British Astronomical Association

VARIABLE STAR SECTION CIRCULAR

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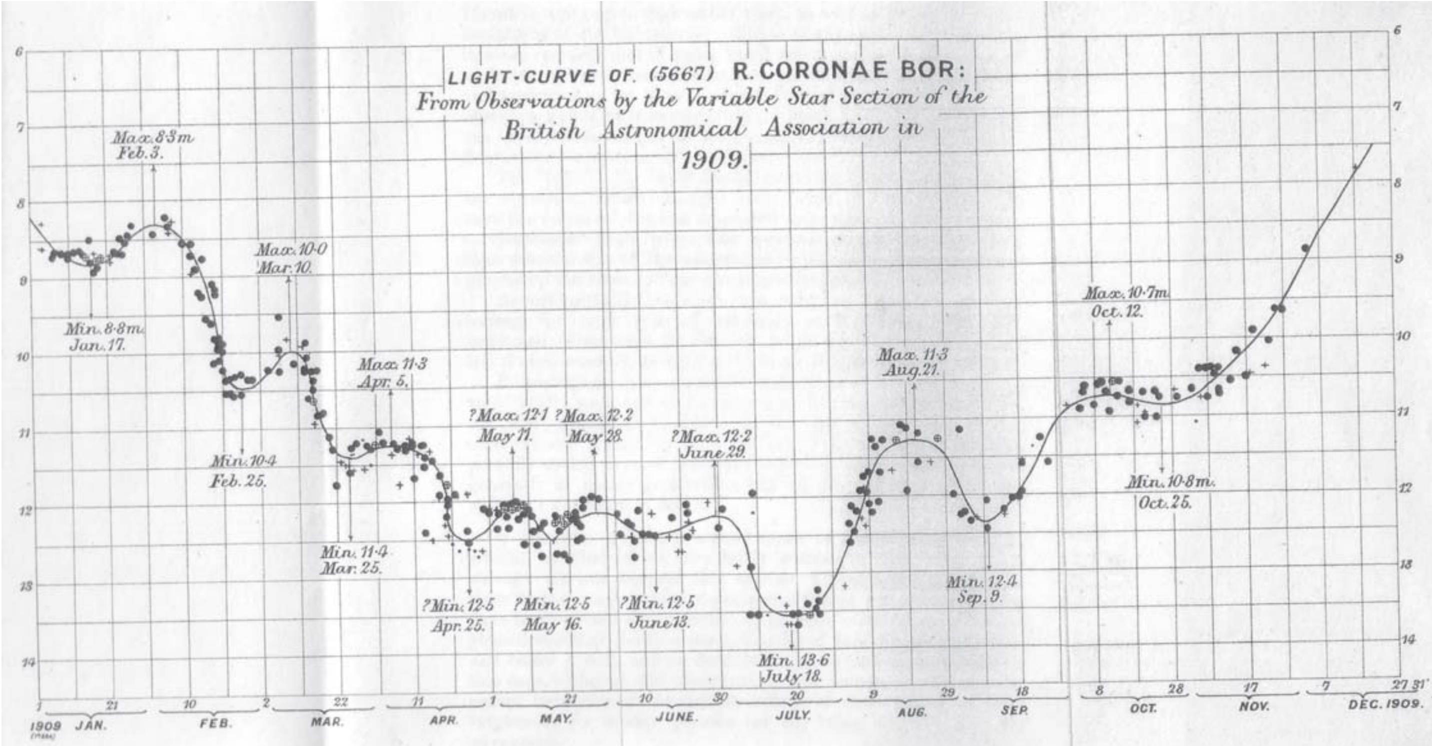


Light curve of R Coronae Borealis by Colonel E. E. Marvick, from observations of the BAA Variable Star Section in 1906.

See article page 29: R Coronae Borealis – One Hundred Years Ago, by John Toone.

FROM THE DIRECTOR

ROGER PICKARD

Another 100,000 Variable Star Estimates.

On the night of December 3rd 2008 at 01:46 UT, Tony Markham from Leek, Staffordshire, made his 100,000 visual variable star estimate, when he observed the beta Lyrae type eclipsing variable LY Aurigae.

As I'm sure all variable star observers will know, this is no trifling amount, and means Tony joins the ranks of Gary Poyner and John Toone (of current active British observers) in reaching this milestone. Only one other observer from the UK has attained this total, Charles Butterworth, who made his observation in the first half of the last century.

Tony started observing variable stars in late 1977 from the village of Aike in East Yorkshire, and since November 1989 has observed from Leek. Amazingly, Tony has made all his observations with either 10x50 or 11x80 binoculars. There are precious few visual observers world-wide who have ever achieved this total, and with many observers switching to CCDs nowadays, it may be that we will not see many more.

We heartily congratulate Tony on this remarkable achievement, but I must also mention one other amazing fact. During the month of December last year, Tony made some 1,800 visual estimates alone! That's far more than the average variable star observer manages in a whole year! It's also remarkable that both John and Gary observe from the West Midlands, rather than the supposedly clearer east or south of England.

John Toone has compiled a list of those observers who have made over 100,000 variable star observations, and since Charles Butterworth reached this number in 1939, Tony becomes only the 25th observer world wide to achieve it.

The full list is as follows:

Observer	Country
Albert Jones	New Zealand
Frank Bateson	New Zealand
Rod Stubbins	Australia
Peter Williams	Australia
Danie Overbeek	South Africa
Reginald de Kock	South Africa
Paul Vedrenne	France
Michel Verdenet	France
Eddy Muyllaert	Belgium
Georg Comello	Netherlands
Charles Butterworth	UK
Gary Poyner	UK
John Toone	UK
Tony Markham	UK
Warren Morrison	Canada
Leslie Peltier	USA
Wayne Lowder	USA

Observer	Country
Marvin Baldwin	USA
John Bortle	USA
Edward Oravec	USA
Gerald Dyck	USA
Thomas Cragg	USA
Gerard Samolyk	USA
Lewis Cook	USA
Cyrus Fernald	USA
Lancaster Hiett	USA

If anyone knows of anybody who has been missed from this list could they please let John and I know.

New Director of the RASNZ Variable Star Section.

At the beginning of the year, the RASNZ Council announced the appointment of Dr Tom Richards, as Director of their Variable Star Section. In his proposal to the RASNZ Council, Tom indicated far reaching plans for the revitalisation of the Section including a change of name to 'Variable Stars South'.

I've since been in touch with Tom, one result of which is his note elsewhere in this Circular. I've also arranged to meet him in early April, when he is over in the UK on holiday with his wife. I first met (indeed, the only time I've met) Tom, was at the AAVSO Meeting in Hawaii, and I hope to have plenty of discussions with him in the future; especially about the way forward for the RASNZ VSS, and mutual observing programmes between our two groups.

Chart Catalogue

I announced via the web site recently, that version 9.0 of the Chart Catalogue was now available, having added the charts John Toone had issued, as mentioned in the last Circular.

Almost immediately, Ian Miller, who has been doing a lot of work adding revised sequences to the database (to enable the checking software to do its job properly), advised me that a number of charts were still listed incorrectly. These have now been corrected and so version 9.1 has been issued.

Would observers please make every effort to use the chart description as listed in this latest version of the Catalogue, as this will allow their observations to be properly validated. Those observations that do not follow this requirement will still be added to the database, but they will be flagged accordingly, as it will mean they cannot be fully checked. (Basically, this means the quoted deduced magnitude can't be checked against the appropriate sequence).

Sadly, this also means that where observers report data derived from the new AAVSO charts (of the form 1076xxx), we can no longer validate it. It's a shame, but the new AAVSO charts are now designed in such a way, that we would have to commit a disproportionate amount of our limited resources, to adapt our system. I therefore appeal to all observers to use our charts, in the knowledge that their data will still be acceptable to the AAVSO. This does also mean, that should a sequence change in the future, our database can be re-worked accordingly. Now, sadly, ours is the only database in the world that can claim that.

Change of Director's email address

Would members please note that I've changed my email address to:
roger.pickard@sky.com

This is because 500-1000 spam messages per day were getting too much! OK, 95%+ were dealt with by my spam filter but I still have to delete them from my spam folder, and of course, just occasionally, a real message or two sneaks through, as with that amount of spam I can't check for them. I plan on keeping the *rdp@astronomy.freeserve.co.uk* address some time yet, but will be obliged if you will update your address books.

The Visual Observing Experiment

Sadly, John Toone decided to eliminate the V Canum Venaticorum estimates in this experiment, because they seemed unreliable. The net effect of that is that I have been replaced by Rhona Fraser as the nominal calibration point for the visual (mv) standard. Whilst this is very disappointing for me, I'm delighted that Rhona is now our standard calibration point! Well done Rhona.

Circular Index

Phil Busby has kindly prepared an updated Index to the Circulars which runs from 14 to 138 (at present). This, therefore, also amalgamates the earlier index from 71-100, and will eventually include that for 12 - 70 although this is still incomplete as it still needs a massive amount of reformatting and typing.

However, part of the index requires checking, 115 to 138, and I wondered if we might have any volunteers who would be prepared to undertake this small task?

Variable Star Section Meeting - Cardiff.

I am pleased to advise, that the next Variable Star section meeting, will be held on Saturday 13th June 2009, at the Faculty Lecture Theatre, Trevithick Building, Cardiff University.

The lecture theatre has a capacity of 150 delegates, and has full projection facilities, including PC, Laptop, and Apple Mac. We also have the Junior Common Room available, which has loose seating and a capacity of 200, and so plenty of room for exhibitions.

Tea and coffee will be available during the morning and afternoon. Lunch will be available in the refectory, and will offer a choice of three meals; Meat, Fish, or Vegetarian, together with a drink (Cold or Hot), and a Sweet. The cost of the meeting will be £10 per head, which will include all refreshments including lunch. There will be no reduction if you do not require lunch.

I am very grateful to Paul Roche and Alison Tripp, of the Faulkes Telescope team, for helping with the arrangements and for meeting some of the costs.

The programme is still being prepared, but if you wish to give a talk please contact me at your earliest opportunity. Similarly, poster papers will be very welcome.

RECURRENT OBJECTS PROGRAMME NEWS.

Gary Poyner

Within the space of five weeks, four major outbursts of stars on the ROP occurred - three of which were extremely rare.

V402 Andromedae was detected in outburst by G. Poyner from a BRT image obtained on October 14.001 UT at magnitude 15.49C. This was the first outburst detected since the outburst of July 27th 2007 (Shears). H. Maehara subsequently reported the detection of superhumps on Oct 17th with a mean Psh of 0.06343(2)d (vsnet-outburst 9554), thus confirming that the outburst was a Superoutburst. The supercycle of V402 Andromedae is not currently known.

V1251 Cygni: Belgian observer Hubert Hautecler detected the first outburst in V1251 Cyg since September 1997 on Oct 19.865 UT at visual magnitude 12.4. Following Hautecler's report, two further outburst observations were reported to VSNET, showing that Jochen Pietz had imaged the field with V1251 Cyg at 16.66C (>2mags above quiescence) on Oct 18.842, and H. Maehara had confirmed the rise on his image of Oct 19.449 at 13.3C. This was only the fifth recorded outburst since discovery in 1963.

The outburst declined slowly, losing ~2 magnitudes in ten days. Following a minimum of 16.66V on Nov 11th, a brief re-brightening was detected by J. Shears on Nov 10.79 at 15.4C. By Nov 15th, the magnitude of V1251 Cyg was <17.0C.

Increasing superhump periods were reported to vsnet by various observers during the declining phase. Measures during the early stages of the outburst indicate that the growth of superhumps had been slower than that of the previous 1991 outburst (vsnet-outburst 9564). J. Shears measured the Psh at 0.076d from a six hour time series run on Oct 24th (see below). Vsnet-alert 10653 reports that the Psh had shortened by Oct 29th, with a new period measured at 0.07574(4)d following a period transition phase.

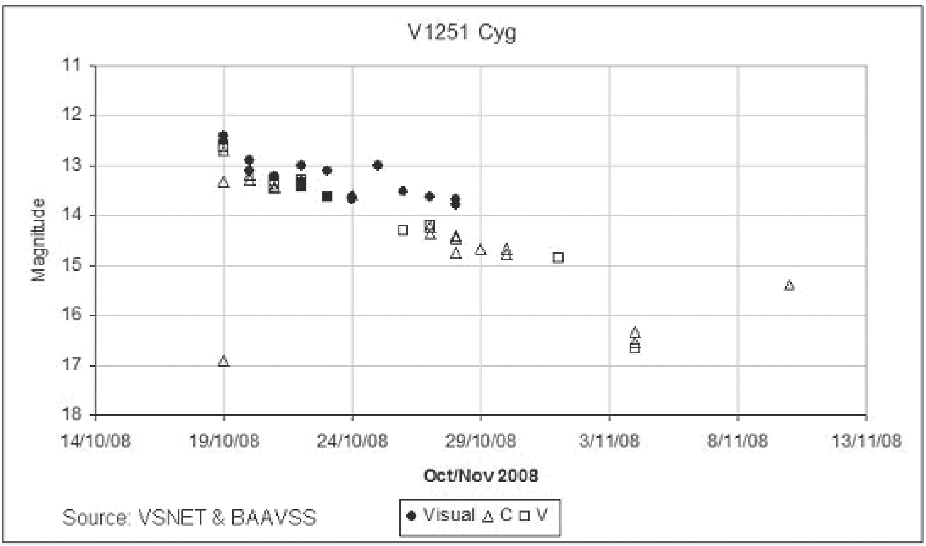


Figure 1.

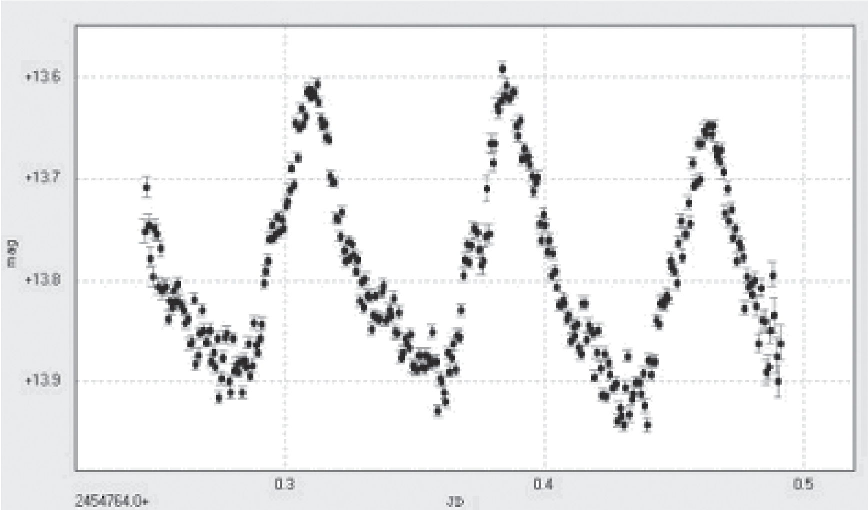


Figure 2: Six hour time series carried out by J. Shears on Oct 24. Psh=0.076d

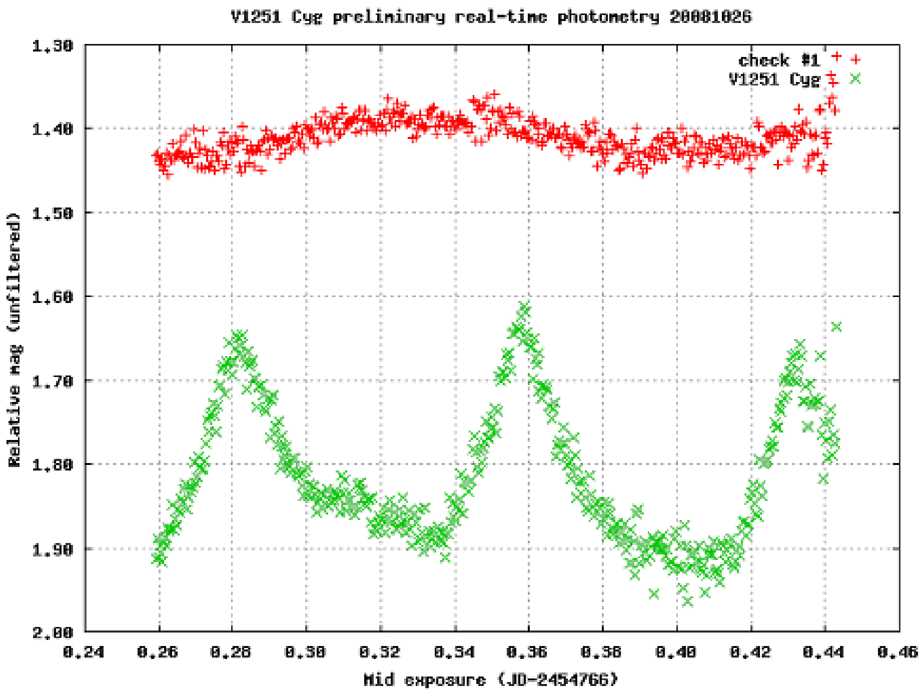


Figure 3: Real time light curve from N. James on Oct 26, revealing 0.3 mag superhumps.

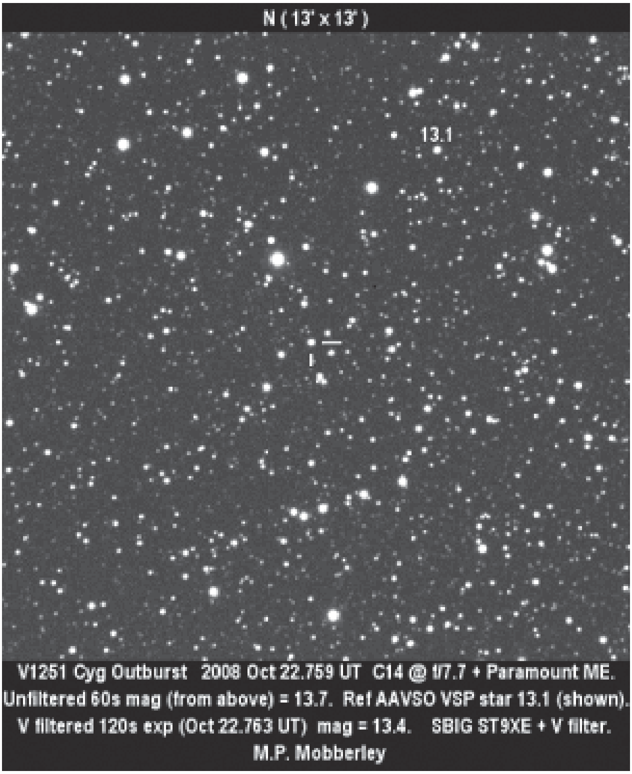


Figure 4:
Outburst image by M. Mobberley.
Oct 22.759UT.

UW Trianguli: The first outburst of this UGWZ type star since March 1995 was detected independently by Carl Knight and Tom Lloyd Evans on Oct 27.896 at mag. 14.8,and Oct 28.008 at mag. 14.3 respectively. Interestingly the outburst was caught 'on the rise', as G. Poyner had a negative observation 96 minutes before Knight's detection...

October		
27.829UT	<15.0	Poyner
27.896	14.8	Knight
27.934	14.5	Knight
28.008	14.3	Lloyd Evans
28.031	14.2	Poyner

Originally classified as a Nova at it's discovery in September 1983, the first DN 'outburst' was detected by T. Vanmunster in March 1995, when it's UGWZ status was identified. The quiescent magnitude is 22.6B.

