Newsletter 2009/3

2009 August

From the Director

After 8 months, what are we doing?

Nobody ever reads articles called "From the Director" because they are boring, sententious exhortations to do more and better. So having got your undivided attention, let me tell you what VSS is doing and how you can get more involved.

Communications

Or ICT. And since people keep wondering what that stands for, it's Information and Communication Technology. In a dispersed international society like ours, electronic communications are vital. This Newsletter comes to you courtesy of the Internet, and indeed everything we do is recorded and communicated on that medium.

Our Website

Our website, http://www.varstars.org is now up and running. It's far from as comprehensive as I would like, yet. But it's getting there. It has two main types of material:

- information about VSS and how-to-join, news (including these newsletters) and other resources—articles, links.
- All about our Programme areas and research projects. Go here to find ongoing results on our projects, and how to take part in them.

It's actually very easy to update the website, and Programme Coordinators and Project Leaders have been invited to send me material as often as they like for inclusion. (Yes, I'm

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the webmaster.) I'm also very much wanting feedback from our members: what else is needed, what isn't working well, suggestions for links and articles to include, and so on.

We want the website to grow and be a valuable resource for our members and all who visit it. I want to get a lot of articles on it; for example, explaining simple basics that can be hard to find elsewhere, like Heliocentric Julian Date. And more advanced ones. For example I've put a version of my hands-on "CCD Photometry with MaxIm" workshop onto it, complete with all image files. But do remember, the Web is an amazing source of information, and we don't intend to waste effort duplicating good stuff already there, such as Wikipedia and AAVSO articles.

The website has (or is meant to have, when I can get it to work) an RSS feed (Really Simple Syndication) . Click on its icon to subscribe to a notification every time the website is updated

Our Email Group

Our other ICT medium is our Google egroup, VSS-Members, whose home page is http://groups.google.com/group/vss-members. This is proving to be a lively forum – as I write the latest thread is a discussion of Yitping Kok's calculation of the distance of Nova Sgr 2009 no.3, now renamed to V5538 Sgr, using his observations. The home page also has a Files area, where you can upload files of interest to other VSS members, such as recent observations. Have a look at what's already there. I'd suggest project-related files, such as recent observations , comp star sequences for novae etc., and more permanent material, is best directed to our website. Email it to me, Tom.Richards@varstars.org.

All VSS members, and others working in closely with VSS projects, can join VSS-members. If you are a member of VSS and for some reason aren't in the egroup, please email me and I'll send you an invitation. You're missing out on just about everything if you're not in it!

Projects

We now have six projects up and running – a varied bunch with something for everyone's taste and equipment, I hope. You can read about them on our website, and choose which ones to join. (That's the *raison d'être* for being a VSS member!) Here they are.

Beginners' Visual Observing (alan.plummer@varstars.org). Learn the way to do visual observation, the cornerstone of variable star work, by following some important southern variables.

Dual-Peak Miras (stan.walker@varstars.org) An intriguing and poorly understood phenomenon. Suitable for visual, PEP and CCD observers doing weekly or even daily observations.

QZ Carinae (stan.walker@varstars.org) A bright eclipsing system, but difficult since its period is 1.8 minutes short of exactly 6 days! It's actually an eclipsing and a non-eclipsing pair. CCD and PEP observations are needed while its eclipses are still visible from AU/NZ and not somewhere out in the Pacific.

R and eta Carinae (alan.plummer@varstars.org) Two extraordinary stars, with data going back for over a century, much of it not public. Part of the project involves studying and publishing

these data, and part involves visual observing with binoculars or a small telescope.

Cataclysmic Variables for the HESS Project (paddy.mcgee@varstars.org) The HESS Project studies gamma-ray emissions from CVs using equipment in Namibia; and looks for outburst warnings for its target stars from Australia/New Zealand. Nightly single observations needed, visual or CCD or PEP.

Equatorial Eclipsing Binaries (tom.richards@varstars.org) A collaborative project with the BAA-VSS. Selected poorly understood eclipsing binaries near the equator are studied to find times of minimum and light curves. Some are chosen as suitable for visual and DSLR observers, some for CCD observers.

Which one (or ones) intrigue you? Get going on it!

We are always on the lookout for more projects, long term or short. You don't have to be a VSS member to organise one. Contact me if you want to set one up.
Tom Richards tom.richards@varstars.org

EDITOR'S COMMENTS

Well said, Tom, now I don't need to say much about anything other than the lack of submissions to the Newsletter. We're beginning to see some of the project observations come through, but surely some of you have interesting material to contribute.

What Yitping Kok and Phil Evans are doing—and putting this onto the website—raises a lot more interest than just observing. After all, our observing is not just about making large numbers of measures—but is more enjoyable if we try to understand what they mean. The AAVSO is trying to nurture this with their epsilon Aurigae project for IYA—in which they actually request non-professionals to try to understand what the eclipses are trying to tell us about this system.

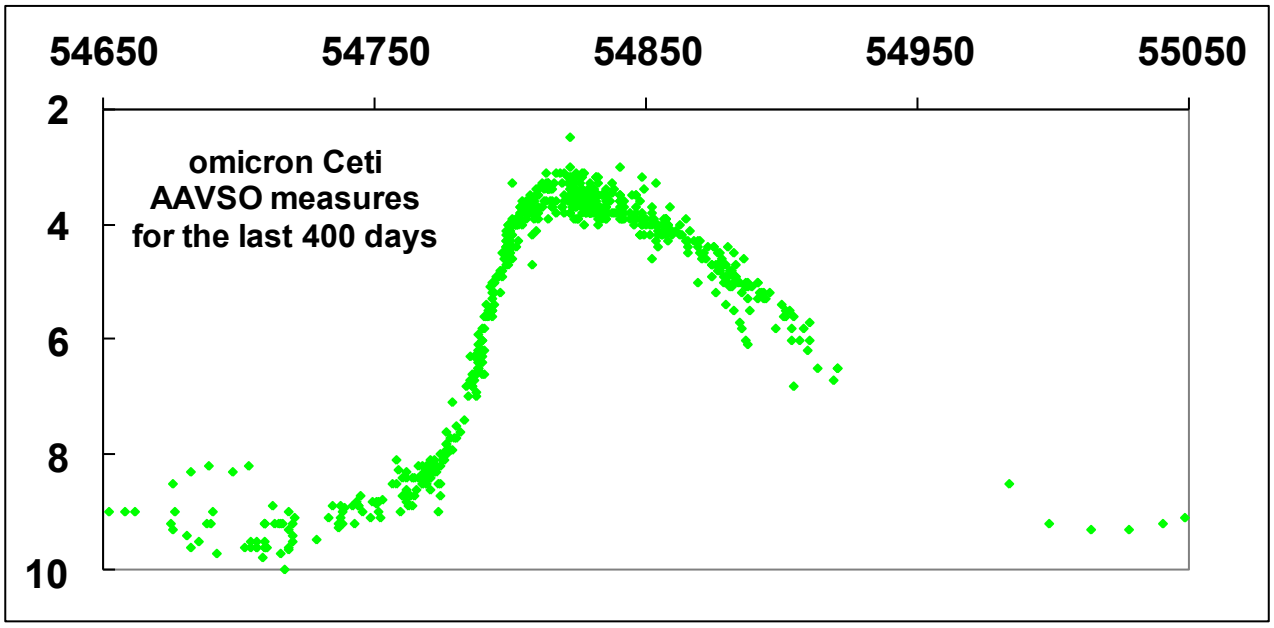
Which is where amateurs have an advantage—we can pursue a line of research which may, in the long term, not prove much. But we enjoy it while we're doing it. You're not under compulsion to get results or even write a paper—as most professionals are. There are exceptions—Baade it was, I think, who tied up one of the major telescopes on a project for three or four years only to find that he was not looking at what he thought he was. (Apologies if I've got the wrong astronomer!) Then we have Peter van der Kamp who had the concept of searching for planets around other stars—but with equipment that just wasn't good enough to deliver. How he would have enjoyed today's facilities!

I must admit to no observing myself, but on two occasions I've tried. On the first of these the photometer failed after the first set of measures—and after careful dismantling and checking it turned out to be a faulty fuse unit. The second saw cloud as I was tuning up on Antares and it's been cloudy ever since. Then the telescope proved awkward to use in an unbalanced fashion so a lot of work corrected this—and reinstalled the heated dewcaps, etc., which are essential to good PEP. ***Stan Walker*** stan.walker@varstars.org

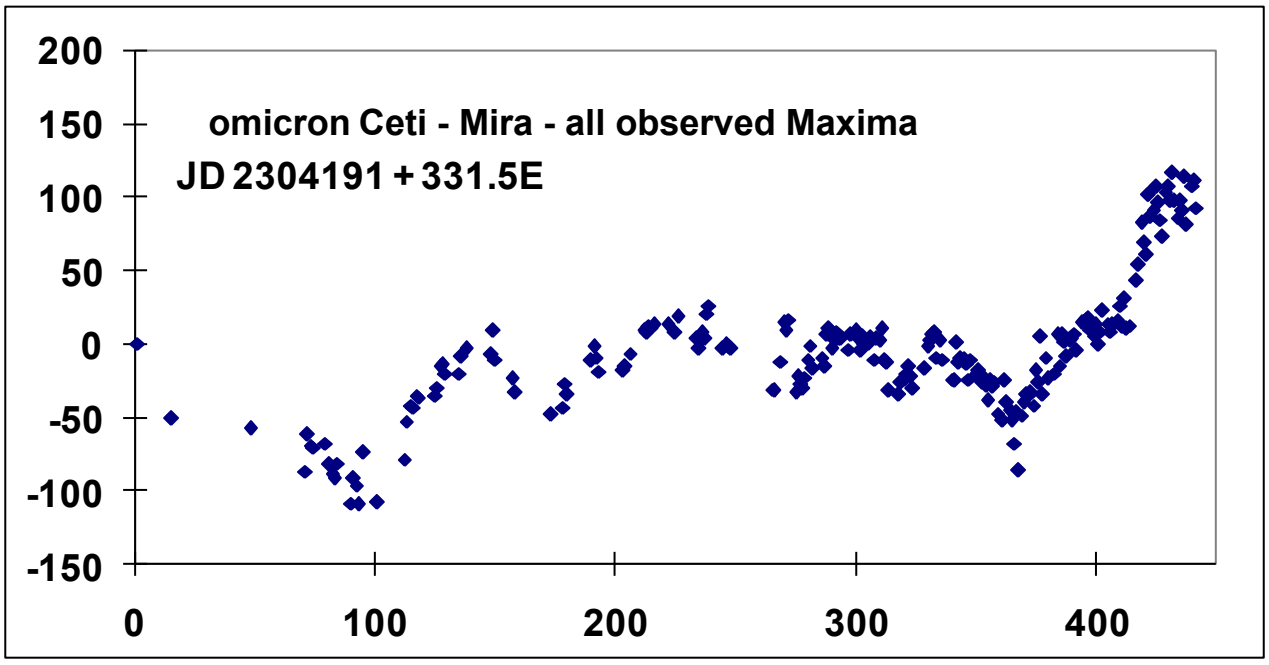
STARS OF THE QUARTER

Let's begin with the star that started it all off—omicron Ceti, or Mira, has been observed since the last decade of the sixteenth century. Observing it is not essential, it's heavily over-observed, but it's an interesting star to watch—in a rather barren part of the sky. And we're not poaching on northern objects as it's actually at declination 3° South!

We won't include a chart—these are easily obtained from the AAVSO website—and set it for the largest size possible. The light curve below shows the last 400 days or so and it's obviously just beginning the rise. Based on the period of ~332 days look for maximum at JD 2455150, about mid-November. But watching it rise is the main part of the fun.



And since Mira has been observed for 415 years or so we can plot all the epochs of maximum in an O-C diagram to look for period changes. Maybe something about 1700 and again—quite clearly—about 1940. Both give or take a few years. Oddly enough, Mira is a little atypical in that it has a close, hot companion interacting in a thick stellar wind.



AND A COUPLE OF NOVAE

Nova Sagittarii 2009 no 3 (now V5583 Sgr) was discovered photographically on 6 August, 2009, by two Japanese astronomers at magnitude 7.7. This was confirmed by ASAS3 which found no trace of the object two days earlier. By August 18 it had faded to magnitude 9.9. It's obviously a fast nova, which means quite bright and the B-V colour of 0.6 near discovery indicates substantial interstellar reddening—which we would expect in Sagittarius. Yitping Kok has done some interesting work, helped by Phil Evans, in estimating the distance and stimulating a discussion on the VSS-members egroup.

