British Astronomical Association

# VARIABLE STAR SECTION CIRCULAR

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## Contents



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**V390 NORMAE (= N. NOR 2007)** NICK JAMES. 15:57UT. 180s exposure. Remote GRAS06, Bigarra Waters, Australia.

150mm f/6 Mac + ST-10 CCD.

FOV 56'.3x37', North up.

# FROM THE DIRECTOR

ROGER PICKARD

**BAA Exhibition Meeting**

It was good to meet some familiar faces once again at the annual BAA Exhibition Meeting. For those unable to attend I thought it high time that I took a few photographs of the Section's admirable displays, a couple of which have been reproduced here. Many thanks to all those submitting material to help make our display one of the best, if not the best.

**New Charts - a reminder**

I'm sure members will have noticed that John Toone usually only draws new charts limited to covering just the full range of the sequence. This is because charts are really only a visual depiction of the sequence and most observers are probably using "Go To" telescopes or charts such as Millennium, Borealis/Eclipiticalis or Uranometria for field location and these are much better quality than the old BAA VSS wide field charts.

However, for those who still use the wider field charts please remember to use the updated sequence for the actual estimate.

A recent example of such a chart is that for RU Pegasi where we have a new 30' chart which replaces the old 20' one but have retained the old 9d and 1d charts which still list some of the old comparisons, albeit now without magnitudes. Please remember to use just the sequence given on the new 30' chart.

As I am sure members will appreciate, this allows John to concentrate his efforts on producing new charts with better sequences.

**Statistics**

In preparing the annual Report for the Journal it has once again become apparent that some members may not yet have sent their observations for 2006 to Clive Beech. This may be because of the incorrect email address for Clive given in earlier Circulars. Please check that Clive has acknowledged receipt of your observation and if not then resubmit them.

In passing, it is also worth noting that Clive has processed all the observations he has received to date for 2006 (over 26,000) with the loss of only 2 observations.

**John Toone**

It was a delight to attend the wedding of John and Irene Toone on Saturday 18th August, and we extend our best wishes to them for the future. Although the weather was not too kind it did stop raining for all the important parts such as taking photos, one of which should appear in the next Circular.


# BAA EXHIBITION MEETING, NATIONAL SPACE CENTRE, LEICESTER.

ROGER PICKARD

# ECLIPSING BINARY NEWS

DES LOUGHNEY

### First Galactic Eclipsing Cepheid

In June 2007 the AAVSO called for observations of ASAS182612 (Alert Notice 35.1 - 8/6/07). This is the first galactic eclipsing Cepheid to be identified. As a Cepheid it has a period of 4.1523 days and a variation of 0.5 m. As an EB it has a period of 51.38 days and a variation of 0.3 magnitudes at primary minimum and 0.2 magnitudes at secondary minimum. The variations are rather small for visual observers so this system is considered a target for CCD observers. The variations occur around magnitude 11.

The AAVSO has prepared a chart. The link to the chart is given in the alert notice. The star is near RX Herculis.

**The Lichtenknecker-Database of the BAV** (German variable star organisation, the Bundesdeutsche Arbeitsgemeinschaft für Veränderliche Sterne e.V.)

Earlier this year the following email was received from Frank Walter the EB Secretary of the Eclipsing Binary Section of the BAV which gave notice of a very welcome development.

"The collection of times of minimum for eclipsing binaries, which is called 'Lichtenknecker-Database of the BAV' in honour of its initiator Dieter Lichtenknecker, was made available to astronomical scientists and interested amateurs in April 2004 for the first time. It was delivered on CD-ROM. A revision (more stars, more minima) was published in January 2006.

The BAV continues its efforts in collecting observatorial results from the international community of variable star observers. The database now contains more than 130,000 observed times of minimum of 1,968 stars. Due to this it is probably the largest collection of times of minimum for eclipsing binaries of the northern hemisphere worldwide.

Now we are proud to make available the Lichtenknecker-Database of the BAV (Rev. 3.0) via WorldWideWeb for everybody. Please look at

http:*//www.bav-astro.de/LkDB/index_e.html*

The BAV has no rights on the stored times of minimum. They are held by the authors and observers. Nevertheless we kindly ask all users of the database to cite the official title 'Lichtenknecker-Database of the BAV' in regard of the enormous efforts of all the people who contributed to it.

If you have any questions or proposals for further improvement please contact the database-administrator Frank Walter (mailto:*bv@bav-astro.de*)."

### AAVSO - Eclipsing Binary Information

The AAVSO now hosts the Eclipsing Binary O-C files that Bob Nelson has developed.

These contain over 1800 O-C files on eclipsing binaries.
The files are found on:
*http://www.aavso.org/observing/programs/eclipser/omc/nelson_omc.shtml*

The site provides a link to Shawn Dvorak's site where his prediction software can provide a list of the eclipses on a particular day.

**Z Draconis**

Z Draconis is quite a popular target for EB observers. Z Dra is a 'fast' eclipser. Although it starts slowly it fades from 11 to 12.6 in just half an hour making it a spectacular astronomical event. After this fade it always seems a challenge because primary minimum is under magnitude 13. In a suburban setting it seems difficult to make comparisons under 13.

A paper has recently been published (IBVS 5742) on "Photometry of the Algol - type Binary Z Draconis" by D. Terrell. The paper describes how a light curve was worked out from observations in 2005. Apparently this is the first photometric work to be done on the system since 1913!

The paper confirms that the eclipse is partial. The light curve of the primary and secondary eclipses is symmetrical, but the light curve between the eclipses is not symmetrical. There does not seem to be any clear explanation of this type of asymmetry, as applied to Z Dra.

The paper finds new elements for Z Draconis - 2453430.71662 + 1.3574179 which confirms that the period of the eclipse is reducing. This continues the trend since about the middle 1980's and indicates that mass transfer is continuing.

Eclipsing Binary Secretary
*desloughney@blueyonder.co.uk*

# DAYTIME PHOTOMETRY OF VARIABLE STARS

## A Letter from Dr Richard Miles:

Earlier this year I used a CCD camera to perform daytime photometry of Comet McNaught (see BAAJ, 117(2), 92-93 (2007)) and was particularly surprised to find that I was able to record an image of Vega when the Sun was 2 degrees ABOVE the horizon! A total of 15 x 60 sec exposures produced an image of the star with a signal=to-noise of 130.

Since then I have investigated the feasibility of performing photometry of other stars during the daytime and have concluded that it is entirely possible. The current VSS observing programs include very few bright stars, the brightest being Gamma Cas (typically about mag 2,0-2.2 but with extremes of 1.6-3.0). Excluding novae and recurrent novae, the program has only 7 other stars that can attain magnitude 4.0 or brighter. Yet looking at the list of the brightest stars there are about 30 stars brighter than magnitude 2.0 accessible from our latitude many of which are variable. Of the brightest stars, Alpha Ori (Betelgeuse) is the one most carefully monitored but even here the AAVSO database has precious few photoelectric measurements during the last few years. Indeed, the move away from photoelectric photometry (PEP) to CCD photometry has meant that brighter stars are getting less attention from amateur astronomers than in the past. An important eclipse of Eps Aur (2.9-3.8) is due in 2009 and unless more is done to champion bright star photometry, it might be at risk of being under observed.

I was heartened though to read in the last VSSC (No.132 June, p4-5) of Des Loughney's proposal to study Beta Lyrae (3.3-4.4) using a DSLR camera and it occurred to me that such a camera might be used not only for bright star photometry but also to measure the brightest stars even during daytime.

I have to admit one of the reasons I have been interested in this novel proposal is the dire weather for observing that we have been experiencing here in the UK. If you can observe stars in the day as well as by night then you will have more chances to observe each year. However, my calculations show that observing stars by day requires a good clear sky and these have been few and far between of late! The limiting magnitude for daytime photometry with any degree of precision is likely to be around V=2.5. If it can be shown that this is a practicality then it also opens up the possibility of monitoring bright stars for an extended period throughout the year. For example, in principle one could follow Betelgeuse's lightcurve for 12 months of the year since at its closest approach to the Sun in June the star is at a solar elongation of about 15 degrees south.

Looking on the Web there is precious little about daytime photometry. I only found one other reference (*http://campus.pari.edu/mwcnew/tharpsposter.pdf*) and that was limited to imaging Vega and Aldebaran.

Well there you have it. I just need a few clear days with blue skies to observe and an article will shortly be winging your way for the VSS Circular.

Sunny skies,
Richard.

# DIFFERENTIAL PHOTOMETRY WITH A DSLR

**Des Loughney**

### Introduction

Experiments have been carried out with a Canon DSLR to establish whether it can be used for differential photometry. Reviews of the Canon and similar modern cameras suggest that they are potentially suitable, because of their low noise, for good quality astrophotography and differential photometry.

A protocol has been worked out that, within certain limitations, allows a measurement of differential magnitude that is more accurate than naked eye estimates. It is possible that under the best conditions excellent results can be obtained.

The protocol was used to make estimations of the magnitude of the eclipsing binary

Beta Lyrae. These estimates are presented as a light curve which illustrates the accuracy that is achievable.

It is now possible for a new class of variable star observation to be made that is more accurate than visual, though less accurate than CCD observations. As only a camera, tripod and very short exposures are needed to do basic differential photometry, DSLRs could be useful educational tools in a variety of astronomical projects within colleges and schools.

## Equipment

The DSLR I use is a Canon 350 D. Reviews suggest that other modern Canon cameras and Nikon cameras, which are described as low noise, would perform in a similar fashion. Detailed reviews of these cameras are available on various web sites (1) and on Jerry Lodriguss's E Book (2).

Experiments were carried out using the lens system that came with the camera, Sigma 25 mm to 125 mm zoom, and, separately purchased, the Canon 85 mm f1.8 lens and the Canon 200 mm f2.8 lens. It was quickly apparent that aperture counts. The three respective apertures are 22 mm (at 125 mm), 47 mm and 72 mm. The Sigma lens is good for daylight images and probably can be used for the differential photometry of naked eye visible stars but is not in the same league as the other lens. The work on the Beta Lyrae estimates used the 85 mm lens.

A good quality Opticron tripod was used for undriven exposures. It is useful to get a tripod that allows the camera to be pointed at 90 degrees. Unless this is specified you may find that you cannot point the camera above 70 degrees. This can be very frustrating as, of course, the best conditions for photometry are above 60 degrees (and should not be done under 30 degrees).

For driven exposures the EQ 6 drive for my 200 mm reflector was used. The camera screwed on one of the rings. This worked well for exposures up to 30 seconds. No experiments were carried out using longer exposures. Differential photometry could be attempted with a DSLR attached directly to a telescope. I have yet to do these experiments. Post imaging processing was carried out using the AIP4WIN software V2 and its differential photometry tools. Good guidance, including tutorials on using the tools, is given in the Handbook of Astronomical Image Processing (3).

Differential photometry requires careful organisation. I use two notebooks. One is to record the time, date and the camera code of the images, and the target star. The other is used to record the estimates that arise from computer processing.

There may be several target stars in one observing session all with different settings.

The number of images generated in one night by the observation of an eclipsing binary may be 20 sets of 10, all carefully timed. This comes to 200 RAW images of 8 Mb each. I purchased an external hard disk to store these. The proper archiving of these images is desirable as they may contain information regarding other variable stars and objects that could be of use in the future. I am amazed at the number of meteor trails that appear on images.

## Camera Settings

Good differential photometry is carried out by getting a good ‘signal to noise ratio’ (SNR) on both the target star and the comparison star. The camera settings and exposures are determined with that in mind. Thus the settings will depend on the magnitude of the stars and how much it will vary on a particular evening. One setting will be fine for a variation of under a magnitude but two may be required for more variation. Settings will also take into account the amount of light pollution, and the height above the horizon, (and the darkness of the sky in the summer months). Settings can be affected by the ambient temperature.

The settings that are taken into account are ISO, f-stop, and exposure. By trial and error the settings for Beta Lyrae, using the 85 mm lens, that gave the best SNR, in my suburban conditions, were ISO 800, f 4 and an exposure of one second at the time of writing (July 2007). When the star was lower, earlier in the year, at midnight, an exposure of two seconds seemed to be appropriate.

To follow the eclipse of RS Canum Venaticorum from 8 to 9.1 magnitudes, in the spring, the settings for the 85mm lens were ISO 1600, f 2.8 and an exposure of 30 seconds.

When following the eclipse of a system such as RZ Cassiopeiae I found that the SNR is satisfactory from 6.2 down to about 7.4 magnitudes with the 85mm lens set on ISO 800, f 4, and six seconds exposure. As RZ Cas fades below 7.4 the settings may need to be changed if the SNR gets too small. The change may be to ISO 1600 and f 2.8 and an exposure of 6 seconds.

The 200 mm lens, a much greater light gatherer than the 85 mm lens, can get good SNRs down to 9.5 magnitudes on an exposure of 3.2 seconds. A ten second exposure got down to magnitude 10; twenty seconds to magnitude 10.5 and thirty seconds to magnitude 11.

All the above settings apply to suburbia. In a dark sky site it must be possible to do much better and go down another one or two magnitudes. If the camera can be used successfully with a telescope of larger aperture than the 72mm of the 200 mm (focal length) lens then, of course, lower magnitudes can be examined for a given exposure.

AIP4WIN software will only accept the camera ‘RAW’ images for photometry purposes. The software has plug ins that recognise most camera RAW file formats. RAW files must not be altered prior to analysis (except for the subtraction of dark frames and the use of flat fields).

