



A Canon EOS 60D DSLR camera attached to HAT 10, one of the telescope units making up the HATNet (Hungarian Automated Telescope Network). For details see the paper by Zhang et al referenced in Publication Watch on page 12.

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From the director – *Stan Walker*

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First of all, I trust you have all enjoyed the festive or holiday season and are looking forward to the challenges of 2016.

The past year, 2015, was a rather active year for Variable Stars South. Some of our members attended the 50th anniversary symposium at Mt John, coupled with the following RASNZ annual conference. There were several presentations and a double poster paper outlining some of the activities of our group.

The new director of the AAVSO, Stella Kafka, with some financial assistance from Variable Stars South, was also at Tekapo and some very useful discussions were held. Following on from this our management group linked by video with Stella in October to discuss various matters, a practice which we will continue on a six-monthly basis.

In June, Andrew Pearce attended the spring meeting of the AAVSO at which he also displayed a paper and met a variety of people there, including Stella. Then Phil Evans attended a meeting in Hawaii of current and past Swinburne University master's students where he introduced VSS to a number of attendees. Hardly at the same level but I attended the December meeting of the Auckland Astronomical Society and listened to a couple of very interesting presentations by two graduate students of JJ Eldridge at Auckland University on neutron stars, supernovae, and their consequences. Good to see serious professional astronomy developing more widely in New Zealand's most populous area.

The year was productive in published papers as can be seen by the abstracts appearing elsewhere in "Publication Watch". And if you haven't sent in abstracts of your 2015 papers be reminded that Phil and the rest of us would like to share your research discoveries.

Whilst on this topic this morning I received an email from one of the groups keeping a watch on papers which explained why I had measured V824 Arae and AB Doradus a couple of decades ago - and here I'd been asking Ed Budding if he knew anything about these two objects!

The next major event - other than something spectacular and unexpected in our skies - is VSSS4, the Fourth Variable Stars Symposium at the University of Sydney on Friday 25 March 2016, in conjunction with NACAA. See the more detailed article elsewhere and visit the overall conference website mentioned there. But it's also accessible through Google. I'll be at the Adina Apartment Hotel, Chippendale, from late Wednesday and I'd be interested in meeting anyone from about Thursday afternoon onward.

David O'Driscoll and Mark Blackford have put together what looks likely to be an enjoyable symposium preceding NACAA XXVII, which also has a strong variable stars presence. This is our first major event in Australia and we hope to see many of our members there - and I look forward to meeting those with whom I've only known by email and the newsletter. A great piece of work by David and Mark.

There are two areas that I'd like to see more discussion about in 2016. The first relates to equipment, what is available, its capabilities or lack of them, and the prices. Then how observers are using them and in what areas. At VSSS4 Hristo Pavlov will describe his use of high speed video camera techniques - another of the many things I wasn't aware of. Some thoughts about all of this appear elsewhere in this newsletter. The other is the why and how of various research projects we are involved in. We hear much about results but little about any professional involvement or the theoretical or astrophysical aspects.

We also have a number of very prolific visual observers but we see little of their activities in the newsletter. Quite clearly it's hard to achieve discrete projects in this area due to the long timescale of evolution of many of the targets. But some, like L² Puppis, do show changes. At Auckland Observatory we worked closely with the visual people in both the LPV and CV fields and as a result made a number of original and significant discoveries. So maybe a few more visual updates in the newsletter? What star seems to have changed?

But stars are not the only things that change! David Moriarty and Margaret Streamer have resigned as leaders of the EA project. The reasons are set out in extracts from David's email *"In my case, I find contact and near contact binaries very interesting and have been reading and studying papers on contact*



binary formation and evolution in order to write up my work with TW Cru over the past 5 years and more recently with BC Gru, RV Gru and V Gru. I am working now on papers on BC and RV Gru (the latter with Tom), as well as preparing for the work with UQ on the spectral project, for which V775 Cen and ST Cen are the principal targets. The latter are probably near contact, or close to being near-contact, binaries. In future, I would like to expand observations and modelling of near contact and contact binaries as well as semi-detached binaries, i.e. studies appropriate to the EW-EB project.

Margaret has now enrolled at ANU in a 4 year part time M.Phil. degree, which will include course work and research that will concentrate on her interests with the oscillating eclipsing binaries.

David will be working with an honours student at UQ in obtaining high resolution spectra from which spectral types and radial velocities of eclipsing binaries can be determined. Margaret Streamer and Sarah Sweet (a postdoctoral astronomer at the ANU Research School of astronomy and Astrophysics) and Michael Drinkwater (Professor of Astrophysics at UQ) are collaborating on the project. They will use the ANU 2.3 metre telescope at Siding Spring Observatory in April, 2016.

The detached eclipsing binary stars (EA) will now form part of an expanded overall eclipsing binaries project led by Tom Richards and Mark Blackford.

4th Variable Stars South symposium – *Mark Blackford*

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By the time you read this newsletter it'll be just two months until Good Friday, March 25th, when we'll be holding VSSS4 in Sydney. The programme (<http://www.nacaa.org.au/2016/event/1547>) is very strong, with a good mix of visual observing, electronic imaging, and analytical presentations – something for everyone to enjoy and learn from. There'll be plenty of time for questions at the end of each talk and during tea and lunch breaks.

The National Australian Convention of Amateur Astronomers, NACAA 2016, will follow on the Saturday and Sunday where several VSS members will present further variable star talks to a more general astro audience (<http://www.nacaa.org.au/2016/programme>). The venue for both events is the New Law School Building at the University of Sydney with state-of-the-art facilities.

