British Astronomical Association

VARIABLE STAR SECTION CIRCULAR

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Contents

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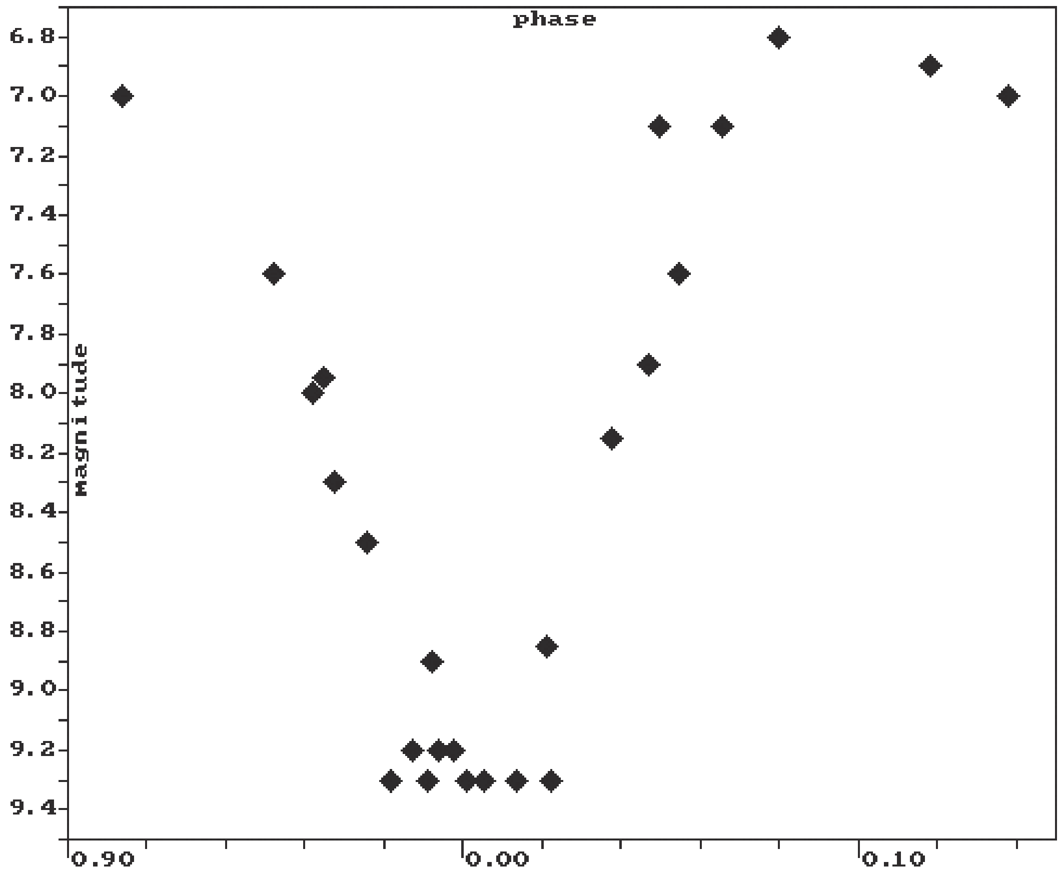
Office: Burlington House, Piccadilly, London, W1J 0DU

U CEPHEI 2009

Tony Markham

Primary Eclipse of U Cep in 2009 (GCVS elements)



Whenever possible, it is best to observe the whole of an eclipse in one night in order to minimise scatter due to different sky conditions. In practice, this isn't always possible – due to the interference of cloud, twilight, etc. This eclipse of U Cephei actually combines data from nine different eclipses. There are a couple of points which are probably in error – the magnitude 8.9 estimate (E-5, F-4) at phase 0.992 and the magnitude 7.1 estimate (C+5) at phase 0.049. The "tidiest" part of this light curve occurs mid-way between maximum and minimum - where the sequence is best and the brightness differences between the variable and comparisons (C,D,E,F) were small.

FROM THE DIRECTOR

ROGER PICKARD

The VSS Workshop, Saturday March 13th

This meeting, hosted by the Hampshire Astronomy Group, proved to be very popular and successful with feedback from several observers stating they were going to undertake Variable Star observing, either visual or electronic.

All presentations were of high quality (I don't necessarily include my own here!) and have been uploaded to the web site for the use of all delegates and any members that may find them useful.

Main VSS Meeting, Saturday May 1st

This year the annual Section Meeting took place at Pendrell Hall, near Wolverhampton. Not that you would think it was near any major urban development as it was surrounded by green fields and farm buildings, and the Hall itself was set in delightful gardens.

Summaries of the talks, which were all interesting, informative, and entertaining will be given in future Circulars.

OLD CIRCULARS

With thanks to Storm Dunlop, some very old Circulars from the time of Felix de Roy, namely numbers 1 to 11, have been placed on the web site and make for some interesting reading.

Furthermore, in VSSC No. 1 Felix de Roy makes mention of two earlier Circulars issued by his predecessor C. L. Brook. Unfortunately we can find no trace of these, so I shall be pleased to hear from anybody who can.

The early Circulars by de Roy are not searchable and if any member knows how they could be converted to that form I shall be pleased to hear from them.

The Director has been missing VSSC No. 14 issued by John Isles in 1972 but, with thanks to John, a copy of this is now on the website as well.

Visual versus CCD Observations

I know this has been mentioned before but I really don't understand why some visual observers are being put off observing (or at least submitting their observations) because they feel "CCDs have taken over". Not so! Have a look at the AAVSO light curve generator for almost any LPV or SR and see the very limited number of CCD observations. They are generally swamped by visual ones if there are any at all. CCD observers generally seem to monitor CVs and the like, i.e. those objects which have a cycle of just a few hours - certainly less than a day. This leaves the field wide open for visual observers to concentrate on what they do best, monitor stars with longer periods, be they LPVs or CVs with long periods between outbursts.

Now there is at least one person looking at LPVs etc. on a regular basis with a CCD in the UK, and that is Clive Beech. However, the trouble with this type of observing, as Clive will confirm, is that there is an awful lot of data to reduce and he has great trouble keeping up with it!

It has also been said on the various AAVSO discussion groups that CCD observers come from visual observers. I disagree. Certainly, when CCDs were first coming in I think this was generally true, but I do not think that is the case now. In my experience nowadays a new observer is either a visual one or a CCD one, and in almost equal proportions but just balanced in favour of the visual observer.

Pay On-line

Thanks are due to Callum Potter, for a new facility for members to pay for the Circulars on-line. From the BAA home page: *http://britastro.org/baa/* , click "Shop" centre top of page, and in the panel on the right hand side click "Section Newsletters".

(Occasional?) Letters Page.

I think we tried to encourage members to write in once before, but I wonder if we should perhaps try again? I do receive the occasional email (and letter) about items that I am sure would be of more general interest, so how about sending something to our Editor for publication? Perhaps for comment by others, or offering advice to others, or even perhaps just for the sheer amusement or whatever of it.

EUROPEAN VARIABLE STAR MEETING

ERWIN VAN BALLEGOIJ
On behalf of the Dutch Variable Star Association


Photograph courtesy Rob Januszewski

In April 2008 the BAA and the AAVSO organized a very successful AAVSO Spring Meeting in Cambridge, UK. It was a joy to meet variable star observers from all over world. Observers whom you knew from discussion groups, but never met in person. Combined with a very interesting program, it was a delight to be there. It is a pity we do not have meetings like this in Europe more often... But wait!

The Dutch Variable Star Association celebrates this year its 50th Anniversary; and we would like to celebrate this with variable star observers from Europe and beyond. Therefore we organize an European Variable Star Meeting from **Friday October 22** until **Sunday October 24, 2010**. The meeting will take place at the university museum in the beautiful historic town of Groningen, a town in the northern part of the Netherlands. We will offer an interesting program, including presentations by professional astronomers, and an excursion. Several professional astronomers have already confirmed their presence. Arne Henden, director of the AAVSO, is one of them.

The registration fee is only 50 Euros and includes a reception, two lunches, one dinner and an excursion. We can offer you affordable accommodation as well. There is no reason not to come. So we hope to see you all! You can find all the information at our website. The link:

www.veranderlijkesterren.info/page30/page30.html

leads directly to the English pages.

Clear Skies, Erwin van Ballegoij
aavso.id.bve@home.nl

RECURRENT OBJECTS, and LONG TERM POLAR MONITORING PROGRAMME UPDATES:

GARY POYNER

V2491 Cygni (Nova Cyg 2008).

A recent paper (V2491 Cyg - a possible recurrent nova, Ragan et al, available for download at *http://arxiv.org/abs/1004.0419*) reveals similarities to other known Recurrent Novae such as RS Oph and V2487 Oph (see VSSC 137). They also indicate that the system is a Polar, with a WD mass of 1.3 Solar Mass - consistent again with other Recurrent Novae.

The amplitude of V2491 Cyg has also been shown to be smaller than classical Novae, although the 10 magnitude range given in the paper does seem to be borderline.

With this in mind, we have decided to add this object to the Recurrent Objects Programme. There is an AAVSO chart and sequence available for download from the AAVSO web pages.

QQ Vulpeculae

Following my notes in the March 2010 VSSC (No 143) on the Long Term Polar Monitoring Programme, Dr. Robert Smith e-mailed to comment on my remarks that QQ Vul may show possible eclipses. Robert mentions that spectroscopic work, carried out by him more than a decade ago, revealed an orbital inclination of 65+/- 7d, which obviously rules out eclipses. He goes on to say that the dips in the light curves "vary with time in a way incompatible with an eclipse by the secondary star, and are usually attributed to cyclotron beaming or to grazing occultation of the accretion pole (see, for example, *Kafka and Honeycutt, AJ, 125, 2188-95, 2003*)."

I'd like to thank Robert for his very helpful and interesting feedback on this.

ECLIPSING BINARY NEWS

DES LOUGHNEY

Epsilon Aurigae

At the time of writing the predicted central brightening of the eclipse is eagerly awaited. It was scheduled to start at the beginning of May, and last until the middle of October. Epsilon is around magnitude 3.77 at its faintest. During the central phase it may brighten to over magnitude 3.6. The brightening in the last eclipse (1982 - 1984) was poorly documented because it centred during the summer period, when epsilon was lowest and nearest the sun. There were no observations at all for nearly a month.

This year conditions are a bit more favourable. The centre of the eclipse is towards the end of July. The second half of the central brightening should be well documented, between early August and mid October, with early morning observations.

Observations of the central brightening are called for. They may show whether the centre of the disk is occupied by a star or a black hole; an accretion disk with or without ‘hot’ spots, and provide more information regarding the structure of the eclipsing disk.

By the beginning of July observations of epsilon Aurigae are easier before dawn. At the latitude of Edinburgh epsilon will be at 18° altitude at 3.00 BST on 1/7/10. On 15/7/10 it will be at 24° at 3.00 BST. Although atmospheric extinction is a factor at these altitudes, and estimates will have to be corrected, good estimates with a DSLR are possible. At 16° altitude, if eta Aurigae is the comparison, the magnitude correction is a dimming of epsilon by about 0.125 magnitude. At 24° altitude the correction is about 0.044 magnitude.