The outburst peaked at magnitude 14.2 (8 mag outburst), fading to 16.4C by November 6th. By November 19th, UW Tri had reached magnitude 17.2C. On vsnet-outburst 9712, T. Kato reports a mean superhump period of 0.05423(3)d, as observed by the Kyoto team of Ohshima & Tanaka. This would indicate that UW Tri has one of the shortest known orbital/superhump periods yet detected - GW Lib being the shortest (vsnet-outburst 9656).

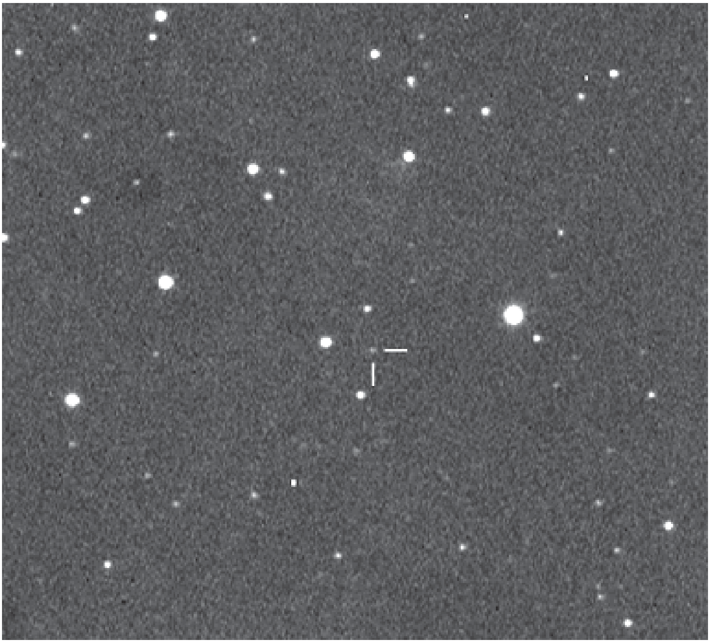


Figure 5:

UW Trianguli declining.
J. Shears
Nov 7.810UT
16.2C

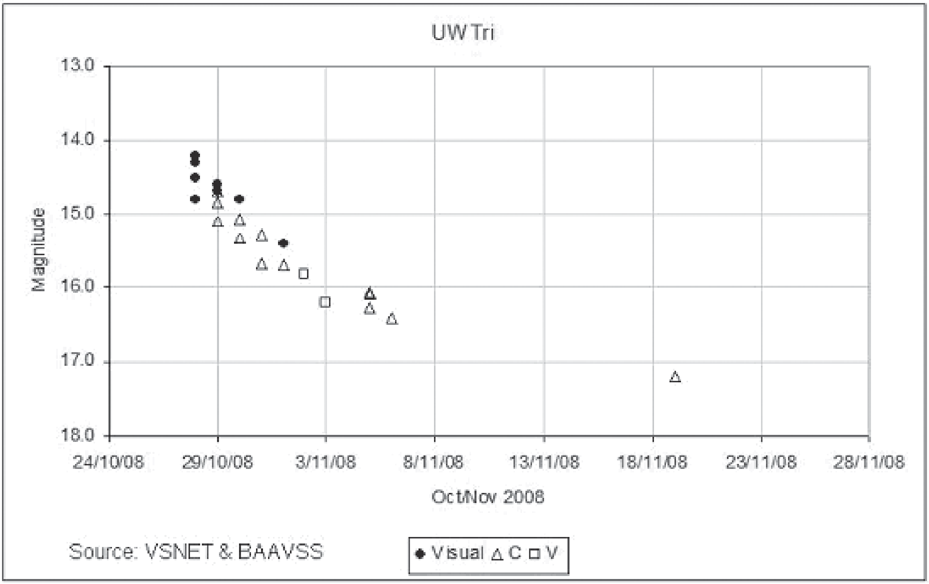
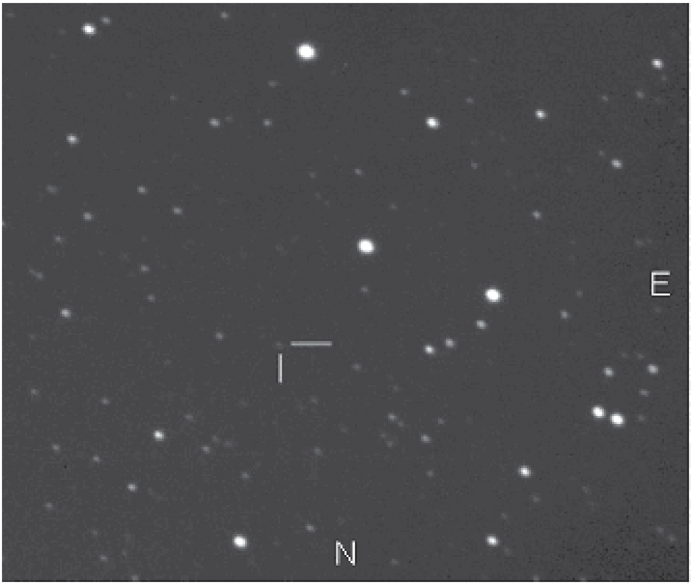


Figure 6.

V358 Lyrae: The first ever outburst of this suspected UGWZ star since it's discovery by Hoffmeister on photographic plates in 1965, was detected by J. Shears and G. Poyner on a shared Bradford Robotic Telescope image on November 22.917 at magnitude 16.11C. V358 Lyr is <20.0 at quiescence.

Figure 7: Cropped BRT image showing V358 Lyrae in outburst for the first time in 43 years.



The initial outburst lasted 13d, before fading to 19.6C by Dec 5th. Two days later a re-brightening was detected by Poyner (from a BRT image) to mag. 17.3C. This re-brightening lasted a further 10 days, peaking at 16.7V. The most surprising aspect of the outburst was the total absence of Superhumps! At the time of writing (Jan 18), the outburst is being written up for the BAAJ, where further details of the outburst, along with analysis of the data will be revealed.

ECLIPSING BINARY NEWS

Des Loughney

'Understanding Variable Stars' by John R Percy

This excellent book was published by Cambridge University Press in 2007. There is a good section on Eclipsing Binaries which comments on the traditional misleading classification of eclipsing binaries into the EA, EB and EW classes. A more logical classification would be into D (detached), SD (semidetached) and K (according to the GCVS) which are contact binaries.

The EA class could be seen as equivalent to the D class, except for the fact that the EA class was named after the prototype Algol, which in fact is a semi detached system. The book also notes that the EB class had a prototype which is Beta Lyrae. This system should not be the prototype for any system as it is atypical with its own bizarre features.

The book had an interesting description of the VV Cephei sub class of eclipsing binaries. These are systems that include supergiants. VV Cephei itself is supposed to have a mass equivalent to 100 solar masses and a size that would extend to the equivalent of the orbit of Saturn in our solar system. It was a bit disappointing to learn that the period of the system is 20.3 years and the next eclipse is not due until 2017.

Epsilon Aurigae

The campaign to observe epsilon Aurigae has now well and truly started in order to discover out of eclipse variations. There have been a good series of observations since October 2008. Although it was expected that there would be out of eclipse variations of up to 0.16 magnitude, the system has been fairly constant for two months (up to the time of writing in early February 2009) at around 2.99V.

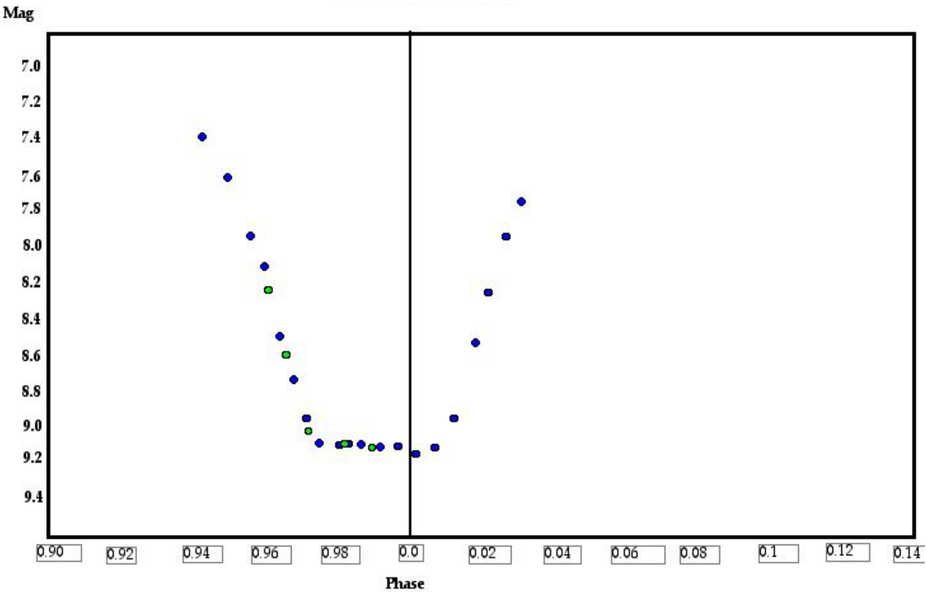
Zeta Aurigae

The campaign to observe this system has also begun. The eclipse is scheduled for March 2009 and, thus, will be over by the time this Newsletter is published. Observations have been made since November 2009 to pick up out of eclipse variations. However, the system seems to be constant at about 3.73V. It is hoped that the weather will allow a good run of estimates in March.

U Cephei

I have waited for some years to observe a full eclipse of U Cephei, which requires about six or seven hours of observations. Somehow, on the night of an eclipse, the sky was not clear for long enough. I managed to get half an eclipse on the night of 8th January 2009 but, amazingly, on the night of the 23rd January it was clear and calm for the whole required time. It was also possible to make more estimates during the following eclipse on 28th January. The estimates have been plotted on figure 1, below.

Figure 1: U Cephei, January 2009. Latest period: 2.493121 days



Every estimate represents an analysis with AIP4WIN photometric tools of 10 RAW images produced by a Canon DSLR. The settings, using a 200 mm lens, were ISO 800, f

3.2, and an exposure of 3.2 seconds. Normally the maximum undriven exposure with a 200 mm lens is 2.5 seconds, but this time can be extended near the pole. This extension reduces scintillation and also allows a better light grasp for the minimum at below magnitude 9.0. The light curve on the phase diagram illustrates well the light curve of a 'total' eclipse as a flat 2 hour minimum. It is sometimes described as a total eclipse, but the curve could equally represent a transit.

If the eclipse had occurred at the predicted time, mid minimum would have occurred at 0 on the phase diagram. Mid minimum is clearly occurring before the predicted time. It turns out that with a correction for heliocentric time the mid minimum was about 30 minutes before the predicted time. This result was confirmation that the latest period quoted on the Krakow site (2.493121 days) is now out of date. The period, after lengthening is reducing and Professor Kreiner states the correct current period is now 2.493086 days.

THE RASNZ REVIVES IT'S VARIABLE STAR SECTION

Dr Tom Richards
Director, Variable Stars South.

It was 1927 when the late Frank Bateson started organising variable star research in the Southern Hemisphere, and set up what became the Variable Star Section of the Royal Astronomical Society of New Zealand. It was 2005, 78 years later, when he retired from its Directorship. Under his control, the VSS-RASNZ effectively became responsible for all variable star observation south of -30 degrees declination, and developed a database of over a million observations, over a thousand charts and comparison sequences, and a large number of publications.

From the 1970s onwards, however, a new breed of variable star observer was emerging, who made use of electronic instrumentation and later, computers. This growing and productive stream was never properly integrated into the VSS however, and with no clear succession plan in place, the Section was in the doldrums by the time of Frank's retirement. Pauline Loader, a Council member of the RASNZ, heroically kept the Section ticking over, receiving observations and publishing newsletters, even though she was not a variable star person. All this time, the hope was that the Section could be renewed and re-invigorated, continuing its leading southern role but coming up-to-date with twenty first century approaches to instrumentation, observing, and communications.

In January of this year, after discussions with key RASNZ members, the Council appointed me the second Director of the VSS-RASNZ, under the new name of Variable Stars South. They did this on the basis of a development plan for VSS in which I set out my plans and goals. The first goal was to retain and develop the international southern role of VSS – not a New Zealand group. Indeed I live in Melbourne, though grew up in Karori, Wellington, walking distance from where Frank did.

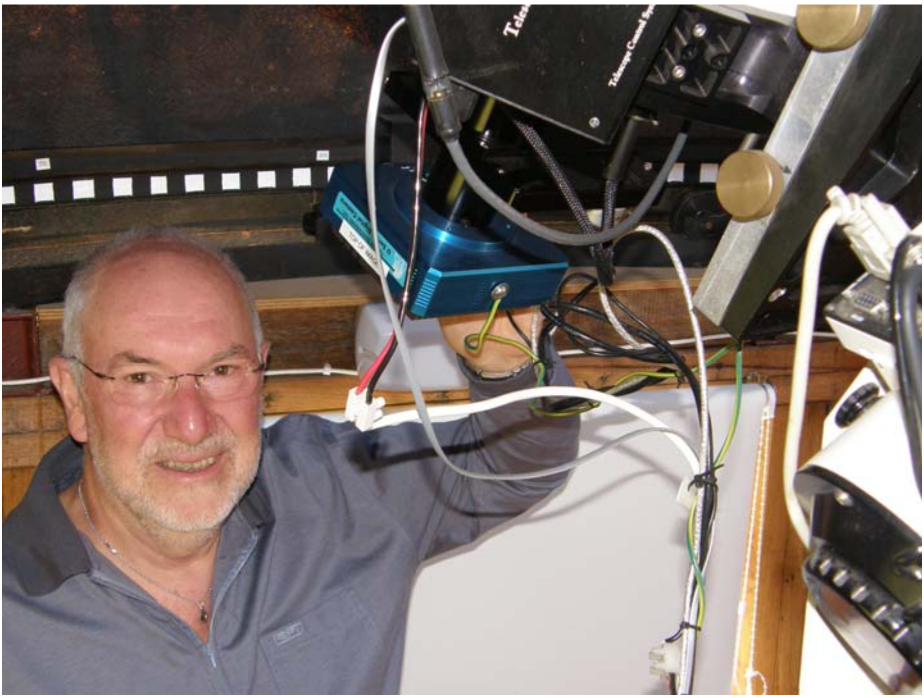
A second goal was to transform VSS into an electronic organisation, working on group projects. It will use all the modern resources of the Internet to bring together variable star researchers and observers around well-planned, focussed projects. Projects are being developed now, and will be announced in due course. A feature of all of them will be group mentoring which is so easily enabled by modern communications. Coordinators are being appointed for various fields of variable star work; the first are Stan Walker of Awanui (north of Auckland) for Long-Period Variables and Alan Plummer of Sydney for Visual Research.

Membership, website, and communications are yet to be set up. I'll put more about that in the next BAA-VSS Circular. By that time we should have a lot to say about activities and projects. Meanwhile see *www.rasnz.org.nz* for the old VSS website and current information about their next conference, which is hosting a Variable Star Colloquium on May 22nd. If you want to find out more about me, my very much under reconstruction website is at *www.woodridgeobsy.org*. Currently, southern observers (and northerners who wish they were down south) communicate via the AVSON egroup – join *http://tech.groups.yahoo.com/group/AVSON/* to keep up to date with VSS-RASNZ developments and other variable matters. Importantly, if you are thinking of a research project involving southern stars, please contact me at the email address below.

My wife Lyn and I are taking a European holiday in March and early April, and I'll be meeting with Roger Pickard for a lot of discussion about both VSSs on 2nd April. I'm sure he will be interested to hear any views you may have on Variable Stars South, to bring up at our meeting.

tom@woodridgeobsy.org

Dr Tom Richards, Director of Variable Stars South.



SEVEN NEW VARIABLE STARS IN CYGNUS

STAN WATERMAN AND RICHARD STRATFORD

Introduction

This is the first of a series of articles about variable stars in Cygnus, found by what is now called 'The Cygnus Project'. I, (SW) have been collecting data in a 2.8° square, densely populated patch of sky in Cygnus, since August the 9th 2003. These articles will describe some of the more interesting of the five hundred or so variable stars in that area. Some of them are challenging, and we shall be soliciting help in explaining them, or in making more measurements. At this point I'd like to thank my friend and colleague, Richard Stratford, for all the work he has done and, and continues to do, on these stars. All the astrophysical information and deductions in these articles are due to him.

We are starting with six stars belonging to five of the major classes of variable stars; an eclipsing binary, a possible Cepheid, a Mira type, a Red Semi-regular, a fast pulsator and two other pulsating stars, not identified with certainty.

Background

First I'd like to mention the numbering system for the stars. In work of this kind it is essential to have one's own starlist, which is cross-correlated to other catalogues. In my case the numbering system is TE*nnnnn where the * stands for the particular sky area which is denoted by the letters 'a' to 'i' in Cygnus and 'p' for my one area in Auriga. Area 'a' is the prime one, and the one I'm dealing with now, centred at (J2000) 21h 08m 30s, +46° 30'. The nnnnn stand for five digits so the catalogue can run to 99999 and the TE is for Temple End, where I live, a settlement of just two houses! So, for example, star TEa01732 is in area 'a' and is in fact an eclipsing binary in the GCVS (V530 Cygni). The numbers run roughly in magnitude order, from around magnitude 9 at a00001 and magnitude 14 at a21394 (the last one in the 'a' catalogue currently).

The eight equal areas 'b' to 'i' surround area 'a'. The vast majority (60,000 of 90,000) of the images collected so far have been in area 'a', so we have dense data to study, and that data can be averaged over a night or a season to probe deeper.

The dates in the figures below are all JD or HJD from Jan 1, 2000. The earliest measurements are from 2003, Sept. 6th, date 1344 and currently processed ones run to 13th Dec. 2007, date 2903. The magnitudes quoted in the light curves are for guidance only. They are derived from the R2 magnitudes in the USNO B1.0 catalogue. The magnitude differences will, however, be much more reliable, in some cases good to better than 1 mmag.

Below, in decreasing order of brightness, are the stars to be discussed in this article. The column 'other ID1' is the USNO B1.0 id if it exists, 'other ID2' is a useful id, for example the IRAS reference for a11459. The value MAGM is the maximum magnitude in a red filter, MAGR the variability, and period1 the dominant period in days.

cat. name	other ID 1	other ID 2	MAGM	MAGR	Period1
TEa00121	3588 1106601	GSC 3588-11066	9.25	0.977	294+2940
TEa00169	3588 623801	BD+45?3394	9.36	0.03	0.03333
TEa00255	3593 106701	TYC 3593 1067 1	9.618	0.057	1.57344
TEa00596	3592 425301	TYC 3592 4253 1	10.597	0.047	1.7698

cat . name	other ID 1	other ID 2	MAGM	MAGR	Period1
TEa02726	1367 417232	V356 Cyg. Cepheid	11.51	0.61	5.0572
TEa03238	3588 7601	TYC 3588 76 1	12.12	0.68	2.77384
TEa07269	1358 404638	GSC 3588-2414	12.53	0.12	0.363727•}3E^{-6}
TEa11459	0 0	IRAS 21032+4642	13.3	6.03	472

The stars in the table range 88,000 -1 in period and 2000-1 in amplitude.

Below is basic data from Vizier/ Nomad on the stars.

