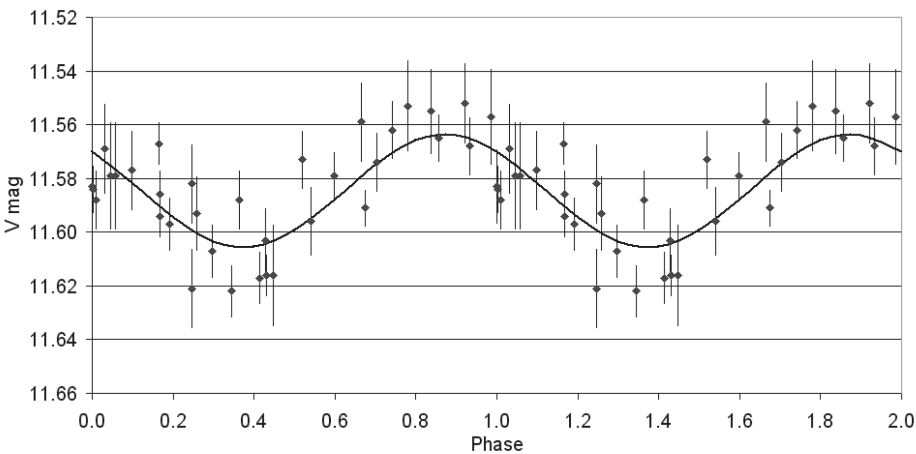

Figure 3. V magnitude phase diagram assuming a period of 0.593 days (showing two cycles with best fit sine curve).

Figure 3 shows the V magnitude phase diagram assuming the 0.593 day period plus a best fit sine curve. The peak-to-peak amplitude is 0.042 mag. The phase diagram for the longer period looks very similar. The V-Ic colour index also shows a sinusoidal variation with amplitude 0.014 mag which is almost in phase with the V magnitude modulation (Figure 4). It appears that the star becomes slightly bluer as it brightens.

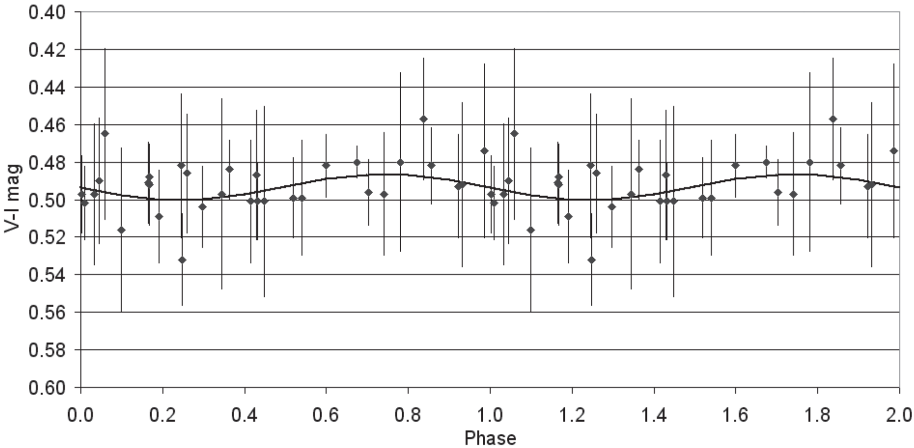

Figure 4: V-Ic colour index phase diagram assuming a period of 0.593 days.

A full analysis of all the data collected for this variable including several time-series is currently underway and will be published in due course. These preliminary results are presented here to show that one benefit of using ensemble photometry is its potential for discovering new variables.

