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VARIABLE STAR SECTION CIRCULAR

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Contents

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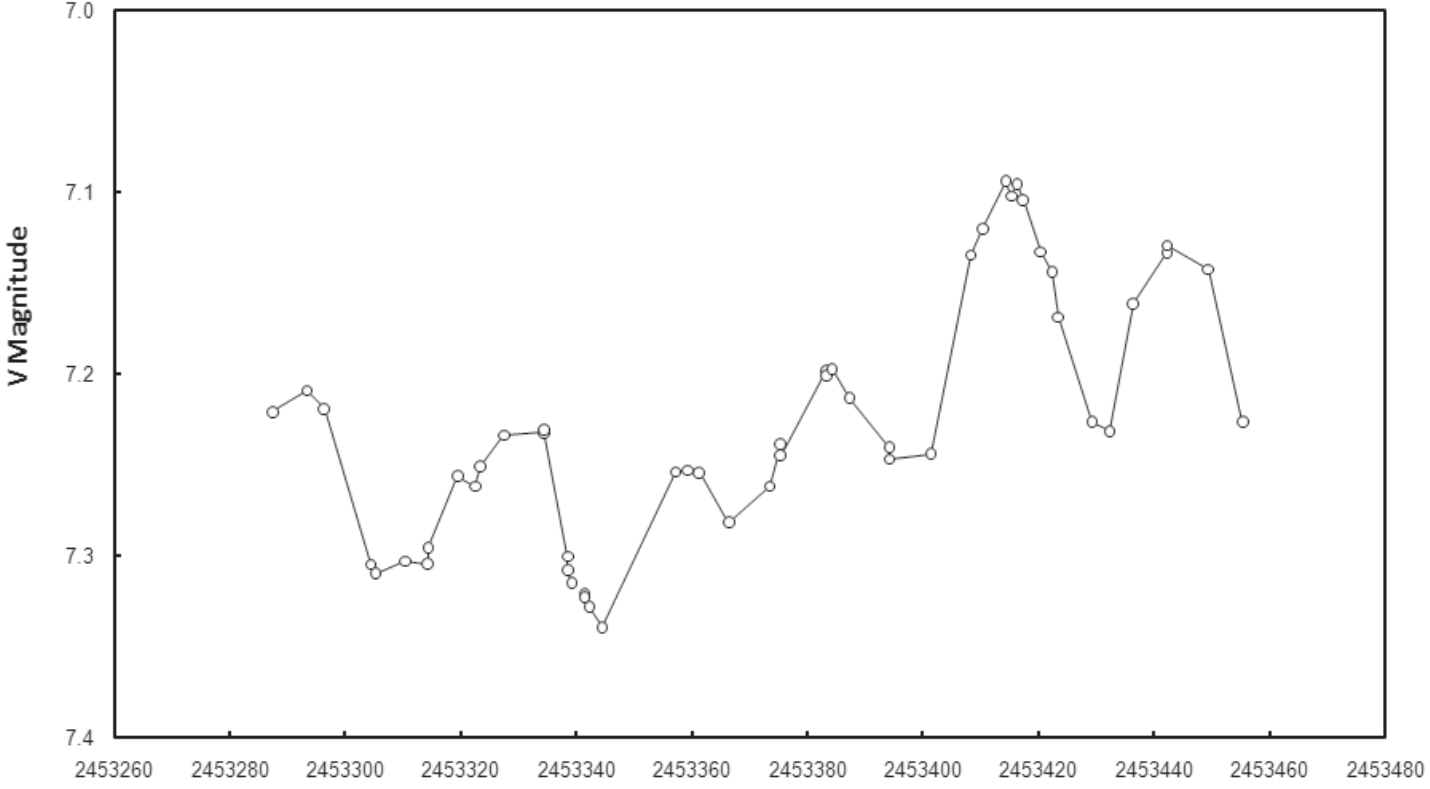
EG ANDROMEDAE LIGHT CURVE

RICHARD MILES: CCD Photometry of the pulsating red giant, EG Andromedae, obtained by Richard Miles during 2004/5, using a Starlight Xpress SXV-H9 camera and 6-cm aperture Takahashi FS-60C refractor + V filter. EG And is a symbiotic star being one component of a binary system with an orbital period of about 480 days.



FROM THE DIRECTOR

ROGER PICKARD

Submitting Data

I met with Clive Beech in the summer, whilst on holiday in south Devon, and it rapidly became clear just how many observers are still not reporting their observations in exactly the required format, making Clive's task almost impossible. This is especially highlighted in early July, when I ask the Officers to send in their reports for the previous year, for my Report to Council that appears in the Journal of the British Astronomical Association. Clive's is always the last to arrive because it is so difficult to correct so many observations, and it demands a great deal of his time. I really started to appreciate this when visiting him. So, observers, please check you are submitting your observations correctly, either by looking at Variable Star Section Circular 133 (available on line if you can not find your own copy), or in http://www.britastro.org/vss/ click on 'Submitting Visual Observations to the BAAVSS' (not Visual Report Form, or Excel Spreadsheet). That page, and the link at the bottom http://www.britastro.org/vss/text/vssc77.txt explain every correct way to submit variable star observations electronically. Note these comments do not apply to those submitting variable star observations on paper. However, that said, it would be better still if all observers with the facility to submit observations digitally could do so, rather than on paper, as this saves someone else having to re-type them into a computer.

Irregular (L type) Stars

Melvyn Taylor has pointed out that interest in these stars is a potential field for CCD or DSLR observers to determine more accurate data, in comparison to visual work. Richard Miles has provided accurate photometry on both SU Andromedae and TX Piscium, stars typical of this class, in recent years. There are about twenty such stars on the programmes and it would be nice to encourage more, electronic, observations. However, I suspect that most of them are too bright for most CCD observers, but if you do have access to a smaller telescope and CCD, or a DSLR camera, then do consider adding some to your programme. The full list is given on page 2.

Albert Jones

Not all members may be aware that on May 8th Albert Jones fell and broke a hip bone. Now this is very serious for anybody let alone someone who has only just passed their ninetieth birthday! Fortunately(?) it was a clean break and so there was no need for a hip replacement. The latest information I have was in an email of 20th July when Albert said he was hoping that he could resume observing before this, but sadly his hip was too sore and he is still a bit wobbly and scared of falling over again, even though he is a teetotaller!

Get well soon Albert.

Full List of Irregular (L type) Stars

Star		RA (2000)	Dec	Type	Range		Period	Chart
SU	And	00 05	+43 33	Lc	8	8.5		1977Sep10
BZ	And	00 38	+45 36	Lb	7.5	8.4		1982Aug16
UW	Aql	18 57	+00 27	Lc	8.9	9.5		028.01
Psi1	Aur	06 25	+49 17	Lc	4.8	5.7		1973Jul14
ZZ	Cam	04 18	+62 21	Lb	7.1	7.9		1972Jul29
W	CMa	07 08	-11 55	Lb	6.4	7.9		213.02
V391	Cas	01 57	+70 12	Lb	7.6	8.4		1978May15
DM	Cep	22 08	+72 46	Lb	6.9	8.6		Undated
BI	Cyg	20 21	+36 56	Lc	8.4	9.9		065.01
UW	Dra	17 58	+54 40	Lb	7	8.2		1974Jul27
DW	Gem	06 31	+27 27	Lb	8	10		MDT 850318
WY	Gem	06 12	+23 12	Lc+E?	7.2	7.9		294.01
BU	Gem	06 12	+22 55	Lc	5.7	8.1	47d	294.01
XY	Lyr	18 38	+39 40	Lc	5.8	6.4		1972Sep16
BL	Ori	06 26	+14 43	Lb	6.3	7.2		211.01
GO	Peg	22 55	+19 34	Lb	7.1	8.3		103.01
KK	Per	02 10	+56 34	Lc	6.6	7.9		1974Jan13
PR	Per	02 22	+57 52	Lc	7.6	8.3		1974Jan13
TX	Psc	23 46	+03 29	Lb	4.8	5.8		276.01
VY	UMa	10 45	+67 25	Lb	5.9	7		226.01
RW	Vir	12 07		Lb	6.7	7.6		317.01

Welcome to Facebook and Twitter?

Tony Markham recently suggested to me that it would be a good idea for the Section to have a Facebook and/or Twitter presence. I have not yet done anything about this, partly because I find it difficult enough keeping up with my emails, without adding an extra workload to my schedule. However, what do other members think. I give below some of Tony's suggestions together with my own comments to, help members decide for themselves .

Tony: As a minimum I would suggest that the VSS sets up a Facebook page called "BAA Variable Star Section" - which should be picked up by anyone searching for "variable star". This page might merely give a brief description of the section and give contact details such as the address of the BAA VSS web pages, but this would at least increase the visibility of the section.
Director: This sounds a good idea and one I will implement.

Tony: Being Facebook, of course, an obvious additional step would be to upload some

light curves and photos. My Facebook pages include a photo album showing some of my light curves, whilst Guy Hurst and David Scanlan have other observing related photos on their pages. If you look at the Facebook pages for the AAVSO or Sky and Telescope you can see other ideas of what you might want to include.
Director: Why have all this and the main VSS Internet pages?

Tony: Setting up a BAA VSS Facebook group would be a more advanced step, that would need more thought and is probably something to put off for now.
Director: Plus we already have vss-alert anyway, so I'm not sure I see the point.

Tony: My use of Twitter on the other hand is clearly defined as a news feed. It is interesting to note that I found out about the latest Jupiter impact at 7am yesterday (Friday 4th June) via a post (from late Thursday evening) from Asteroid Watch on Twitter. In contrast, the TA Circular reporting it wasn't sent until 2pm that day (Friday) and the BAA Circular wasn't sent until around midday today (Saturday 5th June).
Director: This sounds potentially quite interesting and useful.

Do send me any comments you have. It may be that some type of Facebook and/or Twitter service may be in place by the time you read this although I think that is unlikely.

'Easy' Variable Stars to observe

Have you ever wanted quick reference to a list of "easy" variable stars to observe, perhaps as a note to encourage others at your local society? Well, I've now prepared a short list, which whilst far from comprehensive, does provide a starting point.