Star	J	H	K	B	V	R
121	4.668	3.562	2.924	--------- data not reliable ---------		
169	9.367	9.391	9.301	9.669	9.553	9.48
255	9.432	9.378	9.372	10.275	10.061	9.93
596	10.294	10.335	10.33	10.694	10.57	10.5
2726	9.669	9.157	8.935	12.89	12.26	11.26
3238	11.57	11.406	11.336	12.198	12.262	12.3
7269	11.574	11.275	11.112	13.41	12.96	11.89
11459	7.538	6.182	5.349	--------- data not reliable ---------		

For some of the stars we show its setting in a small image sample from Sept 2004, either 121 pixels square (5 arc-min), or 251 pixels square (10.3 arc-min).

TEa00121

Figure 1: Five year light curve of star a00121.

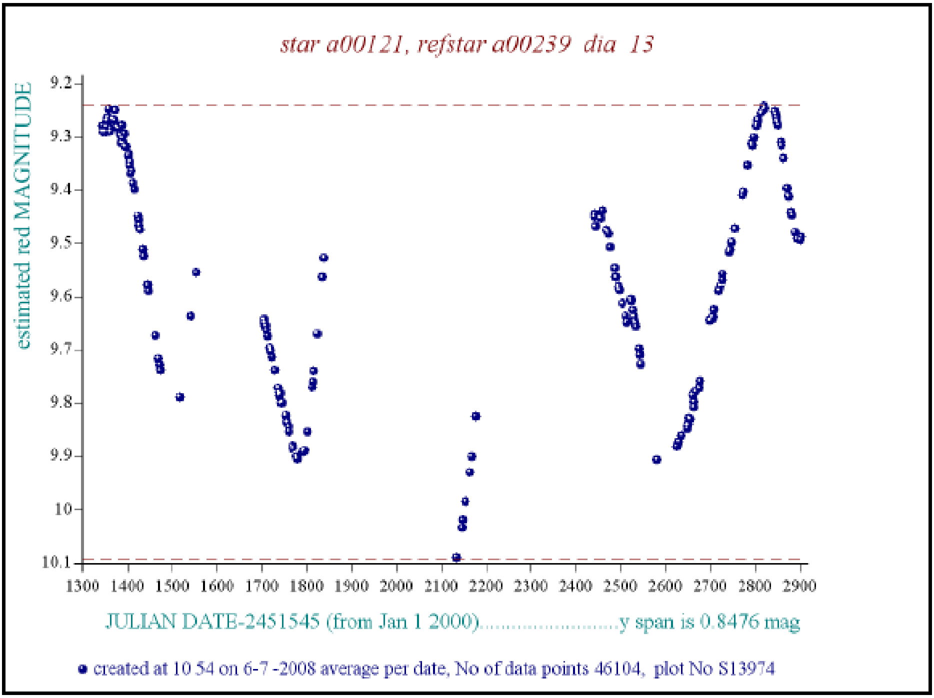
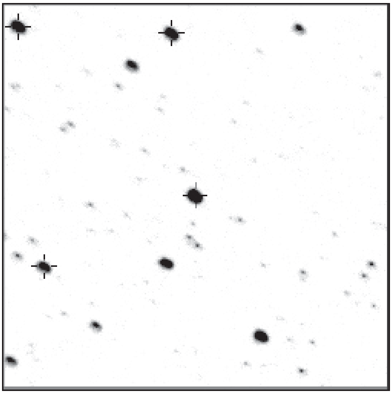


Figure 2: Star a00121



The star images are slightly elliptical because this star is in the corner of the field. There happens to be three other variables in this sample (251 pixels square). The five year light curve is shown above. There are clearly at least two frequencies. The slow one can be only guessed at, and I make it 2940 days. The next most obvious is 5 cycles at about 294 days. Colour temperature estimate: 4105°K. Norman Walker* has done a power spectrum analysis of this star and gets an additional period of 523 days.

RS. In the *J-H*,*H-K* diagram, a00121 is redder than most of Stan's variable stars. It lies in the same part of the diagram as the SRb semi-regular carbon star V Aquilae (C5,4-C6,4, or N6), the Lc-type irregular N-type carbon star SU Andromedae (C6,4), the SRb semi-regular carbon star RT Capricorni (C6,4 or N3) and the Mira variable R Lionis Minoris (M6.5e-M9.0e (Tc:)). V Aql, RT Cap and R LMi all have periods between 300 and 400 d.

LMC red variable stars with log P ~ 2.5-2.6 are extremely luminous, with K ~ 10 and M_K ~ -9. If star 121 has the same absolute magnitude, then $K = 2.924 \Rightarrow d \sim 2.3$ kpc.

This is one of the most westerly of Stan's stars. It is involved in the emission nebulosity north-east of the North America Nebula (NGC 7000). Although a00121 itself is near to the centre of a small fairly dense star cloud, it is in an area of patchy obscuration, and the Vizier data suggest that it is somewhat reddened in the infrared.

This is probably a double-mode semi-regular variable, and possibly a carbon star. The proper motion is $\mu \sim 0.0060$" a^{-1}, although there is a large error. If $d \sim 2.3$ kpc, $v_{tr} \sim 65$ km s^{-1}; in spite of the large uncertainty, this seems a reasonable transverse velocity for an asymptotic giant branch star. **RS**

TEa00169

Star a00169 is one of the highest frequency variables in the list, from area 'a', and has the interesting period of 0.03333 days, or 30.003 cycles a day. A small amount of averaging makes the oscillations more clearly visible, and the plot (Fig.4, page 16) shows a 10 point, or 9 minute average during one night in 2004. The p-p amplitude of the oscillations varies and although the low amplitude makes it hard to be certain of the range, a value between 25 and 29 mmag is most common, but it is often smaller, or a little larger than that. The variability of this star was found by a Fourier search program. It's not sufficiently deviant to show up on a noise scan.

Using simple methods, we can see no change of frequency between 2004 and 2007. The periodogram (2004+2007), (Fig. 3, page 15), shows peaks that are both close to 0.0333318.

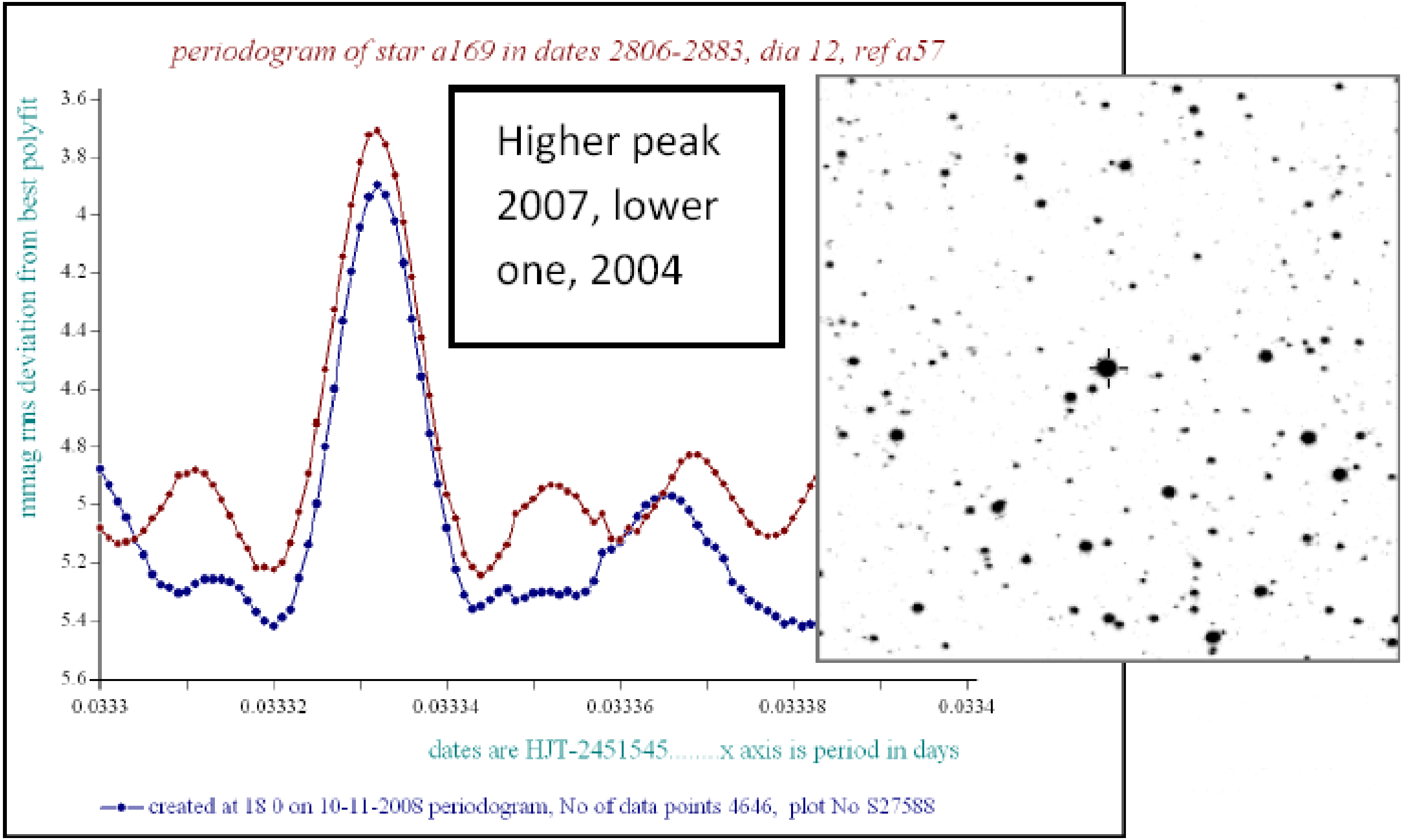
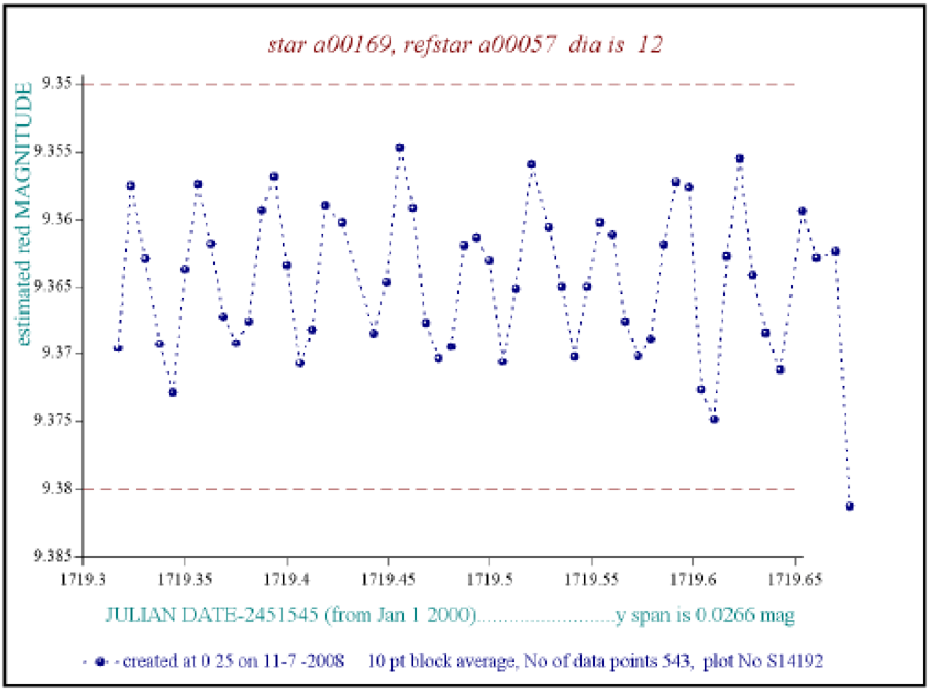


Figure 3: Periodogram, star a00169

Figure 4: Star a00169



RS. According to Vizier, this is an A2 Ib star, with an implied M_V ~ -5. Given that V = 9.553, d ~ 8 kpc. The BVR photometry suggests an early or middle A-type star, around A3-5 V or an earlier-type giant or supergiant. The JHK photometry suggests an early A-type star, and the *B-R/J-K* and *R-J/J-K* diagrams suggest a middle A-type star. The fact that the photometric spectral type agrees with the spectroscopic spectral type shows that the star is at most only slightly reddened ($E_{B-V} \leq 0.07$) and therefore that it is not at the great distance required by its being a supergiant.

A study of the photometric, pulsational and kinematic properties of the different types of pulsating A and F-type stars suggests that this is a short-period early-type λ Bootis star, similar to HD 210111 (NSV25839, in PsA), V1644 Cygni, V1790 Orionis, V346 Pavonis, and ρ Virginis. It is interesting that the λ Bootis stars seem to fall into two subclasses, one with *B-V* ~ 0.09-0.18 and *P* ~ 0.031-0.043 d (log *P* ~ -1.37 to -1.51) and the other with *B-V* >0.20 and *P* ~ 0.11-0.13 d. However, I cannot say whether this apparent subdivision is real. **RS**

TEa00255

We are still not certain what kind of star this is. At first it looked like a Cepheid but it is too hot at a B-V of only 0.214 or a colour temperature of 8,430K. Our measurements make it 8,800K in reasonable agreement. The period has been checked by a correlation method which seems foolproof and at 1.57344 days it is too long for an RR Lyrae star.

RS. On the *B-V, V-R* diagram, a255 appears to be a late A-type star; in fact, it has essentially the same colours as SX Phoenicis. In the JHK two-colour diagrams, it appears to be an early A-type star, which may make it too early for a Cepheid. Stan's 'steps' function gives it T = 8822 K (log T = 3.946), corresponding to a middle A-type supergiant. The *P-L* relation yields M_V = -1.94 for this star, implying d ~ 2520 pc and v_{tr} ~ 30 km s^{-1}. This is all very well, but I am not quite sure about it. Could this be a magnetic Ap star? That would be more consistent with the colour indices and the amplitude. Alternatively, it might be a reddened slowly pulsating B-type star (an LPB in the GCVS), although the colours imply too late a spectral type. **RS**

Figure 5.

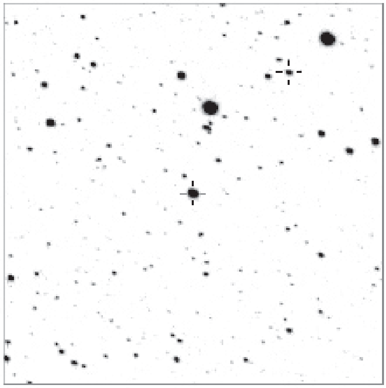
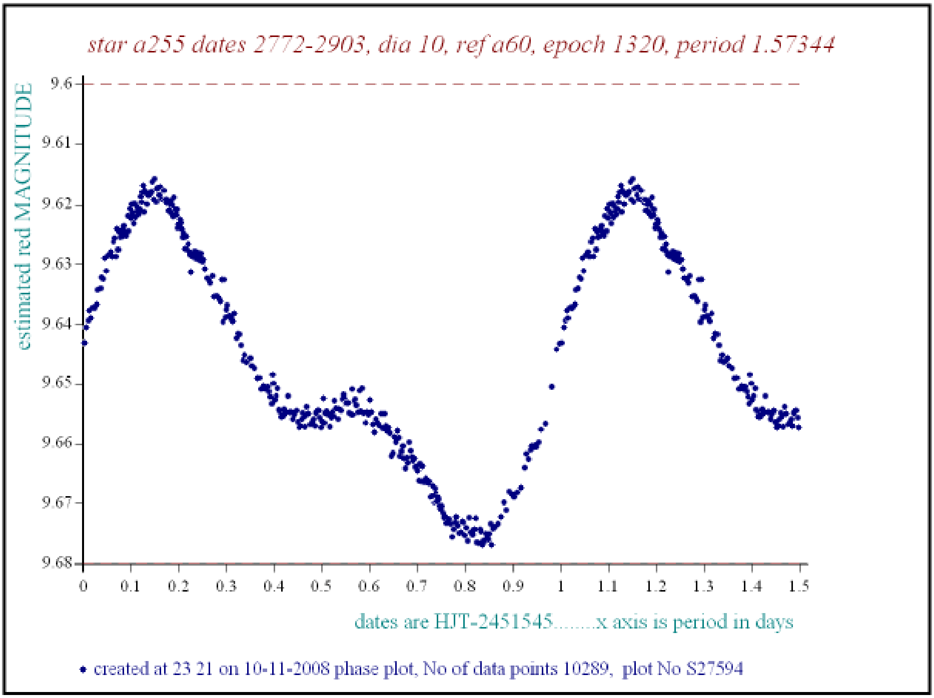


Figure 6: A phase plot of star a00255 from 2007 data.



TEa00596

This star is similar in some ways to the above in that it is hot, the catalogue B-V leads to Tc=9,400K and our approximate measurements to 10,100K. Again the period is too long for an RR Lyrae star, and it's too hot for a classical Cepheid or W Virginis. So what is it?

RS. At first glance, this is an obvious Cepheid variable, with P = 1.7698 d. However, in the *BVR* and *JHK* two-colour diagrams, it appears to be an A-type star. In the *H-K*,*J-K* two-colour diagram, the star has almost the same colours as the hot Siλ4200 star HD 124224 (CU Virginis) and similar colours to those of the B8 IIIp (HgMn) star κ Cancri. In the *B-V*,*V-R* diagram, the star has *B-V* = 0.124, *V-R* = 0.07 and is located near to the A4 V star δ Leonis, but the colours are still quite inconsistent with those of a Cepheid variable. Stan's 'steps' function yields T_{eff} = 10128 K (log *T* = 4.0055), consistent with a spectral type of B9-9.5 V, M_V ~ 0.0, and *d* ~ 1300 pc. The *B-V* colour implies T_{eff} ~ 8400 K, rather too hot for an RR Lyrae star (T_{eff} ~ 6.3-7.6 kK) and definitely too hot for a Cepheid. The *P-C* relation derived from Allen (1973) yields $(B-V)_0$ ~ 0.361, so the star is too blue for its period by $\Delta(B-V)$ ~ -0.24.

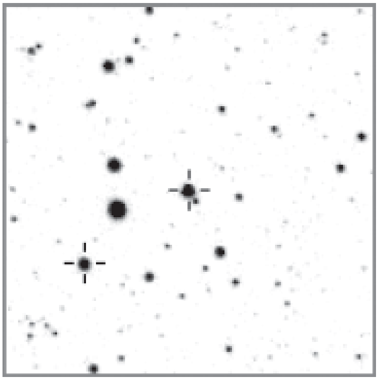


Figure 7.