Has anyone got any colour measures of this star? It's interesting to note that in 1987 with the LMC supernova, the B-V colour changes allowed a determination of the expansion velocity by the second night.

Then along comes Nova Ophiuchi on 16 August at a magnitude of ~10—also discovered by a Japanese astronomer. A real deluge of these things. There are so many that there is considerable value in observing just to make certain that this is not the one that is different. Visual measures are good, but those with CCD equipment should do their best to get a measure every clear night. Professional observatories find it difficult to spare the time to monitor these in detail. And on this theme, our Cataclysmic Variables Coordinator, Paddy McGee, has reminded us of the imminent—hopefully—outburst of the recurrent nova U Scorpii.

At the moment we will be measuring the expanding gas shell and orbital variations will be impossible to detect, but even so there might be something unusual. Nova Delphini was observed from Auckland in the 1960s and had a remarkable light curve, brightening and fading and rebrightening for months. I used to measure it from my back porch! And many novae have unusual features on the decline.

V1412 Aquilae

This star has been receiving some publicity lately—on the speculation that it's a white dwarf (which it is) with something occulting it occasionally, which something might be an exoplanet. Unfortunately, like all white dwarfs, it's faint at around 15.75. The dimmings have an amplitude of 3-4 magnitudes. The companion, if it exists, appears too cool for any type of star—hence the appeal of a planetary body. If it is indeed such it would be an interesting proof of the far distant evolutionary future of stars like the Sun or Sirius.

Arlo Landolt has requested through the AAVSO that nightly monitoring be attempted by those with telescopes large enough to reach these levels. Once a night is probably adequate—and any reasonably large drop in brightness should immediately be monitored and reported. More information on the VSS website or the AAVSO site. Don't expect an easy task. If the Sun became a white dwarf and left a rather depleted Jupiter we'd probably be looking at an orbital velocity of 5-8 km/s and, if Jupiter's core is 100,000 km in diameter, an event lasting 2-6 hours is likely. But then, it might be a dust cloud obscurations as in NGC 2346, or even some unknown type of binary—who knows—so keep an eye open , but be particularly careful about identification.

CATACLYSMIC VARIABLES—CURRENT PROJECTS

Paddy McGee ***paddy.mcgee@varstars.org***

Befitting the international nature of the Year of Astronomy, the (only!) currently listed Project for Cataclysmic Variables is a monitoring project that has the intention of notifying the HESS (High-Energy Stereoscopic System) Cerenkov gamma-ray telescopes array in Africa of outbursts of any of the following three objects – V4641 Sgr, RS Ophiuci, and U Scorpii (http://www.mpi-hd.mpg.de/hfm/HESS/)

These three objects undergo occasional outbursts from their long-term quiescent states, and it is these outbursts we're interested in. The intent of this Project is that when (he said encouragingly… not just "if") any of these sources goes into outburst, we can notify HESS observers of this as soon as possible, and that instrument can start looking at the target soon after the peak of the outburst. Will anything interesting—or anything at all—be seen in gamma-rays? We don't know… but the only way to find out is to look. HESS can't spend its time monitoring these targets in case they become active, so optical monitoring by other observers is an essential way of enabling such Target-of-Opportunity observing by major facilities.

For this kind of programme, what's needed is an indication that the target is in outburst. The long-term behavior of these sources is well-known, so we know what magnitude indicates a quiescent activity level. There can be some low-level variation that is not indicative of an outburst- but any sudden increase, especially more than a magnitude or so, would be very interesting… outburst increases range from about 2 mags for V4641 Sgr to about 8 for U Sco.

Thus, we don't need intensive time-series (i.e. repeated as often as possible) measurements over several hours per night (although, in an ideal world, that would be valuable too). One or more observations per night (perhaps a few hours apart, when possible), on as many nights as possible, will do the trick—we just need to keep an eye on them, and see when one finally goes off.

Such monitoring is suited both to visual and other (usually digital) observing. Although U Sco is not a visual object in quiescence (being around 17th-18th mag), it *is* visual during outburst. RS Oph and V4641 Sgr both may be detected visually in quiescence (depending on your instrument), with both being bright enough in outburst. So, even if you can't see the target in quiescence, you should be able to when in outburst- and that's the whole point!

Please refer to the varstars website for the Project outline. A good source of charts is the AAVSO website, via this link http://www.aavso.org/observing/charts/vsp/. Do note, however, that there is no chart there for U Sco. There is a good article on U Sco in the August 2009 international edition of *Sky and Telescope* which includes a chart with comparison star magnitudes (available online at http://www.skyandtelescope.com/observing/highlights/43435242.html and reproduced on the next page).

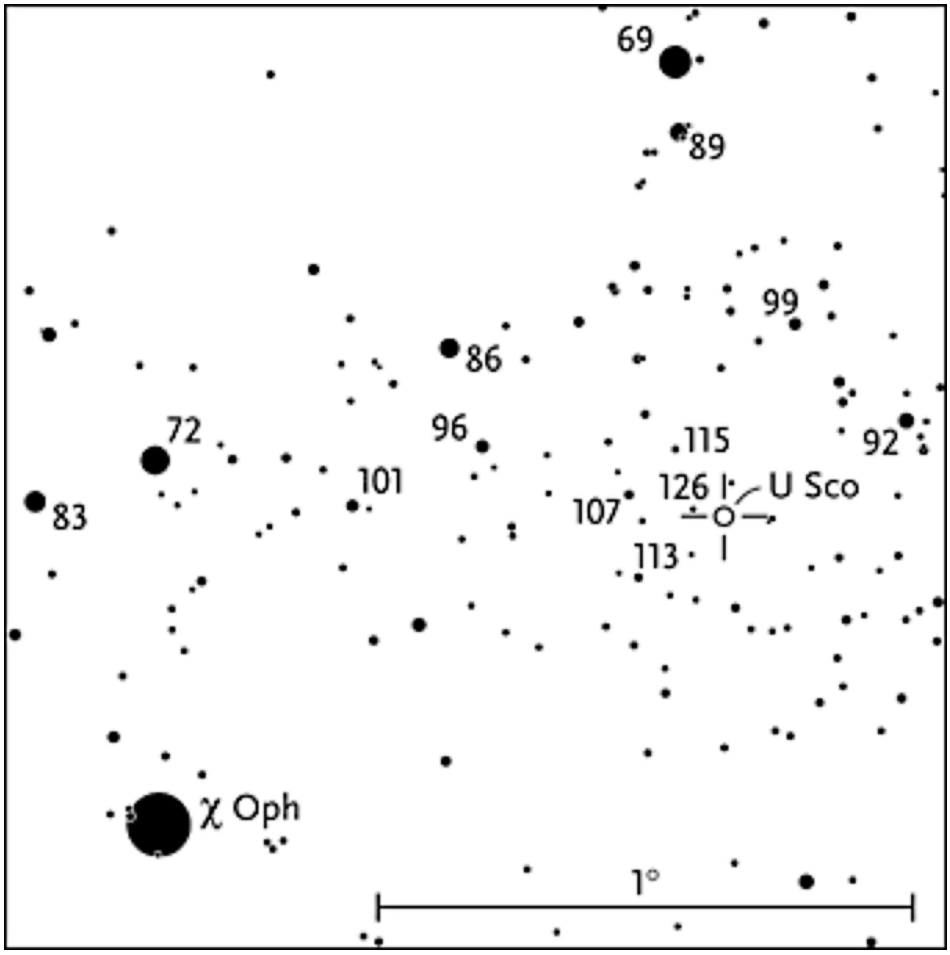
Future Projects

A Project plan is being drawn up for three CV's which are definitely for digital observers only. They are too faint for visual work, being 15th-17th magnitude, even in their active states. They have orbital periods in the range 90-290 minutes and all show variation on orbital time scales (as well as minutes-scale flickering), and longer-term changes in their light-curves due to variations in mass-transfer rate between the two component stars in each system.

These systems were first observed using CCD photometry at Woomera during 1995-1998, with more recent data (2008) on one target from the University of Adelaide Observatory. It is hoped that more data will help to refine measures of their orbital periods (including possible changes thereto), as well as better constrain the state-change behaviour.

All data so far were obtained using a Celestron C14 and SBIG St-6 or ST-9 CCD cameras unfiltered. This Project will explore techniques of time-series differential photometry including- where feasible, based on the reduction software that's used- estimation of the errors present in each night's data. When ready, the Project outline will be available at the varstars website.

The chart of U Scorpii appears below. The magnitudes shown differ little from those used by Pogson in 1863 when the star he discovered U Scorpii at magnitude 9.1. North is at the top. After Pogson discovered this on 20 May, 1863, it faded by 3.3 magnitudes in 8 days.



Stan remembers seeing it and measuring in UBV from Auckland Observatory during an earlier outburst but you have to be quick.

One interesting aspect of Pogson's notes is that he looked for it on 1 June, 1863 during a total lunar eclipse—so he often had strong moonlight to contend with as well. We can't expect that to happen this time around! Nor is the Governor General of India likely to look through your telescope at the star, as happened in 1863!

AMATEUR SPECTROSCOPY TODAY

Bernard Heathcote, Coordinator, Spectroscopy Programme Barfold Observatory
bernard.heathcote@varstars.org

This is intended to be an introductory overview on the current 'state of play' of amateur stellar spectroscopy, covering the instrumentation available and what is being achieved with it. I believe the reader is well aware that the vast majority of what we know about the stellar universe has been achieved through spectroscopic studies and that this area of professional science is vast and complex, both in theory and practice. This complexity and the lack of affordable equipment was probably the main reason why spectroscopy has not been popular with amateur astronomers until recently, but the situation has certainly changed in the last few years. Thanks mainly to the efforts of French amateurs, Christian Buil in particular, the internet and the relatively recent availability of affordable CCD cameras, spectrometers and software, spectroscopy now seems to be booming in our ranks … even though a lot of the complex theory and practice still remains.

Given the nature of VSS it is assumed that members have at least a basic knowledge of the physics and theory behind spectroscopy and it will therefore not be covered here.

Instrumentation

The table on page 13 is an attempt to summarize the fundamental characteristics of the two main types of commercially available equipment. The first type (two examples) is the low resolution S*tar Spectroscope,* which is basically a blazed transmission diffraction grating in a standard 1¼" filter cell. Despite its simplicity and low cost it should not be seen as just an inferior version of the considerably more complex and expensive second type, the higher resolution *Slit Spectrometer* (five examples), as it does have some significant practical advantages over the latter. A basic comparison of the two types follows.

Star Spectroscope

Pro:

A low cost, but still powerful, entry into spectroscopy and a great learning tool.
Simple installation and light weight make it very easy to use.
If used in a filter wheel it can be automated and form part of a photometry sequence.
Full visual spectra (4000-7000Å) can be obtained with a single exposure.
Can image fainter stars than a slit spectrometer (for a given exposure).
Exposure times much shorter than for slit spectrometers, for a given magnitude.
Multiple object spectra can obtained with one image.

This link shows how to use this device as an *objective grating* spectrometer using just a DSLR http://www.threehillsobservatory.co.uk/astro/spectroscopy_11.htm

Con:

Lack of a slit limits usage to 'point sources' … stars.
Low resolution mainly limits it to 'quick look' and star spectral classification work.

Wavelength calibration difficult as lack of a slit means reference lamps can't be used.
Background sky glow noise can limit their use in urban environments
Note: a shallow wedge prism mounted in front of the grating (making a 'grism') reduces coma and improves resolution at red/NIR wavelengths.

Slit (collimated beam) Spectrometer

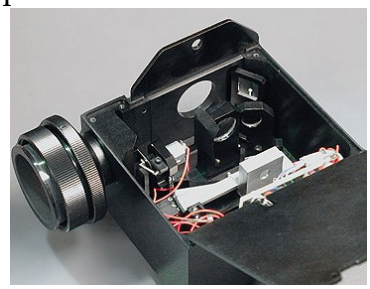
Pro:

Medium to high resolution opens up the whole field of spectral analysis.
Slit allows for spectra of extended objects.
Accurate wavelength calibration with reference lamps (sometimes built in)
Versatility, due to ability to change grating, slit size and cameras (model dependent).
Less affected by sky glow noise, so can be used in urban areas.
The *echelle* design achieves high resolution and broad spectral coverage in one exposure.
Can function as a spectrohelioscope.