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3. GCVS, *http://www.sai.msu.su/groups/cluster/gcvs/gcvs/*
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THE NATURE OF NSV 7883

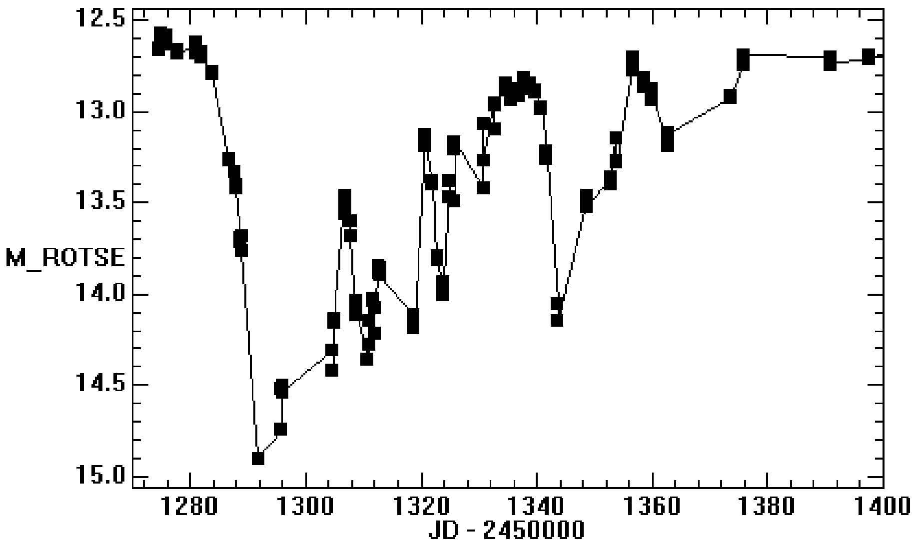
C. Lloyd, K Kinugasa and G. Poyner

NSV 7883 (GSC 00965-01668, 16 39 06.42 +09 47 55.3 2MASS) was apparently first reported as a variable by Wachmann (1929) who found a range of 12.0 - >13.5pg on 12 plates taken between 1911 and 1928, although the GCVS attributes this reference to Blazhko. More extensive observations between 1928 and 1931 reported by Prager (1931) covered only the bright end of the variation, but apparently supported the notion that it was a Cepheid with a period just over one day.

There the matter rested for many years but once into the 21st century NSV 7883 was rediscovered many times. Firstly in the ROTSE-1 data as an LPV without a period (Akerlof et al. 2000) and then with a period of 114 days (Wozniak et al. 2004), then in the ASAS3 data as a "MISC" variable with a period near 60 days (Pojmanski et al. 2005) and most recently in the TASS data (Droege et al. 2006). Despite being a known variable for 80 years the star has not been given a GCVS designation, possibly because no convincing period has been found or because the variation has defied classification.

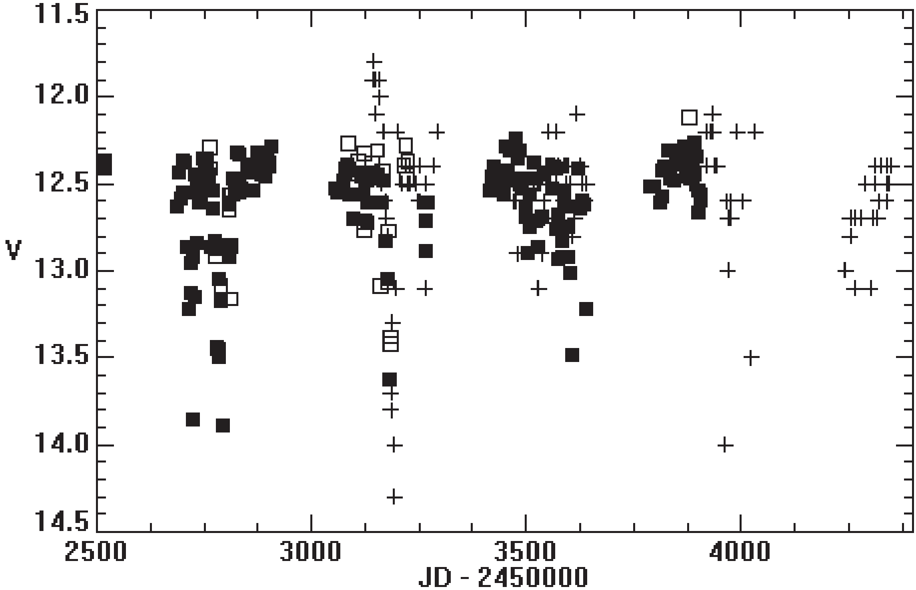
Having said that, several commentators in the recent past have suggested that it is some sort of young stellar object (YSO), perhaps a Herbig Ae/Be star or T Tau-type variable. The most obvious features of the light curve are deep eclipse-like fades, occasionally reaching 2.5 magnitudes, which occur on a time scale of days, but these "dimmings" are not periodic and do not have the same depth. The variation in the light curve can be seen particularly well in a section of the ROTSE data (shown in Figure 1) where the star recovers from a deep fade through a series of weaker and weaker dimmings.

