



*Siding Spring Observatory, as first seen by Mati Morel in March 1969. It has now changed beyond recognition. The three main domes, from left to right, are: the 16-inch Boller & Chivens, the 24-inch Boller & Chivens, commissioned in 1966 and the 40-inch Boller & Chivens, commissioned 1964. All belonged to Australian National University. All are now decommissioned. See Mati's interesting article on his 50 years in astronomy on page 4. Photo by Mati Morel.*

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### Some changes for members – and non-members

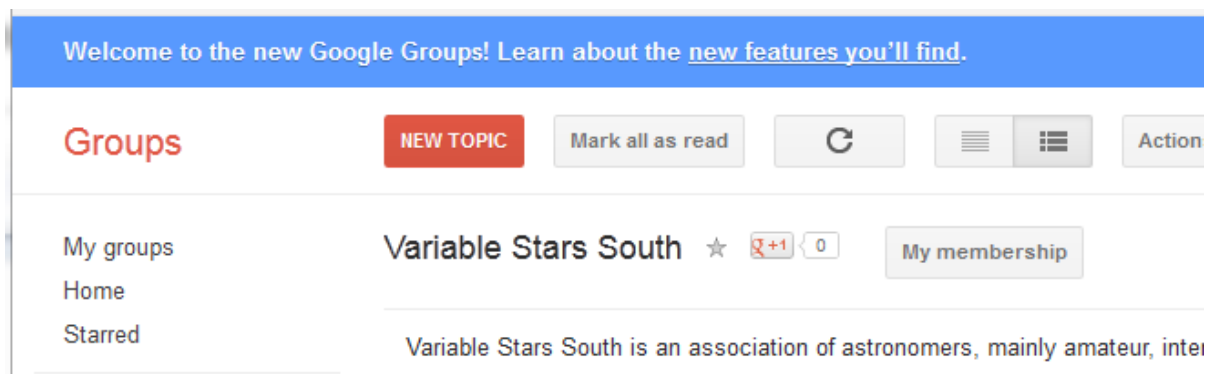
This is the fourth year of our existence as Variable Stars South, and with that comes a certain settled maturity, and in particular an understanding of our membership base and of our financial stability. It is apparent that early decisions aimed at maximising membership privileges – and hence membership and revenue – no longer seem necessary, and now may even be counter-productive.

From now on, anyone — not just members — can join the renamed vss-members egroup (see below for details), and anyone — not just members — can join in project work. Will these changes erode our loyal membership base? It does make membership effectively an annual donation to promote southern variable star research, rather than the securing of individual privileges. We shall see, but it may even attract more members.

One membership privilege remains – access to VSS research grants.

### The VSS-Members Google Group is now VariableStarsSouth

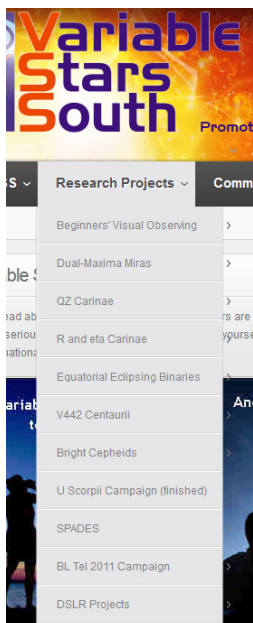
- The Google Group vss-members@googlegroups is now open to anyone, not just VSS members. And it is renamed to VariableStarsSouth. Its URL is <https://groups.google.com/forum/?fromgroups#!forum/variablestarssouth> and to post to it you use VariableStarsSouth@GoogleGroups.com. (Capitalisation in any email address is unnecessary, but may help!) If you belonged to the old vss-members Google Group, you still belong to the renamed group.



- Anyone can join this egroup now, so it can expand to cover all aspects of southern hemisphere variable star work, and not just what VSS does, and not just what our members want to talk about. Some members think we should have done this from the start, but we didn't want to compete with AVSON which is quite separate from us. However AVSON seems to have no traffic now. To join the Variable Stars South Google Group, go to <https://groups.google.com/forum/?fromgroups#!forum/variablestarssouth> and apply. You can also unsubscribe there. But again, if you belonged to vss-members, you are still a member of the renamed group.
- The various forums on our website [www.variablestarssouth.org](http://www.variablestarssouth.org) remain read-access to the public, but to post to them you need to register on the website. You need not be a member to register. To create an account, go to Community > Discussion Forums on our website. (This is not a policy change – it has always been like this.)

### Anyone may contribute to VSS projects

VSS has never collected observations for archival purposes – that is the job of the AAVSO to which all our members should contribute all their observations. Our work is project oriented, and often the requirements on contributing to a project are quite specific to that project. In SPADES for example you can



contribute in two ways, as an observer or as an analyst; and for each role there are specific guidelines and forms to use.

However we have said in the past – and you’ll see this mentioned in numerous places on our website – that you need to be a VSS member to contribute to these projects. That is no longer the case. Anyone may, though they will need to apply to the project leader first. And of course we would still encourage them to join up.

It may take us a little while to spot and remove all the “only-members” remarks on our website about project participation. So in the meanwhile just ignore them!

## VSS Grant to Mark Blackford



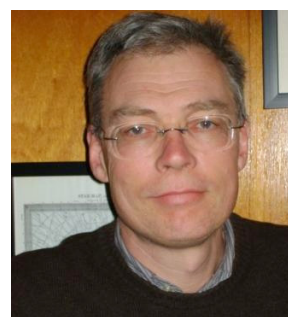
Mark Blackford of Chester Hill, NSW has taken a leading role in developing DSLR photometry in VSS and is a major architect of several DSLR-oriented projects. He is branching into spectroscopy and has successfully applied for the purchase of a Star Analyser diffraction grating to use with his Canon EOS 600D camera. His initial aim is to study spectral response curves in the individual colour channels of the camera’s CMOS sensor. This will not only provide information on changes in the Bayer filter array and sensor, but will provide a way of comparing RGB response curves with those using photometric filters and thus a way of estimating transformation coefficients for comparison with empirically determined values. Beyond this “lab” work, Mark intends to use the grating to obtain spectra for variables under project study.

Congratulations, Mark. We look forward to articles on your work in future Newsletters.

A reminder that any member may apply for a VSS research grant for work in connection with VSS projects. Read more on our website under Community > VSS Research Grants.

## Science fiction – or fact?

I seem to remember reading Analog Science Fiction as a kid in the United States – good quality stuff, not cowboys and indians in outer space. The latest issue (now called Analog Science Fiction and Fact, I see) is graced by an article from Alan Plummer of Linden, NSW, about observing variable stars. I think it’s one of the best – and best written – introductory come-on articles about variables I’ve read in a very long time. Congratulations Alan. If the October issue



isn't with your newsagent, you can buy it online at <http://www.analogsf.com>. Worth reading.

And Alan is still going strong with his Australian Sky and Telescope variable star articles. In April he had a fine two-page spread about the 19th-century NSW astronomer John Tebbutt and his work on R and Eta Carinae.



Talking about 19th century NSW astronomers (well, early 20th), Richard McKim, the Mars Coordinator of the British Astronomical Association, has a fascinating article about Walter Gale (1865-1945) in the August 2012 edition of the BAA Journal (122, 4, p202) – along with some of his Mars drawings and a contemporary cartoon and article from the Sydney Daily Telegraph. (I didn't know it once had pretensions to intellectuality). If you don't know by now why Mr Gale has quite literally rocketed to fame, you lack some Curiosity about Mars exploration. Ask me for a copy of the article.



## Putting Stars in their Place: A 50-year odyssey - *Mati Morel*

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### Introduction

My interest in astronomy began in December 1961. The aspects of astronomy that soon had me hooked were the discipline and the systems required to organize, classify and catalogue stars and celestial objects. One inspirational book, which I studied thoroughly while still at high school, was by Patrick Moore, "A Guide to the Stars" (1960). That book contained lists of bright and easily found double stars, variable stars, Messier objects etc, as well as basic line drawings of the constellations. I copied or traced the whole lot, by hand, into an exercise book which still exists. By the time I had finished high school, and commenced work as a trainee analytical chemist, I felt that I had exhausted the astronomy section of local public libraries, and was casting around for more advanced material which I knew must exist (I knew of no local astronomical society, Sydney being the nearest point of contact). When the 4-vol. SAO catalogue became publicly available in June 1966 I ordered a set without hesitation. This work listed 258,997 stars and cost \$25. It seemed like a bargain, even on my low income.

### Late 1960s

By this time I clearly had a vision, a mental image of following some sort of career path. While astronomy was at the forefront it was never going to produce an income stream. That fell to my day job as an analytical chemist. Study for a qualification in chemistry, which also meant working some shiftwork, inevitably pushed astronomy into the background for several years, but it always managed to rise up when the circumstances permitted. I always had a leaning towards variable stars and charting, and managed to observe an occasional bright nova, such as HR Delphini of 1967. In March 1969 I made a car trip to the western parts of NSW which wasn't complete without a detour through the Warrumbungle Range and a very brief visit to Siding Spring Observatory. The observatory had existed for about five years, with only three telescopes: 16-, 24- and 40-inch Boller and Chivens. A postcard shows all three, in one image.) It wasn't really set up to cater for the tourist traffic back then.

On a couple of occasions in May 1969 I made special trips to the State Library, Sydney to view books and charts not available in Newcastle. The last trip had potentially fatal consequences on the way home. A car accident resulted in a badly smashed up car, but fortunately I survived without a scratch. The astronomy gods must have decided that my time on Earth was not up, just yet.

### Early 1970s

In about 1970 I came across one book which was a very useful guide to the literature. This was by D A Kemp (1970), "Astronomy and Astrophysics: A Bibliographical Guide". It gave me a pretty good overview of what is "out there" in the literature and where to find it. Of course, it would now be badly dated, but is

apparently still available on the second-hand market, and possibly even available for download as a digitized book. A Google search resulted in many hits. In the days before online databases, various authors would take it upon themselves to compile and publish such bibliographies. This sort of material is now maintained and kept up-to-date by CDS Strasbourg and mirror sites.