An informal get-together for VSS members is planned for the Thursday evening preceding VSSS4. The venue is The Duck Inn, Chippendale, (<http://www.theduckinnpubandkitchen.com/>) which has a good menu and beer selection, personally sampled for research purposes only and independently verified by my wife. If you wish to join us please let me know (email address above) because a booking will be required for the restaurant.



These events provide an opportunity to meet face-to-face with fellow variable star enthusiasts from around Australia and New Zealand to exchange ideas and learn from each other. Please join us if you can, registration is via the NACAA 2016 website (<http://www.nacaa.org.au/2016/register>).

*The Duck Inn in Rose St, Chippendale.
(Courtesy of Google Earth.)*

Summary

Improved positions are submitted here for two suspected variables as reported by Innes (1923), namely NSV 4959 and NSV 4965, whose identities are still ambiguous. Close study of Innes' notes may clear up the uncertainty. NSV 17758 and 17759 also now have astrometric positions.

NSV 4959

The discovery records given by Innes in UOC59 are reproduced here. The dates of two plates (not given by Innes) have been located elsewhere.

Position: (1875) $10^h 39^m.7 -59^\circ 32.0'$

Plate No	Date	Exposure	Mag-p	Comment
713	1905 June 2	90 min	14.5	
4040	1913 Apr 29	150 min	13	Definition poor at end
277	?		13	
400	?		13	

Refer to Figure 1, an extract from a Cape (Victoria refractor) plate of 1905 June 28, limit 16.0p, reproduced as a Johannesburg special chart. The nominal position given by Innes is plotted with a cross.

Nearby stars A, B and C are labelled. Their BV photometry, from APASS, is as follows, with errors.

A: V = 13.621 (0.0), B-V = 0.509 (0.014)

B: V = 13.727 (0.0), B-V = 0.103 (0.014)

C: V = 13.683 (0.0), B-V = 0.126 (0.009)

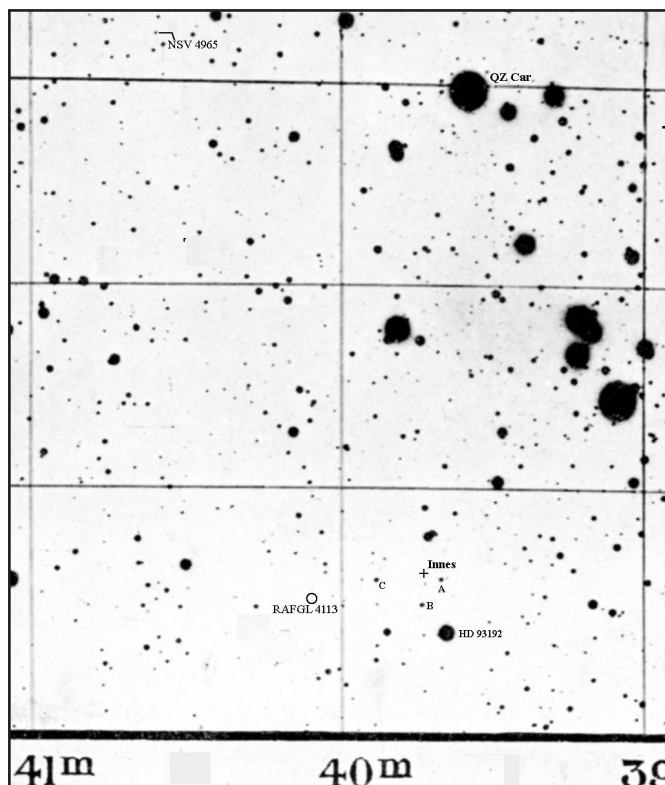


Figure 1. *Fragment of Cape plate of 1905 June 28. Star A is my identification for NSV 4959. RAFGL 4113 is marked but invisible. At the top is NSV 4965, the northernmost star in Innes' "rhomboid", only 3 stars of 4 appearing here.*

The best candidate for NSV 4959 is **A**, the nearest. It has a redder companion 8.6"np, V=15.35, B-V = 0.85 SPM4, (end figs. 44^m25^s.64, 11' 27.2"). The ASAS-3 lightcurve suggests that **A** is slightly variable at V=13.30 ± 0.2. Or just noise? VSX identification (doubtful) is with RAFGL 4113, very red.

RAFGL 4113

Position (J2000) $10^{\text{h}} 44^{\text{m}} 53^{\text{s}}.11$ $-60^{\circ} 12' 01.0''$ $V = 14.33_{\text{CCD}}$ $B = 16.51$ SPM4

B mags from the SPM4 catalogue are not normally to be trusted, but in this case the indicated B-V is in fairly good agreement with the value from 2MASS, $B-V = 2.05$. This star is not a plausible candidate, as it is somewhat distant, and is too faint. It is invisible on the Cape plate of 1905 June 28.

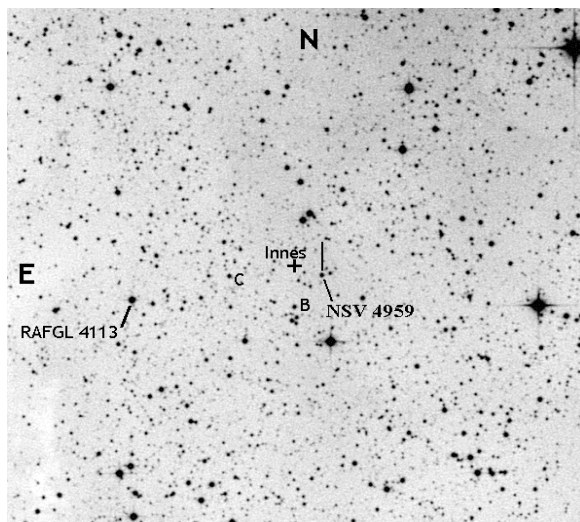
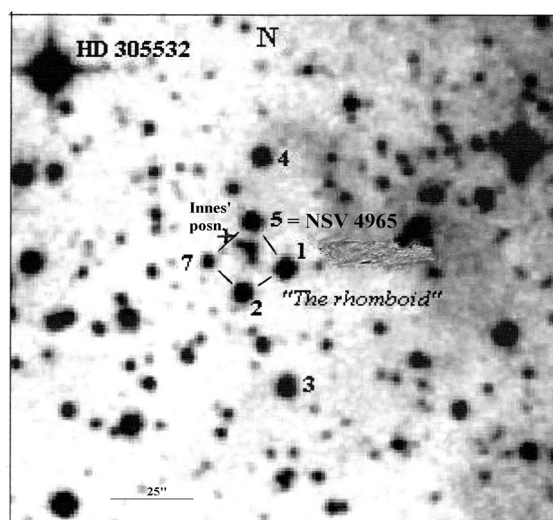