Name	Type	Range (mag)	Period (days)	Chart
R And	M	5.6 - 14.9	409	053.02
RX And	UGZ	10.3 - 15.1	14	001.04
R Aqr	M	5.8 - 12.4	387	096.01
SS Aur	UGSS	10.3 - 17	56	003.03
T Cas	M	6.9 - 13.0	445	067.01
omi Cet	M	2.0 - 10.1	332	039.02
R CrB	RCB	5.7 - 14.8	-	041.04
chi Cyg	M	3.3 - 14.5	408	045.01
R Cyg	M	6.1 - 14.4	426	031.01
SS Cyg	UGSS	7.7 - 12.6	50	005.03
AB Dra	UGZ	11.0 - 15.3	13	007.04
R Hya	M	3.5 - 10.9	389	049.02
R Sct	RVA	4.2 - 8.6	146	026.04
R Ser	M	5.2 - 14.4	356	033.02
T UMa	M	6.6 - 14.0	257	066.01
Z UMa	SRb	6.2 - 9.4	196	217.02

As an extra incentive, the following notes come from the AAVSO web site:

Many stars need to be observed over decades in order to determine their long-time behaviour.

Research on variable stars is important because it provides information about stellar properties, such as mass, radius, luminosity, temperature, internal and external structure, composition and evolution.

In many cases, it is the nature of the variability that provides the clues to the answers.

Finally, whilst preparing the above list I noted an error (now corrected) in the Telescopic Chart Catalogue where R Serpentis was listed as having a period of 256 days. This should read 356 days.

LETTER PAGE

VISUAL OBSERVING

TONY MARKHAM

In VSSC 144, Roger commented "I really don't understand why some visual observers are being put off observing".

The same issue includes an article by Tom Richards which aims to highlight the usefulness of visual work. However, I fear that some of the statements it makes could have the opposite effect.

For example, he states that "If a star varies by 5 magnitudes, a precision of 0.1 mag is all that is needed to get an accurate light curve". Unfortunately, this could easily be interpreted as saying that if the amplitude is less than 5 magnitudes (as is the case for all variables on the binocular programme), then the +/- 0.1 mag accuracy achievable via visual work will be insufficient.

He also adds "visual workers are wasting their time trying to plot the outburst behaviour of dwarf novae, or finding times of minima of eclipsing binaries." This effectively amounts to ruling out the EB programme and the monitoring for eclipses during CV outbursts.

It is very easy to make the mistake of talking ourselves out of observing variable stars (or out of putting in the effort to submit our observations to the VSS database). As John Toone and Roger have pointed out, if we don't observe them visually, then most will hardly be observed at all.

I suspect that part of the problem is the way in which visual observations are published – all too often, they combine the observations of many observers but make no attempt to adjust for personal equations. In the case of red variables this can lead to a "scatter" of as much as a magnitude, misleadingly giving the impression of the accuracy of visual estimates as being +/- 0.5 magnitude rather than +/- 0.1 mag. Inevitably this makes them appear to compare very unfavourably with a CCD based light curve, which will usually be the work of a single observer.

So let's stop over-analysing the scientific usefulness of our observations. Although other methods can be more accurate, VS studies will continue to be primarily dependent on visual work for many more years to come.

EPSILON AURIGAE SPECTROSCOPICALLY AT MID ECLIPSE

ROBIN LEADBEATER

Epsilon Aurigae was predicted to reach mid eclipse around 4th August 2010. Measurements of the neutral Potassium line profile at 7699A confirm this approximate timing. The line became increasingly symmetrical around the system rest wavelength, as the red shifted receding material in the leading half of the edge-on disc, moved away from in front of the F star, to be replaced by blue shifted approaching material in the trailing half of the rotating disc (fig 1).

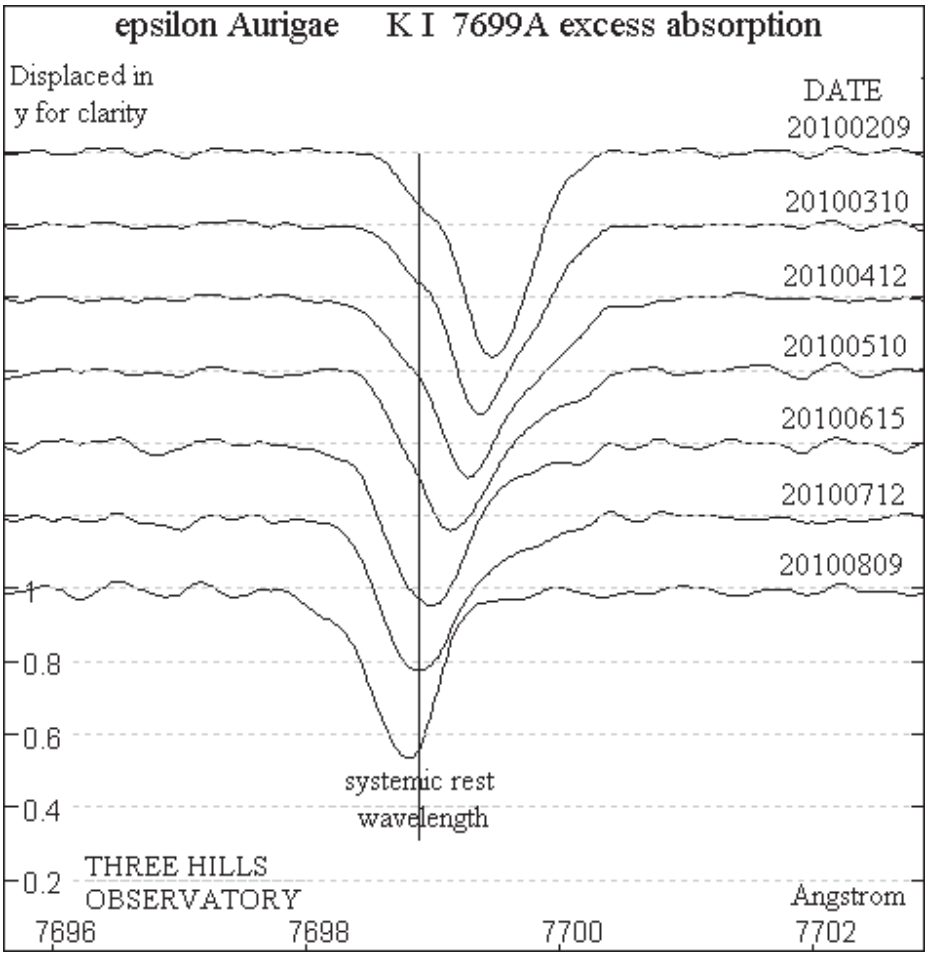


Figure 1: Evolution of the 7699A neutral Potassium line profile approaching mid eclipse.

A joint paper with campaign organiser Dr. Robert Stencel has been published on line [2]. It covers variations in the 7699A line intensity (Equivalent Width) during ingress, and their interpretation in terms of a possible ring like structure as discussed earlier in VSSC [1]. Further measurements made during totality suggest that the drop in intensity of the KI 7699 line, as mid eclipse approached, was more gradual than reported by Lambert and Sawyer on the last eclipse (fig 2) [3]. It is possible that this is connected with the apparent suppression of the mid eclipse brightening during this eclipse, compared to previously.

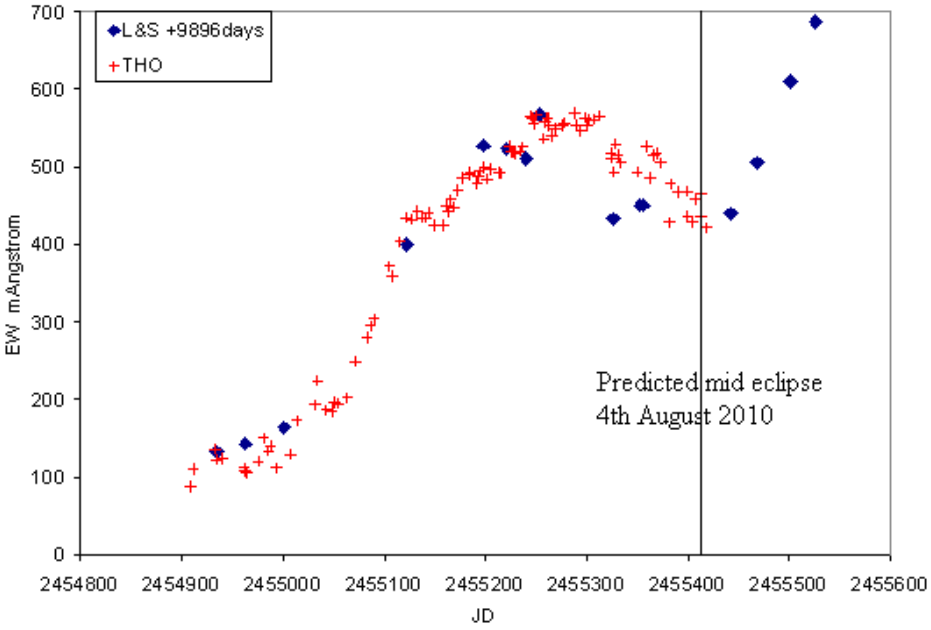


Figure 2: Strength of the 7699A line during the current eclipse compared with that measured by Lambert and Sawyer during the 1982-4 eclipse.

References

1. "Epsilon Aurigae Eclipse Progress" R Leadbeater, VSSC No 142 December 2009.

2. "Structure in the disc of epsilon Aurigae: Spectroscopic observations of neutral Potassium during eclipse ingress."
Robin Leadbeater, Robert Stencel arXiv:1003.3617v2 [astro-ph.SR] 18 March 2010
http://arxiv.org/abs/1003.3617

3. "Epsilon Aurigae in eclipse II Optical absorption lines from the secondary"
Lambert, D. and Sawyer, S. 1986 PASP 98: 389.

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ECLIPSING BINARY NEWS OCTOBER 2010

DES LOUGHNEY

Epsilon Aurigae

The predicted central brightening of the eclipse has not developed to the expected degree. At the time of writing (middle August) epsilon has brightened by a small amount, 0.1 magnitude, to about 3.66. The central brightening was scheduled to start at the beginning of May and last until the middle of October. To date there have been relatively few reliable observations partially because of the low altitude of the system and its nearness to the sun, and the weather. In Scotland there was a 22 day period in July when the short night was clouded out.

Conditions are now more favourable for estimates in the pre dawn sky so we hope that there will be good coverage of mid eclipse. With a lot more estimates we will be able to work out whether the mid eclipse central brightening is a reality. What we are seeing may, however, be the intrinsic variation of the primary star.

