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VARIABLE STAR SECTION CIRCULAR

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Contents

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Rod Stubbings' 22-inch, f/3.8 telescope under construction in Peter Read's workshop, October 2015. (See page 8.)

FROM THE DIRECTOR

ROGER PICKARD

Spectroscopy Workshop October 10

This Workshop, held at the Norman Lockyer Observatory (NLO) on October 10, proved to be a great success, with some 51 attendees. My thanks to the NLO Chairman, David Strange, and his team for making the meeting run so smoothly. Further thanks to David for providing the write-up in this Circular. For those wishing for more in-depth information there is a link on our website to all the presentations.

Full Members Meeting 2016

The next Full Members Meeting will be held on Saturday 19th March 2016 at the Northamptonshire Natural History Society, Humfrey Rooms, Castilian Terrace, Northampton NN1 1LD. I wrote in the last Circular that I hoped to have the Programme in place by now, but I am afraid I have not. However, I am hoping that Tom Marsh will be available to talk to us again and in addition, a number of the VSS Officers will give presentations.

Please place the date in your 2016 diary.

Entering Old VSS Data

I have had a couple of people offering assistance with entering data, so hopefully, we will soon be up to date. But I would always appreciate more help with this task!

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BAA VSS SPECTROSCOPY WORKSHOP AT THE NORMAN LOCKYER OBSERVATORY.

DAVID STRANGE

The attendance of fifty participants at the BAA Spectroscopy Workshop, held at the Norman Lockyer Observatory (NLO) on October 10th 2015, was a testament to the increasing interest about this fascinating aspect of astronomy. People had come from far and wide to attend the meeting. One of our speakers, Olivier Thizy, had travelled from south west France, and another speaker, Robin Leadbeater, had come from Northumberland.

Olivier Thizy is a director of Shelyak Instruments and is passionate about spectroscopy. He launched the proceedings with his subject of "Why we do Spectroscopy". He showed us the construction of his Alpy slit spectrograph, and demonstrated the contrasting line profiles obtained from the blue and golden components of the double star Albireo. He went on to demonstrate how to obtain a Planck curve from the data, and hence how we can work out the temperatures of these two stars. Olivier then covered the subject of the bright emission line stars such as Gamma Cas and Beta Lyrae which had been discovered in 1866 by Father Angelo Secchi. He explained that this emission, seen as bright lines, was caused by re-emitted energy expelled from a disc of matter surrounding each of these stars.

A rather more challenging project for the spectroscopist would be to demonstrate the Doppler-Fizeau effect, obtained from red-shifted galaxy spectra, which shows the expansion of the universe. He also showed us the capabilities of the LHIRES III high resolution spectrograph, which was able to detect Saturn's rotational speed, and analyse spectroscopic binaries. Olivier's talk demonstrated that off-the-shelf equipment and software was now well within the reach of the amateur spectroscopist.

Robin Leadbeater is one of the UK's leading amateur spectroscopists and was next, to talk about "How we do Spectroscopy: preparation, acquisition and data reduction". Robin started his presentation by explaining about the different types of spectrographs currently available, ranging from:

- the entry level diffraction grating: Star Analyser (SA) 100 (£100)
- to the medium resolution Alpy(£1000)
- to the high resolution LISA (£2300) and e-Shel spectrograph (£10K).

He showed that slit spectroscopy, compared with an SA100 grating, gave greater spectral resolution but with the sacrifice of less light transmission. In addition, spectrographic performance is affected by telescope aperture and the focal ratio. Mirror slit guiding is currently the universally adopted solution for focussing and guiding. Robin went through the basics of using the spectral analysis software ISIS, and showed how to produce an instrument response curve and a rectified spectrum. Some projects he highlighted included high cadence differential spectroscopy of the fast transient T Tauri star DN Tau, which had been imaged every 15 minutes. In this case data was obtained using a low resolution slitless spectrograph. He also showed how to use an Alpy 200 for supernovae type identification.

Andy Wilson's talk was titled "My First steps in Spectroscopy", and considering that he

had started just 12 months before, the quality of his spectra showed that he had already mastered the subject. His equipment included a Littrow spectrograph L200, and a LHIRES III in conjunction with a SXVR-H694 CCD. Andy described the process of focussing and positioning the star on the slit, and processing the spectrum, including correcting for tilt and slant. He showed examples of some of his interesting targets, including Kappa Cyg, Rho Persei, Chi Cyg, AG Peg, M42 and Comet Lovejoy.

David Boyd's talk was titled "Observing with a LISA Spectrograph". David is another of our leading UK spectroscopists, regularly submitting his data to the professionals. His equipment includes a LISA spectrograph in conjunction with a C11 and an SXVR-H694 CCD. David showed us how he flux calibrates his data with a view to monitoring changes in the energy output of a star over time, or to detect changes in the energy distribution across the spectrum. He also showed how to correct for interstellar extinction and reddening. Some examples he showed included an outburst of SS Cyg, and the peculiar eclipsing binary V Sagittae. The last part of his talk demonstrated that it is possible to measure radial velocities of stars with a LISA spectrograph.

This intensive workshop ran from 11.00am – 6.00pm, however with a one hour break for lunch there was a chance to have a look at some of the historic prismatic cameras and equipment at the NLO, that was used by Norman Lockyer and his colleagues some 100 years earlier.

Our thanks must be extended to Roger Pickard and the BAA for organising this event and to our excellent speakers who have willingly shared their knowledge and made all their talks available for download from Olivier's website:

http://www.shelyak.com/dossier.php?id_dossier=36&lang=2

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ECLIPSING BINARY NEWS - OCTOBER 2015

DES LOUGHNEY

Shortest Period of an Eclipsing Binary?