## 1972-1973 era

I joined the VSS, RASNZ in 1972, and ordered copies of all published series of charts, as well as the General Catalogue of Variable Stars (3rd ed. 1969), from the director, Frank Bateson. Initially I contributed observations, month by month, using a 20cm Newtonian reflector. On 1973 August 30 Frank was in Sydney for the IAU meeting, and the opportunity arose to meet some Australian amateurs. I travelled to Sydney (by train) to a small informal gathering of amateurs at I P Debono's home at Balgowlah. As I recall, I showed Frank some examples of my efforts at charting the stars and this sowed the seeds of a very fruitful cooperation in chart making in the following years.

## 1974-1980 era

Before the advent of the internet and deep all-sky surveys, the only general all-sky catalogues were the Durchmusterung catalogues - Bonner Durchmusterung (BD) visual from  $+90^\circ$  down to  $-23^\circ$  dec, and the Cordoba Durchmusterung (CD or sometimes CoD) visual and Cape Photographic Durchmusterung (CPD) for the far south. These were mostly out of print, but in 1974 I managed to obtain a microbook version of the BD, and a couple of volumes of the CoD. By 1980 I had added the missing parts of the CoD, as well as the CPD, on microfilm. Useful though they are, their coverage is limited to stars brighter than 11th magnitude as a general rule. In 1979 I first made contact with the CDS, Strasbourg, France. Without internet access in those days, professionals could obtain copies of catalogues on magnetic tape. Alternatively, selected catalogues could be printed onto microfiche cards, and airmailed to the user. I made use of this service regularly in the 1980s.

## 1980-2000 Era.

At the start of this period I realized that some projects I had in mind could not be undertaken using existing catalogues or datasets. These catalogues could be a starting point, but would need extensive reworking and cross referencing to bring them up to date. In 1981 I began work on 'A Visual Atlas of the Large Magellanic Cloud', but had no computer skills or PC, so all calculations (eg rigorous corrections for precession) had to be carried out with a pocket calculator. This alone took about twelve months of constant work. After about 1990 this sort of drudgery was shifted to PC-based programs. The following table lists the major work done in the last 30 years.

| YEAR | PROJECT               | S    | EPOCH 1 | EPOCH 2 | OBJECTS      | N     | FORMAT               | NOTES                     |
|------|-----------------------|------|---------|---------|--------------|-------|----------------------|---------------------------|
| 1981 | LMC Visual Atlas      | 5    | 1875    | 1950    | Stars        | 2431  | Hardcopy             |                           |
| 1981 | LMC Visual Atlas      | 4    | 1900    | 1950    | Stars, neb   | 3549  | Hardcopy             |                           |
| 1989 | SMC Visual Atlas      | 3    | 1900    | 1950    | Stars        | 408   | Hardcopy             |                           |
| 1989 | SMC Visual Atlas      | 5,16 | 1875    | 1950    | Stars        | 779   | Hardcopy             |                           |
| 1990 | Field MW245 (Puppis)  | 11   | —       | 1950    | Stars        | 1487  | Electronic, hardcopy | BV (ptg), MK spect. types |
| 1997 | OB Assoc. Database    | 8    | —       | 2000    | OB assoc     | 71    | Electronic, hardcopy | Lists ~1000 stars         |
| 1999 | Dbase of LMC OB st.   | 12   | 1975    | 2000    | LMC OB st    | 1275  | Electronic           | UBV data for all stars    |
| 2001 | SL clusters (LMC)     | 14   | 1975    | 2000    | LMC star cl  | 898   | Electronic           | Guide 8/9 readable        |
| 2004 | Henize nebulae (MCs)  | 6    | 1950    | 2000    | Emission neb | 532   | Electronic           | Guide 8/9 readable        |
| 2004 | Cats of SMC clusters  | 7    | —       | 2000    | SMC star cl  | 292   | Electronic           | Guide 8/9 readable        |
| 2005 | Project Snapshot      | 2    | —       | 2000    | Stars        | ~5000 | Electronic           | VS comp. stars            |
| 2006 | Cat of sequences      | 15   | 1950    | 2000    | Sequences    | 598   | Electronic           | UBV standards 1953-68     |
| 2007 | Parenago M42 stars    | 10   | 1900    | 2000    | M42 stars    | 2982  | Electronic           | Guide 8/9 readable        |
| 2008 | Galactic Dark Neb.    | 13   | 1950    | 2000    | Dark nebulae | 1456  | Electronic           | Incl. 349 Barnard nebulae |
| 2011 | Photom. cat. of M42   | 1    | 1950    | 2000    | M42 stars    | 16398 | Electronic           | Guide 8/9 readable        |
| 2012 | Late-M stars (SA 158) | 9    | —       | 2000    | M5+ stars    | 920   | Electronic           | 9 sq deg field in Sgr     |

## S = Sources

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## Related Files

Source 8: See Vizier - CDS catalogue V/44. 2322 stars, but no equatorial coordinates.

Source 12: For precise J2000 coordinates, go to <ftp://ftp.lowell.edu/pub/bas/starcats/sanduleak.lmc>

My familiarity with classical works such the CoD attracted the attention of Dr Wayne H Warren of the Astronomical Data Centre at NASA in 1981, and in that year I assisted in proofreading three of the zones of the CoD, which were being computerized. I wrote an extensive overview of the BD, CoD and CPD for NACAA XIV (Melbourne 1990) and this was published in the Proceedings.

## 2000s Era

With the retirement of Frank Bateson in 2004 the old-style VSS went into a state of suspension or hiatus. It seemed an opportune time to summarise the history and achievements of the VSS. This has now been covered in at least two places (Morel and Plummer 2009; Plummer and Morel 2010), with special reference to the work on charts and sequences.

## Files for download

A number of my files, especially some that are listed above, are available for download from the VSS website. Go to <http://www.variablestarssouth.org/> and click on "Information & Resources", then "Catalogues & Databases".

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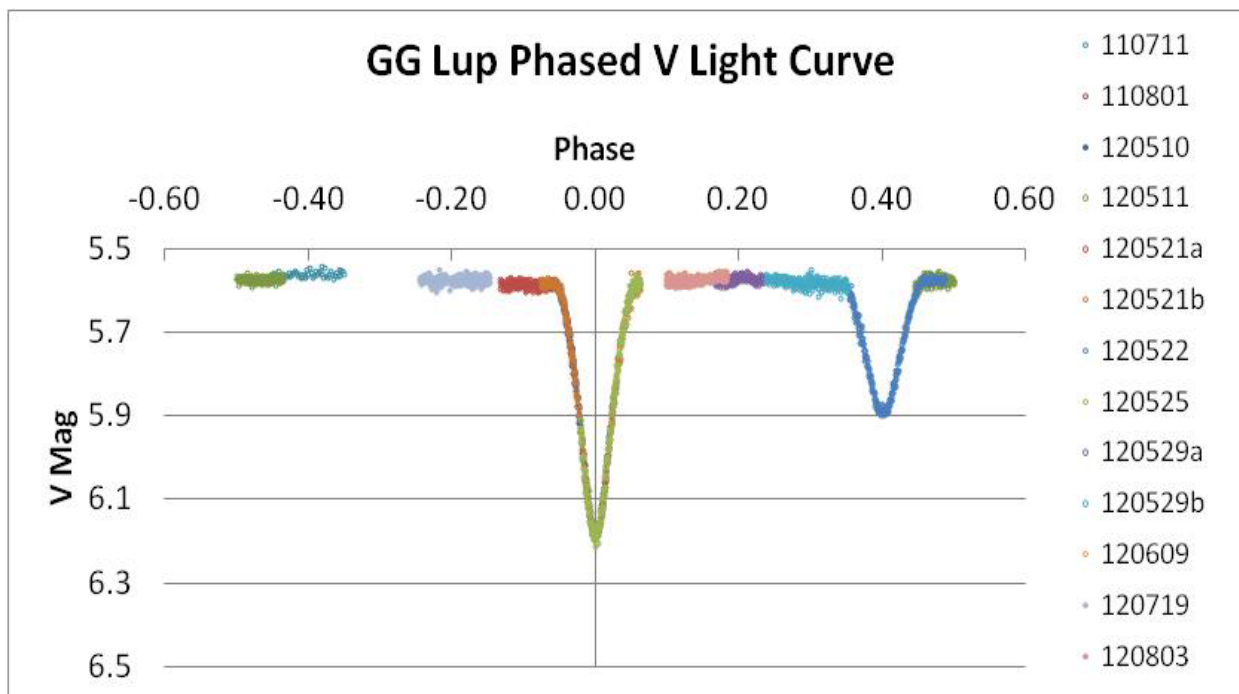
## Southern binaries DSLR project update - *Mark Blackford*

mblackford1@bigpond.com

Since the last VSS Newsletter 9 eclipses of 7 targets stars have been observed (see table below). I lost over a month of observing after I managed to break my Canon 450D DSLR. I now have a new Canon 600D and a Canon 200mm f2.8 lens which have been performing very well for photometry.

| Target   | Const | Type                    |
|----------|-------|-------------------------|
| V0831    | Cen   | Secondary               |
| $\delta$ | Cap   | Primary                 |
| V0486    | Car   | Primary                 |
| GG       | Lup   | Primary & 2 x secondary |
| $\eta$   | Mus   | Primary                 |
| $\zeta$  | Phe   | Secondary               |
| V1647    | Sgr   | Primary                 |

Out-of-eclipse time series were also recorded on a number of nights for GG Lup and  $\eta$  Mus. When completed the light curves will be modelled to determine orbital and intrinsic parameters of the component stars in each binary. Plotted below is the near complete V mag light curve of GG Lup. The secondary eclipse is displaced from phase 0.5 due to the eccentric orbit ( $e = 0.150$ ). Apical motion has caused the secondary eclipse to change from phase 0.51 in 1985 (Andersen, et al. 1993) to phase 0.40 in 2012.