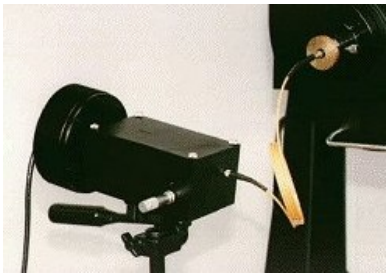
Con:

Significant cost
Weight, unless fibre-optic coupled, can be a problem for small telescopes and mounts
Only a single object's spectra can be obtained at a time
Accurate (auto)guiding is required over long periods.
Limited to brighter objects, otherwise longer exposures (an hour or more) required.
More complex setup and operation involved.

Star spectroscope

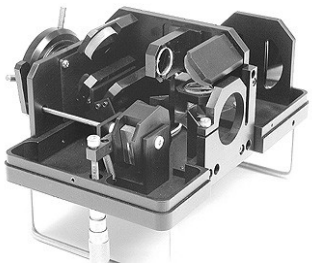


SBIG DSS-7

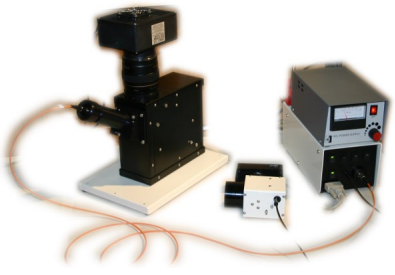


Sivo Nu-View II

Shelyak Lhires III



SBIG SGS

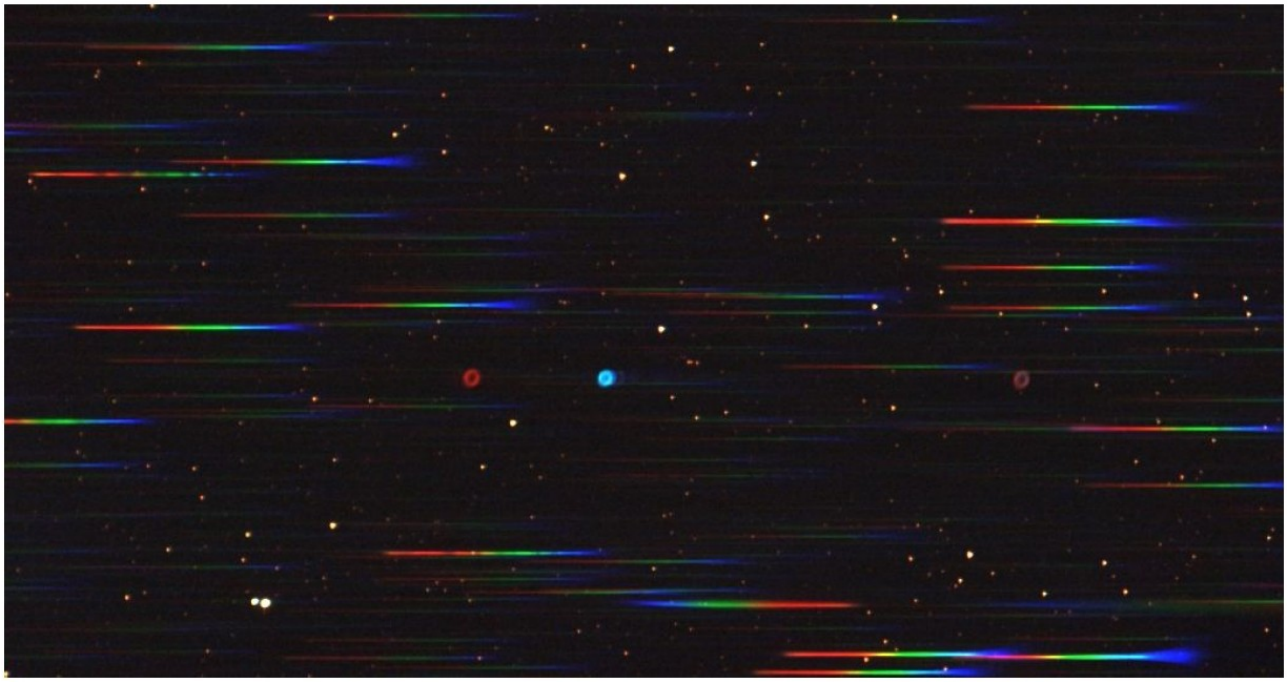


Shelyak eShel

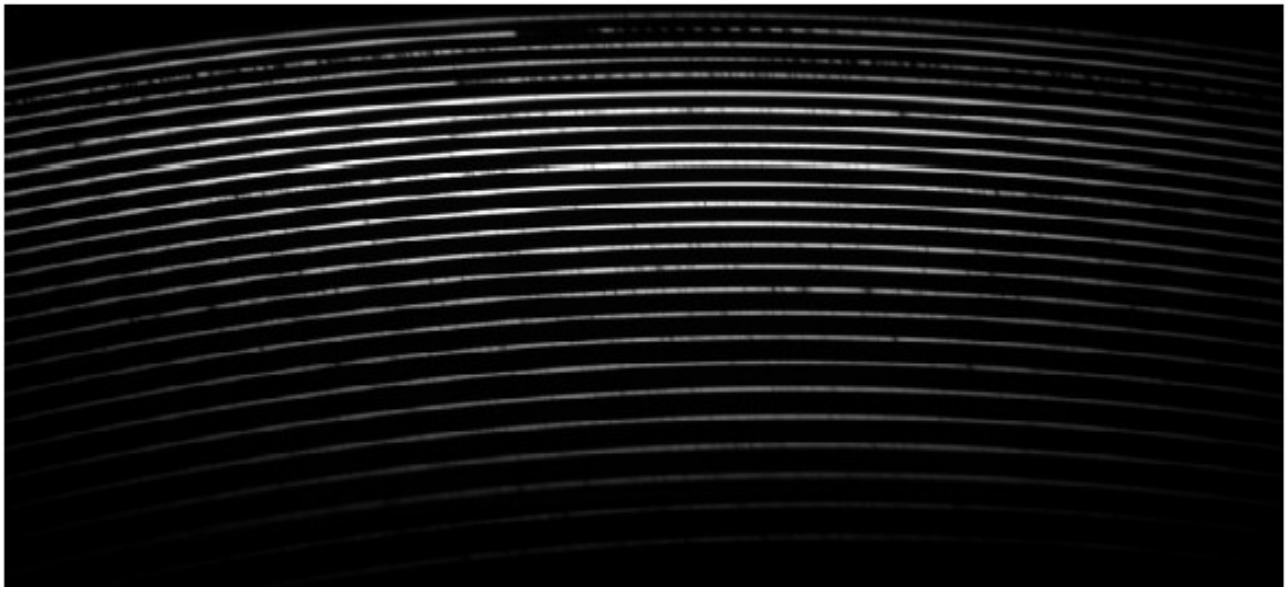
Software

The extraction of data from the recorded spectral data is highly dependent on sophisticated software and the good news is that this is available as freeware. Again, we must thank French amateurs, in this case Valérie Desnoux, for her powerful *Visual Spec* pro-

gram (Windows only) (http://www.astrosurf.com/vdesnoux/), certainly the most used program by amateurs (and some pros). Prior to using Vspec some pre-processing of raw images is required and Buil's freeware *Iris* (http://www.astrosurf.com/buil/us/iris/iris.htm) is a good tool for this. There is of course the free pro software *IRAF* for those masochists seeking a real challenge! http://iraf.noao.edu/



Star spectroscope DSLR spectra



echelle spectra

Capabilities & Challenges

The following is a brief, probably incomplete, list of current research areas and achievements by amateurs using the above, similar, even DIY, spectrometers.

Spectral classification of stars: Easily achieved with low resolution grating and a DSLR. *"Despite the passage of newly 100 years, a quick check of the SIMBAD system showed only some 560K objects with spectral classifications. In particular, many red objects that are routinely monitored by AAVSO observers do not have published classifications."* (Gary M. Cole, Starphysics Observatory)

Nova / SN confirmation and development: The writer was able to confirm a 14 mag LMC nova by detecting Hα emission using a *Rainbow Optics* grating on a C14 scope. Brighter galactic novae development can be studied in more detail with higher resolution spectrometers and an example, using an *SGS*, is described at http://starkey.ws/v475_sge.html

Eclipsing Binaries: Radial Velocity (RV) measurements of bright (3.3 – 6.2 mag) EBs can be measured with reasonable accuracy using high resolution instruments such as the *Lhires III* and *eShel*. On 20 July 2009 UK amateur Robin Leadbeater was apparently the first to detect the start of the long anticipated Epsilon Aurigae eclipse (first since 1983). He achieved this by detecting a 15km/s red-shift of the KI 7699 line, using a *Lhires III.* http://www.threehillsobservatory.co.uk/astro/spectra_40.htm

Quasars: The red-shift of bright quasars, such as 3C273, has even been measured with low resolution star spectroscopes.

See http://www.regulusastro.com/regulus/spectra/3c273.html
http://www.astroman.fsnet.co.uk/quasars.htm

Be stars: This is a popular pro-am research area and involves long term monitoring of the Hα emissions from these eruptive binary stars (10-20% of B stars), in order to help determine the origin and nature of the accretion rings. It does require a high resolution instrument and the research does benefit when combined with RV studies of the orbiting gas and photometry.

See http://arasbeam.free.fr/?lang=en and the BeSS database http://basebe.obspm.fr/basebe/ for the pro-am results.

Exoplanets: at least two amateurs (T. Kaye with a DIY and C. Buil with an *eShel*) have been able to confirm the presence of a planet around tau Bootis by measuring its RV (0.47 km/s)! This did require high resolution, fibre-optic coupled (for mechanical and temperature stability) instruments and sophisticated statistical processing. The results were within 0.2% of the official orbital period! According to Buil "the possibility to find new exoplanets with an accessible setup for non-professional, small research institutions and students is now a reality and opens a new and exciting observational horizon". See http://www.astrosurf.com/buil/tauboo/exoplanet.htm.

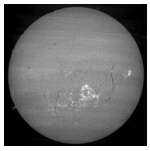
Planet & satellite atmospheres: Methane gas in the atmospheres of planets and sodium emission lines on Jovian moons Io, Ganymede and Europa, indicating volcanism, have been detected.

Asteroids: the taxonomy of main belt asteroids down to 13 mag, based on spectral slope values, has been confirmed with an *DSS-7* and a 14" SCT. http://www.macastronomy.com/MacAstronomy.com/GMASS_files/Stephens-Megna-Spectroscopy V9c.pdf

Hubble Constant: the relatively low resolution *DSS-7* has been used by college students to confirm the Hubble Constant by measuring the RV of eight bright galaxies. http://www.socastrosci.org/2008 papers/2008SASc..27..137L_Paper.pdf

Spectroheliography: a high resolution spectrometer can be used as a spectrohelioscope, producing a very narrow band image of the Sun (such as the 0.3Å Hα below), by letting the solar disk drift across the scope aperture. http://www.eyes-on-the-skies.org/shs/ and http://www.threehillsobservatory.co.uk/astro/spectra_29.htm

Stellar physics: Dale Mais explains how, using data from a C14 mounted *SGS*, it is possible to derive stellar atmospheric temperature and chemical abundances. http://mais-ccd-spectroscopy.com/Qualitative to Quantitative Amateur Spectroscopy.pdf.



What next?

My next objective, as the VSS Spectroscopy Programme Coordinator, is to devise one or more projects in this field. Before I can start to consider the multiple opportunities open to us I ask that members email me, indicating if they have an interest in any particular aspect of spectrographic research and what equipment they have, or plan on acquiring. I will also need to know what scope and imaging equipment they will use.