Figure 1: A section of the ROTSE-1 light curve of NSV 7883 showing a deep fade and subsequent recovery with several weaker dimmings superimposed.



These features do not occur all the time and the star is mostly found close to its maximum brightness, which seems to remain constant over several years (see Figure 2).

Figure 2: The light curve of NSV 7883 covering the years 2003 to 2007 showing the ASAS3 data (filled squares), the TASS data (open squares) and visual data by Poyner (+). The star typically shows two deep fades each season with a general variation of < 0.5 magnitudes from maximum brightness.



In the visible range the colour of NSV 7883, given by V-I = 0.45 from the TASS data (Droge et al. 2006), suggests a spectral type near F0, but the star is likely to be heavily reddened. In the near-IR the colours from 2MASS, J-H = 1.02 and H-K = 0.99, do not correspond to a normal star but are typical of the infrared excess seen in YSOs. In a low-resolution spectrum of NSV 7883, shown in Figure 3, the star clearly has H_α in emission and H_β in absorption. Combined with the relatively early spectral type, the infrared excess and particularly the very deep fades show the star most likely belongs to the UX Ori class of Herbig Ae/Be stars. Many YSOs are associated with either bright or dark nebulosity but a small minority are not, and NSV 7883 belongs to this group.

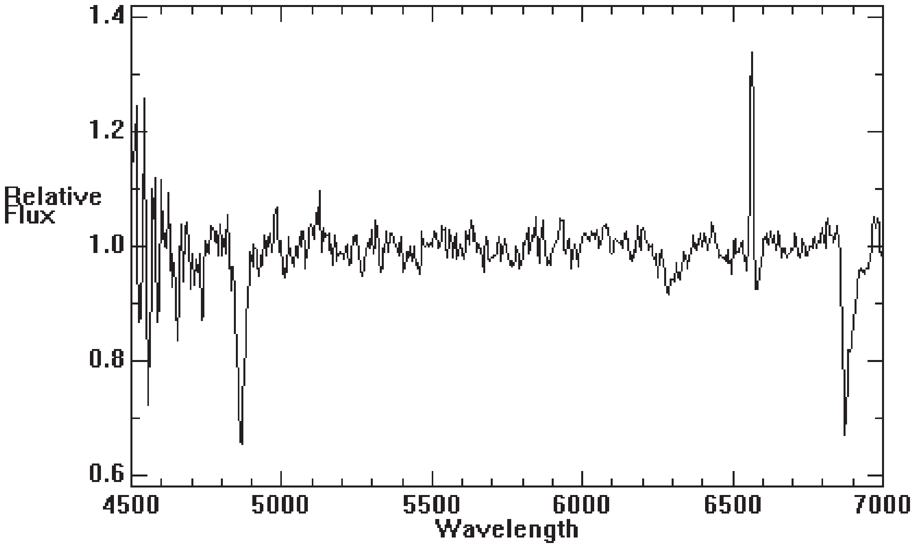


Figure 3: The normalised spectrum of NSV 7883 showing H_α in emission, which should not come as a surprise to anyone, and H_β at 4861 Angstroms in absorption. The two broad feature near 6300 and 7000 Angstroms are due to the atmosphere.

