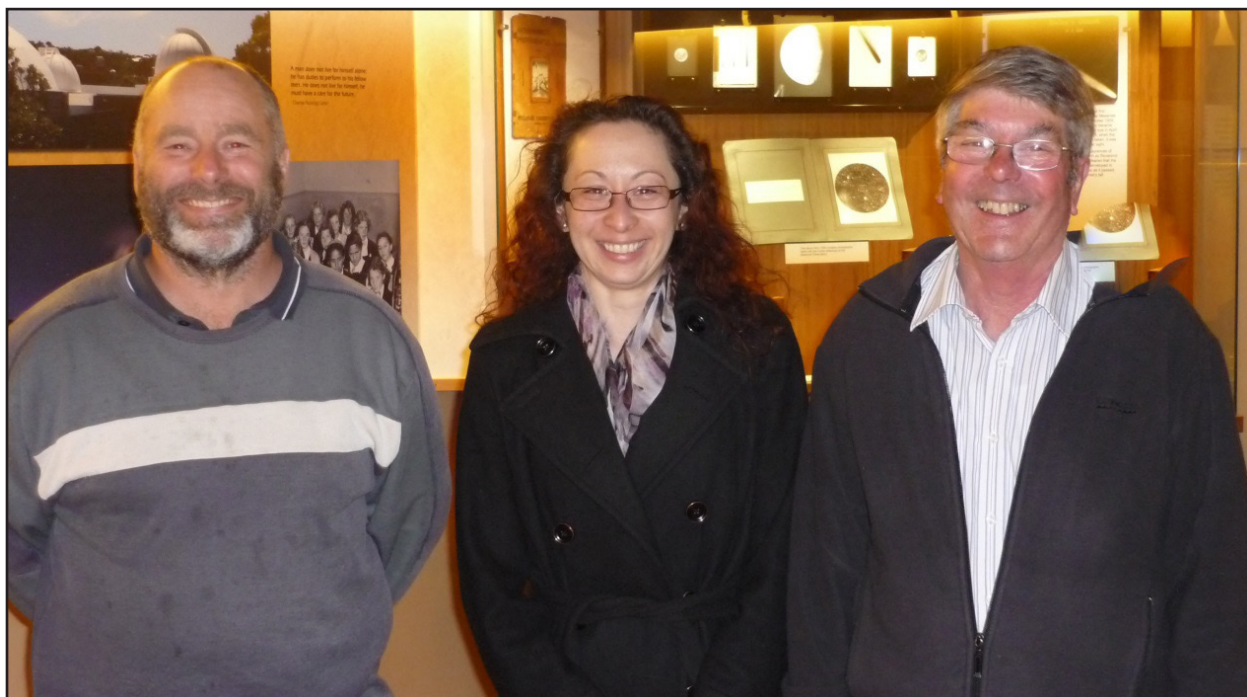




Carl Knight, Stella Kafka and Alan Baldwin at the Carter Observatory, Wellington. See p10 for Alan & Carl's report of their meeting with new AAVSO director Stella Kafka.

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From the Director – *Stan Walker*

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May of this year saw two very interesting and important conferences in New Zealand: the Fiftieth Anniversary Symposium of the Mt John University Observatory and the annual conference of the Royal Astronomical Society of New Zealand. Attendances were good with about 70 at the former and 140 at the latter, certainly the best turnout the RASNZ has ever had. The content of both was of a very high standard and they were the most enjoyable meetings I've attended since PEP4 in 1992 at Hanmer.



The symposium was notable for the attendance of many overseas professional astronomers with strong New Zealand associations - either in the beginnings of their astronomical careers, or who have been closely associated with astronomy in this country. David Buckley at the South Astronomical Observatory and SALT, the South African Large Telescope; Gerry Gilmore of the Cambridge Institute of Astronomy and the Gaia Project, possibly the most ambitious astronomical endeavour of all time; Ed Guinan of Villanova University, Pennsylvania, who discussed a number of interesting southern research projects with us, and many others.

Philip MacQueen, now of McDonald Observatory in Texas, went back in time to the first digital detector at Mt John, and Mike Bessell of Mt Stromlo Observatory, a long time supporter of NZ astronomy and a great help to amateur astronomy, particular with his participation in the PEP Conference series, presented a historical perspective of some aspects of a New Zealand 'National Observatory'. Earlier Audrey Walsh, daughter of Frank Bateson, presented an insight into the establishment of Mt John and the rigours of site testing. Not everyone would agree with the location but the first 50 years have been very rewarding. Unfortunately the 2011 Christchurch earthquakes have destroyed some of the momentum in recent years.

George Wolf, Missouri State University, described observing from Mt John and one of the most loyal supporters of local astronomy, Michael Snowden, now of Cairns, described a few mishaps during his spells at Mt John. In reading the abstracts some of us thought we might need to endure a series of boring historical talks, but as many of the University's graduates and professional astronomers working at Mt John over the years have moved on to prestigious positions in the forefront of research, it was both fascinating and informative!

Many of us have worked with the Mt John people but few have observed from there. So we did not present any papers although we took the opportunity to display a poster paper featuring the work of Variable Stars South which seemed to attract some useful interest, particularly in the field of future pro-am co-operation. We will report more on this in future newsletters, although there are some preliminary reports elsewhere in this one, but the drawbacks of planning and participating in these two conferences has been the need to work twice as hard in non-astronomical areas to catch up on other things.

An interesting part of this conference was a tour of the Mt John site, its telescopes and other facilities on a fine but windy Friday afternoon. For us backyard astronomers you tend to forget that the size of the telescope is related to the cube of the mirror diameter. So even a 1.8 metre telescope is massive! But I'm not sure that I'd swap the comfort and convenience of a telescope in the back yard - or in my case the attic above the farm office - for the isolation and cold. Which is a reason for measuring bright Cepheids from New Zealand's Far North.

One pleasant aspect of this RASNZ Conference was the election of our previous Director, Tom Richards, as an Honorary member of that society. This is awarded to overseas astronomers who have made substantial contributions to astronomy in New Zealand. Previous members have included the late Patrick Moore and Tom joins Brian Warner of the SAAO as one of the current members. The citation accompanying the award appears on page 3. The idea of recognising Tom's efforts in this way was initiated by the current president of the RASNZ, Professor John Hearnshaw, and received wide support, particularly amongst active observers and members of VSS. Congratulations, Tom!

Honorary RASNZ member award for Tom Richards

We wish to propose Thomas Richards, MA Hons, VUW, DPhil, Oxon, recently retired Director of Variable Stars South, as an Honorary Member of this Society. His successful resurrection of the almost defunct Variable Star Section of The Royal Astronomical Society of New Zealand in 2009, and the transformation of this into a thriving organisation with about 100 members, many engaged in serious observational and theoretical research, is an outstanding effort, deserving of high recognition. He has also arranged three symposia in conjunction with RASNZ Annual Conferences, initially at Tekapo in 2007, then VSSS2 at Wellington, 2009 and VSSS3 at Whakatane, 2014, which last event saw 33 participants from both Australia and New Zealand

In building up Variable Stars South he changed its approach by encouraging members to engage in projects with specific goals rather than just make observations to be stored in a database - often not to be used for decades. At this time there are five or six active groups, with other members making measurements which are lodged directly with the AAVSO. Another success has been the development of a quarterly Newsletter, now edited by Phil Evans, which averages hundreds, occasionally thousands, of separate downloads each issue. Tom encouraged David O'Driscoll to develop this very informative and much consulted website which also contains many of the presentations at the Symposia, or at other venues such as the RASNZ Annual Conferences. Apart from this, members have published papers in refereed journals and collaborated with professional astronomers on specific projects, such as delta Scuti stars in eclipsing binaries or a major ongoing project involving QZ Carinae, a massive multiple star system.

Tom began his astronomical interest with solar observing at Wellington College Observatory and received the Murray Geddes prize in 1957. Around 1970, whilst lecturing at the University of Auckland, he set up a planetary group using the Edith Winstone Blackwell Telescope at Auckland Observatory. He also organised several highly successful grazing occultation expeditions and edited the AAS Newsletter. After accepting a position at La Trobe University in Melbourne he initially taught philosophy and, while there with his wife Lynn, he developed the Nvivo software that was the basis for the very successful QSR company QSR International. He became an associate professor in computer science.

Tom has retained his membership of our society through the years and in the last decade or so has presented papers at the annual conferences. He has been president of the Astronomical Society of Victoria and was a recipient of the Astronomical Society of Australia's Berenice Page Medal in 2006 for extensive and ongoing CCD photometry observations of light curves of variable stars and minor planets. Tom is now observing eclipsing binaries, mainly EWs and EBs but some EAs, analysing the data and updating the light elements of many of these. He has authored or been co-author of several refereed papers in this area.



Dr Tom Richards receiving his certificate of honorary membership of the RASNZ from Professor John Hearnshaw.

One of the most interesting presentations at the Tekapo conferences was Gerry Gilmore's summary of the goals of the Gaia project and its capabilities. Since then I've explored a little of the website - it would take months, perhaps years, to work through it all - and found out a little more about what it all means. Perhaps the sheer size of it is best expressed by the comment that the data is expected to fill a million CDs.

What does all of this mean to us amateurs measuring eclipsing binaries, Cepheids or the range of Miras and other LPVs? Is there still a place where useful measures can be made? How will it change amateur astronomy? But this has already been changed, firstly by the original Hipparcos/Tycho measures, more recently by the ASAS project which provided a rich field for people with an interest in discovering new variables by data mining. Other projects have since extended the scope of these. Consider that in a galaxy with perhaps 100 billion stars in it those with measurable variability over a few years will probably number in the billions; what is the value in new variables? Gilmore made one comment when asked would this put us all out of business. ***'We will be measuring the easy ones - the difficult objects will still need more detailed measures and study.'*** This is where projects like ours come in.

One of the most important results will be determining the distance of stars. This allows the absolute magnitude and luminosity to be calculated, subject only to the amount of interstellar absorption. This latter has two effects, it dims the apparent brightness and changes the colour by reddening. This effect is shown in the field of QZ Carinae where the following star colours are seen:

	V	B-V	U-B	Type
QZ Carinae uneclipsed	6.210	0.130	-0.810	O + B
Foreground comparison	6.470	-0.130	-0.600	B5
HD 93131 WR star	6.485	-0.025	-0.880	Oc

Just how bright would be QZ and the Wolf-Rayet star be without the absorption? There are two ways to make the correction, either by plotting B-V against U-B and following an empirically determined correction back to a theoretically determined unreddened value, or by estimating the amount of obscuration by using measures of stars in nearby regions. Gaia will be making more direct measures of these effects on an individual star basis.