Figure 2. Deep view of the field of $A = \text{NSV } 4959$. [RAFGL 4113](#) is clearly shown, as this image is from a DSS IR plate. (Blue plates for this region are scarce). Innes' published position is plotted with a cross. The field is approximately $10' \times 10'$.

NSV 4965

Innes (1923) provides 8 photographic observations, ranging from 14 to 17mag. This suggests a rough average value of 15.75. Innes states: "*Variable in a rhomboid;....the f. star of the rhomboid is taken as =15; New.*" Position given by Innes is: (1875) $10^{\text{h}} 40^{\text{m}}.6$ $-59^{\circ} 19.0'$.



I have identified the rhomboidal group mentioned by Innes. See Figure 3. From his position and notes NSV 4965 is evidently the most northern member of the group. For convenience, stars in and around the group are numbered 1 to 7. Published BV photometry for a few members is given below.

Figure 3. NSV 4965 and a close-up view of Innes' "rhomboid". Innes' published position is plotted with a cross. An enlargement of a DSS R plate. The scale bar at the bottom indicates the scale.

No	V	B-V	Source
1	13.855 (0.138)	0.596 (0.277)	APASS
5	14.325 (0.000)	0.621 (0.032)	APASS NSV 4965
	14.39_{CCD}		SPM4
7	15.77_{CCD}	0.62	SPM4, 2MASS

The available B-V indices for NSV 4965 are discordant. According to APASS, $B-V = 0.621$, but 2MASS gives $J-Ks = 0.86$, yielding $B-V = 1.387$.

Star 7 is relatively faint, but is consistent with the meaning of Innes' notes, as the solitary following star, $m=15$, taken as a useful reference point. It does not appear on the Cape (Victoria) plate, while star 5 (=NSV 4965) is quite distinct. See Fig. 3.

NSV 17758 & 17759

These two stars lie within the field of the open cluster NGC 2539 in Puppis. Their variability was reported in IBVS 3594 by Lapasset, Claria and Minniti (1991). Identification charts have been published by these same authors, as well by Lapasset, Claria and Mermilliod (2000). The latter has been placed on the WEBDA website, so there seems little need to publish another chart, here. My interest is in confirming the J2000 coordinates given by WEBDA.

Table 1. *Identities assigned to NSV 17758 & 17759.*

NSV	V	IBVS 3594	WEBDA	Other
17758	11.72	Star 6	351 = 51 (zone III)	TYC-2 5434 3665
17759	13.378	Star 5	350 = 50 (zone III)	UCAC3 155-097620

NSV 17758 and 17759 are about 8.35" apart, much greater than the VSX positions would suggest. The two components are easily resolved by Tycho-2, 2MASS and CMC14, and others.

The WEBDA coordinates are correct, but in VSX both are very similar, with the risk of confusion.

According to WEBDA, both stars are rated as nm = nonmembers, on basis of proper motion.

Results

Table 2. *Astrometric positions of four NSV stars.*

NSV	RA(J2000)	Dec (J2000)	S
4959	10 ^h 44 ^m 26 ^s .78	-60° 11' 29.6"	2MASS
4965	10 45 25.19	-59 58 20.3	2MASS
17758	08 10 18.16 ± 0.033	-12 47 39.0 ± 0.013	CMC14
17759	08 10 18.72 ± 0.064	-12 47 36.7 ± 0.013	CMC14

Conclusion

On the basis of Innes' discovery positions and notes, NSV 4959 and 4965 can be identified with reasonable certainty, and this is corroborated by recent material, from APASS, ASAS-3 and Digitized Sky Survey images. ASAS-3 data hints at low-level variability in NSV 4959.

For NSV 17758 and 17759, improved coordinates are provided, consistent with WEBDA data.

References

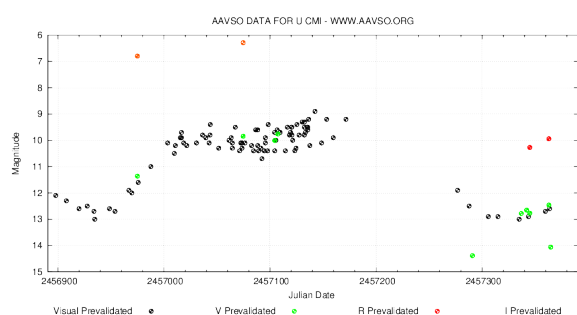
- AVSO: The Variable Star Index database <http://www.aavso.org/vsx> [VSX]
Hog E., Fabricius C., Makarov V.V. et al 2000 Astron. & Astrophys. 355,27 [Tycho-2 Cat.]
Innes R.T.A. 1923 Circ. Union Obs. 59,208
Lapasset E., Claria J.J., Minniti D. 1991 Inf. Bull. Var. Stars 3594
Lapasset E., Claria J.J., Mermilliod J.-C. 2000 Astron. & Astrophys. 361,945
Morel M. 1995 Inf. Bull. on Var. Stars 4238
WEBDA Database for stars in galactic open clusters <http://www.univie.ac.at/webda>