It must be appreciated that the settings are intended to get the right exposure or SNR for the target star and comparison and it does not matter if the rest of the image or other stars are grossly over exposed or under exposed.

## Observations

The first task is to plan an observing session and the camera settings that may be used. Make sure the camera clock is accurate to within a minute and is set to UT. The time of an exposure is recorded on the RAW file. Then the equipment is set up outside and the camera allowed to cool down to ambient temperature. This does improve performance. The next task is to do a set of ten dark frames to produce a master dark frame. The ten images are taken with the cap on the camera. The exposure is the same as the exposure that will be used for the target star. The ten images are processed using the AIP4WIN software to produce a master dark frame. A separate set of dark frames does not have to be done for every observing session. The same master dark frame can be used for all observing sessions within a week or two provided the star, the lens and the settings remain the same.

The Handbook (3) and Guide (2) describe the importance of dark frames and flat fields. They are certainly essential for longer exposures. I have not found it of any practical use to use a flat field for undriven exposures - if care is taken to centre the target star and its comparison. A flat field is also less necessary if a lens is stopped down from its maximum aperture. The 200 mm lens seems to have an even field at f 5.6 whereas vignetting occurs at f 2.8.

Centring the stars is useful because the software centres, by default, the image for analysis. The target star and comparison is then easy to find. Care is taken to ensure that the camera is focused on infinity though not necessarily exactly as a slightly blurred image is an advantage in photometry.

A set of ten images is then taken one after another so that they can be said to have been taken at a point in time. If there is any doubt about the settings and exposure the set of ten will be downloaded to a PC and studied to ensure that there is no need for a repeat. It is exasperating the next day to study images and find out that the target star or comparison is too near the edge of the image and quality is affected.

**Analysis**

The images are downloaded to the PC and processed with AIP4WIN. By default each RAW image is opened as a very high contrast image which does not look very nice but makes it easy to find the target star and comparison. The photometry tools of AIP4WIN do not analyse the star as it appears on the monitor but according to the photon count in the RAW file. The photometry tools will give a magnitude reading for the variable and the comparison, and will calculate the difference. The tools will assign an error value to each reading. Provided the error value is 0.05 m plus or minus, or less, the reading is OK as there is a reasonable signal to noise ratio.

The difference for each image is entered in a notebook. After the ten images have been analysed the average of the ten estimates is calculated. Using the known magnitude of the comparison the magnitude of the variable is worked out. The experiments carried out suggest that better than visual accuracy can be achieved. Estimations to plus or minus 0.05 magnitude seem to be possible. With practice in fine tuning the settings even better results can be achieved.

It can be tedious to do the analysis, but with experience a set of ten images can be taken and analysed in less than half an hour.

The photometry described above is unfiltered. V filters that fit Canon lens are not available commercially. The Canon camera has an infra red filter and a filter array that covers the pixels to produce coloured images. It is not clear what wave band width is actually recorded on the camera's RAW image though it may approximate a V filter. More experiments need to be done to determine the relationship between the band width recorded by a Canon camera and the band width passed by a V filter.

**Errors/ Accuracy**

Some experiments were done to get some idea of the accuracy that is possible with the methodology suggested above. Estimates were made of constant stars. On 26th July 2007 five sets of ten images of Gamma Lyrae were obtained between 23.1 UT and 23.2 UT. The five estimates arising from the five sets were spread over 0.04 magnitude. Gamma Lyrae has a magnitude of 3.24.

The AAVSO has produced a chart for P Cygni ( 2014+37A) which identifies a comparison star of 4.94V and a check star of 5.58V. The difference in magnitude between the two stars is 0.64. Eight sets of ten images were examined and estimates were made of the difference in magnitude between the two stars. The results are illustrated in figure (1). It will be seen that the total spread in estimates is 0.03 magnitude.

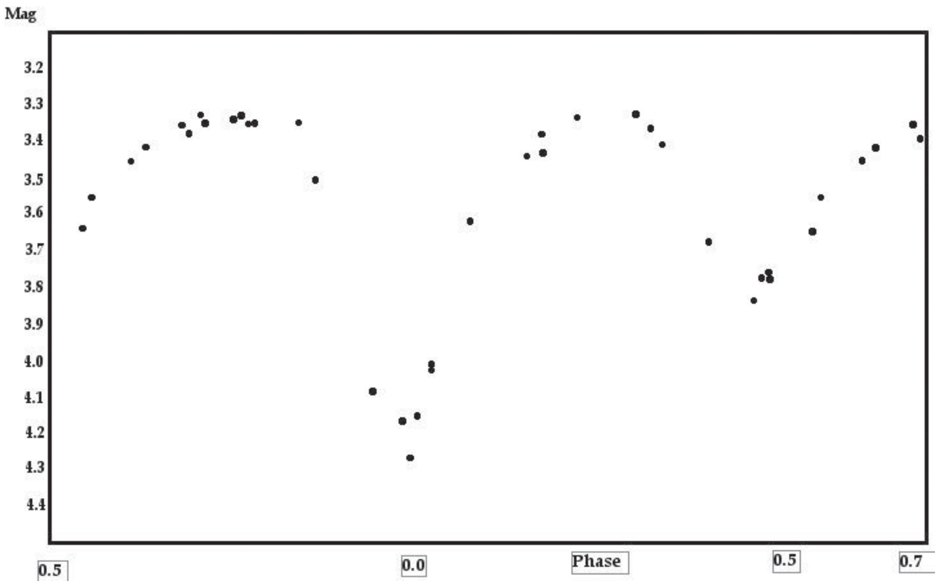
**P Cygni Chart - The Difference between 5.58V and 4.94V**

| Date | Time UT | Difference |
|---|---|---|
| 2/8/07 | 23.1 | 0.64 |
| 1/8/07 | 22.6 | 0.65 |
| 29/7/07 | 22.65 | 0.64 |
| 27/7/07 | 23.1 | 0.65 |
| 26/7/07 | 23.0 | 0.64 |
| 22/7/07 | 22.6 | 0.66 |
| 17/7/07 | 22.9 | 0.67 |
| 16/7/07 | 23.2 | 0.67 |

**Figure 1**

Using the methodology described, the well known eclipsing binary Beta Lyrae has been studied since April 2007. Despite the weather this year it has been possible to make a large number of estimations of the magnitude. Each estimation is based on ten images. The estimations are plotted on a phase diagram (figure 2). The plots are based on the latest elements obtained from the Krakow site (4). A period of 12.9421 days is used which was established on 14/1/05. It can readily be seen that the spread of estimates is much less than visual estimates; the primary minimum is sharply defined; and the secondary minimum is also sharply defined. The secondary minimum is usually blurred when visual observations are used for constructing the Beta Lyrae light curve.

**Figure 2: Beta Lyrae**




If the latest elements are correct then the primary minimum should be centred on 0.0 and the secondary on 0.5. A study of the phase diagram will show that both minima are displaced to the left. Although there is not enough data at the time of writing to make a good measurement of the change of period it may be possible later on when enough estimates have accumulated.

**Charts**

Differential photometry with a DSLR will require charts to be revised. Comparisons will be needed with magnitudes determined to one hundredth of a magnitude.

*D.L. August 2007*

*desloughney@blueyonder.co.uk*

**References**

1. *<http://www.the-digital-picture.com/Reviews/>*

2. 'A Guide to Astrophotography with Digital SLR Cameras' by Jerry Lodriguss (2006).

3. 'The Handbook of Astronomical Image Processing' Richard Berry and James Burnell (2005). Published by Willmann-Bell Inc.

4. Atlas of O-C Diagrams of Eclipsing Binary Stars by JM Kreiner, C H Kim and I S Nha: *<http://www.as.ap.krakow.pl/o-c/data/getdata.php3?BETA%20lyr>*.

# PHOTOMETRY OF V2362 CYGNI (NOVA CYGNI 2006) USING FAULKES TELESCOPE NORTH

**David Boyd**

The Faulkes Telescopes North and South (FTN and FTS) are located at Haleakala, Hawaii and Siding Spring, Australia respectively and their purpose is to provide day-time access to large telescopes for use by schools in the UK. They are alt-azimuth mounted 2 metre aperture f/10 Ritchey-Chretian telescopes fully remotely controlled and equipped with CCD cameras and a comprehensive set of photometric filters (see *http://faulkes-telescope.com/*). The field of view of a CCD image is 4.6 arcmin and a pixel covers 0.28 arcsec on the sky. It is possible to gain access to the FTs by attending a training course at one of their centres in the UK. The course I attended was at the Saturn Centre in Wolverhampton and covered basic operational procedures plus some ideas on possible projects. Most of the people on the course I attended were teachers. The FT team are keen to encourage experienced amateur astronomers to assist teachers in local schools in their use of the telescopes. This is my intention once I have reasonable experience of using them.

My first venture into using the FTs was to try some basic variable star photometry to see how easy this was and to evaluate the results. I booked time on FTN as FTS was not available to users at the time. Users are given on-line access to the telescope in real time in slots of 29 min which have to be booked in advance. If the weather is bad or there are technical problems your slot is liable to be cancelled. Your time slot includes the time it takes you to slew the telescope to your target and rotate the camera, which can take several minutes, and the dead time between images which I measured at about 82 sec per image. It also includes any thinking time on your part so you need to be well prepared with a list of targets, coordinates, etc. You get JPEG images back immediately but have to wait 24 hrs to get the FITS files. These have been bias-corrected and flat-fielded. They contain headers with relevant information about the image.

I chose as my first target the nova V2362 Cygni which erupted in April 2006 and is now slowly fading (see *http://www.theastronomer.org/vars/2007/V2362CygLC_V11.gif*). I have been following it for over a year now and it is still several magnitudes above its ultimate quiescent level. It is difficult to measure now because there is another star about 5 arcsec away which is currently similar in brightness to the nova and is not cleanly resolved with amateur telescopes. Fig 1 shows the central section of an image of the nova (marked) which I obtained on 2007 June 20.

My FTN slot was on June 22 starting at 11.00 UT. As I wasn't sure what exposure to use I took two images of 20 and 40 seconds duration in each of the B and V filters. It turned out from other images I took during the same session that an exposure of 60 sec in V gave peak counts of around 30,000 for 12th mag stars. I've been advised that the CCD camera is linear up to at least 40,000 counts. Stars had much lower counts in the B filtered images. Fig 2 shows the complete 40 second V filtered FTN image. The FWHM of stars is about 1.1 arcsec and V2362 Cyg and its companion are well separated with a clear space at sky background level between them. I used AIP4WIN to measure instrumental magnitudes in all four images. To convert these instrumental magnitudes to magnitudes on the standard photometric system, it is necessary to know the transformation coefficients for the two FTN filters used. Normally this is done by measuring a field of standard stars in both filters but this was not practical in the time slot I had available.

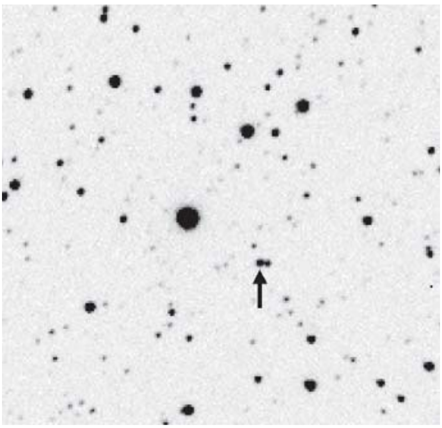


**Figure 1:**
**0.35-m + V filter + SXV-H9 CCD**
**1.4 arcsec per pixel, north at top**

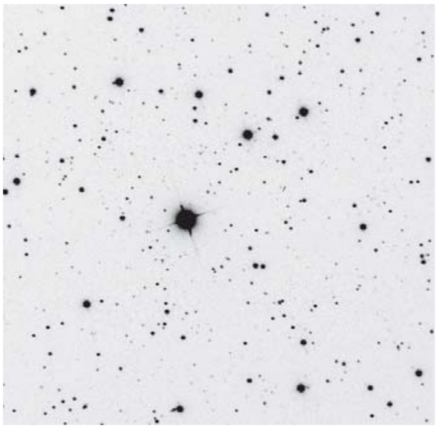


**Figure 2:**
**2.0-m + V filter + HawkCam1 CCD 0.28 arcsec per pixel, north at top**

An alternative, which is not as accurate but is good enough to achieve useful results, is to use stars in the same image which have been accurately measured before. Arne Henden of the AAVSO has calibrated a large number of stars in the field of V2362 Cyg and I used these as my "secondary standards". AIP4WIN has a photometry procedure called extractive photometry which measures the instrumental magnitudes of a large number of stars in an image at the same time. These then have to be correlated with stars measured by Henden. If AIP4WIN is first instructed to carry out astrometry on the image, it will output the RA and Dec of each star along with its instrumental magnitude. Using Excel, the AIP4WIN and Henden lists of stars can be sorted by RA and Dec and the same stars identified in each list. It is worth inspecting the star images individually to exclude ones where the photometry may have been compromised by the presence of another close star or some other problem. Using the 40 sec B and V filtered images, I identified 26 stars in the magnitude range 12.0 to 15.5 for which I had both measured instrumental magnitudes, b and v, and also Henden's "standard" magnitudes, B and V. I plotted B-b against b-v and V-v against b-v for these stars as shown in Figs 3 and 4. The gradients of the two straight lines fitted to these plots gave the required transformation coefficients, Tb and Tv, for the B and V filters. The results were Tb = 0.147 and Tv = -0.101. The equivalent values with respect to B-V were TB = 0.123 and TV = -0.083. The scatter about the lines is due to the combined effect of uncertainties in my photometry and in Henden's calibration. It increases at fainter magnitudes as expected.

