British Astronomical Association

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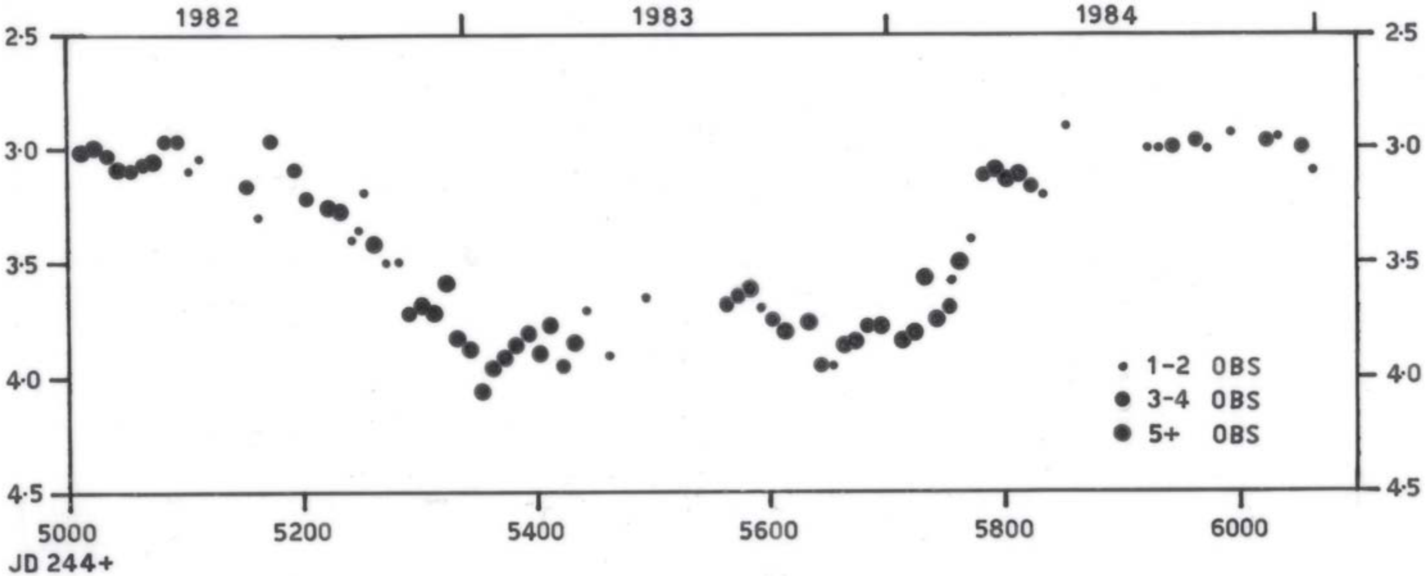
EPSILON AURIGAE 1982-1984

JOHN TOONE



The last eclipse of Epsilon Aurigae as observed by BAA VSS visual observers in 1982-1984. The light curve consists of 10 day means, and clearly indicates that the recovery is more rapid than the fade, and that there is a partial rebrightening during the mid eclipse. These are some of the interesting features for observers to look out for, during the forthcoming eclipse which is scheduled to commence in August 2009.

NEIL BONE (1959 - 2009)

ROGER PICKARD

I am sure that members will be aware that Neil Bone, Director of the Meteor Section and author, died on April 23 after a long battle with cancer.

Neil was a great observer, and besides being Meteor Section Director for the past seventeen years, also contributed observations to most BAA Sections,including the Variable Star Section. Starting when he was a lad of just thirteen, over the course of the next thirtysix years he contributed 12742 observations to the VS database.

He wrote some seven books or "Observer's Guides" ranging from Meteors (of course) and Aurora, via Mars to the deep sky. Perhaps the one that best exemplifies his great depth of astronomical knowledge being "Observing Meteors, Comets, Supernovae and Other Transient Phenomena". He was awarded the BAA Merlin Medal in 2004, for his contribution to the advancement of astronomy, and asteroid (7102) Neilbone was recently named in his honour.

He was always cheerful, with a droll sense of humour, and remained so until the end. He fought his illness, with great optimismism and courage, until the very end and his departure casts a dark cloud over amateur astronomy.

We extend our sincerest condolences to his wife Gina, and their two children Mirada and George.

FROM THE DIRECTOR

ROGER PICKARD

I'm afraid the time has finally come, for a small increase in the subscriptions for the Circulars. Despite our printer using a new printing method, which helps keep costs down, yet another increase in postal charges means that, reluctantly, the subscriptions must go up £1.00 on all categories.

	UK	**Europe**	**Rest of World**
BAA Members	£5.00	£6.00	£8.50
Non-Members	£7.00	£8.00	£10.50

PDF format subscriptions are maintained at £3.00 per year.

European Week of Astronomy and Space Science.

This meeting was integral with the Joint European National Astronomy Meeting (JENAM) and was held at the University of Hertfordshire over the week of 20th -23rd April 2009.

There were a great number of sessions, the majority running parallel with one another but generally themed so that if you were interested in, say, variable stars(!), you could attend most of the presentations.

One of these sessions, a mere one and a half hours in total, was devoted to Professional/Amateur collaboration, and in that time six talks had to be squeezed, all from amateurs.

I gave a short introduction about the objectives of the BAA, with particular reference to point 4, as detailed on the BAA front page (www.britastro.org), "The support of modern advanced techniques for observation, data handling and scientific presentation of results". I pointed out that a number of observing Sections already have some dialogue with professionals, none more so than the VSS.

As there were already two talks on variable stars (from David Boyd and Stan Waterman), I gave up my own presentation in favour of Chris Baddiley, so that he could give his presentation on light pollution.

However, I did prepare a poster paper, highlighting the work of the VSS over the last century, with particular emphasis on the continuous runs of data held on some stars, and the modern collaboration with professionals from all over the world. The work that Gary Poyner and had done, in connection with the binary black hole system OJ287, which culminated in a letter to Nature, was highlighted, of course.

After the presentations, there was an open session where some very good questions were raised, but it was a great shame that there were only about twenty six people in the audience.

Nevertheless, one of them was a young professional from Hertfordshire University, and we have since been in email contact, about how it might be possible to generate more dialogue with other professionals. Watch this space.

Observers who have made over 100,000 Variable Star Estimates.

Following my note in the last Circulars, Michel Dumont wrote to advise that two GEOS (Groupe Europeen d'Observation Stellaire) observers, Alain Figer and Michel himself, have made more than 100,000 estimates. In addition, Tom Richards pointed out a couple of other errors so that the revised list is now:

Observer	Country	Observer	Country
Albert Jones	New Zealand	Gary Poyner	UK
Frank Bateson	New Zealand	John Toone	UK
Rod Stubbings	Australia	Tony Markham	UK
Peter Williams	Australia	Warren Morrison	Canada
Thomas Cragg	Australia	Leslie Peltier	USA
Danie Overbeek	South Africa	Wayne Lowder	USA
Reginald de Kock	South Africa	Marvin Baldwin	USA
Paul Vedrenne	France	John Bortle	USA
Michel Verdenet	France	Edward Oravec	USA
Michel Dumont	France	Gerald Dyck	USA
Alain Figer	France	Gerard Samolyk	USA
Eddy Muyllaert	Belgium	Lewis Cook	USA
Georg Comello	Netherlands	Cyrus Fernald	USA
Charles Butterworth	UK	Lancaster Hiett	USA

Please Note.

Janet Simpson has changed her email address to: *sim_jan@btinternet.com*

ECLIPSING BINARY NEWS

Des Loughney

Zeta Aurigae - 2009 Eclipse

This eclipse took place more or less as scheduled in March/ April 2009. An observation on the 2nd March picked up the start of ingress which was due to last 1.5 days. By the time of the next observation on 4th March totality had been achieved. Better weather allowed more observations of egress on 10th -11th April 2009. The observations suggest that the Krakow predicted time of mid-eclipse (22nd March) was correct, the length of totality at 37 days was correct, and that the period has not changed. As a detached eclipsing binary system, with no mass transfer taking place, this is not surprising.

What was surprising was the depth of the eclipse. Observations from a number of people confirmed that the drop in magnitude was about 0.14V. According to GCVS the drop in magnitude should have been 0.27m and according to Krakow the drop should have been 0.6m. It would be interesting to find out if there is any explanation for the change in the depth of the eclipse.

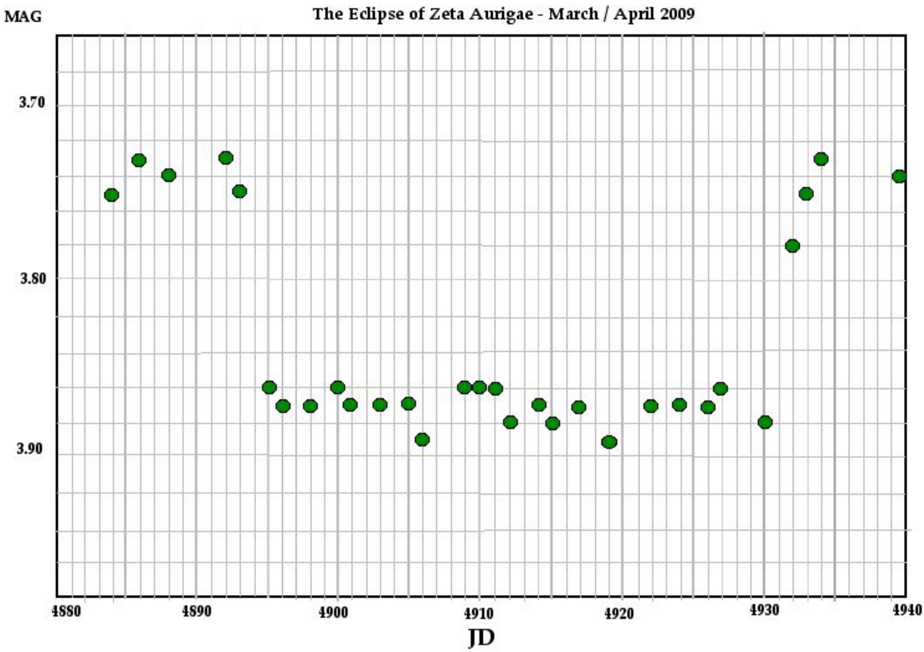


Figure 1: The Eclipse of Zeta Aurigae, March/April 2009

Algol

Earlier this year I received a query about the elements of Algol. The query highlighted the discrepancy between our predictions as published in the BAA Handbook (which are based on the Krakow elements) and predictions published on the 'Sky & Telescope' website. There is a forty minute difference between the predicted times of mid-eclipse.

After the query was received I had hoped to resolve it by observing an Algol eclipse. I could establish an up to date time of mid eclipse and find out which prediction was closest. The weather, however, has not co-operated. I would be pleased to receive any mid-eclipse timing of the Algol system for 2009. Timings will be acknowledged and published in this News.

Epsilon Aurigae

The long awaited eclipse will start soon after this Circular is published, on 11th August 2009. At that time of the year the system will be a pre dawn object. A special section devoted to the Epsilon Aurigae campaign has been created on the BAA VSS section of the BAA website. This special section will be updated monthly, including the latest observations, as the eclipse develops. Of course, if anything of special interest occurs updates will be more frequent. By the end of June we hope to have a Powerpoint presentation of the eclipse ready which can be used by local Societies.

The science behind the observing campaign is very well summarised in an excellent article contained within the 2009 May edition of 'Sky & Telescope'. The article is entitled 'The Very Long Mystery of Epsilon Aurigae' by Robert E. Stencel.

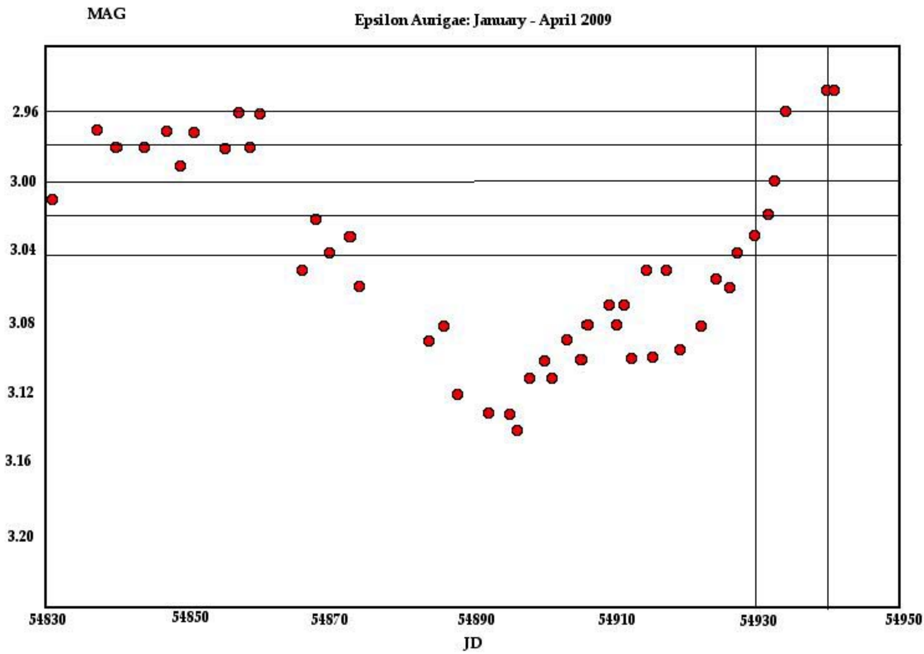


Figure 2: Working diagram of Epsilon Aurigae.