A casual look around a few brighter variables in Guide 9, which uses the Hipparcos survey to estimate distances, found little of help in the variable star area. Mira itself, which can reach around second magnitude at maximum is given a distance of 92pc with a 10% error, the much more luminous and distant *I* Carinae is at 478pc with a 14% error. It's hard to find anything else but I noticed an anonymous B8 object at 1320pc where the uncertainty was around 68%. What type of variable star do we have the best distances for? Not unexpectedly, the humble Me dwarfs which show flares and rotational variations.

Knowing the distance enables calculation of the luminosity by simply applying the inverse square law - that brightness changes by 5 magnitudes every time the distance changes by a factor of 10. And once away from the plane of the galaxy - which is largely defined in the sky by the Milky Way and more accurately by the galactic equator - absorption becomes negligible.

We can then use another relationship. Luminosity changes with radius and temperature in the manner $L = R^2 \times T^4$. All we need to know is the temperature to use the luminosity (once there is a reliable distance to the star) to calculate the radius. A publication such as Allen's Astrophysical Quantities contains lists of temperature/B-V colour relationships for main sequence stars, giants, supergiants, etc. They're probably available on the Internet as well.

So with known distances we can now determine absolute luminosities for any variables of interest. Quite clearly many will change during a cycle but more about that later. How long will it take for the production of a catalogue of Mira variables with distances, luminosities and radii to be compiled. Will this produce any surprises? How do the carbon stars fit with the more normal oxygen dominated Miras? Is there a single period/luminosity relationship? To some extent this is known already from studies of the

Magellanic Clouds but the composition, evolution and age in that separate galaxy may have a larger influence than we realise. The same questions apply in other areas - LPVs, SRs, Cepheids and even binary systems.

The whole system of magnitudes and colours will be rewritten and standardised. I've been trying to work with the charts team of the AAVSO to produce simple charts of Cepheids with two decimal place comparison values based upon transformed Tycho measures - which survey can be looked at as an earlier and simpler version of Gaia. But it seems difficult to change the habits of a century of collecting comparison values from a variety of sources to use with time series photometry of large amplitude Miras and no progress was possible. Gaia will resolve this problem provided access by groups like ours is available. I see that 'catalogues' are scheduled for 2020 but hopefully piecemeal publication will predate this.

The whole system of variable star type allocation is based upon assembling a number of contributing factors to build up an understandable structure. This has changed over time. Even as late as the early 1950s one school of thought attributed the nova explosions to chemical changes affecting the star in some way. The overall classification system is largely based upon appearance - one of the most important aspects being the speed of the variability cycle. This separated the eruptive variables from the pulsating stars fairly early in the study but the mechanisms remained unclear. But now we know that novae and supernovae have completely different causes. Spectroscopy lets us measure surface gravity of a star and gives some clues about mass and density. There are many other contributing methods to help in sorting one type from another.

The names of differing types of variable are clearly confusing. Apart from the eruptive objects there are the Cepheids, an area in which VSS has operating projects. But Cepheids include RR Lyrae stars, delta Scuti stars both low mass objects, along with the more massive delta Cephei objects. What exactly are these anomalous Cepheids that are mentioned occasionally? Then there are the Type II Cepheids or W Virginis objects which have a strange light curve resemblance in some cases to the dual maxima Miras. Whilst on the latter variable star type the criterion for a Mira star includes an amplitude of 2.5 magnitudes which excludes objects like V415 Virginis and should have excluded BH Crucis at the time of its discovery.

So Gaia will allow us to understand stellar variability much better by providing better measures of the physical attributes of many variable star types. This must surely make our hobby much more enjoyable!

Improved data for NSV 3933 and 3936 – *Mati Morel*

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NSV 3933 and NSV 3936 first came to notice as a result of proper motion studies by Innes (1916), when he blinked two Cape plates. He noted two objects on the older plate, No **3560** (1895 March 29) which were missing on later plates, such as No 9871 (1916 May 22). He gave the following the data:

NSV 3933 (1875) 08^h06^m.1 -43°35' Range 10.5 - (16p

NSV 3936 (1875) 08^h 06^m.2 -43° 56' 10.5 - 16p

Both stars are plotted on RASNZ chart No 827, according to the NSV positions. As no photograph or finder chart was published, only the approximate positions are available for identification. The problem here is that the Innes positions are of uncertain accuracy to begin with, and can hardly be better than ± 6 s in RA, and $\pm 1'$ in declination, and as the positions are updated to different equinoxes (1900, 1950 and lately J2000) rounding may degrade the initial uncertainty.

New approach to identification

By Innes' initial report in **UOC35**, he provides another means of identifying his stars on the old plate (not available for examination). Plate **3560** contains a reseau or grid, and Innes gives grid references for 29 proper motion stars (mostly CPD) and the variable stars he discovered. What we call today an **x-y** axis, he refers to as B and A axes. After calculating the *precise* positions of CPD stars on plate 3560 (proper motions adjusted to epoch 1895.25) I used his grid references to determine more precise positions for new or unknown objects, such as the two suspected variables. I have derived the scale of Innes' grid. The B axis runs E-W, and one B unit = 27.668^s RA. The A axis runs N-S, and one A unit = 300.0" Dec.

However, his grid references as published appear to be rounded to the nearest 0.1 unit. The estimated precision, in terms of equatorial coordinates, is only ± 2.5 s RA, and $\pm 20''$ dec, at best. This falls short of what one would prefer, but is still an improvement on the positions available from VSX or GCVS databases, and enables one to reduce the circle of uncertainty significantly.

Adopted best positions

After tackling this problem from different perspectives - using known grid scale, and doing plots of CPD stars with precise positions at epoch 1895.25, I have arrived at the following positions for the NSV stars, which narrows down the search area, and is an improvement on current positions.

Best positions from Innes' grid references.

NSV 3933 (J2000)	08^h 10^m 15^s.7 $\pm 2^s.5$ -43° 56' 00" $\pm 20''$	See Figure 1
NSV 3936 (")	08 10 19.9 ± 2.5 -44 18 01 $\pm 20''$	See Figure 2

Plates 1 & 2, based on DSS (Red), are attached for these objects, with a circle of uncertainty centred on my adopted positions. Both charts are 10' x 10'.

Magnitudes

The photographic magnitudes quoted by Innes for his *pm* stars are taken straight from the CPD, when available. The CPD scale is known to be too bright at the faint end, and cuts out at 10^m.2. Innes has extended this scale down to 12.0, by linear extrapolation. I have looked up about a dozen stars with Innes photo-mags from 10.2 to 12.0, to find the corresponding B mags, from APASS. The results are:

Innes Mag	B (mean)	Individual B
10.2	12.03	11.924, 11.995, 12.183
10.5	12.37	11.82, 12.92
11.0	12.60	12.281, 12.432, 13.08
12.0	13.71	13.136, 13.558, 14.424

Innes estimated both NSV 3933 and 3936 at 10.5p on plate 3560, which converts to $B \approx 12.4$ on the modern photometric scale, and certainly no brighter than $B=12.0$ by this conversion.

Nature of NSV 3933 and 3936

It is currently impossible to verify either of these objects. The original report in UOC35 states that the plate, 3560, was of very good definition, with *no defects*. Nevertheless, one gets the impression that some star images may have been a little soft, or even fuzzy. On that plate Innes reports the discovery of two new "nebulae", not listed in NGC or IC catalogues. The first one is described as a "spindle or Saturn-shaped nebula". It is located at (J2000) 08^h 09^m 59^s.2 -45° 09' 09". The DSS plates clearly resolve it, as a chain of five or six stars. There is **no** nebulosity here or in the vicinity.

The second one is described as a "nebulous looking object of about 13th magnitude". It is located at (J2000) 08^h 10^m 54^s.2 -43° 51' 45". On DSS plates there is **no** nebula here, only a close triple star with possible overlapping images.

NSV 3933. Innes makes a remark which perhaps hints at its nature. He describes its image as "very slightly sharper than those of nearby stars". An unrecognised plate defect?

NSV 3936. Nothing definitive can be said about it. Innes claimed to have observed it at about 16th magnitude on FA plate 32 of 1912 April 20, but on DSS plates this star cannot be identified with any certainty. Possibly also an unrecognised plate defect?

Acknowledgement

This research was made possible through the use of the *AAVSO Photometric All-Sky Survey (APASS)* funded by the Robert Martin Ayers Science Fund.

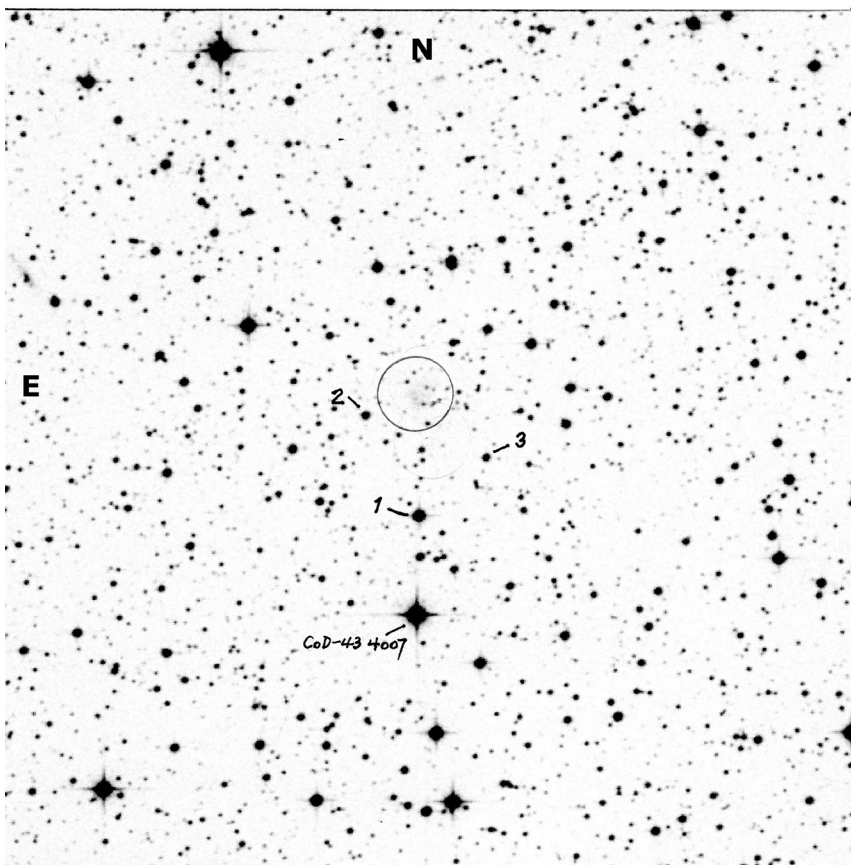


*Fig 1. Field of NSV 3933 with circle of uncertainty. DSS red plate 10' x 10'. Three nearby stars of known (B,V) magnitudes from APASS are labelled as follows:
No 1 (12.786, 12.576); No 2 (15.895, 15.081); No 3 (16.021, 15.612). Innes' published 1875 position places the object at about 71" SSW between 1 and 3.*