Astrophysicists at the University of California Santa Barbara are the first scientists to identify two white dwarf stars in an eclipsing binary system, allowing for the first direct radius measurement of a rare white dwarf composed of pure helium[1]. The scientists observed three-minute eclipses of the binary stars twice during the 5.6-hour orbit.

*See image of system on page 7.

The History of the Observing of Eclipsing Binaries

I am planning an article on the history of the observing of eclipsing binaries. I would like to find out when eclipsing binaries were recognised as such. To illustrate the point I would like to refer to Algol. According to Wikipedia Algol was first recognised as a variable star in 1667. Goodricke discovered the periodic nature of its variations in 1783. He proposed an explanation for its periodicity, suggesting a dark body passing in front of the star, or else that the star has a darker region that is periodically turned towards the Earth. The concept of an eclipsing binary did not exist at that time. On the thinking of

Goodricke, I enjoyed reading the paper of Michael Hoskin[2] entitled "Goodricke, Pigott and the Quest for Variable Stars".

It seems that the first person to conceive of a binary system held together by gravity was William Herschel in 1802. There then seems to have been a long period before a variable star was accepted as an eclipsing binary. This does not seem to have happened until Pickering, in 1881, discussed evidence that Algol was an eclipsing binary which was confirmed by Vogel in 1889.

If anyone is aware of an eclipsing binary that was identified as such before 1881, please let me know. It seems however that certainty regarding an explanation of periodic variability being an eclipsing binary had to wait on spectroscopy.

RX Cassiopeiae

On the 8th October 2015 it was forecast to be a clear night in Edinburgh so I looked for an eclipsing binary that would eclipse that evening. It would have to be convenient to observe at that time of the year. Eventually I found out that the predicted time of the primary eclipse of RX Cas was 23.15 BST. I started my DSLR measurements at 20.30 BST and continued them for 4 hours hoping to get a good profile of the eclipse. I was aware that RX Cas was an EB (Beta Lyrae) system with a period of around 32 days. The primary eclipse is of 0.8 magnitude in depth and the secondary eclipse is of 0.4 magnitude in depth.

RX Cas is easy to find as it is very near RZ Cas and Iota Cas. It turned out that for the whole time on the evening of October 8th the system was at primary minimum which is around 9.50V, so I did not get any profile. Further reading indicated, and this is consistent with a period of 32 days, that the primary eclipse lasts three whole days. To make a good estimate of the time of mid-primary minimum it would be necessary to make sufficient measurements for one and a half days either side of the predicted time of primary minimum.

A cursory literature review shows that RX Cas is an interesting and unsual system[3]. The primary star has a symmetrical non-EB variation over a regular period of about 517 days. This variation is of depth 0.46 magnitude. The two variations are superimposed on one another so that no two light curves over a particular period are the same. It is possible to get minima which are not related to an eclipse but are a reflection of the superimposition.

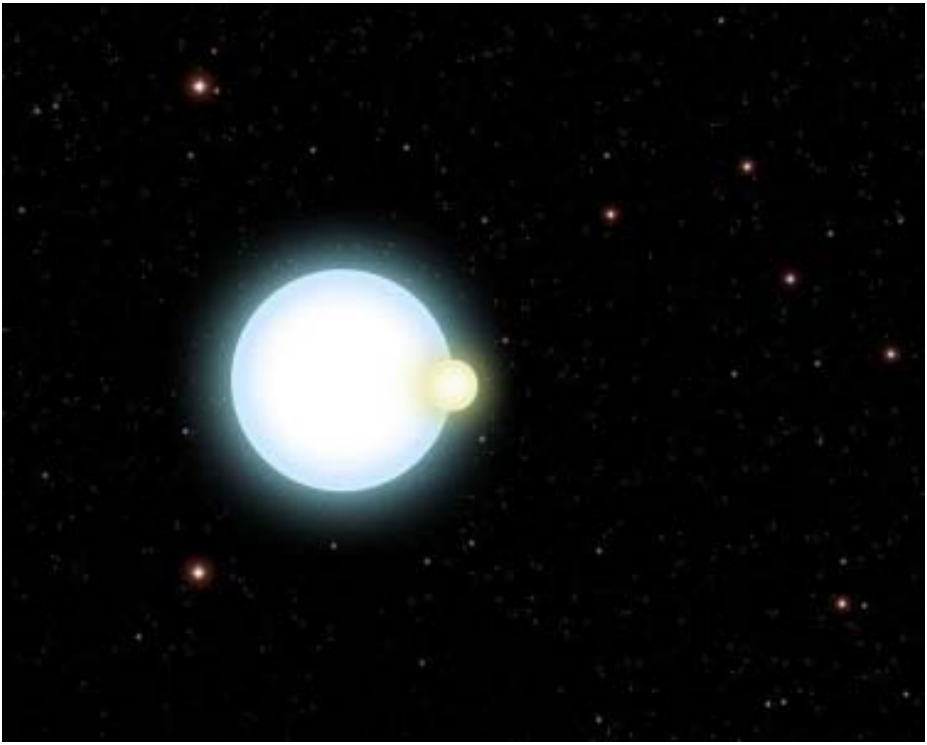
Further papers, for example Strupat [4], suggest that the light curve of the system may be affected by the large amount of circumbinary material due to ongoing rapid mass transfer.

The settings of a DSLR camera for measuring RX Cas are as follows. A 200mm Canon lens was used. The exposure using an undriven mount was 4 seconds at ISO 800 and f2.8. The comparisons used were HIP14724 (8.94V), HIP 15156 (9.39V) and HIP 14686 (8.33V).