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Andersen, J., Claussen, J.V., and Gimenez, A., Astron. Astrophys. 277, 439-451, 1993



The 2012 RASNZ Annual Conference was held in Carterton, in the Wairarapa region on the North Island of New Zealand, from June 15 to 17. The conference had a strong emphasis on the history of astronomy, not least prompted by the Transit of Venus on May 6, 2012. The only item related to variable stars was a poster co-authored by VSS members Roger Butland, Roland Idaczyk, Mark Blackford and Ed Budding entitled Recent Discoveries about  $\eta$  Muscae. The following summary is based on my presentation of the poster's highlights during the poster session at the recent conference.

### Recent Discoveries about $\eta$ Muscae

Poster by R. Butland, R. Idaczyk, M. Blackford, E. Budding

#### Abstract

We present updated developments with the 'Southern Binaries Programme' (Budding 2008), paying particular attention to the multiple star  $\eta$  Mus. Recent developments include advances in accurate radial velocity determinations, the use of DSLR techniques for accurate times of minimum light, and image-stacking techniques for new astrometry. Our group announced the discovery of a new (low mass) component to  $\eta$  Mus in the last year.

#### Spectroscopy & modelling

Spectral data was obtained using the HERCULES spectrograph (Skuljan 2007) on the 1-metre McLellan Telescope at Mount John University Observatory. Neutral helium profile fitting shows the substantially larger width for the secondary Ab-component (figure 1). This measurement implies a higher spin surface velocity compared to the Aa-component, but we would expect both stars' spin to be locked to the orbital period. Perhaps the primary is on the main sequence but in contrast, the secondary has yet to join the main sequence and is still radially expanded. This interpretation is supported by stellar evolution modelling by Siess(2000) and relevant interpolated data is shown in figure 2.

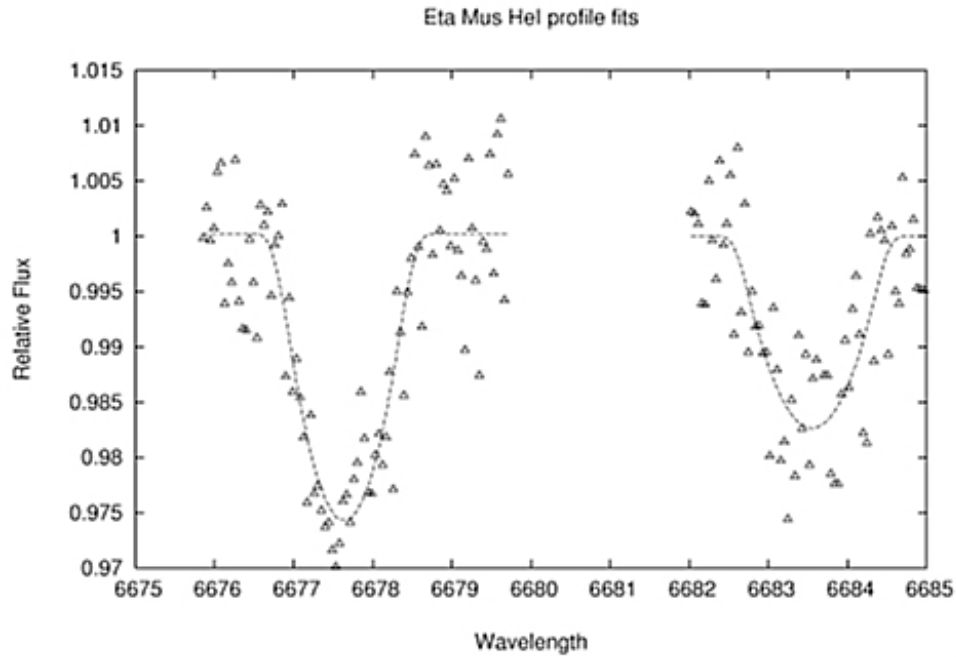


Figure 1: He-I profile fitting showing substantially larger width for the secondary component  $\eta$  Mus Ab.

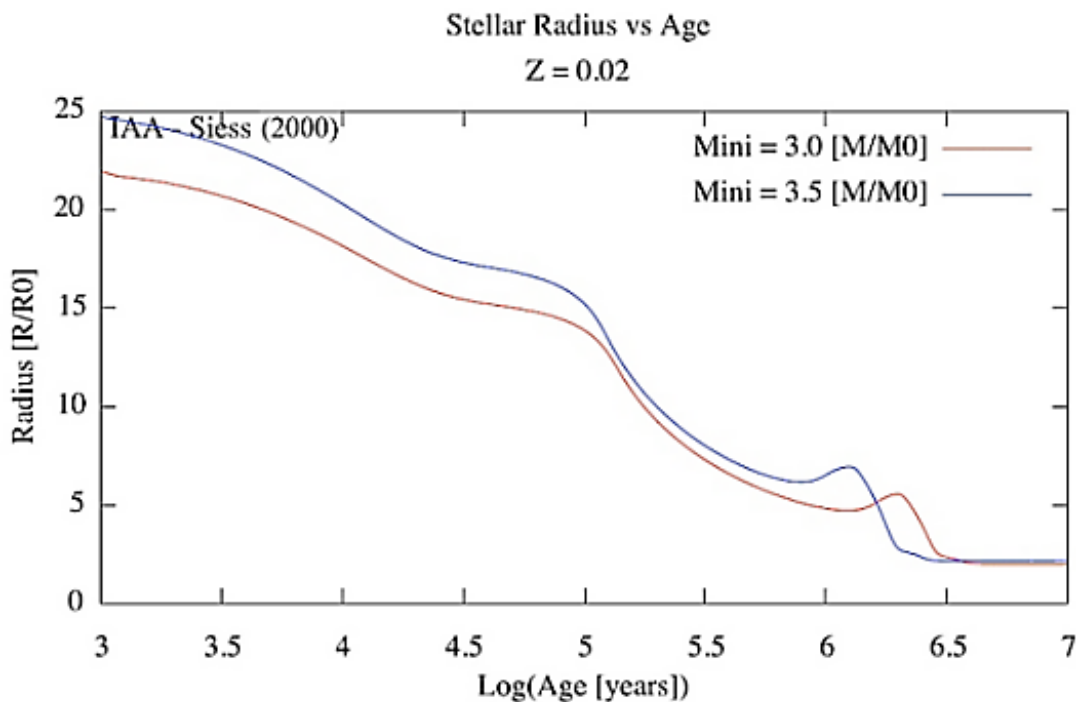


Figure 2: Stellar evolutionary model after Siess (2000) for initial masses of 3.0 and 3.5 solar masses. Note in particular the radius expansion just prior to the stars reaching the main sequence with the less massive component lagging slightly behind. This method also shows that the radius of the less massive B-component can exceed that of the A-component for about half a million years. This is potentially what we are observing.

## Spectroscopy & photometry

A difference between the  $\gamma$ -velocities\* of the components  $\eta$  Mus A and B had previously been interpreted as evidence that the B-component was not gravitationally bound to  $\eta$  Mus A (Baki *et al.* 2007). Using data of 2006 (Baki *et al.*), 2010 and 2011 (Budding & Butland), we created a preliminary model for

\* The gamma ( $\gamma$ ) velocity is just the radial velocity of the centre of mass of the binary system in relation to the observer.

the  $\gamma$ -velocity variation of  $\eta$  Muscae (figure 3). This model for the A-components  $\gamma$ -velocity variation indicates the presence of a D-component with a period of about 5 years in an elliptical orbit (Butland & Budding 2011).

Our position is that the  $\gamma$ -velocity difference between A and B is caused by a periodic change of the  $\gamma$ -velocity of the A-component and that the B-component is indeed part of the  $\eta$  Muscae system.

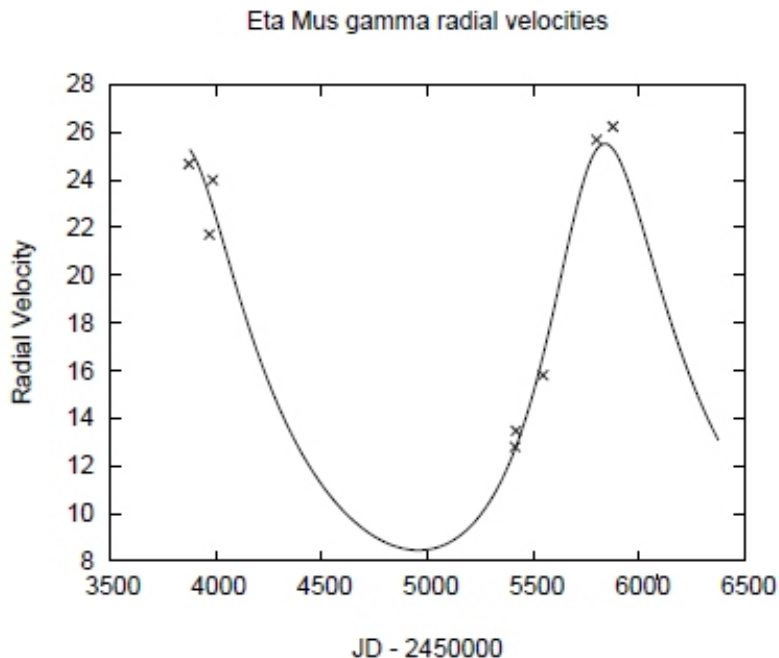


Figure 3: Preliminary model for the  $\gamma$ -velocity variation of Muscae.

New DSLR-photometry was obtained in 2011 and 2012 (Blackford) as part of the VSS Southern Binaries Programme (Blackford 2011, 2012). This data shows times of minima currently lagging behind predictions, which is in agreement with our  $\gamma$ -velocity model. This lag is expected to increase until about October 2012. Then the lag should decrease and turn into a lead until about 2015.