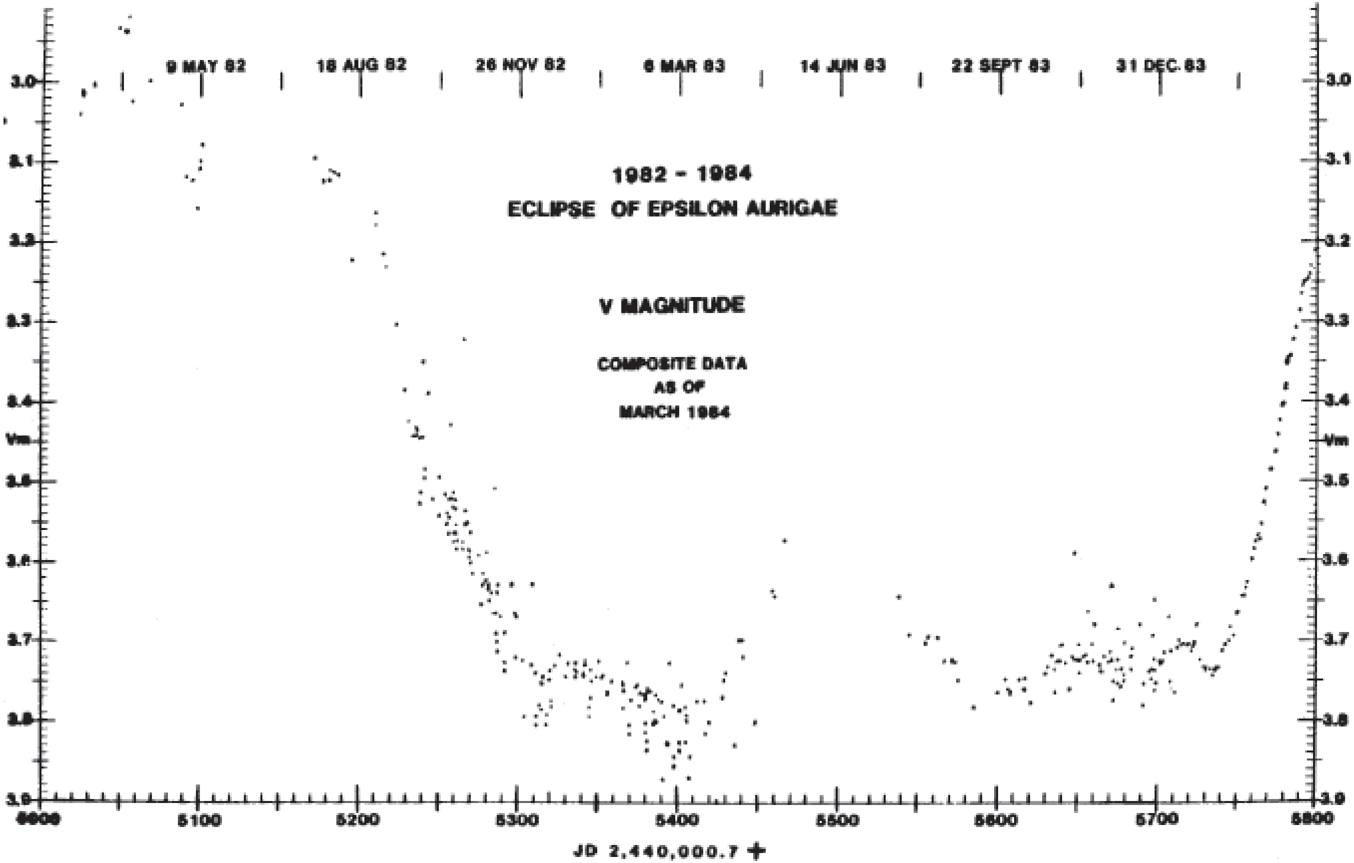
Some Eclipsing Binaries in Cygnus

Y Cygni
This EB has been on the BAA VSS list for some time. It is a straightforward binocular object which is easy to find, being very near the second magnitude star epsilon Cygni. It is an Algol (EA) class eclipsing binary and has distinct, sharp, eclipses. As the two stars are similar in size there is a pronounced secondary minimum. The total variation is between magnitudes 7.3 and 7.9. The primary minimum features a drop of magnitude 0.6 and the secondary minimum 0.4. Eclipses last 7.2 hours.

The period of the primary minimum is 2.996217 days so it does not change very much in terms of universal time. Favourable primary eclipses will not be visible from the UK until 2011. However, favourable secondary eclipses will be visible from October 2010. The unusual aspect of this system is that the secondary minima have a different period which is currently 2.996447 days. This is an evolving system and the periods are changing and worth studying. The current elements are nine years old and it would be useful to bring them up to date.

V367 Cygni
This is a system that is near Y Cygni. It is also a binocular object which varies from around 6.7 to 7.6 magnitudes. It is an EB class eclipsing binary with a similar light curve to Beta Lyrae. It is therefore always changing in brightness and estimates are welcome in and out of eclipse. The depth of the primary eclipse is apparently magnitude 0.6, and

Courtesy of Jeff Hopkins, and thanks to the many other observers who contributed observations to this light curve.
For current International epsilon Aurigae Campaign see *http://www.hposoft.com/Campaign09.html*



secondary eclipse 0.4. The period is 18.598 days.
The unusual aspects of this system are that the magnitude of the maxima varies, and the light curves are not symmetrical around the minima. For some reason this system has not been looked at for over twenty years. It will be worth studying again to see if it has changed.

V453 Cygni
This is an Algol class system which varies between 8.3 and 8.7 magnitudes. Both primary and secondary minima are 0.4 magnitude in depth. The period is 3.8898151 days. This is an intriguing system to study because one star is over 14 solar masses, and the other over 11 solar masses. The larger is judged to be nearing the end of its main sequence life. For this reason the evolution of the system is well worth monitoring.

Charts can be obtained by contacting me: *desloughney@blueyonder.co.uk*

ASSESSING THE EFFECT OF INTERSTELLAR REDDENING.

David Boyd

When we carry out photometry on a star, we measure its apparent magnitude in one or more standard photometry passbands such as B (blue) and V (visual or green). Let's call these apparent magnitudes mb and mv. The apparent colour of the star is described by its (B-V) colour index which is given by (B-V) = mb-mv.

However, these are only the values we measure here on Earth. They are not the same as the absolute magnitude Mv and intrinsic colour index (B-V)0 of the star. If you want to investigate what type of star it might me, you need to know these latter values as they relate to the physical properties of the star and determine where it lies in the Herzsprung-Russell diagram. In this discussion, we are considering an H-R diagram which plots absolute magnitude Mv against intrinsic colour index (B-V)0.

The apparent and absolute magnitudes of a star are related by the equation

$$mv = Mv + 5 * \log10D - 5 + Av \qquad (1)$$

where D is the distance to the star in parsecs and Av is the interstellar extinction, or dimming in brightness, of the light from the star as it travels through space. This dimming is caused by scattering and absorption of starlight by the gas and dust which permeates interstellar space. The absorption is greatest at shorter (blue) wavelengths so the light is progressively reddened by this process. Av is the extinction measured in the V passband and is expressed in magnitudes. Incidentally, the quantity mv - Mv is also called the distance modulus.

The apparent and intrinsic colour indices of a star are related by the equation

$$(B\text{-}V) = (B\text{-}V)0 + E(B\text{-}V) \qquad (2)$$

where E(B-V) is the (B-V) colour excess, the amount of interstellar reddening affecting the light from the star on its journey to Earth. Reddening is also expressed in magnitudes. Now it so happens that, experimentally, the relationship between interstellar extinction and reddening in the V passband is given by

$$Av = 3.1 * E(B-V) \quad (3)$$

In working with these equations to find plausible values for Mv and (B-V)0, we have the problem that there are too many unknowns to get a unique solution. We therefore have to make some assumptions. A useful starting point is to assume no extinction so Av = E(B-V) = 0. Then the intrinsic colour index (B-V)0 = (B-V) and if we assume the star is on the main sequence we can find an initial estimate of Mv by consulting the locus of the main sequence in the H-R diagram. We can then use eqn (1) to make an initial estimate of the distance to the star D. At this point we can consult other sources for further information which might help us.

The amount of interstellar reddening due to dust in our galaxy has been measured in several ways. The latest published information is available in a convenient form on the internet[1]. You specify the position or name of the object and it returns a value for the interstellar reddening E(B-V) and the associated extinction Av due to dust in the galaxy in that direction. This is the total reddening to the edge of the galaxy and the star you are interested in will lie somewhere within the galaxy so will likely experience somewhat less reddening. But at least this gives you an upper limit.

It may be more helpful to look in WEDBA[2] for any star clusters which are close to the star on the sky. This database gives the measured distance and reddening for many clusters and if there is a cluster close to the star on the sky you may be able to estimate the possible reddening of the star by comparing its distance with that of the cluster. Given an estimate of the star's reddening, you can find its intrinsic colour index (B-V)0 from eqn (2) and its extinction Av from eqn (3). Referring back to the main sequence in the H-R diagram with this value of (B-V)0 gives an improved estimate of Mv and putting this back into eqn (1) gives an improved value for the distance D. Thus it is possible to iterate towards a self-consistent set of parameters for the star assuming the star lies on the main sequence. If there is reason to believe it is not on the main sequence, then the estimated value of Mv can be adjusted accordingly.

An example

The star variously known as USNO-A2.0 1500-00686865, USNO-B1.0 1512-0023462, 2MASS J00390981+6112331 and GSC2.3 NALV008506 has been observed to show low amplitude variability with a period of 0.44 days and an amplitude of 0.024 magnitudes[3]. Observational evidence supports its interpretation as a pulsating variable. We want to know where this star lies in the H-R diagram in order to decide what type of pulsating variable it might be.

The measured values of mv and (B-V) are 13.47 and 0.39 mag respectively. This colour index suggests an early F spectral type if the star is unreddened. To give this apparent V magnitude, a main sequence star with this spectral type would lie at a distance of ~1500 pc and have an absolute magnitude of ~2.6. However, as the star is only 1.6° from the galactic plane, it will have experienced some reddening and will thus have an earlier spectral type. Reference[1] gives the total galactic reddening in that direction as ~0.9 mag. The open cluster NGC 189 is 8´ distant from the star on the sky and reference[2] gives its distance as 752 pc with reddening of 0.42 magnitude. The cluster Stock 24 is 47´ away and has a distance of 2818 pc and reddening of 0.50 magnitude. From these we can estimate the reddening of the star to be ~0.46 mag giving an intrinsic colour index of ~ -0.07 magnitude. Referring again to the main sequence in the H-R diagram and working back through the equations, we find that the most probable set of parameters for this star are that it has an absolute magnitude of ~0.5 and is at a distance of ~2000 pc. This indicates a spectral type of late B with the likelihood being that it is a Slowly Pulsating B (SPB) star. While most SPB stars have periods longer than 0.44 days, the period distribution has a tail stretching to shorter periods than this. This star has now been registered in the AAVSO Variable Star Index as VSX J003909.7+611233.

We can see from this example that ignoring the effect of interstellar reddening would have caused (and initially did!) a misidentification of the type of this variable.

Acknowledgements

My understanding of this issue has been significantly advanced with the help of John Greaves and Chris Lloyd and I thank them both for their assistance.

References

1. *http://irsa.ipac.caltech.edu/applications/DUST/*
2. *http://www.univie.ac.at/webda/navigation.html*
3. Boyd D., Lloyd C., dePonthiere P., Julian M., Koff R., Krajci T., Shears J., Staels B., VSX J003909.7+611233: a new Slowly Pulsating B star (SPB) in Cassiopeia? *http://arxiv.org/abs/1001.5277v2*

HAVE YOU SIGNED UP TO TWITTER YET ?

TONY MARKHAM

Your image of Twitter may be of a social networking site used by teenagers and "celebrities" to post updates on their dull lives in great detail …. which are then received on the mobile phones of people who really need to get a life for themselves. You therefore assume that Twitter has nothing to offer amateur astronomers aged 40+.

There is another side to Twitter, however. Rather than having to visit your favourite web sites to check for updates, you can get them to alert you about the latest updates via Twitter … and you never have to post any updates about your own life (unless you really want to !).

Currently there are posts ('tweets') sent out by the AAVSO and the Epsilon Aurigae campaign (and probably some other VS related sources I haven't found yet), although it seems that most Variable Star groups don't yet post via Twitter. However, assuming that you have a life outside of variable stars, there are many groups posting via Twitter that may be of interest to you. These cater for a more general interest in astronomy (APOD, AsteroidWatch, …) , space missions (Herschel, Kepler, Cassini, …) and science in general (GuardianScience, NewScientist, …). The amount of information that can be included in a 'tweet' is limited, so typically the tweet will be a brief description accompanied by a link. Astronomy Now, for example, uses such a link to take you to a video clip in which the editor previews the latest issue of the magazine.