Working With Visual Observations of Eclipsing Binaries

On the 13th March 2010 a Variable Star Workshop was held in Hampshire which included a valuable presentation by Tony Markham on using the data from observing eclipsing binaries. Tony's PowerPoint presentations (in three files) can be downloaded from the BAAVSS website. The address is: *http://www.britstro.org/vss/hag_workshop.htm*

The first file 'Converting your observations into a light curve' illustrates how Excel spreadsheets can be used to produce a light curve expressed as a phase diagram. A phase diagram is a way of combining estimates from various nights, to build up an eclipse curve. This is a very necessary technique in observing eclipsing binaries in our climate. It is rare that the sky is clear long enough to profile a whole eclipse. You have to build up a profile using data from several eclipses on the assumption that the period of the system will not change significantly in a few months. Systems such as V367 Cygni, that are in continuous eclipse over a period of 18 days, change so slowly that only one observation per night is useful. Such a system requires a phase diagram for the construction of a light curve. Those of us who use Macs can be assured that the Numbers part of iWork can be used in a similar way to Excel.

The second file 'Real Light Curves' is a selection of light curves illustrating the potential and limitations of visual observations.

The third file is titled 'When Will Eclipses Occur?'. This shows how you can work out the times of mid-eclipse from the 'Elements' of an eclipsing binary. The current elements of RZ Cassiopeiae are 1.195248 days (the system's period) and Julian Date 2452500.579 (a time when mid-eclipse occurred).

Some More Eclipsing Binaries in Cygnus

In the last VSSC, I highlighted some of the eclipsing binaries that are considered to be

worth observing in Cygnus. Here are a few more which may be good to observe as they are all in continuous eclipse, and are all binocular objects.

V448 Cygni

This EB class system is in the same field of view as V453 Cygni which was described in the last Circular. It is a system which varies from 7.9 magnitude to 8.7. It is in the Beta Lyrae class which means that it is continually in eclipse, with a primary minimum that is 0.8 magnitude deep and a secondary that is 0.4 deep. The period is about 6.52 days.

V382 Cygni

This is an intriguing system of two very massive stars (one of 26 solar masses, and the other of 19 solar masses) which has one of the shortest periods for a Beta Lyrae class system. The period is changing fast and thus the system is well worth studying. It is in continuous eclipse with a period of 1.89 days. It varies from about 8.3 magnitude to 9.2. The primary minimum is 0.8 magnitude deep, and the secondary 0.7. The system is probably misclassified as a Beta Lyrae system as some authorities consider that the stars are in contact. It is therefore more properly an EW system.

With such a short period it goes from maximum to minimum in under 12 hours so estimates every couple of hours will be worthwhile and possible.

The system is easy to find being near the well known variable P Cygni. It is not on the Eclipsing Binary programme but perhaps it should be. With Starry Night Pro it can be found by a search using its Hipparcos classification of HIP 100135.

V 836 Cyg

Yet another EB class system (determined by the shape of its light curve) with a very short period of 0.65 days. It varies from about 8.6 magnitude to 9.2. The primary minimum is 0.6 magnitude in depth and the secondary 0.2. It is a challenging object for visual observers but straightforward for DSLR photometry. As it is also in continuous eclipse useful observations can be made at any time. Several observations per night can be made as the transition from maximum to primary minimum only takes about 4 hours. I intend to study it, as it is near the V367 Cyg system which I am studying (see VSSC 144).

It is relatively easy to find being near Tau Cygni. Its Hipparcos classification is HIP 105437.

Charts can be obtained by contacting me.

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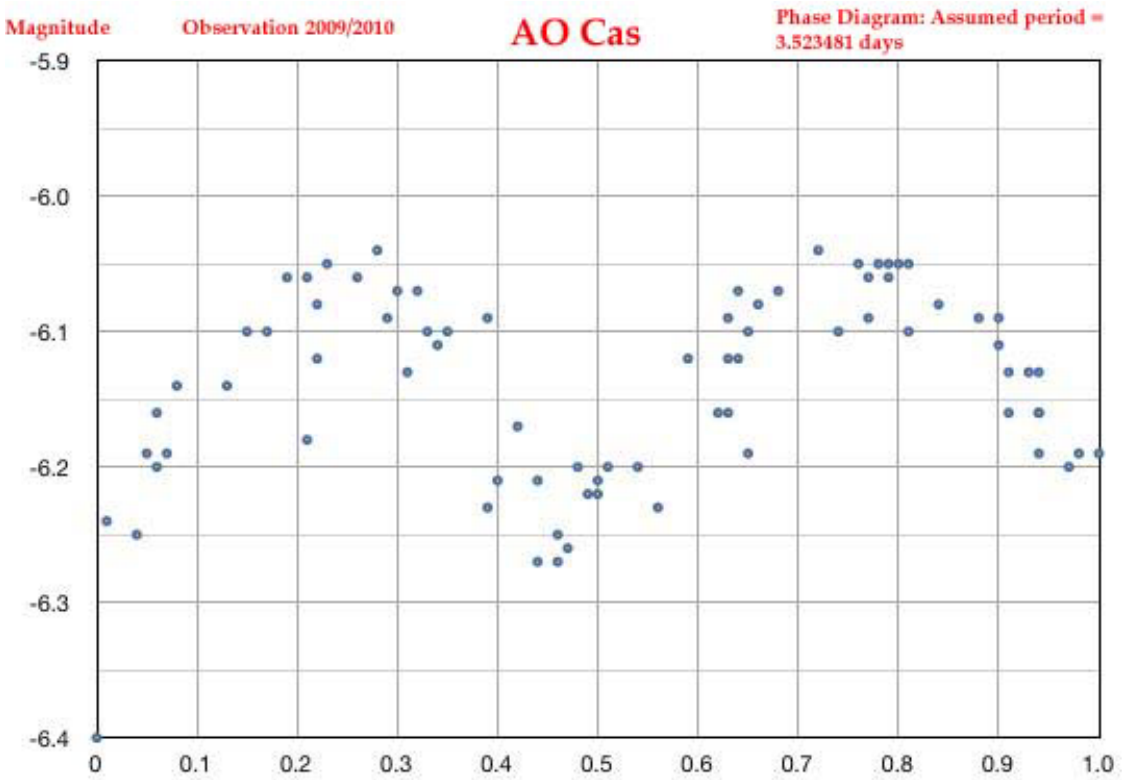
AO CASSIOPEIAE PHASE DIAGRAM

DES LOUGHNEY

Phase Diagram from observations of AO Cas made during the period 2009-2010. The settings I used for a Canon 450D and an 85 mm lens, were exposure 5 seconds, ISO 800, F3.5.

Tony Markham's instructions on making a phase diagram, refered to on page 7, apply to Excel on a PC. Since I use Numbers on a Mac, I had to make some amendments. I have been trying to find a way of reversing numbers. It may exist but I have not found it yet. At present I find it necessary to use minus numbers for the magnitudes to make the phase diagram work. There are actually a few ways in which commands differ. I have not been able to find a way of converting dates into JD.



PV CEPHEI AND GYULBUDAGHIAN'S NEBULA

David Boyd

At the Deep Sky Section meeting in March 2010, there was an appeal for observations of the T Tauri star PV Cephei and the associated Gyulbudaghian's Nebula (also known as HH215). Since then I have been taking a short run of images of the field most clear nights, using an 0.35-m SCT and SXVR-H9 CCD with an R-band filter. I use an R filter as PV Cephei is brighter in R than at shorter wavelengths.

I measure the R magnitude of PV Cephei on each image, and compute a mean value for each night. I selected a suitable set of nearby comparison stars from the Carlsberg Meridian Catalogue 14 (CMC-14) and derived R magnitudes for these from the r' magnitudes in CMC-14, using the formula published in the June 2009 issue of the BAA Journal by Dymock and Miles. I find this quite a reliable source of R magnitudes for fields covered by CMC-14.

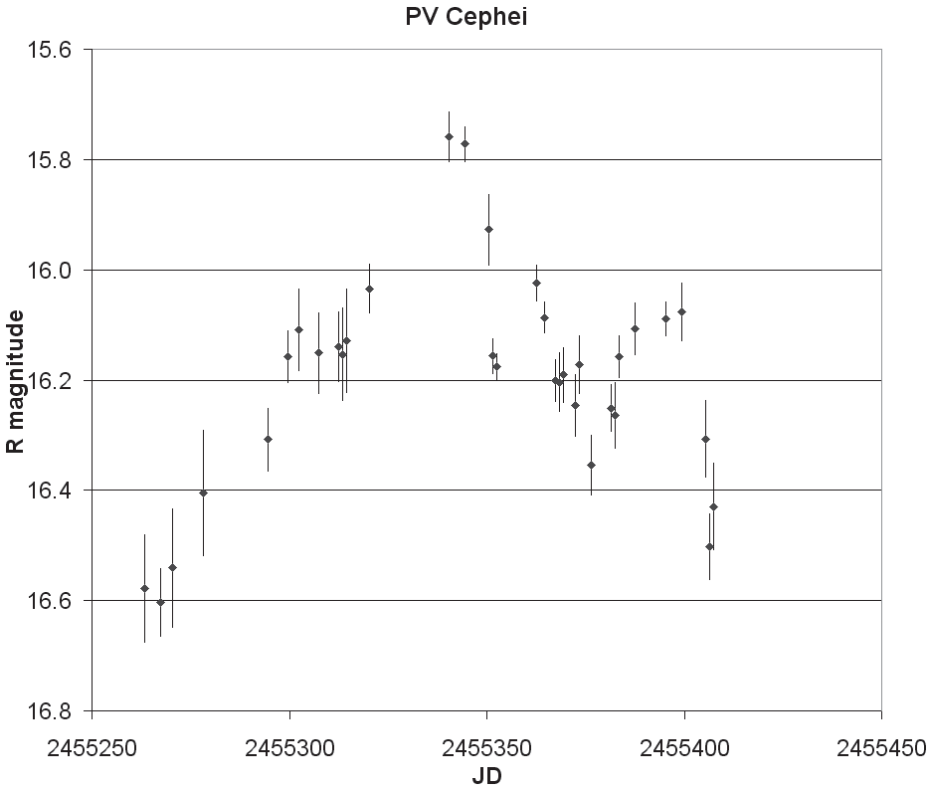


Figure 1: Shows how PV Cephei has varied over the period from early March till the end of July.