Other useful Web Links

Paton Hawksley *Star Analyzer 100*	http://www.patonhawksley.co.uk/staranalyser.html
Rainbow Optics *Star Spectroscope*	http://www.starspectroscope.com/
SBIG *DSS-7*	http://sbig.com/dss7/dss7.htm
Sivo Scientific *v-VIEW II*	http://www.sivo.com/sivosci/sivopage/nuview2.htm
Shelyak *Lhires III*	http://pagesperso-orange.fr/shelyak/en/lhires3.html
SBIG *SGS*	http://www.sbig.com/sbwhtmls/spectrometer2.htm
Shelyak *eShel*	http://pagesperso-orange.fr/shelyak/en/eshel.html
Christian Buil's website	http://www.astrosurf.com/buil/
Baader's spectrometer (German)	http://www.baader-planetarium.de/dados/dados.htm
Star Analyser forum	http://tech.groups.yahoo.com/group/staranalyser/
Lhires III forum	http://tech.groups.yahoo.com/group/spectro-l/
Amateur Spectroscopy forum	http://tech.groups.yahoo.com/group/amateur_spectroscopy/
Spectrohelioscope forum	http://tech.groups.yahoo.com/group/spectroheliosc opes/
Robin Leadbeater's website	http://www.threehillsobservatory.co.uk/astro/spectroscopy.htm

Grating Spectrographs (commercial amateur instruments)

Model	Note	Star Analyser 100	Star Spectroscope	DSS-7	nu-VIEW II	Lhires III	SGS	eShel
Manufacturer		Paton Hawksley	Rainbow Optics	SBIG	Sivo Scientific	Shelyak	SBIG	Shelyak
Type		Star Spectroscope	Star Spectroscope	Slit Spectrometer	Fibre optic feed	Slit Spectrometer	Slit Spectrometer	Fibre optic feed
Optical design		1¼" grating cell	1¼" grating cell	Czerny-Turner	Czerny-Turner	Littrow	Czerny-Turner	Echelle C-T
Resolution class		Low	Low	Low	Low	High	Medium	High
Resolution, R (at Hα)	A	~200	~200	400	900	17,000	2,000	10,000
Resolution (Å)	A, B	~ 30	~ 30	16.0	< 8	0.4	3.3	0.6
RV resolution (km/s)	A	~ 1,500	~ 1,500	750	330	17	150	28
Limiting magnitude	C	~13	~13	~10	~8	~5	~9	~7
Weight (Kg)	D	a few grams	a few grams	0.7	a few grams	1.7	0.7	< 1.0 ? (optic head)
Cost (AU$)	E	$160	$300	$1,900	$2,795	$3,660 (kit $3,240)	$5,900	$17,000
Cost (NZ$)	E	$200	$380	$2,400	$3,530	$4,620 (kit $4,090)	$7,450	$21,500
Slit sizes (μm)		no slit	no slit	25, 50, 100, 200	50 (fibre)	fully adjustable	18, 72	50 (fibre)
Grating type		transmissive	transmissive	reflective	reflective	reflective	reflective	reflective
Grating (lines/mm)		100	200	100	1,200	2,400	150, 600	?
Grating options		na	na	none	300, 600, 1800	150, 300, 600, 1200	1200, 2400?	none
Optimum Focal Ratio		na	na	f/10	f/10 ?	f/10	f/6.3, f/10	f/6
Optimum camera		webcam	webcam, CCD	SBIG ST-7 or 402	Any ?	Any (incl.DSLR)	SBIG ST-7/8	ST-1603, QSI-516
Setup		Scope mounted	Scope mounted	Scope mounted	Optic fibre to scope	Scope mounted	Scope mounted	Optic fibre to scope
Positives		Webcam optimised Cost Weight, simplicity	Visual adapter Weight, simplicity	Auto control Direct view mode	Stability Φ-View (US$695) Weight	Versatility Neon calibrator Kit form available	Built-in autoguider	Full hi-res spectra Stability Th-Ar calibrator
Negatives		Calibration Coma distortions No visual adapter	Calibration Coma distortions	Single grating	Fibre feed losses Cost	Heavy OTA load Stability	Needs SBIG ST-7/8	Cost Fibre feed losses
Best application	F	stars	stars	extended obj., stars	extended obj., stars	extended obj., stars	extended obj., stars	extended obj., stars

Note A — Resolution is proportional to grating size, density, sensor distance and inversally to pixel size, FWHM (or slit width), scope aperture
For star spectroscopes (converging optical beam) resolution is limited by FWHM and chromatic coma

Note B — Assumes a 9μm pixel sensor (e.g. KAF-400/1600 CCD)

Note C — Assumes 10" OTA, front-illuminated (NABG) CCD, 20 min exposure, S/N=10, highest resolution mode

Note D — Does not include recording, or guiding, cameras

Note E — Based on 1 Aug 09 exchange rates and does not include shipping, insurance costs or any import duties.

Note F — Slit-less spectrographs require point source targets (e.g. stars)

ECLIPSING BINARIES FOR FUN AND PROFIT—Part II

Bob Nelson

All right, how does the discussion about potentials and Roche lobes apply to eclipsing binary stars? Well, matter can fill only out to the L2 point; after that, any expansion would result in a mass loss outside that potential. We need only therefore consider the inner potential surfaces.

Algols, named after their prototype Beta Persei (discovered by G. Montanari in 1667, first correctly explained by J. Goodricke in 1782) display a flat (or nearly flat) light curve between eclipses. Today we know that this class represents some very different physical conditions.

In the first place, one can have fully detached systems, such as MW UMa (Nelson 2009a) and V364 Cas (Nelson 2009b). [In fully detached systems, the stars lie fully within the figure-8 potential in Fig. 4 (see previous *Newsletter*); as a result they are totally separate and no matter can be transferred between them.] In both cases, the stars are closely spherical and one has a light curve that is relatively flat between eclipses. (For MW UMa, see Figures 5 and 6.)

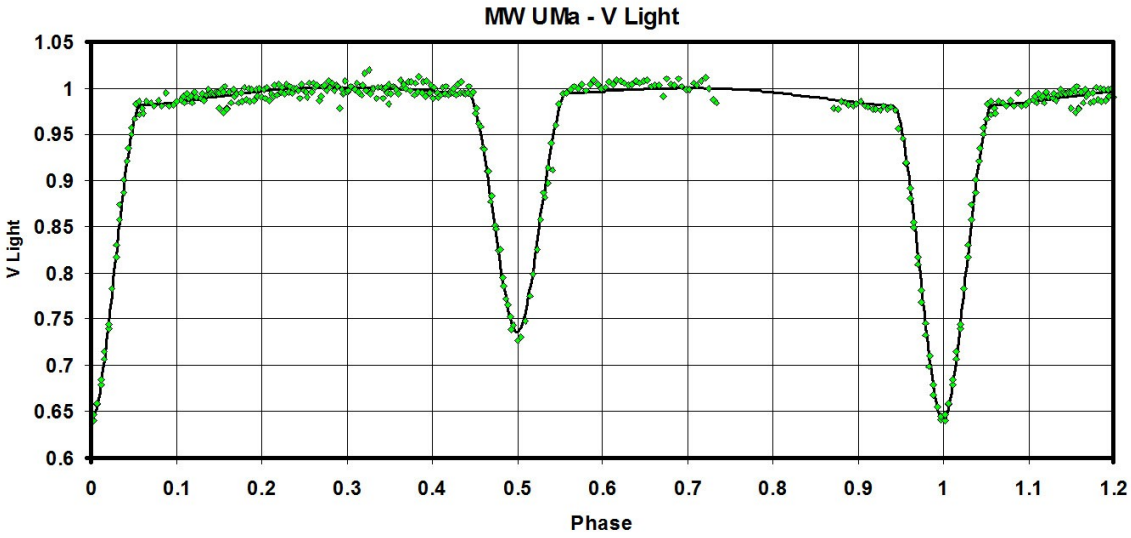


Fig. 5. The V light curve of MW UMa.

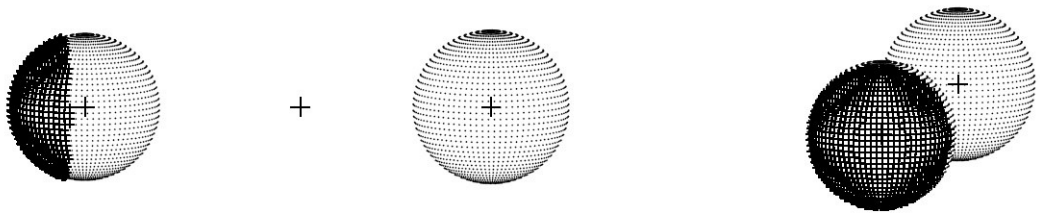
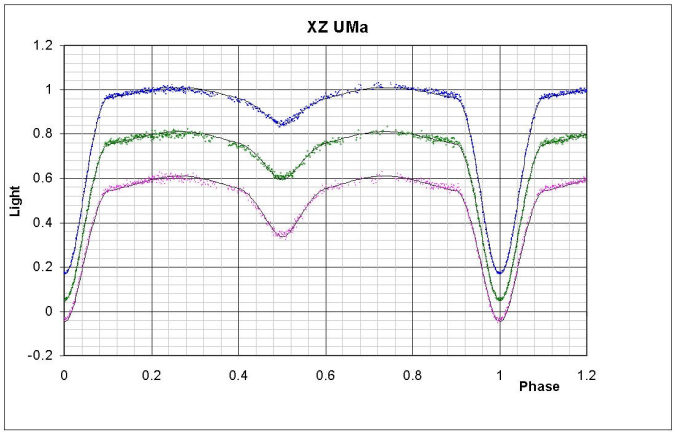


Fig 6. A 3-dimensional representation of MW UMa.

Neither system, however, falls into the *classical Algol* class. Algols are said to be *semi-detached* (in the GCVS: EA/SD). By that we mean that, although one of the stars is completely separate and distinct (falling well within the Roche Lobe), the other -- the less massive one -- fills its Roche lobe to the L_1 point. Matter can, and in fact does, leak out at the L_1 point and eventually falls into the other star. This is the *mass transfer* phenomenon and is responsible for period change.

A good example of a classical Algol is XZ UMa (Nelson & Terrell 2006). The system consists of a A7 primary (T= 7766 K, mass = 1.92 solar masses, radius = 1.70 solar radii) and a G7 secondary (T = 5346 K, mass = 1.20, radius = 2.38 solar radii). Clearly, the secondary star is more evolved than the primary since it is larger than the primary and therefore must have progressed beyond the main sequence hydrogen-burning stage.
But how is the less massive star the more evolved? Everyone knows that the most massive stars are the cosmic gluttons -- they consume their fuel at a prodigious rate and evolve quickly off the main sequence (in a few million years for the very hottest stars). The least massive stars progress at a turtle's pace taking perhaps a few billion years to consume their fuel.

For many years, this was known as the *Algol paradox*. Today, we have a ready explanation. The secondary was once the more massive star -- and therefore evolved first off the main sequence. However, in doing so, it expanded and lost most of its mass through the L_1 point to the other star. See Fig. 7 below for light curves, and Fig. 8 for a 3-D representation.



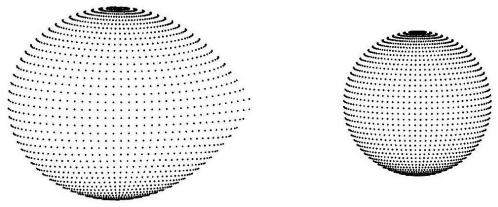


Fig 7. XZ UMa light curves in V, R, and I. **Fig 8. A 3-D representation of XZ UMa.**

A second class is the EB, or Beta Lyrae type (not to be confused with the abbreviation EB = Eclipsing Binary). Here we have two stars that are fully detached but are so close that they are tidally distorted with the result that the light curve is far from flat between eclipses. (Halfway between eclipses -- we say at *quadrature*, each star presents a larger area to us, the observers, hence the light intensity is greater than just before or after an eclipse.) A good example of such a system is DD Monocerotis. Note the greatly distorted shape of each star and the subsequent constantly-changing light curve. Note also the different depths of the eclipses, which is possible because each star can have a different temperature, resulting a different surface brightness.