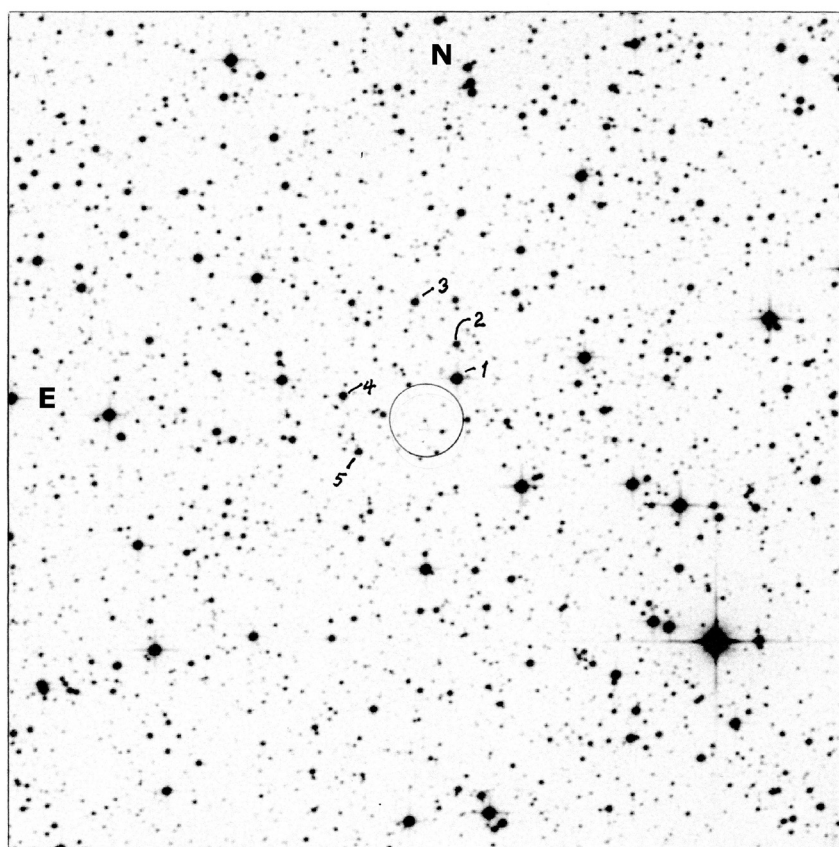


*Fig 2. Field of NSV 3936, with circle of uncertainty. DSS red plate 10'x 10'. Five nearby stars with CCD (B,V) magnitudes, from SPM4, are labelled as follows:
No 1 (13.49, 12.89);
No 2 (16.52, 15.87);
No 3 (16.63, 15.61);
No 4 (17.14, 15.80);
No 5 (16.39, 15.85).
Innes' published position falls within the circle. NSV 3936 is NOT star No 1, though their current positions are in very close proximity.*

References.

- Bateson F. M. and Morel, M. 1985. Charts for Southern Variables, Series 18, Astronomical Research Ltd.
Innes, R.T.A. 1916, Union Observatory Circular 35, 274

AAVSO Spring meeting, Indiana, June 2015 – *Andrew Pearce*

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I was lucky enough to attend the AAVSO Spring meeting held in Muncie, Indiana on June 4-6th 2015. This was my first AAVSO meeting and it was great to meet and talk to people that I've corresponded with for many years. It was well attended with over 60 people (which I understand is pretty good for Spring meetings) and I was the only attendee from outside of the US and Canada. Needless to say I won the 'Marco Polo' award at the banquet for the longest travelled attendee!

The meeting was held at Ball State University in the fantastic Charles W Brown Planetarium. This is a US\$5 million state of the art facility with a US\$1 million projector that is probably one of the best in the world. It was all privately funded so the lucky residents of Muncie can attend the planetarium free of charge. We were given a demonstration on the Friday of the meeting and it was very impressive.

Thanks to the efforts of Stan and Phil, I was able to display a poster paper at the meeting which summarised some of the various VSS projects such as Cepheids, DSLR photometry and LPV's. This generated a lot of interest and discussion about VSS. (Ed: Andrew's poster will shortly appear on the VSS website).

I was fortunate to have long chats with the AAVSO president Jenő Sokoloski whose interest is in galactic novae and she impressed on me that continued observation of novae (long after they fade and lose the attention of most observers) is very valuable. She encouraged VSS members to extend our monitoring of these particularly due to our favourable location.

I also had long chats with Stella Kafka, the new AAVSO Director, and I was impressed with her enthusiasm on a wide variety of VS topics. She is also very passionate about education and considering that the demographic of the meeting was primarily based around more experienced (ie older!) observers, her future efforts to hopefully recruit younger observers deserve to be supported by all of us.

It was also great to finally meet Mike Simonsen after many years of correspondence. He's a very bright and humorous guy and also gave some very interesting presentations on his continued Z Campaign and also the pitfalls that can be met when observing LPVs with close companion stars.

My main interest is in LPV's and in particular stars that show a pronounced hump in their light curves. Frank Schorr maintains a page on the AAVSO web site discussing these "humpers" (<https://sites.google.com/site/aavsolpvsection/aavso-lpv-program/lpv-humpers>). Frank was at the meeting and it was very useful to compare notes and also let him know that there are a number of southern "humpers" that can be added to his list.

The presentations were wide and varied. I was particularly interested in a talk by Joe Patterson of the CBA who spoke about the uniqueness of T Pyx as a recurrent nova and his conjecture that IM Nor (last in outburst in 2002) may be another T Pyx. What makes these systems interesting is that they appear to be blowing themselves apart on a timescale of roughly a million years.

Another presentation that took my interest was actually about solar observing where Kristine Larsen and others had analysed Tom Cragg's very long sequence of solar observations and concluded that he was one of the most reliable observers worldwide which of course comes as no surprise to most of us in VSS!

Overall it was a fantastic opportunity to meet many likeminded VSOers as in WA I'm quite isolated. My daughters have been bugging me to take them to a trip to the States, so I may try and time this for the Annual AAVSO meeting in Boston next year!

The EB & EW binaries project DSLR update – *Mark Blackford*

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Since my last update in the October 2014 VSS Newsletter only a few new DSLR observations have been submitted to the project Dropbox. Jonathan Powles contacted me in April 2015 requesting more times of minimum for RR Cen for a paper he planned to write. I recorded primary and secondary eclipses on April 28 and a primary eclipse on June 8. Neil Butterworth recorded a secondary eclipse on June 5. Folded light curves are shown in the top panels of Fig. 1 below. Our light curves are reasonably consistent despite using different comparison star ensembles.

Neil also observed V0954 Sco on four nights in June and July, recording a near complete light curve (Fig. 1, lower left panel). I recorded an 8 hour time series of NT Aps on July 4th which covered the entire light curve (Fig. 1, lower right panel). Unfortunately data around phase 0.8 was lost due to cloud.

Tom Richards and I would welcome other contributors to the EB and EW Binaries Project.

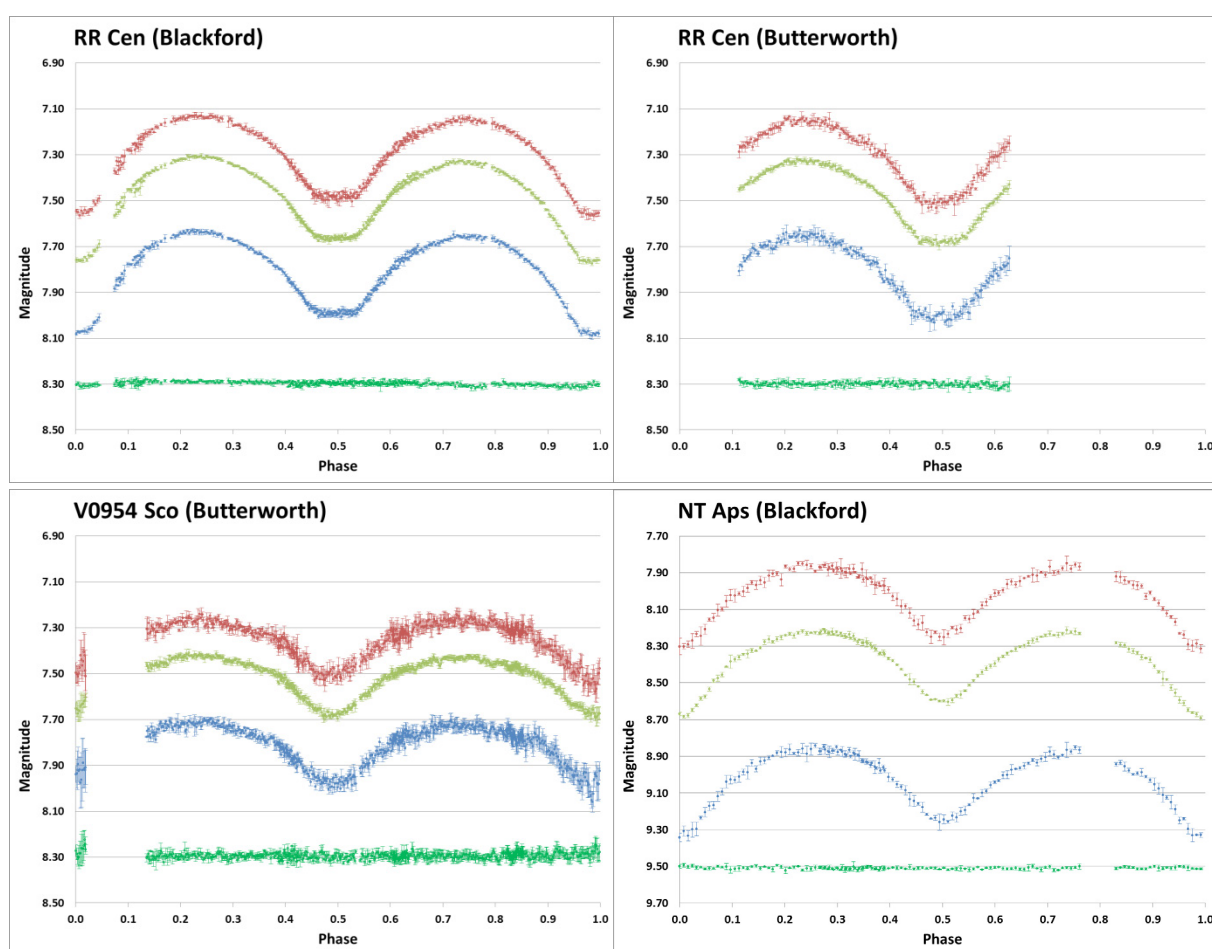


Fig 1. 2015 season light curves of RR Cen recorded by Mark Blackford (top left) and Neil Butterworth (top right), V0954 Sco by Neil Butterworth (bottom left) and NT Aps by Mark Blackford (lower right).