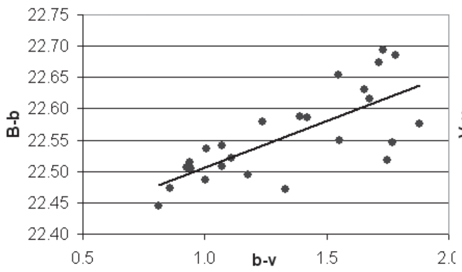



**Figure 3: B-b vs b-v**

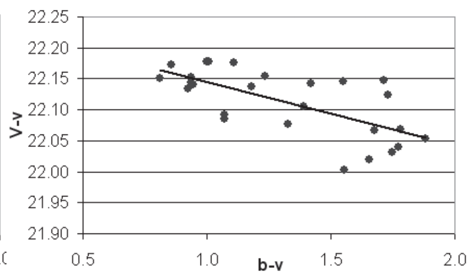



**Figure 4: V-v vs b-v**

I then used the instrumental magnitude measurements of four of the brightest stars calibrated by Henden to calculate mean zero points for each image. Denoting these zero points in B and V respectively as Zb and Zv, the following formulae enable the instrumental magnitudes for stars in each image including the nova and its close companion to be converted to magnitudes on the standard system:

$$B = b + Tb * (b-v) + Zb$$
$$V = v + Tv * (b-v) + Zv$$

For the close companion star I obtained a mean standard magnitude and colour of V = 15.24 and B-V = 0.67. This compares with V = 15.22 and B-V = 0.70 measured by Henden with a 1-m telescope at Flagstaff on May 26. For the nova, my magnitude and colour (obtained at June 22.47 UT) were V = 14.64 and B-V = 1.25.

There was good agreement between the magnitudes obtained by this method and those measured by Henden for the corresponding stars in the field in both B and V across the colour range 0.5 to 1.5, indicating that this simple calibration process works acceptably well.

As can be seen in Figure 1, because the nova and its companion are so close, images taken with smaller aperture telescopes cannot cleanly separate them. They must therefore be measured as a single object using a large enough star aperture to fully include the combined image of both stars. Knowing the magnitude of the companion, it should then be possible to work out the magnitude of the nova itself. To test how well this works, I set a large star aperture sufficient to include both stars on the FTN images and measured the images again. This gave a magnitude and colour for the two stars combined of V = 14.16 and B-V = 1.02. Combining the separate magnitudes obtained above mathematically using the formula

$$M = -2.5 * \log(10^{(-0.4*M1)} + 10^{(-0.4*M2)})$$

gives the values V = 14.15 and B-V = 1.00, in good agreement. This confirms that it should be possible to derive a reasonably accurate magnitude and colour for the nova by measuring the combined image of the two stars and subtracting the companion star mathematically. If you are doing this, you should use Henden's values for the companion star, as these are based on a rigorous calibration.

My first experience of using a FT turned out to be easier than I had expected and produced useful results. The quality and resolution of the images enables measurements to be made which are difficult or impossible with smaller instruments.

# SUPERNOVA 2007AF IN NGC 5584

**Guy Hurst**

S. Nakano of Japan announced on IAUC 8792 the discovery by K. Itagaki of a magnitude 15.4 supernova in NGC 5584 and located at: RA 14h 22m 21.03s, DEC –0 23' 37.6" (2000). The discovery image was obtained with a 0.60-m f/5.7 reflector and reached about magnitude 19.0.

It is 40" west and 22" south of the centre of the host galaxy. The discoverer's unfiltered CCD magnitudes included in the IAU Circular are: 2007 Feb. 24.81 UT, [19.0; 25.73, [18.5; Mar. 1.84, 15.4 (discovery); 2.576, 15.3; 7.648, 13.7.
The type-Ic supernova 1996aq also appeared in NGC 5584

Spectroscopic details separately announced on CBET 865 by F. Salgado et. al., of the Carnegie Supernova Project, indicated that it was of type-Ia and discovered well before maximum light. A spectrum obtained on March 4.34UT with the European Southern Observatory's 3.5-m New Technology Telescope spectrum showed a strong resemblance to that of the normal type-Ia supernova 1994D obtained 10 days before maximum light.

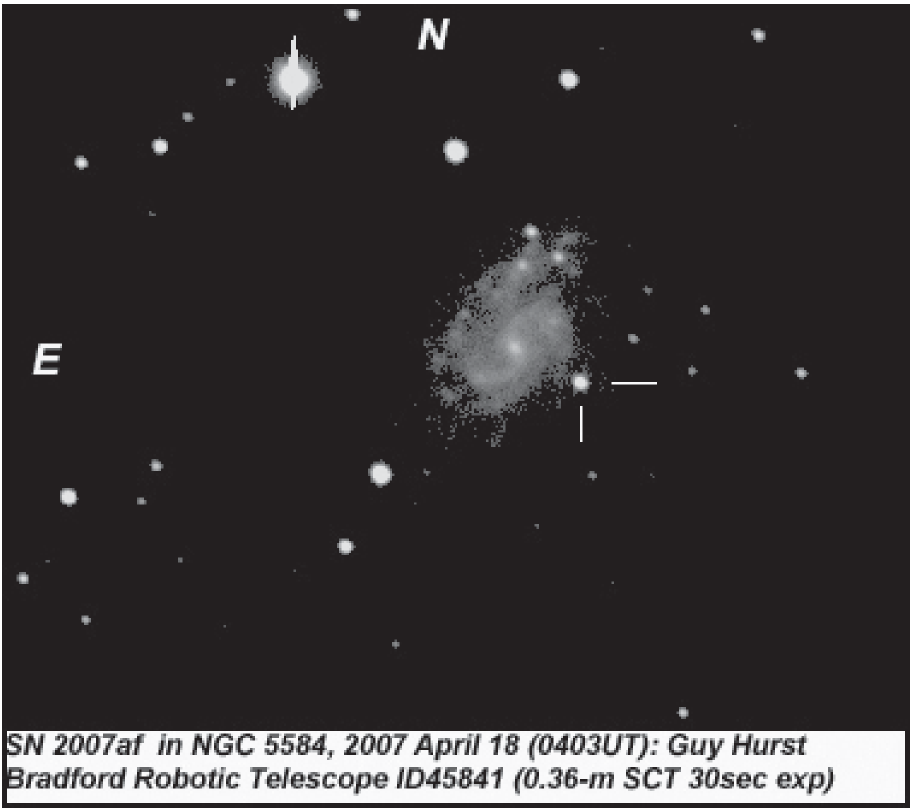
Supernovae are very important objects to study given that certain types, notably type Ia, are used as prime distance indicators. Recently the dispersion in absolute maximum magnitude of this type has caused concern in their role as distance candles, but there has been a suggestion that variation in decline rate may be linked and should therefore be studied.

The difficulty in monitoring extragalactic supernovae as they fade, is that most are found near magnitude 15 or fainter, and they thus prove a considerable challenge, especially to visual observers. However the advancement in imaging, now presents a chance to follow such objects down to magnitudes of 19 or fainter, although their presence in front of the host galaxy's 'nebulous regions' causes difficulties in using photometry to arrive at reliable magnitudes.

During 2007 April the author, who previously had studied such objects by visual means only, decided to start experimental imaging of novae and supernovae with the Bradford Robotic Telescope which operates in a dome at the Observatorio del Teide 8,000 feet up on the Island of Tenerife. The telescope is a Celestron 14 of 3910mm focal length and 365mm aperture, and using the CCD ('Galaxy mode') gives a field of view of 24 arc minutes. Although exposures are generally of one minute, limiting magnitudes of around 19 have been reached during periods when the moon is not nearby.

Supernova 2007af was one of ten supernovae chosen for study, but looked favourable given its expected brightening to maximum and a clear separation from the bright nuclear region of the galaxy. As of 2007 August 3, the supernova has been imaged on 32 dates both in unfiltered mode and also using the red filter. The graph includes some early results from other observers obtained via VSNET and the maximum in 'green' (close to visual) was magnitude 13.8 on 2007 March 18. The decline from maximum by three magnitudes (t3) took about 90 days and was largely linear except for an apparent temporary shoulder around April 19. Monitoring is continuing to enable a more complete analysis to be obtained.

**Figure 1: Supernova 2007af when first imaged with the Bradford Robotic on 2007 April 18 (04h03mUT) then at magnitude 15.0.**



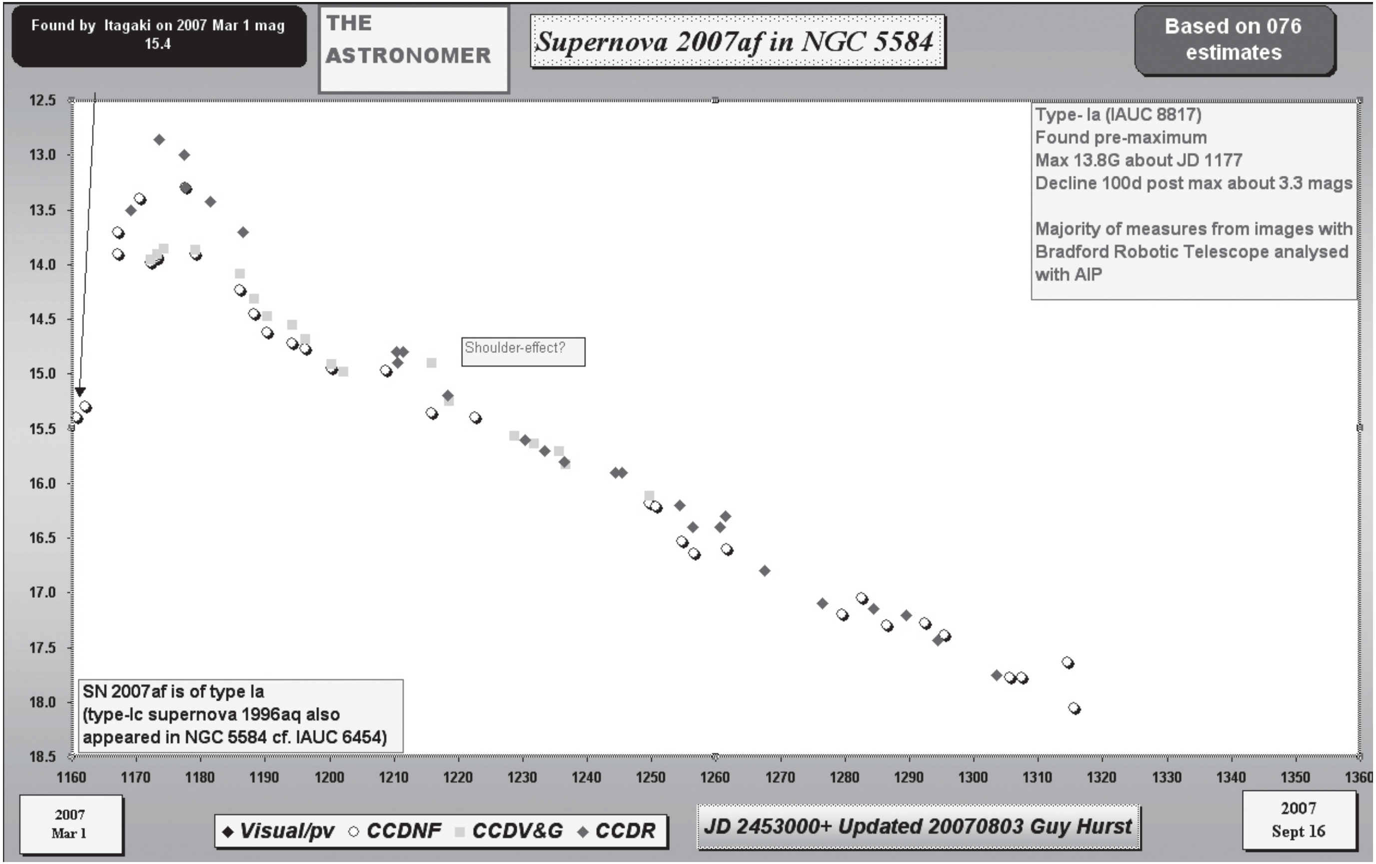



Figure 2: Light curve of supernova 2007af showing plots of 76 measures in unfiltered, green (near visual) and red filters.

# RUTHERFORD APPLETON LABORATORY VSS MEETING 2006

*We have to thank Dr. Arne Henden, Director of the American Association of Variable Star Observers, for providing a synopsis of his lecture given at our 2006 VSS meeting.*

## THE ENIGMATIC V838 MONOCEROTIS

**Dr Arne Henden**

On June 3, 2006, at the normal BAAVSS meeting at Rutherford Appleton Laboratory, Dr. Arne Henden (Director, AAVSO) gave a lecture on "The Enigmatic V838 Monocerotis". Arne has been photometrically monitoring V838 Mon for the past five years; was the discoverer of the light echo around this peculiar nova; and was part of the scientific team using the Hubble Space Telescope (HST) to study the light echo.

V838 Mon exhibited a number of unique attributes; so much so that an entire week-long conference was held at La Palma in May 2006, to discuss the data and consider ways to explain the events.