A current systematic study of RX Cas seems to be well worthwhile as it has been neglected over the past 15 or 20 years.

*Image re: **Shortest Period of an EclipsingBinary?** page 5

Artist's impression of the system of two white dwarf stars.



Credit: Steve Howell/Pete Marenfeld/NOAO
(National Optical Astronomy Observatory)

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DOI: *10.1088/2041-8205/716/2/L146*

2. M.Hoskin, *Journal for the History of Astronomy*, **10**, 23 (1979)

3. C Payne Gaposchkin, 'The System of RX Cassiopeiae', *ApJ*, **103**, 299 (1946)

4. W Strupat, 'Light Curve Analysis of the W Serpentis objects W Crucis and RX Cassiopeiae', *Astron.Astrophys*, **185**, 150-154 (1987)

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ROD STUBBINGS ACHIEVES THE 250K MILE-STONE

JOHN TOONE

I recently received the following message by e-mail from Rod Stubbings:

"October 9th 2015 was the night that I recorded my 250,000th visual observation. It started out as a clear night with some cloud building in the West, so I was out observing early at 7:35 pm (09:34:59 UT). I needed 86 observations to accomplish my goal, and the clouds seemed to be approaching quickly. No outbursts were detected, but (I) checked up on 9 active stars from previous outbursts. At 9:00 pm (10:59:57 UT) I recorded the 250k observation on VW Hyi, which was at minimum around magnitude 14.1. The clouds were now overhead and I only managed another 7 observations before the observing session ended."

Rod is currently the most productive of the world's visual observers. He commenced observing variable stars in May 1993 and it has taken him just 22 years and 10 months to accumulate 250,000 observations which equates to approximately 30 observations every night. Rod passed 200,000 observations as recently as January 2012 (see VSS Circular **151**, March 2012, page 4), so it has taken just 3 years and 9 months to clock up his latest 50,000 observations. The prodigious output of observations means he is about a year (15,000 observations) behind in typing them up and submitting to the AAVSO.

By the time this Circular (166) is published Rod expects to have taken delivery of his new 22-inch, f/3.8 telescope (see inside front cover). He has named it "Infinity", and has told me he expects to observe more rapidly with it, being a Dobsonian. Therefore on this basis I fully expect to be reporting on Rod's 300,000th observation sometime in 2019.

enootnhoj@btinternet.com

*See Rod Stubbings telescope on inside front cover.

V SAGITTAE – A COMPLEX SYSTEM

DAVID BOYD

V Sge is an enigmatic object. Many papers have been written, and many models proposed, for this object, without achieving any clear consensus as to its real nature. One possible model is an accreting white dwarf in a binary that shares similarities with supersoft X-ray sources, but as yet there is no definitive proof of the nature of the accreting object. The secondary appears to be a more massive star emitting a variable wind, with both stars surrounded by a hot gaseous envelope.

One thing is clear however. Its orbital period of around 12.5 hours has been steadily decreasing for over 70 years, as the O-C diagram in Figure 1 shows. Most of the data are from published papers while the seven eclipse times since 2012 are my own measurements. The rate of period decrease is $-5.24(5)*10^{-10}$ yr/yr (0.017sec/yr). Possible reasons are the transfer of material from the massive secondary star to the lighter white dwarf, and a general loss of mass and angular momentum from the binary system carried away by the wind.

The eclipses I have observed have shown considerable difference in their profiles and minimum magnitudes. For example, Figure 2 shows two eclipses of the white dwarf and accretion disc by the secondary star, recorded two orbits apart, on 6th and 7th September 2015. I also recorded spectra through these eclipses to see what, if anything, was changing in the spectrum during eclipse. *Text continued on page 10.