The international observing campaign started in the autumn of 2008 in order to study out of eclipse variations. Such variations had been in the order of 0.1 magnitude with a period of around 65 days. An out of eclipse variation did occur in February - April 2009. The amplitude of this variation has been over 0.2 magnitude. It will be interesting to see an explanation of this change which is, perhaps, an indication of the surprises in store in the observing campaign!

Equatorial Eclipsing Binary Project

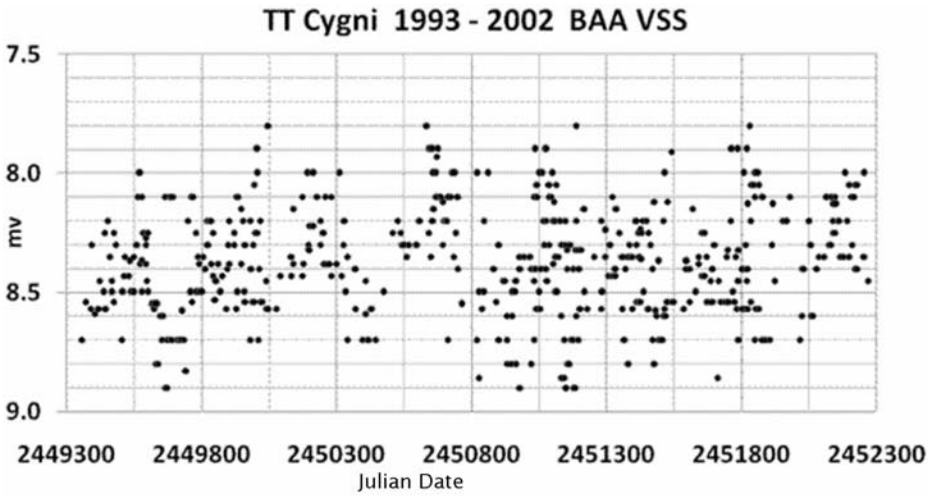
We have had discussions with our New Zealand colleagues regarding a joint observing campaign of EA class eclipsing binaries located between plus and minus ten degrees of the ecliptic. It is envisaged that this will an instrumental campaign.

desloughney@blueyonder.co.uk

TT CYGNI

(RA 19h 41m, Dec. +32º 37', SRB, magnitude 7.4 - 8.7, period 118d, GCVS)

MELVYN TAYLOR



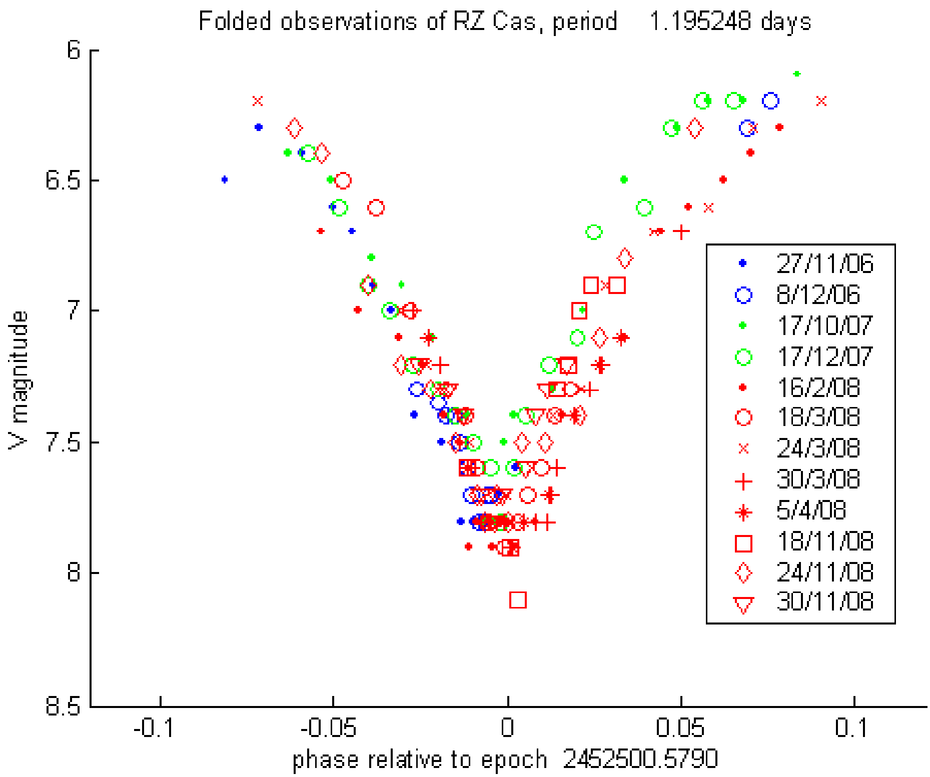
Observers whose estimates are shown on the VSS cd database, and are summarised in this preliminary light curve are:

Albrighton, Anderson, Baker, Bingham, Charleton, Clayton, Currie, Cuthbert, Day, England, Fraser, Freeman, Gill, Good, Gough, Hather, Henshaw, Hoare, Hornby, Hurst, Isles, Jobson, Johnston, Markham, Middlemist, Nicholls, Pickup, Pointer, Poxon, Quadt, Ramsey, Shorten, Smeaton, Swain, Taylor, Toone, Van der Bilt, Wise, Yates and Young.

The 1993 to 2002 light curve shows extreme variation of 7.8 to 8.9, with a mean magnitude of 8.3; standard deviation of the mean was 0.26 over this interval. The sequence chart number is 227.01, and shows several other variables between eta and beta Cygni, including the well known long period chi Cygni.

FOLDED LIGHT CURVE SHOWING THE ECLIPSE OF THE BINARY STAR RZ CASSIOPEIAE, 2006-2008

JOHN HOWARTH



The light curve was drawn from observations made by Janet Simpson covering approximately two years, 2006-2008. The observations were plotted against the 2004 Krakow elements. They show a nice sharp minimum close to phase zero. Interestingly there is a suspicion - just a suspicion - that the minimum actually gets later as time progresses, as the reds do seem to be generally on the right of the blues and greens. This is the impression from these observations from 2006-2008, which if correct is comparable with what was happening during the 1990s,when the assumed period was 1.195247 days.* The 2004 elements give almost the same period (though an epoch that is about 0.04 phase later, which effectively eliminated the error up to that point). The difference in period between the two assumed periods is roughly 0.1 second which amounts over a year to about 0.5 minute, or about 0.00025 phase - not enough to do much even over a decade or so.

* The author is currently working on a more objective and general method of deriving phase offsets, which could yet refute of support this suspicion, and determine whether or not it is a permanent effect.

THE 1367 CLUSTER OF VARIABLE STARS IN CYGNUS

Stan Waterman and Richard Stratford

This is not a real cluster of course, just a random collection that happens to appear close together, to us. This is the densest collection of variable stars in my area 'a' in Cygnus. The area is 10.35 arc-mins square, very close to 1/7th of the area of the full moon. In addition to the 11variables marked with crosses below there are 3 much fainter ones recently found making a total of 14 giving a density in that square of 470 variable stars per square degree!

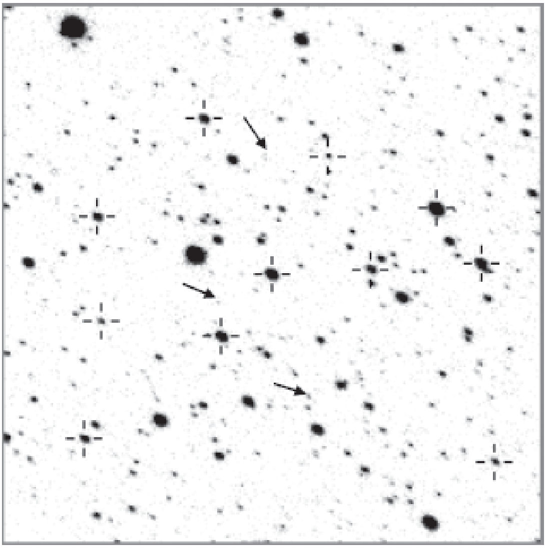


Figure 1.

The star in the middle is a01367 in my (SW) catalogue, they are all listed below with a key, and in Table 1 with their other IDs and other data. The central star a01367, has nominal picture co-ords of 3486, 2895 (in 4080 by 4080 pixels), well off centre,so some oval distortion is visible. The brightest star, top left, is too bright for the catalogue, so the first to appear is a00105. Moving away from 1367, through 105 we get to 'k' or star 5854. This is the only previously known variable in this plot and is V585 Cygni, a medium amplitude and period lpv, see below. At 0.5 magnitude, one might expect it to have the largest amplitude of any star in the sub-image but in fact star 'm', a12507 which is a W UMa type binary (p=0.45562d) varies by 0.85 magnitudes.

```
vars & brighter stars listed
. . . . . . . . e . . . . . . . O   1367v
. . . . . . . . . . . . . . . . a    105
. . . . . . . . . . . . . . . . b    564v
. . . . . i . . . . . . . . . . c    732
. . . . . . . . . o . . . . . . d   1035
. . . . . . . . . . . . b . . . e   1307
. . k . . . . . . . . . . . . . f   2057
. . . . . a . O . . j . . . h . g   2207v
. . . . . . . . . . . f . . . . h   2492v
. . m . . . g . . . . . . . . . i   3769v
. . . . . . . . . . . . . . . . j   5349v
. . . . . . . . . . . . . . . . k   5854v
. . l . d . . . . . . . . . . . l   6822v
. . . . . . . . . . . . . . n . m  12507v
. . . . . . . . . . . . . . . . n  12825v
. . . . . . . . . . . . c . . . o  17496v
```

Key to figure 1.

Basic ID's and values are shown for these stars in the table below.

cat. name	other ID 1	MagM	MagR	Period1
TEa00564	3593 240501	10.36	0.062	
TEa01367	3593 171801	11.327	0.058	3.3883
TEa02207	3593 221301	11.76	0.02	7.362
TEa02492	GSC 3593-1001	11.56	0.09	3.334
TEa03769	1369 445274	12.34	0.09	1.0988
TEa05349	1370 469035	12.56	0.2	110.6
TEa05854	V585 Cyg (L)	12.27	0.61	85.7
TEa06822	1370 468405	12.76	0.03	0.121807
TEa12507	1370 468435	13.43	0.85	0.45564
TEa12825	1370 469322	13.57	0.48	45.23174
TEa17496	1370 468943	14	0.4	54

V585 Cygni is also IRAS 21118+4649. Other ID 1 is the USNO B1.0 ID by default.

'MagM' is the maximum seen in the 5 years analysed (2003 -2007) so far, and 'MagR' the range of variation. At the moment the values are simply derived, where available, from the red values of a single reference star using the Carlsberg Meridian catalogue. At this point I'd like to thank Chris Lloyd for encouraging me to use these (more reliable than the U.S. Naval Observatory) values, and indeed for sorting out and sending me a subset of CMC for the purpose.

Below we look at the stars one at a time. The look must perforce be brief, but full data can be found on the website (*www.the-planet-project.com*). As usual the dates are from January 1st 2000 or JD 2451545. The earliest date from which we have reduced data is 1344 (Sept 6/7th 2003) and the latest is 2903 (Dec 13th 2007).

A number of detailed plots of star data are referred to in the text, eg: log *P/J-K* diagram, log *P/B-R*, *J-K*/log *P* diagram etc. These and many similar reference plots can be found on the website. Symbols used:

L, M, R luminosity, mass, radius.	v_{tr} Transverse velocity	ϕ Phase
$\gtrsim$ greater than or approximately equal to	$L_\odot$ Solar luminosity	μ Proper motion

Star a00564

This is clearly variable but its movement is small. The Tycho B-V is 1.051, leading to a colour temperature of 4,260K, in reasonable agreement with our estimate of 4,157K. To save space no light curve is shown for this star.