The precursor was examined by Goranskij on Sternberg photographic plates, and exhibited constant light behaviour with no indication of increased activity just prior to the outburst. Combined with 2MASS magnitudes and other plate material, the colours indicate a typical reddened B3V star.

The outburst light curve was fairly typical for a "very long", or NC nova, with a month-long premaximum halt, and a 6th magnitude outburst that lasted another 90 days with several peaks. In May 2002, V838 Mon declined suddenly in brightness, reaching V=14.5 by the time it went behind the Sun late in the month. After it became visible the following season, V838 Mon was at V=15, and stayed at that level for the next 4 years.

The main 6th magnitude outburst was sharp and blue, but rapidly became very red as a second peak was reached in March. By May 2002, the spectrum was L-like, even though the star was expanding rapidly in size, reaching about 2000 solar radii during the second season.

An interesting feature of the light curve was that the magnitude level for the past 4 years has been about 0.7mag fainter than the precursor brightness. The assumption is that the precursor images were of a binary system containing two B3V stars, one of which erupted. That outbursting star continues to be very red, and so no longer contributes light at B and V bandpasses, thereby decreasing the measured brightness of the system in those bands.

Besides the unusual light curve and extreme red colour, the main feature of V838 Mon was its light echo. Discovered only a couple of weeks after the start of the main outburst, the light echo rapidly expanded, reaching about 35 arcsec in diameter by the time the first HST visit took place. Subsequent visits showed the continued expansion of the light echo, and since the HST data was taken in multiple bandpasses, the visits made beautiful colour pictures that have been used on book covers, HST highlight shows, and formed a stunning movie. The light echo gives an instantaneous cut through the material surrounding V838 Mon, and when the visits end, will be used to give a three-dimensional model of the nova and its environment. The HST polarized images of the light echo, give a direct measurement of the distance of V838 Mon, which is estimated to be about 6kpc.

Arne closed with a slide of what amateurs can do to help the professionals study this nova. Datamining of archives might find additional images of the precursor, or find other similar systems (such as M31 RV and V4332 Sagittarii). Continued photometry can be used to determine orbital and rotational periods, and watch for other outbursts or events that might happen. Deep imaging might find traces of the light echo at greater spatial distances, and observers should monitor upcoming novae to find another similar system.

In November 2006, V838 Mon gave another surprise, as the B3V companion was eclipsed by something - a dust cloud flung out during the outburst, a grazing passage behind the enlarged outbursting star photosphere, or a hypothesisof your own choice. It recovered its normal brightness by late December and has remained nearly constant in brightness since. Who knows what the next season will bring? Keep tuned!

# ROYAL OBSERVATORY, EDINBURGH VSS MEETING 2007, PART 2

*The summaries of two more talks from this year's BAA Variable Star Section meeting, on the 5th May, at the Royal Observatory Edinburgh,were supplied by the speakers Dr. Martin Hendry, and Stan Waterman.*

# GRAVITATIONAL MICROLENSING: NATURE'S TELESCOPE

**Dr Martin Hendry**
Dept of Physics and Astronomy,
University of Glasgow,
Glasgow G12 8QQ, UK

The phenomenon of gravitational lensing – the bending of light rays by the gravitational field of a massive body – is one of the key theoretical predictions of Einstein's General Theory of Relativity. For many decades of the 20th Century it was thought to be too small an effect to be directly detectable. However, on cosmological scales the lensing of, e.g. a background quasar by a foreground galaxy, is now routinely observed, and multiple images of such a quasar, (typically with arcsecond separation), can be individually resolved. These multiple images represent a powerful probe of the mass distribution of the lensing galaxy, and their analysis provides crucial evidence for the existence of significant amounts of dark matter around galaxies and within galaxy clusters.

On galactic scales, too, lensing has found an important place in the astronomers' toolbox. If the lensing mass is, e.g. a star, the images of the background source are too close together to be individually resolved. We observe instead a temporary change in the source's apparent brightness; this regime is known as 'gravitational microlensing'. By studying how the source magnification changes with time, due to the changing alignment of the observer, lens, and source, we can constrain the mass and distance of the lens. The probability of any *given* background star being lensed is very small, but if we monitor enough of them sooner or later we will catch one in the act! Since the mid-1990s, a number of monitoring programmes – initially pioneered by MACHO, OGLE, and EROS, but now supplemented by many more – have scanned the starfields of the Magellanic Clouds and the Galactic Bulge, steadily accumulating many hundreds of observed microlensing events; the lightcurves of which have helped to constrain the distribution and nature of the dark matter in the halo of our galaxy. The main focus of my talk however, is not the lenses but rather the *sources*: what can gravitational microlensing tell us about the atmospheres and environments of the source stars being lensed? Although this topic can be considered a 'spin-off' from the main purpose of Galactic microlensing surveys, in the past few years it has led to some very significant results.

Why might we expect a gravitational microlens to act as a natural telescope? If we regard the background star as a point-like source, the shape of its microlensed light curve depends only on the projected separation, or *impact parameter*, of the lens and source, and is independent of wavelength. However, stars are strictly speaking not point-like: if the lens were to pass (in projection) very close to the background star – or better still transit its disk – then it would magnify different regions of the disk by different amounts, effectively 'scanning' the extended surface of the source star as the lensing event unfolds. Moreover, we expect that stars (just as we observe for the Sun) will not be uniformly bright, but will display *limb-darkening*: they will appear darker close to their edge because the light that reaches us has travelled through a thicker slab of atmosphere. This effect will also be colour-dependent, since the absorption properties of stellar atmospheres vary with wavelength: thus, the lens will effectively 'see' a star of different size at different wavelengths, causing a wavelength-dependence in the star's microlensed light curve. To observe these extended source effects is challenging: to begin with the probability of a low impact parameter event is very small and even if one were to occur, e.g. for a source star in the Galactic Bulge, it might last for only a few hours to a few days. To carry out the high-precision photometric light curve observations required to probe the extended disk of the source, when one has no idea in advance *which* star (out of millions of background sources) will be lensed might seem like looking for the proverbial needle in the haystack. Fortunately, however, nature provides some assistance. A small, but significant, fraction of lensing events is caused by *binary* systems. These display a much more complicated magnification pattern – rather like the complex, distorted illumination one might see reflected from a sunlit ocean. In particular, when a background source encounters a binary lens its light curve will display two distinct peaks at the points where the *caustics* of the magnification pattern cross the source disk. (These are regions inside which the binary produces extra images of the source, thus dramatically and suddenly increasing its apparent brightness). If the first caustic crossing is observed by a routine microlensing monitoring program, this can trigger an 'alert': many more, and larger, telescopes can then be employed to study the second caustic crossing (a few days or weeks later) much more precisely – probing the extended surce effects due to the non-uniform brightness of the source disk. Indeed this same approach can be applied to respond to single lens events, although the amount of warning time is generally much shorter. Since the late 1990s this 'alert response' strategy has been employed to great effect by a number of groups – most notably the PLANET, or Probing Lens Anomaly NETwork, collaboration. (As PLANET's name might suggest, its goals also included searching for binary lens events where the binary object was not a star but a planetary companion. Microlensing is an exciting new tool for exoplanetary research, complementary to other methods such as radial velocity and transit searches).

So what has nature's telescope revealed? Since the turn of the century little more than a handful of microlensing events have been observed which display the clear signature of extended source effects, but thanks to the success of the alert strategy these events have been intensively monitored photometrically and spectroscopically (using, for example, the VLT in Chile). The published results have established beyond doubt that stars are indeed limb-darkened, just like the Sun – a conclusion which is not surprising but which it would be extremely difficult to verify for an isolated star by conventional observations, without the benefit of the extra magnification that lensing provides. Observations of the latest microlensing events map the radial surface brightness profile of the lensed stars with sufficient resolution to test quantitatively the limb darkening predictions of different stellar atmosphere models. In particular, observed multicolour photometric light curves and high resolution spectra have been used to constrain state-of-the-art 'Next Generation' atmospheric models, comparing them with earlier models that make simpler assumptions about the astrophysics of scattering and absorption of light in a star's atmosphere. While the microlensing data do not yet appear to provide a definitive test of these models – and some puzzling iconsistencies between theory and observation have been reported for at least one extended source event – as more events are observed, and for a wider variety of source stars, a more coherent picture will hopefully emerge that will shape our future understanding of stellar atmospheres. Indeed a number of authors are already investigating how future microlensing observations might help to constrain other aspects of stellar astrophysics, including the presence (or otherwise) of 'starspots' and non-radial surface brightness variations on the source stars and the density and velocity structure of stellar winds, outflows and envelopes surrounding them. Therefore, the future prospects for gravitational microlensing, as a natural telescope to probe stellar astrophysics, appear bright.

*A more technical review article addressing this topic can be downloaded from:*
**http://www.astro.gla.ac.uk/users/martin/publications/microlensing.pdf**

# SOME VARIABLE STARS IN CYGNUS

**Stan Waterman**

This talk is about what I call the Planet Project. That started in late 2000 with a main aim of finding an extra-solar planet by the transit method. That is still the nominal primary focus of the work but because of their sheer number and interest, the variable stars in the target area have dominated the analysis work to date.

There are two main target areas, one in Cygnus centred at 21.08.30, +46.30.00 (area '*a*') and one in Auriga centred at 05.18.00, +41.50.00, (area '*p*'). Auriga follows a convenient eight hours behind Cygnus, allowing data collection to be continued late in the nights in December to March, after Cygnus gets too low. For a short time twelve hour data runs are possible with Auriga. The target areas are 2.7 degrees square. Data has also been

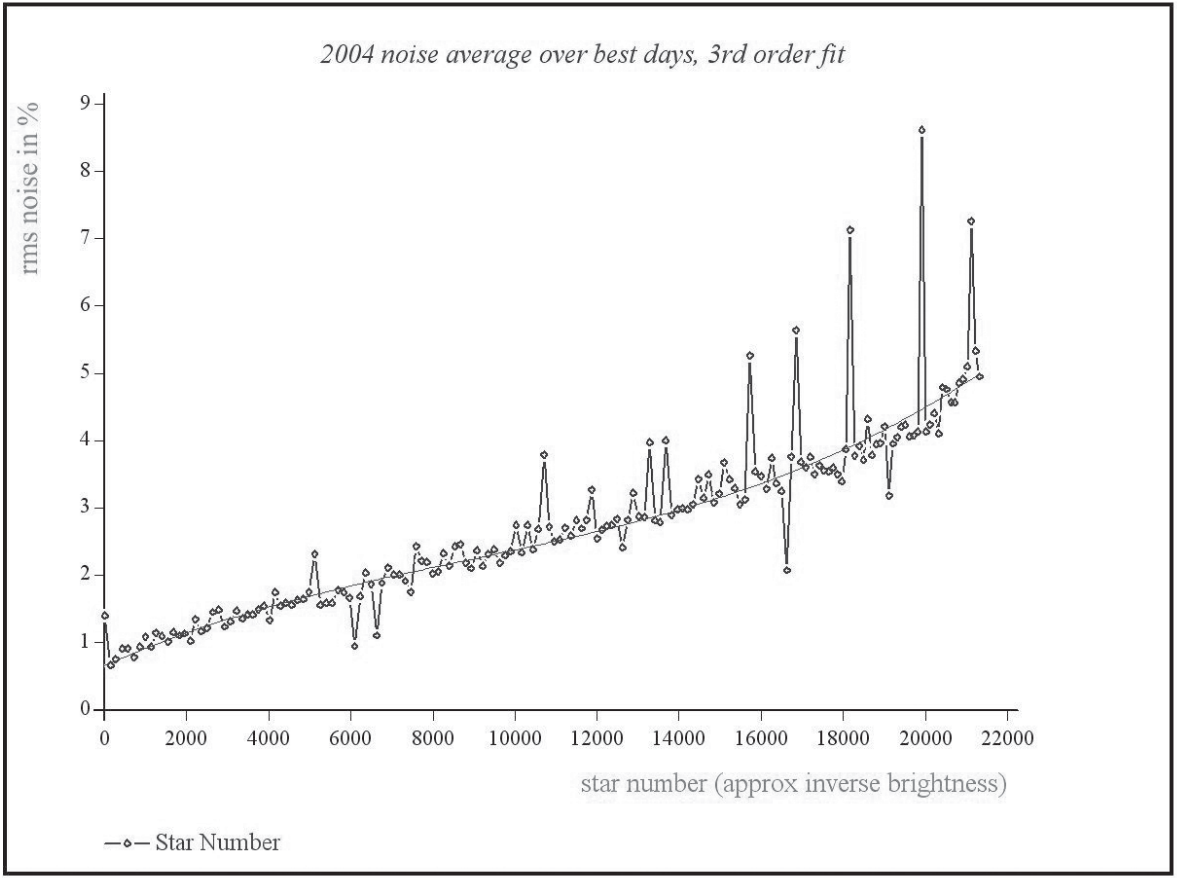



**Figure 1**

collected in the eight contiguous areas around area '*a*' but only data from area '*a*' has so far been analysed.