If you don't want the tweets sent to your mobile, don't select the option to have them sent there. I connect to Twitter using my PC and, while I'm eating my breakfast, I look through the tweets I've received and select the links on those that merit further reading.

Once you have signed up to Twitter (https://twitter.com), you are invited to use the 'Find People' link to register for updates from friends/celebrities. However, rather than do this, you can instead click on 'Browse Suggestions', select a topic such as Science and pick out the sources with which you want to register. If you're not sure, you can click on the link for the source to see recent posts and get an idea as to whether the posts would be of interest to you. You can also see when it last posted (there's little point in registering with a group that hasn't posted for months). To register for posts, simply click on the Follow button.

'Find People' also includes a search function within the 'Find on Twitter' tab. In this, you can enter a keyword such as 'astronomy' or 'telescope'. Once again, you can decide which you want to register with.

And if you can't find an organisation in this way, try going to its web site and see if it has a link via which you can click to register for updates via Twitter.

… and then there's Facebook ….

AMATEUR VARIABLE STAR RESEARCH – WHAT'S USEFUL SCIENTIFICALLY?

The Directions of Southern Hemisphere Variable Star Research

Tom Richards – Director, Variable Stars South, RASNZ

This is a shortened version of the first John Perdrix Address presented to the National Australian Convention of Amateur Astronomers, Canberra, Easter 2010. It is reproduced here by kind permission of the NACAA Inc.

Abstract

Variable star research is changing massively thanks to the impact of new instrumentation and communication, in the hands of amateurs as well as professionals. We review the developments in four areas: eclipsing binaries, pulsating variables, cataclysmic variables, and targets of opportunity such as (super)novae. We examine the likely impact of new surveys such as ASAS-3 and BSM, report on the situation of southern hemisphere research and Variable Stars South; and make conclusions about appropriate future planning for southern hemisphere amateur-based VS research.

Amateur Variable Star Research: What's Useful Scientifically?

My theme in this paper will be the scientific value of amateur variable star research. Just because of its scientific value, I want amateur astronomers to take up variable star observing. I want them to take their eyepieces, or their CCD cameras, or their DSLRs, and enjoy the thrill, and feel the value, of producing real science. So why do only a tiny minority take up variable star work? I think three reasons are given, all spurious:

- **Visual work is out.** I have an 8-inch Dob – but isn't that useless now? Don't I have to throw away my eyepieces and go high-tech with CCDs and computers and automation?
- **No amateur role.** Isn't it all covered by professional surveys anyway?
- **Too scientific.** Don't I have to understand a lot of statistics and physics now to do anything useful?

Visual work is more important than ever, amateur work plays a large role in stellar astrophysics, and the level of scientific engagement can be what suits you. Let us have a look at these three issues, because there is much to learn behind each of them.

Is not visual work irrelevant now?

Visual work remains both vital and in great demand. There are many reasons why visual work is irreplaceable.

1. Visual observers are more agile than their CCD colleagues. A visual observer can cover far more stars in a night than a CCD observer. (However this is changing as more CCD telescopes get controlled by scripting.) He or she can choose the holes in the clouds, can work in poorer conditions. This makes the visual observer much more able to ensure a night-by-night continuity of observation of, for example, a Mira. It also ensures the visual observer is much more likely to detect transient events for which he or she is patrolling – dwarf novae outbursts for example. And a visual observer doesn't need to spend half the next day processing and measuring images!

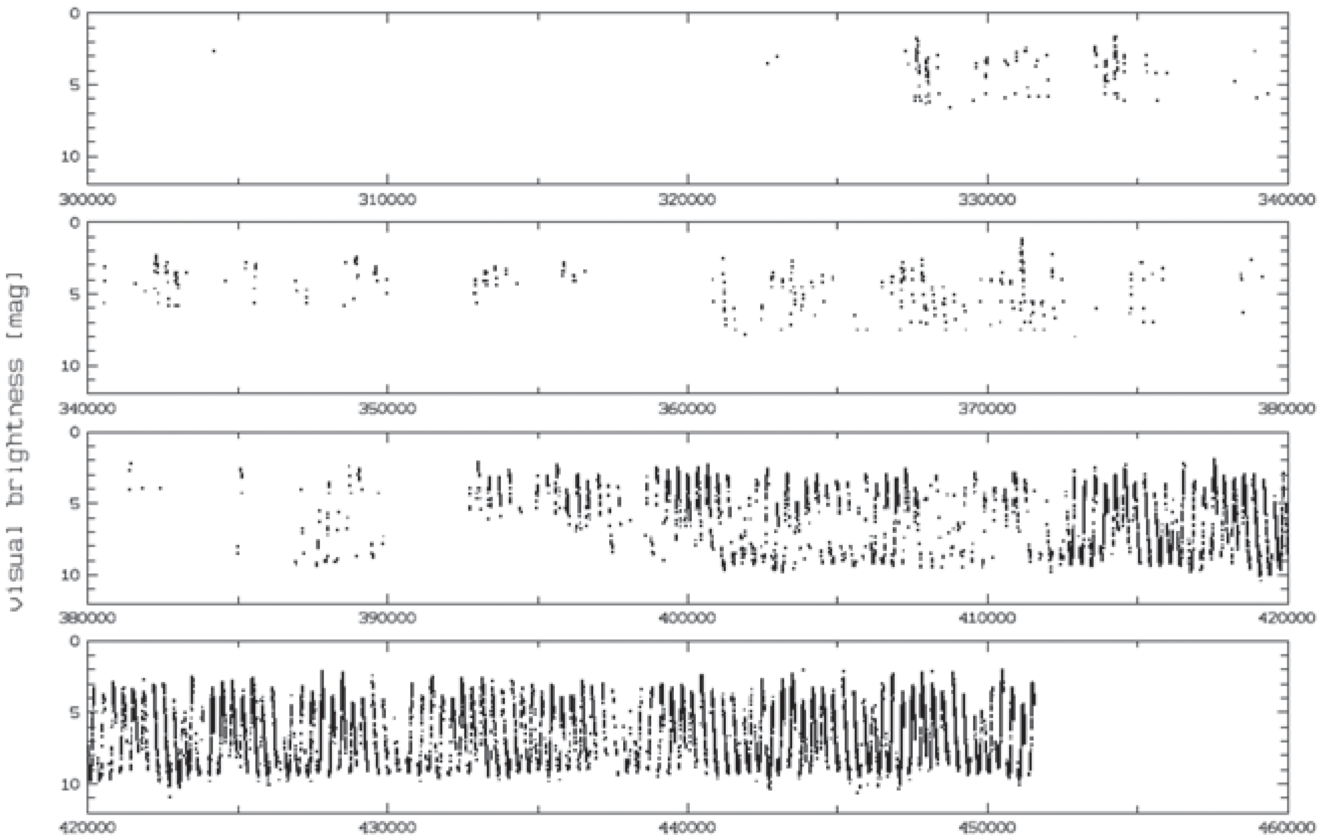
2. The precision levels of visual work are often quite enough. If a star varies by 5 magnitudes, a precision of 0.1 mag is all that is needed to get an accurate light curve.

3. Professionals need and want visual data. Last year, the American Association of Variable Star Observers (AAVSO) had 5,242 requests from researchers for data from their International Variable Star Database, a great deal of it visual. This has over 17 million observations in it, and over a million observations a year are being added to it. Moreover the amount of visual data added per year is increasing too.
In addition, there are hundreds of direct requests a year by professionals for real-time collaborative observations – for visual (and CCD) data as part of a campaign involving spectroscopy, or radio observations, or observations with an X-ray or infrared or some other wavelength of space telescope.

4. Visual data are different from other data. Technologies will come and go, and each will require its data to be transformed to equate with the data of another. But centuries of visual data have been collected in exactly the same way, and constitute a single baseline of data. There is no point in trying to transform CCD data, filtered or not, to agree with visual data. They are measuring something different – the eye has a much wider bandpass than a photometric filter, and a very different response curve from an unfiltered CCD. To obtain data that is consistent with the visual records, you must use the eyeball.

5. Visual data provides a self-consistent ongoing record. The major southern hemisphere automated variable star data collection patrol, ASAS-3, has been going for a decade and a half. SkyMapper at Siding Spring will come online sometime soon.

Figure 1: The entire visual light curve of Mira, 1596-2000.
Gabor Marschalko, and E. Zsoldos (who gathered the data), kindly gave us permission to use their light curve.



How long will their project funding last? For how long will they contribute to variable star data archives? For how long will CCDs with their particular spectral response be the collector of choice? These are a flash in the pan compared to the time span of visual data records – over four centuries since Fabricius discovered Mira, and unlimited in the future. (*See Marschalko's visual light curve of Mira, page 11.*)

6. Visual and CCD observing have different areas of strength and weakness. CCD work excels at time series – image after image of the same star for hours; and on detecting small changes in magnitude below the visual threshold of ~0.1 magnitude. So visual observers should concentrate on variables that change slowly and by large amounts, Miras for example. CCD observers can be wasting telescope time competing in this field. Equally, visual observers are wasting time trying to plot the out-burst behavior of dwarf novae, or finding times of minima of eclipsing binaries.

So let us hear no more of the supposed scientific irrelevance of visual variable star observing, and get on with doing it!

Are Surveys crowding out the Amateur?

Thank goodness for the surveys! They help our work invaluably.

Here in the south, the main, if not the only, survey of relevance to the amateur variable star observer, is **ASAS-3 (All Sky Automated Survey)**. It's a patrol aimed at discovering and monitoring variable stars, and it repeatedly covers the sky, year in year out, so that light curves of variables can be built up. Located at Las Campanas Observatory in Chile, it consists of two f/2.8 Minolta lenses of 200 mm efl, and a 250mm aperture f/3.3 Cassegrain. They all have Apogee AP-10 CCD cameras. They cover any given area of the sky about once every three days in photometric V (visual – i.e. yellow-green) and I (infrared) passbands.

ASAS-3 has its limitations. It saturates on stars brighter than about mag 7. Its data starts to get erratic around mag 13. If you are interested in fainter variables you have no competition. If you are interested in variables that change erratically on any time scale of a month or less, forget ASAS-3. That includes flare stars, all classes of cataclysmic variables, and a lot of short time-scale phenomena in pulsating stars.

Also you can't trust ASAS-3 to give good results in crowded star fields, because of its poor spatial resolution with those Minolta camera lenses. Typically its light curves will be flatter than reality, because of contamination by other stars in the measuring aperture. Nor are its magnitude estimates as precise as a good amateur with a CCD can get, because of the small instruments it uses. So if you are looking for the precise shape of a secondary minimum in an eclipser, ASAS-3 may not help much.

So what has ASAS-3 poached? A lot less than it has provided. It may win on V measures of precisely repeating, or slowly varying, stars in the 8-12 mag range; but otherwise its data is more suggestive than final. Use it to get a feel for stars you might want to observe. Use it to compile lists of observational data, such as periods, of poorly observed stars. Use it to see if a star is worth observing or not.

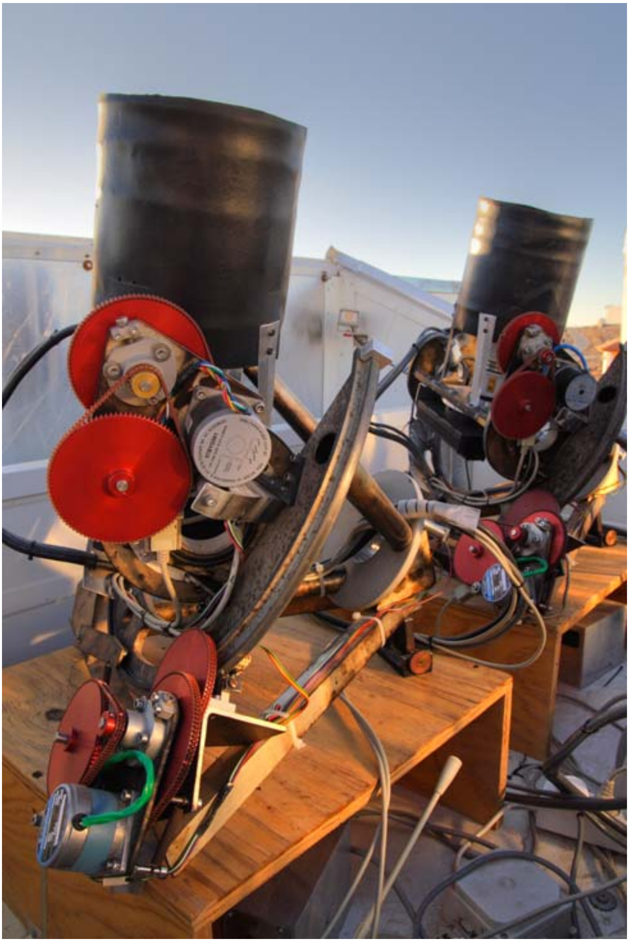


Figure 2:

A picture of the ASAS-3 equipment. Although ASAS online database is often used by amateurs, ASAS is primarily a professional astronomical project, and its data is widely used for scientific research.