Figure 1: V Sagittae O-C with respect to linear ephemeris

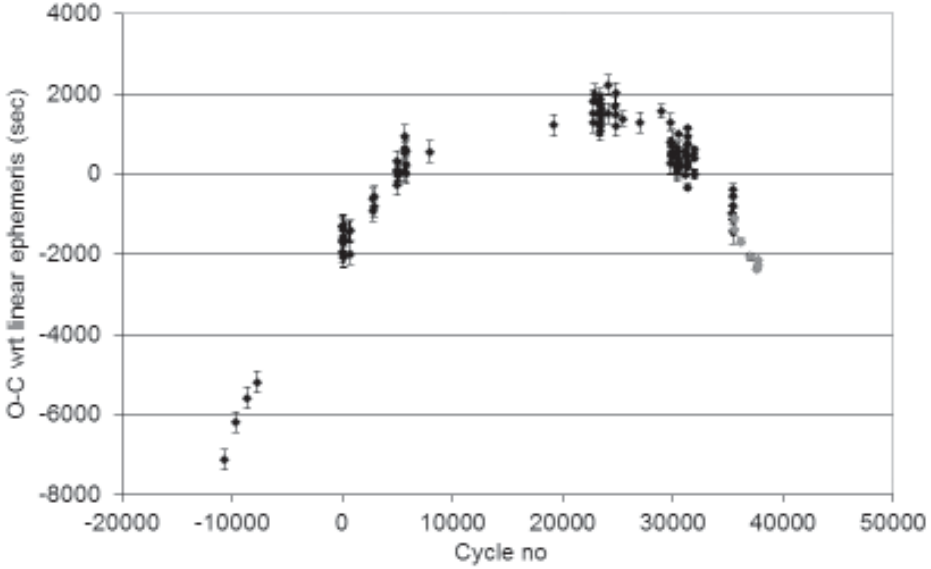
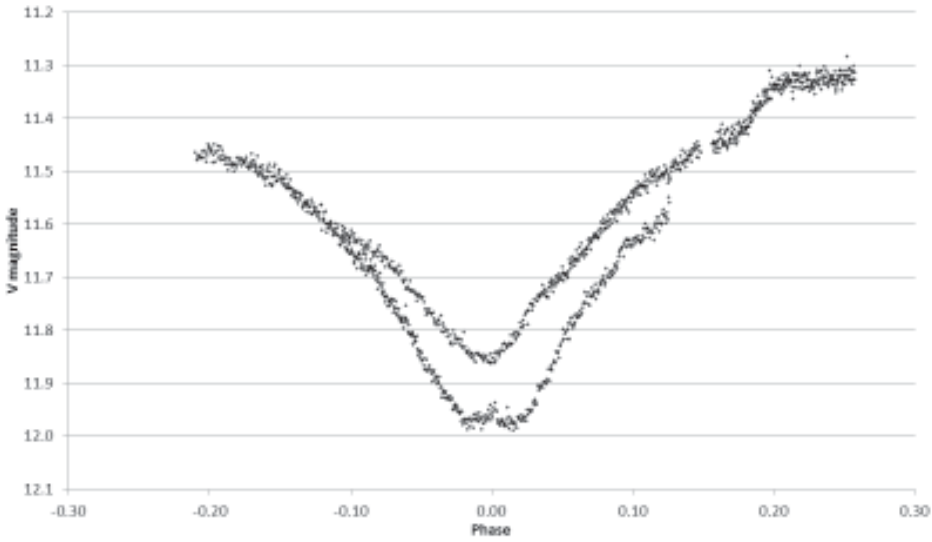


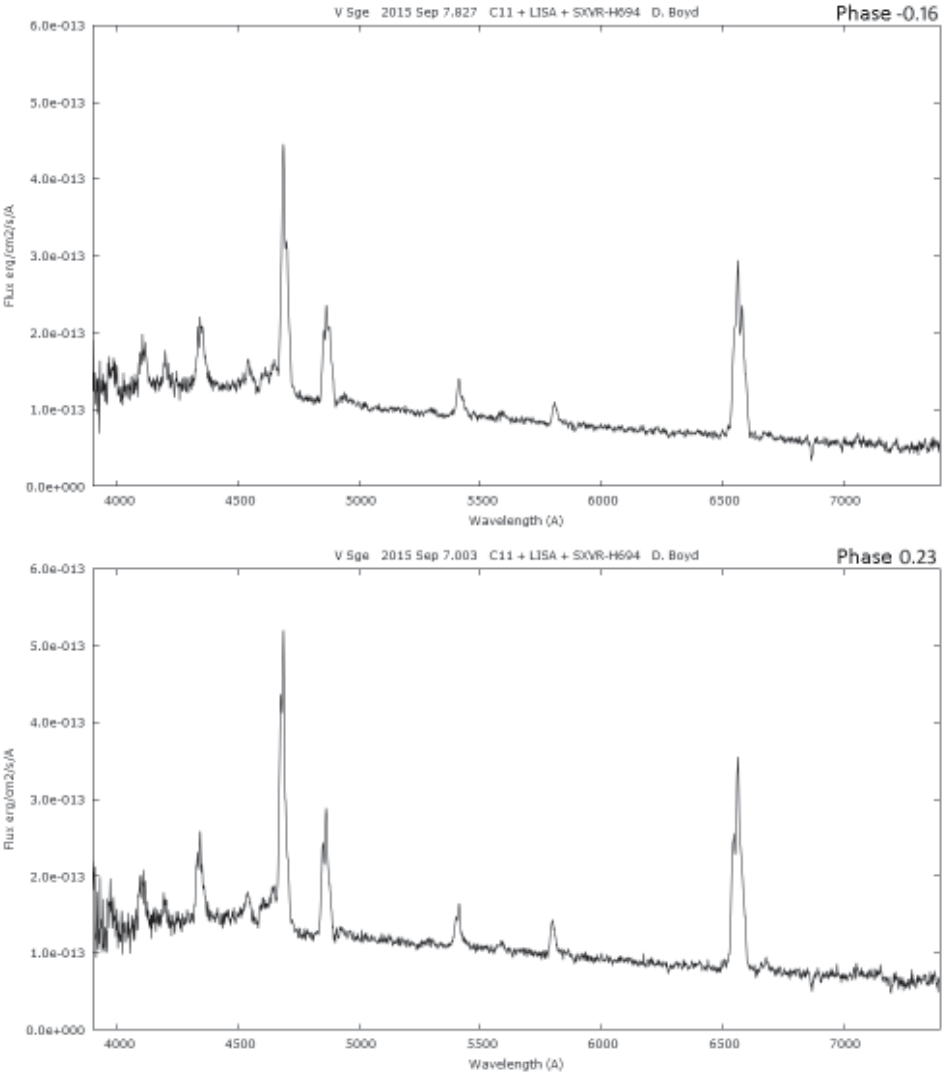
Figure 2: V Sagittae primary eclipses 6th and 7th September 2015



Text continued from page 9*. Figure 3 shows two spectra taken at phases -0.16 and 0.23 during eclipse ingress and egress respectively. The strength of the Balmer and He II emission lines changed little during the eclipse, indicating their source is not being eclipsed, and therefore some distance from the white dwarf, possibly in the gaseous envelope around both stars. However, there is a notable difference in the emission lines on either side of the eclipse. The emission lines show a secondary peak on the red side of the lines, before the eclipse, which fades while another peak grows on the blue side, after the eclipse. In the case of the H-alpha line, the mean velocities of these peaks relative to the H-alpha line during the primary eclipse are +730 km/s and -780 km/s. The

*Text continued on page 11.