Dual maxima Miras for 2016 - and other targets? – Stan Walker

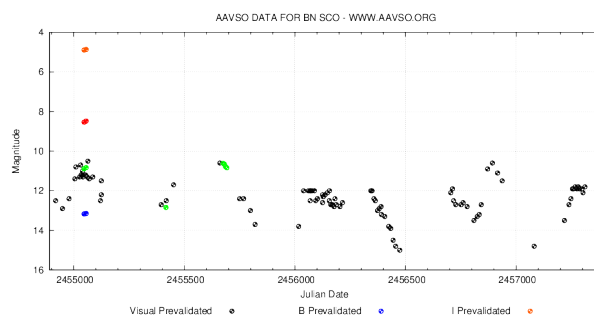
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It's been a while since we looked at these but since the periods are long they don't need too much attention. But why are we looking at these at all? Considered as a group there are probably 800 or so Miras monitored visually by amateur observers. Maybe 1% of these have shown true period changes over the 120 years since they began to be intensively observed. That makes the chances of finding a period change rather low. How do we change the odds?

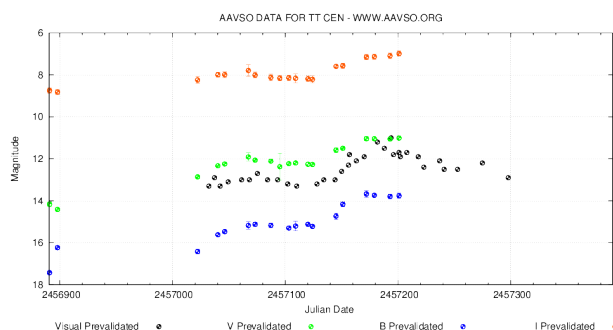
If we examine some of the stars which have shown observed period changes since the 1600s – R Hydrae, BH Crucis, R Centauri, R Aquilae and LX Cygni – they mostly seem to have long periods, 400 - 550 days, relatively low amplitudes, 2.5 to 4.0 visually, and often have distorted light curves with humps, wide or even double maxima. So we might assume that these stars are the most likely to show changes in period. Light curves from the International Database for eight stars which fit these criteria are shown below. All these curves are 500 days to 3 January except for BN Scorpii which covers 2500 days as it has been poorly observed recently.



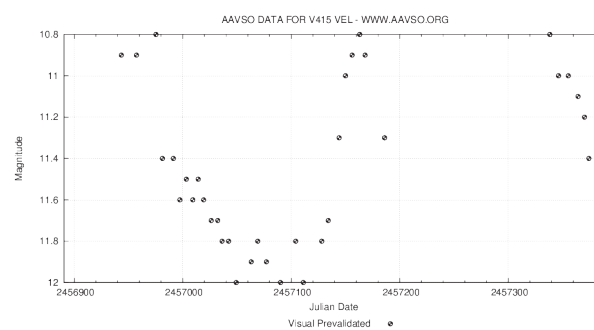
U Canis Minoris - 500 days.



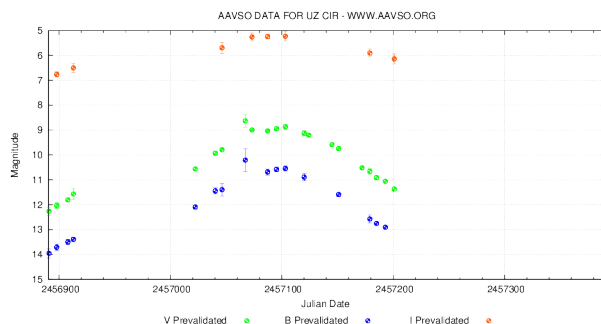
BN Scorpii - 2500 days.



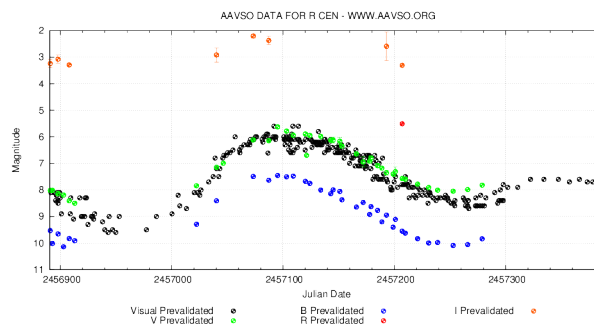
TT Centauri - 500 days.



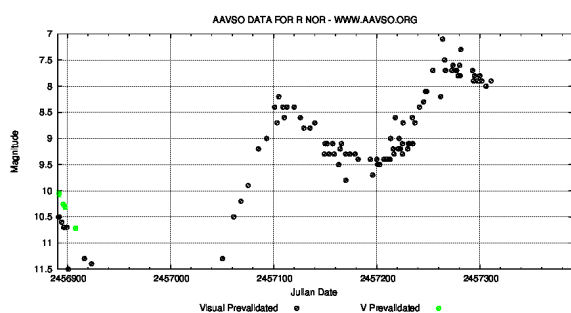
V415 Velorum - 500 days.



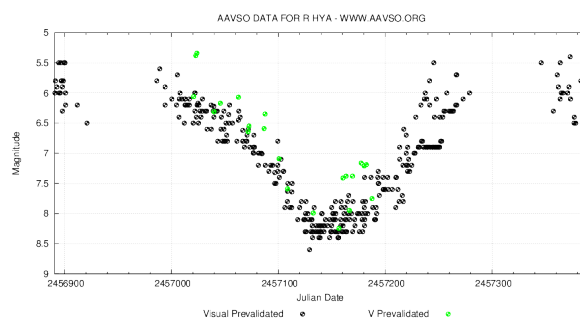
UZ Circini - 500 days.