RS. A small-amplitude variable star, with $m_{max} \sim 10.6$ and $m_r \sim 0.06$ mag. The amplitude varies from year to year, and there is no obvious periodicity. The amplitude averaged over the years of the observing interval is $m_r = 47$ mmag.

The JHK colour indices ($J = 7.461$, $J\text{-}H = 0.865$, $H\text{-}K = 0.316$) are very similar to those of the **M5 III SRb** variable star V Horologii ($J\text{-}H = 0.874$, $H\text{-}K = 0.299$).
The star has a measurable proper motion: $\mu_\alpha \cos\delta = -0.01007''\ \mathrm{a}^{-1}$, $\mu_\delta = -0.00382''\ \mathrm{a}^{-1}$, so $\mu = 0.01077''\ \mathrm{a}^{-1}$ in the direction W21°S (position angle 249°), i.e. at ~28° to the Galactic

plane (going north and to decreasing longitude). If M_V for an M5 III star is -0.3, then, with $V = 11.439$, $d \sim 2.2$ kpc and $v_{tr} \sim 110$ km/s.

The M_K-m_r diagram for Stan's variable stars yields $M_K \sim -3.76$, where as the M_K-log m_r diagram yields $M_K \sim -3.11$. If we take the average value, $M_K = -3.44$, then, with $K = 6.280$, ***d* ~ 880±140 pc** and $v_{tr} \sim 45 \pm 7$ km s^{-1}. These results are obviously inaccurate, but they give some impression of the distance and transverse speed of the star; the lower values of d and v_{tr} are probably nearer to the truth.

a01367

SW & RS. The central star in this group. We don't yet even know its period for certain. Below is a double wave curve formed from the 50,000 points of the whole data set (averaged by 10's after phase overlay). It should be possible to choose between this and a half period with some further investigation. One obvious problem we have is that the star temperature deduced from our measurements, even after correction, is still at 8000 K, very different from the published B-V figures which yield 6530K. However the published JHK photometry supports the hotter value.

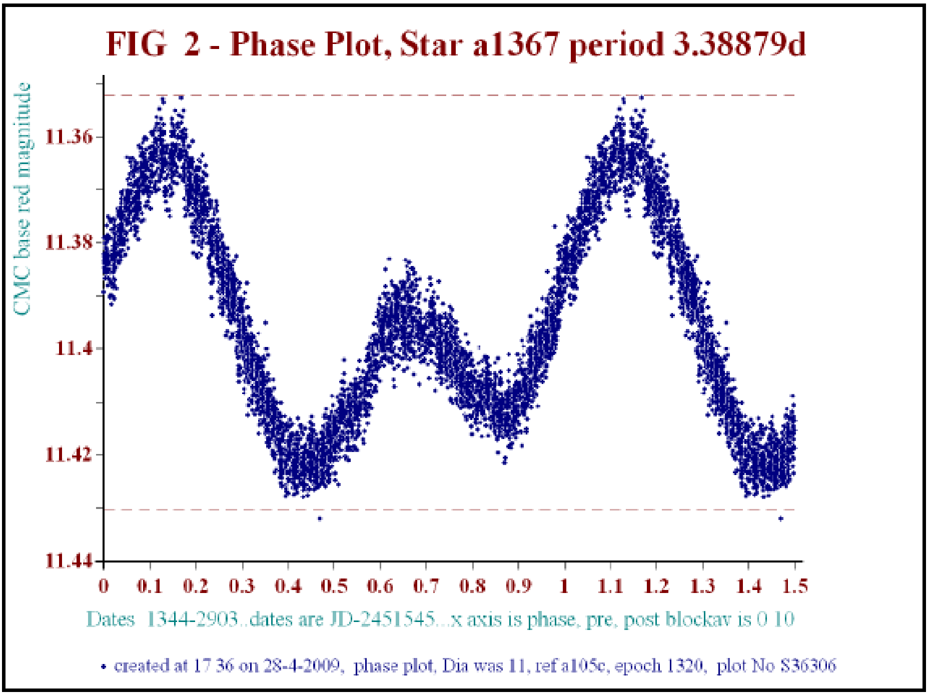


Figure 2: **An unusual variable star, possibly with a double-wave light curve.**

For the entire observing period, ***P* ~ 3.38879±0.00007 d.**

Max. I = 1340.610 + 3.38879 *E*.

The photometry is anomalous: the JHK photometry ($J-H = -0.009$, $H-K = +0.03$) implies that this is an early A-type star, or perhaps an Ap-type star, whereas the published BVR photometry ($V = 11.500$, $B-V = 0.424$, $V-R = 0.28$) makes it an F-type star (perhaps about F5, with $T \sim 6530$ K and $M_V \sim +3$ for a main-sequence star). However, our measurements from 2003 suggest an A2-3 star in agreement with the JHK photometry, so we take that as more probable. From the light curve and the period, this could very well be a rotating variable, a magnetic Ap-type star, i.e. an ACV star; it is not likely to be a pulsating variable or an eclipsing binary.

Unfortunately, it is probably too faint for spectroscopic investigation. The distance for a main-sequence star is $d \sim 500$-800 pc, so, with $\mu = 0.0024''\ a^{-1}$, $v_{tr} \sim 8 \pm 2$ km s-1.

Star a02207

Another low amplitude problematic one, but certainly a hot star, we make is about 10,900K. The most likely period is 7.358 days. A phase plot from 2007/8 is shown. The ephemeris is **Max. = 1335.144 + 7.358 E**.

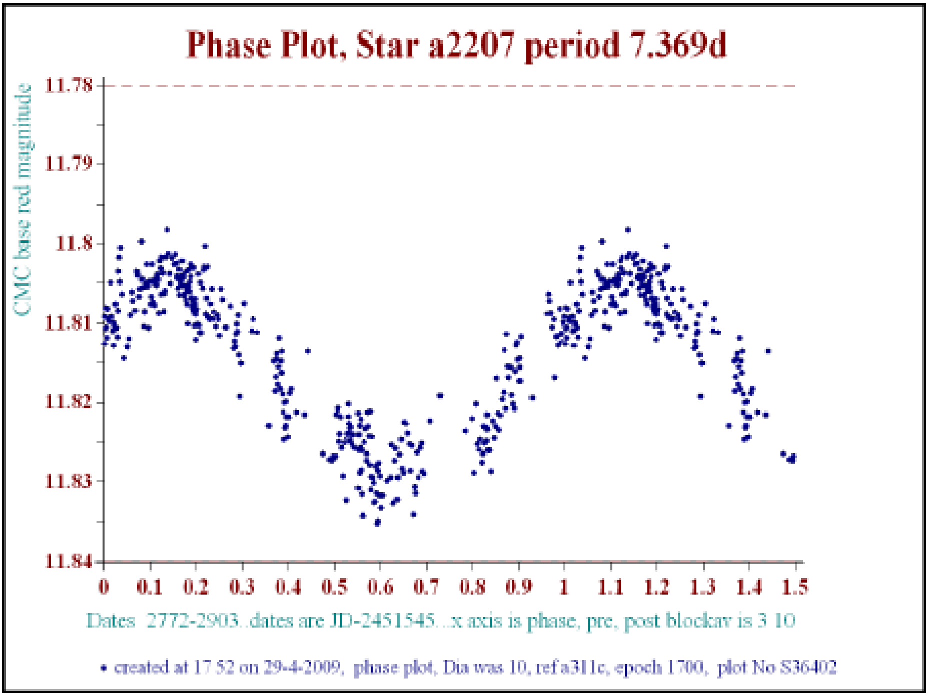


Figure 3.

R.S.... The BVR photometry ($V = 11.787$, $B-V = 0.138$, $V-R = 0.077$) suggests that this is a middle A-type star, with $M_V \sim +1.9$ and $d \sim 950$ pc; the *JHK* photometry ($J = 11.298$, $J-H = -0.016$, $H-K = +0.055$) suggests a slightly earlier spectral type and is compatible with an Ap star. The observed proper motion ($\mu = 0.0090''$/a) yields $v_{tr} \sim 40$ km s^{-1}.
There are three possible explanations for this star, namely a small-amplitude RR Lyrae star (of subtype RRc), a short-period Cepheid or W Virginis star or an Ap star. In other

respects, the star falls among Stan's 'anomalous Cepheids', which include a1367, and is bluer than the RR Lyr stars.
From the *P*-M_V relation given by Cooper and Walker (*Getting the Measure of the Stars*), p. 214 for W Virginis stars, M_V ~ -1.8 ($L \sim 450 L_\odot$). With v = 11.787, d ~ 5.2 kpc (17,000 light-years). With this distance, v_{tr} = 220 km s^{-1}; if all this is correct, the star is very definitely a member of Population II.

However, the best explanation for the relatively long period, the small amplitude, and the nearly symmetrical light curve, is probably that the star is an ACV star seen nearly pole-on, so that we see only one of the magnetic poles.

Star a02492

This is a slightly eccentric and noisy eclipsing binary. Approximate values are (using our star a00054 as a comparison and USNO red magnitudes) as in the box below. A phase plot is shown for 2004 data plus a primary eclipse plot.

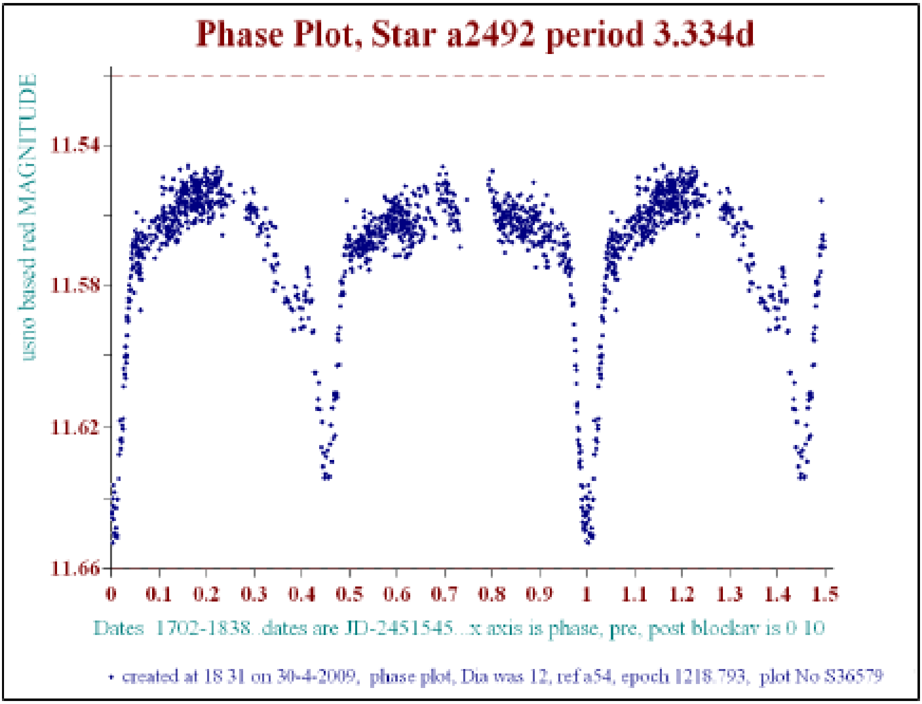


Figure 4.

max 11.554	$\phi 2$=0.452	p=3.3340d
m1 =11.647	d1 0.093 mag	
m2 =11.628	d2 0.074 mag	

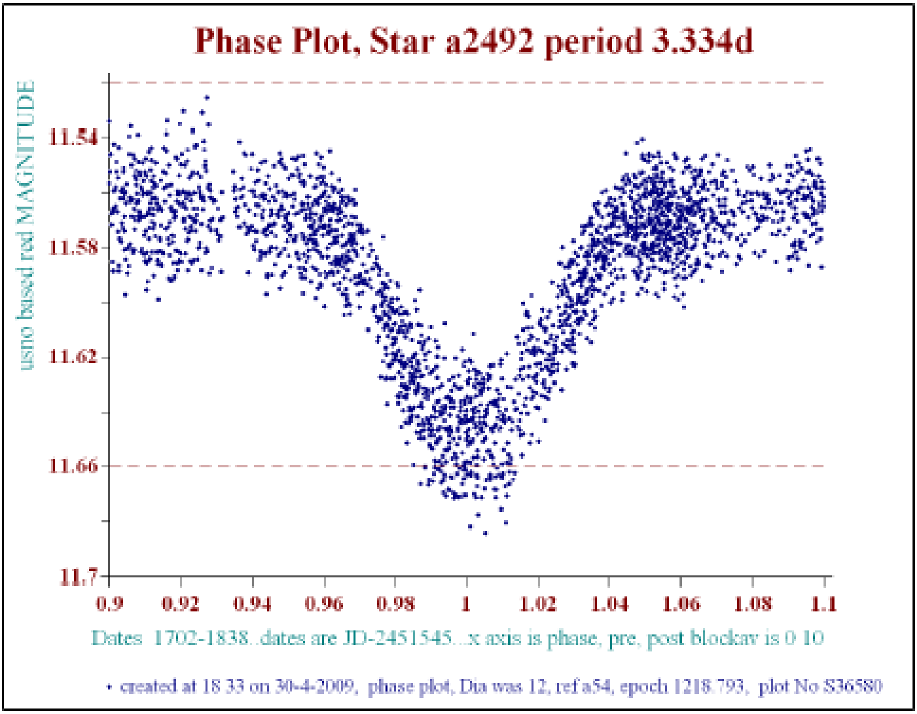
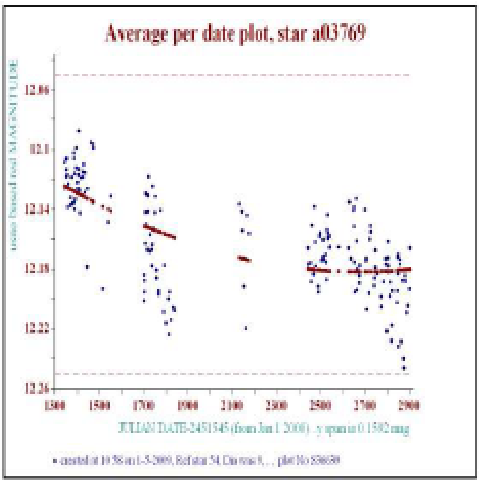


Figure 5: Primary eclipse of star a2492.