AAVSO DSLR Photometry course

I will be presenting the third instalment of AAVSO's DSLR Photometry on-line course between November 2 and December 4, 2015. Details can be found at: <http://www.aavso.org/choice-astronomy>

Practicing and prospective DSLR observers are encouraged to participate. Class size is limited to 15 so if you are interested please register early.

As well as spending time at the RASNZ Conference and the Mt John 50th Anniversary Symposium, Stella spent a few days in NZ visiting Auckland & Wellington. Palmerston North based Carl Knight and Alan Baldwin caught up with her in Wellington on Monday 4 May 2015, firstly for afternoon tea and then at the meeting of the Wellington Astronomical Society in the evening.

The main purpose of the trip was to hand over Carl's model SSP-4 near IR photometer so that Stella could take it back to USA for servicing and re-calibration; this was duly accomplished. In addition the informal meeting over a coffee allowed us to discuss a range of topics about instrumental observing (Carl's passion) and visual observing (Alan's interest), including:



Carl Knight (L), Stella Kafka (C) and Alan Baldwin (R) in the dome at the Carter Observatory.

- Infrared photometry of Betelgeuse;
- Initiatives to reach and inspire young people with astronomy;
- The need for continuing observations, particularly visual observations to maintain continuity with the visual record that goes back in some cases over 100 years.
- Obtaining scientific information on errors in visual observing
- R Coronae Borealis type stars and the recent behaviour of the southern example S Apodis.

Not surprisingly we found Stella was very keen on encouraging visual observing, and in particular increasing interest amongst young students in astronomical observations. She has plans to trial some programmes involving high school students in her local area.

It was an adventurous trip navigating around the one way streets of Wellington at 5 pm to get Stella back to her hotel and then us back to Cuba St for a quick meal. This was followed by a motor-rally tour up the winding road to Carter Observatory for the evening meeting which included an Observing Group meeting.

Stella gave a talk at Carter Observatory to the Wellington Astronomical Society about the different types of variable stars with the title - The Good, The Bad, The Explosive and The Weirdos. The good (well behaved) were eclipsing binaries and regular pulsating stars; the bad were spotted stars and stars that carry on at minimum and then have a cataclysmic event. Explosive stars were supernova and the importance of these as standard candles. Her favourite variables were the Weirdos, and amongst these were the R Cor Bor stars, eg S Apodis; semi-regular (not quite completely chaotic – Carl's preferred classification) stars eg Betelgeuse; and Proto stars eg T Orionis.

After the talk there was time to catch up with some of the members of the local society. The observing group was focused on the forthcoming stellar occultation by Pluto.

Two further highlights of the trip. One was the opportunity, through a friend of Carl's, to visit the manufacturing unit of MagriTech in Newlands. Magritech manufactures high-end NMR instruments which were developed at Victoria University of Wellington under high profile NZ scientist Prof Paul Callaghan. The second was to have the opportunity to see briefly the Carter observatory Space Place displays.

CCD targets for July to September – *Tom Richards*

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The EB and EW types of eclipsing binaries have very short periods, guaranteeing big magnitude changes, and usually eclipses, every night. If you have a CCD-equipped telescope, we seek from you all-night imaging runs on one of the targets below – stick with it for as many nights as you can. Here's what's wanted:

- **Simplest** – HJD/Mag data table from your nightly observations. The magnitudes should be unfiltered, or filtered but un-transformed. Email that to me as a CSV file. Then if you can, use Peranso (<http://www.peranso.com/>) or Bob Nelson's Minima freeware (<http://members.shaw.ca/bob.nelson/software1.htm>) to find the HJD times of any observed minima and email them to me at the same time. This information will allow us to update and improve on existing light elements, as well as look for period change using O-C diagrams.
- **More advanced**, if you have your transformation coefficients – obtain nightly time series in V and B or Ic filters or all three, transform the resulting HJD/Mag data tables, and email me the results. This may enable us to develop an astrophysical model of the system.

If you want to do this work, 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.

Here is the list of targets for July through September, culled from Pribulla, T. *et al*, 2003 CoSka __33__38P and a southern subset of their (much more detailed) catalogue, filtered for CCD mags ($V_{\max} \geq 10$). The paper, full catalogue and southern catalogue 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	HJD0-2400000	Period	SpType	RA2000	DE2000	Vmax	Vmin
V743 Sgr	48393.82	0.276636	G8/K0V	17 43 56	-28 28 42	13.19	13.83
FS CrA	44826.55	0.263638	K3	18 06 12	-37 30 54	13.8	14.6
AB Tel	45885.46	0.325965		18 37 36	-50 57 48	13.4	14.1
BF Pav	49219.62	0.302319	G8V	18 45 36	-59 38 42	11	11.9
V902 Sgr	49191.95	0.293946	G9V	19 25 16	-29 08 54	14.4	14.8
LT Pav	45991.67	0.393672	F8V	19 48 36	-71 01 30	11.4	12.2
HY Pav	47023.81	0.351656	K1V	20 23 47	-73 42 12	11.42	12.16
ST Ind	44843.72	0.401916	F5V	20 35 24	-48 19 20	11.3	11.79
RW PsA	46675.7	0.360451	G6V	22 09 47	-27 04 02	11.05	11.76
RV Gru	46674.92	0.259516		22 39 24	-46 52 32	11	11.4
BC Gru	48479.93	0.307357	G8V	22 44 45	-48 09 50	10.6	10.94

Paper 3 - MR Aps and NSV 1000

This is the third article covering recent CCD work in the EB/EW Project. Project members can access fuller data on these targets in the project's Dropbox. If you're not a member, consider signing up – full details of the project are on the VSS website. More CCD observers interested in doing their own analysis and co-operating with others are always welcome — contact me.

MR Apodis — a year on

ASAS J17057-7343.6
17 07 57.54 -73 43 35.4 (J2000)
EB, Vmag 10.5-11.0.

A year ago in this publication (*VSS Newsletter*, 2014-3, p.10) I confidently announced that MR Aps would be my first target for the newly announced EB-EW Project. Nice short period (0.52 d) to fit into a long winter night, and clear of the Milky Way. Well, what happened?

That year I had one observing run, and a poor one at that, on August 4 ending on an un-measurable minimum. This year I obtained three all-night runs, on May 16, 23 and 25, using B, V and Ic filters. Robert Jenkins in Adelaide got good runs on June 10 and July 2 in B and V. Figure 1 combines and phases our data. There are still phase gaps in our data; and when we obtain complete transformed light curves in B, V and Ic we can proceed to astrophysical modelling. We obtained a provisional period of 0.52795(3) d.

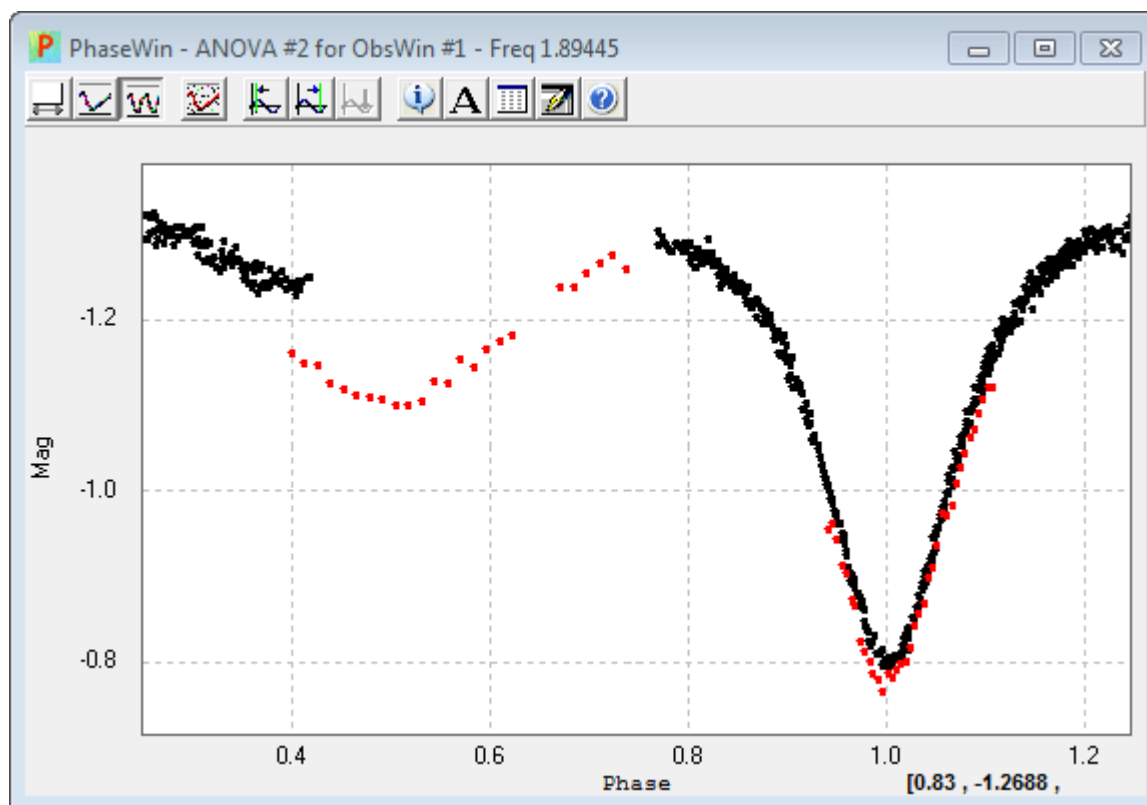


Fig 1. Phased light curve of MR Aps in un-transformed V. Black data points TR, Red points RJ.