For what it is worth, BL Bootis, the prototype of the BL Boo stars, has *J-H* ~ 0.209, *H-K* = -0.036, *J-K* = 0.173, and falls among the F-type stars. It also has a much shorter period (*P* = 0.821295 d) and Δm = 0.61 mag. BL Herculis is no better; its spectral type is F3 II-III, and it falls among the F-type stars in all the two colour diagrams. The thing begins to look like a Slowly Pulsating B star (or LPB in the GCVS). These have $(\log T)_{min}$ ~ 4.05, or T_{min} ~ 11220 K, implying a spectral type of about B8. **RS**

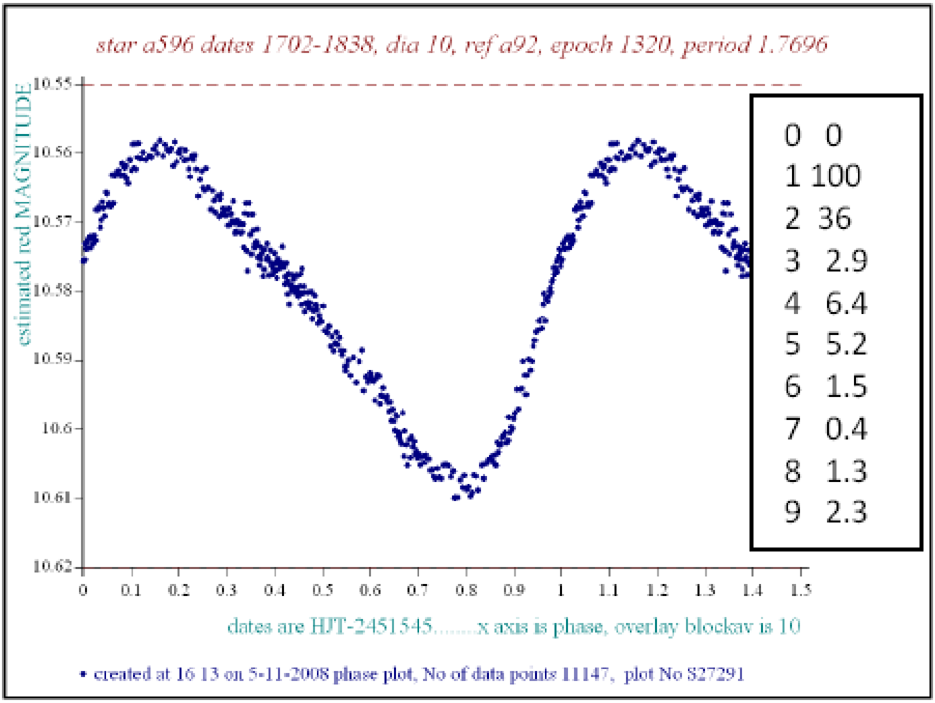


Figure 8: A phaseplot of star a00596 from 2004 data. The table lists the Fourier coefficients for this star in 2004.

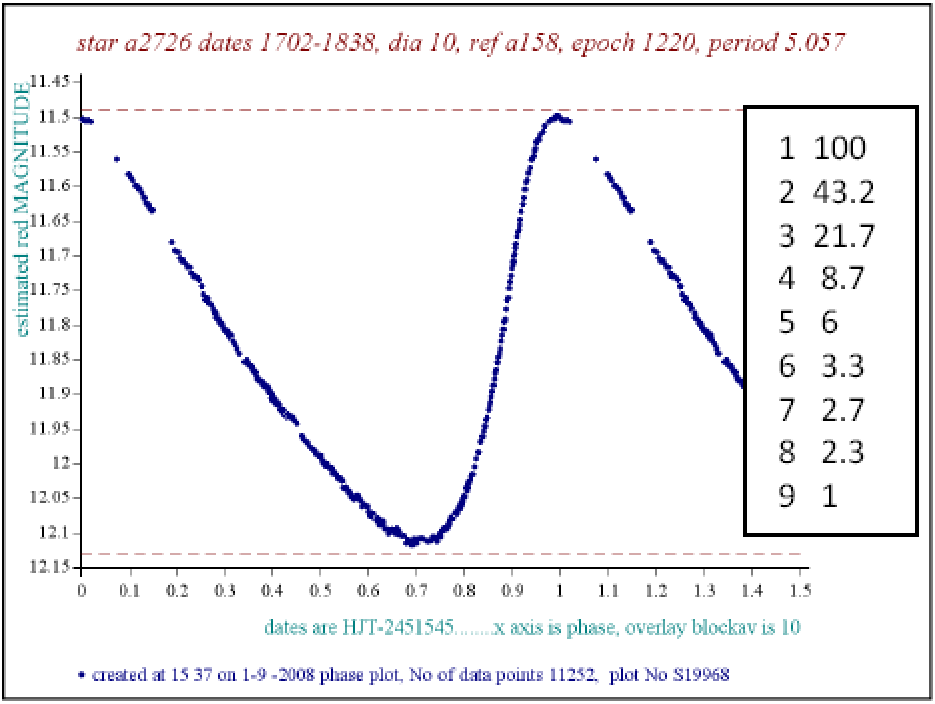


Figure 9: Phase plot of V356 Cygni made from 2004 data.

For comparison, here is a phase plot of V356 Cygni made from 2004 data. The gaps are caused by the period being so near to an integral number of days. The plot has much less scatter than star 00596 (Fig.8,p.18) because, although it is nearly a magnitude fainter, its amplitude is 613 mmags compared to only 49 mmags for 00596. The data for both these plots was captured between 29th August 2004 and 12th January 2005.

The Fourier plot of this phase data (right) shows a smooth, almost exponential decline,the normalised coefficients are on the phase plot above (Fig.9).

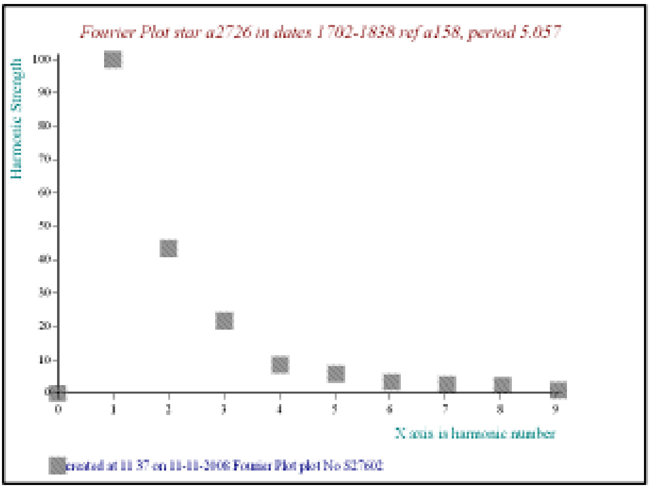


Figure 10: Fourier plot of phase data of V356 Cygni.

Next, an eclipsing binary. With over 100 in the area there is plenty of choice so this one was chosen almost at random. Shown are phase plots from 2007 data. There is no discernable eccentricity.

M1 and M2 have depths of 0.64 and 0.12 magnitudes and half-widths of 8.2% and10.2% respectively. Our measurements suggest a Tc of 7600°K or a B-V of 0.306 which is quite at variance with the numbers above (-0.022).

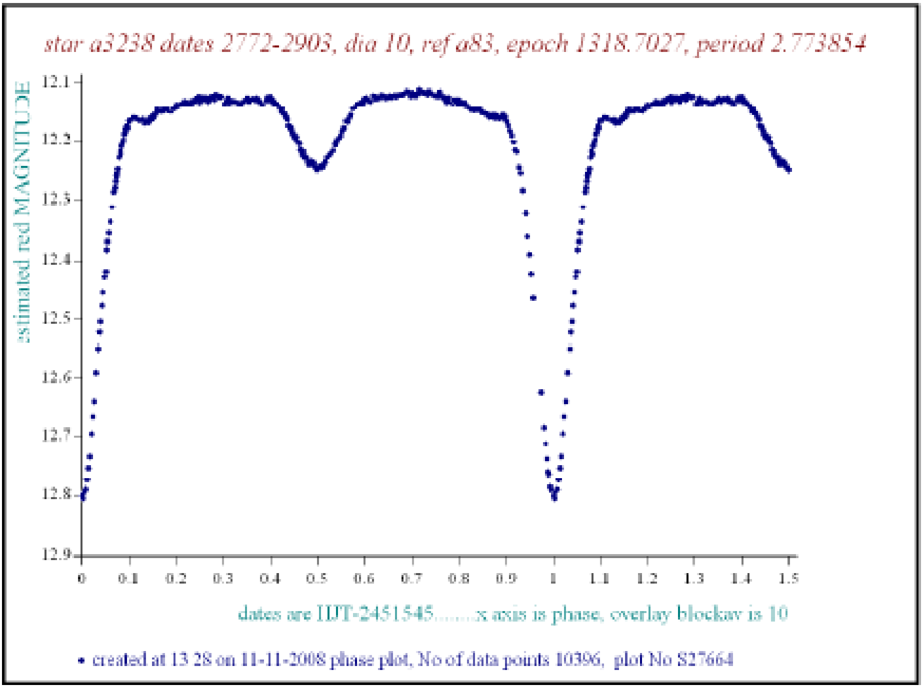


Figure 11: Phase plot of star a03238 from 2007 data.

RS. The observations yield a very good typical semidetached Algol-type light curve. There is a modest reflection effect, with $\Delta m \sim 0.05$ mag.

The BVR colours suggest a late B-type star (about B9), whereas the JHK colours suggest an early F type star; these spectral types are probably consistent with the light curve. The proper motion suggests $d > 1$ kpc and $M_V \sim -0.1$; this absolute magnitude is consistent with a spectral type of about B9, so the star does not appear to be as much reddened as I should have expected from the inferred distance. **RS**

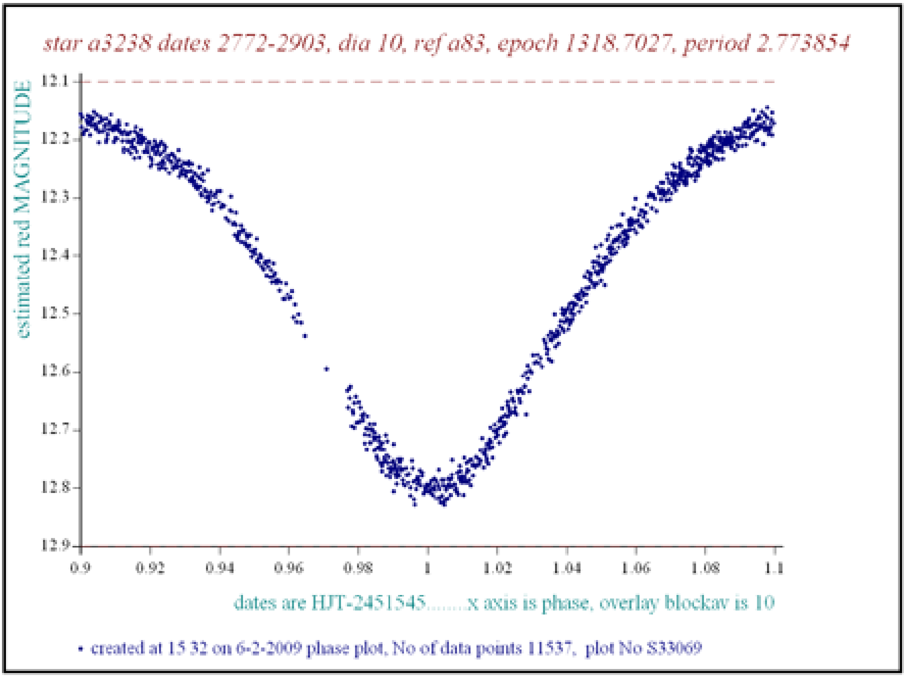
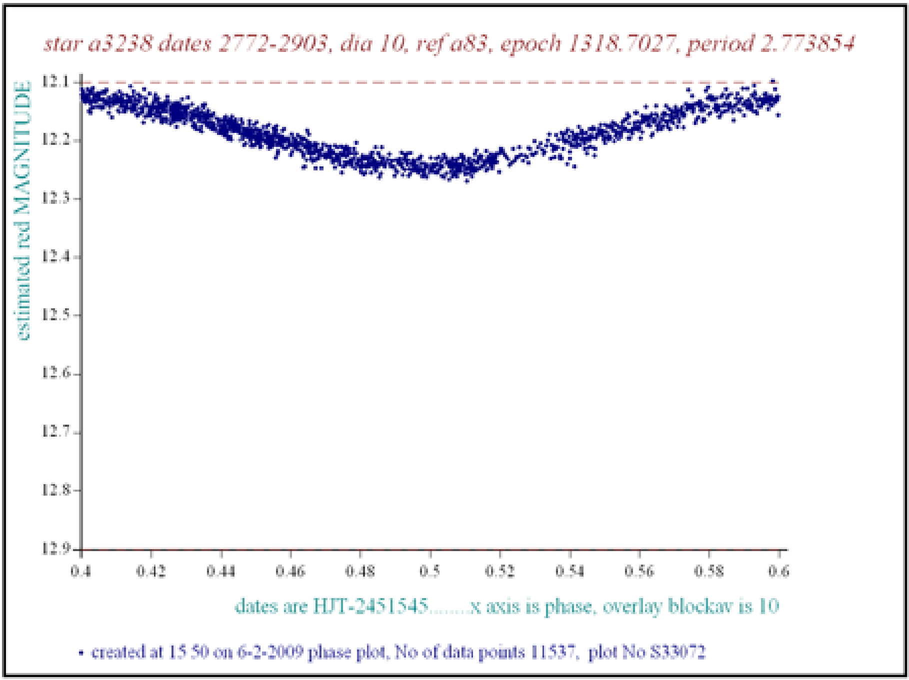


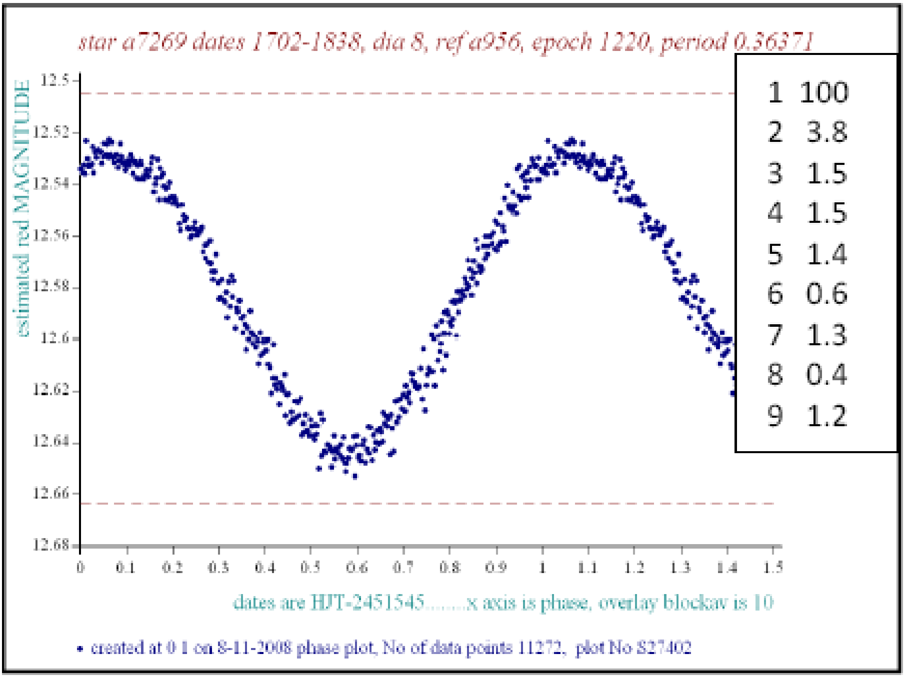
Figure 12: Phase plot of Primary Eclipse.

Figure 13: Phase plot of Secondary Eclipse.



This star is included for the interest that its phase plot is so near to a pure sinewave, only 3.8 second harmonic distortion! The phase plot below is from 2004/5 but a very similar result is obtained for other years.

Figure 14.



RS. An RRc-type pulsating variable. The light curve is almost symmetrical, with $\phi_{min} = 0.50$.
For the period 2003 to 2007 I conclude that $P = 0.363727 \pm 3\times10^{-6}$ d, and there is no evidence for any variation in the period.

The photometric data suggest that this is a late F or G-type star. The JHK colours (J-H = 0.299, H-K = 0.163) are very similar to those of the G2 Ib star ζ Mon. The star is in a dense field, with no obvious evidence of extinction; there are many fainter

Figure 15: Fourier Plot star a07269 in dates 1702-1838 ref a956. period 0.36371

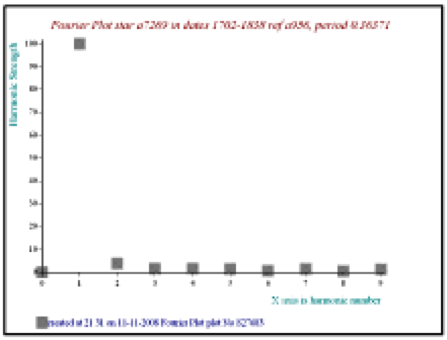
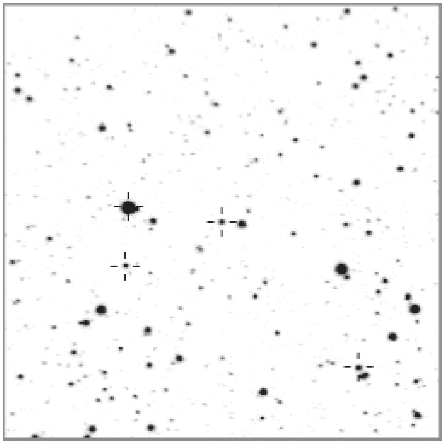


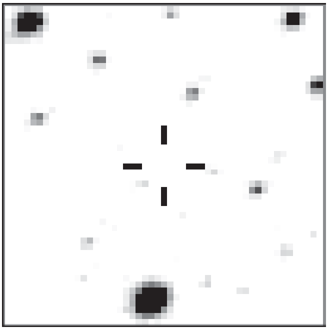
Figure 16.



stars in the field. *B-V* for the star is 0.45 mag., but Allen (1973) gives a mean value of *B-V* = +0.2 mag. for RR Lyrae stars. If $E_{B-V} \sim +0.25$ mag, $A_V \sim 0.78$, so $V_0 \sim 12.96-0.78 \sim 12.18$. With $M_V \sim +0.6$, $d \sim 2.1$ kpc. **RS**

TEa11459

Figure 17.



So far this is the most variable star in area ‘a’ and a special effort was needed. For a star of this brightness, using a 5” refractor, 30 second exposure and processing single images we run out of S/N at about magnitude 15.5. The quantum noise and back-ground noise and errors are about equal to the signal. By adding 100 images that can be improved to about magnitude 18. I don’t actually add the images in fact, but small samples centred on the correct RA and DEC, and previously cut out for every star and every picture. In this particular case it is further complicated by the existence of three very faint companions not many arc-sec away. A few pixels are pared away from the edge of the target star nearest to the brightest interferer to reduce errors when the target star is at its faintest.

Figure 18.

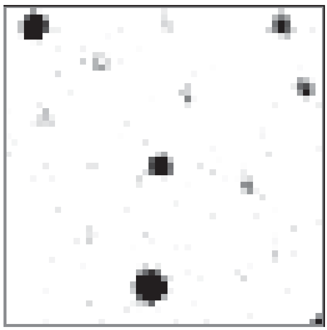


Figure 19.

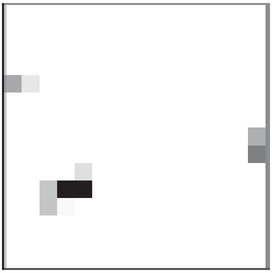


Figure 17, is the star on September 1st 2004 (date 1705) and figure 18 is the star at it’s recent brightest, September 14th 2007 (date 2813). The 1st two clips above are 2.1arc-min square. The three very faint companions can be seen on Figure 19, the third clip, which is 10 times more stretched, and

37 arc-sec square; the target is in the middle and invisible on this clip. The nearest and strongest interferer is 10 arc-sec away from the centre of a11459.