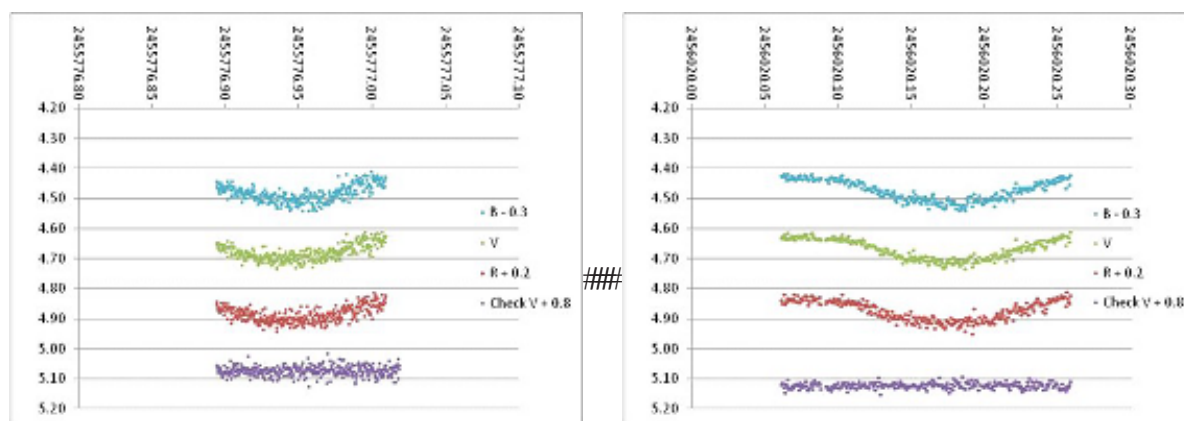


Figure 4: Examples of light-curves obtained in 2011 and 2012 via DSLR-photometry. Left: Primary eclipse (V) HJD 2455776.94567(19). Right: Secondary eclipse (V) HJD 2456020.17638(60).

The eclipse minima shown here were obtained using the calibrated DSLR techniques being pioneered in the VSS Southern Binaries Programme (Blackford & Schrader 2011). Timings are expected to be accurate to  $\sim 0.001$  day. The expected amplitude of the variation associated with  $\eta$  Mus D is about 10 times this value.

## ‘Lucky Imaging’ & astrometry

Using the Crows Nest Observatory’s 14-inch telescope, a new approach to obtain astrometry was attempted using ‘Lucky Imaging’, whereby the target star was video-recorded (unfiltered) and the best frames registered and stacked. A first result of 2010 at f/6.3 is shown in figure 5 (Idaczyk).

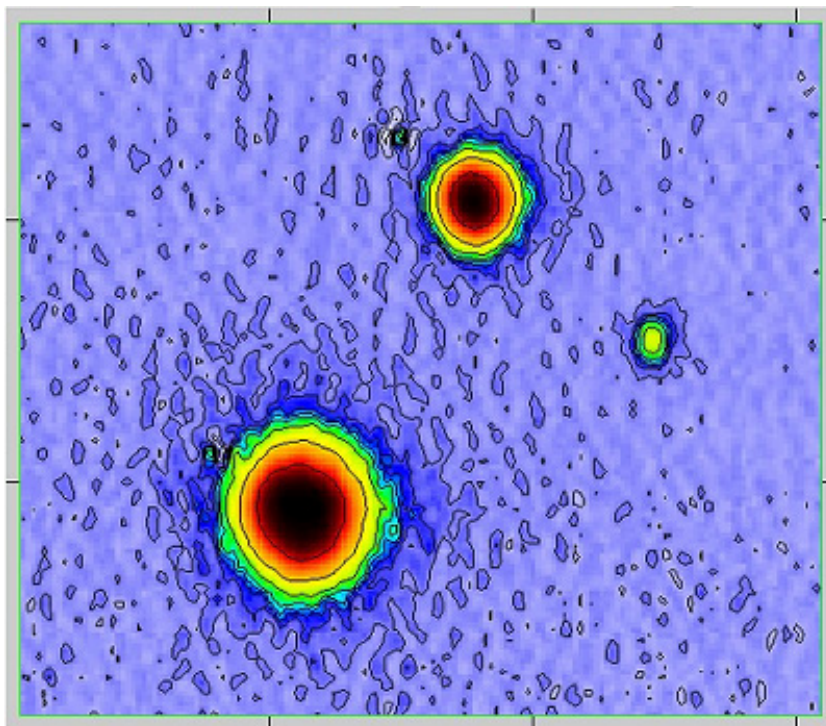


*Figure 5: The  $\eta$  Mus system with components A (lower left) and B (top). The fainter star to the right is UCAC3 045-151165 with a J-mag of 11.2. This compares to J-magnitudes of 4.95 and 7.01 for the A and B components. The faintest stars identified in the pictured field have J-magnitudes of 12.24 (next to  $\eta$  Mus A) and 13.99 (next to  $\eta$  Mus B). Both are less than 20 arcsec from the centre of the respective neighbouring bright star.*

The rationale for the ‘Lucky Imaging’ approach was to achieve an increased signal-to-noise ratio, a higher resolution and to reach down to fainter objects. The problem of bright stars overpowering very close faint objects still remains, as the subject of this observation,  $\eta$  Mus C, is about magnitude 11 and is separated by just under 3 arcsec from  $\eta$  Mus A. To overcome this difficulty, a further refinement of the procedure was introduced in 2012, whereby  $\eta$  Mus and a single comparison star of similar magnitude ( $\mu$  Mus) were both recorded at f/20, with the intention of subtracting the comparison star from  $\eta$  Mus A to reveal any faint underlying signals. This step was inspired by Olsen (2011). This method should allow for the resolution of very small separation angles and thereby reveal the close-by C-component. The 2012 effort could not provide the required quality of data and therefore did not result in new astrometry data.

However, the 2010 results, despite revealing some systemic noise patterns, encourage further exploration of this technique. Excellent seeing conditions will be essential for this technique to succeed. Therefore we encourage other members of the community, who may have suitable instrumentation and favourable observing conditions, to apply and advance this approach.

## Conclusion

This work provides a satisfactory resolution of outstanding issues raised by the rotational speeds of the components of the close binary  $\eta$  Mus A, and its apparent systemic radial velocity variations, within the context of our ongoing programme of studies of young stars.

## Acknowledgements

We thank the Telescope Allocation Committee of the Mt John University Observatory, UC, for generous allocations of time for the Southern Binaries Programme (Budding 2008), which has also been supported, in part by the Turkish Science Research Council, as well as the VSS Section of the RASNZ. The modelling used the online tools at [www.astro.ulb.ac.be/~siess/WWWTools/Isochrones](http://www.astro.ulb.ac.be/~siess/WWWTools/Isochrones).

This research made use of the SIMBAD and VizieR services, operated by CDS, Strasbourg, France.

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## O - C diagram for $\eta$ Muscae

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mblackford1@bigpond.com

Mark Blackford  
Roger Butland  
Ed Budding

The multiple star system  $\eta$  Muscae (HD 114911, HIP 64661, HR 4993) includes a bright eclipsing binary (V  $\sim$ 4.8-4.9, period  $\sim$ 2.39 d) which is being monitored as part of the VSS Southern Binaries DSLR Project. The eclipsing binary is termed star A, and the individual components can be referred to as stars Aa and Ab.

The system also includes a V  $\sim$ 7.3 visual companion, star B, at about 58 arcsec and a 10th mag (J band) pre-main-sequence companion, star C, at  $\sim$ 3 arcsec. The periods of stars B and C are estimated to be about 200,000 years (Tokovinin 1997) and 3,000 years (Butland and Budding 2011), respectively. These are far too long to have a measurable light time effect (LITE) on eclipse times of minima (ToM), at least in our lifetimes anyway.

However star D, recently deduced from radial velocity measurements as described in the previous article, is expected to induce observable LITE on star A eclipse times of minima.

Figure 1 shows the Observed minus Calculated diagram constructed from ToMs of five eclipses observed by DSLR since June 2011. Calculated ToMs are based on the ephemeris from Bakis et al (2007), period 2.3963161 days and epoch 2453974.9160 HJD. The observed ToMs differ by up to  $\sim$ 9 minutes from calculated values, significantly greater than the estimated measurement error.

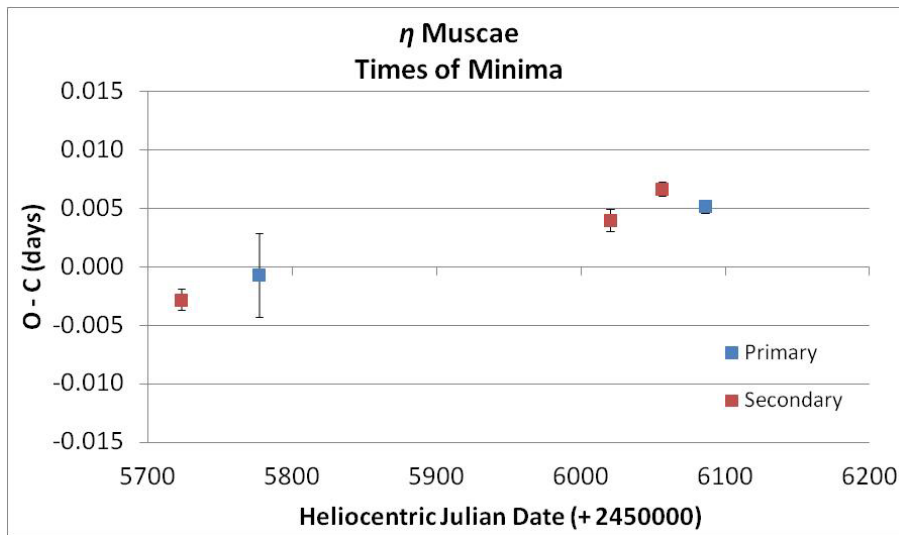


Figure 1: Observed - Calculated times of minimum of two primary (blue) and three secondary (red) eclipses of  $\eta$  Muscae recorded to date.

Integration of the preliminary model  $\gamma$ -velocity curve shown in Figure 3 of the previous article gives the displacement distance of the eclipsing component star A from the centre of mass of the system. From this we can calculate the expected LITE as a function of star D orbital phase as shown by the blue curve in Figure 2 below. Also plotted are measured O-C values for the five eclipses so far recorded.