Meanwhile we note that our light curve (Figure 1) confirms the listed variability type as EB (ellipsoidal stars very close but not in contact). The magnitude range of 0.5 in V is rather shallow. Our period is at the long end for EBs but close to MR's published period. Unfortunately there are not enough published minima to investigate period change at present. The B-V colour index, derived from my transformed data, is ~0.4-0.5, placing it at spectral type F, rather late for an EB.

Completing the phased light curve in at least B and V should enable us to refine it (there are so often

night-to-night anomalies, even with transformed data) and the colour index. Meanwhile our opportunities to get long data runs for this year are slipping away, denied us by a seemingly permanent cloud cover.

NSV 1000 in Hydrus

ASAS J025619-7431.1, GSC 9151 0041, HV 11909.
 02 56 18.81 -74 31 03.9 (J2000)
 EW,V = 12.7 – 13.1, B-V = 0.7 – 0.8

Little is known about this eclipser. There has been no study of it since its discovery by Emily Hughes Boyce (1943), where it is simply announced as “eclipsing”. From its light curve in ASAS-3 (Pojmanski, 2002) it’s plainly an EW (contact or over-contact). See Figure 2. This binary is rather too faint for the ASAS cameras — note the thickness of the light curve. Nevertheless Sebastian Otero (AAVSO 2015) derived from it the only light elements I can find, and checking against my results they seem good.

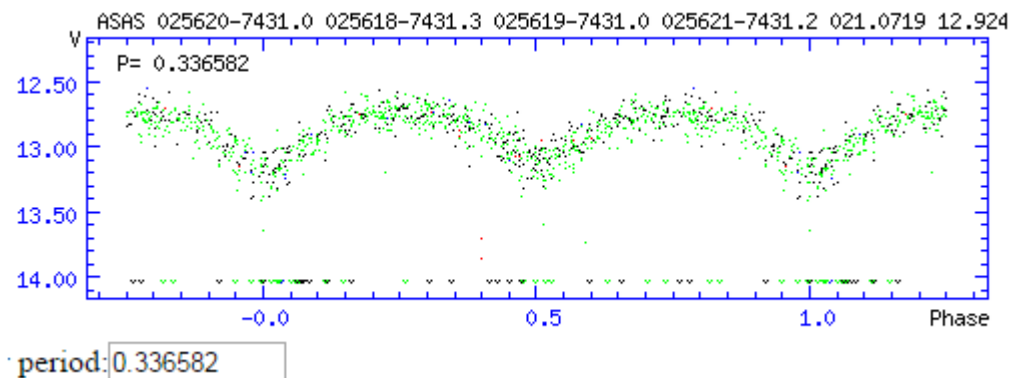


Fig 2. ASAS-3 phased light curve of NSV 1000

I obtained good runs in B, V and Ic over six nights in November and December 2014, including three primary minima and one secondary. The secondary minimum is at exactly half phase, as would be expected. A regression on the minima yielded the light elements:

$$En = 2456973.04666(13) + 0.336581(2) \times n$$

where n is the number of orbital cycles since E0. Otero’s period was 0.336582 d. No period change is evident because of the absence of minima data since discovery, though all EWs undergo period change.

All the data were transformed to the standard B, V and Ic systems and phased light curves obtained as in Figure 3, using PERANSO (Vanmunster, 2015).

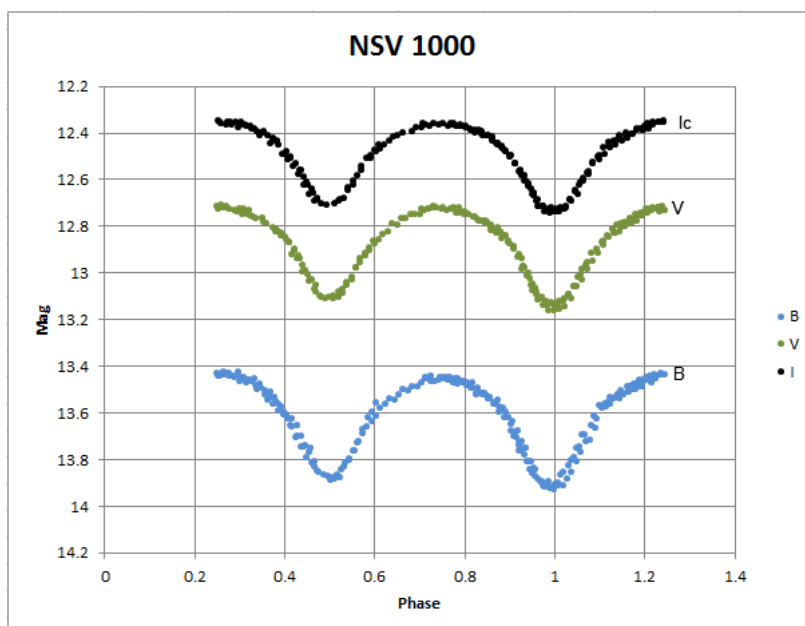


Fig 3. Phased light curves of NSV 1000, using the present data. Top to bottom Ic (black), V (green) and B (blue)

Both eclipses have rounded minima, showing that the eclipses are partial occultations. The secondary, at phase 0.5, is slightly shallower, showing that the eclipsed star is slightly cooler. But not by much — EWs share a common atmosphere, which largely equalises the observed temperatures of the two components. The B-V light curve (Figure 4) shows the uneclipsed B-V colour index is ~ 0.72 corresponding to a G8 spectral type. Late-type EWs such as this are known as W-type (Binnendijk, 1970).

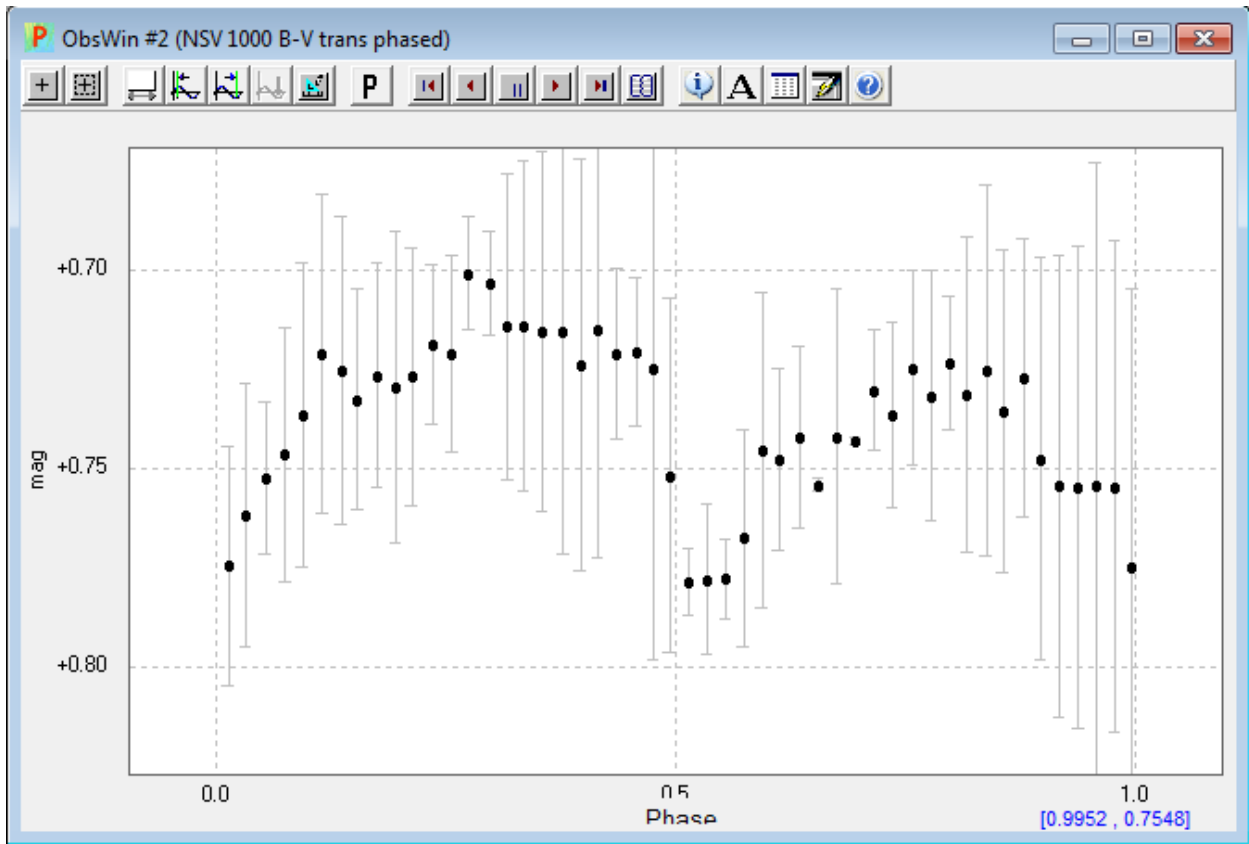


Fig 4. B-V phased light curve of NSV 1000, binned to 0.02 phase.

For W-type EWs the larger (and so more massive) star is cooler and fainter. Why that should be so is a bit of a mystery. At primary minimum the hotter, brighter, smaller component is partially occulted. The secondary minimum is shallower because now the same area (as we see it) of the cooler dimmer star is occulted.

The evolution of W-types is not well understood. They are located on the zero-age main sequence. Their cores are radiative, with a common convective envelope. They appear to be in an unstable configuration, occasionally breaking contact to become EBs. See eg (Rucinski 1974).

The remaining task in the analysis of this system is to derive a shape model, but that is notoriously hard for EWs that only partially eclipse, since determining the mass ratio of the two stars is guesswork without spectroscopic radial velocity data

References

- AAVSO, 2015. <http://www.aavso.org/vsx/index.php?view=detail.top&oid=39624>. (accessed 2015-07-11).
- Binnendijk, L., 1970. *Vistas in Astronomy*, 12, 217.
- Boyce, E.H., 1943. *Harvard Observatory Bulletin*, 917, 1.
- Pojmanski, G., 2002. *Acta Astronomica* 52, 397.
- Rucinski, S.M., 1974. *Acta Astronomica*, 23, 119.
- Vanmunster, T. 2015. Peranso Light Curve and Period Analysis Software, (<http://www.peranso.com>)

Star Colours

When I began observing variable stars in 1965 I enthusiastically bought a few books and read a great deal about how to observe these stars. I was, therefore, a little disappointed when one of the leading people in the DSIR's Optical division suggested much of the folk-lore on visual variable star observing was questionable. Norman actually used stronger words. Recently I've run into the historical lore in a different area - that of selecting suitably coloured comparison stars - red stars for red variables - blue ones for blue variables. Nothing seems to be said about the stars which exhibit large colour changes during a single cycle - Cepheids average about 0.5 magnitudes change in B-V and eclipsing binaries can be even more extreme. What about BH Crucis where B-V changes from 2.5 at maximum to 4.8 at minimum?