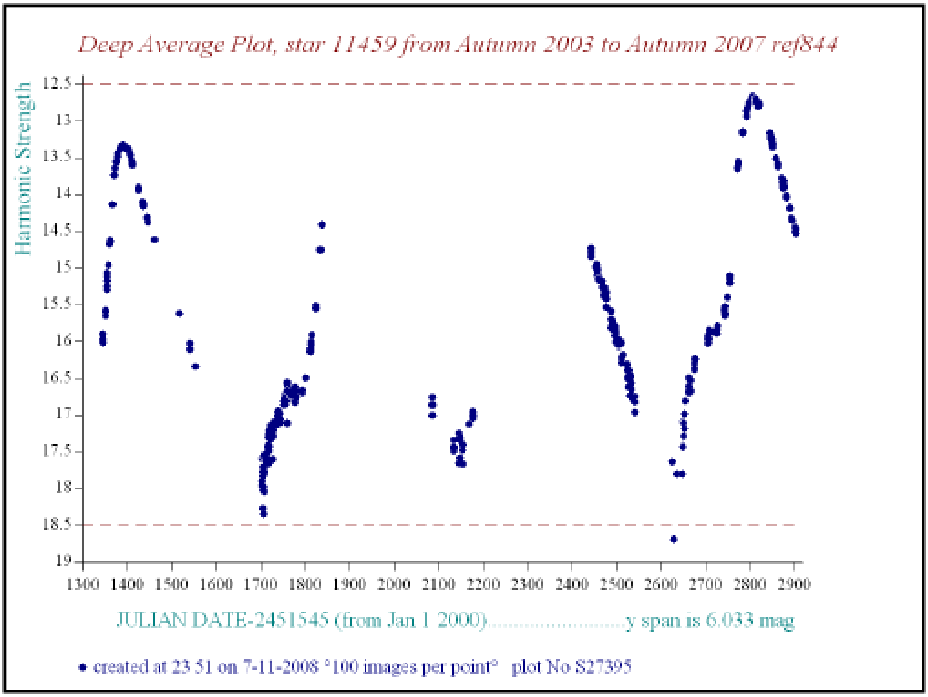


Figure 20: The 5 year plot shows a change of six magnitudes. The downslopes are almost perfectly linear. The upslope has a well defined kink in the two we can see.

RS. A Mira variable, with P ~ 440-470 d.

This is one of the reddest of Stan's stars, and is probably a carbon star.
The pulsation period P ~ 468 d, combined with the formula $M_K = 3.47(\pm 0.19) \log P + 1.00(\pm 0.08) \Rightarrow M_K = -8.3 \pm 0.6$. If $A_K = 0$, the apparent magnitude $K = 5.349 \Rightarrow$ d ~ 5.5$\pm$1.5 kpc.

If B.C. ~ -4.1 mag., M_{bol} ~ -4.2$\pm$0.6 and L ~ 3700$\pm$2000 and $L_\odot$ (log L ~ 3.57$\pm$0.23), consistent with a location of the star on the upper AGB. This appears to be one of the most distant stars on Stan's list. **RS**

* Much more detail on all these stars including Norman's analysis of TEa00121 (and many others) can be found on the website:
www.the-planet-project.com

WR140 AT PERIASTRON

ROBIN LEADBEATER

The Wolf Rayet star WR140 in Cygnus is an archetypal colliding wind binary system, the interaction between the powerful winds generated by the WR and O type stars being a subject of interest for astronomers working at wavelengths from radio to X-ray. The system has a period of just under 8 years, but because of the high eccentricity of the orbit, much of the action takes place within a few weeks either side of periastron. This last occurred on 12th January 2009 (1).

As part of the campaign for this periastron an international team of amateur spectroscopists, supported by a number of professional astronomers, covered the daily unfolding of the event at optical wavelengths using medium resolution (R~4000) spectroscopy (2). The objective was to refine the orbit parameters and detail the wind-wind interactions with more continuous coverage than had previously been achieved. The core of the program was undertaken using the little used 0.5m MONS telescope at the Izana Observatory, Tenerife which was made available free of charge. This was equipped by the team with a suitable spectrograph and continuously manned throughout the three months around periastron; (including Christmas and New Year!). These observations were supplemented by some from members' home observatories, resulting in almost daily coverage despite the usual unpredictable weather at this time of year.

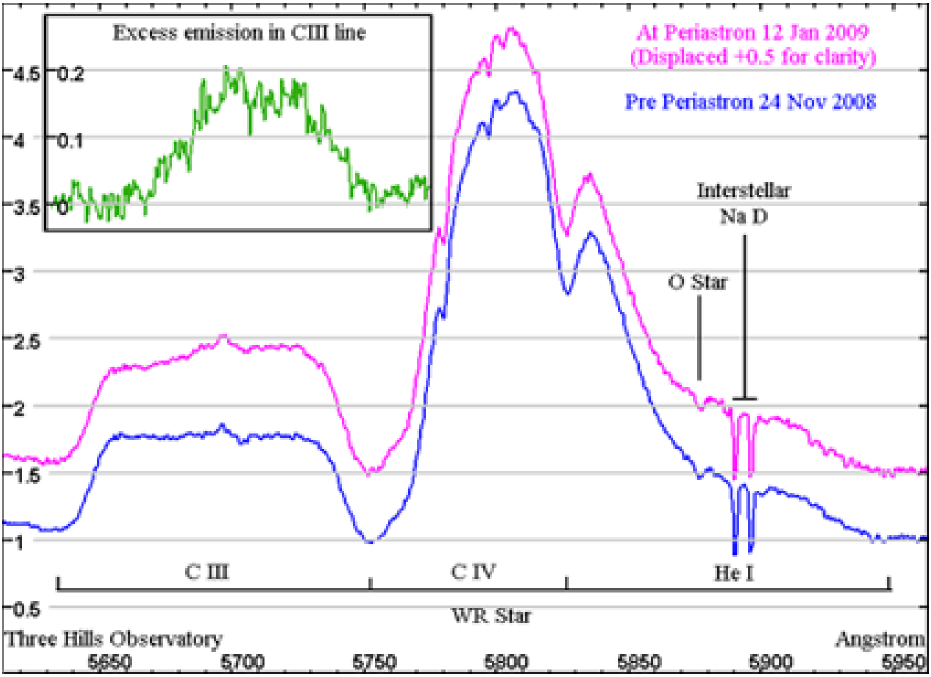
Although the changes in the optical spectrum are subtle, amounting to only a few percent of excess emission superimposed on the usual broad emission lines from the WR star, members honed their observing and data reduction skills in the run up to the campaign and it proved possible to track the changes with good precision.

The team plan to publish a full analysis of the results in due course, however an idea of the changes can be gained from example spectra of the CIII,IV,HeI line region (5600-6000A) presented here (Fig.1, page 26). These were recorded at my observatory before and at periastron using a 200mm aperture and a LHIRES III spectrograph (3). The exposures were typically 2 hours total duration to achieve a signal/noise of ~100. The excess emission is clearly visible, superimposed on the broad CIII line of the WR star. Also highlighted is a typical absorption line from the O star which can be used to measure the radial velocity to a precision of ~10km/sec to more accurately tie down the orbital parameters of the system.

At time of writing most of the detailed changes in the optical spectrum have subsided following periastron. However it is possible that dips in brightness, thought to be due to generated dust, will be seen for several months following periastron, similar to those seen in 2001. These each lasted typically a few days and were of the order of 0.1-0.2 magnitude, greatest in U but also seen in B and V (4)

(1) *www.roe.ac.uk/~pmw/Wr140int.htm*
(2) *www.stsci.de/wr140/index_e.htm*
(3) *www.threehillsobservatory.co.uk*
(4) Astrophys. J., 596, 1295-1304 (2003)
The unusual 2001 periastron passage in the "Clockwork" colliding-wind binary WR140. Marchenko et al

Figure 1: Comparison between spectra taken at Pre Periastron, and at Periastron



www.journals.uchicago.edu/doi/abs/10.1086/378154

robin_astro@hotmail.com

CSS 081231:071126+440405

David Boyd

This newly discovered variable in Auriga (Figure 1), announced by the Catalina Sky Survey website on 2008 December 31st, has one of the most unusual light curves I have observed. Its position is RA 7h 11m 26s, Dec 44° 4' 5". Current opinion seems to be that it is an AM Herculis type cataclysmic variable. These are binary systems in which a small hot white dwarf, with a strong magnetic field, is sucking material from a larger cooler companion star. This material is accelerated in an accretion stream directly onto the magnetic poles of the white dwarf, so doesn't form an accretion disk as happens in non-magnetic CVs. The absence of an accretion disk, and the concentration of energy in the accretion streams near the magnetic poles of the white dwarf, means that the bright source in the system is very small. This should result in very sharp and very deep eclipses which is exactly what we see.

While I was observing it, the object spent most of its time between magnitudes 15 and 16.5, but every 1 hr 57 min, as the two stars orbited each other almost edge-on to our line of sight, there were deep eclipses during which it dropped to mag. 20 (Figure 2). As the images appeared one after the other on the screen, the change in brightness of the star in real time was dramatic. At the beginning of the eclipse the light level dropped rapidly by

3 magnitudes in about a minute, then faded by a further 1 mag over the next 3-4 minutes, before regaining its full brightness in less than a minute. There is a large orbital hump in the light curve, roughly symmetrical about the eclipse, and a shallow eclipse a few minutes before the deep one, possibly caused by the accretion stream occulting the hot spot near the white dwarf pole. The large orbital hump may imply that the magnetic axis of the white dwarf is tilted quite far over towards the secondary star so that the accretion stream onto one pole is much brighter than the other. The variation in the light curve from one orbit to the next is possibly due to the blobby nature of the accretion streams.

Altogether a fascinating object well worth observing.

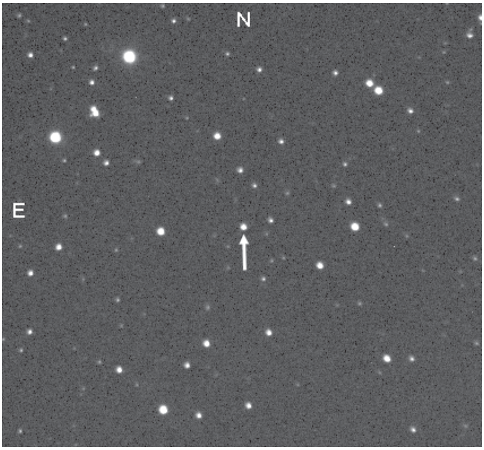


Figure 1: Field of CSS 081231:071126+440405, 2009 Jan 3.000 UT, 60 sec exp, 9’x9', 0.35-m SCT f/5.3 + SXV-H9 CCD.

Figure 2: 6hr light curve of CSS 081231:071126+440405 on 2009 Jan 2/3.

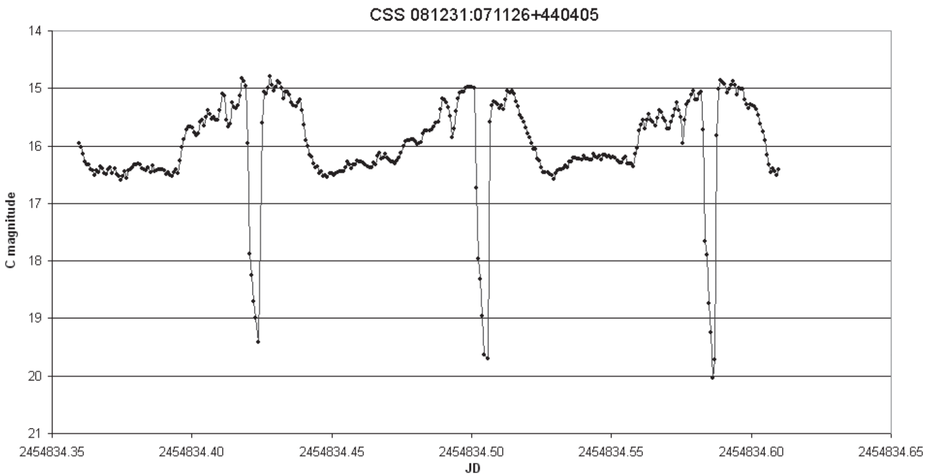


CHART NEWS - R COR0NAE BOREALIS.

JOHN TOONE

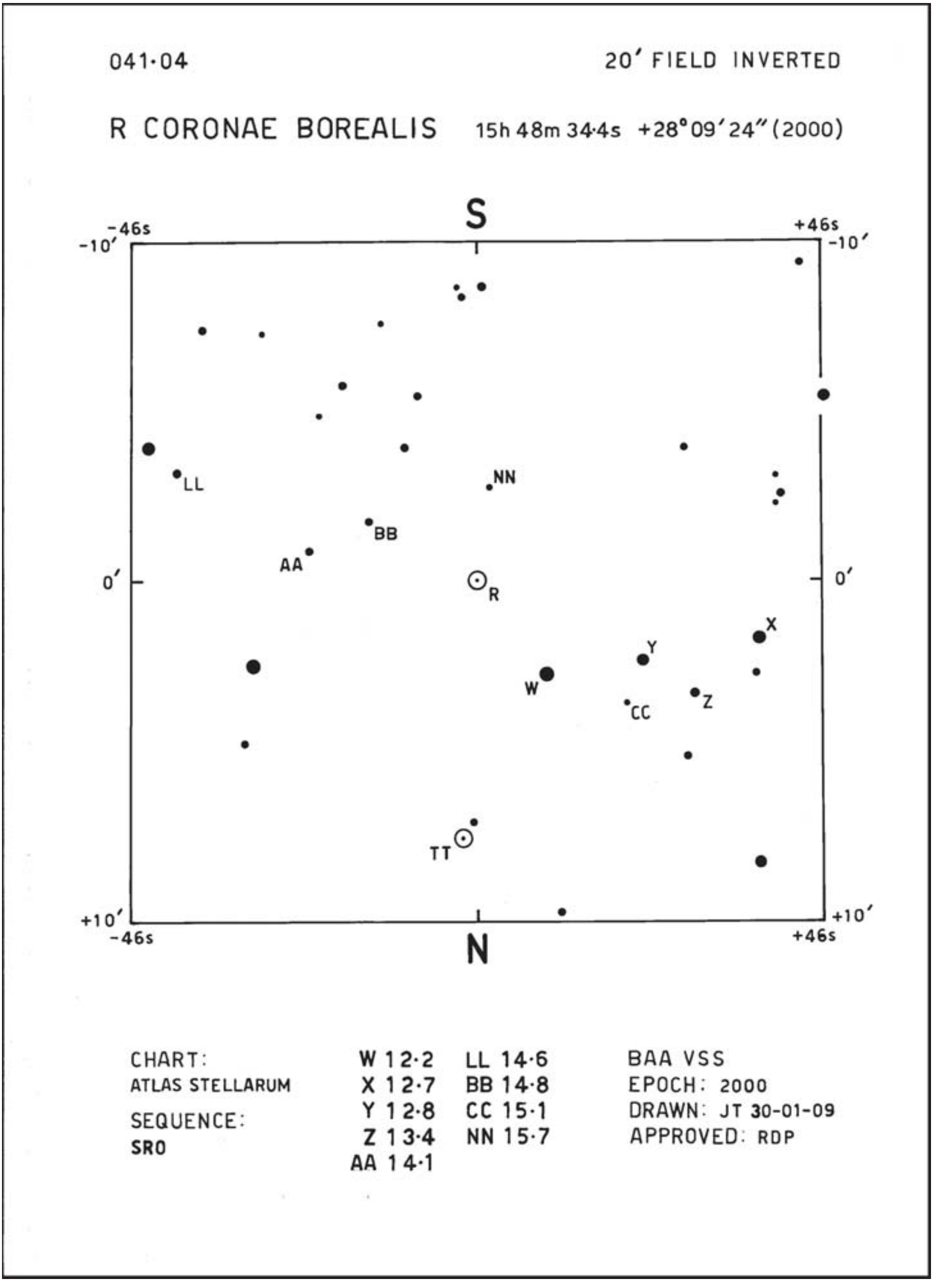


Figure 1: New Chart for R Coronae Borealis.

The current fade of R Coronae Borealis which began in July 2007 is one of the deepest on record. On the 27th January 2009 I secured an observation at magnitude 14.8, but the two step estimates using comparison stars BB and DD were discordant. Roger Pickard had measured the faint end of sequence 041.03 in early August 2007 when R Coronae Borealis was rapidly fading, and found serious discrepancies below magnitude 12.6 (comparison X). This problem was confirmed a year later when the AAVSO released a new sequence which used ASAS3 and CMC14 photometry. When I re-reduced my step estimates of the 27th January 2009 using the AAVSO sequence the discrepancies were eliminated and the deduced magnitude became 15.0. This very faint state has been confirmed by CCDV measures submitted to the AAVSO. According to the BAA VSS database (data input complete back to 1920) there are only a couple of observations fainter than this, when re-reduced to the latest AAVSO sequence:

JD2438617.40 (July 1964)	=CC	15.2	R220	B A Carter
JD2438859.39 (April 1965)	=CC	15.2	R320	B A Carter

The above observations were made during the second longest recorded fade of R Coronae Borealis which occurred between 1962 and 1967. The only recorded instance of a longer fade was during the years 1863 to 1873. The GCVS assigns a minimum magnitude of 14.8 for R Coronae Borealis, but this is likely to be derived from old data measured against the old sequence which was (as we now know) both discordant and poorly calibrated. On the evidence of the BAA VSS database (the only database where data can be re-reduced using source estimates) R Coronae Borealis is very close to an historic faint level and it is important that observers monitor it very closely over the forthcoming apparition. To assist observers in reporting accurately calibrated observations, the BAA VSS chart has been amended to correct the sequence at the faint end. Therefore with immediate effect please use chart ref 041.04 for reporting data in the future.

One additional amendment incorporated into chart 041.04 is that comparison star D is dropped on account of its orange colour which causes issues when R Coronae Borealis is at maximum light. This was the conclusion of a BAA VSS alert discussion in July 2007 involving Colin Henshaw, Mike Gainsford, Wolfgang Renz and myself.

R CORONAE BOREALIS – ONE HUNDRED YEARS AGO

John Toone

When Colonel E. E. Markwick took on the directors role of the BAA VSS at the turn of the twentieth Century, one of his immediate actions was to introduce a programme of twelve variable stars that the observers of the VSS were requested to concentrate their efforts on. This combined with the imposition of standard fixed sequences meant that densely packed light curves were very quickly produced by a relatively small team of observers. One of the most important stars on that original VSS programme was R Coronae Borealis.

In 1909 there was a major fade of R Coronae Borealis which was well covered by six VSS observers listed as follows who accrued a total of 433 observations:

57	C. L. Brook	83	A. N. Brown	100	F. de Roy
63	E. E. Markwick	64	A. A. Nijland	66	P. M. Ryves

The report and light curve for 1909 (drawn by Markwick himself) was published in the Journal of the BAA in May 1910 and an extract from the report is reproduced below:

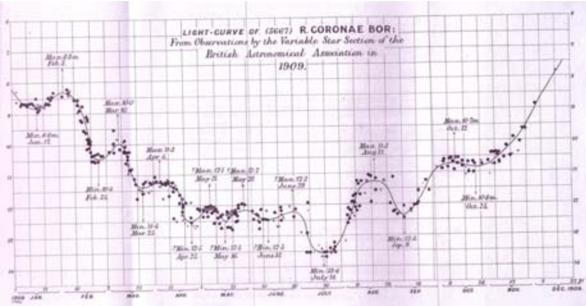


Figure 1: BAA VSS 1909 light curve for R Coronae Borealis by Colonel E. E. Marvick. (*See inside front cover.*)

"The fluctuations of SS Cygni are interesting enough, but we question whether they are not surpassed in this respect by the extraordinary evolutions in the light of R Coronae Borealis in 1909, which are illustrated in the accompaning plate. Here we have the principle curve, which declines from near the 8th mag. at the beginning of the year to a minimum of 13.6mag. on July 18th, after which a general rise takes place, the star arriving at about 7.8mag. on December 18th. Superimposed on this main curve are many minor inflexions, most of them well marked, so that the light-curve resembles the bends in a suspended rope violently agitated from one end.