R.S. The BVR colours are impossible; the JHK colours suggest an early A-type star (perhaps similar to the A4 V star δ Leo) or a reddened B-type star. There is no proper motion or parallax. There is a strong reflection effect. This is probably a partially eclipsing, detached binary system, that consists of two similar early A-type or late B-type stars.



Star a03769

Another pulsator with a small and variable amplitude. The pulsation amplitude of this star has varied from 54 mmag in 2003, 90 in 2004, 76 in 2005, a low of 26 in 2006, and 68 in 2007. In addition its mean brightness seems to have declined by 0.1mag in that time, viz: average per date plot left. The scatter on the 5 year (av per date) phase plot opposite page, is caused by the period being close to 1 day.

Figure 6.

The star may be a long-period RR Lyrae star, or short-period W Virginis star. The star appears to have faded over the observing period, from m_{ave} ~ 12.12 in 2003/4 to m_{ave} ~ 12.19 in 2007, i.e. by ~ +20 mmag./yr. The ephemeris is **Max. = 1340.461 + 1.09787 *E*.**

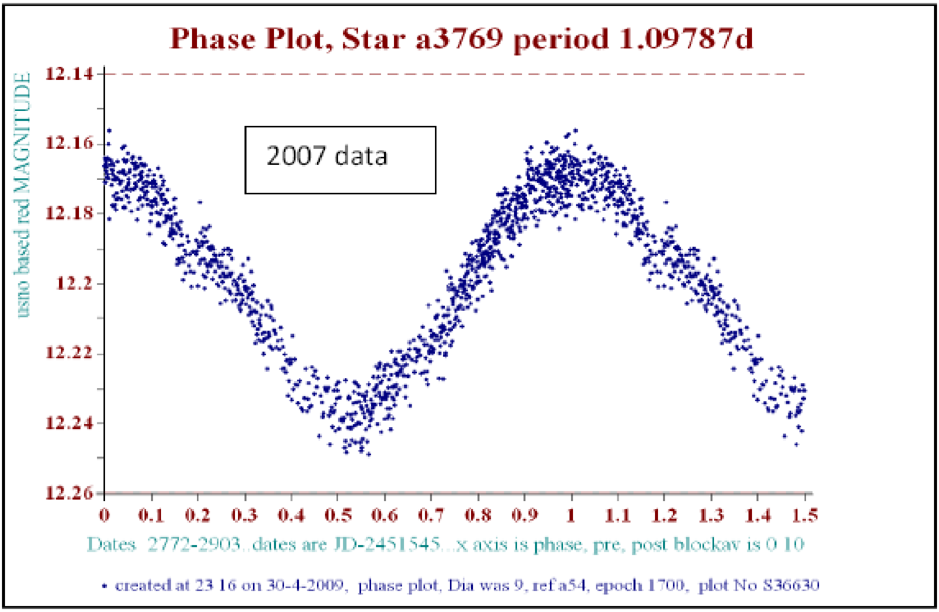


Figure 7.

In the various two-colour diagrams, a03769 falls among the δ Cephei and W Virginis stars, and is much redder than the RR Lyrae stars. In the *J-K*/log *P* diagram, it suggests a reddened (E_{J-K} ~ 0.25, E_{B-R} ~ 0.4-0.7) RR Lyrae, or short-period W Virginis star. In the log μ/V diagram, its estimated position puts it among the low-μ RR Lyrae, or the W Virginis stars. If the star has V = 12.86 and M_V = +0.6 (typical of an RR Lyr star), d ~ 2.8 kpc, and v_{tr} ~ 90 km s^{-1}, it is a fairly high-velocity star.

Star a05349

The light curve of this star is fairly similar to star a05854 (V585) except that it's slightly weaker (0.2 mag compared to 0.5) and slower (110d compared to 85d). One wonders why it escaped notice when V585 was found. Our estimate of its colour temperature (5000K) is quite at variance with its published B-V which gives 8780K.

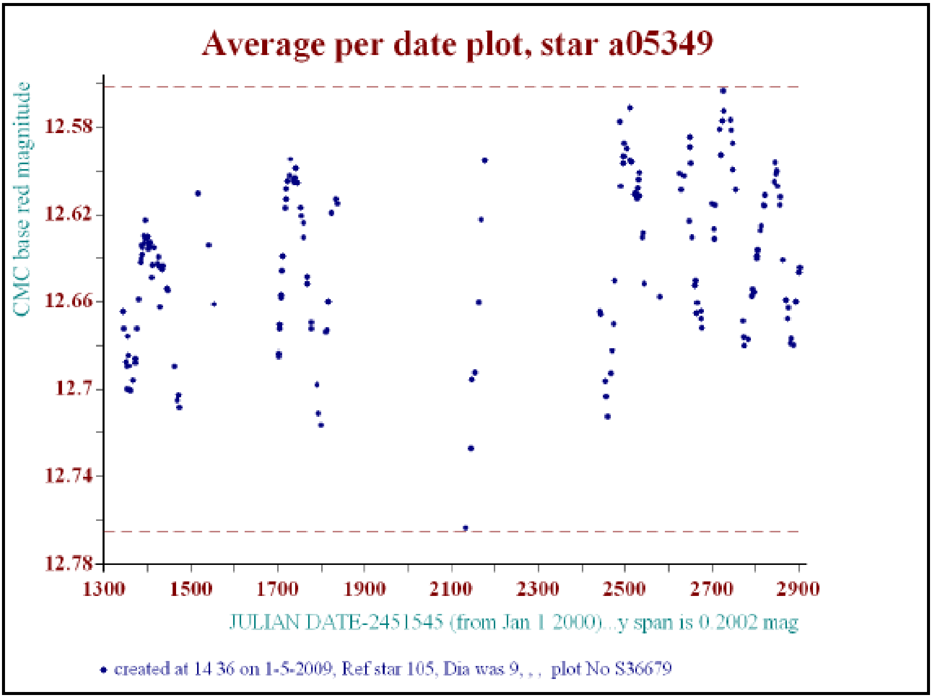


Figure 8.

RS. A very interesting small-amplitude variable star, with m_{max} ~ 12.41 and m_{min} ~ 12.61. The period, P ~ 110 d, suggests a semi-regular (SRa?) variable, but the IR colour indices (J = 10.901, J-H = 0.556, H-K = 0.122) suggest an earlier type star, perhaps something on the Cepheid instability strip or even an SRd star. Counting maxima suggests P ~ 110.6 d. Max. ~ 1398 + 110.6 E.

The star is much too 'blue' for a red giant variable star, and it appears to fall in the Cepheid instability strip. The JHK colours are J = 10.901, J-H = 0.556, H-K = 0.122; the BVR colours are V = 13.26, B-V = 0.18, V-R = 0.91, which seem very doubtful. In the JHK two-colour diagram it falls among the Cepheids, the W Virginis stars, and the RV Tauri (RVA) stars. The B-R and J-K colours are very similar to those of the W Virginis star κ Pavonis and the RVA star AC Herculis. In the log P/J-K diagram, the star falls among the RVA stars and is rather less red than most of the SRd stars. In the log P/B-R diagram, the star falls on top of the RVA star AZ Sagittarii and among the RV Tauri stars and the bluer SRd stars.

The star has a measured proper motion, of $\mu_\alpha \cos\delta = 0.00003''\ a^{-1}$, $\mu_\delta = 0.00769''\ a^{-1}$, and $\mu = 0.00769''\ a^{-1}$, in the direction N0.22°E. The proper motion is at 41° to the Galactic plane, going north and to increasing Galactic longitude; the star appears to be a member of Population II. In the V-log μ diagram, it falls among the W Virginis and RV Tauri stars and on an extrapolated continuation of the SRd stars to fainter values of V; its proper motion is $\gtrsim$10 times what one would expect of a 13th magnitude classical Cepheid.

A very tentative estimate of the absolute magnitude yields M_V ~ -0.4, whence, d ~ 6.4 kpc and v_{tr} ~ 230 km s^{-1}, but these estimates can be little better than guesswork. The great estimated distance implies that the star must be heavily reddened, but this is inconsistent with the low value of *B-V* and the modest value of *B-R*.

Star a05854=V585Cygni

As far as we are aware this is the only variable in this group that was previously known.

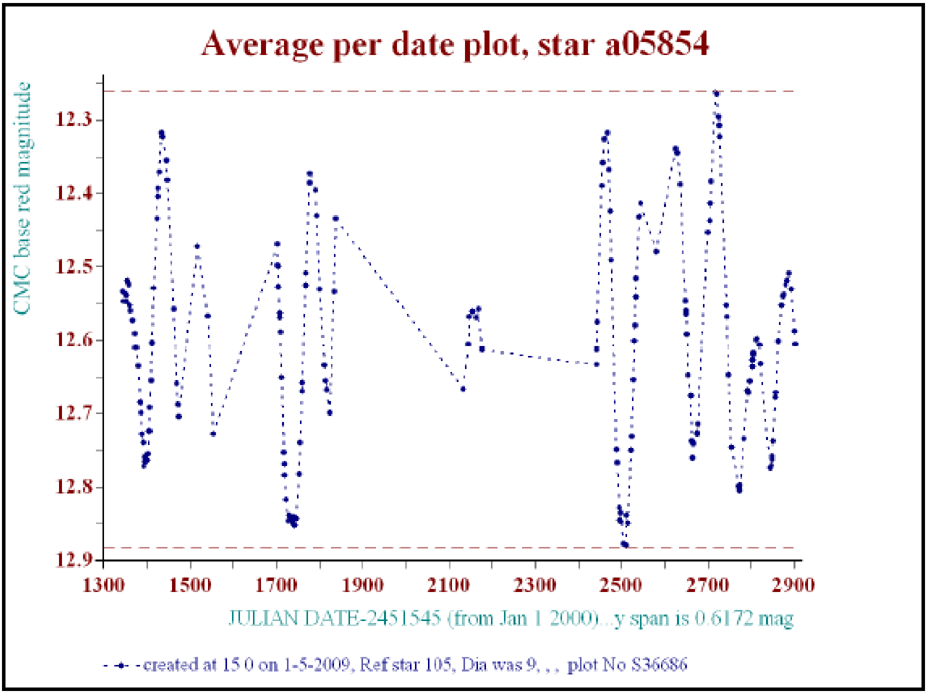


Figure 9.

RS. A medium-amplitude variable star, with m_{max} ~ 12.25-12.3 and m_r ~ 0.5-0.6 mag. According to the GCVS it is an irregular variable star (type L), but Stan's light curves show fairly regular light variations. The minima tend to be flat-bottomed. The average period derived from counting maxima and minima is P_{ave} = 85.7±0.2 d, and the period is consistent enough to justify classifying the star as an SRa-type semi-regular variable; if the amplitude were larger, I should classify it as a Mira variable. The minima brighten from m_{min} = 12.86 in November 2006 to m_{min} = 12.72 in October 2007, and the amplitude decreases dramatically during 2007. The ephemeris is Max. ~1434 + 58.7 *E*.