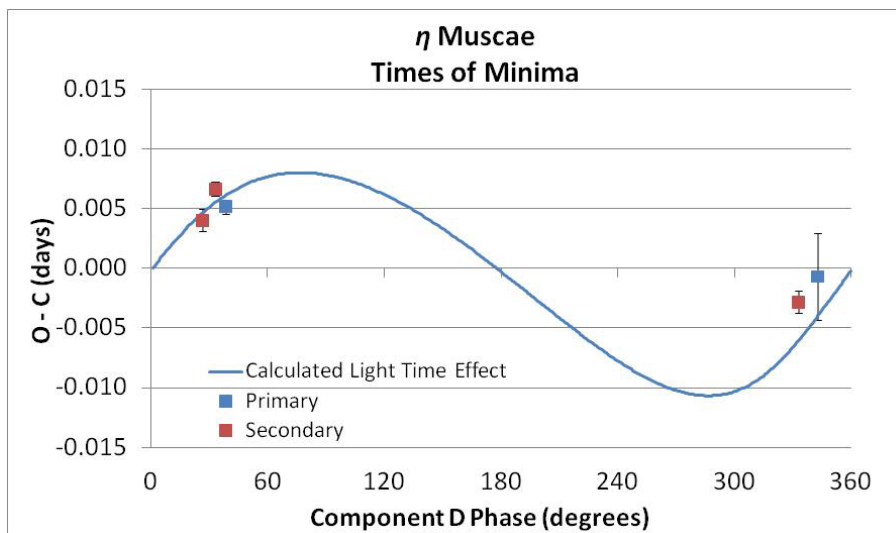


Figure 2: O-C diagram of  $\eta$  Muscae times of minimum as a function of Star D orbital phase.

It must be remembered that period, phase and overall shape of the  $\gamma$ -velocity variation model, and hence the calculated LITE curve in Figure 2, are preliminary estimates. Nevertheless, observed minima changed from leading to lagging the calculated times at about the anticipated date. Thus two independent techniques, spectroscopy (radial velocities) and photometry (eclipse timing), are giving reasonably consistent results.

Continued eclipse and radial velocity monitoring in coming years will lead to further refinement of star D's orbital parameters. A detailed photometry programme is also underway which we hope will lead to a better understanding of the absolute parameters of the eclipsing components.

## References:

- Bakis, V. et al., 2007, MNRAS, 382, 609-620  
 Butland, R.J. & Budding, E., 2011, IBVS, 6004  
 Tokovinin, A. A. 1997, A&AS, 124, 75-84

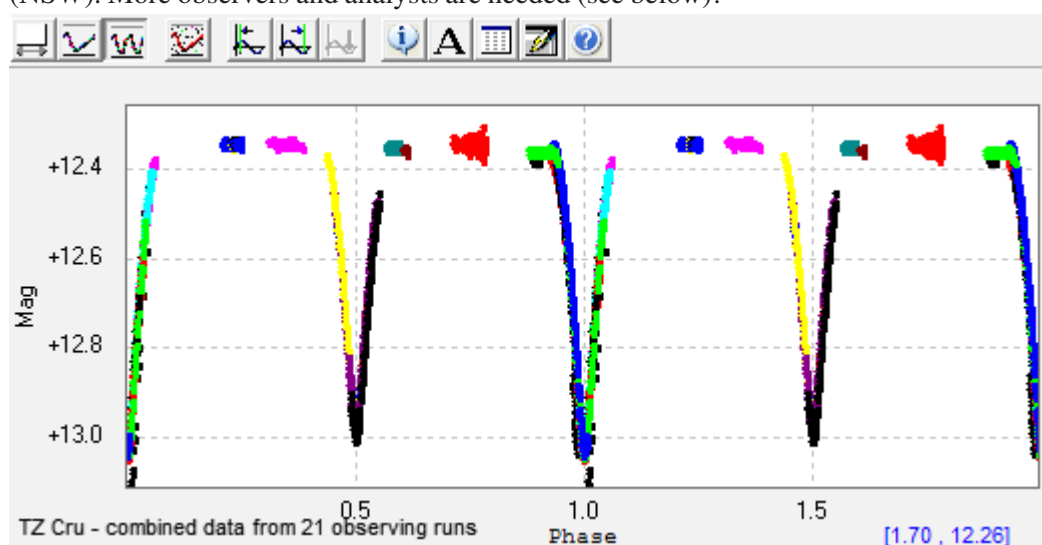
## SPADES – Results rolling in – *Tom Richards*

tom.richards@variablestarssouth.org

Project leaders: Simon O'Toole (Australian Astronomical Observatory) and Tom Richards (VSS)

SPADES is a pro-am collaboration that's Searching for Planets Around Detached Eclipsing Stars. The systems in question are 156 carefully selected southern (and a few equatorial) EA binaries. Read about the project on our website [www.variablestarssouth.org](http://www.variablestarssouth.org) at Research Projects > SPADES.

Margaret Streamer (NSW) and David Moriarty (Qld) have provided the vast bulk of photometric observations to date; other observers are Peter Starr (NSW), Tom Richards (Victoria), Steve Kerr (Qld), Yenal Ogmen (North Cyprus), Dave Herald (NSW), and Bill Allen (New Zealand). A potentially most significant development is the contribution of spectra from Terry Bohlson (NSW) and Bernard Heathcote (Victoria). Analysts are Col Bembrick (NSW), Margaret Streamer, Randal McIntosh (NZ), Tom Richards, David Moriarty, George Stockham (ACT), Roland Idaczyk (NZ), Mark Blackford (NSW), and Jeff Byron (NSW). More observers and analysts are needed (see below)!



*A sample phase diagram created using Peranso software.*

In the last issue I mentioned we were streamlining the SPADES processing pipeline and documentation formats, as a result of discussions at NACAA over Easter. That is now completely in place and working extremely well. All earlier data has been converted to the new format.

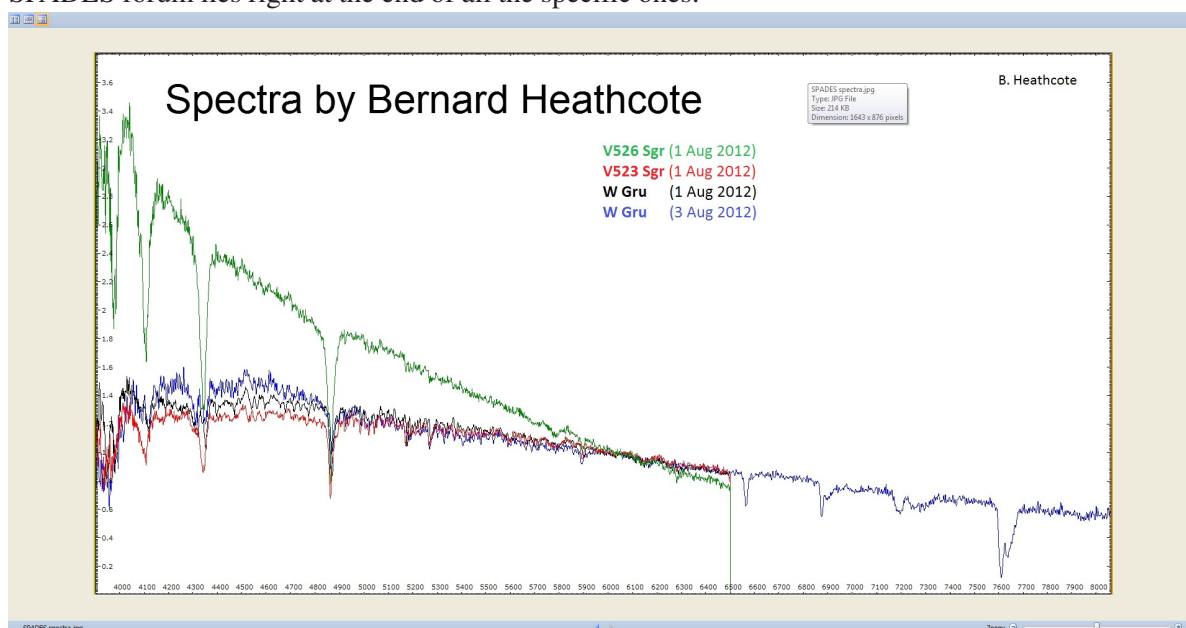
- Observers have new guidelines and an updated observation report form – in the SPADES web pages, see menu items Observing Guide and Observation Report Form. They also have, thanks to Margaret Streamer, a data file just for SPADES to use in David Motl's Ephemerides program, available at Ephemerides File. This is periodically updated as we determine better light elements (LEs). Margaret will always notify updates on the SPADES forum and the VSS egroup.
- Analysts now have a much slicker procedure and associated forms; see menu items Results Form, and Analysis Procedure I. This takes the analysis as far as measuring times of minima, and when enough ToMs are available, performing a regression on them to obtain LEs. The analysis is done in PERANSO and Excel.

The output of this is a number of files for each system under study, found at SPADES Observations under the names of each system. They are:

- Each observation form submitted by observers;
- The updated results form, listing published LE sets (even if poor) and the best LE set the analyst has found so far, ToMs measured from our submitted data, and a regression giving new linear LEs from our ToM data.

- A PERANSO file containing all data obtained for the system to date subdivided by observation set; where minima measurements, light curve combining, and other procedures are carried out. Download this to play with the results yourself!
- An HJD-data text file listing the HJD and V magnitude with error of every observation made. This is output from the PERANSO file for the system and has a fourth Boolean column indicating if the observation is active or deactivated (eg because it's plainly erroneous).

In addition, all observers are required to upload their observational data to the AAVSO, thus ensuring that JD data is available for analysis if wanted. More informal commentary on each system can be found in the forums on our website for each system. Go to the SPADES menu item SPADES Forum and find the one for the system. But beware, due to a bug in the latest release of the Kunena Forum software we are unable to maintain the individual forums, named by the GCVS name for each target, in lexical order. Recently created ones languish in an unsorted heap at the end. And for some inexplicable reason, the general SPADES forum lies right at the end of all the specific ones.



### *Sample spectra of two SPADES candidates*

We now have ToM data on 75 systems and counting – often multiple ToMs. That’s about half the systems in the project. Where we have three or more ToMs (namely in seven systems) we have derived linear LEs with uncertainties.