Estimating the brightness of the nebula is more of an art than a science. After trying various methods I have settled on a rather simple approach and followed this consistently. I first stack all the dark subtracted and flat fielded images taken on the same night using Astrometrica. I load the stacked image into AIP4WIN and, using the Pixel Tool function, I place a square over the nebula large enough to completely enclose it but excluding PV Cephei, and note the mean magnitude within this square. I then note the mean magnitude in a same-sized square on the opposite side of PV Cep, which just contains background sky. I take the difference between these values to get the contribution from the nebula, and divide by the total integrated exposure time to get a number which represents the brightness of the nebula.

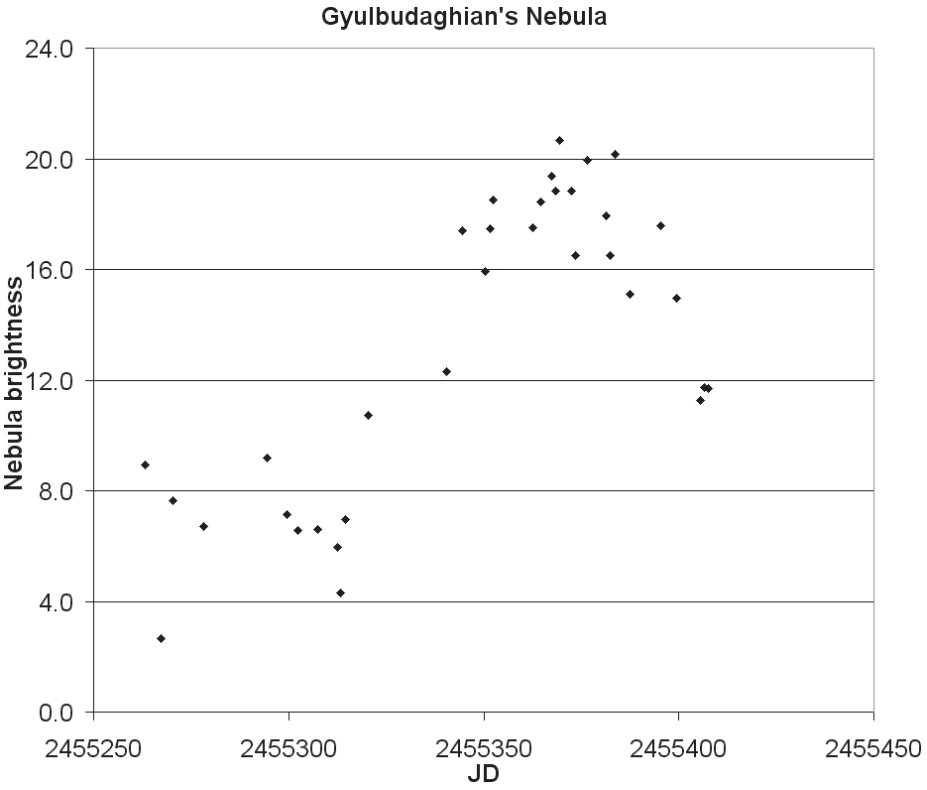


Figure 2: Shows how the nebula brightness varied over the same period.

It looks as though the brightness of the nebula is following that of PV Cephei but with a delay of about 30 days.

Is this what you might expect? The distance of PV Cep is ~500pc. The distance on my images from the star to the brightest part of the nebula is about 11 arcsec. At that distance, this corresponds to about 0.026pc, or about 1 light month. So a change in the light output of the star should result in a change in the brightness of the nebula about 1 month later, which is what I see.

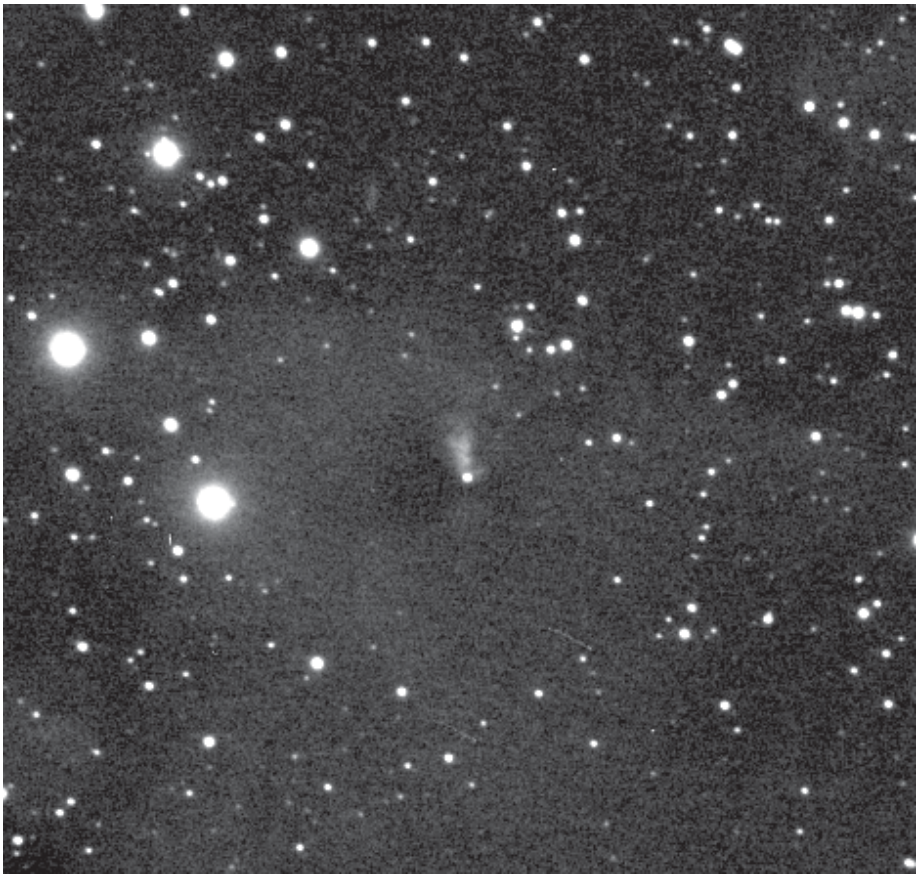


Figure 3: PV Cephei and Gyulbudaghian's Nebula, on 2010 July 9. Total exposure time 21.3 min.

WR140 PERIASTRON CAMPAIGN UPDATE

ROBIN LEADBEATER

The preliminary analysis of optical spectra covering the periastron of archetypal colliding wind binary system WR140 in 2008/9 has now been completed. The spectra were taken by a group of amateurs as part of a Pro-Am collaboration. The results were presented as a poster at the 39th Liège International Astrophysical Colloquium, 12-16 July 2010 [1]. The detection here at Three Hills Observatory of excess C III emission around periastron [2] was confirmed by the results from the other observers. The intensive and extended measurement of radial velocity of the two components of the system has improved the accuracy of the orbital parameters. (fig 1)

continued page 14

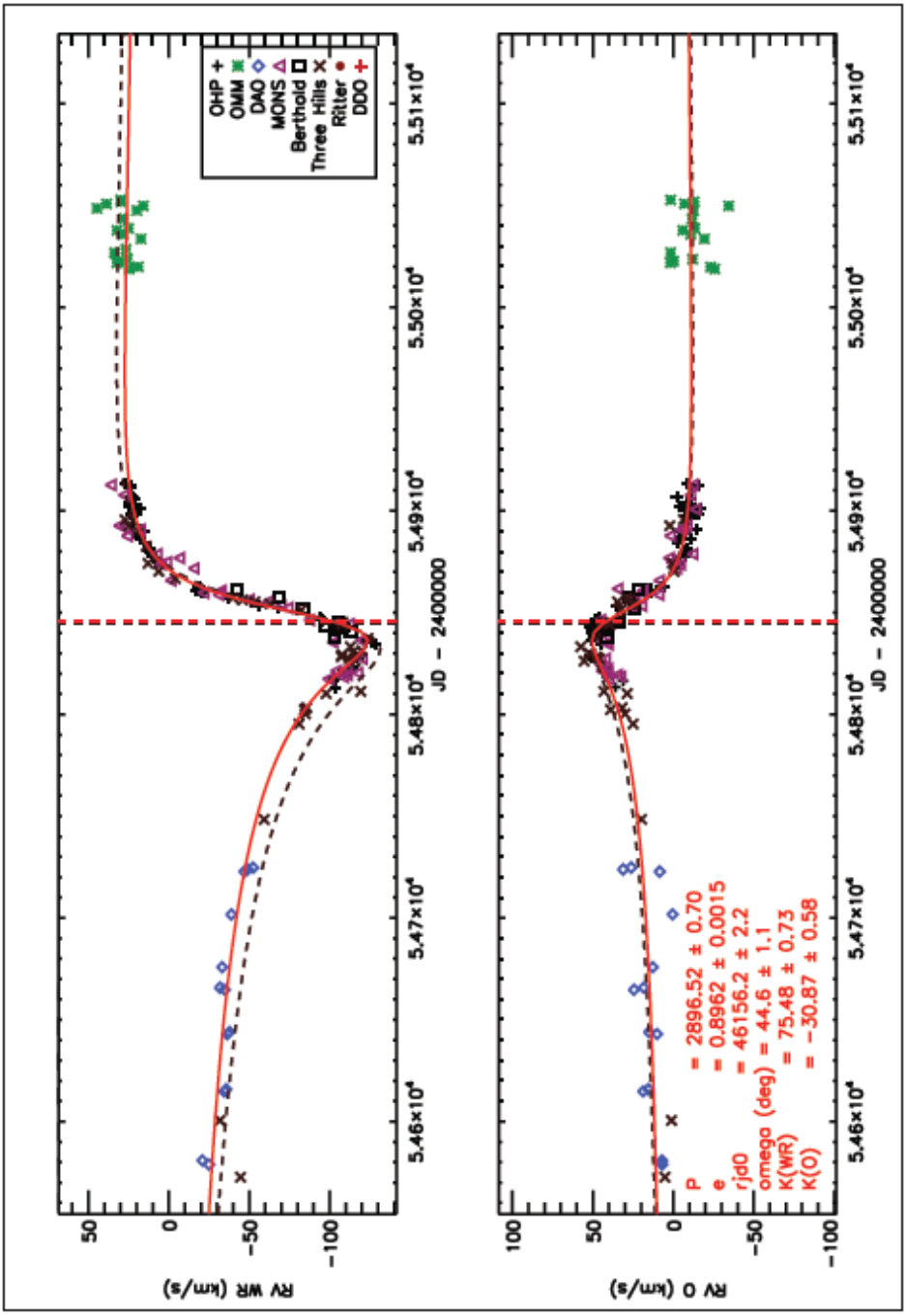


Figure 1: WR140 radial velocity measurements around periastron 2009.
Reproduced from ref 1, courtesy R Fahed et al.