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THE PERIOD OF SUSPECTED ECLIPSING BINARY Q1997/11

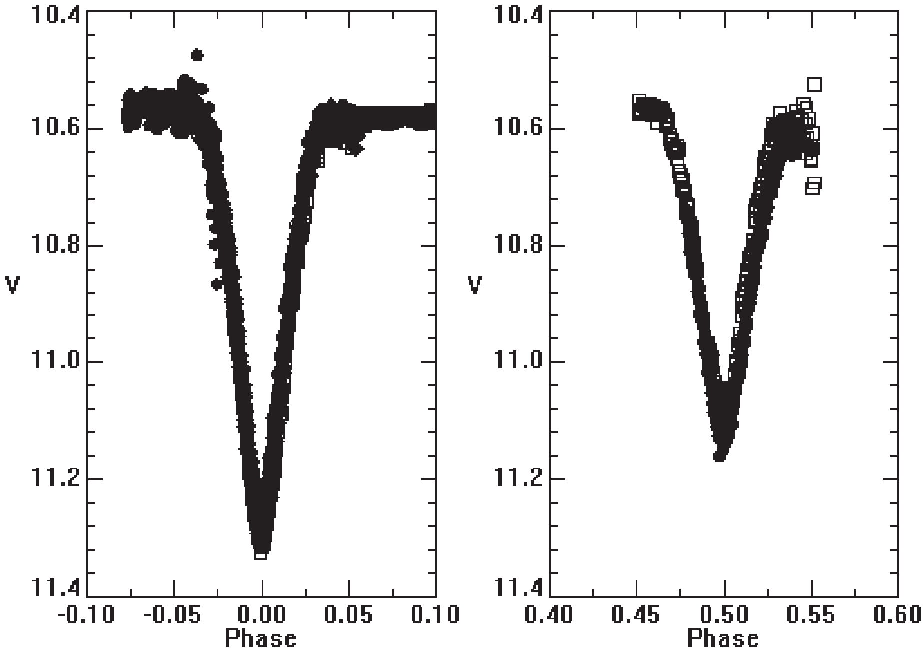
C. Lloyd, R. Koff, R. Huziak, R D. Pickard, D.R. Boyd and S. Dvorak and M. Collins.

For the uninitiated, Q1997/11 is the designation given by “The Astronomer” to one of the variable stars discovered by Collins (1997), as part of the UK Nova/Supernova patrol. The star corresponds to GSC 3752-0986 at 05 24 24.58 + 54 39 21.9 (2000 2MASS), and was identified as an eclipsing binary with a range of 10.3 – 11.1pg. Observations made during 1988 -1997 show four eclipses nearly a magnitude deep, and perhaps another four with about half that depth. Based on the timings of these the most likely period appeared to be near 31 days but this was not totally convincing. The publication of the ROTSE-1 archive (Wozniak et al. 2004) provided another four timings but did not resolve the matter. Last year we reanalysed the data and a period of 1.03 days emerged as a very likely candidate. Observations based on a provisional ephemeris quickly showed that there were two unequal eclipses with depths of 0.8 and 0.6 magnitudes and that the true period was just over two days. The ephemeris of primary minimum is:

$$JD\_MinI = 2454\,175.868 + 2.0668 \times E$$

The light curve (shown in Figure 1) suggests that the two components are relatively similar, probably, main-sequence stars, and the optical and near-IR colours indicate a spectral type near G7. However, these are not ordinary stars as the system is coincident with the X-ray source 1RXS J052423.9+543916, so one of the stars is probably chromospherically active.

Figure 1: The light curve of Q1997/11 around primary and secondary eclipse.



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IBVS 5780-5800

Gary Poyner

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5781 166. List of timings of minima eclipsing binaries by BBSAG observers. (Diethelm, 2007)
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(Van Genderen & Sterken, 2007)
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5799 Observations of variables. (The Editors, 2007)
5800 NSVS 14256825: A new HW Virginis type system. (Wils et al, 2007)

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BINOCULAR PRIORITY LIST

MELVYN TAYLOR

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

ECLIPSING BINARY PREDICTIONS

DES LOUGHNEY

The following predictions, based on the latest Krakow elements, should be usable for observers throughout the British Isles. The times of mid-eclipse appear in parentheses, with the start and end times of visibility on either side. The times are hours UT, with a value greater than 24 indicating a time after midnight. D indicates that the eclipse starts/ends in daylight; L indicates low altitude at the start/end of the visibility and << indicates that mid eclipse occurred on an earlier date.