Obviously an hour's talk can not cover six years work in any depth so, as this was a variable star meeting, I decided to select a few of them and show light curves. The star data collected over the last four years from area '*a*' is organised into a main list of the brightest 17,000 stars (brightness reduces as star number increases, approx range mag 9 to 14). Going fainter there are about 150,000 accessible stars which have been barely looked at yet. In that first list of 17,000 there are about a thousand stars that can be definitely said to vary (the limit of certainty is around 1% for the brighter stars and 4% for the fainter ones). Of those, only 40

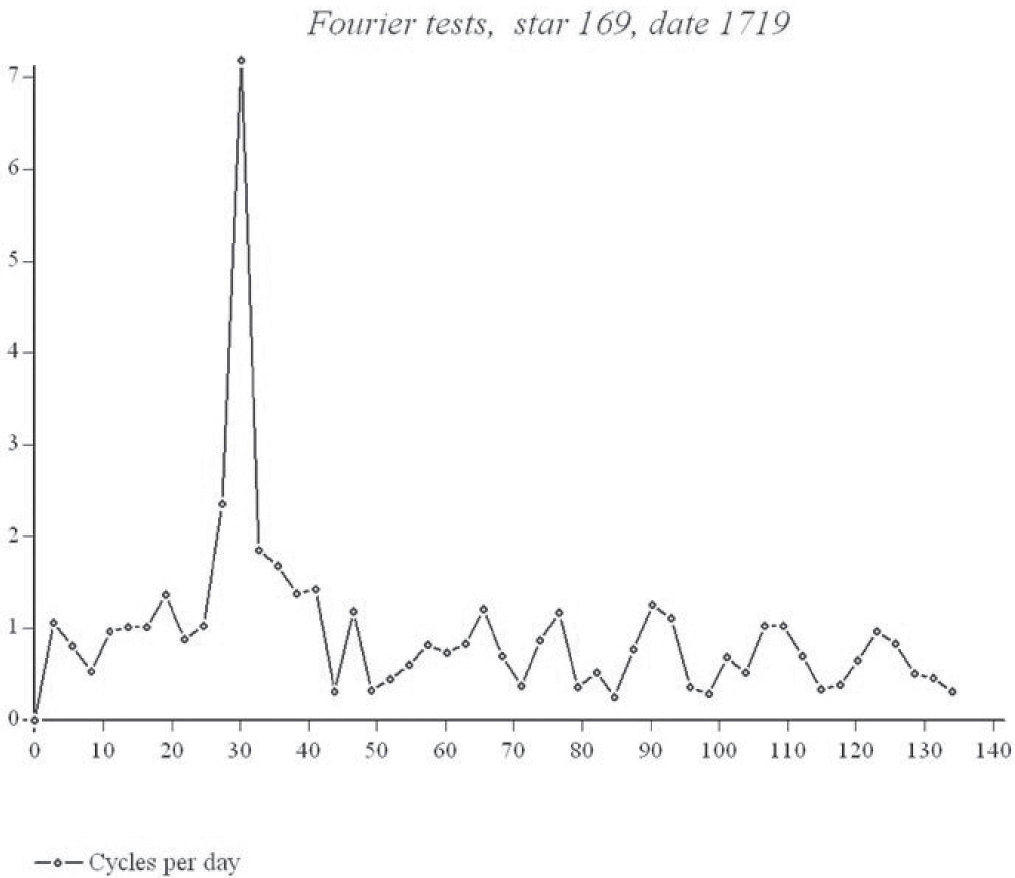



**Figure 2**

appear in the GCVS and NSV catalogues.

Before getting on to the results, a brief mention was made of the methods for finding variable stars, and the search for those elusive planet transits. For the variable stars the first filter is ‘noise’. If one plots the RMS noise of the brightness measurements of a large number of stars a plot like Figure 1 is obtained. To find both fast and slow variables, two plots are needed, over one night and over one season. The majority of ‘quiet’ stars then form the curves and deviations that indicate variability. Another filter is Fourier analysis. This can detect low level fast oscillators (period of order hours) whose ‘noise’ appears not to be significantly deviant ( because the amplitude is so low, viz: Figures 2 and 3).

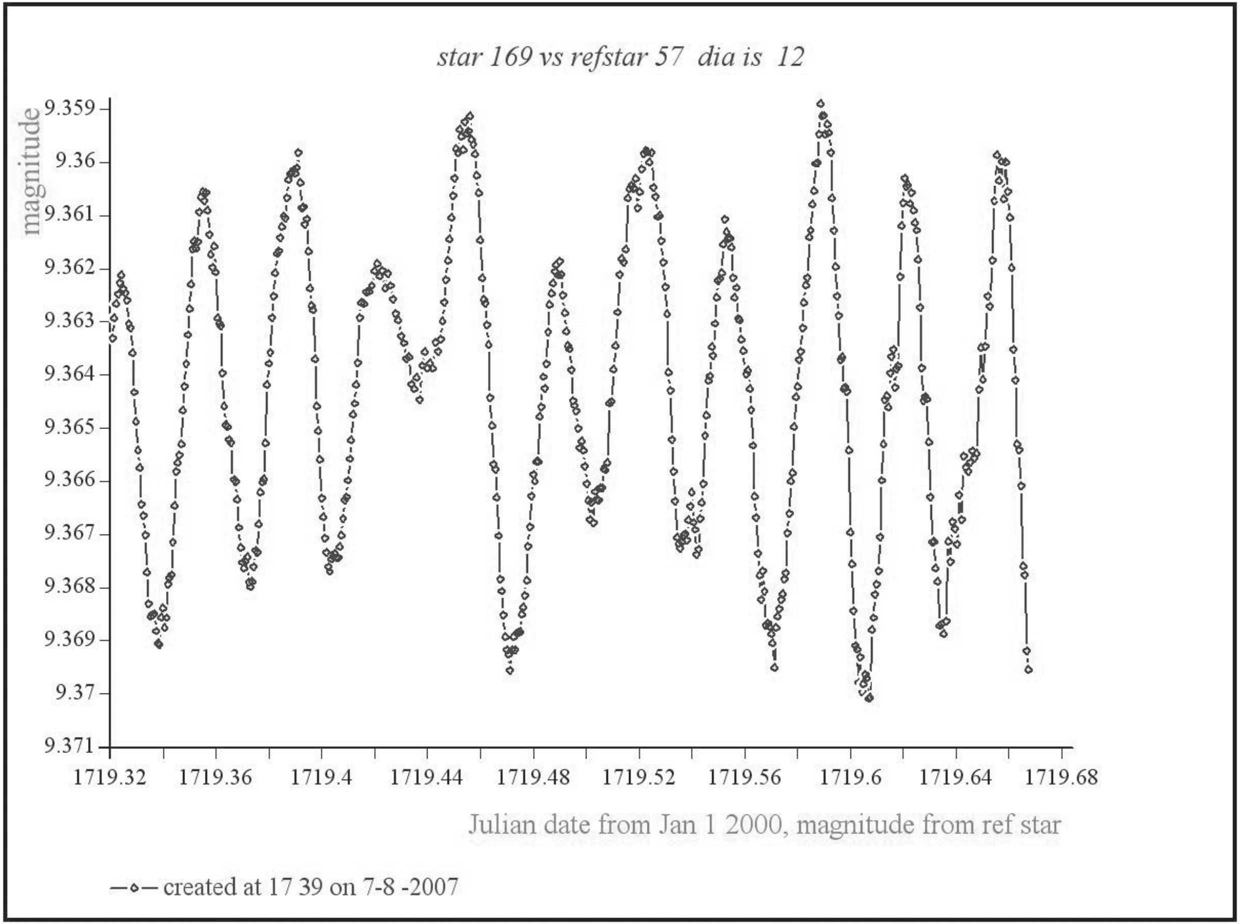



**Figure 3: The fastest star.**

By far the most central processor unit intensive, but essential for planet hunting, is pattern searching. One can search for specific patterns (dips are easiest) but it is also possible to search for unspecified patterns; the only requirement being that it repeats with a constant period and amplitude.

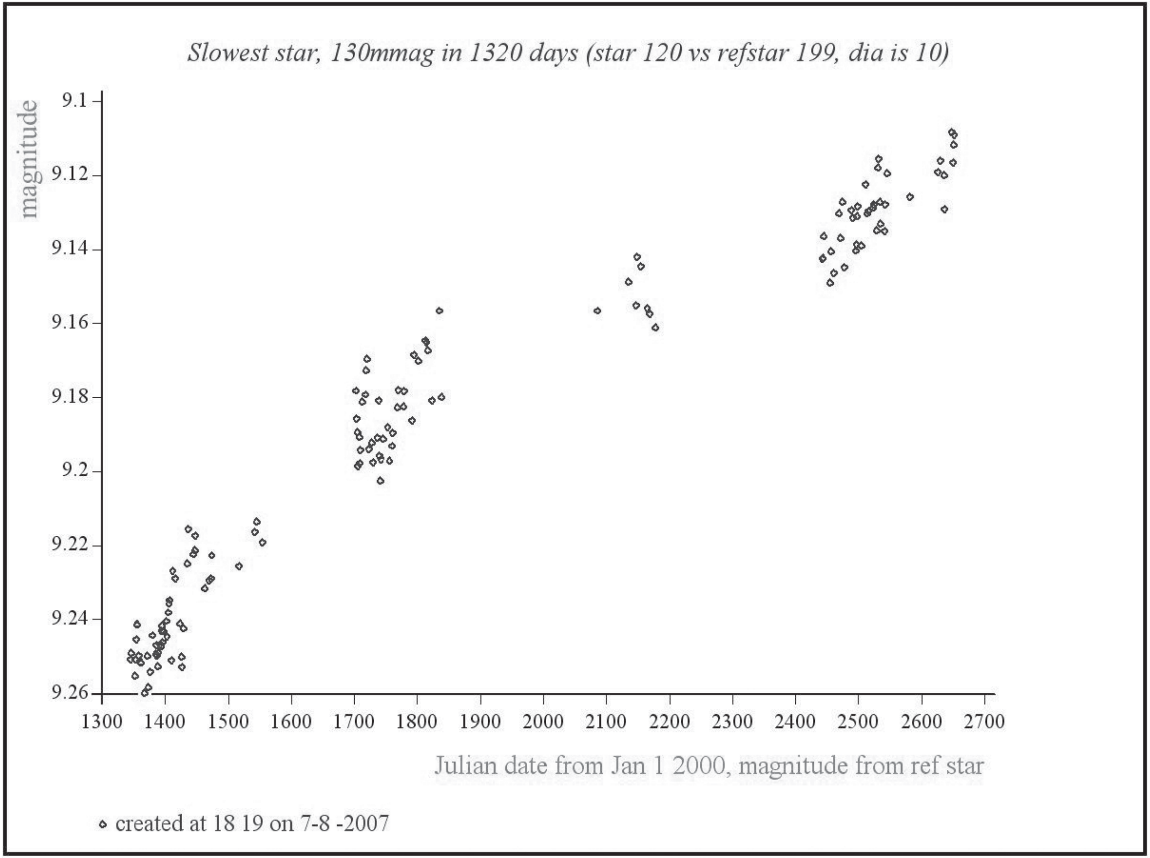



**Figure 4:**
**The slowest star**

By contrast the slowest I've seen has so far brightened by just 130milli-magnitudes in nearly four years (1320 days) - it's period looks like being over ten, possibly fifteen years.

Some light curves of stars that do appear in the GCVS catalogue were shown, and a few that don't. These latter were classified as:

My fastest star:
Figure 3
The slowest one:
Figure 4
The quietest or least moving one:
Figure 5
The most moving one:
Figure 6
The most interesting star-so far perhaps!:
Figure 7

The fastest star has already been mentioned to illustrate the Fourier searching: Star *a169* in my catalogue has a period of close to 30 cycles per day and an amplitude that varies from 0.5% to 4%, 5 to 40 milli-magnitudes.

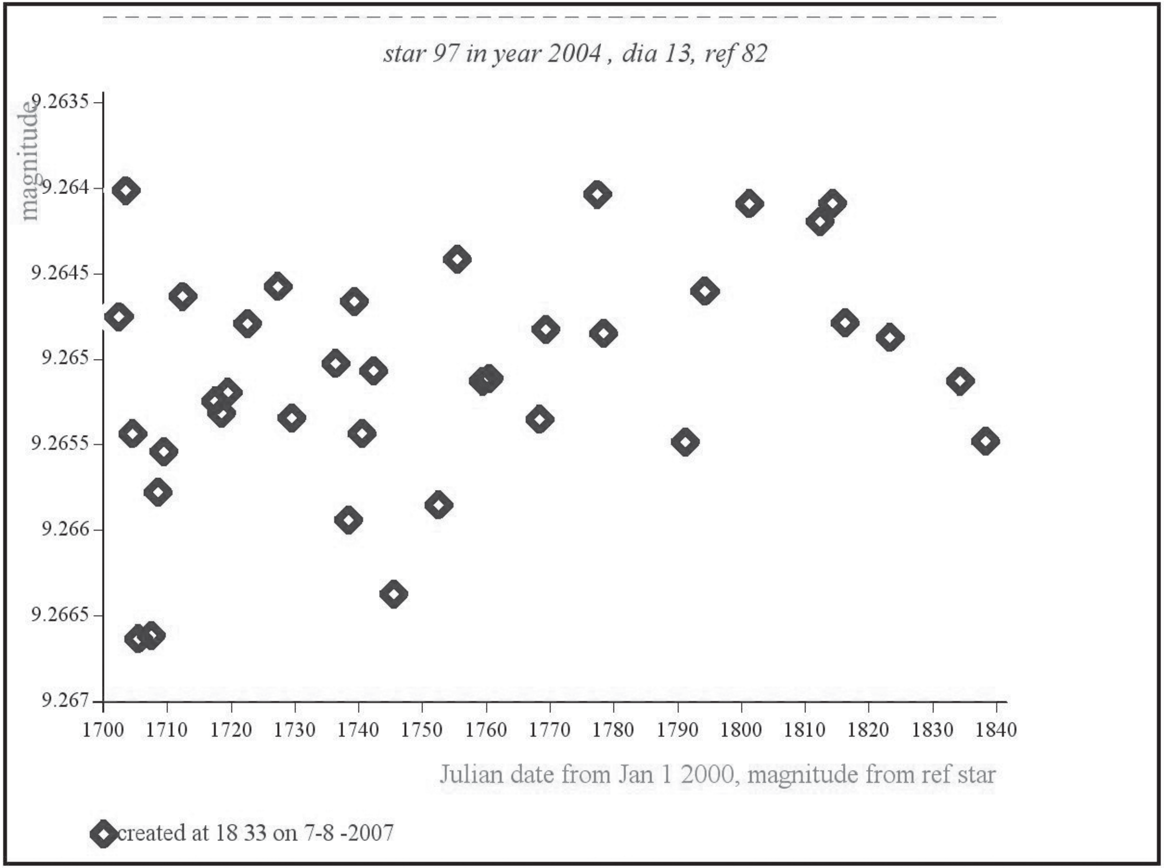



**Figure 5: The quietest or least moving star**

Someone, (mainly by chance), has to win, and the quietest star in 2004 in my list was *a97*. On daily averages this had extremes separated by only 2.5 milli-magnitudes. This was referenced to star *a82*. A randomly different (but similar) result is obtained using a different reference star.