Continued from page 12.

This is proving key to the interpretation of measurements made by other members of the team at wavelengths from radio to gamma. Following the success of the collaboration, a permanent group has been set up to foster further Pro-Am collaboration using spectroscopy in the area of massive star research [3]

References

1. "Spectroscopic follow-up of the colliding-wind binary WR140 during the 2009 January periastron passage." R. Fahed et al 2010 *http://www.stsci.de/pdf/liege_wr140.pdf*

2. "WR140 at Periastron" R. Leadbeater VSSC No 139 March 2009

3. The ConVento Group: *http://www.stsci.de/convento*

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VARIABLE STAR SECTION MEETING
PENDRELL HALL
SATURDAY, 1ST MAY 2010

THE CENTRAL STARS OF PLANETARY NEBULAE.
PROF. ALBERT ZIJLSTRA

Central stars of planetary nebulae are difficult to observe. They are hot and therefore faint, and the surrounding nebula creates a very bright background. The central star of the Bug nebula (NGC 6302), one of the hottest known at around 200,000 K, was discovered only last year using the newly upgraded HST. Observing variability in such stars is a challenge. It is, however, a challenge well worth the effort.

Three different types of brightness variations are observed in the central stars of planetary nebulae. They occur at widely different time scales. The slowest one, is changes due to the evolution of the star, occurring over decades. The fastest occur in close binaries, and are caused by varying illumination of a companion star during its orbit. The last one is a type of nova eruption, lasting years to decades.

Regarding evolution, this is not normally considered as a cause of variable stars: stars evolve rather slowly, and millions of years may be required before a star might change notably. But the phase following the ejection of a planetary nebula is the fastest phase

of stellar evolution (leaving explosions aside), when the star evolves within around 10,000 years across the HR diagram from a temperature of around 3000 K to well over 100,000 K. At this rate, the star may be seen to change within decades.

Such changes may be detected even where the star itself is too faint to be seen! The nebula is visible because of bright emission lines, from ionized elements. Each element becomes ionized at a different stellar temperature. Combining all ionization stages which contribute to the observed spectrum of emission lines gives a good indication of how hot the star should be. If the star becomes hotter, this should be reflected in a changing brightness of some emission lines.

The brightest planetary nebula is NGC 7027. It is unique among the bright planetaries in not having a proper name! We have monitored the nebula for 25 years. Changes were seen in the radio flux, using the Very Large Array in the USA. The radio flux follows the strength of the hydrogen lines, but the absolute brightness can be measured more accurately in the radio than in the optical. We measured a decrease in the radio flux of around 0.25% per year. The star of NGC 7027 (barely detectable in existing images) must have increased in temperature by 3900 K since the monitoring began. (The current temperature is about 175,000 K.)

We have used the heating rate to calculate the mass of the central star of NGC7027. We derive a mass of 0.655+/-0.10 solar masses, among the most accurate stellar masses yet determined.

The second type of changes mentioned above is a short-term, periodic variability with a typical amplitude of 0.05 - 0.1 magnitude. This arises in a close binary system, where there is: a faint star in close orbit around a very luminous star of a planetary nebula. The faint companion is illuminated by the luminous star on its 'day' side, to such a degree that this side becomes much hotter than the 'night' side. In a close orbit, the difference can be thousands of degrees. Over the orbit, the 'day' side is more or less visible, and this gives a notable modulation of the light curve. Typical periods are between a few hours and a few days. Especially Brent Miszalski and collaborators have uncovered a large number of these close binaries within planetary nebulae. A few of these are even eclipsing binaries.

Long-duration eclipses are also seen. One case, M2-29 in the Galactic Bulge, has shown an eclipse event lasting three years! This is interpreted as a long-term orbit (17 years) taking the star behind a circumbinary dusty disk. Obviously, a distant companion is required. Interestingly, during the onset of the eclipse a fluctuation in the light curve was detected with a period of 23 days. This may be due to a close, low-mass companion. One other planetary nebula shows a very similar light curve: NGC 2346 with its central star V651 Monocerotis. It also appears to have a dusty disk, and a low-mass companion star.

The third type of variability, a nova-like eruption, is rarely observed. A recent case was the eruption of Sakurai's Object in 1995. Although nova-like, it is strictly speaking not a nova eruption. Novae occur when a white dwarf accretes hydrogen from a companion star, and ignites it on its surface. In a central star of a planetary nebula, it is not the hydrogen but the helium which erupts, and the helium is not accreted but is left over from the hydrogen burning, which has only just terminated. Models of such an event predict it to be very slow, with the star brightening over centuries before the helium runs out, and the star rejoins the white dwarfs. But Sakurai's Object did not know about these model

predictions. It rebrightened within a few years and ejected a new planetary nebula during 1997. The star was not seen after this: a thick dust layer in the new ejecta hid it from sight. However, we detected a radio source at the position of the star during 2004. The radio emission showed that the nebula was beginning to become ionized, caused by heating of the star. So the star is already moving back to the high temperatures of young white dwarfs. We have continued to monitor the radio flux, and further increases show that the star is getting hotter at around 1000 K per year. The evolution is progressing at a rate 100 times faster than predicted by the models! We have devised new models for the structure of such stars which can reproduce the fast evolution, but these are still controversial. The new models predict that the star will peak in temperature in around 200 years, and may show a second loop around the HR diagam.

A possibly similar eruption was observed in AD 1670 by Hevelius, namely CK Vulpeculae. This is the oldest recorded nova. But the eruption shows intriguing aspects: it brightened 3 times over 2 years. An emission line nebulosity was found in the 1980's, and we found from proper motion measurements that it was indeed ejected around 1670. A radio source was detected at the centre, but there is no visible star. It is unknown what kind of star this is, but it may be an eruption similar to Sakurai's Object, although if this is true it does not show a second loop in the HR diagram.

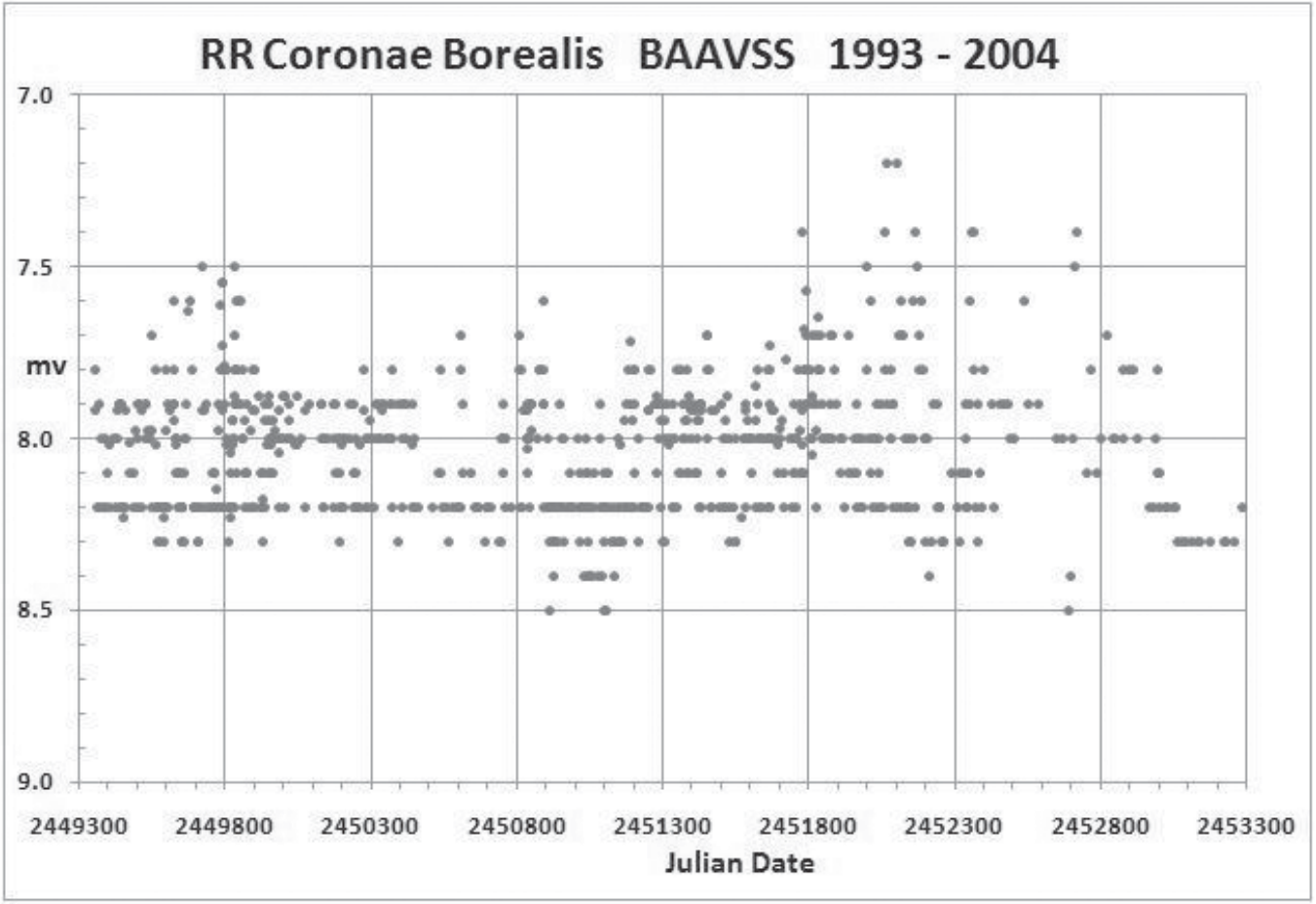
In all these cases, changes in the stars of planetary nebulae provide important knowledge on the stars: mass, binarity, and structure. The changes are difficult to detect, but have been very worthwhile. There may be further types of variability yet to be uncovered!

RR CORONAE BOREALIS 1993 – 2004.