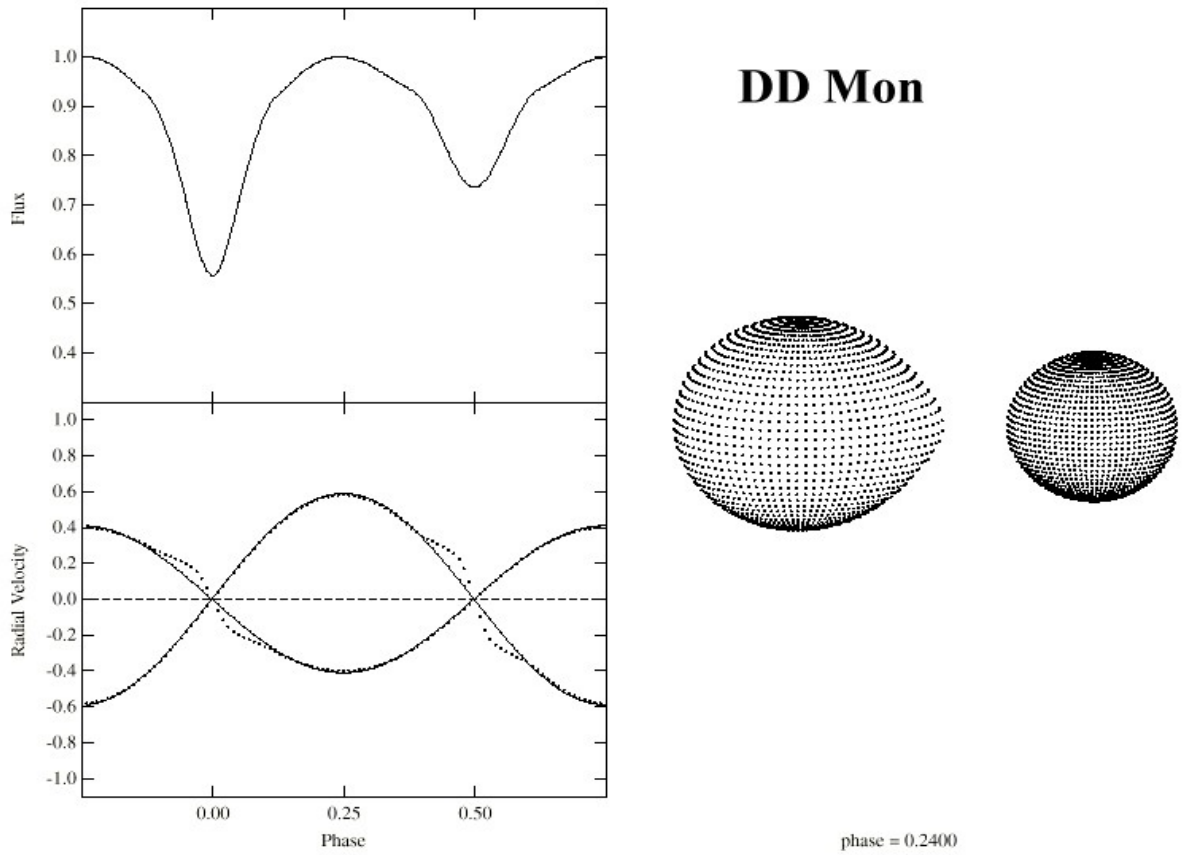


Fig. 9. Light curve (upper left), radial velocity curves (lower left), and 3-D representation (right).

Finally, we have the EW, or Ursae Majoris type. In this case, both stars over-fill their Roche lobes, resulting in one dumbbell-like structure joined at a neck. A good example of an EW type is TU Muscae in Figure 10 (at last, a southern system!). (Of course, the bulk of the mass of each star is concentrated at the centre.) However, the important point

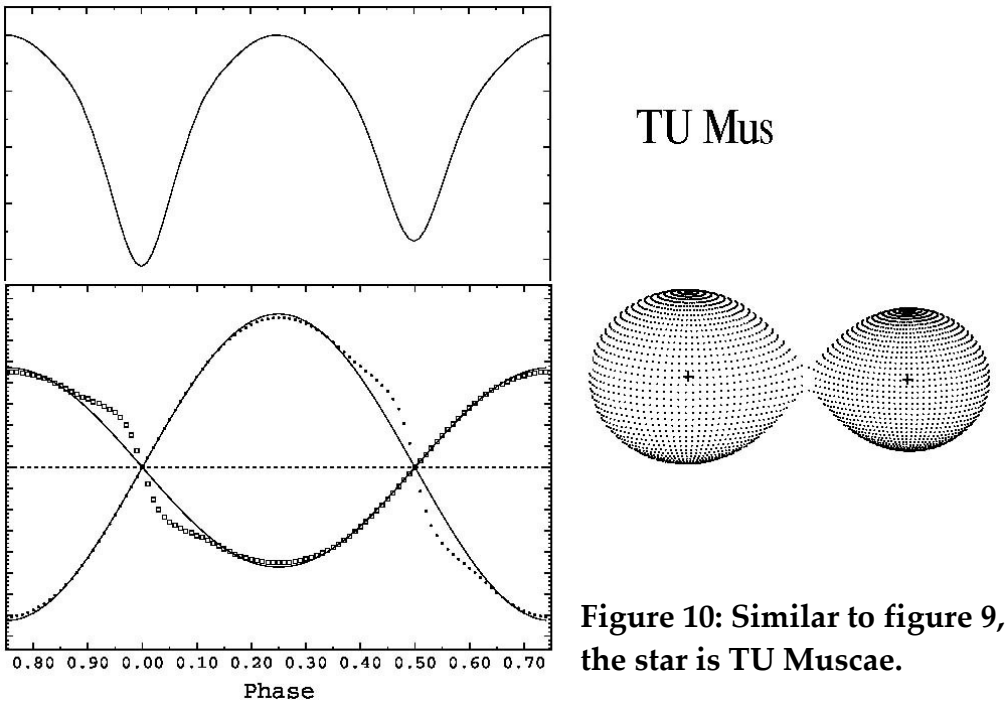


Figure 10: Similar to figure 9, but the star is TU Muscae.

is that mass and energy can flow freely from one to the other. The result is that, not only is the light curve never flat (as in the EB case), but also, the surface temperatures must be fairly equal, and eclipse depths, similar.

The photometric data were collected by the author while on leave at the University of Canterbury in Christchurch, NZ in the first half of 2002. (He used the 0.61 m Optical Craftsman telescope.) The RV data were acquired by Dirk Terrell at the ESO; he analyzed the data and wrote the paper (2003AJ.....126..2988T). The system is unusual in that both stars are very hot (Primary: O7.5 , T = 35,000K; Secondary: O9.5, T = 31,300 K) and also evolved some 3-6 Mega years from the main sequence. Apparently, very little is known about the structure and evolution of very hot overcontact binaries.

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QZ CARINAE—PROGRESS OR LACK OF IT!

Stan Walker ***astroman@paradise.net.nz***

It was a bit late in the season when we made a start on this one—and some unexpected problems have arisen. These are largely in the area of compatibility of measures. I've collected up a range of BVRI data on a number of stars from the International Database of AAVSO, as well as the V measures from ASAS3. Then I've been working with Terry Bohlsen to find out why these seem to differ so widely. Terry has been measuring E Regions as part of this investigation with his CCD—a 40′ x 20′ field is quite luxurious when compared with my old single-channel UBV photometer and produces plenty of raw data.

One of the reasons for disparities seems to be the various reduction methods outlined by a variety of authors—some of whom have rarely used a telescope for photometry. This seems to result in what Danie Overbeek referred to long ago as 5% photometry—great for LPVs and other large amplitude variables such as we're looking at in the Dual Maxima Mira project—but not ideal for stars such as QZ where we're looking for 0.005 magnitude accuracy. With its advantages of simultaneity in sky and often in comparison and check this should be easy to achieve—but it doesn't seem to be happening—the measures are at best 0.02—0.03, not even good enough for EB modelling, although OK for timing eclipses.

I'd be interested in hearing from people doing CCD filter photometry what methods they're using to transform measures to the standard system. I wrote my own transformation/reduction software back about 1980 and it works well—but even looking through the actual code I'm not clear what it's doing in some places. Maybe once I've got this *Newsletter* away I'll have the time to look into it more deeply! But I think that in the interests of obtaining good quality measures we should all be using calibrations, transformation and reduction techniques which produce top-quality results.

Equatorial Eclipsing Binaries Project

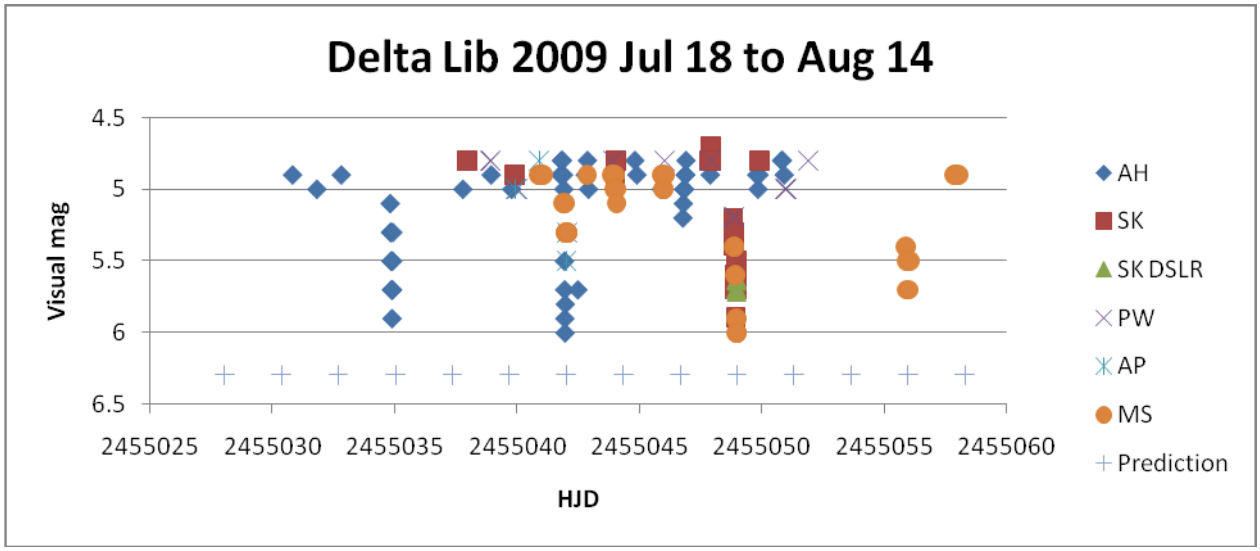
Tom Richards Eclipsing Binaries Coordinator

Delta Librae

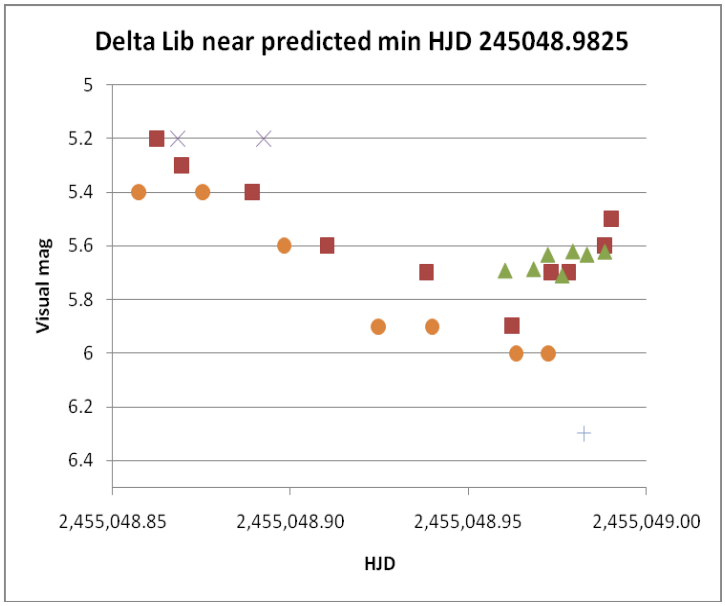
The first star chosen for the EEB Project was Delta Librae. Why? Well, it's naked eye, great in binoculars, and has a 1-mag eclipse, so visual observers can expect to get good eclipse data. It's also a good training ground for DSLR cameras, which are relative newcomers in variable star photometry.

The star is classified in GCVS as an EA/SD – Algol-type light curve but the stars are semi-detached, i.e. one star fills its Roche Lobe. If it fills it completely, it will be donating mass to the other star, which means its behaviour can be expected to change over the years as the mass ratios of the pair change. The star has been subjected to quite intense spectroscopic investigations, but oddly little photometry.

We have five observers at present, all doing visual work: Aline Homes, Steve Kerr, Alan Plummer, Margaret Streamer and Peter Williams. Steve is also doing DSLR work. Des Loughney who's handling the collaboration on this project for the Variable Star Section of the British Astronomical Association, has also obtained DSLR data from the Canary Islands, but I haven't seen it yet. Aline tells me she has data earlier than any of this: I'm looking forward to that. Full HJD/mag data will be published on our website shortly.
The season for δ Lib is just about over, and we'll have to resume work on it in a few months. But already we have data on four eclipses, as shown in this first diagram:



The crosses at the bottom indicate the times of eclipse predictions appearing on the Krakow eclipsing binary website, at http://www.as.up.krakow.pl/o-c/data/getdata.php3?DELTA%20lib. The elements are 2442960.705 + 2.32735416 E. As Steve Kerr first suspected, eclipses are actually occurring quite a bit earlier than predicted, around 45 minutes, as the next diagram shows. This blows up the third eclipse seen in the above diagram.