R Centauri - 500 days.



R Normae - 500 days.



R Hydrae - 500 days.

How should we observe these stars? Visual observers can provide the overall shape of the light curve and it's pointless to duplicate their efforts. But can the colours tell us anything? The simplest thing to consider is temperature as revealed by the B-V colour. In a normal Mira star there is little change but in the case of BH Crucis it changed from 2.5 to 3.5 during each of the initial 421 day cycles and now varies from 3.0 to 4.5 during the present 525 day cycles. So with a star like R Centauri, the period of which has decreased by about 60 days in maybe 60 years, has there been any significant change in colour? Since the shortening period should be related to a smaller star we should expect a slightly less red object. Unfortunately, the measures are not yet adequate to answer this question.

It's not a question of quantity. A good colour measure every 15 days, with perhaps a shift to every 10 days in the significant parts of the cycle, is adequate to follow the colour changes, if any. The next question is what filters should be used. Since all these targets are emission line objects there will be signatures at both extremes - the U filter will show an excess due to the concentration of Balmer lines in that region and the I filter will show a similar excess if there is any significant mass loss. So there is a need for the full UBVRI set of measures. The best CCDs can manage this although the U signal will be weak and less accurate. But there is one major problem in using CCDs at the brighter levels that these stars reach at maximum - the sensitivity of the CCD detector causes saturation.

But it can be done. QZ Carinae is a bright eclipsing binary which varies between $V = 6.20$ and 6.45 or so. In 2009, 2010 and 2013 Terry Bohlsen stopped down his telescope and made enough BV measures to determine the light time effects in those years. These are critical to the ongoing analysis of that system. There are other methods which I discuss elsewhere in this newsletter (see page 10).

Returning to the eight stars listed, what we need to identify is why these stars differ from the general run of Miras with long term stable periods. Some of these differences are discussed in a paper about BH Crucis (Walker, *JAASO Volume 37*, 2009). Others may be found in the spectra. The two Miras where periods have changed by 20% in two or three decades, BH Crucis and LX Cygni, both have SC spectra although in the former case it fluctuates and has become CS at times. Keenan made this point in a discussion of this star at the Small Telescope Colloquium in Christchurch, 1985. So the key to the different types of period changes may be quite simple.

But there are interesting stars apart from these strange Miras. Andrew Pearce spoke about some of these at the AAVSO last June - Miras with humps or bumps on the light curves. And the DMM star BH Crucis has now turned into one of these. Back in the 1970s a visual observer in the Auckland Society was intrigued by a 'stillstand' in L² Puppis when it should have been rising. So we put it onto our observing list and made 40 UBV measures. Later, in the 1990s, we noted that the visual observers had it at a rather fainter magnitude and began some more measures. This star has now been observed to have a visible gas/dust cloud around it which can be photographed with high resolution equipment.

If most Miras are not doing anything spectacular what should visual observers look at? One area where there may be possibilities is a region in the H-R diagram a little above the classical horizontal branch, which may well be a region which stars traverse after departing from the AGB. Neil Butterworth, Andrew Pearce and I cooperated on unravelling some of the behaviour of ST Puppis, a type 2 Cepheid which is probably one of these objects - but there are also RV Tauri stars, maybe R CrB stars and a variety of strange binary objects with hot subdwarf components. The amplitudes are lower, which is why we're looking at two decimal comparisons for good visual observers.

CCD targets for February to April – *Tom Richards*

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Here is the list of targets for October through January. It is culled from Pribulla, T. *et al*, 2003 CoSka__33__38P and a southern subset of their (much more detailed) catalogue of contact binaries that need more work, filtered for CCD mags ($V_{\max} \geq 10$). The paper, full catalogue and southern catalogue (with much more information than presented below) are in the project's Dropbox folder. Go to Papers\ Pribulla Targets. You can find out a lot more about each target at the AAVSO's VSX portal, www.aavso.org.

Star	Epoch HJD0-2400000	Period [d]	SpType	RA2000	DE2000	Vmax	Vmin
FM Vel	46121.64	0.38958		09 47 42	-53 28 18	12.43	13.1
V901 Cen	48500.16	0.354229		11 14 03	-51 32 56	11.94	12.3
TV Mus	45789.56	0.445682	F8V	11 39 58	-64 48 59	11	11.3
EH Hya	47656.72	0.29691	G7V	12 04 51	-33 09 36	14.2	15
BR Mus	44992.77	0.798197	B4V	12 04 52	-72 52 12	10.64	11.28
VY Cru	43204.77	0.695599	A8	12 35 31	-63 15 06	13.1	13.6

If you want to work on these targets, please contact me and I'll send you an invitation to share the VSS EB-EW Dropbox folders. There you will find project information, useful papers, and our data for each target under observation. Yours will be added, and you will be a co-author when we publish.

Also if you're unsure about how to do any of this work, email me and we'll discuss it. But first, as a background, do read the pages about the EB-EW Binaries project on our website (<http://www.variable-starssouth.org/projects/projects/eb-and-ew-binaries-project>). You will also find the pages on the EA Binaries project useful, as well as the article on targets in the previous newsletter.

Mistakes in the last newsletter

The table in this article in the 2015-4 newsletter is completely wrong! And nobody seemed to notice. It would seem that the rows got misaligned when I copied them in. The data for each target is for a quite different star. For reference, here is the corrected table. The body is the same as before, just the star names are different.