The average ϕ_{min} determined from six minima is ϕ_{min} = 0.49±0.07, so the light curve is nearly symmetrical.

This is one of the reddest of Stan's variable stars, with *J* = 6.623, *J-H* = 1.040, *H-K* = 0.484; these colours are similar to those of the M7 IIIe Mira variable star R Aquilae (*P* = 300 d).

The star fits well into the *P-L-C* relations for Stan's other red variables, except that the amplitude m_r appears to be slightly larger than the average for its period. The star is perhaps redder in *J-K* than normal for its period and amplitude, but that may be the effect of interstellar reddening. The estimated $M_K \sim -5.7$; with $K = 5.099$, $d \sim 1.4$-1.5 kpc.

——————————Star a06822——————————

This star had an amplitude of about 26 mmag in 2003, 33 mmag in 2004 (shown), but only 21 in 2006, and 16 in 2007. Its period seems to be the same in all years.

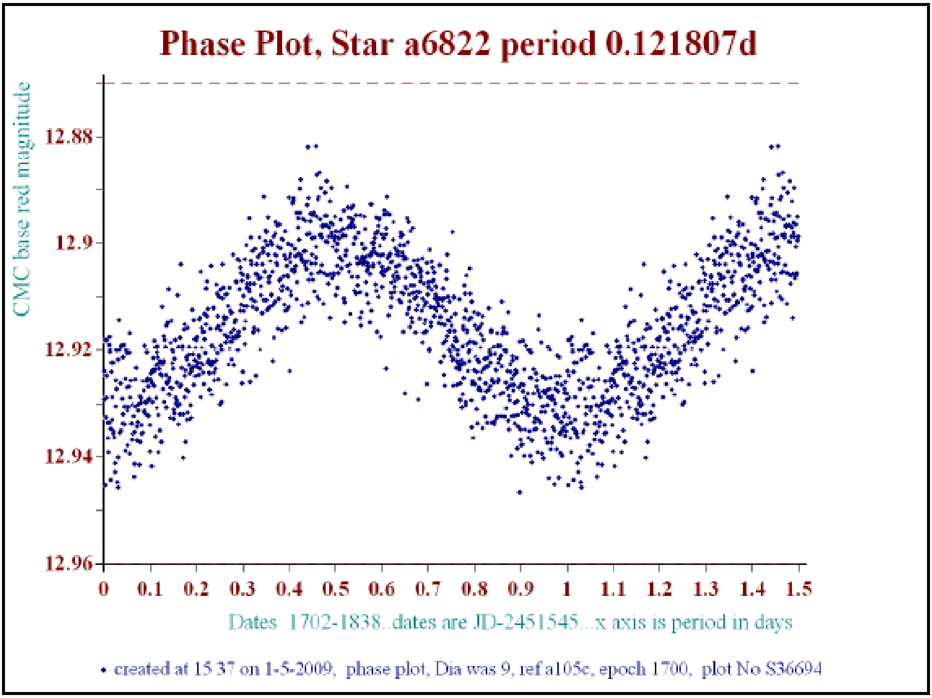


Figure 10.

RS. A small-amplitude variable star (typically $m_r \sim 20$-35 mmag.) with $m_{max} \sim 12.87$ and $P = 0.121807$ d. The light variations change from night to night.

The *JHK* photometry ($J = 11.946$, J-$H = 0.132$, H-$K = 0.112$) suggests that this is an F-type star; the JHK colours are similar to those of β Cas (F2-5 III-IV). The *BVR* photometry ($V = 13.03$, B-$V = 0.03$, V-$R = 0.74$) is obviously inaccurate, but the *B-R* colour is again consistent with an F-type star. The period and the inferred spectral type imply that this is a δ Scuti type star.

The one point against the interpretation of the star as a δ Sct variable, is the proper motion ($\mu_\alpha \cos\delta = 0.0106''$ a^{-1}, $\mu_\delta = 0.01575''$ a^{-1}, $\mu = 0.0190''$ a^{-1}). In the *V*-log μ diagram, the star falls among the SX Phoenicis stars rather than among the δ Scuti stars. The position angle of the star's proper motion is $\theta = 34°$, only about 7° from the Galactic plane, so it is probably a disc star. The period is longer than that of most SX Phoenicis stars, but XX Cygni closely resembles a6822 in its JHK indices and its period. If a6822 has the same M_V as XX Cygni ($M_V = 2.87$), d ~ 1.1 kpc and v_{tr} ~ 100 km s^{-1}, on the low side for an SX Phoenicis star but rather high for a δ Scuti star.

Star a12507

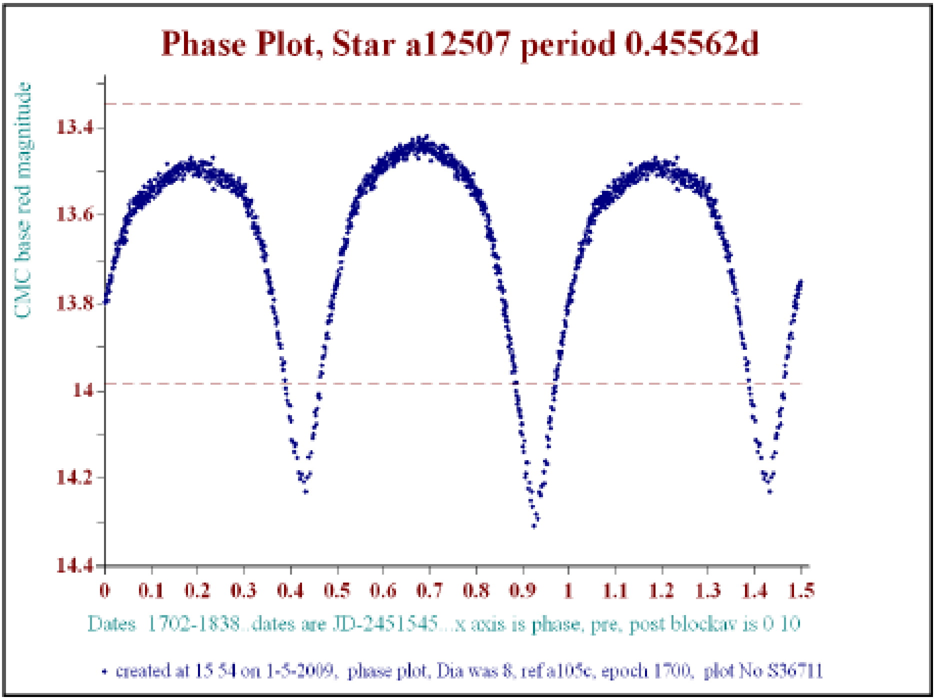


Figure 11.

RS. This is a W Ursae Majoris star, with very similar eclipses. The quadratic ephemeris for the interval 2003-7 is **Min II = 1344.570 + 0.455637 *E* -6.6×10^{-10}*E*^{2}**. It appears that the minima change places; the secondary minima during 2003/4 and 2007 are the primary minima during 2004/5 and 2006. During the first part of 2007, the two minima are of equal depths. There is no systematic difference in the shapes of the primary and secondary minima, and it is therefore not clear whether the larger or the smaller star is the hotter component.

The B-V colour ($V = 14.00$, B-$V = +0.44$) suggests that this is an early F-type star (F0-F5); however, the JHK colours ($J = 12.159$, J-$H = 0.429$, H-$K = 0.121$) are almost identical to those of α Centauri A (G2 V) and definitely imply that it is a G-type star.

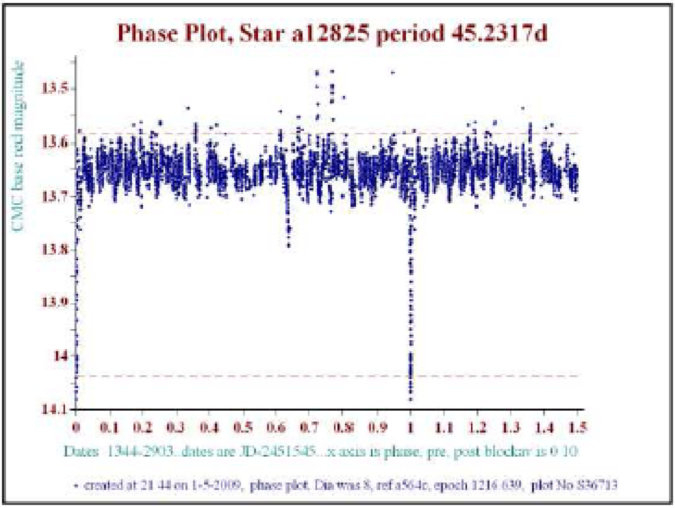
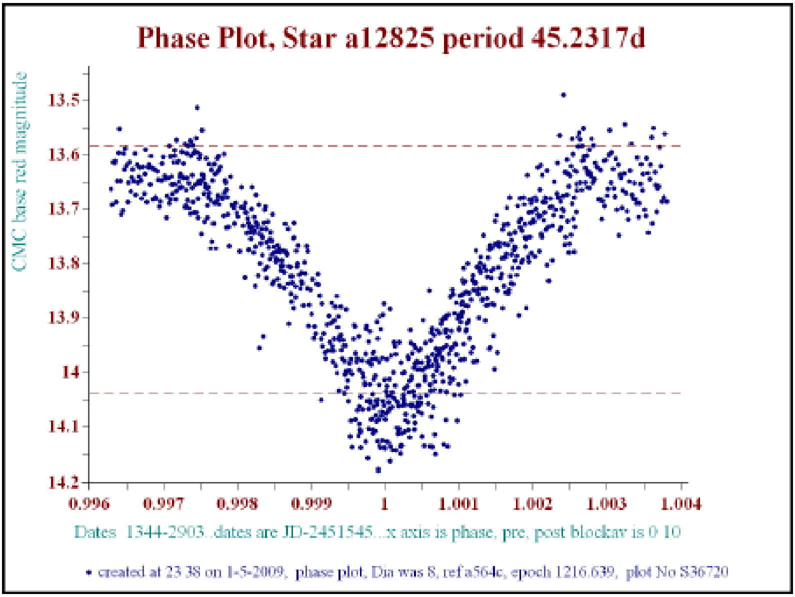


Figure 12.

This eccentric eclipsing binary is a challenge and not yet solved. Left is a phase plot from full 5years data and below a phase plot of what we assume is primary minimum.

Figure 13.



RS. The orbit is definitely eccentric, with $\phi_{II} \sim 0.64\pm0.005$, if the period is correct. The parameters of the light curve are $m_{max} \sim 13.64\pm0.01$, $m_{minI} \sim 14.06$, $m_{minII} > 13.77$, $\phi_{II} \sim 0.64\pm0.05$. We do not have observations of a full minimum at $\phi = 0.64$ so we do not know whether it is the primary or the secondary minimum; for the time being, I shall assume that it is Min. II. This assumed secondary minimum falls about 28.95 days after one primary minimum and about 16.28 days before the next; this minimum is also much broader ($\Delta t >$

0.49 d) than the primary minimum (Δt ~ 0.22 d), implying that secondary minimum occurs near apastron.

The JHK photometry (J-H = 0.260, H-K = 0.083) suggests that this is an early G-type star, and this is consistent with our temperature estimate, T = 6021 K; the JHK colours are quite similar to those of the Sun. The BVR photometry is less clear; V = 13.83 and B-V = 0.19, consistent with an A-type star, but V-R = 0.65, more consistent with a K-type dwarf star. The B-R colour (0.84) is consistent with a late F or early G star. There is no proper motion, so the star is probably fairly distant.

The star is in the north-east of Stan's cloud, in a region of patchy obscuration and a fairly sparse stellar density; however, the exact location of the star seems to be in a denser star cloud, perhaps marking a 'window' of reduced extinction. Since the JHK colours should not be grossly affected by interstellar extinction, this is probably a comparatively unreddened F or G star rather than a distant reddened early-type star; the photometry, with an absolute magnitude M_V ~ +4.5, implies d ~ 700 pc.

The existence of an F/G-type eclipsing binary star with a relatively long-period and an eccentric orbit may have some bearing on the formation of planetary systems around solar-type stars.