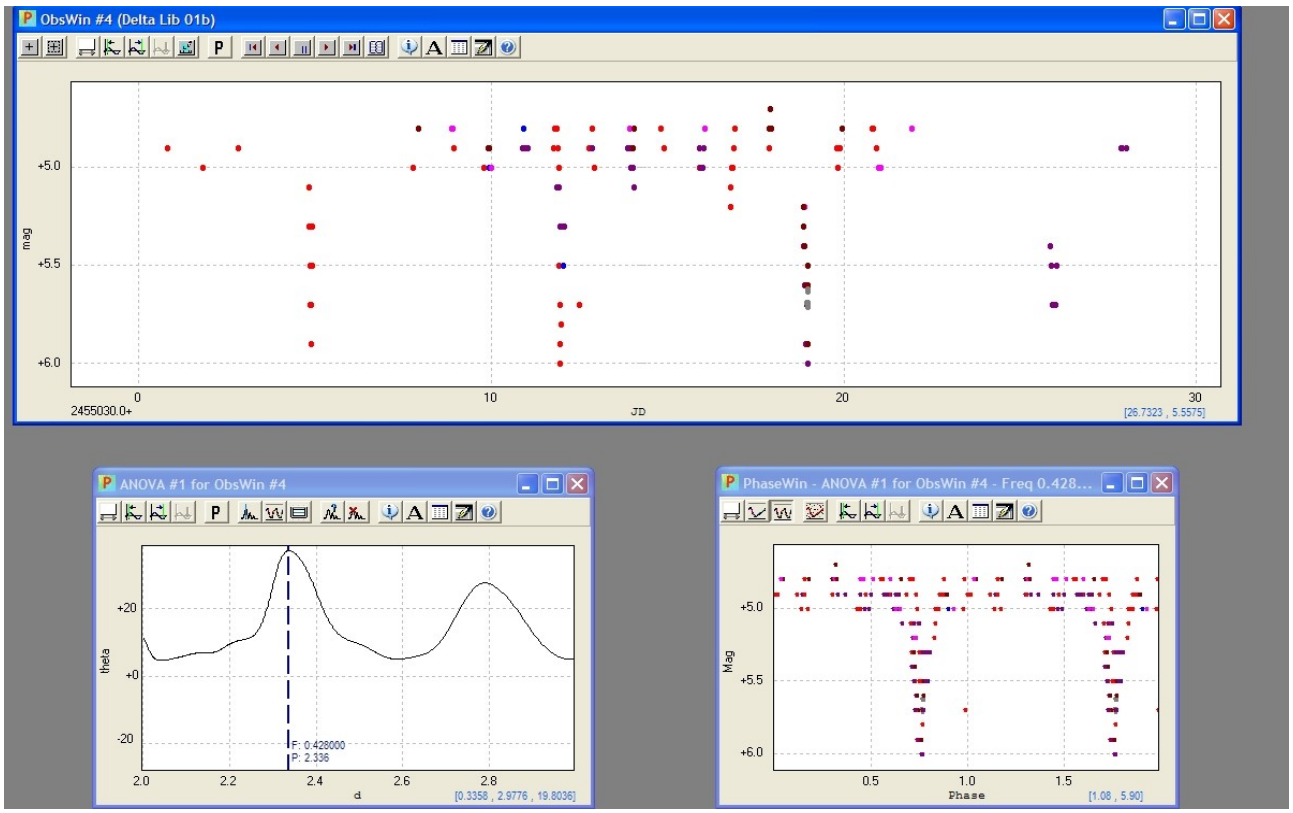
However we do need more data to pin down this discrepancy properly, and I'm hoping that by the time you read this we'll have another eclipse or two well observed. DSLR data will become increasingly important in the future as we try to obtain a precise light curve. CCDs are not helpful since comparison stars are quite a distance away.Future work will be to investigate as much historical photometric data as we can find, to try to pin down the suspected period changes over time.

Meanwhile other stars have been added to the EEB Project, this time for CCD work. Details are on our website.

And in a recent email Ranald McIntosh goes a little further .....'I am aware that we have not yet received enough observations to do a serious analysis for periodicity etc, but I could not help feeding the data received to date into Peranso and try my luck. For me this is very much a learning exercise but I am starting to understand the constraints that come with 'insufficient data'.

My preliminary 'rough' canter indicates that the periodicity is in the vicinity of 2.32 to 2.36 days (I said it was rough) and that the minima are occurring earlier than predicted, as mentioned by Tom in his recent report. At this stage the 'best' Phase diagram is achieved with P = 2.336 days.

The attached jpg is a screen grab showing just one of the 8 programs I ran against the data, which included a variety of Statistical as well as Fourier analysis routines (Those familiar with Peranso will know what I mean).



THE TANELORN OBSERVATORY

Diana Watson *carlwatson@xtra.co.nz*

In England when I used to take the dog for the bedtime walk, I would look up and pick out the constellations like Orion. We moved to New Zealand in 1973 and when I looked up here I was amazed to see that Orion's belt and sword were not just three main stars and I could see a Milky Way stretching across the sky. We rented a farmhouse on the Bay of Plenty Plains about five miles from Edgecumbe and Carl thought my interest in the stars warranted buying a telescope, he wanted it for photography as well. It was decided to purchase a Celestron 8, which has been used now and again for photography and looking at distant objects but has done a lot of mileage in astronomy.

I was encouraged to join Whakatane Astronomical Society, not many small towns have an Observatory. I am still a member! In 1980 we moved into our own home, about five miles the other side of Edgecumbe, across the plains to Thornton, which is about nine miles from Whakatane. Carl decided that he would build me a wee observatory for the C8, though supposed to be portable, I find it an "only just". It is near the house and makes a great deal of difference to my comfort on a cold night.

I played around with the telescope for some time but felt that such an expensive toy should do some proper work. Jim Duthie in the Society was a good friend of Dr. Frank Bateson and Frank would visit Whakatane and give a talk. About this time he talked about variable stars and the useful work done by amateurs. I did not find it that easy to get going, then a certain person by the name of Stan Walker, with Brian Marino, gave a day seminar at the Auckland Observatory and quite a large contingent from the Whakatane Society attended. I was determined to try and with the help of Don Brunt (the only other person in the district to do observations) I made my first observation in October 1988.

I also use binoculars,(12x36), clamped on a tripod, or can use them, (image stabilized) hand held.I have not made a prolific number of observations but made regular contributions most months through to 2005, when other commitments took over. When the Moon was troublesome I made it my friend and did some lunar occultations, again until 2005 and from this followed Minor Planet occultation work, this I have been able to continue to date, as they are not so demanding of time.Now I am determined to do some variable observations again and have made a start!

STUDYING SOUTHERN VARIABLES COLLOQUIUM—I

In the next pages Carl Knight reviews the morning session of this Colloquium. But with the help of Marc Bos we can now show a little of the actual scene.

Brian and Pauline Loader with some other notables in the background—Ranald McIntosh in serious discussion with Pam Kilmartin and Alan Gilmore—Grant Christie explaining something to an anonymous listener and Bob Evans on the right.

Pauline kept the light burning for VSS for several years and is probably grateful at the time of this picture that someone else is now organising things like this Colloquium.

And the anonymous astronomer from the fist picture turns out to be Stephen Hovell from Pamapuria in New Zealand's Far North, seen here chatting to another visual observer in Bob Evans our Treasurer and Membership officer.

If it were't for the Editor we'd have the most northern and southern observers in New Zealand—but Waiharara is a few kilometres north of Pamapuria.

Grant Christie, President of the Royal Astronomical Society of New Zealand welcomes participants to the Colloquium—the first real meeting of Variable Stars South.

Grant has been asociated with Auckland Observatory research—and that done at other Auckland sites— since he was a schoolboy. He now concentrates mainly on photometry of lensing events in an endeavour—already very successful—to detect exoplanets.

STUDYING SOUTHERN VARIABLES COLLOQUIUM—I

Carl Knight sleepless.knight@paradise.net.nz

Introduction:

The Colloquium was attended by 32 on a miserable day in Wellington.

Grant Christie kicked off proceedings with a brief welcome to the attendees. His introduction was upbeat and encouraging. He noted that variable star observing is "one of the elite occupations of the Amateur World in terms of its contribution to science" and that "there is room for everybody" the CCD equipped and the visual observer.

He further made the case for Amateur Variable Star observing, "Funding is an issue for all sky surveys...we can't rely exclusively on these. They're all very well while they're running." Suggesting that once the funding is gone, there is a gap to be filled by the amateur.

As a visual observer I found Grant's point that "there's a role for visual astronomers detecting outbursts, novae and dwarf novae" still quite heartening.

He touched on Brian Warner's vision—at PEP 4 in Hanmer— for all sky surveys to > Mag 20 with amateur astronomers doing the data mining. "What about amateurs publishing?... We want to see the results and not just add more data", he remarked.

Grant concluded the introduction by thanking Pauline Loader for stepping into the breach and running the RASNZ Variable Star section until a replacement Director could be found. And we all look forward to the VSS under Tom Richards.

Stan Walker spoke next on the "Changing periods in Mira and similar stars."

Stan Walker – Changing Periods in Mira and Similar Stars.

The stars in question are cool red giants before the helium flash, and Asymptotic Giant Branch (AGB) where the Miras are located.

Stan began with a key question, "Long Period Variables (LPV), why do we look at them?" In summary, there can be enormous differences between successive maxima despite the internal energy production remaining the same; When we measure their spectral class or pulsation period we are measuring something about their evolution; Furthermore their pulsation tells us something about their physics.

There is a long history of observation of cool red giants. The first observations were made some 413 years ago. Observations of Mira itself dates back to the 1500s.

Stan moved on to examine and compare the following in more detail:

Miras

Semi-regular (SR) stars of various kinds – SRa, b, c, d.

Semi-regular stars of short period

Small Amplitude Red Variables (SARV).

Long Period Variables

The Mira, RR Sgr has a well defined period of 334 days. The semi-regular SRc CL Car has a period of around 513 days and is more regular than LPVs. θ Aps is semi-regular with more frequent pulsations of lower amplitude. β Gru is lower amplitude pulsations again. Finally the SARV HR8889 varies by only a tenth of a magnitude.

Red Variables.

Discussing Miras, Stan noted that according to current theories, Miras should evolve through the AGB in around 60k years. Based upon those theories, we should see one Mira leaving the AGB every 5 years – but we don't. The theories are wrong! Good news for all, there's work to be done!

We know little about the nature of the departure of Miras from the AGB according to Stan. We don't know if the departure is abrupt or gradual, or how the departure changes the star and its light curve.

The O-C Diagram and Period Changes.

The Observed – Calculated (O-C) diagram is used to detect changes in period.

Examining R Aql, in 1870 there was a big change in period. O-C reveals that we see maxima earlier and earlier. Clearly it is evolving in some way. Whist colour (which gives temperature) is pivotal in tracking evolution, Stan pointed out that we lack colour in old observations.

Mira, with roughly 400 years of maxima data, shows changes in period around 1700, though we can be less certain of this, and definitely around 1940 when its changed period by two days.

RR Sgr switches between two periods, this according to Stan is quite unexpected. T Eri shows similar behaviour. Other stars show evidence of alternating periods, among them R Pic and T Cen.

Others we can be less sure of. We lack data, and there is too much variance in the data we have to make a determination.