MELVYN TAYLOR

RR CrB is within a field of magnitude 5.5 stars lambda and mu Coronae Borealis, with brighter ones defining the area of north-west CrB and eastern Bootes. This star along with the nearby suspected SRB star SW CrB is also not far from the long period objects V CrB (6.9-12.6, period 358d) and X CrB. RS CrB is a fainter SRA type object about 4° away from RR CrB. The chart seq. no. 220.01 shows an extensive range of comparison stars, the variable of spectral class M5 (B-V +1.3) lies at R.A. 15h 41m, Dec. 38° 33' (2000). This plot shows the small semi-regular variations of 61d (GCVS data) and a possible long period around 2300d. Its mean amplitude is magnitude 7.6 to 8.4 convenient for observing with binoculars or small telescopes; the mean magnitude in this interval is 8.0 (individual extreme estimates range 7.2 to 8.5).

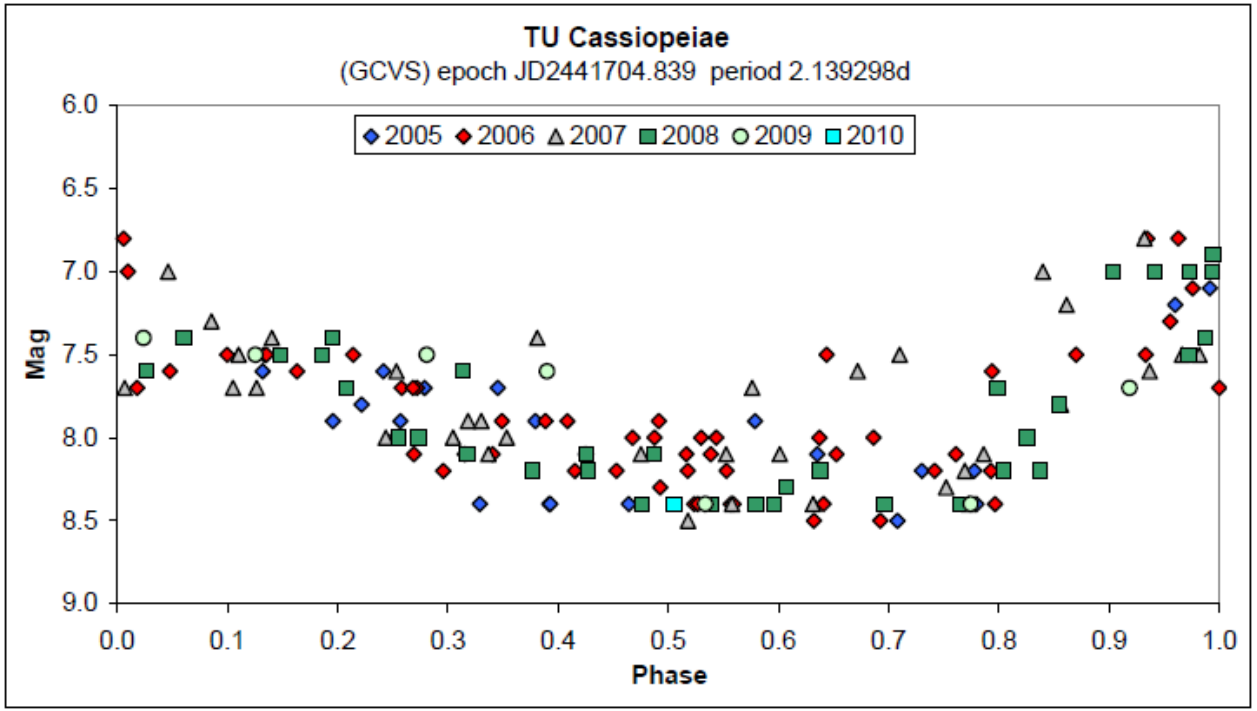
Observers of the star in the BAA cd database to 2005 are: Albrighton, Baransky, Bingham, Brown, Burch, Butler, Charleton, Clayton, Currie, Farrer, Fraser, Freeman, Gough, Granslo, Hather, Henshaw, Hoare, Hornby, Howarth, Hurst, Isles, Jackson, Jobson, Koushiappas, Markham, Middle-mist, Mormyl, Nartowicz, Nicholls, Northwood, Pickup, Pointer, Poxon, Quadt, Ramsey, Shorten, Smith, Toone, Veleshchuk, Wise, and Yates.


RR Coronae Borealis BAAVSS 1993 - 2004
7.0
7.5
mv
8.0
8.5
9.0
2449300
2449800
2450300
2450800
2451300
2451800
2452300
2452800
2453300
Julian Date

TU CASSIOPEIAE PHASE DIAGRAM 2005-2010

JANET SIMPSON

I was able to make this phase diagram after reading Tony Markham's instructions which can be found on the BAA VSS website: *http://www.britastro.org/vss/*



On the left hand sideof the web page scroll down to 'Past Meetings', click 'Hampshire Astronomy Group Variable Star Workshop. Look for 'Eclipses - when/ did will they occur? - Tony Markham, and click on the first 'download'(1Mb.) Save and open 'TM Eclipses_ when'.

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		072.02	
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	230.02	
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?	111.02	
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		041.04	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	089.03	
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	101.02	
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	

Updated 7th February 2010, M.T.

* *

ECLIPSING BINARY PREDICTIONS

DES LOUGHNEY

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

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

The variables covered by these predictions are :

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

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

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

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

October

2010 Oct 1 Fri
TV Cas.....02(06)05D
X Tri.....03(05)05D
RZ Cas.....04(06)05D
U Cep.....D19(20)25
U CrB.....D19(22)22L
Y Psc.....D19(22)27
SS Cet.....L21(22)26
TX UMa.L23(26)29D

2010 Oct 2 Sat
AI Dra.....01(03)04
X Tri.....02(04)05D
RW Tau....02(07)05D
Z Dra.....D18(19)21
Z Vul.....20(25)26L
SW Cyg....20(26)29D
TV Cas.....22(26)29D

2010 Oct 3 Sun
X Tri.....01(04)05D
Z Per.....03(08)05D
TW Dra....D18(17)22
U Sge.....D18(21)25L

2010 Oct 4 Mon
X Tri.....01(03)05D
Z Dra.....01(04)05D
U Cep.....03(08)05D
RZ Cas.....D18(21)23
TV Cas.....D18(21)26
RW Tau....20(25)29D
SS Cet.....L21(21)26
TX UMa.L23(27)29D
X Tri.....24(26)29

2010 Oct 5 Tue
RS CVn.....D18(14)20
Y Psc.....D18(17)21
S Equ.....D18(20)25L
RZ Cas.....23(25)28
X Tri.....23(26)28

2010 Oct 6 Wed
Z Per.....05(10)05D
TV Cas.....D18(17)21
U Cep.....D18(19)24
Z Dra.....18(21)23
AI Dra.....20(22)23
X Tri.....22(25)27

2010 Oct 7 Thu
U Sge.....01(06)01L
RZ Cas....04(06)05D
SW Cyg..D18(16)22
Z Vul.....D18(23)25L
RW Tau...L19(20)24
SS Cet.....L21(20)25
X Tri.....22(24)27
TX UMa.24(29)29D

2010 Oct 8 Fri
AI Dra.....01(03)04
Z Dra.....03(05)05D
U CrB....D18(20)22L
X Tri.....21(24)26

2010 Oct 9 Sat
TW Dra...02(07)05D
U Cep.....03(07)05D
X Tri.....20(23)25

2010 Oct 10 Sun
RS CVn.L03(09)05D
TV Cas....04(08)05D
U Sge.....D18(15)21
RZ Cas....D18(20)22
X Tri.....20(22)25
Z Dra.....20(22)25
SS Cet.....L20(20)24
HU Tau....L21(18)22

2010 Oct 11 Mon
TX UMa.02(06)05D
AI Dra.....D18(17)18
U Cep.....D18(19)24
X Tri.....19(22)24
TW Dra...22(27)29D
RZ Cas.....22(25)27
TV Cas....23(27)29D
SW Cyg..24(30)29D

2010 Oct 12 Tue
Z Dra.....05(07)05D
S Equ.....D18(17)22
Z Vul.....D18(21)25L
X Tri.....18(21)23
AI Dra.....20(22)23
HU Tau....L20(19)23

2010 Oct 13 Wed
Y Psc.....01(05)04L
RZ Cas....03(05)05D
RW Tau.04(08)05D
Z Dra.....D18(16)18
X Tri.....D18(20)23
TV Cas.....19(23)27
U Sge.....19(25)24L
SS Cet.....L20(19)24

2010 Oct 14 Thu
AI Dra.....01(02)04
U Cep.....02(07)05D
TX UMa....03(08)05D
X Tri.....D18(20)22
TW Dra.....D18(22)27
V367Cyg.D18(61)28L
HU Tau.....L20(21)25
Z Dra.....22(24)27

2010 Oct 15 Fri
RS CVn....L03(04)05D
Z Per.....D18(14)18
U CrB.....D18(17)21L
TV Cas.....D18(18)23
X Tri.....D18(19)21
V367Cyg.D18(37)28L
S Equ.....22(28)25L
RW Tau.....22(27)29D

2010 Oct 16 Sat
V367Cyg.D18(13)28L
X Tri.....D18(18)21
U Cep.....D18(19)24
RZ Cas.....D18(19)22
SW Cyg.....D18(20)26
Y Psc.....19(24)27L
SS Cet.....L20(18)23
HU Tau.....L20(22)26

2010 Oct 17 Sun
TX UMa....05(09)05D
V367Cyg.D18(<<)28L
TV Cas.....D18(14)18
AI Dra.....D18(17)18
TW Dra.....D18(17)22
Z Dra.....D18(17)20
X Tri.....D18(17)20
Z Vul.....D18(18)24
RZ Cas.....22(24)26

2010 Oct 18 Mon
Z Per.....D18(15)20
X Tri.....D18(17)19
RW Tau.....L19(21)26
HU Tau.....L20(24)27
AI Dra.....20(21)23
Z Dra.....24(26)28

2010 Oct 19 Tue
U Cep.....02(07)05D
RZ Cas.....02(05)05D
TV Cas.....05(09)05D
S Equ.....D18(14)19
X Tri.....D18(16)19
RS CVn..D18(23)20L
SS Cet.....L20(18)22

2010 Oct 20 Wed
Z Vul.....00(05)01L
AI Dra.....01(02)04
RS CVn.L03(<<)05D
X Tri.....D18(15)18
Y Psc.....D18(18)23
U Sge....D18(19)24L
HU Tau.....21(25)29