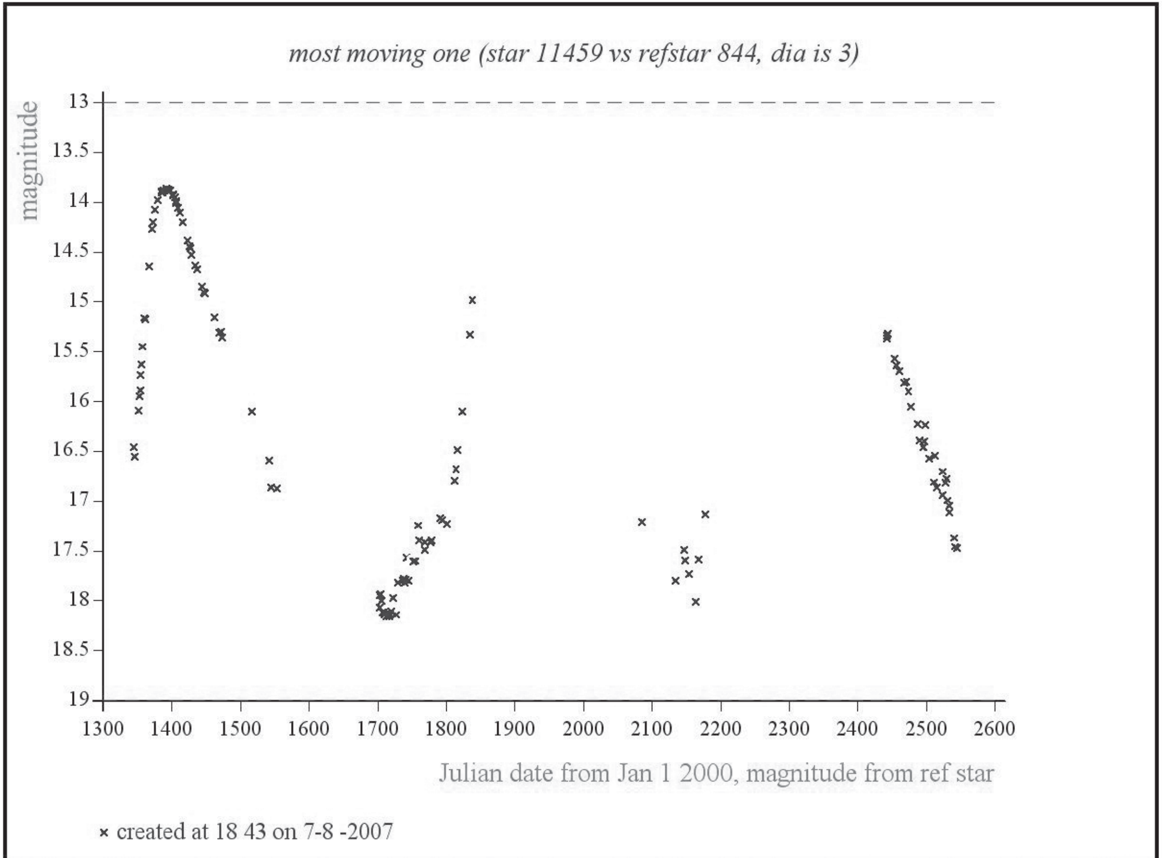



**Figure 6: The most moving star.**

The star that may have moved the most is *a11459* (IRAS 21032 +4642) which has varied from fainter than magnitude 18 to a maximum near to magnitude 13; this is a known IRAS star; classified interestingly as non-variable.

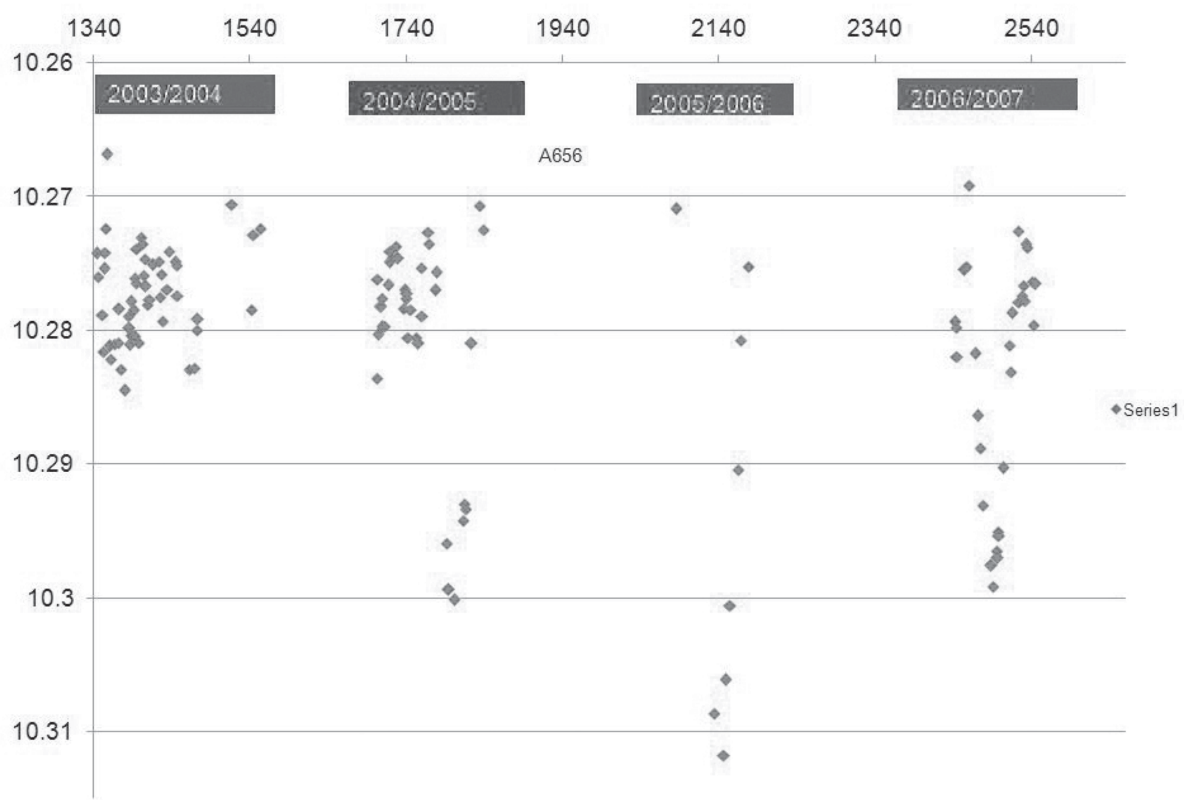



**Figure 7: The most interesting star.**

Finally, what I called 'my most interesting star', *a656* (aka GSC 3588 6513). This has exhibited dips in 3 years out of four (autumns 2004, 2005, and 2006, but not 2003). The dips spaced by near to 345 days and the deepest being in 2004 at 35 milli-magnitudes. I'm naturally waiting with some interest to see what happens in September 2007. Based on what we have so far I'd expect an insignificant dip, maybe not discernable, but if it is, then the minimum will be mid September. I'm hoping to be csurprised!

*August 2007*

## BINOCULAR PRIORITY LIST

**MELVYN TAYLOR**

| Variable | Range | Type | Period | Chart |
|---|---|---|---|---|
| *AQ And* | 8.0-8.9 | SRC | 346d | 82/08/16 |
| *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 | | 83/10/01 |
| *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? | 84/04/12 |
| *V CVn* | 6.5-8.6 | SRA | 192d | 214.01 |
| *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 | | 83/10/01 |
| *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 | | 041.02 |
| *W Cyg* | 5.0-7.6 | SRB | 131d | 062.1 |
| *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? | 106.01 |
| *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 | 049.01 |
| *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? | 108.01 |
| *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 | 84/04/12 |
| *AG Peg* | 6.0-9.4 | NC | | 094.01. |
| *X Per* | 6.0-7.0 | GC+XP | | 84/04/08 |
| *R Sct* | 4.2-8.6 | RVA | 146d | 026.03 |
| *Y Tau* | 6.5-9.2 | SRB | 242d | 84/04/12 |
| *W Tri* | 7.5-8.8 | SRC | 108d | 114.01 |
| *Z UMa* | 6.2-9.4 | SRB | 196d | 217.01 |
| *ST UMa* | 6.0-7.6 | SRB | 110d? | 102.01 |
| *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 |

## NOVA VULPECULAE 2007 SPECTRA

**ROBIN LEADBEATER**

A series of low resolution spectra of Nova Vul 07 were recorded by Robin Leadbeater (R~80) and Maurice Gavin (R~40). They cover a period of three days starting pre maximum (twelve hours after discovery), and were taken using a transmission diffraction grating in a simple slitless configuration. The spectrum of this object evolved rapidly with the initial Helium emission lines disappearing over a period of twenty hours followed by the emergence of a strong Hydrogen alpha emission line after three days. A shift in the continuum from blue to red is also clear.

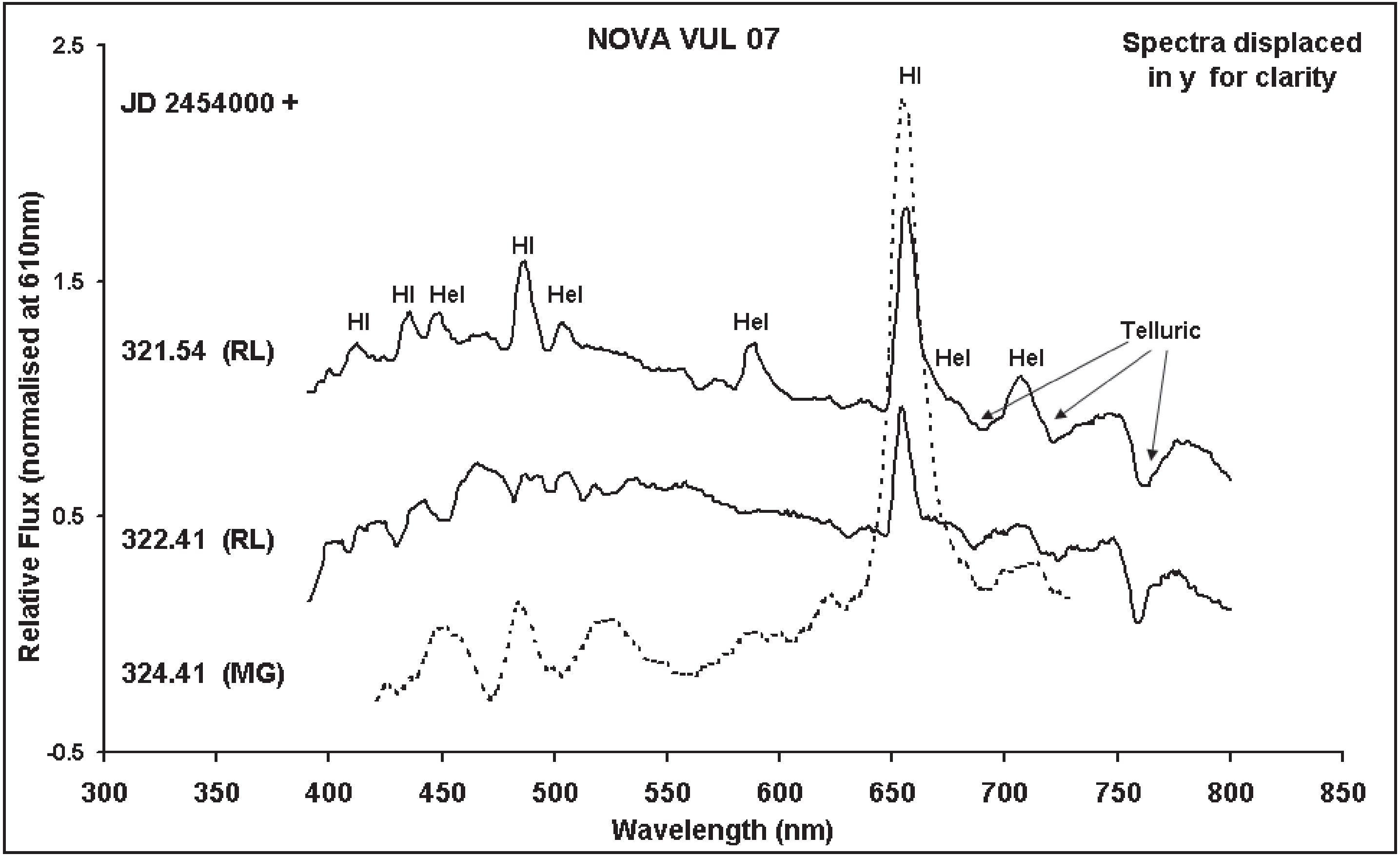



Figure 1: Spectra of Nova Vul 07, recorded by Robin Leadbeater and Maurice Gavin.