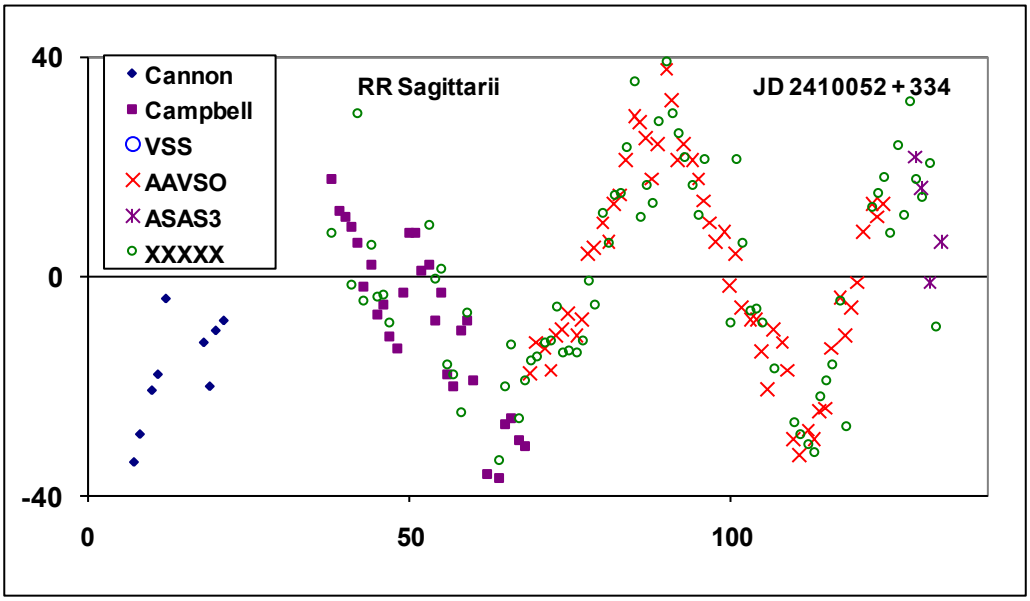


Figure 1: O-C Diagram of RR Sagittarii based on the elements of maximum epoch— JD 2410052 + 334 E.

Days early (-) or late to the left, cycle numbers along the bottom.

Accuracy of Epoch Determinations.
While the driving mechanism for Miras is the same as that of Cephieds, that is driven by ionisation and recombination, and the subsequent impact of each on stellar opacity, a Mira is a star that began at <10 solar masses that has expanded enormously from a few solar radii to 300-1000 solar radii. The Mira's atmosphere is extremely tenuous, and it is further surrounded by a shell of gas, and a shell of dust, each of which has their own radiation signature. With the resulting jitter in the maxima and minima data being in the order of 5%, according to Stan, achieving accuracy of <0.1 magnitudes is largely wasted effort—that visual observation is adequate—and indeed that visual observers are doing a good job.

Other Aspects of Red Variable Stars.
There is evidence according to Stan, that the period of red variables affects their behaviour.

<100 days, small amplitude variables - semi-regular with one of more periods, SARVs.

100-200 days, multiple periods are present.

200-400 days, regular single period.

>400 days yields erratic light curves with dual maxima and changing periods.

Composition is also very important, especially the role of TiO – it increases the temperature sensitivity of a star. Generally where red variables are concerned, the hotter, the less opaque the envelope is—with cooling it becomes more opaque.

Models of red variables focus on a single fundamental frequency. Yet many are observed, according to Stan to pulsate in multiple modes, a fundamental based upon size (diameter) and density, and then overtones.

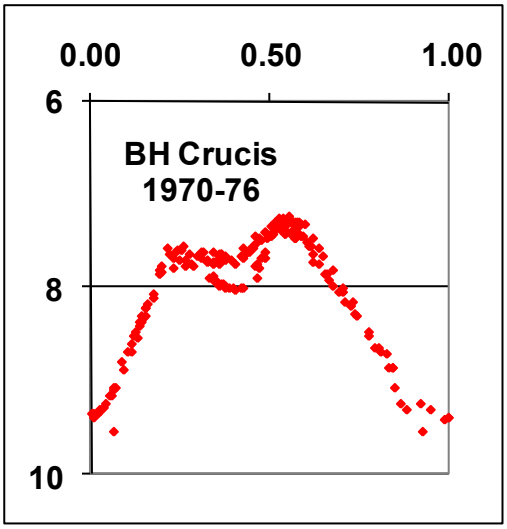
Period Changes in Detail.
Stan next moved on to examine the period changes of R Hya in detail. It has been observed from 1666 and has exhibited a decreasing period for much of that time. Then in the last 150 years it moved slowly from decreasing to alternating periods.

R Aql also maybe showing signs of a change from a decreasing to an alternating period.

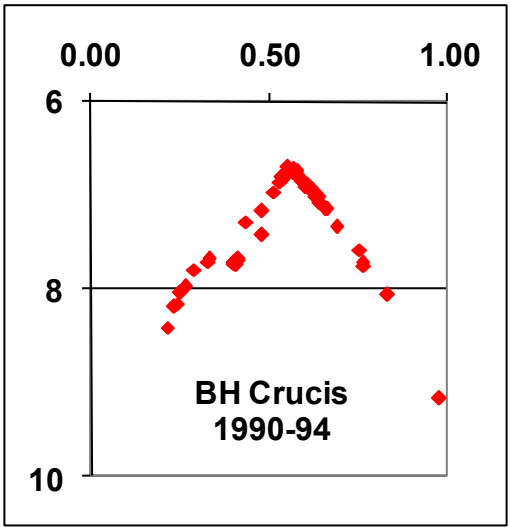
Bright, 7th magnitude BH Cru begs the question, "Why was it not found until 1969", according to Stan. "Was it previously too faint?" BH Cru is an SC and like only a handful of others it exhibits a double maximum. During the past 40 years its light curve has changed dramatically as has its period from 421 to 525 days. Furthermore, colour changes in BH Cru indicate a change in surface temperature – it has become steadily redder – it appears to have maintained the same brightness, so therefore it must have expanded in order to produce the same brightness with a cooler surface temperature.

What period changes tell us.

In the case of R Hya and R Aql, shortening periods of pulsation implies they are becoming smaller and hotter.



PE Measures from Auckland Observatory on the left, from Milton Road Observatory on the right. All in V of the UBV system.



In the case of BH Cru, it has been cooling, and its largely steady brightness and lengthening period of pulsation implies considerable expansion. Currently there are no models that predict any changes in internal energy production so what then is causing the observed behaviour? Some suggest that chemical opacities have a role in altering the energy flow within the star and hence influence pulsation.

Semi-regular Stars.

SRs are a mixed group. Those with a longer period resemble Miras and LPVs but differ in that they exhibit lower amplitudes and less regular pulsations. At the shorter period end, they exhibit far more variety of behaviour. Some pulsate in several periods at once and the stronger these periods are, the more erratic the light curves become.

Stan drew attention to the transition typically shown on the HR diagram between Red giant, Helium flash, Horizontal branch and Asymptotic Giant Branch and the need to firmly establish where the stars we are observing fit. Stan notes, "It's not as simple as it looks here – judging by the examples I've shown. Or is the evolution similar to that of binary stars where we see them at different stages but don't recognise them at others, e.g., the 2-3 hour dwarf nova period gap."

What is needed according to Stan, is measurements of SR stars with low amplitudes and also those with short or unknown periods.

In offering clarification to this article, Stan recently communicated to me, "We cannot understand red variables by studying Miras alone. SR, SARVs, LPVs and Miras are all part of the same interesting puzzle, but too little is being done to study the non-Mira stars."

Stan Walker explaining a very tricky point—with gestures— in answer to a question.

Dennis Sullivan – Southern variable White Dwarfs over an Extended Period.

Dennis Sullivan gave the next presentation, detailing work done at Mt John University Observatory to study southern White Dwarfs (WD). His work has been one of evolution and refinement as lessons were learnt over time and technology advances, especially the application of the same enabled the quality of the data to be greatly increased.

One of the issues Dennis highlighted in his work at Mt John was that when attempting to track the pulsations of WDs, variations in transparency and cloud can mimic the phenomena that the project is attempting to capture. Using Fourier Transforms, the coherent WD phenomena can be distinguished from the incoherent (transparency, clouds, etc.) and useful data obtained.

To achieve this, multiple apertures are required on a photometer monitoring:

The sky.

A suitable comparison star.

The WD target.

Initially the time series photometry work was performed with a photometer. This required a very accurate time source.

The next phase was a CCD system developed at the University of Texas. This uses a frame transfer CCD. It has the advantage of allowing more data to be captured. It takes milliseconds to transfer data to the buffer side of the CCD chip, and then the data can be read at a more leisurely pace whilst the exposed side of the CCD is continuing to capture more data from the target. The system also offers integration time in the order of 10 seconds. However, the CCD system is not as good as the three channel photometer yet.

Dennis touched on the cooling mechanism for WD cores. Due to the extreme density and opacity of the WD core, the core cannot cool by radiative means. Instead the WD core cools by neutrino emission. During the morning tea break, I was able to get Dennis to explain in more detail:

> "The mean free path of a photon is such that very little in the way of energy is able to escape by photon emission. Instead it requires the far more exotic process of neutrino cooling. This is a rare reaction where the collision of two gamma rays in the dense core yields a virtual electron-positron pair. Instead of recombining and annihilating, the electron-

Dennis Sullivan makes a very serious point in his white dwarf presentation.

positron pair further decay into a pair of neutrinos. The mean free path of neutrinos is enormous – measured in light years of lead – and so the energy associated with the original gamma rays is emitted from the core by means of the neutrinos produced by the decay of the virtual electron-positron pair."

Dennis gave an example of how the three channel photometer is used to discriminate the WD pulsation period from the noise. To obtain the data necessary, the effects of the sky are removed from the raw data in the following manner:

K x (WD – Sky) / (Cmp – Sky)

Then Fourier analysis is used to reveal the WD pulsation period(s).

Roland Idaczyk – Absolute Parameters of Young Stars: V831 Centauri.

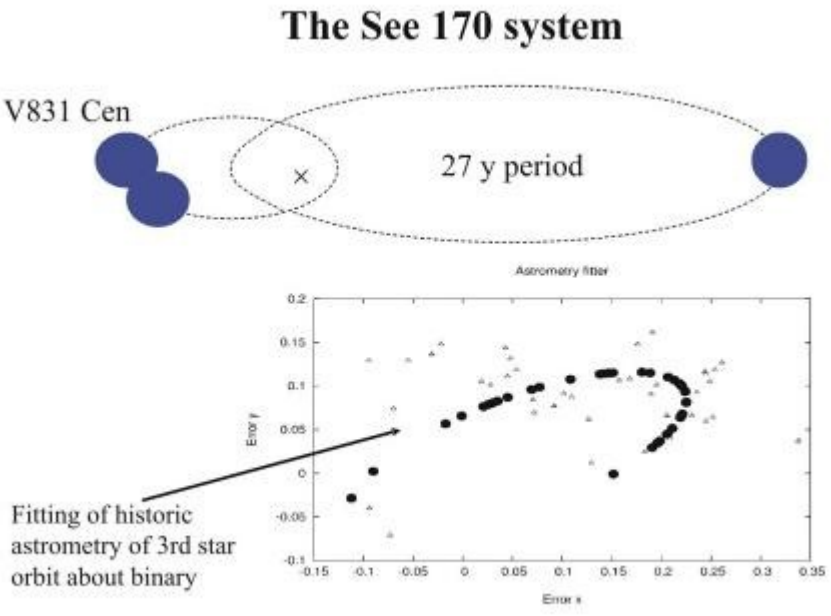
Roland presented a work in progress involving himself and a number of collaborators. They have been working on a complex multiple system. V831 Cen is an ECB, part of the 27 year period multiple See 170 depicted below. See 170 is itself part of the larger multiple I 424— illustrated overleaf— with a 1500 year period.

There is evidence of asymmetries in the light curve of V831 Cen when Hipparcos data V-Band photometry is fitted to the V-Band photometry of Waelkens & Bartholdi (1982). Roland remarked that this might be due to the influence of a third unseen component in V831 Cen. Spectra of V831 Cen also indicate a third component.