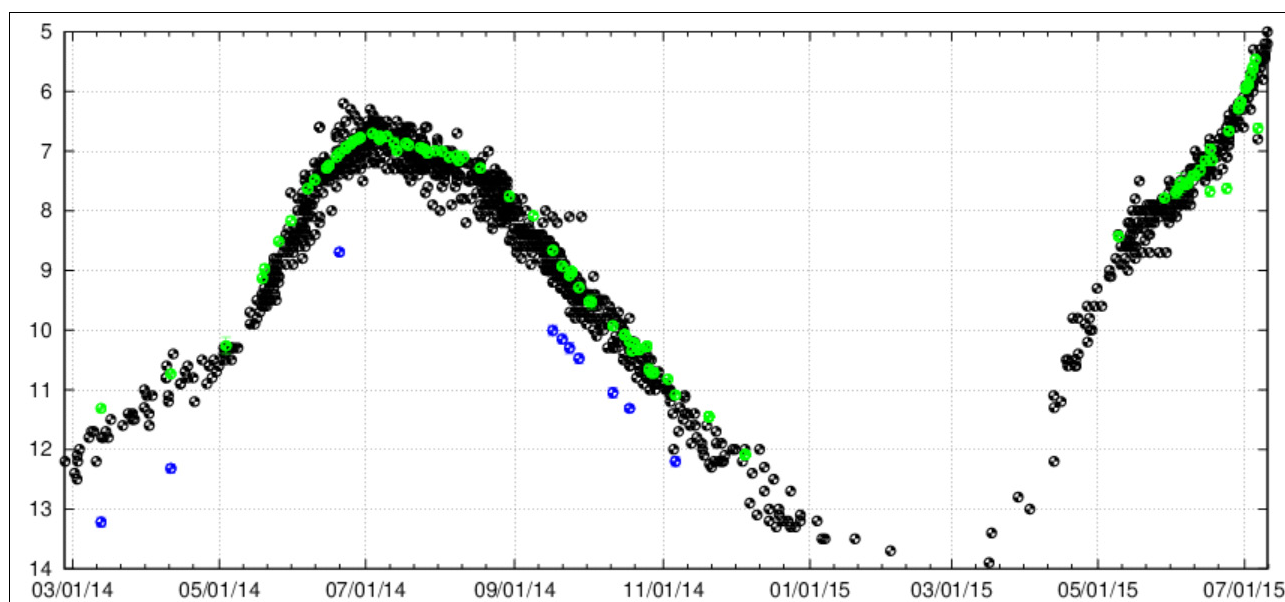


Fig 1. Measures of Chi Cygni from the International Database. The visual measures have a scatter of close to a magnitude. The B-V measures are incomplete but appear to show the star is bluer at minimum, indicative of a hotter companion. Notice the humps on both rises and that the current maximum is already more than a magnitude brighter than the previous one - good illustration of the non-repeatability of Mira light curves.

Our visual Cepheid project needs comparison stars located close to the variable and giving a tight series of steps - say <0.25 magnitude steps over a 1.5 magnitude range. The colours of our target stars, which are mainly those with periods in excess of 10 days - range from about mean $B-V = 0.6$ to 1.1 . So we're looking at $B-V$ colours from 0.3 to 1.4 . Clearly the ideal comparisons are A5 to G9 or K0. But what if the stars we choose are not ideal? How does this affect our goal of achieving 0.05 magnitude accuracy?

Harold Johnson and James Hardie, along with their co-workers, and Alan Cousins and Richard Stoy at Royal Observatory in Cape Town developed a variety of concepts in the 1950s and 60s, all based upon the newly set up UBVRI system, which allow us to understand how colours are affected by the atmosphere and to produce sets of observing rules to minimise the errors. This marked the transition from the uncertainties of photographic emulsions to the use of photoelectric detectors, initially laboriously constructed and cumbersome devices, but quickly moving on to the commercial pm tubes such as the 1P21 and the more sensitive and flexible EMI series such as the EMI 6256 and EMI 9502, the early work horses of southern hemisphere photoelectric photometry - PEP. Atmospheric extinction is a major factor but so is the response of the human eye. We can do little about the latter, some people see farther into the blue or red than others, but we can measure the atmospheric effects and allow for these.

The most important colour in general variable star astronomy is $B-V$ which is largely governed by temperature. It is the difference between the V (visual) and B (blue) filters and is affected by the atmosphere. The usual measure of this atmospheric effect is based upon the absorption of a column of air vertically

above the observer - one air mass. At an altitude of 37 degrees for the celestial pole, the latitude of Auckland, the atmospheric path length is about 1.65 air masses. Using empirical measures on good nights we determined that travelling through one air mass would reduce the light intensity by 0.15 magnitudes through the V filter, and 0.18 to 0.20 through the B filter. Being in a city there was an azimuthal effect due to industrial concentrations which needed some care in target selection. This individual filter effect is primary extinction and can be averted by measuring objects close together in the sky. So comparisons are better close to the variable.

But how are the measures affected if the stars are different in colour? Put simply, a colour difference of 1.0 magnitude in B-V will produce a secondary extinction of 0.18 - 0.15 (taking the lower value) or 0.03 at Auckland for every air mass change of 1.0. With a star directly overhead there is a colour correction of ~0.03 needed if the B-V colours differ by a magnitude. So even if you calibrate your system with directly overhead measures you should extract this secondary term to match the catalogue value, which is how the star appears above the Earth's atmosphere. If you do not, you will produce an altitude dependent transformation value. No problem if you always measure at similar altitudes or use comparisons closely matching the target star in colour, hence the visual observers' concept of using red comparisons for red Mira variables. But the variables are usually much redder than the comparisons; usually 0.5 to 1.0 with oxygen dominated Miras but reaching 2.0 to 3.0 for carbon stars. Bearing in mind the inaccuracy of visual measures with sequences using steps of 0.5 to 1.0 magnitudes, and the non-repeatability of Mira light curves, it probably doesn't matter all that much with Miras. Nor does the colour of the comparison which will introduce errors of only 0.03 to 0.05 per air mass at reasonable altitudes.

Cepheids are much more regular and we're measuring light variations about 4 to 6 times smaller. We're also looking for small period changes related to evolution of the star and epochs of maximum need to be precisely determined. So how great are extinction effects? Primary extinction can be ruled out as we're operating above 1.5 air masses with close-by comparisons. For the secondary calculation let's assume comparison star colours of 0.0 to 1.5 in B-V and a median B-V value of 0.85 for the targets as described above. So the error is $1.5 \times 0.85 \times 0.03 = 0.038$ or 38 millimagnitudes. And a value of 25 millimagnitudes, representing the error for a star vertically overhead, is a constant offset. So colour errors are well within our target of 50 millimagnitudes. The onus is back with the observer to make careful estimates - and since the amplitude is 4-6 times less than Miras it's clear that our sequence steps need to be similarly smaller. All of these concepts have been borne in mind when we've selected the sequences. Even if the colour term is 0.05 in more polluted atmospheres the errors are $0.038 \times 0.05/0.03 = 0.063$ which is better than conventional visual measures.

But how does this match up with reality? Only the experienced visual observers can help with this question. Do the rules for the artificial eye of the CCD or other photoelectric systems adequately describe what happens with the real biological eye? Perhaps some of our members can comment from real experience - either in the Newsletter or through the Google group. It's an important aspect of the visual Cepheid project.

Comfort and proximity

I mentioned BH Crucis above. For some years we compared AO V measures to visual measures by Frank Ives using a 3" refractor and Gordon Herdman using a small Celestron. Much of the literature suggest that looking too long at red stars causes them to appear brighter than they are. But when the visual measures were compared with the PEP V measures the reverse was the case. The visual measures at minimum, when the B-V colour was ~4.8, were about half a magnitude fainter than the PEP V. A similar situation was found with L² Puppis, although this star is not particularly red at a B-V of 1.6 but the colour deepened to 1.8 when it faded. It's still faint, varying from 6.5 to 8.5. Not many such comparisons are available as few amateurs are making BV measures of such stars. It seems that the Auckland group was one of the few areas where this was possible although we now see an increasing number of valuable DSLR and CCD measures of some of the stars discussed in earlier Newsletters.

The physical aspects of visual observing are often overlooked. One of the first purchases from a grant to the Auckland Observatory research team was two comfortable chairs - one for the recorder, the other a swivelling and tiltable chair so that there was never any strain upon the observer's body. If you're strain-

ing to look through an eyepiece the eye comes under pressure, so that the limiting magnitude suffers, as does accuracy. I've often wondered if this affects binocular observing. Compared to small telescopes such as the 80mm refractor or the C90 and 102mm S-Cs available, binocular measures appear less accurate. Why?

Proximity in this case has two aspects, position in the sky and closeness to the variable in magnitude. Do any possible errors resulting from comparisons of different colour outweigh the errors of not having them in the same field of view? Unfortunately, with bright variables there is often no choice.

The second consideration is the size of the magnitude step. There seems to be a strong tendency for observers to decide that the comparison and variable are equal in brightness. The illustration shows a star with a visual range of 1.0 magnitudes which gives 11 observable steps if we're working to 0.1 values. There are 28 observations by a good observer. Note that there are 9 at 4.0 and 4 at 3.8, whereas any concentration should be near maximum or minimum, not mid-range.