Figure 3: Spectra around primary eclipse



Continued from page 10*. wavelength of the H-alpha line is stable throughout the eclipse.

I repeated the observations for a pair of eclipses of the secondary star on 30th September and 1st October. These are shown in Figure 4, and again these two eclipse profiles differ considerably. Spectra were taken during these eclipses and Figure 5 (over page) shows two spectra taken at phases 0.45 and 0.64. This time the secondary peaks, although not so clearly defined, appear most strongly on the blue side before the eclipse, and on the red side after the eclipse. The mean velocities of the side peaks relative to the H-alpha line during the secondary eclipse are +590 km/s and -980 km/s.

It appears that these secondary peaks, although noted in papers by Williams et al.[1], and Wood and Lockley[2], have not yet been fully explained, either why they change in this way as they pass through the primary eclipse, or why their behaviour in the secondary eclipse is reversed compared to the primary eclipse.

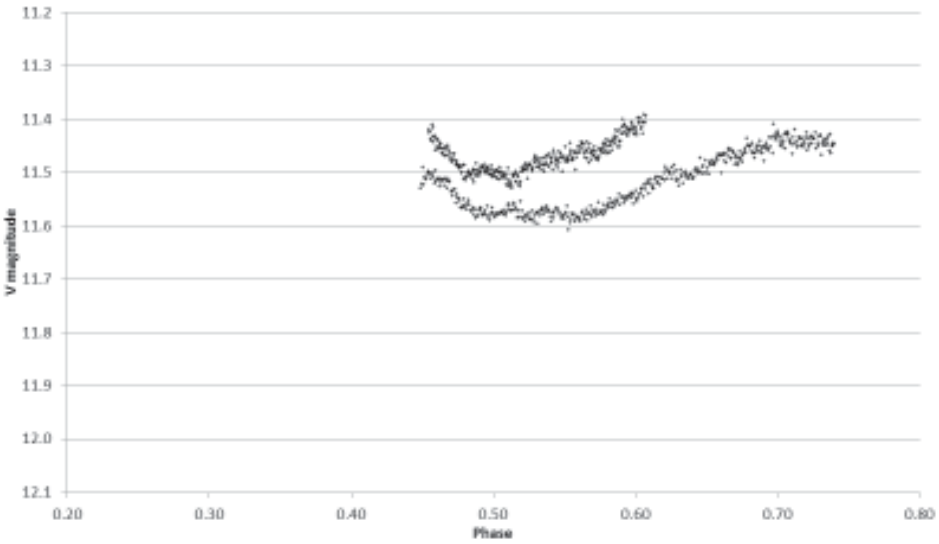
This is a fascinating star and at 11th magnitude it is well within the reach of amateur photometry and spectroscopy.

References

1. Williams G. A. et al, 'Photometry and spectroscopy of V Sagittae through eclipse', *MNRAS*, **219**, 809 - 814 (1986)

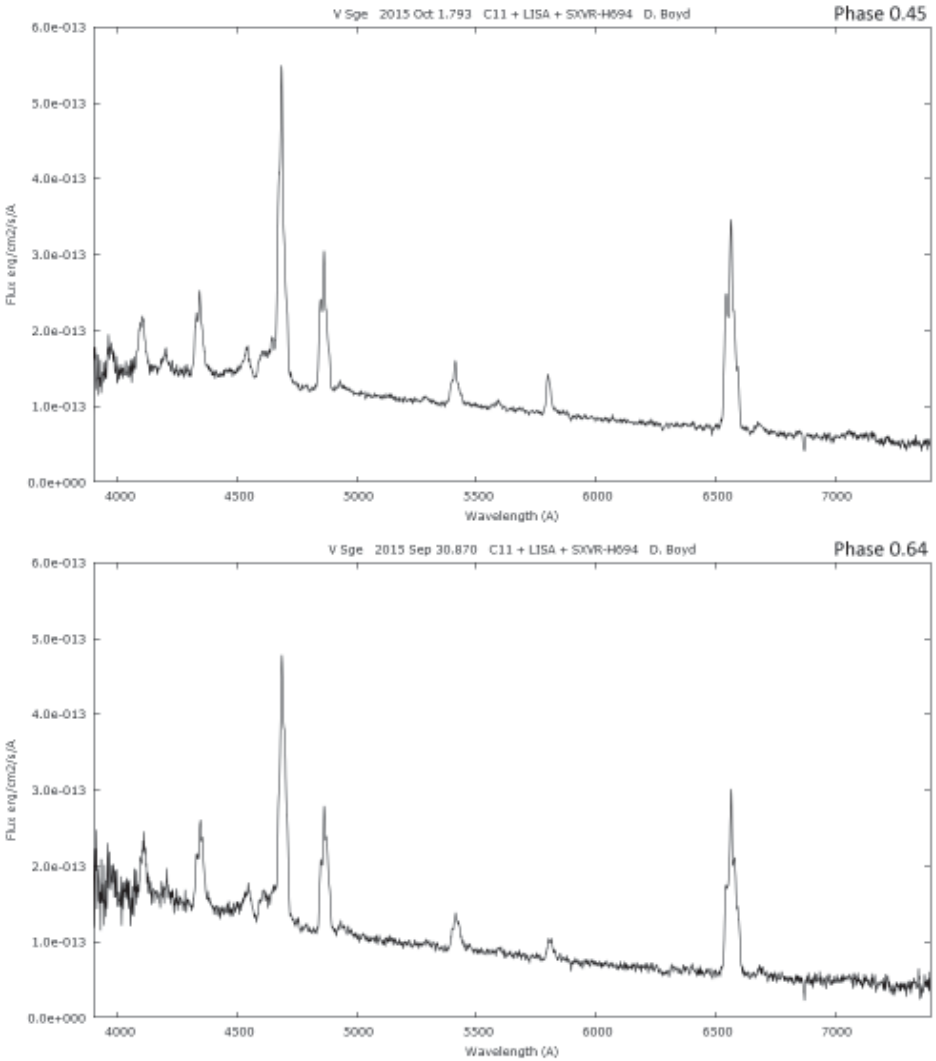
2.Wood J.H., Lockley J.J., 'The nature of V Saggitae', *ASP Conference Series*, **121,** 457 (1997)