2010 Oct 21 Thu
TV Cas 01(05)05D
SW Cyg...03(09)05L
Z Per.....D18(16)21
U Cep.....D18(19)23
Z Dra.....D18(19)22
RW Tau....L18(16)21

2010 Oct 22 Fri
U CrB.....D18(15)21
Z Vul.....D18(16)22
RZ Cas.....D18(19)21
S Equ.....19(24)24L
SS Cet.....L20(17)22
TV Cas.....20(24)29
HU Tau....22(26)30D

2010 Oct 23 Sat
Z Dra.....01(04)06D
TW Dra...03(08)06D
AI Dra.....D18(17)18
RZ Cas.....21(24)26
U Sge.....22(28)24L

2010 Oct 24 Sun
U Cep.....02(06)06D
RW Tau...06(10)06D
Z Per.....D18(18)23
RS CVn..D18(19)19L
TV Cas.....D18(20)24
AI Dra.....20(21)23
Z Vul.....22(27)24L
HU Tau....24(28)30D

2010 Oct 25 Mon
RZ Cas.....02(04)06D
SW Cyg.D18(23)29L
Z Dra.....18(21)23
SS Cet.....L19(17)21
U CrB..... 20(26)21L
TW Dra.....22(27)30D

2010 Oct 26 Tue
AI Dra.....01(02)03
U CrB.....L05(02)06D
TX UMa...D18(14)19
TV Cas.....D18(15)20
U Cep.....D18(18)23

2010 Oct 27 Wed
RW Tau.....00(05)06D
HU Tau.....01(05)06D
Z Dra.....03(05)06D
AI Dra.....06(07)06D
U Sge.....D18(13)19
Z Vul.....D18(14)19
Z Per.....D18(19)24

2010 Oct 28 Thu
Y Psc.....02(07)03L
RZ Cas.....D18(18)21
TW Dra.....18(23)28
SS Cet.....L19(16)21

2010 Oct 29 Fri
U Cep.....01(06)06D
HU Tau.....02(06)06D
U CrB.....D18(13)18
RS CVn..D18(14)19L
TX UMa.D18(15)19L
AI Dra.....D18(16)18
S Equ.....D18(21)24L
RW Tau.....18(23)28
Z Vul.....20(25)24L
Z Dra.....20(23)25
RZ Cas.....21(23)25

2010 Oct 30 Sat
TV Cas.....02(06)06D
SW Cyg....D17(13)19
Z Per.....D17(20)25
U Sge.....D17(22)23L
AI Dra.....20(21)22

2010 Oct 31 Sun
RZ Cas.....01(04)06D
HU Tau.....04(08)06D
Z Dra.....05(07)06D
X Tri.....05(08)06D
U Cep.....D17(18)23
TW Dra.....D17(18)23
SS Cet.....L19(15)20
Y Psc.....21(25)26L
TV Cas.....22(26)30D

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2010 Nov 1 Mon
AI Dra.....01(02)03
X Tri.....05(07)06D
Z Dra.....D17(16)18
TX UMa.D17(17)19L
RW Tau.....L18(18)22
U CrB.....18(24)20L
TX UMa....L21(17)22

2010 Nov 2 Tue
X Tri.....04(07)06D
U CrB.....L05(00)05
HU Tau.....05(09)06D
AI Dra.....05(07)06D
TV Cas.....D17(21)26
Z Per.....D17(22)27
V367Cyg.D17(51)27L
Z Dra.....22(24)27

2010 Nov 3 Wed
U Cep.....01(06)06D
RS CVn.....03(09)06D
X Tri.....03(06)06D
TW Dra.....D17(14)19
RZ Cas.....D17(18)20
V367Cyg.D17(27)27L
Z Vul.....18(23)24L
SS Cet.....L19(15)19
SW Cyg.....21(27)28L

2010 Nov 4 Thu
X Tri.....03(05)06D
V367Cyg.D17(03)27L
AI Dra.....D17(16)18
TV Cas.....D17(17)21
TX UMa.D17(18)18L
Y Psc.....D17(20)24
RZ Cas.....20(22)25
TX UMa....L21(18)23

2010 Nov 5 Fri
X Tri.....02(04)06D
U CrB.....05(10)06D
V367Cyg..D17(<<)24
Z Dra.....D17(17)20
U Cep.....D17(18)22
S Equ.....D17(18)23L
Z Per.....18(23)28
AI Dra.....20(21)22

2010 Nov 6 Sat
RZ Cas.....01(03)05
X Tri.....01(04)06D
TW Dra.....04(09)06D
U Sge.....D17(17)22
SS Cet.....L19(14)19
Z Dra.....24(26)28

2010 Nov 7 Sun
AI Dra.....01(02)03
X Tri.....01(03)06
RW Tau.....02(07)06D
RZ Cas.....05(08)06D
TX UMa.D17(20)18L
TX UMa....L21(20)25
X Tri.....24(26)29

2010 Nov 8 Mon
U Cep.....01(05)06D
RS CVn...L01(04)06D
TV Cas.....04(08)06D
AI Dra.....05(07)06D
Y Psc.....D17(14)18
SW Cyg....D17(16)23
Z Vul.....D17(21)23L
U CrB.....D17(21)20L
Z Per.....20(24)29
TW Dra.....23(28)30D
X Tri.....23(26)28

2010 Nov 9 Tue
RZ Cas.....D17(17)20
Z Dra.....D17(19)22
U Sge.....20(26)23L
RW Tau.....20(25)30
X Tri.....23(25)28
TV Cas.....23(27)30D

2010 Nov 10 Wed
AI Dra.....D17(16)17
U Cep.....D17(17)22
TX UMa.D17(21)18L
RZ Cas.....19(22)24
TX UMa....L21(21)26
X Tri.....22(24)27

2010 Nov 11 Thu
Z Dra.....01(04)06D
TW Dra.....19(24)29
TV Cas.....19(23)27
AI Dra.....20(21)22
Z Per.....21(26)30D
X Tri.....21(24)26

2010 Nov 12 Fri
RZ Cas.....00(02)05
U CrB.....L04(08)06D
S Equ.....D17(15)21
RW Tau....D17(19)24
RS CVn..D17(23)18L
HU Tau.....L18(16)20
X Tri.....21(23)26

2010 Nov 13 Sat
SW Cyg....00(06)04L
U Cep.....00(05)06D
AI Dra.....00(02)03
RS CVn.....L01(<<)06
RZ Cas.....05(07)06D
SW Cyg.L05(06)06D
TV Cas.....D17(19)23
Z Vul.....D17(19)23L
Z Dra.....19(21)23
X Tri.....20(22)25
TX UMa...L20(23)28

2010 Nov 14 Sun
AI Dra.....05(06)06D
TW Dra....D17(19)24
HU Tau.....L18(17)21
X Tri.....19(22)24
Z Per.....22(27)30D

2010 Nov 15 Mon
Z Dra.....03(06)06D
RW Tau....D17(14)19
TV Cas.....D17(14)18
RZ Cas.....D17(17)19
U Cep.....D17(17)22
U CrB.....D17(19)19L
X Tri.....18(21)23
S Equ.....20(26)23L
Y Psc.....22(27)25L

2010 Nov 16 Tue
AI Dra.....D17(16)17
U Sge.....D17(20)22L
X Tri.....18(20)23
HU Tau.....L18(18)22
RZ Cas.....19(21)24
TX UMa...L20(24)29

2010 Nov 17 Wed
TV Cas.....05(10)06D
TW Dra.....D17(14)19
RS CVn...D17(18)18L
SW Cyg....D17(20)26
X Tri.....17(20)22
AI Dra.....19(21)22
Z Dra.....20(23)25
RZ Cas.....24(26)28
Z Per.....24(29)30D
U Cep.....24(29)30D
2010 Nov 18 Thu
RW Tau.....04(08)06D
Z Vul.....D17(16)22
X Tri.....D17(19)21
HU Tau.....L18(20)24
2010 Nov 19 Fri
AI Dra.....00(02)03
TV Cas.....01(05)06D
U CrB.....L03(06)06D
RZ Cas.....04(07)06D
Z Dra.....05(07)06D
S Equ.....D17(12)18
X Tri.....D17(18)21
Y Psc.....D17(21)25L
TX UMa....21(26)30D
2010 Nov 20 Sat
TW Dra.....05(10)06D
AI Dra.....05(06)06D
Z Dra.....D17(16)18
U Cep.....D17(17)21
X Tri.....D17(18)20
HU Tau.....L18(21)25
TV Cas.....20(25)29
V367Cyg....21(66)26L
Z Vul.....22(27)22L
RW Tau.....22(27)30D
2010 Nov 21 Sun
Z Per.....01(06)06D
RZ Cas.....D17(16)18
X Tri.....D17(17)19
V367Cyg.D17(42)26L
Z Dra.....22(24)27
2010 Nov 22 Mon
SW Cyg..L05(10)06D
RS CVn...D17(14)17L
AI Dra.....D17(16)17
X Tri.....D17(16)19
U CrB.....D17(17)19L
V367Cyg.D17(18)26L
TV Cas.....D17(20)24
S Equ.....17(23)22L
RZ Cas.....18(21)23
HU Tau.....19(23)26
TX UMa....23(27)30D
U Cep.....24(28)30D
2010 Nov 23 Tue
TW Dra.....00(05)06D
V367Cyg.D17(<<)26L
U Sge.....D17(14)20
Z Vul.....D17(14)20
Y Psc.....D17(15)20
X Tri.....D17(16)18
RW Tau.....D17(21)26
AI Dra.....19(21)22
RZ Cas.....23(25)28
2010 Nov 24 Wed
Z Per.....02(07)06D
X Tri.....D17(15)17
TV Cas.....D17(16)20
Z Dra.....D17(18)20
HU Tau.....20(24)28
2010 Nov 25 Thu
AI Dra.....00(01)03
RZ Cas.....04(06)06D
U Cep.....D17(16)21
TW Dra.....19(24)29
Z Vul.....20(25)22L
Z Dra.....24(26)29
2010 Nov 26 Fri
TX UMa....00(05)06D
U CrB.....L03(04)06D
AI Dra.....05(06)06D
RW Tau.....D17(16)20
SW Cyg.....17(23)27L
U Sge.....18(23)21L
HU Tau.....21(25)29
2010 Nov 27 Sat
RS CVn.....02(09)06D
Z Per.....04(09)06D
SW Cyg.....L05(<<)06
del Lib.....L06(13)06D
RZ Cas.....D17(15)18
U Cep.....23(28)31D
2010 Nov 28 Sun
TV Cas.....02(07)07D
Z Vul.....D17(12)17
AI Dra.....D17(16)17
TW Dra.....D17(20)25
Z Dra.....17(19)22
RZ Cas.....18(20)22
HU Tau.....23(27)30
2010 Nov 29 Mon
TX UMa..02(07)07D
RW Tau...05(10)07D
U CrB....D17(14)19L
S Equ.....D17(20)22L
AI Dra.....19(20)22
TV Cas.....22(26)30
RZ Cas.....22(25)27
2010 Nov 30 Tue
Z Dra.....01(04)06
Z Per.....05(10)07D
U Cep.....D17(16)21
Z Vul.....18(23)22L
Y Psc.....24(28)24L
AI Dra.....24(25)27