Star a17496

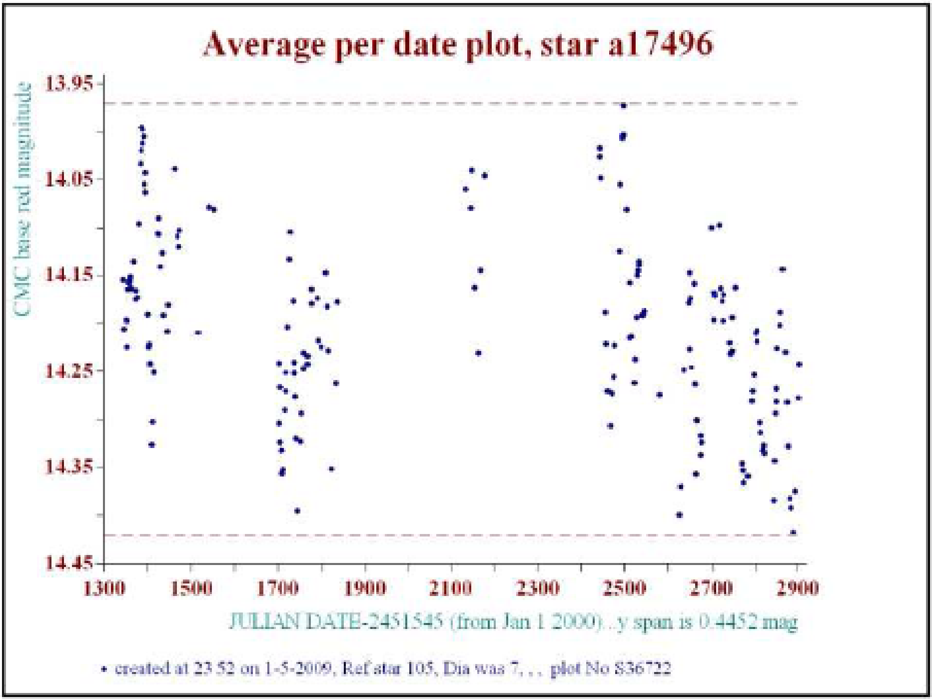


Figure 14.

A small-amplitude variable star (m_{max} ~ 14, m_r ~ 0.33 mag.), with light variations on a time-scale of about 50-60 d. The amplitude appears to be fairly constant (m_r ~ 0.3±0.03 mag.) but the maxima and minima may be variable by ~0.2 mag. The light variations are semi-regular at best.

The star appears to have episodes of regular or semi-regular variation, alternating with episodes of chaotic light variations. During the episode of regular variations in early 2006 and 2007/8, P ~ 55 d.
During 2003/4, we get P = 75.48 d (=50.32 d×1.5); this period yields a light curve that is very noisy.

The star appears to be a SRb star rather than an irregular variable; an average period P ~ 54 d, with m_r ~ 0.25 mag. seems reasonable. The star fits well into the period-luminosity-JHK colours relations found for Stan's other red variable stars.
The JHK colour indices of the star (J = 8.192, J-H = 1.058, H-K = 0.452) are similar to those of the carbon stars S Centauri, X Cancri and T Caeli, so a17496 could well be a carbon star, with a spectral type of about C4-6. However, the period is probably too short for a carbon star and the amplitude is too small.
The star does not have a measured proper motion. The period of 54 d yields M_K ~ -5.01, so, with K = 6.682, and assuming that there is no interstellar extinction in the K-band, we find d ~ 2.2 kpc.

Fainter Stars

We now know there are at least three other variable stars in this patch, marked with arrows in the bitmap. Two are Rmag 15.4, the brightest one (bottom of the three) is about R14.4. They have not been studied properly yet but we do know that one is a W Ursae Majoris type star, one is a red variable and one is a pulsator with a period of 0.18361 days.

Figure 15: Stan's observatory.

R CORONAE BOREALIS IN 2009 – THE FAINTEST FULLY SUBSTANTIATED FADE.

JOHN TOONE

On the 28th January 2009 I reported via BAA VSS Alert, a visual observation made on that morning of R Coronae Borealis at magnitude 15.0. This indicated a further fade of 0.2 magnitude during the solar conjunction period of November and December 2008, that also put it fainter than the official GCVS listed minimum of mag 14.8.

This triggered a search of historical data to establish whether R Coronae Borealis had previously been observed at this faint level. R Coronae Borealis has been on the programme of the BAA VSS since 1900, but the data for 1900-1919 has not been input yet. However, a search of the database for 1920-2008, lists only two observations at a similar faint level (corrected to current sequence 041.04):

JD2438617.40 (July 1964)	=CC	15.1	R220	B A Carter
JD2438859.39 (April 1965)	=CC	15.1	R320	B A Carter

The above observations were made during the second longest recorded fade of R Coronae Borealis in the years 1962-1967, and all VSS observers at the time were recording negative estimates apart from B. A. Carter. B. A. Carter observed from the city of Birmingham, and any visual observations of 15th magnitude with a 22cm reflector from a non rural site have to be considered suspect. However, a 32cm reflector under good seeing could have reached 15th magnitude even in urban locations back in 1965. Therefore it would appear possible, but not confirmed, that R Coronae Borealis dipped briefly to 15th magnitude in April 1965.

Checking the AAVSO data from the 1962-1967 period, there are a few isolated observations in the range 14.9-15.1, but the main body of data indicates fades to magnitude 14.4 around JD2438600 and JD2438880. Unfortunately the AAVSO do not record the light estimate details, so we cannot be certain exactly how the data converts to the current day sequence, but one could make a reasonable approximation. On the basis that all the observers were using the 1928 chart traced from HCO, it can be assumed that most observations were made using the comparison star closest to R Coronae Borealis which is labelled 143. This comparison star is BB at magnitude 14.8 on the current BAA VSS sequence. Consequently, it is likely that R Coronae Borealis was around magnitude 14.9 during this faint period. Although not a precision conversion, I consider that the mean of multiple observations by AAVSO observers, would give a safer indication of the minimum level, rather than a single fully converted observation. To conclude therefore it would seem that the faintest that R Coronae Borealis got to during the 1962-1967 fade was around mag 14.9.

A check of reports and light curves in BAA Journals, confirmed that there were no deep fades to rival that of 1965 and 2009 in the period 1900-1919. This then left 19th Century data to be investigated, and I put out the following appeal in BAA VSS Alert messages on the 4th February 2009:

"*As for the 19th Century there are possibilities that R Coronae Borealis went even fainter, most likely during the 10 year fade between 1863 and 1873. The most direct* *method of ascertaining this is to review No. 57 of the Publications of the Potsdam Observatory, where Ludendorff published a monograph on R Coronae Borealis covering the years 1783 to 1905. If the light estimates are not given there, I am sure the reference sources would be, and it is likely that many would refer to the Astronomische Nachrichten which to some extent is available through the NASA ADS system. A quick review of the Ludendorff paper by someone fluent in German, and conversant with sequences and data reduction, could instantly assess whether it's worth digging any deeper.*" A couple of years ago I did a similar exercise on bright maxima of Mira and found myself translating Wargentin and Argelander data, and found it most laborious because I was not fluent in German. When researching these things I think it is a big advantage to get close to the source of the data, and if it is part of your national heritage as well, then you will have maximum motivation. Wolfgang Renz responded positively to the above appeal and transmitted the following report.

Wolfgang Renz.

Here comes the evaluation of Schönfeld's R Coronae Borealis observations articles:

1873 AN vol 80:
http://articles.adsabs.harvard.edu/full/seri/AN.../0080//0000004,000.html >1873 AN vol 80 No.1906-1907 index

Edward Schönfeld - Beiträge zur Kenntnis des Lichtwechsels veränderlicher Sterne:
http://articles.adsabs.harvard.edu/full/seri/AN.../0080//0000081.000.html

R CrB obs by Schönfeld, Jan 1865 - Sept. 1872:
http://articles.adsabs.harvard.edu/full/seri/AN.../0080//0000088.000.html
(there is no better standard ADS entry than 1873AN.....80....1)

Schönfeld said that he observed her in 400 nights since 1865. He cited his "*Wiener Abhandlung*" (Vienna paper) for giving the comparison star sequence he used (which does not seem to be accessable) and referenced the article *Schmidt AN #1895*. He also gave three additional fainter comparisons he used for his step scale for the refractor:

B1855 coords		**comp. ID**		**steps**	**(mag note**
RA	**Dec**	**Schönfeld**	**Schmidt**	**Schönfeld**	**in GIF)**
15 42 45	+28 39.0	k	y	10.6	~ 12.1
15 42 57	+28 38.5	l	p	7.9	~ 13.0
15 43 02	+28 39.5	l′	-	5.6	~ 13.8

The 5.6 steps of l′ are set arbitrarily (there is no comparison with 0 steps).
The full sequence is:
1′=5.6 st, l=7.9 st, k=10.6 st, f=15.0 st, e=19.7 st, d″=23.6 st, d′=25.8 st (the two 'd' are swaped in the Vienna paper), g=29.0 st, h=31.7 st, p=34.6 st, n=36.2 st, m=42.1 st, c=47.1 st, b=53.3 st.
He had an other step scale for the smaller comet finder:
p=36.4 st, n=37.9 st, m=43.4 st, c=48.5 st, b=53.9 st, a=59.6 st
that was adapted to the refractor step scale to give about the same values.
These steps are NOT Argelander steps (step 1 = smallest detectable brightness difference).

His faintest estimates on his step scale are all extrapolations to the faint end, by using full or half steps. If I would report such observations, I would mark them all as at least less certain, if not uncertain. The noted magnitudes in the GIF, are hand written by a reader who obviously processed his step scale somehow. But I have no idea what kind of magnitude values (s)he used. Depending which exemplar was used for the scan, it was maybe someone who is well known and published a paper about R Coronae Borealis.

Lets try to match his comps via VizieR. I get certain IDs with UCAC coordinates:

comp	J2000 coords		J2000 coords		_r	_x	_y	ID
id	RA hms	Dec° ′ ″	RA °	Dec °	′	′	′	GSC 1.2
R CrB	15 48 34.42	+28 09 24.3	237.143395	+28.156749	0.00	0.00	0.00	02039-01605
k	15 48 43.19	+28 12 12.6	237.179948	+28.203498	3.41	1.93	2.81	02039-01463
l	15 48 56.03	+28 11 56.8	237.233445	+28.199112	5.40	4.76	2.54	02040-00650
l′	15 49 03.04	+28 12 51.4	237.262683	+28.214267	7.19	6.31	3.45	02040-00101

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His faintest observations during that time span are:

DATE	steps	(mag note in GIF)	vis V mag
1865-10-13	3.6		13.88
1866-10-03	3.8		13.83
1868-06-12	3.6:		13.88:
1868-06-25 <	4.0 >	14.3: >	13.79:
1869-04-12	3.6	14.5	13.88
1869-08-26	3.6	14.5	13.88
1869-08-28	2.6:	14.9:	14.12:
1871-10-14	3.8	14.4	13.83
1871-10-17	3.6:	14.5:	13.88:
1871-07-07	3.6	14.5	13.88
1871-08-24	3.1	14.7	14.00
1871-09-01	3.1	14.7	14.00
1871-09-02	3.6	14.5	13.88
1872-09-08	3.3	14.6	13.95

(the faintest 2.6: obs is: l’ 3 R CrB, R at LM)

Beside the fact that the estimates are not very certain due to extra-polation, its (relative) accuracy should be in the range of ~ +/-0.5 steps or +/-0.12 to 0.2 mag V.

So Ludendorff’s comment in 1908AN....178...91L that R Coronae Borealis reached the faintest magnitude of 15.0 in Schönfeld’s 1872 obsservations, has to be corrected to ~ 14.1 or 14.0 mag V and is therefore not the faintest ever observed visual magnitude of R Coronae Borealis.

The above derived visual magnitude values are by ~ 1 magnitude, brighter than the currently observed visual magnitude values of ~ 14.9, and the measured ones of ~ 15.1

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comp id	steps Schönfeld	(mag note in GIF)	UCAC VR	CMC14 r’	GSC232 QuickV	+/-	TASS Mark IV PV2 V	+/-	I	+/-	SDSS g	+/-	r	+/-	2MASS J	+/-	H	+/-	Ks	+/-
k	10.6	~ 12.1	11.81	12.005	12.05	0.30	12.321	0.087	11.510	0.106	12.590	0.001	12.119	0.001	10.910	0.018	10.545	0.026	10.491	0.021
l	7.9	~ 13.0	12.44	12.665	12.64	0.30	12.901	0.207	12.211	0.111	13.405	0.002	12.780	0.002	11.706	0.021	11.452	0.030	11.397	0.024
l’	5.6	~ 13.8	12.99	13.256	13.16	0.30	-		-		13.744	0.002	13.366	0.002	12.326	0.021	12.048	0.031	11.994	0.021

Fortunately all these 3 stars have Henden photometry, so we don’t have to use color conversion formulae. They are even chosen comparison stars in the current AAVSO and BAA sequence:

id	AAVSO	BAA	RA(J2000)	ra err	DEC (J2000)	dec err	n	V	B-V	U-B	V-R	R-I	V-I	Errors						
R	CRB		237.143380	0.093	28.156713	0.078	3	14.927	0.370	99.999	0.286	0.530	0.829	0.043	0.082	9.999	0.023	0.026	0.041	6
k	122	W	237.179909	0.012	28.203515	0.024	3	12.220	0.698	99.999	0.410	0.376	0.785	0.014	0.023	9.999	0.010	0.016	0.026	6
l	128	Y	237.233459	0.029	28.199138	0.012	3	12.843	0.614	99.999	0.355	0.329	0.683	0.019	0.025	9.999	0.019	0.012	0.030	6
l’	134	Z	237.262712	0.029	28.214328	0.029	3	13.412	0.558	99.999	0.328	0.313	0.641	0.018	0.026	9.999	0.015	0.021	0.034	6

Recent SRO photometry shows the mean B-V of R Coronae Borealis at ~ +0.43 mag and the V-Ic at ~ +0.80, so the comparisons fit relatively well and applying some kind of visual colour correction won’t give a very different result than using V mags directly.