In the descending curve each fluctuation consists of a deep drop, followed by a comparatively slight rise, thus resembling a steep step on stairs, with a narrow foothold. After minimum the process seems to be reversed, the rise being well marked and the fall comparatively small. This minimum is in every way different to that observed in 1905, when there were few or no minor fluctuations. The mean of the intervals between successive maxima is 35.9d., of minima 33.0d., taken respectively from 8 maxima and 9 minima.

No.57 of the Publications of the Potsdam Observatory consists of an elaborate monograph on this star, by Ludendorff, and many observations by members of our Section are utilised therein. All the important observations are given, from those of Pigott in 1783 up to September 1905, as well as graphical representations of the light-curve. Those of 1859 and 1883 resemble in some respects that of 1909, but I am doubtful if this type of variation has ever been determined before with such exactitude and assurance as we have secured in the past year. A single observer, unless he is extraordinarily lucky and very industrious, can hardly hope to get at such comparatively short and small fluctuations as are now dealt with."

The descriptive style of this report is quite dated with references to suspended rope and steep stairs but when one examines the light curve the phrases used are instantly recognisable. The scatter in the data is relatively small for visual photometry and as Markwick pointed out the collective efforts of the six VSS observers was bringing out fine detail in the light curve that had not been previously recorded. The reference to 'minor inflexions' with a mean period of 33.0-35.9 days is particularly interesting because this was many decades before R Coronae Borealis was recognised to have semi periodic pulsations. Between 1972 and 1991 several periods were reported for these pulsations ranging from 27 days to 74 days but often settling on 44 days. In 1991 Cottrell, Lawson & Buchhorn (MNRAS, 244, 149) suggested that the pulsation light curve may be convolved with the decline light curve in its early stages depending upon the pulsation phase at the onset of the decline. Since the BAA VSS data from 1909 is derived from just six experienced observers who observed quite intensively using a single sequence the errors will be relatively small from a visual photometry aspect. Therefore this light curve from 1909 might provide early evidence of the pulsations of R Coronae Borealis and that the period may have lengthened subsequently.

On a final note, this report and light curve is a testimony to the mature and fine status that the VSS was in one hundred years ago, which was still a time when no other variable star association was in existence.

VARIABLE STAR WORKSHOP Saturday 18th October

James Clerk Maxwell Building, School of Physics and Astronomy, University of Edinburgh.

Part 2

OBSERVING VARIABLE STARS WITH BINOCULARS.

Melvyn Taylor

The construction of a binocular was shown by aid of a cross-section, and basic specifications were explained, as well as the usual problem when using a high magnification, of mounting the device in order to view stable images. A few proprietary forms were described such as a universal L-bracket, or a hinge clamp for fixing via a heavy tripod to the very useful parallelogram (giraffe-like) device, that allows the binocular to be positioned into a fixed position. The latter is an ideal situation when showing others the sky, assuming that someone does not make a grab, shifting the binocular position, hence mis-locating the object which should be on view. The parallelograms require a very sturdy tripod, possibly a surveyor's, rather than a camcorder/camera type. Several other ideas have been used, for example, a garden lounger converted to rest the observer in a comfortable position, and support the binocular at the observers' eyes. Light estimates of a star made with the same hand-held binocular in comparison with a mounted one will differ slightly. Some large sized instruments are available on a customised tripod. These may use angled eyepieces for ease of viewing, and have interchangeable eyepieces to change the magnification and field size. When selecting a binocular for hand use, it would seem sensible to actually handle the binocular, check several aspects of it, before purchasing.

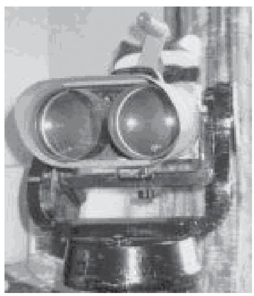


Figure 1: George Alcock's 25 x 105 tripod mounted binoculars.

Several binocular styles relate to optical design, for example, the roof prism, Zeiss porro prism, the terrestrial (straight-through), and Galilean style of opera-glass. Prism quality is also important for the ultimate aim of image quality, with modern BaK-4 type being subtly superior to the BK7 glass. Focussing mechanisms that provide a crisp image are either centre-focus, the most common, or with the eyepieces having their own movement. Though optical distortions, collimation of a faulty instrument and lens coatings were not described in detail, these aspects are worthy of study. In quality binoculars all air-to-glass surfaces are multicoated, which means that ghost images and internal reflections are reduced. The centre bridge, that gives eye access to the eyepieces, should not be too slack, the motion smooth if even a bit rigid. Similarly the focussing action needs to be smooth and not jerky, which would upset the precision required to image stars as near pin-point.

Simple Tests for Binoculars.

Mechanical:

- Check for hinge movement, anything rattling, loose screws, and smooth focussing (central or eyepiece).
- The position of the threaded mounting bush is relevant, as it is either on a barrel, or in line of the centre spindle, and this may dictate how to mount the binocular.
- Each barrel should have its optics collimated, but it is also a matter of importance that the axes of both barrels are parallel in the same plane. If the axes are mis-aligned the field will not appear wholly circular, and it would be like seeing two circles slightly offset to the other. This defect is not good for the observer's eye status, and would affect one's eyesight if used over time.

Condition:

- Check for internal blemishes (mildew or paint flecks on the optics), by turning the binocular around and inspecting the objectives against various lighting angles.
- Personal experience over a plastic carrying strap that became brittle, then broke, instantly presenting me with a monocular and a broken barrel, meant a sturdy (non-plastic) strap was obtained.

Coatings:

- The best coatings can be judged by looking down on the objective, with a hand over the eyepiece, and examining reflections. A totally white reflection means the optical surface is not coated. Multi-coatings reveal reflections that are noticeably fainter.

Exit Pupils:

- Check if round with no grey edges, and if no internal parts visible.

Distortions:

- Check star 'shape' when moved to near the edge of field.
- 'Line' distortions – Try looking at a thin vertical or horizontal element (a radio mast, or aerial) through one barrel at a time. It should display minimal curvature and little false colour to its edges.

Throughout the history of binoculars, image quality and body shape have been improved through a multitude of factors. For example: the hinge, glass quality, achromatic improvement, miniaturisation, anti-reflective properties, and the fairly modern aspect of image stabilisation that gives superb views without the need for a mounting.

For visual observing, one of the important quantities is the size of the observer's pupils under working conditions (dark, or light polluted), since it is important to try to match this to binoculars with the right sized exit pupil (aperture in millimetres divided by the magnification). The writer's 16x70 Swift is showing its exits in figure (2) below. It is wise and economic to match the instrument exit size to the observer's actual working pupil. There is little point in wasting the 7 x 50 (7mm diameter) area, if your adapted pupil is say 5mm, for which a 10 x 50 binocular would be better. There is an approximate relation of 0.35mm reduction in adapted pupil size per 10 years. Sky Publications, market a small device that allows the pupil size to be assessed. Alternatively it may be measured with some experimentation, and the aid of a sequence of tiny holes separated by a variety of millimetres in a thin piece of black, plastic. (A small diameter sewing needle heated to assist creating small holes and handled with pliers is one suggestion.) Dark adaptation takes a long while to be 'finalised', so use a fixed amount of time, say 5 to 15 minutes, before checking the exit pupil size. Several ways of aiding the process are well known but not appropriate to publish openly. Most visual observers will have an assessment of their dark adapted pupil size.

observer's pupil	**suitable binoculars**
5mm	10x50
7mm	9x63 or 10x70
8mm	10x80

Ideally aperture in millimetres divided by the magnification should match the observer's adapted pupil size.

This writer's age, and light-polluted observing situation, is not amenable to anything above a 5mm diameter exit pupil, but in a (rarely used) dark, unpolluted sky this could change to a 6 - 6.5mm. In light-polluted areas, or using a site surrounded by lights that may stray into the aperture, two dew-shields help the situation and assist keeping optics less damp.

Figure 2: 16x70 with its exit pupil, side guard and clamp.

The effective range in magnitude that an instrument will 'see' depends on several factors but the basic specification and simple formula of 2+5logA (mm) gives a check on the faintest star visible. Very few observations should be made near the limit of the optics, with the usual wisdom indicating to choose stars varying in the range about 1 to 4 magnitudes brighter than the theoretical or practical cut-off brightness. (The two criteria are very likely to be different!). My 16x70 under local skies may allow T Coronae Borealis to be seen in its usual state, say about magnitude 10.5, so this binocular is usually honed on objects that vary from about 6.5 to 9.5 magnitudes. An 8x40 with a theoretical limit of about 9.0 will be used on variables varying between about 4.5 to 7.5; this instrument and observer struggle to get magnitude 8.5 stars. (I hasten to note that observing is mainly done under a bright light dome of Wakefield, West Yorkshire, and it is a delight to see fainter in different UK or overseas locations).

In an attempt to suggest improving visual observation, a slide offered a few pointers, but several items were not that serious! The content is reproduced here:

How to improve visual estimation.

Avoid: Cloudcover, mis-identification, date/time mistakes, bias(!), pre-conceived values of comparison star magnitudes, transcribing an incorrect record, very low altitude objects (except in some circumstances, e.g. novae, supernovae), bright (moonlit or twilight) sky, hazy conditions, stepping on pets (the local hedgehog), ‘live’ electrics, opening fridge door (unless astronomy friendly lit), dropping important things (flask of warm soup, kendal mint cake, chocolate).
Choose and use: (If possible) best quality and state of optics, same optical system for the phase of the object, objects not near limit of observation, consistent use of comparisons of similar colour, and those that are close to variable in distance, comparisons that have a small brightness difference between them, check the optimum line of position angle joining variable and comparison(s), a consistent method of light estimation, an amount of time for dark adaptation, a comfortable posture and warm clothing (obvious?), the frame of mind: i.e. no hurrying, enough down-time after a traumatic day, use anger-management methods in case of local (neigbourhood) circumstances, i.e. the house and garden lighting policy may well be different from the observer!

The importance in recording an accurate time of observation, as well as correct date, possibly by using a radio controlled timepiece was made.

Figure 3.

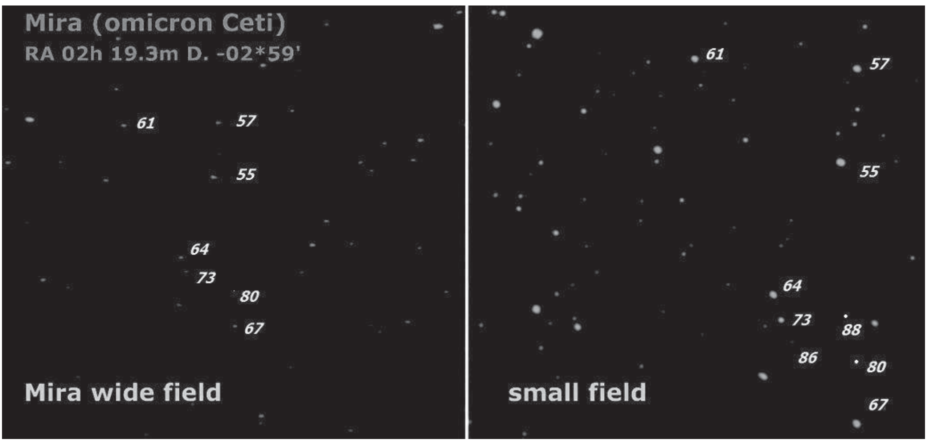
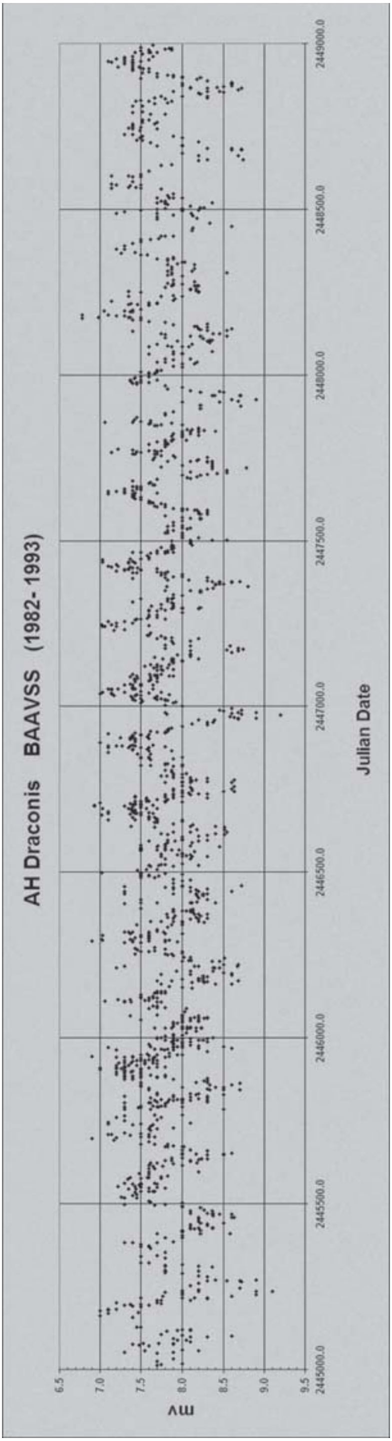


Figure 4.



A method of finding star fields, and positively identifying an object, was highlighted by an example of the visibility, and magnitude of omicron Ceti (Mira) from two different scaled images with implanted comparisons, shown in figure (3) opposite page. Relevant VSS charts were also shown in relating the problem of field orientation and size. The VSS charts, drawn mainly by John Toone, are often used in conjunction with larger fields for aiding the initial search area, these being prepared from drawn atlases or planetarium style software. On trips where A4 size charts may be a handicap, the writer has a set of ‘abbreviated’ VSS charts hand drawn (black permanent ink) to 10cm square and corner tagged for easy use.

The BAA VSS programme of binocular variables was briefly described, with several type stars emphasized either in relation to its field and comparisons, or with a VSS light-curve showing the kind of variation, figure (4). A few programme stars were shown as examples of a variable class to indicate problems like the Purkinje effect, or where comparison stars are well placed in relation to the line joining the variable. It is well known that different estimates are made when these ‘lines’ are either horizontal or vertical. The case of rho Cassiopeiae the hypergiant which is varying 4.2 to 6.8 magnitudes in extreme, shows large scatter between observers, and individuals may consider their estimate not worth reporting, which is not the case. Please report light estimates as observed with no alteration. Due to perception of coloured stars, some observers try to reduce the hue by expanding the stars into de-focussed discs thence using the fractional method of estimation consistently to make the estimate. Other typical stars observable with binoculars were; AH Draconis, AC Herculis, X Ophiuchi, chi Cygni, TT Cygni, R Scuti, AG Pegasi, R Coronae Borealis, AB Aurigae, and SS Cygni near maximum.

Observers who like to see variations over shorter time scales than the general slower classes, could take on several of the eclipsing binary variables like RZ Cassiopeiae, W Ursae

Majoris, HU Tauri, U Cephei and the easily found VV Orionis. This latter object is near the famous belt stars, but its beta Lyrae type variations are small, about 0.4 and 0.2 mag. amplitude so very near the practical limit for a serious visual observer.

WHY OBSERVE VISUALLY IN THE 21ST CENTURY?

John Toone

This is an outline, of the presentation given at the VSS Variable Star Workshop in Edinburgh, on the 18th October 2008. See page 40, for the report of the 'Visual Observing Experiment', which formed part of this presentation.

A short summary of visual observing of variable stars was outlined. Visual observing had been in widespread use for 160 years, dating back to the 1840's, when astronomers took Argelander's lead and started to regularly record magnitude estimates of variable stars. Prior to the Millennium, the majority of light curves of variable stars had been constructed from visual observations, produced in the main by amateur astronomers. There are two principle methods of making visual magnitude estimates, namely fractional, and step. The fractional method uses two comparison stars, and the observer estimates (in fractions) the brightness of the variable, relative to the two comparison stars that nearest bracket it in terms of brightness. The step method involves a single comparison star (although it can be done with several comparison stars individually) where the observer estimates the step difference between the variable and comparison star. The fractional method is easiest to use, and beginners tend to use it. The step method is often, really only for the experienced observer who has trained their eye to measure steps of 0.1 mag. Visual observations are measured, recorded ,and reported to 0.1 magnitude, although the accuracy attained is probably no more than +/- 0.2 magnitude. There are systematic differences between individual observer's visual data, and this is primarily due to the differing colours of both the comparison stars, and the variable star, and the colour sensitivity of the observer's eyes. The visual method has been under threat for 100 years, now by electronic devices that can attain much greater measurement accuracy.

To illustrate the perceived threat of modern electronic measuring devices (CCD's), it was pointed out that although there was an equal split between CCDV and visual data (44,000 observations by each group) submitted to the VSS in 2007, the CCDV data was acquired by just 5 observers, compared with 33 visual observers. Therefore by examining recent raw statistics, it would appear that visual data is not only less accurate than CCD data, but is also less efficient in terms of acquisition.

So onto the title of the presentation: 'Why observe visually in the 21st Century?'

Firstly, a light curve was shown combining the two leading VSS observer's data on SS Cygni in 2007. Roger Pickard (CCDV), and John Toone (visual), made 140 observations of SS Cygni. The CCDV observations were all made on one night (time series) whereas the visual data was spread over 140 nights. Consequently the light curves of the individual data sets looked entirely different but both were scientifically useful. The CCDV dataset confirmed variation in the order of 0.2 magnitude in just a few hours whilst the star was at minimum light. The visual data on the other hand showed the full range of variation (4 magnitudes) throughout the year including four outbursts. Therefore this example illustrated how visual and CCDV datasets can compliment each other. Visual data can show the overall variations, to a lower but acceptable accuracy level, whilst CCDV data can accurately record micro variations over a limited time span.

A series of light curves were then shown illustrating combined visual, and CCD data submitted to the AAVSO in 2007 and 2008, and was presented through the AAVSO light curve generator:

SS Cygni is probably the favourite target for AAVSO CCD observers and the light curve for 2007/2008 was well covered by CCDV observations which showed all of the outbursts. However, there were still some minor gaps in the light curve that were fortunately plugged by visual data.

U Geminorum was still well covered by CCDV data, but the gaps were larger than with SS Cygni. The light curve covered the 2007/2008 apparition which was extraordinary in that it had four outbursts. The first outburst at the very start of the apparition was only recorded by visual observers so it is thanks to them that four outbursts were recorded in an apparition for the first time. An erroneous mini rise of U Geminorum was recorded by CCDV around JD2454583 which was probably due to misidentification of the variable. So it is not just visual observers who are prone to misidentifying variable stars.

VY Aquarii showed the super outburst of mid 2008, which was the first detected since 1993. The outburst was well covered by CCD observers, but this important photometric opportunity might have been missed, if it were not for visual observers who first reported the outburst. Visual observers check the field night after night, reporting negative observations (its normal minimum is magnitude 17), but since the rise is so sudden they have a good chance of detecting any outburst, before the CCD observers.