December

2010 Dec 1 Wed
HU Tau....00(04)07D
RZ Cas.....03(05)07D
SW Cyg...D17(13)19
TW Dra...D17(15)20
TV Cas.....17(22)26
RW Tau...24(29)31D
RS CVn..L24(28)31D
2010 Dec 2 Thu
TX UMa..03(08)07D
AI Dra.....05(06)07D
del Lib...L06(04)07D
Z Dra.....19(21)23
U Cep.....23(28)31D
2010 Dec 3 Fri
HU Tau....01(05)06L
U CrB.....L02(01)07D
Z Per.....06(11)07D
RZ Cas.....D17(15)17
TV Cas.....D17(17)21
U Sge....D17(18)21L
2010 Dec 4 Sat
Z Dra.....03(06)07D
TW Dra...05(11)07D
del Lib...L06(12)07D
AI Dra.....D17(16)17
RZ Cas.....17(20)22
Y Psc.....18(23)24L
RW Tau.....18(23)28
2010 Dec 5 Sun
HU Tau....03(07)06L
TX UMa..05(10)07D
U Cep.....D17(16)20
Z Vul.....D17(21)22L
AI Dra.....19(20)22
SW Cyg.....21(27)26L
RZ Cas.....22(24)27
2010 Dec 6 Mon
SW Cyg..L04(03)07D
X Tri.....04(07)04L
U CrB.....06(12)07D
U CrB.....D17(12)18
Z Per.....D17(13)17
S Equ.....D17(17)21L
Z Dra.....20(23)25
RS CVn.....L24(23)29
AI Dra.....24(25)26
2010 Dec 7 Tue
TW Dra.....01(06)07D
RZ Cas.....02(05)07D
X Tri.....03(06)04L
TV Cas.....04(08)07D
HU Tau.....04(08)06L
RW Tau.....D17(17)22
U Cep.....23(27)31D
2010 Dec 8 Wed
X Tri.....03(05)04L
AI Dra.....05(06)07D
Z Dra.....05(07)07D
TX UMa....06(11)07D
Y Psc.....D17(17)21
TV Cas.....23(28)31D
2010 Dec 9 Thu
X Tri.....02(05)04L
SS Cet.....02(07)03L
HU Tau.....05(09)06L
del Lib.....L06(04)07D
Z Per.....D17(14)19
Z Dra.....D17(16)18
V367Cyg.D17(56)24L
U CrB.....17(23)18L
TW Dra.....20(25)30
2010 Dec 10 Fri
X Tri.....01(04)04L
U CrB.....L02(<<)05
V367Cyg.L06(32)07D
U Sge.....D17(12)18
U Cep.....D17(15)20
SW Cyg....D17(17)23
Z Vul.....D17(19)21L
RZ Cas.....D17(19)21
V367Cyg.D17(32)24L
TV Cas.....19(23)27
Z Dra.....22(25)27

2010 Dec 11 Sat
X Tri.....01(03)04L
del Lib.....L06(12)07D
V367Cyg..L06(08)07D
V367Cyg..D17(08)24L
AI Dra.....19(20)22
RZ Cas.....21(24)26
RS CVn.....L23(18)24

2010 Dec 12 Sun
X Tri.....00(03)04L
SS Cet.....02(07)02L
V367Cyg.L06(<<)07D
Z Dra.....07(09)07D
V367Cyg.D17(<<)24L
Z Per.....D17(15)20
TV Cas.....D17(19)23
TW Dra.....D17(21)26
U Cep.....22(27)31D
X Tri.....23(26)28L
AI Dra.....24(25)26

2010 Dec 13 Mon
RW Tau.....02(06)06L
RZ Cas.....02(04)07
U CrB.....04(10)07D
Z Vul.....L07(06)07D
S Equ.....D17(13)19
Z Dra.....D17(18)20
U Sge.....D17(21)20L
X Tri.....23(25)28

2010 Dec 14 Tue
AI Dra.....04(06)07D
RZ Cas.....07(09)07D
TV Cas.....D17(14)18
TX UMa.....L18(14)19
X Tri.....22(24)27
Z Dra.....24(26)29

2010 Dec 15 Wed
SW Cyg.....00(06)01L
SS Cet.....01(06)02L
SW Cyg...L03(06)07D
HU Tau.....D17(13)17
U Cep.....D17(15)20
TW Dra.....D17(16)21
Z Vul.....D17(16)21L
Z Per.....D17(17)21
RW Tau.....20(25)30
X Tri.....21(24)26

2010 Dec 16 Thu
del Lib....L05(04)07D
TV Cas.....05(10)07D
RZ Cas.....D17(18)21
U CrB.....D17(21)17L
S Equ.....19(24)20L
X Tri.....21(23)26

2010 Dec 17 Fri
U CrB.....L02(<<)02
HU Tau.....D17(15)19
Z Dra.....17(19)22
TX UMa...L18(16)20
AI Dra.....19(20)21
X Tri.....20(22)25
RZ Cas.....21(23)25
U Cep.....22(27)31D

2010 Dec 18 Sat
SS Cet.....01(05)02L
TV Cas.....01(05)07D
del Lib....L05(11)07D
Z Vul.....L06(03)07D
TW Dra....06(11)07D
Z Per.....D17(18)23
RW Tau....D17(19)24
X Tri.....19(22)24
AI Dra.....24(25)26

2010 Dec 19 Sun
RZ Cas.....01(04)06
Z Dra.....02(04)06
HU Tau.....D17(16)20
SW Cyg.D17(20)25L
X Tri.....19(21)24
Y Psc.....20(24)23L
TV Cas.....20(25)29

2010 Dec 20 Mon
U CrB.....02(07)07D
AI Dra.....04(06)07D
RZ Cas.....06(08)07D
Z Vul.....D17(14)20
U Cep.....D17(15)19
U Sge.....D17(15)20L
X Tri.....18(20)23
TX UMa....L18(17)22
SS Cet.....24(29)26L

2010 Dec 21 Tue
TW Dra..02(07)07D
RS CVn...02(08)07D
RW Tau..D17(14)18
HU Tau...D17(17)21
Z Per.....D17(19)24
TV Cas...D17(20)24
X Tri.....17(20)22
Z Dra.....19(21)24

2010 Dec 22 Wed
RZ Cas....D17(18)20
X Tri.....D17(19)22
Z Vul.....20(25)20L
U Cep.....22(26)31D

2010 Dec 23 Thu
Z Dra.....03(06)07D
del Lib..L05(03)07D
Z Vul.....L06(01)07
TV Cas....D17(16)20
X Tri.....D17(18)21
U CrB...D17(18)17L
Y Psc....D17(18)23L
HU Tau...D17(19)23
S Equ....D17(21)20L
TX UMa..L18(19)23
AI Dra.....19(20)21
U Sge.....19(24)20L
RZ Cas.....20(23)25
TW Dra..21(26)31D
SS Cet.....23(28)26L

2010 Dec 24 Fri
RW Tau...03(08)05L
SW Cyg..04(10)07D
X Tri.....D17(18)20
Z Per.....D17(21)26
AI Dra.....23(25)26

2010 Dec 25 Sat
RZ Cas.....01(03)06
del Lib..L05(11)07D
Z Vul.....07(12)07D
Z Vul.....D17(12)17
U Cep.....D17(14)19
X Tri.....D17(17)19
HU Tau...D17(20)24
Z Dra.....20(23)25
RS CVn.L22(28)31D

2010 Dec 26 Sun
AI Dra.....04(05)07
RZ Cas....05(08)07D
X Tri.....D17(16)19
TW Dra..D17(21)26
TX UMa.....L18(20)25
RW Tau.....22(27)29L
SS Cet.....23(27)25L

2010 Dec 27 Mon
U CrB.....L01(05)07D
TV Cas.....02(07)07D
Z Dra.....05(07)07D
U Sge.....L06(10)07D
Y Psc.....D17(13)17
X Tri.....D17(16)18
Z Per.....17(22)27
HU Tau.....18(21)25
Z Vul.....18(23)20L
U Cep.....21(26)31

2010 Dec 28 Tue
V367Cyg.L05(46)07D
X Tri.....D17(15)17
Z Dra.....D17(16)18
RZ Cas.....D17(17)20
V367Cyg.D17(46)23L
SW Cyg.....18(24)25L
TV Cas.....22(26)30

2010 Dec 29 Wed
SW Cyg.....L02(00)06
V367Cyg.L05(22)07D
TW Dra.....D17(17)22
RW Tau.....D17(21)26
V367Cyg.D17(22)23L
TX UMa.....L17(22)26
AI Dra.....18(20)21
HU Tau.....19(23)27
RZ Cas.....20(22)24
SS Cet.....22(27)25L
Z Dra.....22(25)27

2010 Dec 30 Thu
del Lib.....L04(03)07D
V367Cyg.L05(<<)07D
Z Vul.....L05(10)07D
V367Cyg.D17(<<)23L
U Cep.....D17(14)19
S Equ.....D17(18)20L
U Sge.....D17(19)19L
TV Cas.....17(22)26
Z Per.....19(23)28
RS CVn.....L22(23)29
AI Dra.....23(25)26

2010 Dec 31 Fri
RZ Cas.....00(03)05
V367Cyg.L05(<<)07D
Z Dra.....07(09)07D
V367 Cyg..D17(<<)19
HU Tau.....20(24)28

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The **deadline for contributions** to the next issue of VSSC (number 146) will be 7th November, 2010. All articles should be sent to the editor (details are given on the back of this issue).

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