You will find the data on minima, light elements and spectra collected in a table on our website at Info & Resources > Catalogues and Databases. It is combined with data from other VSS eclipsing binary projects and will have frequent updates. See article about this database elsewhere in this Newsletter.

These results, though early in the overall SPADES process, are very significant for several reasons.

1. For nearly all of these systems they provide the only empirically determined eclipse data obtained in recent years (the main exception is SuperWASP and it only covers a few of our targets). The ASAS3 cadence is far too slow to obtain the light curve of an individual eclipse.
2. For most of the systems, existing light elements provide badly erroneous ephemeris predictions (ie half an hour error or more at the present epoch). This can often be true of light elements that have been calculated from inspection of ASAS3 data, which can be very good at providing periods, but very poor at ToM measurements. Surprisingly, it can be true of SuperWASP in some cases.
3. In several cases there is a “P/2P ambiguity” in the data, including historical data such as ASAS3. Some authors will publish a period twice that of others. Are we seeing two eclipses of effectively equal depth, or a good primary plus a very small, perhaps unnoticed, secondary? This can sometimes be very hard to pin down with just photometric data. We have resolved this in some cases, but not yet in others.

## SPADES on Gemini South

We have obtained telescope time on the Gemini South 8-metre on Cerro Pachon in Chile to do very high resolution imaging of the following fourteen SPADES target systems:

VZ Hya, AT For, AO Vel, HU Hya, W Gru, V523 Sgr, CE Scl, TU CMa, V526 Sgr, TT Hor, TZ CMa, V521 Mon, CW Eri, and V635 Mon.

The principal investigator is Simon O'Toole (AAO), and co-investigators are Pierre Maxted (Keele Uni, UK) and Tom Richards, David Moriarty and Margaret Streamer (VSS). Pity we don't have to go there to run the telescope!



We will use the Near-Infrared Coronagraphic Imager on Gemini South to test the claim that essentially all close binary stars with orbital periods less than three days have extra companions on wider orbits. We have selected a sample of bright short-period binaries from the SPADES project target list, and will search for additional low-mass stellar and substellar companions. A significant number of non-detections will challenge the multiplicity claim. Our results will

also be used to check the suitability of targets on the SPADES list.

NICI combines an 85-element curvature adaptive optics system, a dedicated Lyot coronagraph, and a specialized dual-channel camera into a single instrument optimized to detect large Jovian-type planets around nearby stars. The imaging scale is 18 mas/pix and field of view is 18x18 arcsec. Read all about it at [www.gemini.edu](http://www.gemini.edu).

It is most important for SPADES observers to give priority to photometry on these systems. Several of them are well placed for observation during southern spring (see below). Ideally we want several primary and secondary eclipses, and complete light curves.

### More SPADES team members wanted!

If you have a 30-cm or bigger scope (or even a bit smaller!) with a CCD camera and Johnson V filter, we want you! And if you're comfortable with Excel and PERANSO, we want you! This is a big project with immediate results in the form of light elements, and long term results in the form of planetary discoveries. And a lot in-between. Ideally we want three or more really well-observed minima on each of our targets in each observing season. So there's 3x156=468 hours-long observing runs wanted in each year (936 if you include the secondary eclipses). Plus the analysts to process the observational data and derive ToMs and LEs. And there's more work beyond all that too!

In the southern spring months (September through November, and throw in the rest of August) systems between 22 h and 5 h RA are best placed for observation, culminating at midnight at some time in that period. They are (the priority Gemini targets are bolded):

RU Gru, **W Gru**, **CE Scl**, CT Phe, **AT For**, **CW Eri**, **TT Hor**, RR Men, V648 Ori, ES Ori, and RV Pic.

Not many, because it's a barren part of the sky, so we should be able to give them very dense coverage at all phases! Get in touch with me if you decide to join the SPADES team and give them a go!



# The VSS Eclipsing Binary minima, light elements and spectra database – *Tom Richards*

tom.richards@VariableStarsSouth.org

## Description

Three VSS projects (Equatorial Eclipsing Binaries, SPADES and Southern Binaries DSLR) are collecting data on southern eclipsing binaries. Whilst the goals and methods of these projects differ, they have in common producing measurements of minima, calculations of linear light elements, and classification of spectra – all derived from VSS project observations.

These results are being combined into a downloadable CSV text data table on our website, which will be updated frequently. Updates are notified on the Variable Stars South Google Group (<https://groups.google.com/forum/?fromgroups#!forum/variablestarssouth>).

|    | A                                                                          | B    | C              | D        | E     | F                                    | G             | H        | I          | J        | K        | L       |
|----|----------------------------------------------------------------------------|------|----------------|----------|-------|--------------------------------------|---------------|----------|------------|----------|----------|---------|
| 1  | VSS Eclipsing Binary Database                                              |      |                |          |       |                                      |               |          |            |          |          |         |
| 2  | Release 1 - 2012-08-20                                                     |      |                |          |       |                                      |               |          |            |          |          |         |
| 3  | <a href="http://www.variablestarssouth.org">www.variablestarssouth.org</a> |      |                |          |       |                                      |               |          |            |          |          |         |
| 4  | System                                                                     | Type | HJD_min        | Error    | Vmag  | Notes                                | E0            | E0 error | P          | P error  | Spectrum | Project |
| 43 | Cru AA                                                                     | II   | 2455996.170181 | 0.000071 | 11.44 |                                      |               |          |            |          |          | SPADES  |
| 44 | Cru AA                                                                     | I    | 2456070.02838  | 0.00145  | 11.55 |                                      | 2455732.92888 | 0.00069  | 3.78764306 | 0.000020 |          | SPADES  |
| 45 | Cru AA                                                                     | II   | 2456124.94859  | 0.00009  | 11.45 |                                      | 2455732.92896 | 0.00053  | 3.78764310 | 0.000020 |          | SPADES  |
| 46 | Cru AF                                                                     | I    | 2455774.85     | 0.01     | 9.93  | See forum re possible double period. |               |          |            |          |          | SPADES  |
| 47 | Cru AF                                                                     | I    | 2455791.909935 | 0.000029 | 9.90  |                                      |               |          |            |          |          | SPADES  |
| 48 | Cru AF                                                                     | I    | 2455800.00000  | 0.00017  | 10.63 |                                      |               |          |            |          |          | SPADES  |

*Sample output of the eclipsing binaries database*

## Downloads

Download the database in CSV text format, together with its Readme, from our website at Info & Resources > Catalogues & Databases. You can also access it at Info & Resources > Eclipsing Binaries and VSS > VSS Eclipsing Binary Database.

## Resetting Lost Passwords – *David O'Driscoll*

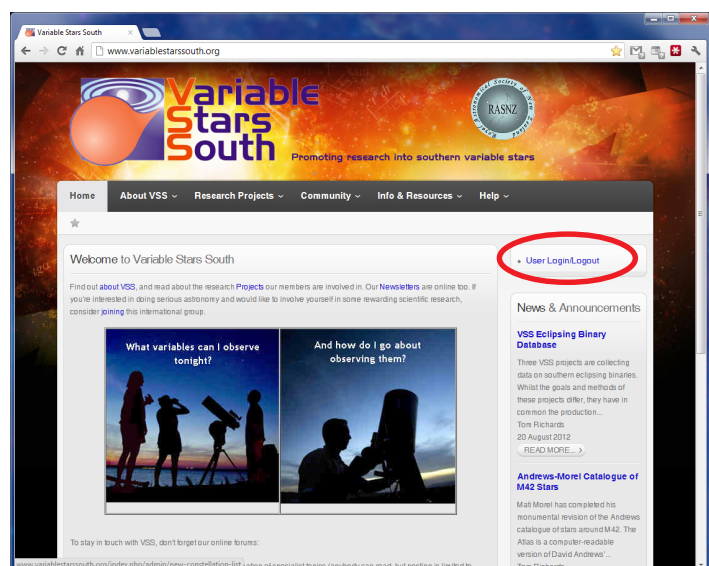
As webmaster, the single most common request I get is how to reset a lost password! Believe me, I feel your pain. After 30 years in IT, I have had more user IDs than I care to think about, and even now I lose the odd password!

## Getting started

The first place to start is the home page of the VSS website. From there you should click the “User Login/Logout” link (see Figure 1).

*Figure 1: The home page of the VSS website*

When you see the prompt for your user ID and password, click the link “Forgot login?” as highlighted in Figure 2.



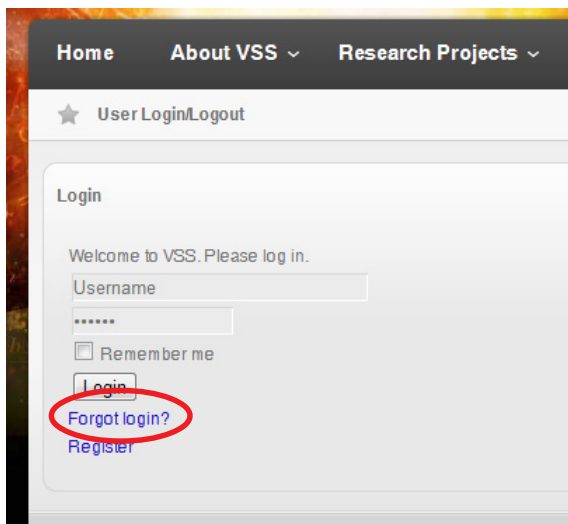


*Figure 2: What to do when you can't remember!*

This will then ask you whether you need your User ID or password. You have to pick one or the other, as shown in Figure 3.