Star	Epoch HJD0-2400000	Period [d]	SpType	RA2000	DE2000	Vmax	Vmin
BQ Phe	48500.19	0.436968	F3/5V	00 25 24	-46 55 27	10.47	10.59
RT Hyi	47068.99	0.283997		01 11 04	-79 10 54	13.2	14.1
AD Phe	51418.42	0.379924	G2V	01 16 38	-39 42 31	10.27	10.8
BE Scl	48500.27	0.422901	F8	01 21 33	-29 07 53	10.37	10.83
YZ Phe	47849.43	0.234727	K3V	01 42 26	-45 56 54	12.7	13.2
AU Phe	45292.67	0.30666		01 50 23	-46 58 28	12.5	13
SY Hor	45294.88	0.311784	G9V	04 14 18	-46 26 57	11.4	12.1
RW Dor	48413.27	0.285464	K1V	05 18 32	-68 13 33	10.8	11.4
HI Pup	48500.28	0.432567		07 33 38	-50 07 25	10.7	11
BP Vel	47234.7	0.264985	K1V	08 18 07	-45 23 30	12.55	13.4
BU Vel	41013.39	0.516285	A8V	08 40 06	-42 49 44	10.49	11.07
FM Vel	46121.64	0.38958		09 47 42	-53 28 18	12.43	13.1

The strange case of V353 Vel

Greg Crawford recently contacted me for a target, and I offered V353 Vel from the Pribulla catalogue (not listed above). The data line in the full catalogue is correct, but GCVS lists it as DSCTC (low amplitude Delta Scuti type), and VSS lists it as ELL (low amplitude close binaries with ellipsoidal components, without eclipses but with brightness changes whose period is that of the orbit). As far as I can see, its inclusion in the Pribulla catalogue of contact binaries (W UMa (EW) types with a common envelope)

is based on Hipparcos data. This system is normally too bright for CCDs ($V = 7.62$ to 7.67 according to VSX), but there is a good comparison star well within the CCD frame, unusually for such bright stars.

So, there is undoubtedly doubt about this system, and who better than Greg and others in the project to sort it out? If you want to have a go, contact me and I'll put you in touch with Greg.

Photometry of bright stars – *Stan Walker*

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Introduction

Elsewhere I have updated the dual maxima Mira (DMM) project and discussed the need for UBVR measures through all stages of the light curves. This creates some problems in that some of these stars reach fourth to sixth magnitude in V and are also very red. But part of the solution to this behaviour may lie in the UB region. This same difficulty exists in a wide range of bright objects which are not studied much as they present observational problems.

One of the common beliefs is that U measures are impossible with conventional low-cost CCD cameras. But Jonathan Powles mentions in emails his measures of the recent nova in Sagittarius and also of the eclipsing binary UW Canis Majoris. In the latter case the U signal is small compared to V, maybe 15%, but it still provides valuable information. In the case of these DMM stars U-B values to 0.1 are probably adequate. The paper I mention shows a very different U-B value between two maxima of similar brightness. The exposure times are extremely short but is that a problem?

Comparison stars may not be close. The attitude amongst CCD users is that if there is not a comparison star on the same frame that is a disaster. But PEP photometry was almost always sequential and accuracies of 8 to 12 millimag in V and B-V for snapshot measures were easily obtainable, with U-B probably 15 to 30 millimag due to atmospheric effects. If your equipment is correctly calibrated, which means that you have values for primary and secondary extinction, colour differences become relatively unimportant. The more modern CCDs seem able to be used with very short exposures to avoid saturation.

But there are other methods. Saturation problems are not so great with conventional PEP. There the dynamic range is much greater and it's simple to alter the amplification of the system by varying the operational voltage or if you're using photon detection to adjust the prescaling unit. But we did find that even with very high speed components we began to suffer severe problems with the 50cm EWB telescope when the photon separation became less than 100 nanoseconds. Unlike using an analogue to digital converter either a photon is detected or it isn't and subsequent amplification plays no part. So for very bright objects we used the A/D system limited only by the current the photomultiplier tube could handle.

Even so, if we wished to measure Jupiter or stars like Betelgeuse we had to cut down the light somehow. One idea used was to make a mask at the front end of the telescope with a few dozen 12mm holes. We overlooked what this did to the resolution and all stars had a theoretical diameter of ~ 9 arcseconds, but with scintillation this increased to about $15''$. Not a good solution. A single 50mm hole was more effective with a reduction of 100x or 5 magnitudes.

In time we came up with a different idea - using sun control film as applied to windows to avoid heat and glare. One product was advertised as transmitting only 18% of visible light and two layers of this affixed to ordinary glass gives a transmission of 3.24%, or close to 5 magnitudes. Four layers produce 7.5 magnitudes, or 1000x, reduction but there's an easier way. Coupled with a stopped down telescope aperture the bright limit is increased by ~ 10 magnitudes. Does the concept have an application in bright star photometry?

The immediate criticism is that this will affect the transformation coefficients at an unacceptable level. But how correct is this? One authority stated that DSLR photometry could not achieve better than 5% accuracy but even with a $b-v/B-V$ coefficient in excess of 2.0 V and B-V are acceptably accurate at around 2% - indeed more so than poorly transformed CCD measures using commercial filters. In this context, back in the 1970s we had considerable success using low cost Wratten gelatine filters on some small photometers. Like DSLR the responses are different from the standard system but could be easily

transformed. I'm working on a presentation for NACAA at Easter and in checking filter passbands there seems to be a wide variety of filter responses depending upon the manufacturer. Then as compared to PEP techniques some transformation methods of today are not ideal.

This film/glass combination is probably much less costly than neutral density filters. It should be placed in front of the corrector plate on S-C telescopes where the incoming light is essentially parallel and any smudges or smears do not affect the derived magnitude in any way. The glass needs to be good quality and 4mm would not unduly overload the front of the telescope. An even simpler solution is to use one of the smaller telescopes such as a 90mm or 102mm but innovation seems to be at a low ebb in these 'everything available off the shelf' days.