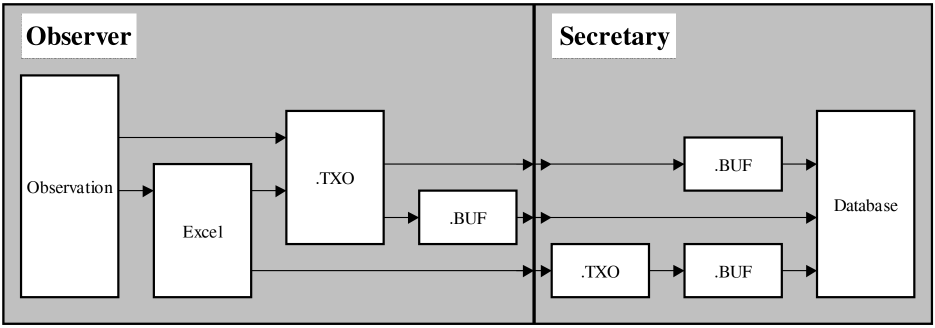
**Clive Beech:** "The telescope is a William Optics ZenithStar 80 ED apochromatic refractor. I have bought it for a semi-automatic observatory I am building specifically for photometry of variable stars, asteroids and comets. It should be up and running during September. I am working on the lens heater at the moment and will then start on the enclosure."

## THE VISUAL DATABASE – ELECTRONIC SUBMISSION OF OBSERVATIONS

### Clive Beech

The goal of the database is to provide a flexible, up-to-date and easily accessible repository of visual observations for a large number of objects. The current visual database provides the basis for achieving this goal although it currently falls short on the accessibility front. In this short article I would like to address some aspects of entering data into the database as this is a current and continuing task and leave the accessibility issue for another day.

The flow of the electronic submission of a report from the observation to the database should follow one of the following routes.




**Where:**

Excel: BAAVSS visual observations spreadsheet available from John Saxton's Website at: *www.lymmobservatory.net*

.TXO: Primary Data Format – Based on original file format by David McAdam. Details also available from BAAVSS website at: *http://www.britastro.org/vss/ObstoBAA.htm* and *http://www.britastro.org/vss/text/vssc77.txt*

.BUF: Format processed ready for entry into the database using the VSS software also available from John Saxton's Website (see above).

It can be seen that there are several possible routes that require more or less intervention by myself, as Secretary. These can be summarised as;

* the observer emails a finished .BUF file,
* the observer emails a .TX0 file or
* the observer emails a spreadsheet.

Of these flows the observer generated .BUF is the most convenient as it is ready for adding to the database. The next most convenient form of data is the BAAVSS Excel spreadsheet. Although this requires post-processing it is far easier to locate and correct errors than is the case with the raw .TX0 format.

The least convenient form of data is, "None of the above" where the observer has used a unique form for the data. Data that is sent in this way requires complete transcription into one of the standard forms and this quickly becomes an onerous task (especially when I would rather be processing my own data).

The software tools for processing the observations from Excel to .TX0 and from .TX0 into the .BUF format developed by John Saxton do achieve the goal of producing a compiled database. However, the software has limitations and often discards data if it encounters something that it dislikes.

Some common problem areas are:

**Object:** Do not use a \ in the name.

**Estimate:** Multiple step or fractional estimates may be used or even mixed however, a comma must separate individual estimates in theentry. Eg: A(2)V(4)F, E-2, =D

When using Step please follow the usual convention of + for brighter and – for fainter. These have sometimes been incorrectly used when 'forcing' a CCD observation by creating a dummy estimate.

Do not add = except where the target is the same as a comparison: =F is OK, =F+4 is not, simply use F+4.

When "shoehorning" a CCD measurement into the database please remember that the software was written to process visual observations. It is not tolerant to an estimate such as B+4.564. Please refer to John Saxton's manual on the VSS software available from *www.lymmobservatory.net*, or try a dummy report and run the software to see the effect of the estimate.

**Derived magnitude:** The magnitude must be correctly calculated and based on the chart that the observer has specified. The software checks the calculation using a sequence file and discards miscalculation.

**Chart:** Specify the chart so that the software can check the observation.

**Date (Month):** Please use the three letter short form for the months, JAN, FEB... and JUL (not JULY) and SEP (not SEPT).

Please use the correct year. An incorrect year sometimes gets overlooked when copy and paste has been used.

**Excel Sheet:** Don't change the spreadsheet or add extra lines in the header section. The automated routines cannot tolerate a change of format. Do not add extra columns.

**Typographical errors:** These are sometimes difficult to spot but please look for these before emailing data. Common error are:

- Brackets the wrong way round, eg A(2)V)3)D
- Number 9 or 0 in place of brackets eg A(2)V93)D
- Commas in place of decimal point eg9,5

**Email:** When emailing the observation be sure to use the address *clivebeech@blueyonder.co.uk*. If you do not receive a reply then check the email address (do not use clive.beech@...). In case of problems feel free to telephone on 01752 211799.

If there are any questions regarding the format of the files or confusion on how to submit an entry then email the details.

Thank you for all the observations and please keep them coming.

*clivebeech@blueyonder.co.uk* *01752 211799*

# ECLIPSING BINARY PREDICTIONS

DES LOUGHNEY

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

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

The variables covered by these predictions are :

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

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

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

## October

**2007 Oct 1 Mon**
U Sge X00(04)01L
SW Cyg D19(14)20
Z Vul D19(16)22
RW Tau L20(20)25
Z Dra 21(24)26
Y Psc 21(26)28L
Z Per 23(28)29D
TW Dra 24(29)29D

**2007 Oct 2 Tue**
S Equ 01(07)01L
X Tri 05(07)05D
RS CVn D18(22)21L

**2007 Oct 3 Wed**
RS CVn L04(<<)04
X Tri 04(06)05D
U CrB D18(13)19
Z Vul 22(27)26L

**2007 Oct 4 Thu**
TV Cas 02(07)05D
X Tri 03(06)05D
U Sge D18(14)19
Z Dra D18(17)19
TW Dra 19(24)29D

**2007 Oct 5 Fri**
Z Per 00(05)05D
X Tri 03(05)05D
S Equ D18(17)22
Y Psc D18(20)25
SW Cyg 22(28)29D
TV Cas 22(26)29D
Z Dra 23(25)28

**2007 Oct 6 Sat**
X Tri 02(04)05D
Z Vul D18(14)20
U CrB 18(24)22L

**2007 Oct 7 Sun**
X Tri 01(04)05D
RW Tau 05(09)05D
RS CVn D18(17)20L
TW Dra D18(20)25
TV Cas D18(22)26
U Sge D18(23)25L

**2007 Oct 8 Mon**
X Tri 01(03)05D
Z Per 02(06)05D
Z Dra D18(19)21
Z Vul 20(25)25L
S Equ 22(28)25L
X Tri 24(26)29

**2007 Oct 9 Tue**
Y Psc D18(15)19
TV Cas D18(17)21
RW Tau 23(28)29D
X Tri 23(26)28

**2007 Oct 10 Wed**
Z Dra 01(03)05D
TX UMa D18(14)19
TW Dra D18(15)20
SW Cyg D18(17)23
W Ser 20(59)20L
HU Tau L21(18)22
X Tri 23(25)28

**2007 Oct 11 Thu**
Z Per 03(08)05D
W Ser D18(35)20L
X Tri 22(24)27

**2007 Oct 12 Fri**
SS Cet 05(09)05D
W Ser D18(11)20L
RS CVn D18(12)18
S Equ D18(14)19
Z Dra D18(20)23
RW Tau L19(22)27
HU Tau L20(19)23
X Tri 21(24)26

**2007 Oct 13 Sat**
TV Cas 04(08)05D
W Ser D18(<<)20L
TX UMa D18(16)20L
U CrB D18(22)22L
Z Vul D18(23)25L
V367Cyg D18(55)28L
X Tri 20(23)25

**2007 Oct 14 Sun**
Z Dra 03(05)05D
Z Per 04(09)05D
U Sge D18(17)23
V367Cyg D18(31)28L
X Tri 20(22)25
HU Tau L20(21)24
TV Cas 23(28)29D

**2007 Oct 15 Mon**
SW Cyg 01(07)05D
SS Cet 04(09)05D
V367Cyg D18(07)28L
RW Tau L19(17)21
X Tri 19(22)24
S Equ 19(25)25L

**2007 Oct 16 Tue**
TW Dra 01(06)05D
V367Cyg D18(<<)28
TX UMa D18(17)20L
X Tri 18(21)23
TV Cas 19(23)27
Z Dra 20(22)25
HU Tau L20(22)26
Y Psc 23(27)27L

**2007 Oct 17 Wed**
RS CVn L03(07)05D
X Tri D18(20)23
U Sge 20(26)24L

**2007 Oct 18 Thu**
SS Cet 04(08)05D
Z Dra 04(07)05D
TV Cas D18(19)23
X Tri D18(20)22
Z Vul D18(21)25L
HU Tau L20(23)27
TW Dra 20(25)29D

**2007 Oct 19 Fri**
X Tri D18(19)21
TX UMa D18(19)19L
SW Cyg D18(21)27
TX UMa L22(19)24

**2007 Oct 20 Sat**
TV Cas D18(14)18
X Tri D18(18)21
U CrB D18(20)21L
Y Psc D18(22)26
HU Tau 21(25)29
Z Dra 21(24)26

**2007 Oct 21 Sun**
RW Tau 01(06)05D
SS Cet 03(08)05D
X Tri D18(17)20
TW Dra D18(21)26

**2007 Oct 22 Mon**
RS CVn L03(02)06D
TV Cas 05(10)06D
X Tri D18(17)19
TX UMa D18(20)19L
S Equ D18(21)24L
TX UMa L22(20)25
HU Tau 22(26)30D

**2007 Oct 23 Tue**
Z Per D18(13)18
X Tri D18(16)19
Z Dra D18(17)19
Z Vul D18(19)24
RW Tau 19(24)29

**2007 Oct 24 Wed**
TV Cas 01(05)06D
SS Cet 02(07)06D
SW Cyg 05(11)05L
U CrB L05(06)06D
X Tri D18(15)18
TW Dra D18(16)21
Y Psc D18(16)21
U Sge D18(20)24L
Z Dra 23(26)28
HU Tau 24(27)30D

**2007 Oct 25 Thu**
TX UMa D18(22)19L
W Ser D18(38)19L
TV Cas 20(25)29
TX UMa L22(22)27

**2007 Oct 26 Fri**
Z Per D18(14)19
W Ser D18(14)19L
RS CVn D18(21)19L
RW Tau L18(18)23

**2007 Oct 27 Sat**
HU Tau 01(05)06D
SS Cet 02(06)05L
RS CVn L02(<<)04
W Ser D18(<<)19L
U CrB D18(17)21L
Z Dra D18(19)21
TV Cas D18(20)24

**2007 Oct 28 Sun**
Z Vul D18(17)22
SW Cyg 18(24)29L
TX UMa 19(24)19L
TX UMa L21(24)28

**2007 Oct 29 Mon**
Z Dra 01(03)06D
HU Tau 02(06)06D
TV Cas D18(16)20
Z Per D18(16)21
S Equ D18(18)24L

**2007 Oct 30 Tue**
SS Cet 01(06)05L
TW Dra 02(07)06D
Z Vul 22(27)24L

**2007 Oct 31 Wed**
HU Tau 04(07)06D
U CrB L05(04)06D
U Sge D17(15)20
RS CVn D17(16)19L
Z Dra 18(20)23
TX UMa L21(25)30

## November

**2007 Nov 1 Thu**
Y Psc 00(05)02L
V367 Cyg 01(46)03L
RW Tau 03(07)06D
Z Per D17(17)22
V367Cyg D17(46)27L
TW Dra 21(26)30D

**2007 Nov 2 Fri**
SS Cet 00(05)05L
TV Cas 02(07)06D
Z Dra 03(05)06D
HU Tau 05(09)06D
SW Cyg D17(14)20
Z Vul D17(14)20
V367Cyg D17(22)27L

**2007 Nov 3 Sat**
V367Cyg D17(<<)27L
U CrB D17(15)20L
U Sge 18(24)23L
RW Tau 21(26)30D
TX UMa 22(27)30D
TV Cas 22(26)30D

**2007 Nov 4 Sun**
X Tri 05(08)06D
V367Cyg D17(<<)18
Z Per D17(18)23
TW Dra D17(21)26
Y Psc 19(23)26L
Z Dra 20(22)25
Z Vul 20(25)24L
SS Cet 24(28)29L