Courtesy of Dr. Grzegorz Pojmanski.

Bright Star Monitor South is the interesting new kid on the block. Provided by the AAVSO, it will be mounted at Peter Nelson's observatory at Ellinbank, near Warragul in Gippsland, Victoria. Peter will be assisted by Chris Stockdale and Rod Stubbings. See *http://www.aavso.org/news/bsm.shtml*. It's a 60 mm Takahashi refractor on a Celestron mount with an SBIG ST-8 CCD camera and photometric filters. It's run by ACP observatory control software and MaxIm camera control software. It is designed to study magnitude 2-8 stars.

BSM-S might cover 200 stars on a good night, one exposure each in one filter. But multiple filters, stacking images to improve quality, imaging standard fields for calibration, will all slice that number down – let alone if a time series is taken. Expect it to cover its program stars once per night in one or two colours. Early work with BSM-S will be used to get comparison star calibration, then the monitoring of selected bright under-observed variables. That will scarcely make a dent on visual or PEP work, especially since it will not do what visual observers excel at so importantly – following their favourite stars for decades.

BSM is cheap and simple. Any reasonably handy amateur could set up the same gear, and it would be good to have many of them in the southern hemisphere.

Figure 3: The BSM-North equipment at Tom Krajci's observatory in New Mexico. BSM-South will be the same. Courtesy of Tom Krajci

(*A comment received from Tom Krajci concerning the performance of BSM has been included at the end of this paper - Editor*)*

Is Variable Star Work for the Eggheads?

Yes, you can immerse yourself in the maths and stats and physics if you want to. But you don't have to. Very many observers are most happy just to collect data and send it in, without worrying too much about the scientific ins and outs of it. But, certainly, the more you understand about your data and what you're observing, the more exciting and motivating it becomes. Even that does not mean maths and stats and physics, so much as reading good articles and books, such as John Percy's "*Understanding Variable Stars*" (New York, Cambridge University Press, 2007).

Amateur variable star work is rather like amateur telescope making. You read a book, you find a mentor, you grind away and do a Foucault test, you build a tube and mount. And lo! a powerful instrument. If you want to you can study the physics of optics, do fancy maths to design something special, and learn some tricky engineering to build a more wonderful mount. But you do not have to. Whatever turns you on, or off. And variable star observers, like amateur telescope makers, come in all ages from the very young, and come from all walks of life and educational backgrounds. Everyone has as big a role to play as they want, and in their own inimitable way.

If you can enter data into a spreadsheet, if you can cruise the web, you have the technical skills you need. Beyond that, it is a matter of finding your star and looking at it.

Current Areas of Variable Star Research

Amateur variable star observing isn't what it used to be. Once, here in the south, you just took Frank Bateson's ordered list of stars to observe and started with the first – L2 Puppis and very easy – and reported your visual brightness estimates to him. Then you worked your way through the list, encountering harder and harder stars. I stopped at VW Hydri because I could never see it. That made you a good and useful variable star observer, provided you mailed your data to Frank every month. All you needed was binoculars or a cheap backyard reflector, Frank's booklet and maps, pen and paper, envelope and stamp.

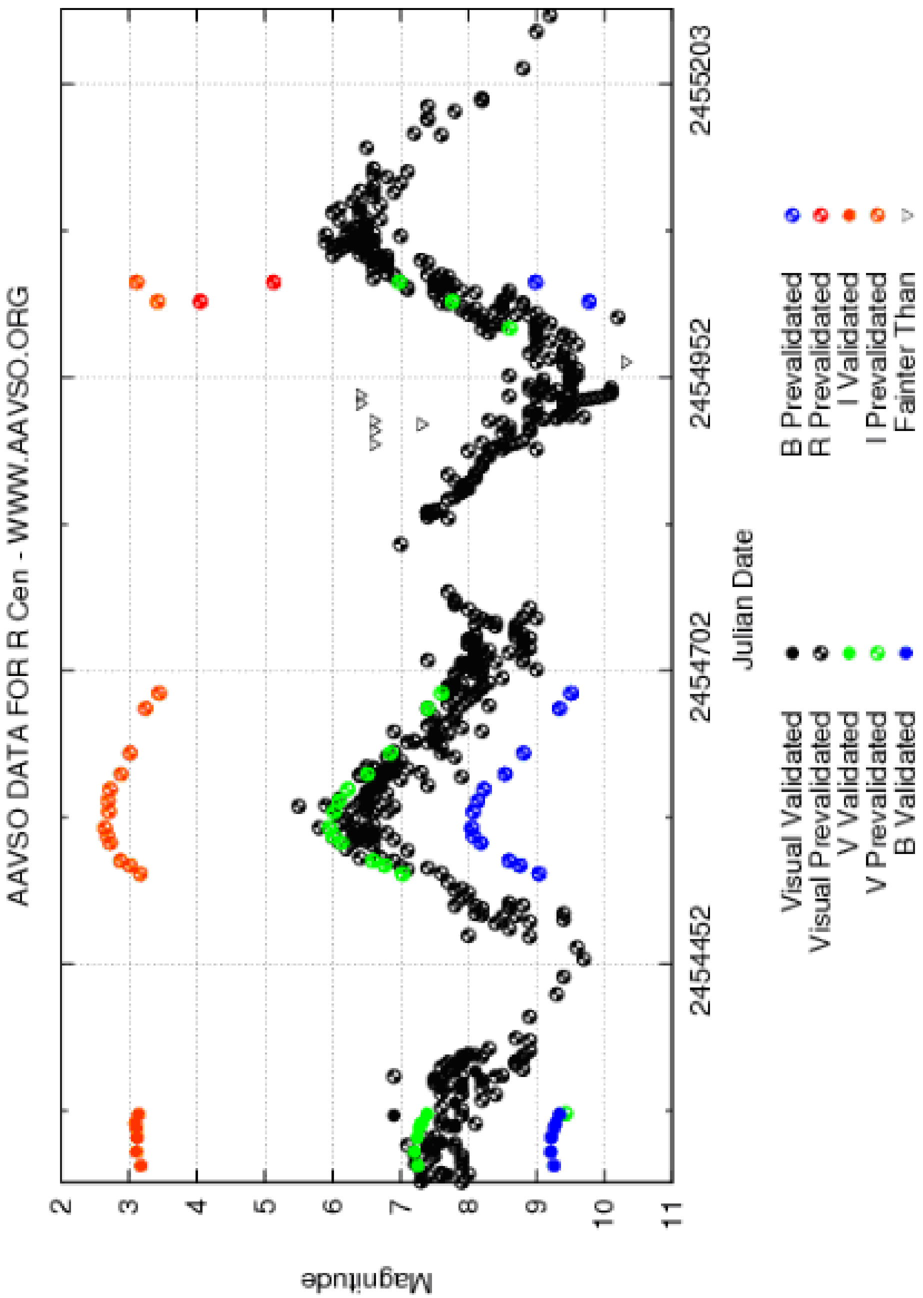
You can still do that. And you ought to do that. It is simple, it is satisfying, and it helps you learn about variables in a very direct way – there's just you and that point of light.

But even this simple and basic visual observing isn't quite what it used to be. Charts are far better and more accurate, so your magnitude estimates aren't led astray by hard-to-read charts with very inaccurate comparison star magnitudes (Frank's chart of VW Hydri was almost unusably bad!). And you need to throw away the envelope and stamp, and upload on the Internet instead. That's actually a most significant change, because now instead of the New Zealand Variable Star Section (formerly the reporting destination for southern observers) producing typewritten sheets of magnitude estimates, you data goes immediately into the vast International Variable Star Database hosted by the AAVSO. There you can immediately see your magnitude estimates and those of others on the same star, you can command a light curve of the last few years of data, and you can ask for the light curve to be folded on the period of variation of the star. (See the AAVSO light curve of the Mira variable R Centauri below – and note the contributors to it!) Most importantly, researchers and analysts can access all the data on a star, including yours, electronically so they can analyse it computationally in whatever way they want. The IVSD is the single most important research database for variable stars, and whatever you send to it will be forever available to others.

Plus ça change? Amateur variable star work remains almost completely photometry (brightness measurement), but some hardy souls are venturing into spectroscopy, the other major way of obtaining astrophysical information. But spectroscopy is a light hog, so with the exception of work on very bright stars, it remains up to the professionals.

Incidentally if you look closely at the R Centauri light curve on page 16, you'll see the I data is much brighter than visual, and the B (photometric blue) is fainter. That is as it should be, since a Mira is brightest in the infrared. But more significantly, the B, I and visual curves have different shapes. You cannot reduce B and I, or even V, to visual, they are measuring different things.

Figure 4: Four years of photometric data on R Centauri in the AAVSO database. This



shows the value of obtaining data both visually and with CCDs. Courtesy of Arne Henden

Additional Info

Plot New Light Curve
Download Complete Data Archive
Quick Look Data
Find Chart(s)
Tips on how to use this in a publication or poster.

Get More Info on R Cen Via:
The International Variable Star Index

The following observers have contributed to this light curve:

AAA	ALVES, AVELINO	BRAZIL	AAP	ABBOTT, PATRICK	CANADA	AAX	AMORIM, ALEXANDRE	BRAZIL
ACN	ADIB, CARLOS	BRAZIL	AWY	ARAUJO, WESLEY	BRAZIL	BALJ	BALDWIN, ALAN	NEW ZEALAND
BLD	BLANE, DAVID	SOUTH AFRICA	BVO	BIBE, VICTOR	ARGENTINA	BWZ	BLOWN, ERIC	NEW ZEALAND
CMB	CLARK, MICHAEL	NEW ZEALAND	CMN	CAMERON, REX	AUSTRALIA	CMQ	CAMILLERI, PAUL	AUSTRALIA
CR	CRAGG, THOMAS	AUSTRALIA	DSI	DI SCALA, GIORGIO	AUSTRALIA	ERW	EVANS, ROBERT	NEW ZEALAND
HJX	HODAR MUNOZ, JUAN	BRAZIL	HSP	HOVELL, STEPHEN	NEW ZEALAND	HYD	HAMBLY, DEBORAH	NEW ZEALAND
JA	JONES, ALBERT	NEW ZEALAND	JPM	JACOBS, PERCY	SOUTH AFRICA	KIL	KISS, LASZLO	AUSTRALIA
KSH	KERR, STEPHEN	AUSTRALIA	KYI	KOK, YITPING	AUSTRALIA	MEV	MORELLE, ETIENNE	FRANCE
MZK	MENZIES, KENNETH	USA	ODI	O'DRISCOLL, DAVID	AUSTRALIA	PAW	PLUMMER, ALAN	AUSTRALIA
PMO	POLL, MICHAEL	SOUTH AFRICA	RFP	REIS-FERNANDES, PAULO	BRAZIL	RHE	RODRIGUEZ, HECTOR	URUGUAY
SBN	SILVA BARROS, ADRIANO AUBERT	BRAZIL	SFU	STREAMER, MARGARET	AUSTRALIA	SGLE	SCHRADER, GLEN	AUSTRALIA
SJX	SMIT, JAN	SOUTH AFRICA	SQL	SALVO, RAUL	URUGUAY	WCG	WYATT, CHRISTOPHER	AUSTRALIA
WJ	WHITEHEAD, JAMES		WPT	WEDEPOHL, PETER	SOUTH AFRICA	WPX	WILLIAMS, PETER	AUSTRALIA

Let's have a look at four major areas of amateur variable star research. Variable Stars South has projects running in all these areas to which you can contribute. In all four areas, there are frequent calls for a special campaign, often in conjunction with a major observatory or space telescope.