Figure 4: V Sagittae secondary eclipses 30th September and 1st October 2015



*See page 12 for V Sagittae Figure 5.

V Sagittae Figure 5: Spectra around secondary eclipse



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AO CASSIOPEIAE - AN ECLIPSING BINARY?

DES LOUGHNEY

In 2014 measurements were made of the eclipsing binary system AO Cas. It was a challenge to study the system as the amplitude of the eclipses is only 0.2 magnitude. AO Cas is not a target for visual estimations because of the small amplitude, but is a target for DSLR photometry. A Canon 550D DSLR with a 100mm lens was used to image the star.

The settings were ISO400, f4.5 and an exposure of 5 seconds. For each magnitude measurement 30 images were stacked and the green channel analysed with AIP4WIN. Usually one measurement was made every evening. However, if the sky was clear for a sustained period, then another measurement was made after about 4 hours.

Three comparisons were used. These were HIP 1982 (5.72V), HIP 1921 (5.58V), and HIP 2497 (5.59V). The transformation co-efficient of the camera is 0.08. Using that, and knowing the difference in (B-V) between AO Cas and the comparisons, it is possible to convert the green channel magnitude into a V magnitude.

AO Cas is a system composed of two massive hot blue stars of spectral types O7/O9III and O8/O9III that respectively weigh anywhere between 20.30 and 57.75 times, and 14.8 and 31.73 times, the mass of our Sun[1]. The system has a current period of 3.523487 days[2]. The GCVS states that the variation is from 6.07V to 6.24V.

The system is classified as ELL/KE which means that the system is a rotating ellipsoidal variable. The combined brightness of the two components changes with a period equal to the period of orbital motion. The light change seen by an observer results from any mechanism that changes the visible light emitting area, and is not necessarily due to an

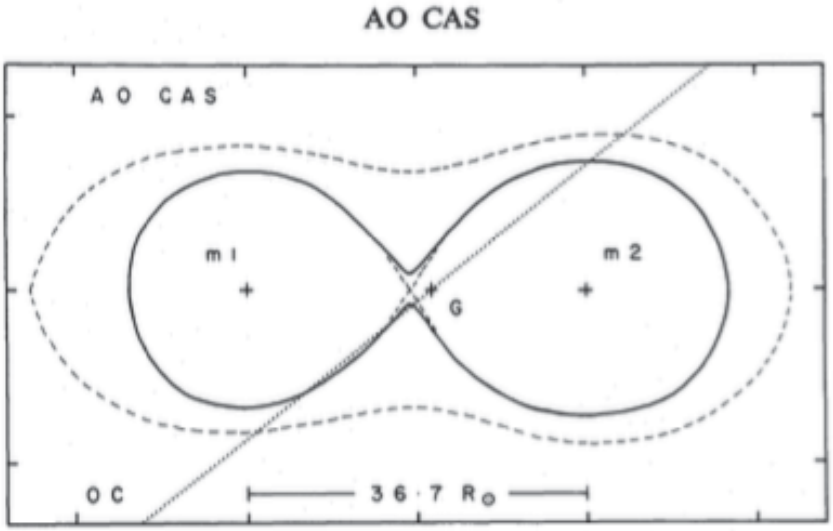

Figure 1: An illustration of the system at phase 0.25, D P Schneider and Kan Ching Leung, 1978 [3]

eclipse. The term KE signifies that the stars are in contact.
My measurements have been plotted in Figure 2. The vertical axis is the V magnitude and the horizontal axis is the phase of the system (calculated using the current period). There are well defined maxima and minima with an amplitude between 5.97V and 6.22V. The light curve seems to be asymmetric, with the rise to a maximum being not as steep as the fall to a minimum. The light curve seems similar to a light curve published in 1949[4], see Figure3.