**2007 Nov 5 Mon**
X Tri 05(07)06D
RS CVn 05(12)06D
RS CVn D17(12)18
S Equ D17(15)21
TV Cas 18(22)26

**2007 Nov 6 Tue**
X Tri 04(07)06D
Z Dra 04(07)06D
RW Tau L17(20)25
U CrB 20(26)20L
SW Cyg 22(28)28L
TX UMa 23(28)30D

**2007 Nov 7 Wed**
X Tri 03(06)06D
U CrB L04(02)06D
SW Cyg L06(04)06D
Z Vul D17(12)18
Z Dra D17(15)18
TW Dra D17(17)22
TV Cas D17(17)21
Z Per D17(20)25
SS Cet 23(28)29L

**2007 Nov 8 Thu**
X Tri 03(05)06D
Y Psc D17(18)22
W Ser D17(42)18L
S Equ 20(26)23L
Z Dra 22(24)26

**2007 Nov 9 Fri**
X Tri 02(05)06D
RW Tau L17(15)19
W Ser D17(18)18L
Z Vul 18(23)23L

**2007 Nov 10 Sat**
TX UMa 01(06)06D
X Tri 01(04)06D
RS CVn L01(07)06D
W Ser D17(<<)18L
U CrB D17(13)19
U Sge D17(18)23L
Z Per D17(21)26
SS Cet 23(27)28L

**2007 Nov 11 Sun**
X Tri 01(03)06
TV Cas 04(08)06D
Z Dra D17(17)20
SW Cyg D17(18)24
X Tri 24(26)29

**2007 Nov 12 Mon**
RW Tau 04(09)06D
S Equ D17(12)18
HU Tau L18(16)19
Z Dra 23(26)28
X Tri 23(26)28
TV Cas 24(28)30D

**2007 Nov 13 Tue**
TW Dra 02(07)06D
TX UMa 02(07)06D
Z Per 18(23)27
U CrB 18(24)20L
U Sge 21(27)22L
SS Cet 22(27)28L
X Tri 23(25)28

**2007 Nov 14 Wed**
U CrB L04(00)05
Z Vul D17(21)23L
HU Tau L18(17)21
TV Cas 19(23)27
X Tri 22(24)27
RW Tau 23(28)30D

**2007 Nov 15 Thu**
RS CVn L01(02)06D
Z Dra D17(19)21
S Equ 17(23)23L
X Tri 21(24)26
TW Dra 22(27)30D

**2007 Nov 16 Fri**
SW Cyg 01(07)03L
TX UMa 04(09)06D
SW Cyg L05(07)06D
TV Cas D17(19)23
HU Tau L18(18)22
Z Per 19(24)29
X Tri 21(23)26
SS Cet 21(26)28L

**2007 Nov 17 Sat**
Z Dra 01(03)06
U CrB 05(10)06D
U Sge D17(12)18
RW Tau 17(22)27
X Tri 20(22)25

**2007 Nov 18 Sun**
TV Cas D17(14)18
TW Dra 17(22)27
HU Tau L18(20)23
X Tri 19(22)24

**2007 Nov 19 Mon**
TX UMa 05(10)06D
Z Vul D17(19)23L
RS CVn D17(21)18L
V367Cyg D17(60)26L
Z Dra 18(21)23
X Tri 19(21)23
Y Psc 20(25)25L
Z Per 20(25)30
SS Cet 21(25)28L

**2007 Nov 20 Tue**
RS CVn L01(<<)03
TV Cas 06(10)06D
RW Tau D17(17)21
SW Cyg D17(21)27L
U CrB D17(21)19L
U Sge D17(21)22L
V367Cyg D17(36)26L
X Tri 18(20)23
HU Tau L18(21)25

**2007 Nov 21 Wed**
Z Dra 03(05)06D
V367Cyg D17(12)26L
TW Dra D17(18)23
X Tri 17(20)22

**2007 Nov 22 Thu**
TV Cas 01(05)06D
V367Cyg D17(<<)26L
X Tri D17(19)21
S Equ D17(20)22L
W Ser D17(46)17L
HU Tau 18(22)26
SS Cet 20(25)28L
Z Per 22(27)30D

**2007 Nov 23 Fri**
RW Tau 06(11)06D
X Tri D17(18)21
Y Psc D17(19)24
W Ser D17(22)17L
Z Dra 20(22)25
TV Cas 21(25)29

**2007 Nov 24 Sat**
U CrB L03(08)06D
W Ser D17(<<)17L
TW Dra D17(13)18
RS CVn D17(16)17L
Z Vul D17(17)22
X Tri D17(18)20
HU Tau 20(24)27

**2007 Nov 25 Sun**
Z Dra 04(07)06D
SW Cyg 05(11)06D
SW Cyg D17(11)17
TX UMa D17(13)17L
X Tri D17(17)19
TV Cas D17(20)24
SS Cet 19(24)27L
Z Per 23(28)30D

**2007 Nov 26 Mon**
RW Tau 01(05)06D
Z Dra D17(15)18
X Tri D17(16)19
HU Tau 21(25)29

**2007 Nov 27 Tue**
TW Dra 03(08)06D
Y Psc D17(14)18
X Tri D17(16)18
TV Cas D17(16)20
U Sge D17(16)21
U CrB D17(19)19L
Z Dra 22(24)26

**2007 Nov 28 Wed**
X Tri D17(15)17
SS Cet 19(23)27L
RW Tau 19(24)29
HU Tau 22(26)30

**2007 Nov 29 Thu**
Z Per 00(05)07D
RS CVn 05(11)07D
Z Dra 06(09)07D
RS CVn D17(11)17L
Z Vul D17(14)20
S Equ D17(17)22L
SW Cyg 19(25)26L
TW Dra 23(28)31D

**2007 Nov 30 Fri**
SW Cyg L04(01)07D
Z Dra D17(17)20
U Sge 19(25)21L
HU Tau 24(28)31D

## December

**2007 Dec 1 Sat**
TV Cas 03(07)07D
U CrB L03(06)07D
RW Tau D17(18)23
SS Cet 18(23)27L
TX UMa L19(16)21
Z Vul 20(25)22L
Z Dra 23(26)28

**2007 Dec 2 Sun**
Z Per 02(07)07D
del Lib L06(00)06
TW Dra 18(23)28
TV Cas 22(26)30

**2007 Dec 3 Mon**
HU Tau 01(05)07L

**2007 Dec 4 Tue**
RS CVn 00(06)07D
del Lib L06(08)07D
Z Vul D17(12)18
RW Tau D17(13)17
SW Cyg D17(14)20
U CrB D17(17)18L
Z Dra D17(19)21
TV Cas 18(22)26
SS Cet 18(22)27L
TX UMa L19(18)22
Y Psc 22(26)24L

**2007 Dec 5 Wed**
HU Tau 03(06)06L
Z Per 03(08)07D
TW Dra D17(18)23

**2007 Dec 6 Thu**
Z Dra 01(04)06
S Equ D17(14)19
TV Cas D17(17)21
Z Vul 18(23)21L

**2007 Dec 7 Fri**
RW Tau 03(07)06L
HU Tau 04(08)06L
U Sge D17(19)21L
SS Cet 17(22)26
TX UMa L19(19)24

**2007 Dec 8 Sat**

U CrB L02(04)07D
Z Per 05(09)07D
V367Cyg L07(50)07D
TW Dra D17(14)19
Y Psc D17(21)24L
V367Cyg D17(50)25L
Z Dra 18(21)23
SW Cyg 22(28)26L
RS CVn L23(26)31D

**2007 Dec 9 Sun**

SW Cyg L04(04)07D
HU Tau 05(09)06L
del Lib L06(00)06
V367Cyg L07(26)07D
V367Cyg D17(26)25L
S Equ 19(24)21L
RW Tau 21(26)30L

**2007 Dec 10 Mon**

Z Dra 03(05)07D
TV Cas 04(08)07D
V367Cyg L06(02)07D
V367Cyg D17(02)24L
SS Cet D17(21)26
TX UMa L19(21)25

**2007 Dec 11 Tue**

X Tri 03(06)04L
TW Dra 04(09)07D
del Lib L06(08)07D
Z Per 06(11)07D
V367Cyg L06(<<)07D
V367 Cyg D17(<<)23
U CrB D17(14)18L
Z Vul D17(21)21L
TV Cas 24(28)31D

**2007 Dec 12 Wed**

X Tri 03(05)04L
Y Psc D17(15)20
RW Tau D17(20)25
Z Dra 20(22)25

**2007 Dec 13 Thu**

X Tri 02(05)04L
SW Cyg D17(18)24
SS Cet D17(20)25
TX UMa L18(22)27
TV Cas 19(23)27
RS CVn L23(21)27
TW Dra 23(28)31D

**2007 Dec 14 Fri**

X Tri 01(04)04L
Z Dra 05(07)07D
Z Vul L07(08)07D
Z Per D17(12)17
U Sge D17(13)19

**2007 Dec 15 Sat**

X Tri 01(03)04L
U CrB L02(01)07D
HU Tau D17(13)17
RW Tau D17(15)19
Z Dra D17(16)18
TV Cas D17(19)23

**2007 Dec 16 Sun**

X Tri 00(03)04L
del Lib L05(<<)06
Z Vul D17(19)21L
SS Cet D17(20)24
S Equ D17(21)21L
TW Dra 19(24)29
TX UMa 19(24)29
Z Dra 22(24)27
X Tri 23(26)28L

**2007 Dec 17 Mon**

Z Per D17(13)18
TV Cas D17(14)18
HU Tau D17(14)18
U Sge D17(22)20L
X Tri 23(25)28L

**2007 Dec 18 Tue**

SW Cyg L03(08)07D
RW Tau 04(09)06L
del Lib L05(07)07D
U CrB 06(12)07D
Z Dra 06(09)07D
U CrB D17(12)17L
X Tri 22(25)27

**2007 Dec 19 Wed**

TV Cas 06(10)07D
Z Vul L06(06)07D
HU Tau D17(16)20
Z Dra D17(17)20
SS Cet D17(19)24
TW Dra D17(19)24
TX UMa 21(25)30
X Tri 21(24)26

**2007 Dec 20 Thu**

Z Per D17(15)20
X Tri 21(23)26
RW Tau 23(27)29L
Z Dra 23(26)28

**2007 Dec 21 Fri**

TV Cas 01(05)07D
U Sge L07(08)07D
Z Vul D17(17)20L
HU Tau D17(17)21
X Tri 20(22)25

**2007 Dec 22 Sat**

U CrB L01(<<)05
TW Dra D17(15)20
SS Cet D17(18)23
SW Cyg D17(21)25L
X Tri 19(22)24
TV Cas 21(25)29
TX UMa 22(27)31D

**2007 Dec 23 Sun**

SW Cyg L03(<<)03
RS CVn 05(11)07D
del Lib L05(<<)05
Z Per D17(16)21
S Equ D17(18)20L
HU Tau D17(19)22
Z Dra D17(19)21
RW Tau 17(22)27
Y Psc 18(22)23L
X Tri 19(21)24

**2007 Dec 24 Mon**

Z Vul L06(04)07D
U Sge D17(17)20L
TV Cas D17(20)24
X Tri 18(20)23

**2007 Dec 25 Tue**

Z Dra 01(04)06
U CrB 04(10)07D
del Lib L05(07)07D
TW Dra 05(10)07D
SS Cet D17(18)23
HU Tau D17(20)24
X Tri 17(20)22
TX UMa 24(28)31D

**2007 Dec 26 Wed**

Z Vul D17(15)20
TV Cas D17(16)20
RW Tau D17(16)21
Z Per D17(17)22
X Tri D17(19)22
V367Cyg 20(65)23L

**2007 Dec 27 Thu**

SW Cyg 05(11)07D
V367Cyg L05(41)07D
SW Cyg D17(11)17
Y Psc D17(17)21
X Tri D17(18)21
V367Cyg D17(41)23L
HU Tau 17(21)25
Z Dra 18(21)23
RS CVn 24(30)31D

**2007 Dec 28 Fri**

TW Dra 00(05)07D
V367Cyg L05(17)07D
U Sge L06(02)07D
V367Cyg D17(17)23L
SS Cet D17(17)22
X Tri D17(18)20

**2007 Dec 29 Sat**

U CrB L01(<<)02
TX UMa 01(06)07D
Z Dra 03(05)07D
V367Cyg L05(<<)07D
Z Vul L06(02)07
V367Cyg D17(<<)23L
X Tri D17(17)19
Z Per D17(19)24
HU Tau 19(23)26

**2007 Dec 30 Sun**

TV Cas 03(07)07D
del Lib L04(<<)05
V367Cyg L05(<<)07D
S Equ D17(15)20L
X Tri D17(16)19
TW Dra 20(25)30

**2007 Dec 31 Mon**

U Sge L06(11)07D
Z Vul D17(12)18
X Tri D17(16)18
SS Cet D17(17)21
SW Cyg 19(25)24X
Z Dra 20(23)24X
HU Tau 20(24)24X
TV Cas 22(26)24X

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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 134) will be 7th November, 2007. All articles should be sent to the editor (details are given on the back of this issue)



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# TELEPHONE ALERT NUMBERS

**Nova and Supernova discoveries**
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**Variable Star Alerts** Telephone Gary Poyner (see above for number)