Miras and Long Period Variables

These have long been a favourite with amateurs because of their large variations in brightness – amplitude of 10 magnitudes or more, long periods (typically 200-500 days), and unpredictable behavior. There is much still that is not understood about these stars, and photometry in the hands of amateurs is vital for unlocking their secrets. The long history of their visual study requires that visual work on them continues.

Mira (o Ceti) itself was the first variable star other than a nova or supernova to be discovered, by David Fabricius in 1596, predating the invention of the telescope. Miras are red giants, the biggest and coolest, yet about the brightest, stars known. They have a mass comparable to the Sun's, yet a radius of 1-2 Astronomical Units, so on average are a big red vacuum.

Southern Miras have been well observed in the past, but continuing visual and CCD colour data are needed. Alan Plummer has organized a "Beginners Visual Observing" Project for Variable Stars South, which is an excellent place to start with variable stars, and to meet the Mira, R Carinae. For more on this project see *http://www.varstars.org/Project-1-Beginners%27-Visual-Observing.html.*

Despite decades of study and theorising, there are many obvious features of the light curves of Miras that are without satisfactory explanations. Consider for example Stan Walker's Variable Stars South project on dual-peak Mira stars. He noticed that some Miras have maxima in pairs without a full fade between them, and that certain regularities seem to occur in these double maxima – both in a given star and statistically in the whole tribe.

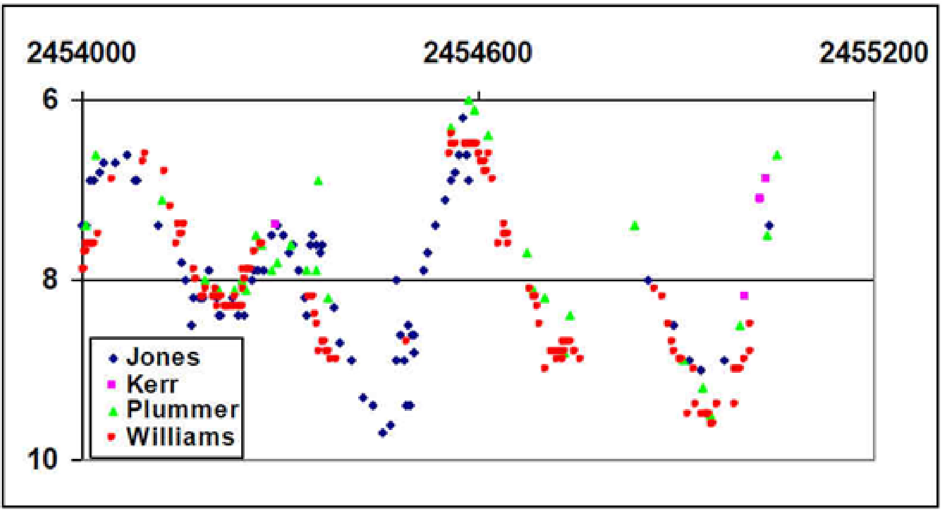


Figure 5: Visual observations by VSS members of four years of R Centauri. Note the double peaks. This covers about the same period as the AAVSO plot above.

Courtesy of Stan Walker

Knowing fairly well, as we do, the mechanism of pulsation in such stars, we should be able to explain these double-peak phenomena, but at present it is hard to see how. All we can say is that its cause is likely to be something rather fundamental in the pulsation mechanism. Stan's project involves VSS members in close visual monitoring of twelve such stars. He is also after filtered CCD data to get colour information – an excellent example of how visual and CCD workers can collaborate on different aspects of a project. For more information on the project see *http://www.varstars.org/DMMs-Working-Area.html* or Stan's article on them in the August 2009 VSS Newsletter (online at *http://www.varstars.org/Newsletters.html*).

Cepheids and other pulsating variables

Miras are far from the only pulsating variables. There is a whole family of them, ranging from the yellow supergiant δ Cepheids to the ZZ Ceti or DAV white dwarfs. These all lie on the *Cepheid Instability Strip* of the H-R diagram, a thin band stretching almost from top to bottom of the H-R diagram. In this strip, the Cepheids are the brightest, and can be easily seen in the Magellanic Clouds and nearby galaxies. When Henrietta Leavitt's work on Cepheids in the Larger Magellanic Cloud, published in 1912, showed that their luminosity bore a strict relationship to their period (the period-luminosity law for Cepheids), she gave Edwin Hubble what he needed to establish the distance scale of the Universe.

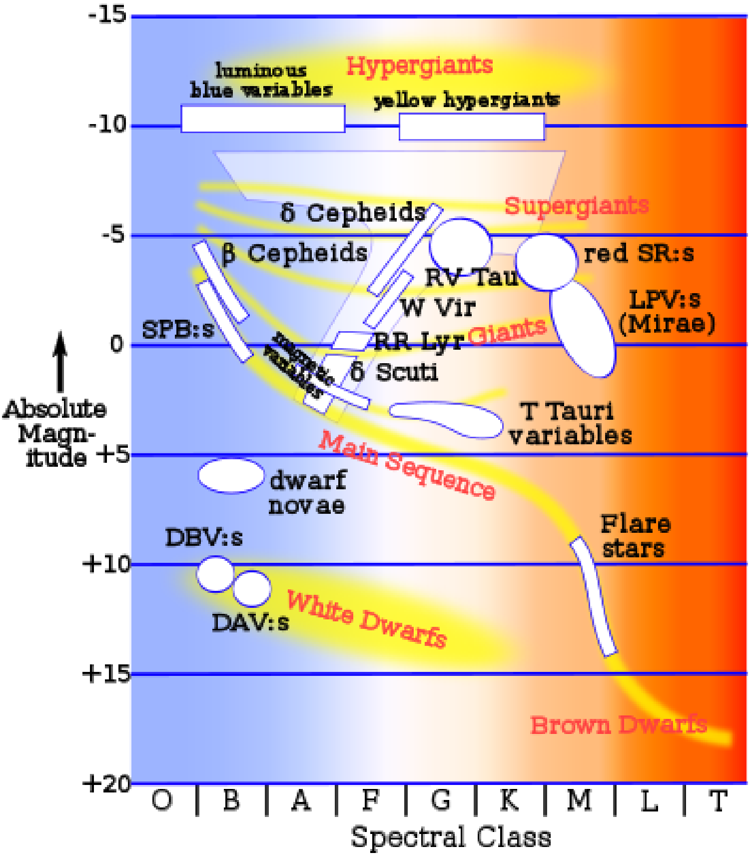


Figure6: The Hertzsprung-Russell Diagram showing the location of many classes of variable.

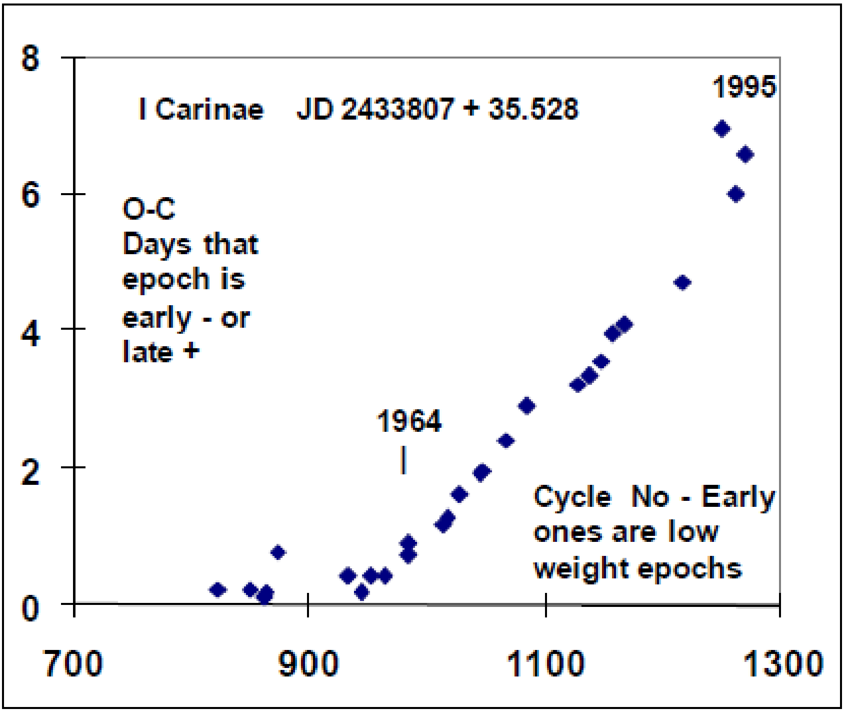
This Diagram is on a NASA education website. Original source unknown.

Other types of variable in this strip are, getting progressively fainter, the W Virginis stars, the RR Lyraes, and the Delta Scutis which are close to the Main Sequence, and the DAV white dwarfs. Even though these groups have different period-luminosity laws, their pulsation is due to the same mechanism. Except for the Delta Scutis, these stars have all burnt their core hydrogen into helium and have moved off the Main Sequence into their rather fascinating death throes. A layer of helium not far below the surface of all these stars, at just the right temperature, is the cause of their instability. When it heats up it ionizes and expands, and an ionized gas is opaque, grabbing all the photons that pass through it – which heats it even more. But expansion cools a gas, and anyway the radiant heat from below is now trapped by the opacity and can't get through. So the helium layer cools and shrinks until it de-ionises, when the photons from below can get through again. And so the cycle continues.

These stars are never quite regular, exhibiting overtone pulsations, period changes, and changes in light curve shape. Extensive photometric data are needed on all of these effects, so they can be studied in detail and the theories of pulsation tested against them. In this way we are discovering that many of these stars can have several pulsation modes like a 3-dimensional violin string, and that their interiors are changing quite quickly with time.

Stan Walker has started up a VSS Project on bright Cepheids to detect period changes. These are visual targets, though Stan seeks CCD data as well. As an example, here is a diagram of the period changes of l Carinae over 40 years, measured mainly at Auckland Observatory. Although the magnitude data obtained was not visual, for these bright Cepheids visual data is perfectly adequate to find times of maxima – if there are enough observations.

Figure 7: Period change in l Carinae (Auckland Observatory PEP data)



Courtesy of Stan Walker

The VSS project is examining 13 bright southern Cepheids. Early results can be expected about now, but a project like this needs to run some years to get a good fix on period changes. You can read all about this project, and how you can join in, at *http://www.varstars.org/BCs-Working-Area.html*.

Eclipsing binaries

Thank goodness for eclipsing binaries1 If there weren't any, we would have only limited, indirect ideas about the masses and sizes of stars. But by timing the eclipses of these edge-on binaries we get these fundamental parameters free of any astrophysical assumptions. All you need is a little early-high-school algebra. Here's how:

1. Time between (primary) eclipses is the orbital period P of the system
2. Since the system is edge-on to us, spectroscopic Doppler measurement gives the orbital velocities v_1, v_2, of the stars.
3. From P and v, we get orbital radius $a = Pv/2\pi$ (distance $2\pi a$ = time x speed)
4. From Newton's modification of Kepler's third law we get masses: $m_1 + m_2 = a^3/P^2$ Then by timing the sides and floors of the eclipses, it's easy to calculate the radii of the stars, and hence their density – again, just from the geometry without astrophysical assumptions.

That is not the end of the usefulness of photometry of eclipsing binaries. Far more can be learned from detailed study of their light curves and how they, and their orbital periods, change with time – again, the work of amateurs.