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

The variables covered by these predictions are :

RS CVn	7.9 - 9.1V	Z Dra	10.8 - 14.1p	HU Tau	5.92 - 6.70V
TV Cas	7.2 - 8.2V	TW Dra	8.0 - 10.5v	X Tri	8.88 - 11.27V
U CrB	7.7 - 8.8V	S Equ	8.0 - 10.08V	TX Uma	7.06 - 8.80V
SW Cyg	9.24 - 11.83V	Z Per	9.7 - 12.4p	W Ser	8.4 - 10.2
V367 Cyg	6.7 - 7.6V	U Sge	6.45 - 9.28V	U Cep	6.8 - 9.4
Z Vul	7.25 - 8.90V	RW Tau	7.98 - 11.59V		

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

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

April

2008 Apr 1 Tue
S Equ........04(09)04D
TW Dra....D20(16)21
X Tri.........20(23)21L
RS CVn....23(29)28D

2008 Apr 2 Wed
TX UMa..00(05)04D
Z Dra........03(06)04D
U Cep.......03(08)04D
X Tri......D20(22)21L
Z Vul.........L23(19)25

2008 Apr 3 Thu
del Lib......02(08)04D
X Tri......D20(21)21L
U Sge......L24(27)28D

2008 Apr 4 Fri
TV Cas.....04(08)04D
U Cep.......D20(20)25
X Tri......D20(21)20L
Z Dra..........21(23)25

2008 Apr 5 Sat
Z Vul...........01(06)04D
TX UMa....02(07)04D
X Tri........D20(20)20L
SW Cyg....L20(26)28D
del Lib.........L22(16)23
TV Cas.......24(28)28D

2008 Apr 6 Sun
X Tri........D20(19)20L
U CrB......D20(23)28D
RS CVn....D20(24)28D
RW Tau.......22(27)22L

2008 Apr 7 Mon
TW Dra......01(06)04D
U Cep.........03(08)04D
X Tri........D20(19)20L
TV Cas.......D20(23)27
del Lib......L22(24)28D

2008 Apr 8 Tue
S Equ.......L02(06)04D
TX UMa...03(08)04D
Z Per..........D20(15)20
HU Tau......D20(17)21
X Tri.......D20(18)20L
Z Dra............22(25)27

2008 Apr 9 Wed
TV Cas......D20(19)23
U Cep........D20(20)25
RW Tau...D20(21)22L
TW Dra.....21(26)28D
Z Vul.......L23(28)28D

2008 Apr 10 Thu
del Lib........02(08)04D
SW Cyg.....D20(16)22
HU Tau...D20(18)22L
U Sge..........L23(21)27

2008 Apr 11 Fri
Z Per..........D20(17)21
Z Dra.........D20(18)20
RS CVn......D20(19)26

2008 Apr 12 Sat
W Ser.......L01(38)04D
U Cep........03(08)04D
RW Tau......D20(16)21
HU Tau...D20(20)22L
TW Dra.....D20(21)26
del Lib........L21(16)22

2008 Apr 13 Sun
Z Dra.........00(02)04D
W Ser.......L01(14)04D
U CrB........D20(21)27

2008 Apr 14 Mon
U Sge.........00(06)04D
W Ser......L01(<<)04D
Z Per.......D20(18)23L
U Cep.......D20(19)24
HU Tau...D20(21)22L
del Lib.....L21(24)28D
Z Vul.......L22(26)28D
SW Cyg.....23(29)28D

2008 Apr 15 Tue
TV Cas.......01(05)04D
W Ser...... L01(<<)04D
S Equ.......L02(03)04D
TW Dra.....D20(16)22
Z Dra.........D20(20)22