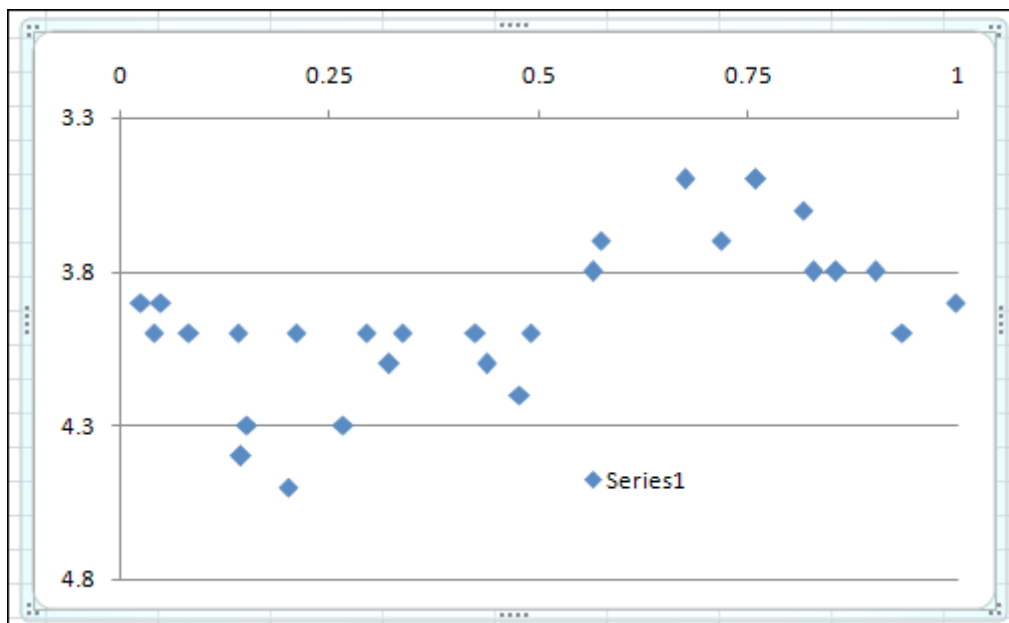


Fig 2. Some visual measures of l Carinae over about 4 cycles. The PEP amplitude is about two tenths less than the visual range. The real problem is the steps in the light curve caused by the measures being made only to 0.1 magnitude. Much better accuracy is quite possible.

We are trying to remove this clumpiness, hence the need to have small steps in the sequence. If these steps are 0.2 magnitudes then there is more likelihood that the observer will avoid the trap of deciding the magnitudes are equal. Indeed, it should be possible to divide the 200 millimag gap into two, three or even four parts. Sebastian Otero has been doing this for years. Brian Marino and I earlier did similar things with QZ Carinae, VW Hydri and EX Hydrae. At this stage observers will complain that it takes too long. But are we seeking accuracy or merely numbers of measures?

Let's also consider the results and their value. Visual observers tend to concentrate in two areas, either the large amplitude Miras or the similarly large amplitude CVs. But most don't observe both. The assorted variable star groups monitor about 600-800 Mira stars of which about 1% have shown true period changes in a century. A poor reward for the time put in! But there are the possibilities involved with the hump and dual maxima Miras which need explanation. The visual CV people have a better success ratio with about 200 novae a century, but few are different. Then there are the DN and NL stars but measures of these are now inadequate to follow changes in the long term behaviour, which is probably more important than much of the observing done at present with CCDs and is not possible visually.

So there is a much better chance of results with Cepheids. The majority of those with periods in excess of 12 days show either continuous small period changes, or larger abrupt changes. In a six month season they will go through between 5 and 15 cycles and it is not necessary to follow through one complete cycle as with a Mira star. The measures are fitted to a mean light curve and seasonal epochs determined. With computers, of course, each observer can make his own complete light curve and even compute his own

epoch - but it's better to combine all the data.

The Cepheid project website will be updated and visual charts available from the website, but only 5 stars with large RAs are available for observation at present with the Milky Way trending north during our winter. The main season begins in October and good charts with reliable and consistent values for all target stars will then be available.

Results

What do we hope to obtain from all of this? At present the production of seasonal epochs for a website presentation is a priority. If you're interesting in helping in this area contact me directly and the data will be made available to you, together with the methods.

From the seasonal epochs O-C diagrams are compiled showing changes, or otherwise, in the periods. Some of these go back to the late 1880s. Once again, room for helpers.

Mean light curves, based upon PEP or DSLR BVR(I) measures will also appear on our site. The actual light curves will be inspected at intervals of 5 to 10 years to determine whether there are changes in shape or amplitude. This is not possible visually, which is why selective photoelectric monitoring is desirable.

At present we're working with the brighter objects - maxima brighter than $V = 9$ in most cases - but if this does not provide enough targets some fainter Cepheids can be measured with CCD cameras and appropriate filters.

So, in conclusion, the comparison star requirements for Cepheids are simple but the steps must be much smaller, around 0.2, so that the greater accuracy required can be achieved. A challenge for the more experienced and more patient amongst us, but more rewarding in the results.

The Red Dwarf challenge – *Tom Richards*

tomprettyhill@gmail.com



The Emmy-awarded BBC-TV series with Rimmer, Kryten, Lister and his cat, and Holly the computer was not only the best science-fiction comedy ever broadcast, but also made “red dwarf” a household name for little red stars.

Red dwarfs comprise about 75% of the stars in our galaxy, but how much do we know about them? Of the eight stars closer to the Sun than Sirius is, six are red dwarfs; the other two are α Centauri A and B. And even that pair sport an orbiting red dwarf, Proxima. They're faint of course, and their closeness doesn't make up for absolute magnitudes usually >10.0 . The brightest, AX Mic only 3.5 pc away, shines at $V_{\text{mag}} 6.8$, absolute magnitude 8.82. Their intrinsic faintness guarantees them long lives, trillions of years, and many will be survivors from the birth of our galaxy, 12 billion years old.

If you were looking for stars with habitable planets, you might well decide that their overwhelming

commonness and their longevity make them good candidates. Surely many, many of them will have lasted long enough for life to evolve around them, especially since being cool they should lack the killer short wavelength radiation. As David Moriarty pointed out to me, life began very early on our planet and will start up wherever the physico-chemical conditions are right; so one fascinating speculation with red dwarf planets is where evolution could take life if it had triple the life-span of Earth.

You'd be half right. A team using the high-precision HARPS spectrograph on the ESO 3.6 metre telescope at La Silla in Chile to study radial velocity changes in 102 southern red dwarfs, discovered nine super-Earths (Bonfils *et al*, 2013). Some of their stars had no such planets — if they'd been there they would have been detected; and some may have had planets below the limits of detectability. Based on that, the team concluded about 41% of red dwarfs (but with a large uncertainty — call it 20% to be conservative) would have Earth-type planets in their habitable zones, where water would be liquid on the planet. So those planets are in our galaxy by the hundreds of billions.

But you'd be half wrong too. The habitable zones of these cool stars are very close in and narrow, typically 0.1 AU from the host star and 0.1 AU thick. At that distance a planet would be tidally locked, with one side baking permanently in the starlight and the other side facing interstellar cold. However it's now calculated even a thin atmosphere could transfer heat from the hot to the cold side sufficiently well to sustain temperate climates (Joshi & Haberle, 2012). Other models looking at the effect of clouds and oceans also give hope of tempered climatic extremes. However Lissauer (2007) argues that such planets, being formed close in to the brighter pre-main-sequence proto-red-dwarf and quite quickly, are likely to have lost most of their volatiles including water when they were formed.

But the strikes against life don't lie just with the planet, the star makes problems too. Red dwarfs have large starspots which can reduce their luminosity by up to 40%; and may randomly emit flares that can double their luminosity. Life seeking a stable climate would be challenged by that, if not destroyed. It may be that only very young red dwarfs have flares, but these stars also have extreme ultraviolet and X-ray emissions which together with the flares could easily erode a planet's atmosphere, especially since it likely has only a weak magnetic shield.

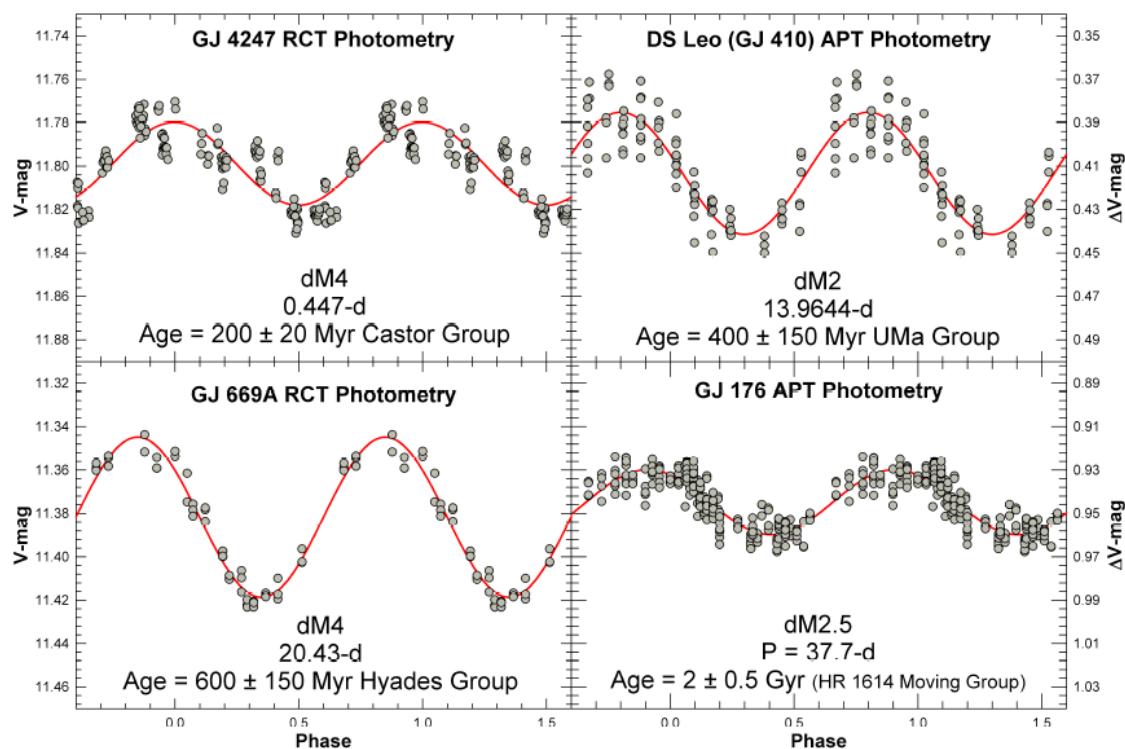
Living with a Red Dwarf

Does the ubiquity of these stars outweigh the threats to life in a close-in rocky planet? Does the probability of life, even if tiny, get multiplied by the billions of potential red-dwarf sites of life to give us hope of life being common in our galaxy? The "Living with a Red Dwarf" Program at Villanova University in Philadelphia is trying to answer that question. Go to <http://www.astronomy.villanova.edu/lward/> for a project outline and many materials. One of the principals of that project, Ed Guinan, attended the outstanding conferences (Mount John 50th Anniversary and RASNZ) at Tekapo in May, and aside from giving a memorable presentation on the subject, spent much time discussing project collaboration with myself, David Moriarty, and others.