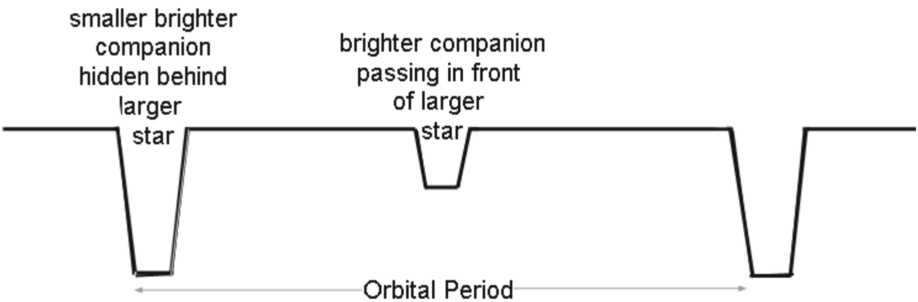


Figure 8: Schematic showing light curve of one revolution of an eclipsing binary system. The small star is far brighter than the large one.

The type of light curve in the image above indicates the two stars are detached or well separated from each other. However many binary stars are so close to each other that they raise tides, and indeed atmospheric gas can be sucked off one star, usually cool and diffuse, by the other, usually hot and much more massive. Such systems are called *semi-detached*. The artist's sketch below shows a red dwarf losing mass via an accretion stream to a white dwarf, where it forms an accretion disk.

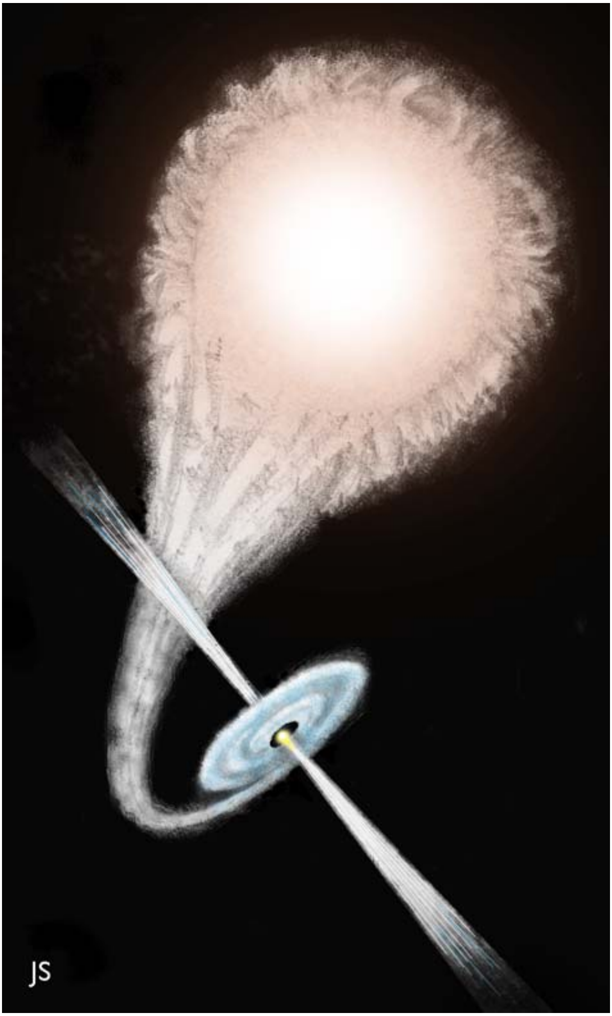


Figure 9: Semi-detached binary system showing the accretion stream flowing from the cool red star to an accretion disk around a white dwarf, with polar jets.

At times this disk is the most luminous part of the system, more luminous than the stars. But more about that later. Matter can fall off the accretion disk onto the central star, where it can be blown off via the little-understood *polar jets*. Accretion disks and jets are extremely important in astrophysics at all scales, and semi-detached binaries, particularly eclipsing ones, are very convenient laboratories for studying the accretion phenomenon. Because of the mass transfer and mass loss from the system as a whole, the orbital period of a semi-detached can change; and amateur studies of period changes in eclipsing binaries over the decades are most important in quantifying the mass transfer and mass loss.

What sort of work can amateurs do on eclipsing binaries? The simplest is to get accurate times of minima (ToM), and hence the orbital period. This can be compared with historical data to measure period change. The next step is to acquire full light curves. Both times of minimum and light curves are publishable data. But beyond that, the amateur can use software (the Wilson-Devinney code, available from *http://members.shaw.ca/bob.nelson/software1.htm*) to analyse the shape of the light curve and obtain astrophysical parameters of the system such as mass ratios, luminosities, temperatures, limb darkening, shape distortions, and even star-spots. David Bradstreet's BinaryMaker 3 (*http://www.binarymaker.com/*) can even produce visual models of the system.

VSS is running a project in collaboration with the Variable Star Section of the British Astronomical Association, to obtain ToM and light curves of a range of equatorial eclipsing binaries. Some of the results of this work in progress can be found in a poster in this conference. This project is aimed at amateurs with CCD cameras and does not require filters. Requirements are to obtain a time series though the night on the nominated star or stars, and derive a table of magnitudes against times using standard photometric software such as MaxIm. More observers are needed! Another project on far-south eclipsers is in the planning stage. For more information see *http://www.varstars.org/Project-6-Equatorial-Eclipsing-Binaries.html.*

Novae: dwarf, recurrent, ordinary and super

Back to the topic of mass transfer and accretion disks in semi-detached binaries. Accretion disks are essentially unstable, and various things can happen to them over time.

Dwarf Nova outbursts. The accretion disk gains too much matter, turbulence increases and the disk heats up, creating a thermal outburst. At such times the disk can be far brighter than the two stars put together. Such outbursts, of around six magnitudes — 250-fold increase in brightness — only last a few days as the excess matter is dissipated into space or onto the star in the centre, and the disk cools. Some systems however get stuck in a permanent outburst.

Nova and Recurrent Nova explosions. The accretion disk deposits gas, mainly hydrogen, onto the surface of the primary star, usually a white dwarf. When a few Earth masses of hydrogen build up in this way, the extreme temperatures and gravitational pressures involved cause it to detonate as a nova explosion. The system brightens by up to 15 magnitudes – a million-fold increase. The detonated layer is thrown off as an expanding shell which is sometimes visible. Accreting systems will endure many nova explosions, usually spaced thousands of years apart; but sometimes only a few years, in which case they are called recurrent novae.

Type Ia Supernovae. It is believed that not all the hydrogen shell gets blown off the primary star by the nova explosion, but slowly accumulates. When this pushes the mass of the star over 1.4 solar masses — the Chandrashekar Limit — the internal structure of the star is incapable of withstanding the pressure; it collapses almost instantaneously, then rebounds in a supernova detonation, destroying the star. All that's left is the beautiful expanding shell and maybe a remnant neutron star or black hole. Brightening by up to 20 magnitudes (100 million times) they are amongst the brightest events in the universe and provide us a way of measuring the size and expansion rate of the universe as a whole.

However the accretion mechanism leading up to the supernova collapse is not well understood, which provides one reason amongst many others for studying novae, dwarf novae and in particular recurrent novae. Where you have an eclipsing recurrent nova, as in the currently novating U Scorpii, you can get precise timings of the orbital period. Before and after measurements will reveal how much mass was lost from the system, and whether the primary, as theorized, retains some of the hydrogen shell.

What can amateurs do with these "cataclysmic variables"?

The discovery of novae and supernovae is very much in amateur hands – one of the most important services amateurs can provide. Tom Boles, working under unfriendly English skies, has bagged 127 supernovae with a 35 cm telescope and CCD camera, and his collaborators a lot more. Tim Puckett and his team — worldwide but based in the US (Puckett Observatory Supernova Search) have discovered 210 with similar equipment. To do this work you need a CCD-equipped telescope and an automated mount that can be programmed to slew to a hundred likely fields overnight. The control software of choice is Astronomer's Control Program (*http://dc3.com/*). The software to detect supernovae in the images is bundled in with the MaxIm camera control and image processing software package (*http://www.cyanogen.com/*).

Monitoring novae as they decline can be done visually and with CCDs.

Visual patrols for dwarf nova outbursts alert CCD observers to take time series of the fluctuating outbursts, allowing study of the behavior of the accretion disk. This amateur photometry is one of the most important tools for testing theories of accretion disk behavior and the outbursts in them, and the novae and ultimately supernovae they give rise to.

A Tabular Summary

I have pointed out some, only some, of the critically important areas of astrophysical research to which amateurs can contribute, and how they can do it. The following tables summarise and extend this discussion of amateur variable star research. They discuss only visual and CCD techniques.

Equipment Capabilities

Equipment	*Useful data*	*Advanced*
Naked eye	Bright LP Pulsators and Cepheids	
Visual (Binoculars, telescope)	LP pulsators – daily to weekly. Cepheids -daily. High amplitude irregulars & eclipsers (> 1 mag). Outburst detection – all types	
Scope + CCD	As for visual but especially for variations of amplitude < 1.0 mag. Also time series on anything that changes in under an hour.	Colour work on all types using photometric filters. Exoplanets, Miras and DNe at minimum, novae etc when extremely faint. Nova, supernova detection.

Observations: What's useful/advanced

Area	*Useful*	*More Advanced*
Long Period Pulsators	Photometry to 0.1 mag, times of max and min. Daily-weekly snapshots. Aim to find light curve, period. (Visual)	Daily-weekly colour data to 0.01 mag, Time series at min. (filtered CCD)
ShorterPeriod Pulsators (Cepheids & shorter)	LC shape, period. Data frequency 1/50 period or shorter, precision 1/10 amplitude or smaller. (Visual on Cepheids, unfiltered CCD on RR Lyraes and δ Scutis)	Data to 1/100 period or shorter, precision 1/100 amplitude or smaller. ToMax, period and epoch to corresponding accuracy. (Filtered CC D)
Dwarf Novae and the like.	Outburst alerts (visual)	Time series on outbursts to 0.01 mag (filtered or unfiltered CCD)
Novae, Supernovae	Outburst/fading detection (automated CCD systems). Outburst monitoring to 0.1 mag, daily to weekly (Visual, unfiltered CCD)	Data to 0.01 mag – daily at outburst, weekly at late stages. Time series to 0.01 mag (exploratory) (Filtered or unfiltered CCD)
Irregulars, Peculiars	Outburst/fading detection for appropriate types e.g. RCBs (Visual). Photometry to 0.1 mag when they're doing something interesting (Visual, CCD)	Varies widely with type, but in general time series or spot photometry to 0.01 mag, frequency to 1/100 of "interesting" variation timescales (Filtered or unfiltered CCD)
Eclipsers	Times of minima – precision 1/10 amplitude or better, times to 1 minute. (Visual, unfiltered CCD)	LC data to 0.01 period and amplitude or better. (Colour or unfiltered C CD, visual for large amplitude cases)

Conclusion – What can you do?

In this paper I have, by outlining four types of variable star amongst many, tried to show the crucial importance of amateur variable star research to the whole of astrophysics — and that it is not being replaced by professional equipment and methods. In amateur work, the role of the visual observer remains of fundamental importance, not least so as to provide continuity in one photometric system (the eyeball) that does not reduce to others. Visual and CCD work often go hand in hand on a particular project – both are needed to get full data.

Amateur variable star work can be extremely simple, in terms both of equipment and of background skills and knowledge – or it can be as sophisticated as you want to make it. It's all very useful.

Finally I have presented a couple of tables to guide the amateur astronomer who has felt the lure of contributing to variable star research. They may help her or him to decide which areas to specialize in, based on their equipment and interests. But not least, they point to the need to make observing decisions based on requirements of observing frequency, and hence to think realistically about how one is constrained by personal time available, weather, and equipment access.