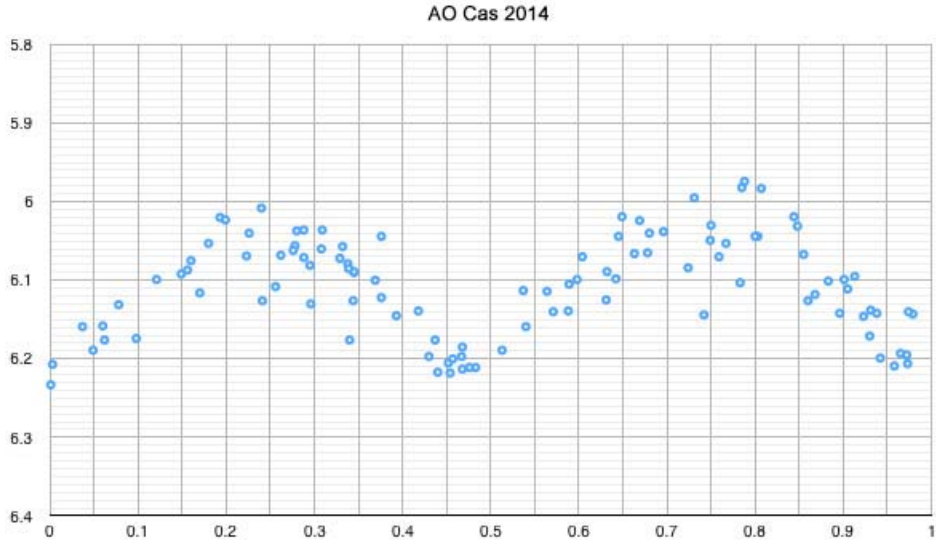

Figure 2: Light-curve of AO Cassiopeiae by Des Loughney, 2014.

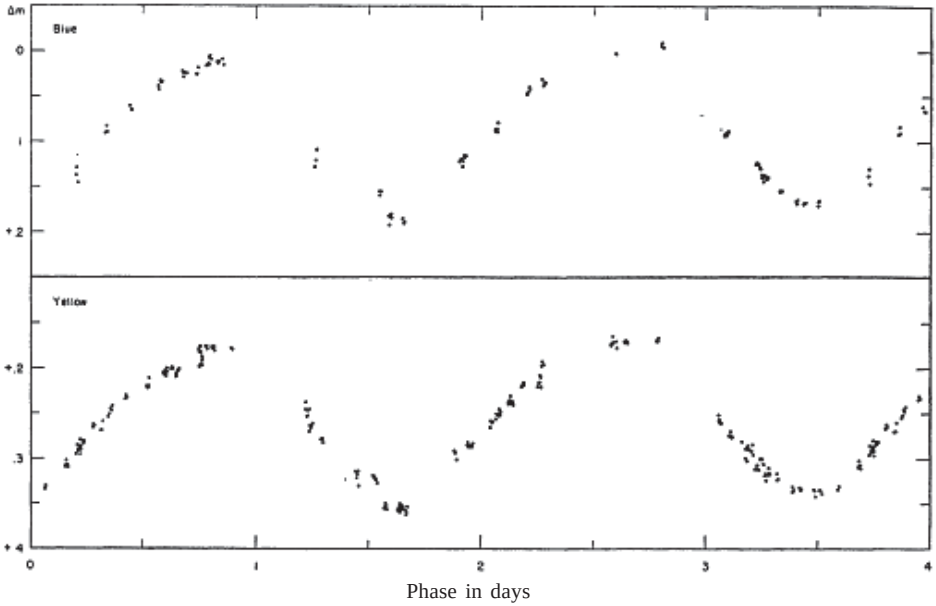

Figure 3: Light-curves of AO Cassiopeiae by W A Hiltner,1949. (4)

Eclipsing Binary!

There is no doubt that AO Cas is a binary system but is it eclipsing? A 1978 paper 'Evolved Contact Systems of Spectral Type O: AO Cassiopeiae'[3] states that the inclination of the system is very low, 51 degrees, and that the light variation is entirely due to tidal distortion. It is self evident that the system cannot be in a total eclipse as the light

would drop by 50% at a minimum. The amplitude would be far greater than 0.2 magnitude.

Some of the features of the light curve determined in 2014, from a reading of the papers, support the contention (given in the papers) that the light variation is due to the ellipsoidal stars. These features (of the light curve) include the differing slope before and after maxima, and the slightly different heights of maxima.

While it is interesting to be able to pick up light changes due to tidal distortion it must be questioned whether this system should still be classified by Krakow and the GCVS as an eclipsing binary system.

Despite the system not being an eclipsing binary more measurements are being done in 2015 and will continue into 2016. The evolution of a pair of massive stars is interesting in itself. The light curve is subject to abrupt changes[5]. The scatter seen in Figure (3) may not be solely due to atmospheric conditions or instrumental deficiencies.

References:

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2. 'An Atlas of Eclipsing Binary Stars' J M Kreiner, Chun-Hwey Kim, Il-Seong Nha: AO Cas. (2001)

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THE BINOCULAR SECRETARY ROLE

JOHN TOONE

With the handover of the position of Binocular Secretary from Melvyn Taylor to Shaun Albrighton, I thought that this would be a suitable time to review the role of the Binocular Secretary within the BAA VSS.

The BAA VSS got officially involved in the observation of binocular variables in 1970 when Sir Patrick Moore launched the Binocular Sub-Section with the following words:

"Binoculars are much more valuable than is generally recognized. There are, moreover, some 'binocular variables' which need attention. This field has not been fully exploited as yet; and the purpose of this note is start off a Binocular Sub-Section which will report to the Director through its co-ordinator, and Mr Glasby has asked me to be the co-ordinator for the moment."

The establishment of a Binocular Sub-Section was in response to the highly successful Binocular Sky Society, that was formed in 1967 and by 1974 had generated 70,000 observations of 250 bright variable stars. George Alcock's discovery of Nova Del in 1967 had

Melvyn Taylor (left) & Shaun Albrighton (right) pictured at Merevale Hall, Warwickshire on 28th August 1982. Photo by John Toone

given added impetus to observers equipped with binoculars and the work of the Binocular Sky Society.

In 1971 the Binocular Sub-Section was reorganized and became the Binocular Group with S J Anderson appointed as Co-ordinator supported by M D Taylor and J C Smith who were preparing the charts and sequences.