CI Cygni underwent its brightest outburst since 1975 in the late summer of 2008. Prior to the outburst, there was only a sprinkling of CCDV data, and the outburst was detected and reported by visual observers. Whilst the outburst has been underway, CCD coverage has been much improved.

R Andromedae had good CCDV coverage during the last minimum cycle in early 2008, but has subsequently only sparsely covered the latest maximum, which is well covered by visual data.

R Comae Berenices clearly showed the effect that differing sequences can have on CCDV data. The minimum in spring 2008 shows some CCDV data consistently a full magnitude in error. For many years it has been known that visual data is only as good as the sequence used, and that the same sequence must be used if combining data. This basic rule applies equally to CCD data.

Z Ursae Majoris showed a very neat light curve, comprising visual data with just a sprinkling of CCDV points. The CCDV points alone, in 2008, would not give an accurate representation of the variation of this star.

V CanumVenaticorum, was similar to Z Ursae Majoris, with a well defined light curve dominated by visual data. There was insufficient CCDV data, to record the primary variations in 2008.

X Ophiuchi showed a well defined light curve purely from visual data. The five CCDV data points completely missed the primary maximum which occurred in February 2008.

The above examples, were intended to show the latest state of visual versus CCD data, reported to the AAVSO. It was clear, that if the AAVSO relied solely upon CCD data in 2008, the light curves of most wide range variable stars would have significant gaps in them.

Some advantages of visual observing were then explained. Firstly it is inexpensive, with the only equipment necessary being minor optical aid, and free issue charts & sequences. It is easy to learn and apply. During the presentation, the workshop participants had the opportunity to make visual estimates, using colour images of star fields, during the 'Visual Observing Experiment'. The observer can set up quickly in order to take advantage of unexpected clearing skies, the only limitation being one of dark adaptation. The target shift speed is also an advantage, because the visual observer can rapidly move onto objects anywhere where the sky is clear. Finally, the observation can be instantly reduced and analysed, thus leading to timely alerts if the variable is behaving abnormally.

Some reasons for continuing visual observing were then given. Large range variables do not require CCD levels of accuracy. Light curves of Long Period Variables and bright Cataclysmic Variables are ideal for visual observers to target. CCD coverage of most variable stars is patchy, as was demonstrated by the AAVSO light curve generator. Accurately measured V sequences, geared towards visual observers, are now becoming available. This allows visual data to be combined with CCD data, and makes the visual data more accurate and linear on its own. The extension of up to 160 year datasets is of increasing importance. The longer any dataset time series goes on, the more scientifically valuable the data becomes. Visual observers are very good at issuing timely alerts on unusual activity, which CCD observers can thankfully follow up with precision accuracy.

In conclusion the following was stated:

- The CCD has not made visual observers redundant.
- Any variable star exceeding one magnitude in range warrants visual monitoring.
- The BAA VSS has the Worlds largest homogenous visual database, and applies best practice procedures for visual data acquisition and reduction.
- Your continued contribution is scientifically important and very much valued.

THE VISUAL OBSERVING EXPERIMENT.

John Toone

This report is a summary finding of the 'visual observing experiment' undertaken at the VSS Variable Star Workshop at Edinburgh on the 18 October 2008.

There were two primary objectives of the experiment:

- 1. To establish an indication of the normal range (scatter) of visual data for red variable stars, using the latest sequences comprising non red comparison stars from the Hipparcos and Tycho catalogues.
- 2. To calculate a personal equation figure for the individuals participating in the experiment, and establish how much the personal equation contributes to the scatter in the data.

Five popular, bright and easily locatable red variable stars were selected for the experiment. Colour images of the binocular field of each variable star were projected, and volunteer participants were invited to make visual magnitude estimates, by comparison with the latest VSS charts/sequences which were also projected. In order to assist any newcomers to the technique of making visual magnitude estimates, the presenter first displayed an image of the Scutum Star Cloud, and proceeded to make a fractional magnitude estimate of R Scuti from the image, with the aid of the VSS chart. Each participant then filled in the standard VSS observation report form with their 'visual estimates' of the other five variable stars, which were V Canum Venaticorum, AG Pegasi, R Serpentis, Z Ursae Majoris and RY Ursae Majoris.

The eleven male and five female participants consisted of a range of seasoned veteran observers (80,000+ visual observations) to complete novices. The age range was also extensive, in the region of twenty to seventy. Some of the participants were CCD observers, more used to measuring black images on a white background. It was intended that the single images, uniform controlled conditions, and generous time allowed, would allow the objectives of the experiment to be realised.

The red variable stars selected had an average B-V of +1.4 over a range of +1.2 to +1.8, according to the Hipparcos, & Tycho catalogues. The comparison stars used were generally non red, with an average B-V value of +0.8, and a range of +0.2 to +1.2. The average B-V difference between the comparison stars and the variable stars, was therefore 0.6 magnitude, which would in theory [using the Howarth and Bailey formula mv = V + 0.159(B-V)] result in an average visual estimate (mv) being 0.1 magnitude fainter than an equivalent CCDV measurement.

The individual estimates from the experiment, are listed below for each star, and the resultant magnitudes averaged out. With the exception of V Canum Venaticorum, the full range of estimates for each variable was between 0.5 and 0.7 magnitude , which can be taken as the benchmark for scatter for moderately red variable stars. I n the case of V Canum Venaticorum, where the range was nearly double, at 1.3 magnitude, several participants said they had difficulty with comparison star E, and could not distinguish any difference from comparison star G. The general view was that comparison star E was close to the edge of the image field and that the film response might have been uneven. This illustrates the negative effect that a poor sequence could have on visual data, i.e. the scatter might double. The sequence for V Canum Venaticorum is in fact fine, with good photometry, so the problem lay with the photographic image used in the experiment.

Eighty estimates of the five stars, were obtained by the sixteen persons participating in the experiment. Fortyseven of these estimates were self reduced (the calculation of the magnitude of the variable) but ten were in error by 0.1 magnitude or more, representing 20% of the total. This is four times more than that reported by Dave McAdam, when checking the data submitted to the VSS database in 2000. It is likely that the workshop time constraints, and lack of calculators, probably contributed to this error count increase. Fortunately, the inclusion of the full estimate within the VSS database, systematically ensures that these mathematical errors are fully eliminated. Unfortunately, other VS organisations don't require the submission of the full estimate, which results in the retention of these errors within their databases.

Estimate Table

Name	V CVn	AG Peg	R Ser	Z UMa	RY UMa
Pam Foster	G(1)V(2)H=7.2	G(2)V(1)J=8.0	E(1)V(2)G=6.6	C(1)V(1)D=7.7	1(1)V(2)4=7.0
Rhona Fraser	G(3)V(2)H=7.4	G(4)V(1)J=8.1	E(3)V(2)G=6.9	D(2)V(3)E=8.1	1(3)V(2)2=7.1
Dave Gavine	G(2)V(3)H=7.3	G(4)V(1)J=8.1	E(2)V(3)G=6.7	D(1)V(4)E=8.0	1(3)V(2)2=7.1
Alex Gibberd	=G = 7.0	G(3)V(1)J=8.1	E(1)V(1)G=6.8	C(2)V(1)D=7.8	1(1)V(1)2=7.1
Alice Amanda Key	=G = 7.0	=J = 8.2	E(2)V(1)G=7.0	C(1)V(2)E=7.8	1(1)V(2)2=6.9
Robin Leadbeater	B(1)V(1)E=6.2	J(1)V(1)K=8.5	D(3)V(1)G=7.0	C(4)V(1)D=7.8	1(2)V(1)2=7.2
Ron Livesey	B(4)V(1)E=6.4	=J = 8.2	E(3)V(1)G=7.1	C(4)V(1)D=7.8	1(2)V(1)2=7.2
Tom Lloyd Evans	G(1)V(4)H=7.1	G(4)V(1)J=8.1	E(2)V(1)G=7.0	C(3)V(1)D=7.8	=2 = 7.4
Des Loughney	G(1)V(3)H=7.2	J(1)V(3)K=8.3	F-2,G+4 = 7.0	D+2 = 7.7	=2 = 7.4
Horst Meyerdierks	=G = 7.0	G(4)V(1)J=8.1	E(3)V(2)G=6.9	D(1)V(1)E=8.2	=2 = 7.4
Roger Pickard	=E = 6.5	J(1)V(4)K=8.3	E(3)V(1)G=7.1	=D = 7.9	1(4)V(1)2=7.3
David Richards	E(2)V(3)G=6.7	G(4)V(1)J=8.1	E(1)V(4)G=6.5	C(3)V(1)D=7.8	1(6)V(1)2=7.3
Janet Simpson	G(2)V(1)H=7.5	=K = 8.7	E(3)V(1)G=7.1	D(1)V(2)E=8.1	2(1)V(1)4=7.6
Lyn Smith	E(2)V(1)G=6.8	=J = 8.2	D(2)V(1)G=6.9	=D = 7.9	1(1)V(2)2=6.9
Roger Stapleton	B(2)V(1)E=6.3	=J = 8.2	E(1)V(2)G=6.6	D(1)V(3)E=8.0	1(1)V(1)2=7.1
Melvyn Taylor	G(2)V(3)H=7.3	=J = 8.2	E(3)V(1)G=7.1	=D = 7.9	1(1)V(1)2=7.1
Range	6.2 to 7.5	8.0 to 8.7	6.5 to 7.1	7.7 to 8.2	6.9 to 7.6
Average	6.93	8.21	6.89	7.89	7.19

The individual observer deviations from the mean magnitude for each star (apart from V Canum Venaticorum where the image was deemed flawed and the estimates unreliable) were then calculated, and are tabulated opposite. The average individual deviation was then calculated, to give a guide to each observer's relative position to the overall mean value (in other words their personal equation for red variable stars). A positive deviation means brighter than average, and a negative deviation means fainter than average. The full range for all participants was between Pam Foster at +0.23 (bright) and Janet Simpson at -0.33 (faint). So the total deviation range was 0.56 magnitude, and the extreme deviation range for any single observer was no more than 0.5 magnitude. Rhona Fraser turned out to be the only participant in the experiment that had a calculated mean deviation of zero on the mv scale. So we now have evidence that Rhona can be used as the nominal calibration point for the visual (mv) photometric standard. A further calculation was then done to transform the personal deviations to the V magnitude scale, using the Howarth and Bailey formula mv = V + 0.159(B-V). This meant that the personal deviation was shifted 0.1 magnitude from the mean mv scale to the V scale (but disregarding the zero point differential between mv and V for the sequence, and assuming that the colour response of the images was uniform). On this basis, the results from this experiment indicate that the mean visual range in V, is +0.1 to -0.4 magnitude, and the extreme range is +0.3 to -0.6 magnitude, which evenly flanks the mean range. Amazingly, all of Alex Gibberd's estimates were precisely aligned with the V magnitude scale, therefore on the evidence of this experiment, it would appear that Alex's eyes have an identical response to that of a CCD when observing red variable stars with non red comparison stars.

The personal equation is not something that visual observers should be concerned about, and is primarily due to the individuals differing eye sensitivity response to different coloured stars. The VSS is in the process of eliminating differing coloured comparison stars within sequences, but the difference between sequences and certain variable stars (especially red variable stars) will remain. The understanding of the relationship between

Personal Equation Table

Name	AG Peg	R Ser	Z UMa	RY UMa	Range mv	Aver-age mv	Range V	Aver-age V
Pam Foster	+0.2	+0.3	+0.2	+0.2	+0.3to+0.2	+0.23	+0.2to+0.1	+0.13
Rhona Fraser	+0.1	0	-0.2	+0.1	+0.1to-0.2	0.00	0.0to-0.3	-0.10
Dave Gavine	+0.1	+0.2	-0.1	+0.1	+0.2to-0.1	+0.08	+0.1to-0.2	-0.02
Alex Gibberd	+0.1	+0.1	+0.1	+0.1	+0.1to+0.1	+0.10	0.0 to0.0	0.00
Alice AmandaKey	0	-0.1	+0.1	+0.3	+0.3to-0.1	+0.08	+0.2to-0.2	-0.02
Robin Leadbeater	-0.3	-0.1	+0.1	0	+0.1to-0.3	-0.08	0.0to-0.4	-0.18
Ron Livesey	0	-0.2	+0.1	0	+0.1to-0.2	-0.03	0.0to-0.3	-0.13
Tom LloydEvans	+0.1	-0.1	+0.1	-0.2	+0.1to-0.2	-0.03	0.0to-0.3	-0.13
Des Loughney	-0.1	-0.1	+0.2	-0.2	+0.2to-0.2	-0.05	+0.1to-0.3	-0.15
HorstMeyerdierks	+0.1	0	-0.3	-0.2	+0.1to-0.3	-0.10	0.0to-0.4	-0.20
Roger Pickard	-0.1	-0.2	0	-0.1	0.0to-0.2	-0.10	-0.1to-0.3	-0.20
David Richards	+0.1	+0.4	+0.1	-0.1	+0.4to-0.1	+0.13	+0.3to-0.2	+0.03
Janet Simpson	-0.5	-0.2	-0.2	-0.4	-0.2to-0.5	-0.33	-0.3to-0.6	-0.43
Lyn Smith	0	0	0	+0.3	+0.3to0.0	+0.08	+0.2to-0.1	-0.02
Roger Stapleton	0	+0.3	-0.1	+0.1	+0.3to-0.1	+0.08	+0.2to-0.2	-0.02
Melvyn Taylor	0	-0.2	0	+0.1	+0.1to-0.2	-0.03	0.0to-0.3	-0.13
Range mv	0.2to-0.5	0.4to-0.2	0.2to-0.3	0.3to-0.4				

individual observers colour response, and deviation from the visual (mv) mean, can help to refine visual data for red stars during the analysis process.

One method of refining visual data for red variable stars during the analysis process, is to apply corrections for the individual personal equations to the observations, and then calculate ten day or five day means, depending upon the rate of change, and quantity/distribution of data available. If combining with CCD data, then a further pre-adjustment could be applied using the Howarth and Bailey formula, which would convert the visual data to the V scale (or vice versa if the analyst wants to compare CCD data with historical visual data) as has been done in the final column of the personal equation table above. This would eliminate a significant proportion, of the wide scatter currently seen in raw light curves of red variable stars, and greatly improve the appearance of the plotted data.

The estimates and personal equation figures were examined to see if there were any major trends with respect to the participant's age or gender. The only item of note, was that the female participants recorded mean personal equation figures across the full range (0.56 magnitude), whereas the male participants were concentrated very much in the mid range (just 0.23 magnitude). To establish whether this is a real gender effect would require further and more extensive sampling.

In summary the principle findings of this experiment are as follows:

- 1. For moderately red (B-V +1.4) variable stars using non red (B-V +0.8) comparison stars under identical conditions and instrumentation, the scatter in visual data is no more than 0.7 magnitude.
- 2. Most of the scatter (0.5 magnitude) can be accounted for by the personal equation range which is +0.2 to -0.3 magnitude in mv and +0.1 to -0.4 mag in V. The remaining scatter (0.2 mag) is the errors normally to be expected in visual observations.

This limited experiment has helped to quantify the effects on visual data that red variable stars impose, and I am grateful to all of the volunteer participants at the Variable Star Workshop for their most invaluable input. In the future it would be interesting to do a similar exercise for blue/white variables (B-V -0.2 to +0.4) because it is possible that the personal equation factor may not be constant across the full colour range. So please can members be prepared to participate in Visual Observing Experiment Part 2, at a future VSS meeting.

Important Note:

Observers should never apply any form of colour correction to the visual data they submit to the VSS, otherwise they could reduce the effectiveness of the analysts work. Visual observers should always carefully record and report exactly what they see, and never be concerned about how they think their raw data might measure up against any other data.

IBVS 5821-5846

GARY POYNER

5821: Detection of increase in the optical light of Be/X-ray binary system GRO J2058+42. (Kiziloglu et al,2008)
5822: Photometric sequences and astrometric positions of Nova Vul 2007 N.2 And Nova Cyg 2008. (Henden & Munari, 2008)
5823: The GEOS RR Lyr survey. (Le Borgne et al, 2008)
5824: Photometric analysis of a new W UMa system in Vulpecula. (Capezzali et al, 2008)
5825: BN UMa and CF Del: Two new Galactic field double mode RR Lyr stars. (McClusky, 2008)
5826: Discovery of short-periodic pulsating component in the eclipsing Binary Y Leonis. (Turcu et al, 2008)
5827: The unconfirmed eclipsing nature of V348 And and detection of Variability of HD 1438. (Zasche & Svoboda, 2008)
5828: Optical spectroscopy SN 2007gr of type 1c. (Tarasova, 2008)
5829: New outburst of V1118 Ori (2007-2008). (Garcia & Parsamian, 2008)
5830: BAV results of observations – photoelectric minima of selected eclipsing binaries and maxima of pulsating stars. (Hubscher, 2008)
5831: BVRcIc photometric observations of V733 Cep (Persson's star) (Semkov & Peneva, 2008)
5832: Recent CCD photometry of AB Dor, and a comment on the long term Activity cycle. (Innis et al, 2008)
5833: On the accretion state switching in EX Dra. (Halevin & Henden, 2008)
5834: Photometric sequences and astrometric positions of Nova Cyg 2008 N.2 and Nova Sgr 2008. (Henden & Munari, 2008)
5835: New and archive times of minima of eclipsing binary systems. (Borkovits et al, 2008)
5836: UX Ari: New photometry and longitudinal asymmetry in spot activity in orbital reference frame. (Rosario, et al, 2008)
5837: 166. List of timings of minima eclipsing binaries by BBSAG observers. (Diethelm, 2008)

5838: Observations of the active southern RS CVn binary V841 Cen in 2007 and 2008 – a large, long lived spot wave. (Innis & Coates, 2008)
5839: Plate archive photometry of the progenitors of Nova Cyg 2008 N.2 and Nova Sgr 2008. (Rajka & Ulisse, 2008)
5840: Confirmation of the RRd nature of V458 Her. (Hambsch & Wils, 2008)
5841: Evidence for short term variations in two O-type stars. (Becker et al, 2008)
5842: Short period oscillations found in the Algol type system GSC 4550-1408. (Dimitrov et al, 2008)
5843: Times of minima observed by Pi of the sky. (Ogloza et al, 2008)
5844: Multicolour CCD photometry of three RRab stars. (Jurcsik et al, 2008)
5845: V965 Cygni. An A and F type very high fill out binary with strong Magnetic activity?. (Samec et al, 2008)
5846: Multicolour CCD photometry of four RRab stars. (Jurcsik et al, 200)
5847: Elements for 8 eclipsing binaries. (Haussler et al, 2008)
5848: V772 Cas: An intrinsically variable BpSi star in an eclipsing binary. (Gandet, 2008)
5849: The cool dwarf interacting eclipsing binary, HH95-79. (Samec et al, 2008)
5850: Early spectroscopy and photometry of the new outburst of V1647 Ori. (Kun, 2008)
5851: The longitudinal magnetic field of the ROSAP star HD 99563. (Elkin et al, 2008)
5852: The new contact binary GSC 2414-0797. (Robb et al, 2008)
5853: The GEOS RR Lyr survey. (Le Borgne et al, 2008)
5854: Maxima of RR Lyr stars from AAVSO international database. (Le Borgne et al, 2008)
5855: Long term BVRcIc photometry of carbon and symbiotic stars in the Draco dwarf galaxy. (Munari et al, 2008)
5856: Short period oscillations in the Algol type systems II: Newly discovered variable GSC 3889-0202. (Dimitrov et al, 2008)
5857: Variable Stars in the field of the open cluster King 7. (Bukowiecki & Maciejewski, 2008)
5858: Elements for 10 RR Lyrae stars. (Haussler et al, 2008)
5859: Multicolour CCD photometry of three RRab stars. (Kun et al, 2008)
5860: BVRcIc photometry of the eccentric eclipsing binary HD350731. (Kleidis et al, 2008)
5861: Eclipse mapping of RW Tri in the low luminosity state. (Halevin & Henden, 2008)
5862: Dwarf Nova Trianguli 2008 as a WZ Sge type object. (Shugarov et al, 2008)
5863: The 79th name list of variable stars. (Kazarovets et al, 2008)
5864: Variable Stars in the field of the open cluster NGC 457. (Macijewski et al, 2008)
5865: Long term optical observations of the BE/X-ray binary system V0332+53. (Kiziloglu et al, 2008)
5866: The 2008/2009 eclipse of EE Cep will soon begin. (Galan et al, 2008)
5867: A multicolour photometric study of CN Orionis. (Spogli et al, 2008)
5868: Tow pairs of interacting EB's towards the LMC in the OGLE database. (Ofir, 2008)

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

BINOCULAR PRIORITY LIST

Melvyn Taylor

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

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

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

* *

ECLIPSING BINARY PREDICTIONS

Des Loughney

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

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

The variables covered by these predictions are :

RS CVn	7.9 - 9.1V	AI Dra	7.2 - 8.2	U Sge	6.45 - 9.28V
TV Cas	7.2 - 8.2V	Z Vul	7.25 - 8.90V	RW Tau	7.98 - 11.59V
U Cep	6.8 - 9.4	Z Dra	10.8 - 14.1p	HU Tau	5.92 - 6.70V
U CrB	7.7 - 8.8V	TW Dra	8.0 - 10.5v	X Tri	8.88 - 11.27V
SW Cyg	9.24 - 11.83V	S Equ	8.0 - 10.08V	TX Uma	7.06 - 8.80V
V367 Cyg	6.7 - 7.6V	Z Per	9.7 - 12.4p	Del Lib	4.9 - 5.9
Y Psc	10.1 - 13.1	SS Cet	9.4 - 13.0	RZ Cas	6.3 - 7.9

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

For information on other eclipsing binaries see the website:
http://www.as.ap.krakow.pl/o-c/index.php3

Again please contact the EB secretary if you have any queries about the information on this site and how it should be interpreted.