Re:BSM-S

** Tom Krajci suggested that BSM-S will probably cover down to magnitude 10, even magnitude 12 at lower SNR. As he continues to work with Celestron to optimise mount firmware (faster slews and drive train backlash takeup routine), Tom said, it will probably be possible to cover 300-400 targets on long winter nights, if it is only one filter/one exposure per target.*

IBVS 5927 - 5931

Gary Poyner

5927 A proposed uniform nomenclature for pulsating hot dwarf stars. (Kilkenny et al, 2010)

5928 Maxima of high amplitude delta Scuti stars. (Wils et al, 2010)

5929 CCD minima for selected eclipsing binaries in 2009. (Nelson, 2010)

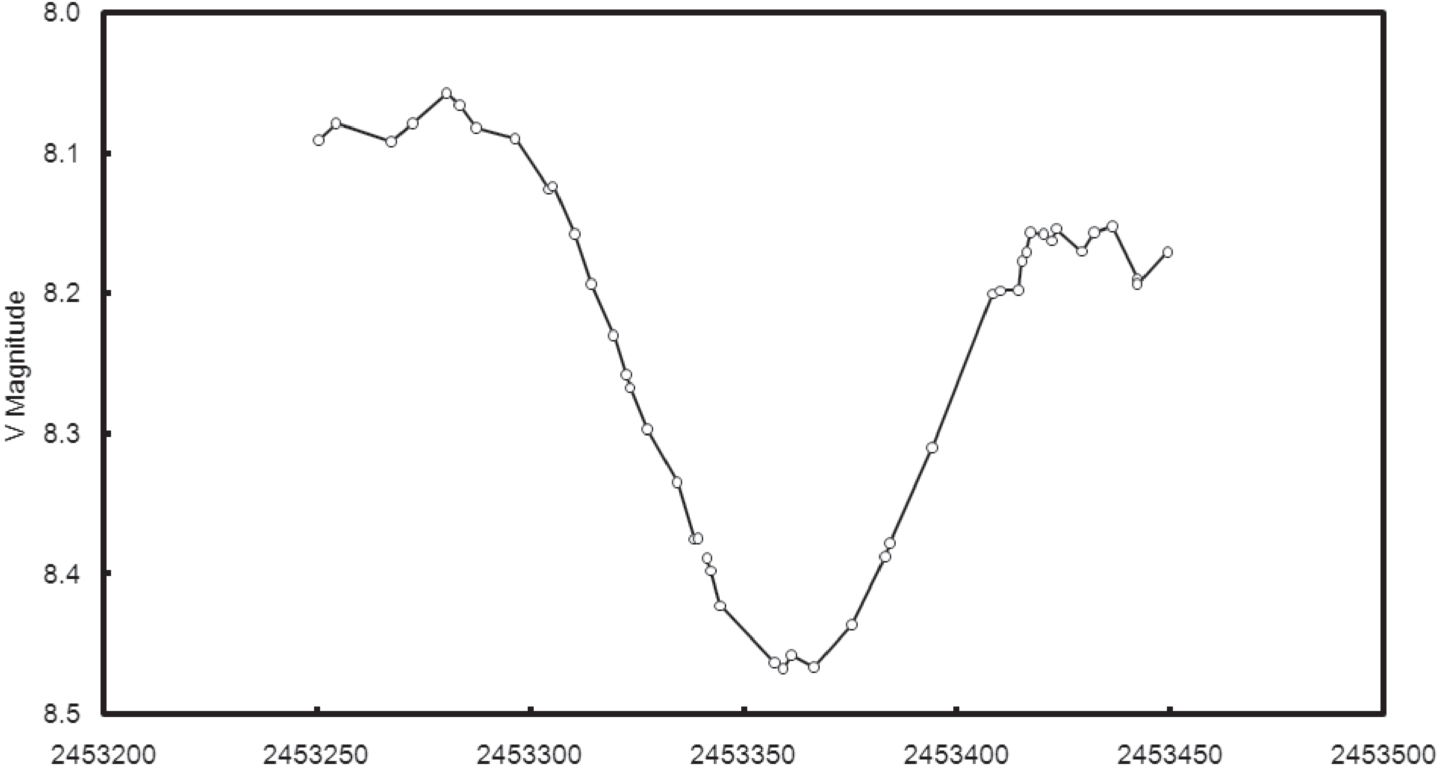
5930 BVRcIc photometric evolution and flickering during the 2010 outburst of the Recurrent Nova U Scorpii. (Munari et al, 2010)

5931 101 minima times of eclipsing binaries observed by INTEGRAL/OMC. (Zasche, 2010)

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

SU ANDROMEDAE LIGHT CURVE

Richard Miles: CCD Photometry of the irregular pulsating supergiant carbon star, SU 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.



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.

JULY

2010 Jul 1 Thu
Z Dra.........01(03)02D
Z Vul.........D22(18)23
TX UMa...23(28)26D
X Tri..........L24(21)24
2010 Jul 2 Fri
TW Dra..D22(25)26D
AI Dra..........23(24)25
2010 Jul 3 Sat
RW Tau..L02(<<)02D
Z Dra.........D22(20)23
del Lib.....D22(22)24L
U Cep.....D22(26)26D
U CrB.....D22(28)26D
Z Vul.........24(29)26D
2010 Jul 4 Sun
RZ Cas......D22(20)22
S Equ......D22(25)26D
2010 Jul 5 Mon
TX UMa...01(06)02D
TW Dra.....D22(21)26
RZ Cas......22(24)26D
del Lib........23(30)24L
2010 Jul 7 Wed
Z Dra........D22(22)24
U Sge......D22(24)26D
TV Cas...D22(26)26D
SW Cyg.....23(29)26D
2010 Jul 8 Thu
U Cep.....D22(25)26D
Z Vul......D22(27)26D
AI Dra..........23(24)25
2010 Jul 9 Fri
Z Per..........D22(18)23
TV Cas......D22(21)25
2010 Jul 10 Sat
del Lib.....D22(21)24L
U CrB.....D22(25)26D
Y Psc.......L23(26)26D
RS CVn.....23(29)26D
2010 Jul 11 Sun
RW Tau...L01(05)02D
S Equ......D22(22)26D
Z Dra......D22(24)26D
RZ Cas...D22(24)26D
2010 Jul 12 Mon
SW Cyg.....D22(19)25
Z Per..........D22(20)25
del Lib........23(29)24L

2010 Jul 13 Tue
RZ Cas.......02(05)02D
Z Vul.......D22(25)26D
U Cep......D22(25)26D
V367Cyg.D22(61)26D
2010 Jul 14 Wed
RW Tau....L01(00)02D
TW Dra......02(07)02D
U Sge..........D22(18)24
V367Cyg.D22(37)26D
Y Psc...........L22(20)25
AI Dra...........22(24)25
2010 Jul 15 Thu
V367Cyg.D22(13)26D
Z Per...........D22(21)26
RS CVn....D22(25)26L
Z Dra..........23(25)26D
2010 Jul 16 Fri
V367Cyg.D22(<<)26D
TW Dra...D22(26)26D
TV Cas.......23(27)26D
2010 Jul 17 Sat
del Lib......D22(21)23L
U CrB......D22(23)26D
RZ Cas.......D22(23)26
U Sge.......D22(27)26D
2010 Jul 18 Sun
S Equ..........D22(19)25
Z Vul.......D22(22)26D
Z Per........D22(23)26D
TV Cas....D22(23)26D
U Cep......D22(25)26D
2010 Jul 19 Mon
RZ Cas.......02(04)02D
TW Dra...D22(22)26D
del Lib.........22(29)23L
2010 Jul 20 Tue
Z Dra..........01(03)02D
TV Cas.......D22(18)22
RS CVn....D22(20)26L
AI Dra...........22(24)25
2010 Jul 21 Wed
SW Cyg...D22(22)26D
Z Per........D22(24)26D
2010 Jul 22 Thu
S Equ..........00(06)02D
RW Tau......02(07)02D
TW Dra......D22(17)22
Z Dra..........D22(20)23

2010 Jul 23 Fri
Z Vul.........D21(20)26
RZ Cas.....D21(23)25
U Cep....D21(24)27D
2010 Jul 24 Sat
Z Dra........03(05)03D
del Lib....D21(20)23L
U CrB.......D21(21)27
U Sge.....D21(21)27D
Z Per......D21(25)27D
2010 Jul 25 Sun
RW Tau..L00(01)03D
RZ Cas.....01(03)03D
X Tri.........02(05)03D
S Equ........D21(16)22
Y Psc........23(27)27D
2010 Jul 26 Mon
TV Cas.....01(05)03D
X Tri.........02(04)03D
Z Vul.........02(07)03D
Z Dra........D21(22)25
del Lib.......22(28)23L
AI Dra.........22(23)25
2010 Jul 27 Tue
X Tri.........01(04)03D
TV Cas..D21(24)27D
Z Per.........22(27)27D
2010 Jul 28 Wed
RW Tau.....L00(<<)01
X Tri.........00(03)03D
U Sge........01(07)03D
U CrB.......02(08)03D
Z Vul.........D21(18)23
U Cep....D21(24)27D
S Equ........21(27)27D
X Tri.........24(26)27D
2010 Jul 29 Thu
TX UMa..D21(18)22
TV Cas.....D21(20)24
RZ Cas.....D21(22)25
Y Psc.........L21(22)26
X Tri.........23(25)27D
2010 Jul 30 Fri
SW Cyg..D21(26)27D
Z Dra...........21(24)26
TW Dra....22(27)27D
X Tri.........22(25)27D
Z Per.........23(28)27D
Z Vul.........24(29)27D

2010 Jul 31 Sat
RZ Cas........00(03)03D
U Sge...........D21(16)21
U CrB.........D21(19)24
del Lib......D21(20)22L
X Tri...........L22(24)27

AUGUST

2010 Aug 1 Sun
TX UMa.....D21(19)24
V367Cyg..D21(52)27D
X Tri............L22(23)26
AI Dra............22(23)25
2010 Aug 2 Mon
Z Vul............D21(16)21
TW Dra....D21(22)27D
U Cep.......D21(24)27D
V367Cyg..D21(28)27D
del Lib..........21(28)22L
X Tri............L22(23)25
2010 Aug 3 Tue
Z Per............00(05)03D
AI Dra.........03(04)03D
V367Cyg..D21(04)27D
U Sge........D21(25)27D
X Tri............L22(22)25
RS CVn........23(29)25L
Z Dra...........23(26)27D
U CrB..........24(29)26L
2010 Aug 4 Wed
HU Tau........L01(<<)01
TV Cas........02(06)03D
V367 Cyg...D21(<<)24
SW Cyg.......D21(16)22
TX UMa..D21(21)24L
RZ Cas........D21(22)24
S Equ........D21(24)27D
X Tri............L22(21)24
Z Vul...........22(27)27D
RW Tau.....L24(27)27D
2010 Aug 5 Thu
TW Dra.......D21(18)23
X Tri............L21(21)23
TV Cas........22(26)27D
RZ Cas........24(26)27D
2010 Aug 6 Fri
HU Tau.......L01(<<)03
Z Per............02(07)03D
Z Dra...........D21(19)21
X Tri............L21(20)23

2010 Aug 7 Sat
U CrB.........D21(16)22
del Lib......D21(20)22L
TV Cas.......D21(21)25
TX UMa.D21(22)24L
U Cep......D21(23)27D
X Tri..........L21(19)22
AI Dra..........22(23)24
RW Tau.......L23(22)26

2010 Aug 8 Sun
HU Tau....L01(00)03D
Z Dra..........01(03)03D
TX UMa....L03(<<)03
RS CVn....D21(24)24L
SW Cyg......23(29)27D

2010 Aug 9 Mon
AI Dra........03(04)03D
TV Cas.......D21(17)21
Z Vul.......D21(25)27D
del Lib.........21(27)22L

2010 Aug 10 Tue
Y Psc..........00(05)03D
HU Tau....L01(02)03D
U Sge..........D21(19)25
Z Dra..........D21(20)23
RZ Cas.......D21(21)23
TX UMa.D21(24)24L
U CrB.........21(27)26L

2010 Aug 11 Wed
TX UMa..L03(00)03D
S Equ..........D21(21)26
RZ Cas.......23(26)27D

2010 Aug 12 Thu
HU Tau....L00(03)03D
Z Dra..........03(05)03D
U Cep......D21(23)27D

2010 Aug 13 Fri
SW Cyg......D21(19)25
RS CVn....D21(19)24L
Y Psc.......D21(23)27D
TX UMa....21(25)24L
AI Dra..........22(23)24
U Sge..........22(28)27D
TW Dra......23(28)27D