The Binocular Sky Society was merged with the BAA VSS in 1974, causing the Binocular Group to be further reorganized, in order to continue the work of the Binocular Sky Society, having absorbed their officers and observers. Alan Pickup, the former Director of the Binocular Sky Society, became the Binocular Group Co-ordinator and he set up a programme of 170 mainly semi-regular and irregular variables, 40 of which were classed a as priority objects.

At the BAA VSS meeting held in Chester on 13th September 1975 Alan Pickup outlined his strategy for the Binocular Group as follows:

"The accent (is) being placed at the moment on providing good charts for observers. Analyses of observations are to be carried out in the Journal when reliable sequences are available. Feedback to observers at present is provided by the variable star notes in The Astronomer."

The binocular programme with a priority list, the feedback to observers through The Astronomer, and the analysis of data in the Journal remains largely intact today, the only difference is that we now have reliable sequences based on V photometry.

Melvyn Taylor became the Binocular Group Co-ordinator in 1978 and ushered in a much needed period of stability. Melvyn ensured that the strategy of Alan Pickup and the work of the Binocular Sky Society would continue for 40 years after its merger with the BAA VSS.

The work of the Binocular Group received a further boost in 1981 with the merger of the North Western Association of Variable Star Observers which also concentrated on binocular variables and provided an influx of additional observers.

A few adjustments were made to the binocular programme in the 1990's and 2000's to delete some variables showing negligible variation (UV Boo, SW CrB and CK Ori, etc) and to introduce some more active variables (RS CrB, CE Lyn and tau4 Ser, etc).

In 2008 Tony Markham became the first observer to complete 100,000 observations entirely with binoculars and by 2015 Melvyn Taylor and Shaun Albrighton had both exceeded 90,000 binocular observations.

The BAA VSS now has an enviable record in terms of binocular variable star data that precedes the introduction of reliable sequences that can be handled by virtue of having recorded the light estimates within the database.

In summary the position of Binocular Co-ordinator or Secretary has been held as follows:

1970: P A Moore	1971: S J Anderson
1972: B Morell	1972-1973: S J Anderson
1974-1976: D A Pickup	1977: A L Smith
1978-2015: M D Taylor	2015: S W Albrighton

Melvyn Taylor's term as Binocular Co-ordinator/Secretary has lasted an incredible 37 years which is in stark contrast to the rapid turnover of the preceding 7 years. Between 1983 and 1999 Melvyn took on additional roles within the BAA VSS, such as Secretary and the Assistant Director but throughout this time he never relinquished the duties of the Binocular Secretary.

Shaun Albrighton has been undertaking visual photometry of binocular variables since 1978 and is the ideal person to manage the important binocular work of the BAA VSS going forwards.

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BINOCULAR PROGRAMME

Shaun Albrighton

The various Priority levels of the Binocular Programme can now be found on the VSS web site at:

http://www.britastro.org/vss/bin_prog_priority_191013.htm, or for a full listing in constellation order at: ***http://www.britastro.org/vss/chartcat_binoc.htm***

In addition, these listings can be obtained in paper format from both:
Shaun Albrighton < ***shaun@albrighton1.wanadoo.co.uk*** >
and Roger Pickard <***roger.pickard@sky.com*** >. They can also be viewed in Circulars 157 - 160

ECLIPSING BINARY PREDICTIONS – WHERE TO FIND THEM

Des Loughney - *desloughney@blueyonder.co.uk*

The publication of Eclipsing Binary Predictions is now discontinued in the VSS Circular. Predictions for RZ Cas, Beta Per and Lambda Tau can still be found in the BAA Handbook. Predictions, completed on a monthly basis, are available on the BAA VSS website at:

http://www.britastro.org/vss/dpredict.html

If readers require paper copies of the predictions please contact me.

The best source for predictions for Eclipsing Binaries is the Mt. Suhora Astronomical Observatory, Cracow Pedagogical University website (known as the Krakow website)at:

http://www.as.up.krakow.pl/o-c/index.php3

Click on 'Constellation List', choose your constellation and then choose your system.

A webpage will then appear with lots of useful information regarding the system. In the section entitled 'Light Elements' there is a link entitled 'current minima and phase'. When you click on this link, in the example of Beta Lyrae, you get predictions of primary and secondary eclipses for a period of three months. For systems with very short periods such as RZ Cas the predictions are for one week. For a system such as SW Cyg, with a period of around 4.57 days, the predictions are for a month.

The Krakow website does not tell you how much of an eclipse will be observable at a particular time of the year at your latitude and longitude. However, it has some useful literature references for each system, although they may not necessarily be up to date.
Nor are references to the 'Information Bulletin on Variable Stars' included, but these can be found at: *http://www.konkoly.hu/IBVS/IBVS.html*

Although the Krakow website lists the depth of eclipses it does not list the actual V magnitudes at maximum and minimum. For an indication of these magnitudes you will need to visit the 'General Catalogue of Variable Stars' website at: *http://www.sai.msu.su/groups/cluster/gcvs/gcvs/*

Click on 'GCVS Query Form', type in a designation such as SW Cyg, and click on 'Search'. The resulting information displayed shows that maximum is 9.24V, primary minimum 11.83V, and secondary minimum 9.30V. These magnitudes, however, may have been determined some time ago.

The GCVS website gives SW Cyg a period of 4.57313411 days but the Krakow website lists the period of SW Cyg as 4.572986 days. The latter is more likely to list the most up to date period. It must always be borne in mind that small changes in a period can result in significant changes in the times of minima if the period was determined a few years ago.

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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 167) will be 7th February 2016. All articles should be sent to the editor (details are given on the back of this issue).

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