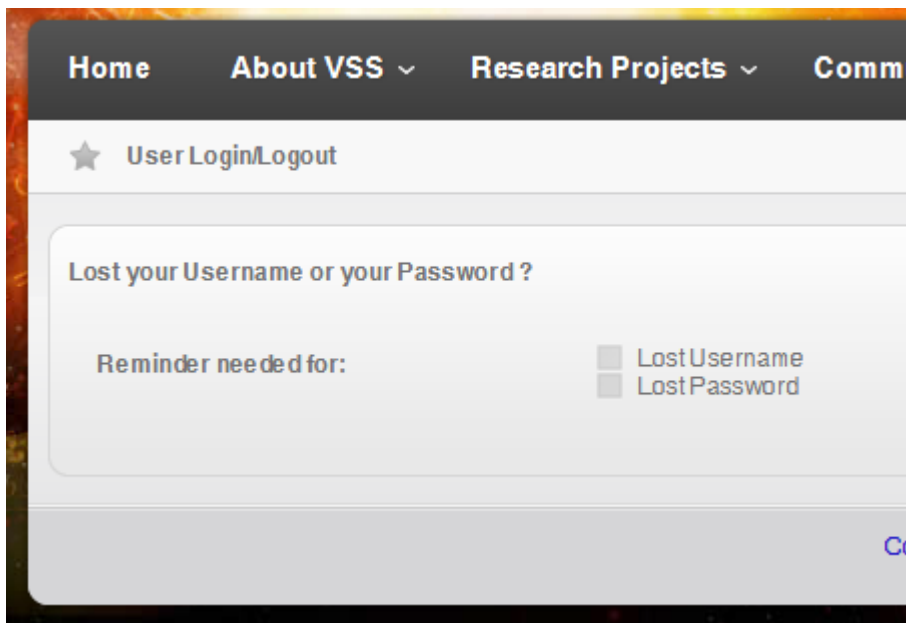
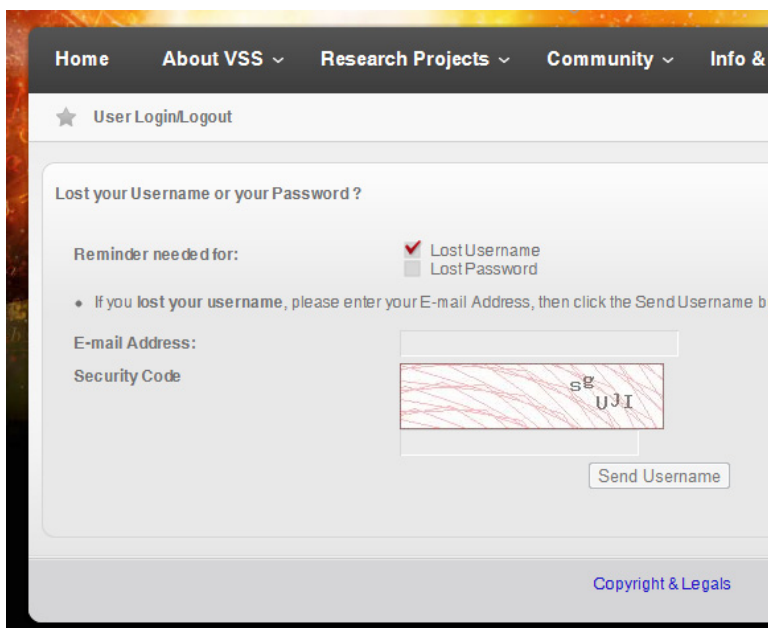


*Figure 3: Selecting what you need to know*

Tick the grey box next to your required option, and you will see either Figure 4 or Figure 5.



## Getting your User ID

*Figure 4: How to get your user ID*

If you need your user ID, you must specify the email address to which it should be sent. This must be the email address you used when you registered on the site or as a VSS member. You will also be asked for a security code – one of those annoyingly hard to read codes that is designed to prove you are a human being, not an Internet website crawler! Click the button to have the system send the email.

## Getting a password

Figure 5: Getting your password

Home About VSS Research Projects Community Info &

★ User Login/Logout

Lost your Username or your Password ?

Reminder needed for: ☐ Lost Username ☒ Lost Password

- If you lost your password but know your username, please enter your Username and your E-mail Address. We will email you a new password shortly. Use this new password to access the site.

Username:

E-mail Address:

Security Code:

[Copyright & Legals](#)

If you have lost your password, then you will see Figure 5 above. This requires you to enter your user ID, your registered email and the security code.

## The email you'll get

The type of email you'll get will look something like the following:

The user account firstname.lastname has this email associated with it.

A web user from <http://www.variablestarssouth.org> has just requested that a new password be sent.

Your New Password is: w6h4cbkm

If you didn't ask for this, don't worry. You are seeing this message, not them. If this was an error just log in with your new password and then change your password to what you would like it to be.

NOTE: This email was automatically generated from Variable Stars South (<http://www.variablestarssouth.org>).

You can then use your password to log in. Once you have logged in, you might like to set it to something easier to remember.

## If all else fails!

If for any reason the steps above don't work, you've changed your email address or you just want a helping hand, fear not! Drop me an email at [webmaster@variablestarssouth.org](mailto:webmaster@variablestarssouth.org) and I can help you out. I can log into the system's backend to set a temporary password. The important thing is to get you accessing the system!

## AAVSO CCD school - *Phil Evans*

phil@astrofizz.org

At the end of July and beginning of August I attended the AAVSO CCD School run by Dr Arne Hendon, the director of the AAVSO. The school was held at Tufts University in Boston, MA and was a weeklong intensive course that had the primary aim of making the participants better photometrists. Time will tell if it succeeded in my case.

We were accommodated and fed in Carmichael Hall at the Medford campus of Tufts while the lectures were held in one of the seminar rooms at Paige Hall - a 10 minute walk from Carmichael across some rather beautiful grounds.

Our rooms were not luxurious and I heard more than a few grumbles about them not being up to expectations. Having to share bathrooms and showers was also a concern of many – in my case I had to walk 120 paces to reach the men's bathroom and showers on my floor. The aircon was so noisy I had to turn it off at night - good job I'm used to nighttime temperatures in excess of 27°C.



*My rather spartan room at Carmichael Hall.*

There were no complaints about the food which was plentiful, interesting and well balanced.

The course began with an introduction by Arne of his career in astronomy and quickly moved on to descriptions of the project work we were expected to tackle outside of lecture hours. We were each given a DVD with all the CCD frames for the various projects which included a crowded field, an exoplanet, a supernova decline, a GRB afterglow, a bright star and a cataclysmic variable. There followed a brief discussion of why amateur astronomy software was a great deal easier to use than that which the professionals use. There's no Maxim DL CCD program for most professional scopes, instead there's often only a hastily written hotchpotch of routines added to by successive post docs - and there's never a manual.

For photometry though, most professionals use IRAF and that was what Arne used throughout the course. IRAF is a vast collection of routines for almost anything you might want to do with a CCD frame, but it is command line driven and tedious to use. I think I'll stick with Maxim and Muniwin.

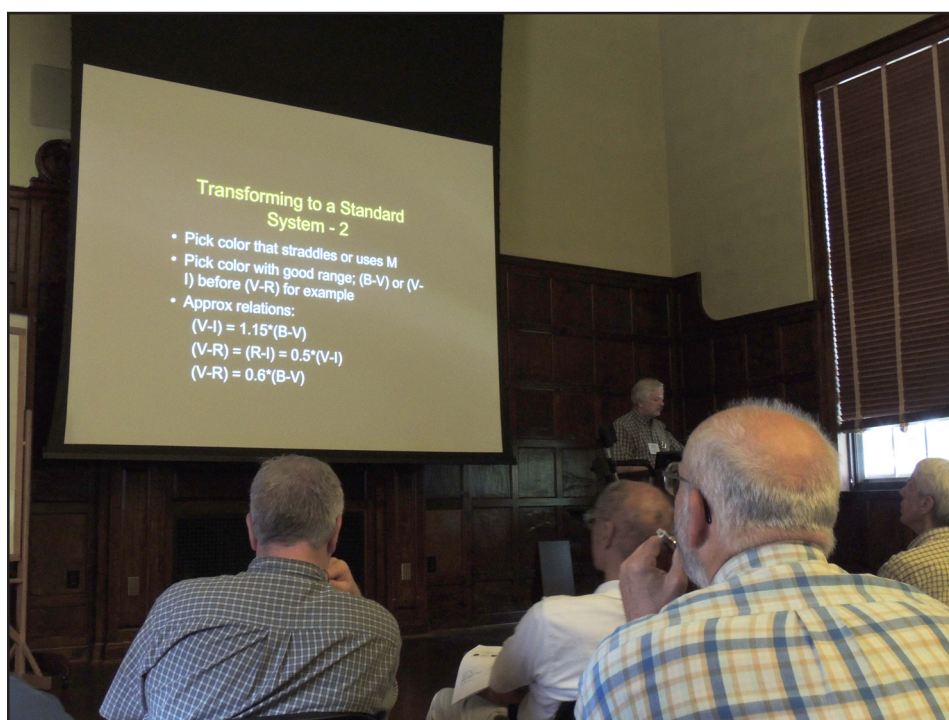
With the preliminaries out of the way we got down to discussions on filters, the advantages and disadvantages of coloured glass versus interference filters and in particular the problem of red leak with



*Morning break from the lectures. Left to right: Alan Sliski, Gary Walker, Sara Beck and Yenal Ogmen (check out the tattoo on Yenal's left arm).*

very red stars, and also the problem of emission line objects which cannot be transformed properly.

Our second topic was the detectors themselves and here we looked at construction, grading and defects,



*The school was conducted as a series of lectures by AAVSO director, Arne Hendon using Powerpoint presentations.*

compared front and backlit chips, thick and thinned chips, anti-blooming gates, charge transfer efficiency, quantum efficiency and well depth. This was followed by a brief look at mono and colour CCD cameras (including Foveon chips), near infra-red arrays (very expensive) and DSLRs. Arne was not impressed with most work done with DSLRs. We looked at observing defects including blooming, saturation, fringing and 'cosmic ray' hits. Here I was surprised

to learn that what most of us think are cosmic ray impacts on CCD frames are, in reality, radiation events from the background.

Topics 4, 5 & 6 took us through a trip through bias, darks, flat-fielding and a more advanced discussion of filters and filter systems especially relating to spectroscopy.

Arne left the next two topics, astrophysics I and astrophysics II, for the last day but unfortunately we never got around to them as we ran out of time. We did have time for time though and here we looked at the various ways of synchronising our computer clocks and using Maxim's shutter error measuring system.