When using these three comparisons to derive a linear regression step scale to V mag conversion, I get:

$$V = 14{,}74 - 0{,}2382 * steps$$

with a R^2 of 0.9996. Its so good that its either accidental or more probably he used some kind of magnitude measurements to derive the step scale from.

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mag V. So, it is in in my opinion, pretty certain that the current minimum is already now, actually the faintest ever observed minimum of R Coronae Borealis.

Wolfgang Renz, Karlsruhe, Germany

J.T. In summary the following is concluded: On the basis of Wolfgang Renz's research into 19th Century data, and AAVSO/BAA VSS data from the 20th Century, it would appear that the current fade of R Coronae Borealis is of record proportions. The visual and CCDV data acquired during the period January to May 2009, can fully substantiate that R Coronae Borealis has reached a record faint level of mag 15.0.

DSLR TRANSFORMATION CO-EFFICIENTS.

Des Loughney

The pixels on the sensor of a Canon camera are covered by an array of blue, green, and red filters. This array is called a Bayer Array. This allows the software that comes with the camera to construct high quality colour images, in the way it combines the light that has passed through the filters. There are twice as many green filters as red and blue ones.

Within the software package AIP4WIN, a Canon RAW image can be separated into red, green, and blue images by separating the data from the pixels covered by a particular filter. These different images are called red, blue, and green channel images. The green channel image can be analysed with AIP4WIN's photometry tools.

The magnitude that is derived from analysing the green channel images, approximates a V magnitude, but is not a V magnitude. A correction needs to be applied to determine the V magnitude. The correction is made using what is called a transformation co-efficient (TC).

The TC has to be determined for each camera model, since the specification for the green filter response will vary. The TC is determined empirically. The method we use works well, if the stars are not too red.

If one examines a number of non-varying stars in close proximity, which are of known (and similar) magnitude, one finds that the difference in the green channel magnitudes, is the same as the difference in their V magnitudes, provided that the colour of the stars is more or less the same. Generally, however, each star is of a different colour and this can be expressed in terms of its colour index, for example in terms of the difference in its B magnitude and its V magnitude, i.e. its (B-V) colour index. The magnitudes used to derive this colour index are from the Johnson UBV system. The (B-V) of a star will be listed on various databases including, for fairly bright stars, the Hipparcos Catalogue.

If you know the TC for your camera, you can use it to apply a correction to the measured magnitude, to transform it to the standard one, e.g. the V magnitude system. The correction depends on the difference in colour between the comparison star used, and the target object.

The TA for a pair of stars, is the difference between the observed green channel magnitudes divided by the difference between their (B-V) values. I sometimes represent it by an equation:

TCa = (OD-ED) / [(B-V)1 - B-V)2]

where OD is observed difference in magnitude and ED the estimated difference from literature values. TCa is the transformation co-efficient, derived from that particular pair of stars.

Although the TCs of each pair measured, should theoretically be the same, they invariably are not! This is because few stars are actually constant, or their tabulated magnitudes may be wrong or out of date, and there may also be errors in the quoted (B-V) values. Analysing pairs of unvarying stars around lambda Aurigae I obtained values of 0.16, 0.15, 0.13 and 0.17, which average to 0.153. Thus, I determined the overall TC for my Canon 450D DSLR camera to be 0.15.

Epsilon Aurigae has a (B-V) colour index of +0.537. The comparison star I use is eta Aurigae, which has a (B-V) of - 0.148. The total difference in (B-V) is therefore 0.537, plus 0.148, which gives a total of 0.685. When you multiply this figure by the TC, you get 0.1025. This is what I add to my green channel magnitude estimates, to yield an accurate V magnitude.

Another example is P Cygni, and the comparison 36 Cygni of V magnitude 5.58. The B-V of P Cygni, according to Hipparcos is 0.377. The B-V of 36 Cygni is 0.056. The difference between the (B-V)s is 0.321. When you multiply this value by the transformation co-efficient of 0.15, you find the green channel magnitude has to be corrected by an addition of 0.05. Thus on 21st May 2009 I determined the green channel magnitude of P Cygni to be 4.85. I therefore made the V magnitude to be 4.80.

If you were looking at a pair of stars, where the comparison (B-V) value was greater (that is a greater positive value) than the target star, you would need to subtract the value of correction, determined using the TC.

It should be noted, the correction to be applied to an eclipsing binary system, may change during the eclipse. Out of eclipse, you may be looking at a (B-V) which is a composite of the (B-V) values of two stars. During a ‘total’ eclipse, one star is obscured, and the (B-V) of the visible star maybe somewhat different. As regards the Zeta Aurigae system, for example, the out-of-eclipse correction was 0.23 magnitude. During totality, as the visible star was redder, the correction was 0.28 magnitude.

My thanks to Richard Miles, for reviewing this statement, and suggesting helpful amendments.

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22nd May 2009

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.

July

2009 Jul 1 Wed
RS CVn....D22(24)26D
Z Per.........L22(22)26D

2009 Jul 2 Thu
SW Cyg.......D22(19)25
RZ Cas.......D22(21)24
TW Dra.......23(28)26D
U CrB.........23(29)26D

2009 Jul 3 Fri
Y Psc...........02(06)02D
RZ Cas........23(26)26D

2009 Jul 4 Sat
U Cep......D22(26)26D
Z Per.........L22(23)26D
TV Cas........23(27)26D
Z Dra..........23(25)26D

2009 Jul 5 Sun
RW Tau.....L02(05)02D
S Equ...........D22(20)25
del Lib......D22(20)24L
Z Vul........D22(21)26D
AI Dra........D22(23)24
TW Dra....D22(23)26D

2009 Jul 6 Mon
RS CVn.......D22(19)26
TV Cas.....D22(22)26D
V367Cyg.D22(63)26D
Y Psc........L23(25)26D

2009 Jul 7 Tue
U Sge........D22(21)26D
Z Per........D22(24)26D
del Lib......D22(28)24L
V367Cyg.D22(39)26D

2009 Jul 8 Wed
RW Tau....L01(<<)02D
V367Cyg..D22(15)26D
TV Cas........D22(18)22
TX UMa.....D22(18)23
TW Dra.......D22(19)24
RZ Cas........D22(21)23

2009 Jul 9 Thu
Z Dra..........01(03)02D
S Equ...........01(06)02D
V367Cyg.D22(<<)26D
U Cep......D22(26)26D
U CrB......D22(27)26D
RZ Cas........23(25)26D

2009 Jul 10 Fri
Z Vul.........D22(19)24
Z Per.......D22(26)26D
Y Psc..........L23(19)24

2009 Jul 11 Sat
U Sge.........01(06)02D
TX UMa...D22(20)25
Z Dra.........D22(20)23
SW Cyg..D22(23)26D
AI Dra.......D22(23)24

2009 Jul 12 Sun
S Equ.........D22(17)22
del Lib.....D22(20)24L

2009 Jul 13 Mon
Z Vul..........01(06)02D
Z Per..........22(27)26D

2009 Jul 14 Tue
TV Cas......00(04)02D
RZ Cas......D22(20)22
TX UMa.D22(21)26L
U Cep.....D22(25)26D
del Lib.....D22(28)23L

2009 Jul 15 Wed
X Tri..........02(05)02D
Z Vul..........D22(17)22
Z Dra.........D22(22)24
TV Cas...D22(24)26D
S Equ.........22(27)26D
RZ Cas......22(25)26D

2009 Jul 16 Thu
X Tri..........01(04)02D
RW Tau......02(07)02D
U CrB.....D22(25)26D
Z Per..........24(29)26D
TW Dra.....24(29)26D

2009 Jul 17 Fri
X Tri..........01(03)02D
TV Cas......D22(19)23
AI Dra.......D22(23)24
TX UMa.D22(23)26L
U Sge......D22(25)26D
Z Vul..........22(28)26D

2009 Jul 18 Sat
X Tri..........00(03)02D
X Tri..........23(26)26D

2009 Jul 19 Sun
RW Tau...L01(01)02D
AI Dra.......02(03)02D
del Lib.....D22(19)23L
Z Dra.........D22(24)26
TW Dra..D22(24)26D
U Cep.....D22(25)26D
X Tri..........23(25)26D

2009 Jul 20 Mon
Z Per..........01(06)02D
RZ Cas......D22(19)22
TX UMa.D22(24)25L
SW Cyg..D22(26)26D
RS CVn......22(29)26L
X Tri.......L23(25)26D

2009 Jul 21 Tue
del Lib.....D22(27)23L
RZ Cas......22(24)26D
Y Psc.......L22(26)26D
X Tri..........L22(24)26

2009 Jul 22 Wed
TW Dra.....D22(20)25
S Equ......D22(24)27D
Z Vul.......D22(25)27D
X Tri..........L22(23)26

2009 Jul 23 Thu
TV Cas......02(06)03D
RZ Cas......02(05)03D
Z Per..........02(07)03D
U CrB.....D21(22)27D
AI Dra.......D21(23)24
TX UMa.D21(26)25L
X Tri..........L22(23)25
Z Dra.........23(25)27D

2009 Jul 24 Fri
U Sge.........D21(19)25
U Cep.....D21(25)27D
TV Cas...D21(25)27D
X Tri..........L22(22)24

2009 Jul 25 Sat
AI Dra.......02(03)03D
SW Cyg.....D21(16)22
RS CVn...D21(24)25L
V367Cyg.D21(53)27D
Y Psc..........L22(21)25
X Tri..........L22(21)24

2009 Jul 26 Sun
del Lib......D21(19)23L
TV Cas.......D21(21)25
V367Cyg.D21(29)27D
X Tri...........L22(20)23
TX UMa 23(27)25L

2009 Jul 27 Mon
V367Cyg.D21(05)27D
Z Vul.......D21(23)27D
RZ Cas.......D21(24)26
X Tri...........L22(20)22
U Sge..........22(28)27D

2009 Jul 28 Tue
Z Dra..........01(03)03D
V367 Cyg..D21(<<)25
del Lib......D21(27)23L

2009 Jul 29 Wed
RZ Cas.......02(04)03D
S Equ..........D21(21)27
AI Dra........D21(22)24
U Cep......D21(24)27D
SW Cyg......24(30)27D
RW Tau....L24(27)27D

2009 Jul 30 Thu
TX UMa....00(05)01L
RS CVn....D21(19)25L
U CrB.........D21(20)26
Z Dra..........D21(20)23

2009 Jul 31 Fri
TW Dra......01(06)03D
AI Dra........02(03)03D

August

2009 Aug 1 Sat
Z Dra..........02(05)03D
Z Vul..........D21(21)26
RW Tau.......L24(21)26

2009 Aug 2 Sun
S Equ..........02(08)03D
del Lib......D21(18)22L
RZ Cas.......D21(23)25
TW Dra...D21(25)27D
TV Cas.......23(27)27D

2009 Aug 3 Mon
U CrB.........01(07)02L
SW Cyg......D21(19)26
Z Dra.........D21(22)24
U Sge.......D21(22)27D
U Cep......D21(24)27D

2009 Aug 4 Tue
RZ Cas......01(04)03D
Z Vul.........03(08)03D
AI Dra.......D21(22)24
TV Cas......D21(22)27
del Lib.....D21(26)22L