The project (Engle & Guinan 2011) involves studying the activity of red dwarfs over their lifetimes, in particular the variability and chromospheric activity induced by their magnetic dynamos — these stars being near to fully convective. Many of the stars can have their ages determined by relating them to the star clusters or populations they belong to, and by other means. Kapteyn's Star for example, may be an old member of the Omega Centauri globular. Rotation periods are the third measure along with age and activity, needed to characterise these stars. Rotation is a measure of the strength of the magnetic dynamo, and hence of flare, starspot and EUV activity. Relating age, rotation and activity provides the history needed to get a clear perspective on whether life could evolve on red dwarf planets, as well as understanding the stars better.

Photometry needed!

Photometrically the aim of the project is the long-term monitoring of the variability and colour of selected southern M and late K dwarfs, including determination of rotation periods. Periods can be determined photometrically with CCDs or, for brighter targets, DSLRs. The rotation of starspots can provide a measurable wave in the star's luminosity, as illustrated by the four phased light curves from (Engle & Guinan 2011). Note how the periods — from 0.477 to 37.7 d — correlate quite strongly with age.



Representative V-band light curves are shown for four dM2–4 stars (from Engle & Guinan, 2011).

Published rotation periods for many red dwarfs are believed to be poor, eg Hipparcos and ASAS3 data, due to insufficiently precise photometry. Moreover if the photometry was done for another purpose such as colour index determination, the data may form a very poor time series. And the old story of professional telescope time, the inability to book for usefully long time series, gives the amateur who completely controls his or her own telescope time a big advantage.

In my own case, as advised by Scott Engle, I'm concentrating right now on V645 (Proxima) Cen, which has a period of ~83 d and a solar-like activity cycle of ~7.6 yr. Vital statistics: Vmag = 11.18 - 11.27 (for the rotation cycle), 11.18-11.21 (for the activity cycle), BV = 1.72, spectrum dM5.5e, mass = 0.12 Sun, distance = 1.3 pc. The period data come primarily from ASAS-3 and PROMPT, but with an amplitude of only 0.03 mag in V better data are needed. Tests show I can measure it in B and V to ~0.004 mag transformed, under average conditions, so I plan to get a snapshot every clear night. Targets with a much shorter period – or if you catch a flare or are looking for a planetary transit – would need time-series data through the night. The CCD field of Proxima has two stars of similar colour to it but 1.5 mag fainter — not good — and one a bit brighter with BV = 1.45. With those I should be able to avoid any secondary extinction problems (colour change of stars with altitude) and get reliable magnitudes, especially since red is little affected. Since Proxima is coeval with α Cen A and B which are very well studied indeed, it can shed much light on red dwarf evolution.

An interesting pair, two of the six closer than Sirius, make up the very close visual binary (2.0"), BL and UV Cet, aka Luyten 726-8 A and B respectively. UV, the brighter at V=13.2, is the prototype for flare star classification. A tough call for photometry, since you'd have to make sure the light from one doesn't contaminate the other.

For DSLR observers, a very enticing target is Kapteyn's Star (VZ Pic) at V = 8.85. It's the nearest Population II star to us, a little further than Sirius at 3.92 pc, ~11.3 Gyr old, and hosts two super-Earths which have had plenty of time to grow any life — one is in the habitable zone. It has a long period, ~84 d, which needs refining. There are many more in the list.

If you're interested in taking on this photometry challenge, contact me for target selection and guidance. It's best if a given target is worked by only one observer, as the precision required by the task is easily polluted by trying to combine data from different instruments.

Rimmer and his crew would be proud.

References

- Bonfils, X. et al, 2013. *Astronomy & Astrophysics* 549, A109.
- Engle, S.G. & Guinan, E.G. 2011. "Red Dwarf Stars: Ages, Rotation, Magnetic Dynamo Activity and the Habitability of Hosted Planets". 9th Pacific Rim Conference on Stellar Astrophysics. ASP Conference series. arXiv:1111.2872. Not yet published; preprint from <http://www.astronomy.villanova.edu/livingwithareddwarf/>.
- Joshi, M. & Haberle, R. (2012). "Suppression of the water ice and snow albedo feedback on planets orbiting red dwarf stars and the subsequent widening of the habitable zone". *Astrobiology* 12 (1): 3–8. [arXiv:1110.4525](https://arxiv.org/abs/1110.4525).
- Lissauer, J.L., 2007. *Astrophysical Journal*, 660, L149-L152.

Publication Watch

The persistent work of 17 EB observers, ably led by Margaret Streamer and David Maoriarty, has paid off with the publication of their paper in volume 43 of the JAAVSO.

Streamer, M., Byron, J., et al. (2015). "*Revised Light Elements of 78 Southern Eclipsing Binary Systems*." *Journal of the American Association of Variable Star Observers (JAAVSO)* 43: 67.

Abstract. Since 2011, members of Variable Stars South have undertaken intensive time series observations and analysis of eclipsing binary systems, most of which are south of declination -40° . Many of them have not been observed in detail since their discovery 50 to 80 years ago. New or revised light elements are presented here for 60 systems and revised O–C values for a further 18 systems. A pulsating component has been discovered in four of the binary systems: RZ Mic, V632 Sco, V638 Sco, and LT Her.

And your editor has had his observations of exoplanet transits noticed by the professional community with the publication of a paper in *Astronomische Nachrichten* Vol 336 No 2.

Vanko, M., Evans, P., Tan T G. (2015). "*The refined physical properties of the transiting exoplanetary system WASP-41*." *Astronomische Nachrichten* 336: 145.

Abstract. We present the first follow-up study of the transiting system WASP-41 after its discovery in 2011. The main goal of this paper is to refine the physical parameters of the system and search for possible signs of transit timing variations. The observations used for analysis were taken from the public archive of the Exoplanet Transit Database (ETD). Assuming three different limb darkening laws, we found the best-fitting model and redetermined parameters of the system. Although system parameters obtained in this study were found to be in good agreement with the discovery study, the planetary radius determined here is notably smaller, namely $1.12^{+0.06-0.07} R_{\text{Jup}}$. The Safronov number $\Theta = 0.071 \pm 0.002$ and equilibrium temperature $T_{\text{eq}} = 1271 \pm 50$ K were also determined. Both values indicate that the planet WASP-41b belongs to Class I of transiting planets. No significant transit timing variations were detected.

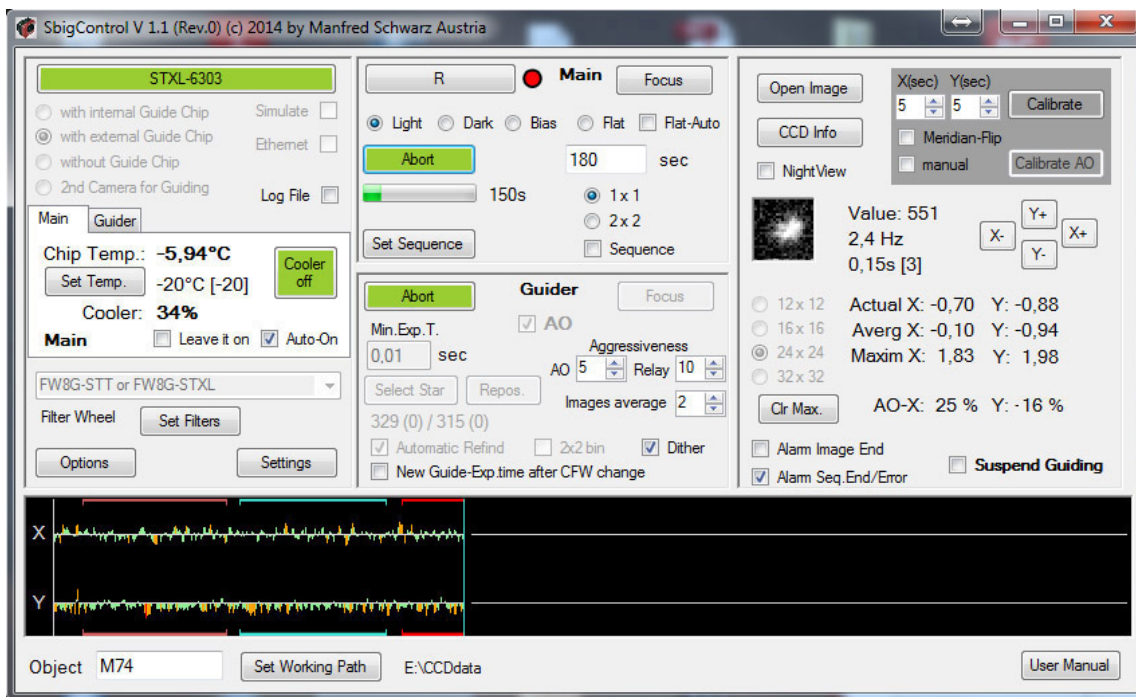
Software Watch

A cheap (USD45) but functional alternative to MaximCCD for controlling SBIG CCD cameras is available from Manfred Schwarz at his website <http://www.astrophoto.at/SbigControl/SbigControl.htm>

According to the website SbigControl has:

- Automatic save of images in an automatic created folder structure
- Automatic change of guiding exposure time during guiding, if star brightness changes
- Automatic find of optimal Flatfield exposure time
- Open shutter during guiding without imaging (most software turns the shutter permanently)
- Selectable acoustic alarm for end of image, end of sequence or error condition
- Log file for imaging, with time stamps and much more data

- Many user changeable parameters to customize the software for your needs
- Is easy to use



Hardware Watch

Nikon enthusiasts now have a DSLR alternative to Canon for astronomical use - the Nikon 810A



From the Nikon website:

The D810A is designed exclusively for astrophotography—a first for Nikon models. Its IR filter is optimized for H-alpha red tones, resulting in four times greater sensitivity to the 656 nm wavelength than a standard DSLR. Celestial objects like emission nebulae can be captured in staggering detail by the 36.3-megapixel full-frame CMOS image sensor, which has no optical low-pass filter for even greater resolution. Capture views of the nighttime sky you may not have thought possible.

I have always been a Nikon fan but won't be paying US\$3,799.95 (body only) for one when, for much less than that, I could buy a dedicated cooled astronomical CCD from SBIG or any other similar manufacturer.

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) who prefers 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 would always be appreciated.

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