2008 Apr 16 Wed
RS CVn......D20(15)21
HU Tau....D20(22)22L
TV Cas.......21(25)28D
V367Cyg..L22(55)28D

2008 Apr 17 Thu
del Lib........01(08)04D
Z Dra.........02(04)04D
U CrB........02(08)04D
U Cep........02(07)04D
Z Per........D20(19)22L
V367Cyg..L22(31)28D

2008 Apr 18 Fri
TV Cas......D20(20)24
HU Tau...D20(24)21L
V367Cyg..L22(07)28D

2008 Apr 19 Sat
SW Cyg.....D20(19)25
U Cep........D20(19)24
Z Dra.........D20(21)24
del Lib........ L21(15)22
V367 Cyg...L22(<<)27
Z Vul........L22(24)28D

2008 Apr 20 Sun
U CrB........D20(19)25
Z Per....... D20(21)22L
RW Tau...D20(23)22L
HU Tau......21(25)21L
U Sge.......L23(24)28D

2008 Apr 21 Mon
TW Dra..... 02(07)04D
RS CVn......03(10)04D
Z Dra.........04(06)04D
del Lib......L21(23)28D

2008 Apr 22 Tue
S Equ.......L01(00)04D
U Cep........02(07)04D

2008 Apr 23 Wed
TX UMa....D20(16)20
RW Tau....D20(18)21L
Z Per........D20(22)22L
Z Dra...........21(23)25
TW Dra......22(27)27D
U CrB........24(30)27D

2008 Apr 24 Thu
del Lib.......01(07)03D
TV Cas.....03(07)03D
SW Cyg....03(09)03D
Z Per.........L03(<<)03
U Cep...... D20(19)24
Z Vul.........L22(22)27

2008 Apr 25 Fri
TV Cas.....22(26)27D
RS CVn.....23(29)27D

2008 Apr 26 Sat
W Ser........03(42)03D
TX UMa..D20(17)22
TW Dra....D20(22)27
Z Per......D20(23)22L
del Lib....... L21(15)21

2008 Apr 27 Sun
W Ser......L01(18)03D
U Cep.......02(07)03D
Z Per......L03(<<)03D
Z Vul.........03(08)03D
U CrB.......D20(17)22
TV Cas.....D20(22)26
U Sge.........L22(19)24
Z Dra..........22(25)27

2008 Apr 28 Mon
W Ser......L00(<<)03D
SW Cyg..D20(23)27D
del Lib....D20(23)27D

2008 Apr 29 Tue
W Ser.....L00(<<)03D
S Equ........L01(<<)02
TV Cas......D21(17)21
TW Dra....D21(17)22
U Cep.......D21(18)23
TX UMa..D21(19)23
Z Per......D21(25)22L
Z Vul.........L21(19)25

2008 Apr 30 Wed
Z Per.......L02(01)03D
RS CVn..D21(24)27D
U CrB.......22(27)27D
U Sge........22(28)27D

May

2008 May 1 Thu
del Lib.......00(07)03D
RW Tau..D21(25)21L

2008 May 2 Fri
Z Dra..........00(03)03D
Z Vul..........01(06)03D
U Cep.........01(06)03D
S Equ..........02(08)03D
TX UMa....D21(20)25
Z Per...........21(26)21L

2008 May 3 Sat
Z Per........L02(02)03D
del Lib.........D21(15)21

2008 May 4 Sun
U Cep........D21(18)23
Z Dra.........D21(20)22
Z Vul...........L21(17)23
TV Cas.......24(28)27D

2008 May 5 Mon
V367 Cyg...00(45)03D
RS CVn......D21(19)25
TX UMa....D21(22)26
del Lib.....D21(22)27D
V367Cyg.D21(45)27D

2008 May 6 Tue
Z Dra.........02(04)03D
Z Per........L02(03)03D
V367Cyg.D21(21)27D
TV Cas....D21(23)27D
Z Vul 23(28)27D

2008 May 7 Wed
U Cep.........01(06)03D
V367Cyg.D21(<<)27D
U CrB......D21(25)27D
SW Cyg...D21(26)27D
U Sge........L22(22)27D
TW Dra......22(27)27D
del Lib........24(30)27D