April

2009 Apr 1 Wed
U Cep.........03(08)04D
del Lib........04(10)04D
Z Per........L04(05)04D
TX UMa....D20(18)22
RS CVn......D20(20)27
RZ Cas.......D20(20)23
TV Cas.......D20(21)25
RW Tau.......21(26)23L

2009 Apr 2 Thu
SW Cyg......02(08)04D
RZ Cas..........23(25)27

2009 Apr 3 Fri
TV Cas.......D20(16)20
Z Dra.........D20(18)20
U Cep.........D20(20)25
del Lib........L22(18)24
U Sge........L24(29)28D

2009 Apr 4 Sat
S Equ........L03(01)04D
RZ Cas.......03(06)04D
TW Dra......03(08)04D
Z Per........L04(07)04D
TX UMa..D20(19)24
RW Tau....D20(20)23L
V367Cyg.L23(63)28D

2009 Apr 5 Sun
Z Dra..........00(03)04D
AI Dra........D20(20)22
del Lib......L22(26)28D
V367Cyg.L23(39)28D
Z Vul........L23(25)28D

2009 Apr 6 Mon
U Cep.........03(08)04D
RS CVn......D20(15)22
SW Cyg.......L20(22)28
V367Cyg..L23(15)28D
TW Dra......23(28)28D
AI Dra...........24(25)26

2009 Apr 7 Tue
TV Cas.......03(07)04D
Z Per........L04(08)04D
HU Tau......D20(16)20
Z Dra..........D20(20)22
RZ Cas.......D20(20)22
TX UMa....D20(21)25
U CrB.........D20(22)28
V367Cyg.L23(<<)28D

2009 Apr 8 Wed
del Lib.......03(10)04D
U Cep.......D20(20)24
RZ Cas.........22(24)27
TV Cas......23(27)28D

2009 Apr 9 Thu
Z Dra.........02(04)04D
HU Tau......D20(17)21
TW Dra..D20(23)28D

2009 Apr 10 Fri
RZ Cas......03(05)04D
TV Cas......D20(22)26
TX UMa...D20(22)27
del Lib........L22(17)24
Z Vul.......L23(23)28D
U Sge.......L23(24)28D

2009 Apr 11 Sat
S Equ.........L02(<<)04
U Cep........03(07)04D
U CrB........03(09)04D
HU Tau...D20(19)22L
AI Dra.......D20(20)22
Z Dra........D20(21)24

2009 Apr 12 Sun
TV Cas......D20(18)22
TW Dra.....D20(19)24
X Tri.......D20(22)20L
del Lib.....L21(25)28D
AI Dra..........24(25)26

2009 Apr 13 Mon
Z Dra.........04(06)04D
RZ Cas......D20(19)22
U Cep.......D20(19)24
HU Tau...D20(20)22L
TX UMa.D20(24)28D

2009 Apr 14 Tue
U Sge.........03(09)04D
S Equ.........03(09)04D
U CrB........D20(20)25
RZ Cas.........21(24)26

2009 Apr 15 Wed
del Lib.......03(09)04D
HU Tau...D20(21)22L
RW Tau...D20(22)22L
SW Cyg..D20(25)28D
Z Dra............21(23)26
Z Vul..........L22(21)26
RS CVn.....23(30)28D

2009 Apr 16 Thu
RZ Cas......02(05)04D
U Cep........02(07)04D
TX UMa...21(25)28D

2009 Apr 17 Fri
AI Dra......D20(20)21
HU Tau..D20(23)22L
del Lib.......L21(17)23
U Sge........L23(18)24

2009 Apr 18 Sat
TV Cas.....00(04)04D
U CrB.......01(06)04D
Z Vul........02(08)04D
RW Tau.....D20(16)21
U Cep......D20(19)24
AI Dra.........24(25)26

2009 Apr 19 Sun
RZ Cas.....D20(19)21
TV Cas..D20(24)28D
HU Tau.....20(24)21L
del Lib....L21(25)28D
TX UMa..22(27)28D
Z Dra...........23(25)27

2009 Apr 20 Mon
SW Cyg....D20(15)21
RS CVn..D20(25)28D
RZ Cas........21(23)26
Z Vul.........L22(19)24
U Sge......L23(27)28D
TW Dra....24(29)28D

2009 Apr 21 Tue
S Equ......L02(06)04D
U Cep.......02(07)04D
U CrB.......D20(17)23
TV Cas.....D20(19)23

2009 Apr 22 Wed
RZ Cas.....02(04)04D
del Lib......02(09)04D
Z Dra........D20(18)20
TX UMa..24(28)27D

2009 Apr 23 Thu
Z Vul.........00(05)03D
U Cep.......D20(19)23
AI Dra......D20(20)21
TW Dra.D20(24)27D
V367Cyg.L22(53)27D

2009 Apr 24 Fri
Z Dra........00(03)03D
del Lib.......L21(17)23
V367Cyg.L21(29)27D
U CrB.......22(28)27D
SW Cyg....23(29)27D
AI Dra.........23(25)26

2009 Apr 25 Sat
Z Per.........D20(16)21
RZ Cas.....D20(18)20
RS CVn.....D20(20)26
V367Cyg.L21(05)27D

2009 Apr 26 Sun
TX UMa..01(06)03D
U Cep.......02(07)03D
TW Dra....D20(19)24
Z Dra........D20(20)22
RZ Cas.....D20(23)25
RW Tau..D20(24)21L
del Lib....L21(24)27D
V367Cyg..L21(<<)26

2009 Apr 27 Mon
TV Cas.....02(06)03D
Z Vul........22(27)27D
U Sge.........L22(21)27

2009 Apr 28 Tue
RZ Cas.....01(03)03D
S Equ......L01(03)03D
Z Dra........02(04)03D
U CrB.......D20(15)21
Z Per......D20(17)22L
U Cep.......D20(18)23
TV Cas.....21(25)27D

2009 Apr 29 Wed
del Lib......02(08)03D
TX UMa..03(07)03D
RW Tau..D21(18)21L
SW Cyg....D21(19)25
AI Dra......D21(20)21

2009 Apr 30 Thu
RS CVn.....D21(15)21
TV Cas.....D21(21)25
Z Dra........D21(22)24
AI Dra.........23(25)26

May

2009 May 1 Fri
U Sge........01(06)03D
U Cep.......01(06)03D
del Lib......D21(16)23
Z Per......D21(19)22L
U CrB....D21(26)27D

2009 May 2 Sat
RZ Cas.....D21(22)25
Z Vul......L21(25)27D

2009 May 3 Sun
U Cep.......D21(18)23
del Lib....D21(24)27D

2009 May 4 Mon
RZ Cas.....00(03)03D
SW Cyg....02(08)03D
Z Per......D21(20)21L
Z Dra..........21(23)26

2009 May 5 Tue
TW Dra......00(05)03D
S Equ........L01(00)03D
AI Dra........D21(20)21
2009 May 6 Wed
U Cep.........01(06)03D
del Lib........02(08)03D
AI Dra..........23(24)26
2009 May 7 Thu
Z Per........D21(21)21L
TW Dra...D21(25)27D
Z Vul........L21(23)27D
U Sge........L22(25)27D
TV Cas.......23(27)27D
2009 May 8 Fri
Z Per...........L02(<<)02
del Lib........D21(16)22
U Cep.........D21(18)22
RZ Cas.......D21(22)24
SW Cyg...D21(22)27D
U CrB......D21(24)27D
Z Dra..........23(25)27D
2009 May 9 Sat
TV Cas.......D21(22)26
RS CVn......23(29)27D
RZ Cas.......24(26)27D
2009 May 10 Sun
TW Dra......D21(20)25
del Lib.....D21(24)27D
2009 May 11 Mon
U Cep.........01(05)03D
Z Per........L02(<<)03D
TV Cas.......D21(18)22
V367 Cyg...23(68)27D
2009 May 12 Tue
S Equ..........L00(<<)02
Z Vul..........D21(21)26
V367Cyg.D21(44)27D
AI Dra..........23(24)26
2009 May 13 Wed
Z Dra..........00(03)03D
del Lib........01(07)03D
U Cep.........D21(17)22
V367Cyg.D21(20)27D
2009 May 14 Thu
Z Per........L01(00)03D
V367Cyg.D21(<<)27D
U Sge..........D21(19)25
RZ Cas.......D21(21)23
RS CVn...D21(25)27D
2009 May 15 Fri
S Equ........02(07)03D
Z Vul........02(08)03D
del Lib......D21(15)22
Z Dra........D21(20)22
U CrB....D21(21)27D
RZ Cas.....23(26)27D
2009 May 16 Sat
U Cep.......00(05)03D
2009 May 17 Sun
TV Cas.....00(04)02D
Z Per......L01(02)02D
Z Dra........02(04)02D
TX UMa.D21(17)21
Z Vul........D21(19)24
del Lib...D21(23)26D
SW Cyg.D21(26)26D
U Sge........22(28)26D
2009 May 18 Mon
U Cep.......D21(17)22
TV Cas..D21(24)26D
AI Dra.........23(24)25
2009 May 19 Tue
TW Dra....01(06)02D
Y Psc......L02(02)02D
U CrB.......02(08)02D
RS CVn....D21(20)26
Z Dra.......D21(22)24
2009 May 20 Wed
Z Vul........00(06)02D
del Lib......01(07)02D
Z Per......L01(03)02D
TX UMa.D21(18)23
TV Cas.....D21(19)23
RZ Cas.....D21(20)23
2009 May 21 Thu
U Cep.......00(05)02D
TW Dra.D21(26)26D
RZ Cas.....23(25)26D
S Equ......L24(28)26D
2009 May 22 Fri
SW Cyg....D21(15)22
Z Vul........D21(17)22
U CrB......D21(19)25
2009 May 23 Sat
Z Per......L01(04)02D
U Cep.......D21(17)21
TX UMa.D21(20)24
Z Dra.......D21(23)26
2009 May 24 Sun
TW Dra......D21(21)26
U Sge.......D21(22)26D
del Lib.....D21(23)26D
Z Vul..........22(27)26D
AI Dra...........23(24)25
2009 May 25 Mon
U Cep.........24(29)26D
2009 May 26 Tue
U CrB.........00(06)02D
Z Per...........01(06)02D
TV Cas.......02(06)02D
RZ Cas.......D22(20)22
TX UMa....D22(21)26
SW Cyg......23(29)26D
2009 May 27 Wed
del Lib........00(07)02D
TV Cas....D22(25)26D
RZ Cas.......22(25)26D
Z Dra..........23(25)26D
2009 May 28 Thu
U Sge..........02(08)02D
S Equ........L23(25)26D
2009 May 29 Fri
U CrB.........D22(17)22
TV Cas.......D22(21)25
TX UMa.D22(23)26D
Z Vul.......D22(25)26D
2009 May 30 Sat
V367Cyg.D22(58)26D
AI Dra..........23(24)25
U Cep.........23(28)26D
2009 May 31 Sun
U Sge.........D22(17)22
SW Cyg......D22(19)25
del Lib.....D22(22)26D
V367Cyg.D22(34)26D

June

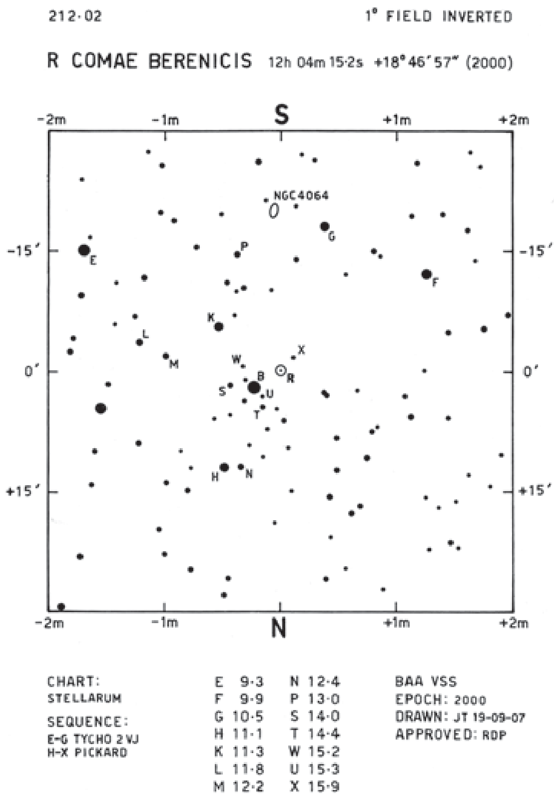
2009 Jun 1 Mon
Z Dra..........00(03)02D
V367Cyg.D22(10)26D
TX UMa.D22(24)26D
U CrB......D22(28)26D
2009 Jun 2 Tue
V367Cyg.D22(<<)26D
RZ Cas....D22(24)26D
RS CVn.......23(29)26D
del Lib.........24(30)26D
2009 Jun 3 Wed
Y Psc.......L01(03)02D
Z Dra.........D22(20)22
Z Vul.......D22(23)26D
U Sge.......D22(26)26D
2009 Jun 4 Thu
TX UMa.D22(26)26D
TW Dra...D22(26)26D
S Equ.......L23(22)26D
U Cep........23(28)26D
2009 Jun 5 Fri
AI Dra...........22(24)25
TV Cas.......23(27)26D
2009 Jun 7 Sun
Y Psc.......L01(<<)02D
Z Dra.........D22(22)24
TW Dra...D22(22)26D
del Lib.....D22(22)26D
TV Cas....D22(22)26D
RS CVn...D22(24)26D
TX UMa....22(27)26D
2009 Jun 8 Mon
Z Vul.......D22(21)26D
RZ Cas.......D22(23)26
U CrB.....D22(25)26D
2009 Jun 9 Tue
SW Cyg...D22(22)26D
U Cep........23(28)26D
del Lib........23(30)26L
2009 Jun 10 Wed
RZ Cas.......02(04)02D
TW Dra......D22(17)22
U Sge..........D22(20)26
TX UMa....24(29)26D
2009 Jun 11 Thu
Z Dra......D22(23)26D
S Equ..........L22(19)24
AI Dra...........22(24)25
2009 Jun 12 Fri
X Tri..........01(04)02D
RS CVn......D22(19)26
2009 Jun 13 Sat
X Tri........L01(03)02D
Z Vul..........D22(19)24
U Sge..........23(29)26D
2009 Jun 14 Sun
X Tri........L01(03)02D
TX UMa....02(06)02D
del Lib.....D22(21)25L
RZ Cas......D22(23)25
U Cep........22(27)26D
S Equ..........24(29)26D

2009 Jun 15 Mon
TV Cas........00(04)02D
X Tri.........L01(02)02D
U CrB.......D22(23)26D
Z Dra...........23(25)26D
2009 Jun 16 Tue
Z Vul...........00(06)02D
X Tri.........L01(01)02D
RZ Cas........01(04)02D
TV Cas.....D22(24)26D
del Lib..........23(29)25L
2009 Jun 17 Wed
X Tri.........L01(00)02D
AI Dra............22(23)25
2009 Jun 18 Thu
Y Psc...........00(05)02D
X Tri.........L01(00)02D
TV Cas........D22(19)23
SW Cyg....D22(26)26D
V367 Cyg..D22(48)26D
TW Dra.......22(27)26D

2009 Jun 19 Fri
X Tri...........L01(<<)02
V367 Cyg..D22(24)26D
U Cep.......D22(27)26D
2009 Jun 20 Sat
Z Dra...........01(03)02D
X Tri............L01(<<)01
V367 Cyg..D22(00)26D
RZ Cas........D22(22)25
U Sge........D22(23)26D
Z Vul...........22(28)26D
2009 Jun 21 Sun
del Lib.......D22(21)25L
TW Dra....D22(23)26D
S Equ........D22(26)26D
Y Psc.........L24(23)26D

2009 Jun 22 Mon
RZ Cas....01(03)02D
Z Dra.......D22(20)22
U CrB...D22(21)26D
2009 Jun 23 Tue
AI Dra.....D22(23)25
del Lib......22(29)25L
2009 Jun 24 Wed
TW Dra..D22(18)23
U Cep...D22(27)26D
2009 Jun 25 Thu
TV Cas..D22(25)26D
Z Vul.....D22(25)26D
Z Per.........L23(19)24
2009 Jun 26 Fri
U CrB......02(07)02D
RZ Cas....D22(22)24
Z Dra.......D22(22)24
RS CVn....23(29)26D

2009 Jun 27 Sat
U Sge......D22(18)23
TV Cas...D22(21)25
SW Cyg..23(29)26D
2009 Jun 28 Sun
RZ Cas...00(02)02D
del Lib..D22(21)24L
S Equ...D22(23)26D
Z Per........L22(20)25
2009 Jun 29 Mon
U CrB.....D22(18)24
AI Dra....D22(23)24
U Cep..D22(26)26D
2009 Jun 30 Tue
Z Vul....D22(23)26D
Z Dra...D22(24)26D
del Lib..D22(28)26D



NEW CHART

John Toone

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The **deadline for contributions** to the next issue of VSSC (number 139) will be 7th May, 2009. 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)