Publication Watch

Pavlov, H., Mallama, A. (2015) *Video Technique for Observing Eclipsing Binary Stars*. Journal of the American Association of Variable Star Observers (JAAVSO) 43: 80

Abstract. Video recording has been used for more than a decade to time astronomical events such as stellar occultations. We present a technique for using video to determine the time of minimum of eclipsing binary stars and we examine various aspects of using video. The free open source software packages OccuRec and Tangra have been enhanced to offer better support for the recording and reduction of video observations of eclipsing binaries. We present our work in a style and detail that is appropriate for both video observers unfamiliar with variable stars and for variable star observers unfamiliar with video. We present the results of ten times of minima of southern eclipsing binary stars determined using the video technique.

Mallama, A., Pavlov, H., (2015) *Sudden Period Change and Dimming of the Eclipsing Binary V752 Centauri*. Journal of the American Association of Variable Star Observers (JAAVSO) 43:1

Abstract Video photometry was used to determine a time of minimum light of V752 Centauri at heliocentric JD 2457051.1458 ± 0.0002 . The observed time was late by nearly two hours relative to the ephemeris in the General Catalogue of Variable Stars (GCVS). Analysis of this and other timings indicates that the orbital period of V752 Cen increased abruptly by 7.49×10^{-6} days in 2004 after remaining constant for at least the previous 34 years. Simultaneously, the star became fainter by 0.07 magnitude in the V band during primary eclipse, as indicated by an analysis of ASAS data. Dimming of 0.02 to 0.03 magnitude occurred at other phases in the light curve, too. By 2008 the star had returned to its normal brightness. The dimming and the period change may both have been the consequence of material escaping from one of the stars. The deepening of the primary eclipse is also consistent with a color change.

Walker, S., Butterworth, N., et al., *Changing Periods of ST Puppis*. JAAVSO Volume 43, 2015

Abstract ST Puppis is a reasonably bright W Virginis variable star, a Type 2 Cepheid with a record of substantial and erratic period changes - 21 during the interval 1900 to 1985 with a range of magnitude from 17.4 to 19.2. It was observed as part of Variable Stars South's Cepheid project by Butterworth in 2014 and 2015 using DSLR photometry in BGR passbands and visually by Pearce in 2015. The known period changes are shown graphically and doubtful ones examined and discarded if necessary. With its period and amplitude with a frequently changing period it is a suitable and worthwhile object for visual observing.

If you thought that Mira was the first variable star to be discovered here's a paper that may change your mind, but be prepared for some very heavy statistics.

Jetsu L., Porceddu S., (2015) *Shifting Milestones of Natural Sciences: The Ancient Egyptian Discovery of Algol's Period Confirmed*. PLoS ONE 10(12): e0144140. doi:[10.1371/journal.pone.0144140](https://doi.org/10.1371/journal.pone.0144140).

The ancient Egyptians wrote Calendars of Lucky and Unlucky Days that assigned astronomically influenced prognoses for each day of the year. The best preserved of these calendars is the Cairo Calendar (hereafter CC) dated to 1244 – 1163 B.C. We have presented evidence that the 2.85 days period in the lucky prognoses of CC is equal to that of the eclipsing binary Algol during this historical era. We want-

ed to find out the vocabulary that represents Algol in the mythological texts of CC. Here we show that Algol was represented as Horus and thus signified both divinity and kingship. The texts describing the actions of Horus are consistent with the course of events witnessed by any naked eye observer of Algol. These descriptions support our claim that CC is the oldest preserved historical document of the discovery of a variable star. The period of the Moon, 29.6 days, has also been discovered in CC. We show that the actions of Seth were connected to this period, which also strongly regulated the times described as lucky for Heaven and for Earth. Now, for the first time, periodicity is discovered in the descriptions of the days in CC. Unlike many previous attempts to uncover the reasoning behind the myths of individual days, we discover the actual rules in the appearance and behaviour of deities during the whole year.

Of interest to those who use DSLR cameras the following paper available from the arXiv by Zhang et al shows that millimag photometry and exoplanet detection is possible with a consumer camera.

Zhang, M., et al 2015 *Precision multi-band photometry with a DSLR camera*. <http://adsabs.harvard.edu/abs/2015arXiv150603097Z>

Abstract. Ground-based exoplanet surveys such as SuperWASP, HATNet and KELT have discovered close to two hundred transiting extrasolar planets in the past several years. The strategy of these surveys is to look at a large field of view and measure the brightnesses of its bright stars to around half a percent per point precision, which is adequate for detecting hot Jupiters. Typically, these surveys use CCD detectors to achieve high precision photometry. These CCDs, however, are expensive relative to other consumer-grade optical imaging devices, such as digital single-lens reflex cameras (DSLRs). We look at the possibility of using a digital single-lens reflex camera for precision photometry. Specifically, we used a Canon EOS 60D camera that records light in 3 colours simultaneously. The DSLR was integrated into the HATNet survey and collected observations for a month, after which photometry was extracted for 6600 stars in a selected stellar field. We found that the DSLR achieves a best-case median absolute deviation (MAD) of 4.6 mmag per 180 s exposure when the DSLR colour channels are combined, and 1000 stars are measured to better than 10 mmag (1%). Also, we achieve 10 mmag or better photometry in the individual colors. This is good enough to detect transiting hot Jupiters. We performed a candidate search on all stars and found four candidates, one of which is KELT-3b, the only known transiting hot Jupiter in our selected field. We conclude that the Canon 60D is a cheap, lightweight device capable of useful photometry in multiple colours.