2008 May 8 Thu
TV Cas.......D21(19)23
Z Dra.........D21(21)24
TX UMa.D21(23)27D

2008 May 9 Fri
S Equ........L00(05)03D
Z Per........L02(05)03D
U Cep........D21(18)23

2008 May 10 Sat
TW Dra...D21(23)27D
W Ser........L24(46)27D

2008 May 11 Sun
U Sge..........02(07)03D
Y Psc........L03(06)03D
TX UMa.D21(25)27D
Z Vul.......D21(26)27D
W Ser.......L24(22)27D

2008 May 12 Mon
U Cep........01(06)03D
Z Per........L02(06)03D
SW Cyg.....D21(16)22
del Lib.....D21(22)27D
Z Dra.........D21(23)26
W Ser......L23(<<)27D

2008 May 13 Tue
TW Dra.....D21(18)23

2008 May 14 Wed
TV Cas......01(05)03D
U Sge.........D21(16)22
U Cep........D21(17)22
U CrB.....D21(23)27D
TX UMa... 22(26)27D
del Lib........24(30)27D

2008 May 15 Thu
Y Psc.......L02(01)03D
TV Cas...D21(25)27D
S Equ.......L24(25)27D

2008 May 16 Fri
Z Vul.......D21(24)26D
Z Dra.........23(25)26D
SW Cyg.....23(30)26D

2008 May 17 Sat
U Cep........00(05)02D
TV Cas......D21(20)24
U Sge......D21(26)26D
TX UMa...23(28)26D

2008 May 19 Mon
U Cep........D21(17)22
del Lib.....D21(22)26D
RS CVn......22(29)26D

2008 May 21 Wed
Z Dra.........00(03)02D
TX UMa...01(05)02D
SW Cyg.....D21(19)25
U CrB........D21(20)26
Z Vul.......D21(22)26D
del Lib........23(29)26D
TW Dra.....23(28)26D

2008 May 22 Thu
U Cep........00(05)02D
S Equ.......L23(22)26D

2008 May 23 Fri
Z Dra.........D21(20)22
V367Cyg.D21(59)26D

2008 May 24 Sat
TX UMa....02(07)02D
U Cep.........D21(17)22
U Sge..........D21(20)26
TW Dra...D21(24)26D
RS CVn...D21(24)26D
V367Cyg.D21(35)26D
TV Cas.......22(26)26D
W Ser........L23(50)26D

2008 May 25 Sun
U CrB.........02(07)02D
Z Dra..........02(04)02D
V367Cyg.D22(11)26D
W Ser........L23(26)26D

2008 May 26 Mon
V367Cyg.D22(<<)26D
Z Vul..........D22(20)25
del Lib......D22(21)26D
TV Cas.......D22(22)26
W Ser........L23(02)26D
U Cep.........24(29)26D

2008 May 27 Tue
TW Dra......D22(19)24
Z Dra..........D22(22)24
U Sge..........23(29)26D

2008 May 28 Wed
U CrB.........D22(18)24
del Lib.........23(29)26D

2008 May 29 Thu
Z Vul...........01(06)02D
RS CVn.......D22(19)25
S Equ L23(19)25

2008 May 30 Fri
Y Psc........L01(02)02D
SW Cyg...D22(23)26D

2008 May 31 Sat
Z Vul..........D22(17)23
Z Dra..........D22(23)26
U CrB.........23(29)26D
U Cep.........23(28)26D

June

2008 Jun 1 Sun
X Tri..........02(04)02D

2008 Jun 2 Mon
S Equ..........00(06)02D
X Tri........L02(04)02D
del Lib.....D22(21)26D
Z Vul..........23(28)26D
TV Cas.......24(28)26D