Much of the remainder of the sessions was taken up demonstrating IRAF and the AAVSO's own photometry package VPHOT. To be honest they were of little help to me as VPHOT requires you to upload your images, which is fine if you have a fast connection and a substantial data cap, but I have neither. We lost quite a lot of time due to various computer problems, almost all caused by a slow internet connection as a guest on the Tufts WiFi system.

By the end of the week there were still several of the planned topics that we didn't have time to cover, nor did we have time to go over the homework projects. I would have preferred more time spent



*Ron Dantowitz, director of the Clay Centre Observatory, showed us around his magnificent facility. Photo by Jim Seargeant.*

on errors, uncertainties, transforming magnitudes to a standard system and the astrophysics of binary systems.

I would have liked some practical exercises whereby a tutor could have guided us, but the entire school was conducted as lectures and solely by Arne himself. Not everyone at the school was as inexperienced as me and I'm sure that some of the more experienced hands could have given one or two of the lectures themselves. Still, this was the first time the AAVSO had given such a course and I'm sure they'll make it even better next time.

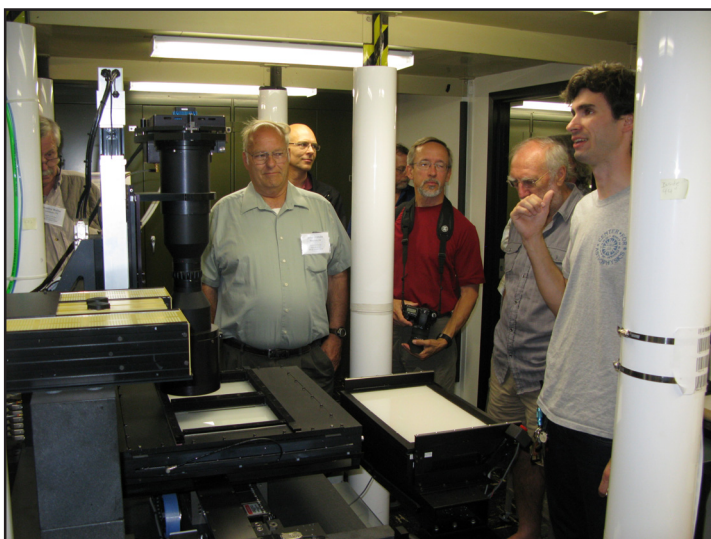
My isolation on the island where I live means I rarely get to meet other amateur astronomers, so for me one of the good aspects was the opportunity to meet and chat with so many photometrists. I was also very pleased to meet Yenal Ogmen from Cyprus who has contributed to some of the VSS campaigns and also to meet fellow antipodeans Greg Bolt from Perth and Peter Nelson from Victoria (and Peter's wife Gracie).

After the day's lectures our evening excursions were interesting. The first was to the Clay Centre at Dexter and Southfield schools. Did your high school have a 5-storey astronomy and science research building with a 25 inch scope on the roof inside a dome with active thermal control? Does your high school boast astronauts among its alumni? Does your school conduct experiments jointly with the ISS, NASA, MIT, USNO, the Russian and the Italian space agencies? Mine didn't but the kids at Dexter and Southfields do and they do it well.

Equally interesting was the visit to the Harvard College Observatory and the 9 inch Great Refractor. We also had a tour around the lab where the half million or so glass photographic plates taken by astronomers

in years gone by are being scanned and digitised.

It was a long way to travel to Boston for me - 36 hours - but I had relatives in the Boston area so I was able to visit them and justify the expense to my wife. Was it worth it? Yes, it was. I learned a lot that was new to me, I made new friends and I also learned that I have been doing nothing wrong in my photometry to date. Overall I'd give the course 8 out of ten, but I'm willing to bet that the next time it is held it would get the full ten.



*The plate scanner at the Harvard Astronomical Observatory. Left to right: Brad Walters (partially hidden), John Centala, Phil Sullivan (partially hidden), Rick Wagoner, Phil Evans and a staff member of the scanning team whose name completely escapes me. Photo by Jim Seargeant*



*It wasn't all lectures and homework as some of us managed to escape Hall and head for town and a restaurant on a few evenings. Left to right: Greg Bolt, Phil Evans, Gracie Nelson, Barbara Harris, Leslie Brown, Peter Nelson and John Pye.*

# Software Watch

## Aperture Photometry Tool

As its name suggest this program does aperture photometry and thats all it does, at present. I'm sure it will evolve in the future from a single frame application to a full-fledged time-series program.

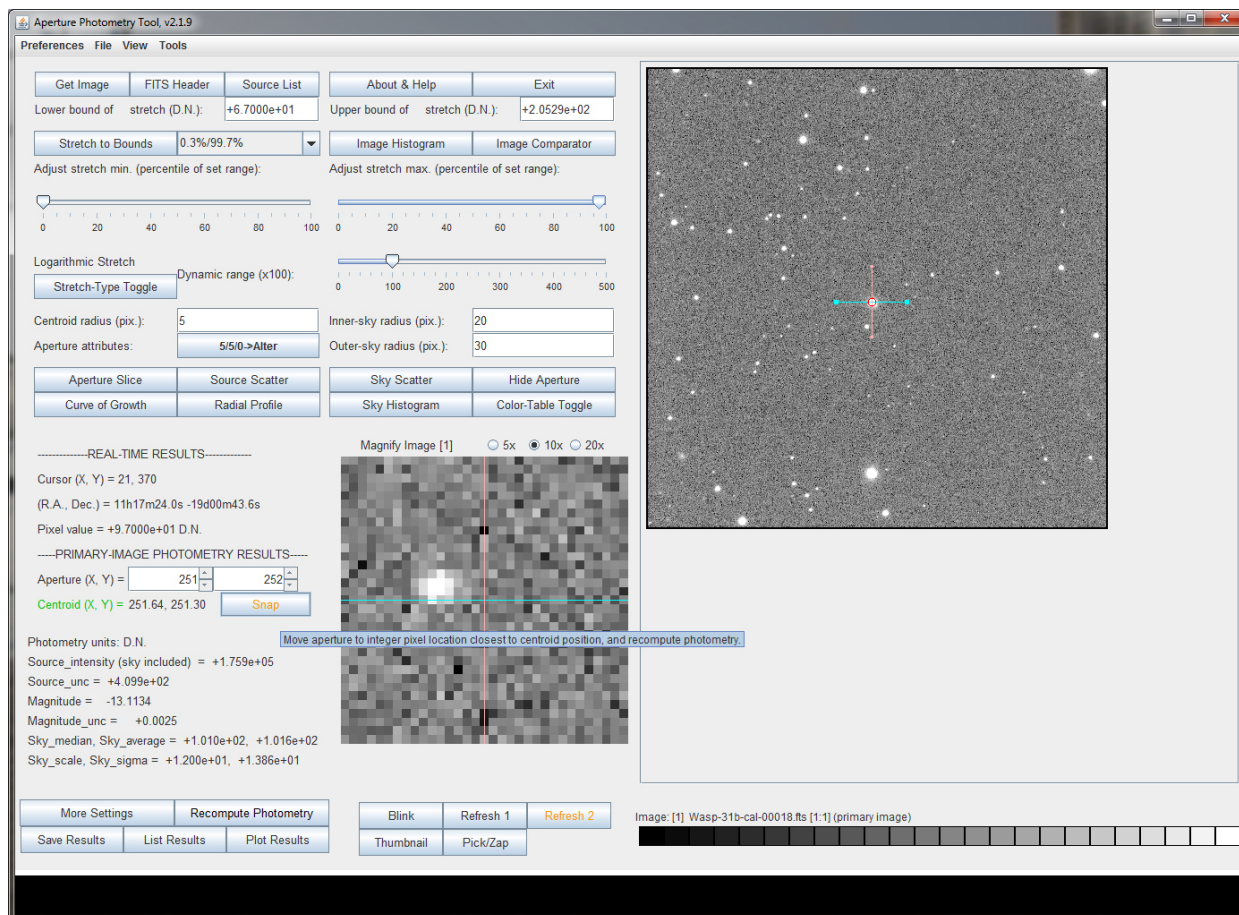
It is currently in version 2.1.9 and you can download it from:

<http://www.aperturephotometry.org/aptool/download/>

Here's the blurb from the web site:

*Aperture Photometry Tool (APT) is software for astronomical research, as well as for learning, visualizing and refining aperture-photometry analyses. Image overlays, graphical representations, statistics, models, options and controls for aperture-photometry calculations are brought together into a single package. Professional astronomers appreciate APT's rich set of features and functions, and you will, too. APT is free of charge under a license that limits its use to astronomical research and education. It is perfect for the science center, observatory, or classroom. Also, it is quite simply the best FITS-image viewer you will find.*

And here's a screen grab of it measuring a random image from my files:



It's a bit fiddly to install as you need to ensure you have an up-to-date version of the Java Runtime Environment and possibly setup your environment variables. Full instructions for doing this and execution instructions are given in the Software Documentation available on the web site. To use it you must run a batch file that brings up a command window which must stay running while you use the program.

I've yet to use it for any length of time so it would be nice if someone could download a copy and give it a thorough workout prior to writing an in-depth review for a future newsletter.

## About

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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.VariableStarsSouth.org> and its e-group <https://groups.google.com/forum/?fromgroups#!forum/variablestarssouth>. 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** Dr Tom Richards, 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

We invite all who are interested in southern variable star research to join VSS. Your membership fees support the organisation’s overheads and support the VSS Research Grants Scheme. The joining fee is NZ\$30.00 and thereafter the annual membership renewal, due on 30<sup>th</sup> April, is NZ\$20.00. Members and non-members alike can take part in VSS projects, join the VariableStarsSouth forum on Google Groups, and make use of our website’s online specialist forums (to contribute to a forum, register through the “User Login/Logout” link on the home page). Financial members are eligible for research grants, see Community > Research Grants on our website.

## NEWSLETTER ITEMS

These are welcomed and should be sent to the Editor ([phil@astrofizz.com](mailto: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 February, May, August and November, 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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