Hardware watch

The following note on a new focusing system from Optec Inc is contributed by David Moriarty

The OPTEC Fast Focus – a secondary mirror focusing system

Celestron Schmidt Cassegrain telescopes are notorious for image shifts during focusing, which is a serious problem for accurate photometry during all night runs on a variable star. At Glen Aplin, a typical temperature range in winter is 5° C at the start of the evening and -5° or sometimes -9° C in the early morning. As the temperature fell, refocusing was required every 45 – 60 minutes. This is particularly important for variables in crowded fields. I had been using a Robofocus attached to the primary mirror focusing knob, so the star images moved each time, which caused magnitude changes that were often more than those due to seeing variability.

Optec have produced a focusing system with a stepper motor that moves the secondary mirror along the optical axis (<http://www.optecinc.com/astronomy/catalog/fastfocus/19714.htm>). It has 44,800 steps (0.197 microns/step). I installed it on the Celestron EdgeHD 14, and set the focuser to its mid position of 22,400 steps, then focused on a star using the primary mirror knob. With the primary mirror in that position, I locked it tightly with the clutches, then inserted 2 machine screws into the position for the transport bolts on the EdgeHD14. They are 20 mm longer than the original transport bolts and just finger tight, i.e. not very tight, and fixed with a lock nut on the outside (I could not find a supplier of bolts or screws with a nylon tip, which would have been preferable). The primary mirror is quite stable.

For a temperature change of 1° C, focus is maintained with a 25 step movement. Temperature compensation is automatic for each filter, once the system is calibrated. In the Focus tab under the Observatory Window in MaximDL, the focuser must be connected, and there is a button for “Temp. Tracking”, which must be enabled. During a run, Maxim turns off the temperature compensation function briefly while it moves the filter wheel between the filters and applies the predetermined offset for each filter, then turns the compensation function on again.

Software Watch

AstroImageJ

A free astro image processing program. From the website: <http://www.astro.louisville.edu/software/astroimagej/>

AstroImageJ is ImageJ with astronomy plugins and macros installed. It includes tools based on the Göttingen ImageJ astronomical resources with useful additions.

- Runs on Linux, Windows and Mac OS
- Provides an interactive interface similar to ds9
- Reads and writes FITS images with standard headers
- Allows FITS header viewing and editing
- Plate solves and adds WCS to images seamlessly using the [Astrometry.net](http://www.astrometry.net) web interface
- Displays astronomical coordinates for images with WCS
- Provides object identification via an embedded SIMBAD interface
- Aligns image sequences using WCS headers or by using apertures to correlate stars
- Image calibration including bias, dark, flat, and non-linearity correction with option to run in real-time
- Interactive time-series differential photometry interface with option to run in real-time
- Allows comparison star ensemble changes without re-running differential photometry
- Provides an interactive multi-curve plotting tool streamlined for plotting light curves
- Includes an interactive light curve fitting interface with simultaneous detrending
- Allows non-destructive object annotations/labels using FITS header keywords
- Provides a time and coordinate converter tool with capability to update/enhance FITS header content (AIRMASS, BJD, etc.)
- Exports analyses formatted as spreadsheets
- Creates color images and with native ImageJ processing power
- New in version 3.1.0 (requires update) --
- Optionally enter reference star apparent magnitudes to calculate target star magnitudes automatically
- Optionally create Minor Planet Center (MPC) format for direct submission of data to the MPC

It is free and available from the website above. There is a forum for users at <http://astroimagej.1065399.n5.nabble.com/>

I like the inclusion of exoplanet transit modelling and if I get chance I'll try it out and provide a full review in a later newsletter.

About

Variable Stars South is an international association of astronomers, mainly amateur, interested in re-searching the rich and under-explored myriad of southern variable stars.

Renamed from the Variable Star Section of the Royal Astronomical Society of New Zealand, it was founded in 1927 by the late Dr Frank Bateson, OBE, and became the recognised centre for Southern Hemisphere variable star research.

VSS covers many areas and techniques of variable star research, organised into “Projects” such as Beginners’ Visual Observations and Dual-Maxima Miras. The goal of each project is to obtain scientifically useful data and results. These may be published in recognised journals, or supplied to international specialist data collection organisations.

VSS is entirely an internet based organisation, working through our website <http://www.VariableStars-South.org> and its e-group <http://groups.google.com/group/vss-members>. It also encourages members to work in with major international organisations such as the British Astronomical Association, the Center for Backyard Astrophysics and the American Association for Variable Star Observers.

To find out more, please visit our website, where, incidentally, you will find PDF copies of all our newsletters. Our website has a great deal of information for VSS members, and for anyone interested in southern hemisphere variable star research. All VSS project information and data is kept here too.

Who’s who

Director Stan Walker, FRAS.

Treasurer/Membership Bob Evans

Newsletter Editor Phil Evans

Webmaster David O’Driscoll

Visit our website to see a list of our area advisers, and to find out about our projects and how to contact their leaders

Membership

New members are welcome. There is no annual subscription but donations would be gratefully received. Find out how to join by visiting the VSS website. There you will find out how to join by post, email, or directly online. If you join by email or online and wish to make a donation you will get a link to pay by PayPal’s secure online payment system, from your credit card or bank account.

After you’ve joined and received your membership certificate, you will be signed up to the VSS-members egroup (see above), and you will also receive a password to access the members’ areas of our website.

Newsletter items

These are welcomed and should be sent to the Editor (phil@astrofizz.com). I’d prefer Microsoft Word (or compatible) files with graphics sent separately. Don’t use elaborate formatting or fancy fonts and please do not send your contribution as a fully formatted PDF file.

Publication dates are January, April, July and October, nominally on the twentieth day of these months and the copy deadline is the thirteenth of the month, though earlier receipt would always be appreciated.

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