2008 Jun 3 Tue
X Tri.......L02(03)02D
U Sge......D22(23)26D

2008 Jun 4 Wed
X Tri.......L02(02)02D
TV Cas...D22(23)26D
del Lib.......22(29)26D
Z Dra........23(25)26D

2008 Jun 5 Thu
TW Dra.....00(05)02D
X Tri.......L02(02)02D
U Cep.......23(28)26D

2008 Jun 6 Fri
X Tri.......L01(01)02D
TV Cas......D22(19)23

2008 Jun 7 Sat
X Tri.......L01(00)02D
TW Dra..D22(24)26D
Z Vul......D22(26)26D
U CrB....D22(27)26D
W Ser......D22(54)26D

2008 Jun 8 Sun
X Tri.......L01(00)02D
SW Cyg..D22(26)26D
W Ser......D22(30)26D
S Equ......L22(27)26D

2008 Jun 9 Mon
Z Dra........00(03)02D
X Tri.........L01(<<)01
W Ser......D22(06)26D
del Lib....D22(20)26L

2008 Jun 10 Tue
U Sge.........D22(17)23
TW Dra.....D22(20)25
U Cep.......23(28)26D

2008 Jun 11 Wed
Z Dra........D22(20)22
del Lib....D22(28)26L
V367Cyg.D22(50)26D
Z Per..........L24(20)24

2008 Jun 12 Thu
TV Cas......01(05)02D
Z Vul......D22(24)26D
V367Cyg.D22(26)26D
RS CVn..D22(28)26D

2008 Jun 13 Fri
V367Cyg.D22(02)26D
SW Cyg.....D22(16)22
TV Cas...D22(25)26D
U Sge......D22(27)26D

2008 Jun 14 Sat
Y Psc......L00(04)02D
V367 Cyg D22(<<)22
TX UMa...D22(17)22
U CrB....D22(24)26D
Z Per.......L23(21)26D

2008 Jun 15 Sun
TV Cas......D22(20)25
Z Dra........D22(22)24
S Equ......D22(24)26D
U Cep.......22(27)26D

2008 Jun 16 Mon
del Lib....D22(20)25L

2008 Jun 17 Tue
TX UMa..D22(19)24
Z Vul......D22(22)26D
RS CVn..D22(23)26D
Z Per.......L23(22)26D
SW Cyg.....24(30)26D

2008 Jun 18 Wed
Y Psc......L00(<<)02D
del Lib....D22(28)25L

2008 Jun 19 Thu
TW Dra.....01(06)02D
Z Dra.....D22(23)26D

2008 Jun 20 Fri
TX UMa D22(20)25
U Sge......D22(21)26D
U Cep.......22(27)26D
Z Per.......L23(24)26D

2008 Jun 21 Sat
U CrB....D22(22)26D
TW Dra..D22(25)26D
W Ser......D22(58)26D

2008 Jun 22 Sun
RS CVn.....D22(19)25
SW Cyg.....D22(20)26
Z Vul.........D22(20)25
S Equ......D22(21)26D
W Ser......D22(34)26D
TV Cas........2(26)26D

2008 Jun 23 Mon
W Ser......D22(10)26D
del Lib.....D22(19)25L
TX UMa.D22(22)26D
Z Dra.........23(25)26D
Z Per........L23(25)26D

2008 Jun 24 Tue
U Sge.........00(06)02D
W Ser.........D22(<<)25
TW Dra.....D22(21)26
TV Cas...D22(22)26D

2008 Jun 25 Wed
Z Vul..........01(07)02D
U Cep.....D22(27)26D
del Lib.....D22(27)25L

2008 Jun 26 Thu
S Equ.........02(07)02D
TX UMa.D22(24)26D
Z Per........L23(26)26D

2008 Jun 27 Fri
Z Vul..........D22(17)23

2008 Jun 28 Sat
Z Dra.........00(03)02D
U CrB........D22(20)26

2008 Jun 29 Sun
Y Psc.........01(05)02D
S Equ.........D22(18)23
TX UMa.D22(25)26D
V367Cyg.D22(64)26D
Z Per..........23(28)26D
Z Vul..........23(28)26D

2008 Jun 30 Mon
Z Dra.........D22(20)22

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If you are unsure if the material is of a suitable level or content, then please contact the editor for advice.

The **deadline for contributions** to the next issue of VSSC (number 136) will be 7th May, 2008. All articles should be sent to the editor (details are given on the back of this issue)

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