2009 Aug 5 Wed
HU Tau.....L01(<<)02
S Equ.........D21(18)24
TW Dra.....D21(20)26
Y Psc.........23(28)27D

2009 Aug 6 Thu
AI Dra.......02(03)03D
U CrB.......D21(18)24
TV Cas......D21(18)22
Z Vul.........D21(19)24

2009 Aug 7 Fri
HU Tau...L01(00)03D
U Sge.........02(07)03D
Z Dra...........21(24)26

2009 Aug 8 Sat
TW Dra.....D21(16)21
RZ Cas......D21(22)25
U Cep.....D21(24)27D
S Equ.........23(29)27D

2009 Aug 9 Sun
Z Vul.........01(06)03D
HU Tau...L01(01)03D
del Lib.....D21(18)22L
Y Psc.........D21(22)27
U CrB........23(29)26L

2009 Aug 10 Mon
RW Tau.....00(05)03D
RZ Cas......01(03)03D
U Sge.........D21(16)22
AI Dra..........21(22)23

2009 Aug 11 Tue
HU Tau...L00(02)03D
Z Vul.........D21(17)22
del Lib.....D21(26)22L
Z Dra.........23(25)27D

2009 Aug 12 Wed
TV Cas......00(04)03D
AI Dra.......02(03)03D
SW Cyg..D21(23)27D
V367 Cyg..23(67)27D
RW Tau...L23(23)27D

2009 Aug 13 Thu
HU Tau....L00(04)03D
U CrB.........D21(15)21
Y Psc..........D21(16)21
Z Per...........D21(17)21
U Cep......D21(23)27D
TV Cas....D21(24)27D
U Sge.......D21(26)27D
V367Cyg.D21(43)27D
RS CVn.......22(28)24L
Z Vul...........22(28)27D

2009 Aug 14 Fri
TW Dra......02(07)03D
Z Dra..........D21(19)21
V367Cyg.D21(19)27D
RZ Cas.......D21(22)24

2009 Aug 15 Sat
HU Tau.......01(05)03D
V367Cyg.D21(<<)27D
TV Cas.......D21(19)24
S Equ.......D21(26)27D

2009 Aug 16 Sun
RZ Cas.......00(03)03D
Z Dra..........01(03)03D
del Lib......D20(18)21L
Z Per...........D20(18)23
U CrB.........20(26)25L
AI Dra...........21(22)23
TW Dra......21(26)27D

2009 Aug 17 Mon
HU Tau.......03(06)03D
X Tri...........03(05)03D

2009 Aug 18 Tue
AI Dra........01(03)04D
X Tri...........02(05)04D
Z Dra..........D20(20)23
U Cep......D20(23)28D
RS CVn....D20(23)24L
del Lib......D20(25)21L
Z Vul........D20(26)28D

2009 Aug 19 Wed
X Tri...........02(04)04D
Z Per...........D20(19)24
TW Dra......D20(21)26

2009 Aug 20 Thu
X Tri...........01(03)04D
Z Dra..........03(05)04D
TX UMa....D20(16)20
U Sge..........D20(20)26
RZ Cas.......D20(21)24

2009 Aug 21 Fri
X Tri..........00(03)04D
Y Psc..........01(05)04D
RW Tau......02(07)04D
TV Cas.......02(06)04D
SW Cyg......20(26)28D
X Tri..........24(26)28D
RZ Cas.......24(26)28D

2009 Aug 22 Sat
TW Dra.....D20(17)22
Z Per..........D20(21)26
Z Dra.........D20(22)25
S Equ.......D20(23)28D
AI Dra...........21(22)23
TV Cas.......21(25)28D
X Tri..........23(25)28D

2009 Aug 23 Sun
del Lib.....D20(17)21L
TX UMa...D20(17)22
RS CVn...D20(19)23L
U Cep........D20(23)27
Z Vul.......D20(23)28D
U CrB......D20(24)25L
X Tri............22(25)27
RW Tau....L22(25)28D
U Sge..........23(29)28L

2009 Aug 24 Mon
AI Dra........01(03)04D
TV Cas.......D20(21)25
Y Psc.......D20(24)28D
X Tri............21(24)26

2009 Aug 25 Tue
Z Per..........D20(22)27
del Lib.....D20(25)21L
X Tri............21(23)26

2009 Aug 26 Wed
S Equ..........04(09)04D
SW Cyg......D20(16)22
TV Cas.......D20(16)21
TX UMa.D20(19)23L
RZ Cas.......D20(21)23
X Tri............20(23)25
Z Dra...........21(24)26
RW Tau......L22(19)24

2009 Aug 27 Thu
X Tri..........L20(22)24
RZ Cas..........23(25)28

2009 Aug 28 Fri
TW Dra......02(07)04D
RS CVn......D20(14)20
Y Psc..........D20(18)22
Z Vul..........D20(21)27
U Cep.........D20(22)27
Z Per........D20(23)28D
X Tri...........L20(21)24
AI Dra...........20(22)23

2009 Aug 29 Sat
RZ Cas.......04(06)04D
S Equ..........D20(19)25
TX UMa.D20(20)23L
X Tri..........D20(21)23

2009 Aug 30 Sun
AI Dra...........01(02)04
TV Cas.......03(07)04D
del Lib......D20(17)20L
X Tri..........D20(20)22
U CrB......D20(22)24L
U Sge.......D20(23)27L
TW Dra......22(27)28D
Z Dra..........23(26)28D
SW Cyg......24(30)28D

2009 Aug 31 Mon
Z Vul...........03(08)04L
X Tri..........D20(19)22
V367Cyg.D20(58)28D
Z Per...........20(25)28D
TV Cas.......23(27)28D

September

2009 Sep 1 Tue
RW Tau......04(08)04D
SS Cet.........04(09)04D
X Tri..........D20(19)21
RZ Cas.......D20(20)23
TX UMa.D20(22)23L
del Lib......D20(25)20L
V367Cyg.D20(34)28D

2009 Sep 2 Wed
S Equ..........01(06)03L
TX UMa....L01(<<)02
V367Cyg.D20(10)28D
X Tri..........D20(18)20
Z Dra..........D20(19)21
Z Vul..........D20(19)24
U Cep.........D20(22)27
TW Dra......D20(22)27
TV Cas.......D20(22)27
RZ Cas..........22(25)27

2009 Sep 3 Thu
U Sge..........03(08)03L
V367Cyg.D20(<<)28D
AI Dra...........20(22)23
Z Per...........21(26)28D
RW Tau......22(27)28D

2009 Sep 4 Fri
Z Dra..........01(03)04D
RZ Cas.......03(05)04D
SS Cet.........03(08)04D
TV Cas.......D20(18)22
SW Cyg......D20(20)26
TX UMa.D20(23)22L

2009 Sep 5 Sat
Z Vul...........01(06)04L
TX UMa....L01(<<)04
AI Dra...........01(02)04
Y Psc..........02(07)04D
S Equ..........D20(16)22
TW Dra......D20(17)23

2009 Sep 6 Sun
del Lib......D20(16)20L
U Sge..........D20(18)23
U CrB......D20(19)24L
Z Dra..........D20(20)23
RW Tau.......L21(21)26
RS CVn.......22(28)22L
Z Per...........23(27)28D
HU Tau.......L23(20)24

2009 Sep 7 Mon
SS Cet.........03(07)04D
Z Vul..........D20(17)22
RZ Cas.......D20(20)22
U Cep.........D20(22)26
TX UMa....20(25)22L

2009 Sep 8 Tue
TX UMa..L01(01)04D
Z Dra..........03(05)04D
del Lib......D19(24)20L
Y Psc..........21(25)28D
S Equ..........22(27)27L
RZ Cas..........22(24)27
HU Tau.......L23(21)25

2009 Sep 9 Wed
SW Cyg......03(10)04D
AI Dra...........20(21)23
U Sge..........21(27)27L
Z Vul...........23(28)27L

2009 Sep 10 Thu
Z Per..........00(05)04D
TV Cas......00(04)04D
SS Cet........02(07)04D
RZ Cas......03(05)04D
Z Dra............20(22)25
TX UMa...22(26)22L
HU Tau......L22(23)27

2009 Sep 11 Fri
TX UMa.L01(02)04D
AI Dra..........01(02)04
TW Dra.....03(08)04D
RS CVn...D19(23)22L
TV Cas.........20(24)28

2009 Sep 12 Sat
Z Vul.........D19(15)20
Y Psc.........D19(20)24
U Cep........D19(21)26
HU Tau......L22(24)28

2009 Sep 13 Sun
Z Per..........01(06)04D
SS Cet........01(06)04D
del Lib.....D19(16)19L
U CrB........D19(17)23
RZ Cas......D19(19)21
TV Cas......D19(19)24
SW Cyg..D19(23)28D
TW Dra.....23(28)28D

2009 Sep 14 Mon
TX UMa.L00(04)04D
Z Vul..........20(26)27L
RZ Cas.........21(24)26
Z Dra...........22(24)26
HU Tau...L22(25)28D
RW Tau.....24(29)28D

2009 Sep 15 Tue
U Cep........04(09)04D
del Lib.....D19(24)19L
S Equ......D19(24)26L
AI Dra..........20(21)23

2009 Sep 16 Wed
SS Cet........01(05)04D
RZ Cas......02(04)04D
Z Per..........03(08)04D
RS CVn...D19(18)22L
U Sge......D19(21)26L
TW Dra.....D19(23)28
U CrB........22(28)23L
HU Tau.....23(27)29D

2009 Sep 17 Thu
TX UMa....01(05)05D
AI Dra...........01(02)03
Z Dra..........D19(17)19
U Cep.........D19(21)26
RW Tau.......L21(23)28

2009 Sep 18 Fri
X Tri..........04(07)05D
SW Cyg......D19(13)19
Z Dra.............23(26)28

2009 Sep 19 Sat
SS Cet.........00(05)05D
HU Tau......00(04)05D
TV Cas.......02(06)05D
V367 Cyg...03(48)05D
X Tri..........04(06)05D
Z Per...........04(09)05D
TW Dra......D19(18)23
RZ Cas.......D19(18)21
Z Vul........D19(24)27L
V367Cyg.D19(48)29D

2009 Sep 20 Sun
U Sge..........00(06)02L
TX UMa....02(07)05D
X Tri..........03(06)05D
Y Psc..........04(08)05D
U Cep.........04(09)05D
U CrB.........D19(15)21
del Lib......D19(15)19L
V367Cyg.D19(24)29D
RW Tau.......L20(17)22
RZ Cas..........21(23)25
TV Cas.......21(25)29D

2009 Sep 21 Mon
HU Tau......02(05)05D
X Tri..........02(05)05D
V367Cyg.D19(00)29D
RS CVn......D19(14)20
Z Dra..........D19(19)21
AI Dra...........20(21)22
SS Cet.........24(28)29D

2009 Sep 22 Tue
RZ Cas.......01(04)05D
X Tri..........02(04)05D
V367 Cyg..D19(<<)20
U Cep.........D19(21)25
S Equ.......D19(21)26L
TV Cas.......D19(21)25
SW Cyg......21(27)29D

2009 Sep 23 Wed
AI Dra........01(02)03
X Tri.......01(03)05D
Z Dra.......01(03)05D
HU Tau...03(07)05D
TX UMa.04(08)05D
U Sge.......D19(15)21
U CrB......20(26)23L
Y Psc.......22(27)29D

2009 Sep 24 Thu
X Tri.......00(03)05D
TV Cas....D19(16)21
Z Vul.....D19(21)26L
SS Cet......23(28)29D
X Tri..........24(26)29

2009 Sep 25 Fri
U Cep......04(08)05D
TW Dra...04(09)05D
HU Tau...04(08)05D
RZ Cas....D19(18)20
Z Dra.......D19(21)23
X Tri..........23(25)28

2009 Sep 26 Sat
RW Tau...02(06)05D
S Equ.......02(07)02L
RS CVn.L04(09)05D
U Sge....D19(24)25L
RZ Cas.......20(23)25
X Tri..........22(25)27

2009 Sep 27 Sun
Z Dra.......03(05)05D
SW Cyg...D19(17)23
U Cep......D19(20)25
Y Psc.......D19(21)26
AI Dra........20(21)22
X Tri..........22(24)27
SS Cet......22(27)29D
TW Dra...23(28)29D

2009 Sep 28 Mon
RZ Cas 01(03)05D
TV Cas 03(07)05D
RW Tau 20(25)29D
X Tri..........21(23)26

2009 Sep 29 Tue
AI Dra........00(02)03
S Equ.......D19(18)23
Z Vul.......D19(19)25
Z Dra..........20(22)25
X Tri..........20(23)25
TV Cas....23(27)29D

2009 Sep 30 Wed
U Cep......03(08)05D
U CrB...D19(23)22L

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

The **deadline for contributions** to the next issue of VSSC (number 139) will be 7th August, 2009. All articles should be sent to the editor (details are given on the back of this issue).

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