2010 Aug 14 Sat
HU Tau......00(04)03D
TX UMa..L02(01)03D
del Lib......D21(19)21L
Z Dra..........D21(22)25
Z Vul.......D21(23)27D
TV Cas.......23(27)27D

2010 Aug 15 Sun
S Equ...........02(07)03D
AI Dra.........03(04)03D
SS Cet.........03(07)03D

2010 Aug 16 Mon
RW Tau.......00(05)03D
HU Tau.......02(06)03D
RZ Cas........D20(20)23
TV Cas........D20(23)27
TW Dra....D20(23)27D
del Lib.........21(27)21L
TX UMa.....22(27)24L

2010 Aug 17 Tue
TX UMa..L02(03)03D
Y Psc..........D20(18)22
U Cep......D20(23)28D
U CrB.......D20(25)25L
RZ Cas........23(25)28D

2010 Aug 18 Wed
SS Cet.........02(07)04D
SW Cyg.......03(09)04D
HU Tau.......03(07)04D
RS CVn.......D20(15)21
S Equ..........D20(18)23
TV Cas........D20(18)22
Z Dra............22(24)26
RW Tau.....L23(23)28D

2010 Aug 19 Thu
RZ Cas........03(06)04D
TW Dra......D20(19)24
Z Vul..........D20(20)26
V367 Cyg....21(66)28D
AI Dra..........22(23)24

2010 Aug 20 Fri
TX UMa..L02(04)04D
U Sge........D20(22)28D
V367Cyg.D20(42)28D

2010 Aug 21 Sat
SS Cet.........02(06)04D
AI Dra.........02(04)04D
V367Cyg..D20(18)28D
del Lib......D20(19)21L
RW Tau........L22(18)23
S Equ..........23(28)28D

2010 Aug 22 Sun
Z Vul..........02(07)04D
V367Cyg.D20(<<)28D
RZ Cas........D20(20)22
U Cep.........D20(22)27
SW Cyg....D20(23)28D
Z Dra.........23(26)28D

2010 Aug 23 Mon
TX UMa..L02(06)04D
del Lib.........20(27)21L
RZ Cas.........22(25)27

2010 Aug 24 Tue
TV Cas.......01(05)04D
SS Cet.........01(06)04D
U Sge..........02(08)04L
Z Vul..........D20(18)24
U CrB......D20(22)25L

2010 Aug 25 Wed
Y Psc.........02(06)04D
RZ Cas.......03(05)04D
Z Dra.........D20(19)21
TV Cas.......20(24)28D
AI Dra..........21(23)24

2010 Aug 26 Thu
TX UMa....03(07)04D
Z Vul..........24(29)28D

2010 Aug 27 Fri
SS Cet.........00(05)04D
Z Dra.........01(03)04D
RW Tau.......02(07)04D
AI Dra........02(04)04D
X Tri..........03(06)04D
Z Per..........D20(16)21
U Sge.........D20(17)22
TV Cas.......D20(20)24
U Cep.........D20(22)27
RS CVn.......23(29)23L
TW Dra......24(29)28D

2010 Aug 28 Sat
X Tri..........02(05)04D
del Lib......D20(18)20L
RZ Cas.......D20(19)22
S Equ........D20(25)28L
Y Psc.........20(25)28D

2010 Aug 29 Sun
X Tri..........02(04)04D
Z Vul..........D20(16)21
Z Dra.........D20(21)23
RZ Cas.........22(24)26
RW Tau....L22(25)28D
SS Cet.........24(28)28D

2010 Aug 30 Mon
X Tri..........01(04)04D
Z Per..........D20(17)22
TW Dra D20(24)28D
del Lib......D20(26)20L
U Sge..........20(26)27L

2010 Aug 31 Tue
X Tri........00(03)04D
RZ Cas.....02(05)04D
Z Dra........03(05)04D
U CrB....D20(20)24L
SW Cyg....20(26)28D
AI Dra........21(23)24
Z Vul.........22(27)28L
X Tri........24(26)28D

2010 Sep 1 Wed
Y Psc........D20(19)24
U Cep...... D20(22)27
RS CVn..D20(24)23L
RW Tau.... L22(20)24
X Tri........23(26)28D
SS Cet.......23(28)28D

SEPTEMBER

2010 Sep 2 Thu
AI Dra......02(03)04D
TV Cas.....02(06)04D
Z Per........D20(19)24
TW Dra....D20(20)25
Z Dra...........20(22)25
X Tri..........22(25)27

2010 Sep 3 Fri
RZ Cas.....D20(19)21
X Tri..........22(24)27
TV Cas.....22(26)28D

2010 Sep 4 Sat
del Lib....D20(18)20L
S Equ.....D20(22)27L
RZ Cas........21(23)26
X Tri..........21(24)26
SS Cet....L23(27)28D

2010 Sep 5 Sun
TW Dra....D20(15)20
SW Cyg....D20(16)22
Z Per.........D20(20)25
TV Cas.....D20(21)26
Z Vul......D20(25)27L
X Tri..........20(23)25
HU Tau.....L23(19)23

2010 Sep 6 Mon
RZ Cas.......02(04)04D
RS CVn....D20(19)23L
U Sge..........D20(20)26
U Cep.........D20(21)26
del Lib......D20(26)20L
X Tri.............20(22)25
AI Dra...........21(22)24
Z Dra............22(24)26

2010 Sep 7 Tue
RW Tau.......04(09)04D
TV Cas........D20(17)21
U CrB.........D20(18)24
X Tri..........D20(21)24
V367Cyg..D20(56)28D
SS Cet.......L23(26)28D
HU Tau.......L23(20)24

2010 Sep 8 Wed
AI Dra........02(03)04D
S Equ...........03(08)03L
X Tri...........D19(21)23
Z Per...........D19(21)26
V367Cyg.D19(32)28D

2010 Sep 9 Thu
Y Psc...........03(08)04D
V367Cyg..D19(08)28D
Z Dra..........D19(17)20
RZ Cas........D19(18)21
X Tri...........D19(20)23
RW Tau.......22(27)28D
HU Tau.......L23(22)26
U Sge...........24(29)27L
SW Cyg......24(30)28D

2010 Sep 10 Fri
V367Cyg.D19(<<)28D
TX UMa....D19(15)20
X Tri...........D19(19)22
Z Vul........D19(23)27L
RZ Cas..........20(23)25
SS Cet.......L22(26)28D
U CrB.........23(29)24L
Z Dra............23(26)28

2010 Sep 11 Sat
TW Dra......01(06)04D
TV Cas.......04(08)04D
RS CVn.......D19(14)21
del Lib......D19(17)20L
X Tri...........D19(19)21
S Equ..........D19(19)24
U Cep.........D19(21)26
Z Per...........D19(23)28
HU Tau.......L22(23)27

2010 Sep 12 Sun
RZ Cas......01(04)04D
X Tri.........D19(18)21
RW Tau......L21(22)26
AI Dra..........21(22)24
Y Psc.........22(26)28D
TV Cas......23(27)28D

2010 Sep 13 Mon
U Sge.........D19(14)20
TX UMa...D19(17)21
X Tri.........D19(17)20
Z Dra.........D19(19)21
del Lib.....D19(25)19L
TW Dra.....20(25)28D
SS Cet.....L22(25)28D
HU Tau......L22(25)28

2010 Sep 14 Tue
AI Dra..........02(03)04
U Cep........04(09)04D
U CrB........D19(16)21
SW Cyg.....D19(19)25
TV Cas......D19(23)27
Z Per..........19(24)28D
S Equ.........24(29)27L

2010 Sep 15 Wed
Z Dra.........01(04)04D
RZ Cas......D19(18)20
Z Vul.........D19(21)26
HU Tau...L22(26)28D

2010 Sep 16 Thu
TX UMa.D19(18)22L
TV Cas......D19(18)23
TW Dra.....D19(20)25
Y Psc.........D19(21)25
U Cep........D19(21)26
U Sge.......D19(24)26L
RZ Cas.........20(22)25
SS Cet.....L22(25)28D

2010 Sep 17 Fri
Z Dra.........D19(21)23
U CrB........21(26)23L
Z Per..........21(26)29D
HU Tau.....23(27)29D

2010 Sep 18 Sat
RZ Cas......01(03)05D
Z Vul..........02(07)03L
S Equ.........D19(16)21
del Lib.....D19(17)19L
AI Dra..........21(22)23

2010 Sep 19 Sun
Z Dra.........03(05)05D
SW Cyg.....03(09)05D
U Cep........04(09)05D
TW Dra.....D19(16)21
TX UMa.D19(20)21L
SS Cet......L22(24)29D

2010 Sep 20 Mon
TX UMa...L00(<<)00
HU Tau......01(05)05D
AI Dra.............(03)04
Y Psc.........D19(15)19
Z Vul.........D19(18)24
del Lib.....D19(25)19L
Z Per..........22(27)29D

2010 Sep 21 Tue
RW Tau......00(05)05D
RS CVn...L05(05)05D
U CrB........D19(13)19
RZ Cas......D19(17)19
U Cep........D19(20)25
Z Dra...........20(22)25
S Equ..........21(26)26L

2010 Sep 22 Wed
TV Cas......01(05)05D
HU Tau......02(06)05D
TX UMa.D19(21)21L
RZ Cas.........19(22)24
SS Cet.........L22(23)28
TX UMa....L24(21)26
Z Vul..........24(29)26L

2010 Sep 23 Thu
Z Dra.........05(07)05D
U Sge.........D19(18)23
SW Cyg..D19(23)29D
RW Tau......L20(23)28
TV Cas.........20(24)29
Z Per..........23(28)29D
RZ Cas......24(26)29D

2010 Sep 24 Fri
HU Tau......03(07)05D
U Cep........04(08)05D
U CrB.....D19(24)23L
AI Dra..........21(22)23

2010 Sep 25 Sat
TW Dra.....01(06)05D
RZ Cas......05(07)05D
Z Vul.........D19(16)22
TV Cas......D19(20)24
TX UMa.D19(23)21L
RS CVn...D19(24)21L
SS Cet........L21(23)27
Z Dra...........22(24)27
TX UMa....L24(23)27

2010 Sep 26 Sun
AI Dra..........02(03)04
V367Cyg...02(47)05D
RS CVn...L04(00)05D
U Cep........D19(20)25
V367Cyg.D19(47)29D
RW Tau......L20(18)22
U Sge.........21(27)25L

2010 Sep 27 Mon
Z Per..........01(06)05D
TV Cas......D19(15)20
RZ Cas......D19(16)19
V367Cyg.D19(23)29D
TW Dra.....21(26)29D
Z Vul..........22(27)26L
Y Psc.........23(28)29L

2010 Sep 28 Tue
X Tri..........05(07)05D
V367Cyg.D19(<<)29D
SW Cyg.....D19(13)19
Z Dra.........D19(17)20
S Equ.......D19(23)26L
RZ Cas.........19(21)24
TX UMa....19(24)21L
SS Cet.........L21(22)27
TX UMa....L23(24)29

2010 Sep 29 Wed
U Cep........03(08)05D
X Tri..........04(06)05D
V367 Cyg..D19(<<)19
RZ Cas.........23(26)28
Z Dra...........23(26)28

2010 Sep 30 Thu
Z Per..........02(07)05D
X Tri..........03(06)05D
Z Vul..........D19(14)19
RS CVn...D19(19)21L
TW Dra.....D19(21)26
AI Dra..........21(22)23

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If you would like to prepare an article for consideration for publication in a Variable Star Section Circular, please read the *Notes for Authors*, published on the web pages at: **http://www.britastro.org/vss/circs.htm**; reproduced in full in VSSC132 p 22, or contact the editor (details on back cover) for a pdf copy of the guidelines.

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 145) will be 7th August, 2010. All articles should be sent to the editor (details are given on the back of this issue).

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