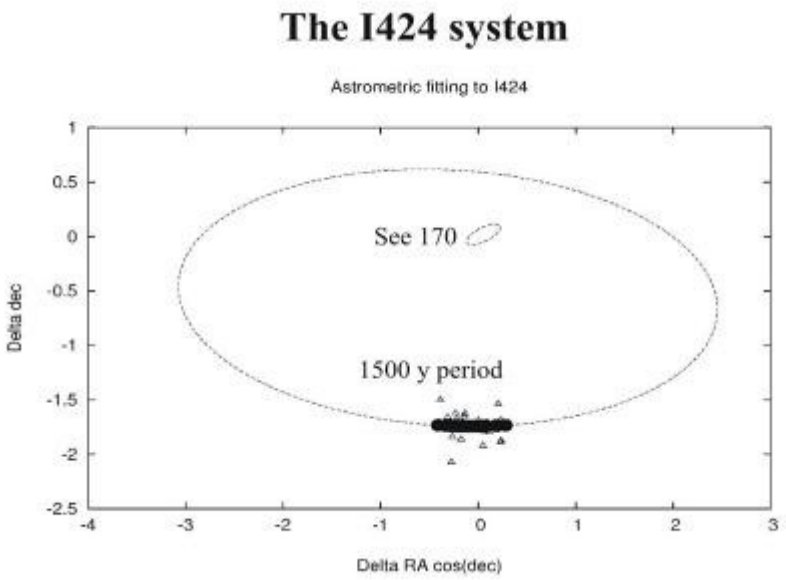
The team has experienced considerable difficulties gathering data from its Wellington region based observatory for various reasons:

- Noisy data.
- No photometric nights.
- Always some atmospheric cloud – even if it's not visible.

The team is now attempting to complement the existing multi-band photometry of V831 Cen with I-Band photometry. According to Roland, I-Band photometry of the system has not been done yet. As of the time of the VSS Colloquium, they had insufficient data having done I-Band photometry only between January and



April 2009. The project is very much a work in progress, but the team is hoping that I-Band will produce new information.



Roland further discussed issues the team has experienced with sky noise and saturation. There were a number of possible solutions suggested from the Colloquium attendees.

Preliminary findings regarding the third component of V831 Cen.

The third component's contribution to the spectra of V831 Cen shows rare earth elements Chromium (Cr I), Europium (Eu I), Gadolinium (Gd II), Manganese (Mn I), Samarium (Sm II) and possibly Neodymium (Nd II). This suggests that the third component is peculiar, "a Bp or Ap type star" according to Roland.

Aims for the project in the future include:

- Better data on the ECB minima.
- More information about the third component in V831 Cen.

Roland Idaczyk answering questions—a good feature of the Colloquium was the audience involvement

Finally Roland concluded with a plea to "watch this space" as it's early days for this project and much more data needs to be gathered yet.

Tom Richards – Bad Contacts: An Attempt to Classify some Little-studied Southern Eclipsing Contact Binary Variables that Aren't.

Tom Richards has been investigating little studied southern eclipsing contact binary (EW of the W UMa class) variables as part of a US based project with 12 members. He has been using his own 16" RCOS – other members have been trying to use a Global Rent-a-Scope instrument at Moorook, South Australia with limited success.

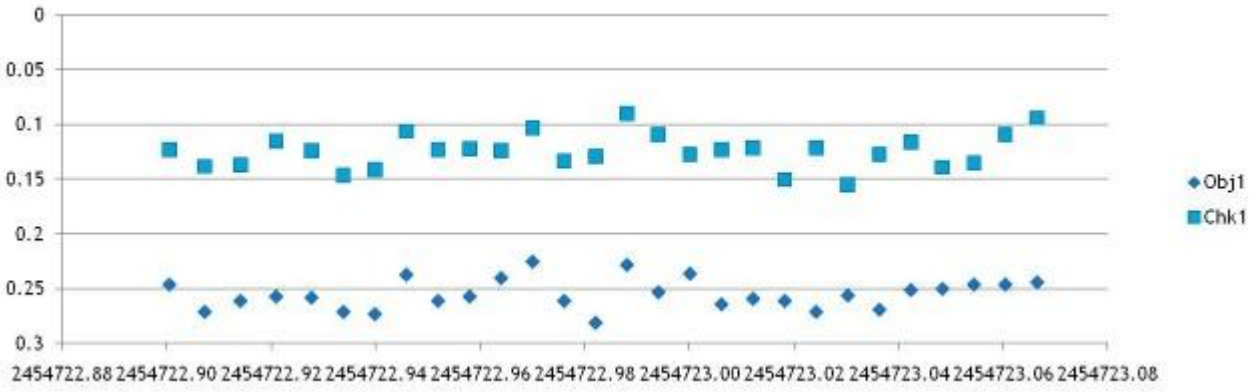
What is expected of the stars in the study, if they are genuine EWs is:

- A period of < 1d.
- The components share an atmosphere – so the light curve varies continuously with no flat portion.
- Minima about equal.
- Amplitude of variability of between 0.1 and 1.0 magnitudes.

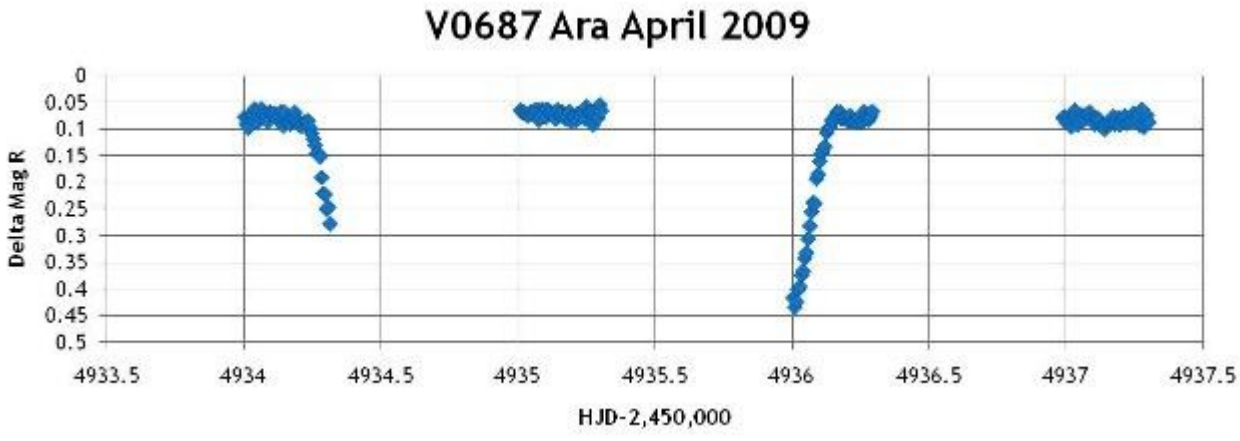
In the EWs that Tom has looked at to date, there are problems. One very notable issue is that if these stars have a common envelope, that envelope should have the same temperature, yet their minima vary – why? Whilst the GCVS says these are EW stars, Tom points out that the photometric data were not that good when the classification was decided.

First Suspect: V0687 Arae.
Tom subtitled this, "Or why I'm glad I'm not a professional astronomer".

There are lots of data but no meaningful light curve so Tom set about doing his own photometry over a number of nights, which yielded pretty much a flat curve – what Tom described as "boring". The curve was flat enough that any variability at all was all within the "error bars" so to speak. It seems very unlikely that V0687 Ara is an EW) at all.



Then Tom finally observed something genuine, a decline and then a climb. Eventually Tom had enough "scraps" – including the flat line data – as he called them to estimate a minimum, extrapolate another, and arrive at a possible period of 1.616d. The extrapolated light curve—below— now looks like an EA detached binary, not an EW.



Now Tom had an ephemeris to test with some predictions for full eclipses of the system and just needed some cloudless nights to prove it. Alas, by the time of the Colloquium the much needed cloudless nights had not occurred. Tom has subsequently informed me that later work was confirming his hunches until two months of solid cloud set in. (BAA VSS members will be pleased to note that "cloud" is not just a UK phenomenon.) So in concluding the case of V0687 Ara:

Tom Richards is backgrounded by a slide showing different aspects of the binary systems he's discussing.

- It may be an EA, not an EW, with a period of around 1.61 days.
- It's nothing at all like the GCVS classification.
- More data is needed to get an a thorough coverage of the orbit. Is it elliptical? What is its inclination?
- An accurate ephemeris for times of minima is needed.
- Light curves in different colours, to see if there are two separate stars of different temperatures.

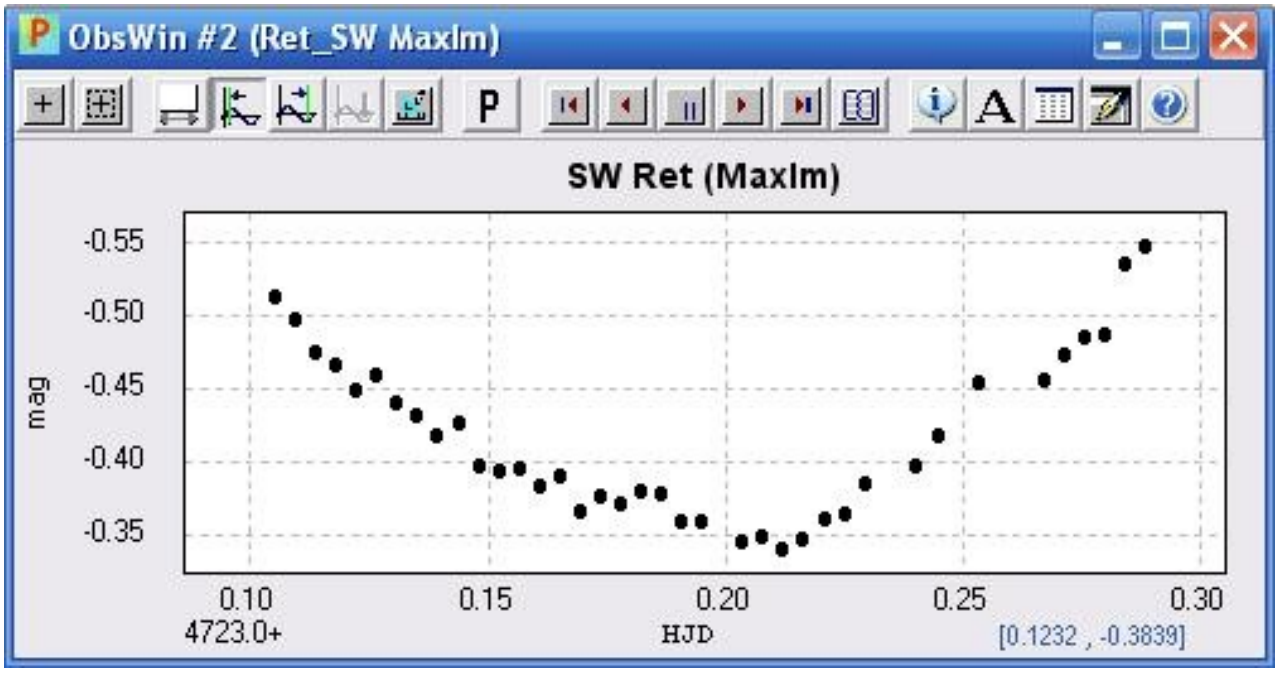
SW Reticuli – a Star With Many Disguises.
The next case Tom examined is that of SW Ret.

- The original GCVS in 1953 classifies the system as an EW with a period of 0.52774d.
- The ASAS-3 survey says it is an RRc which is a variant of RR Lyrae with an amplitude of variation of <1 magnitude, and a period of 0.2 to 0.5 days.
- To further muddy the waters, Szczygiel & Fabrycky (Mon. Not. R. Astron. Soc., 377, 1263-1274 (2007)) offer the opinion that SW Ret is an RRd. They worked at the very limits of the ASAS-3 data and concluded that SW Ret has two periods, an overtone of 0.3548111d and a fundamental of 0.4766242d.

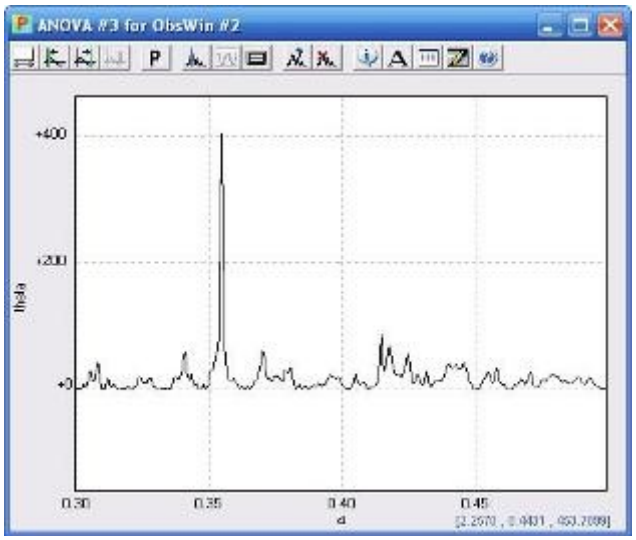
To quote Tom, "Who is right?"

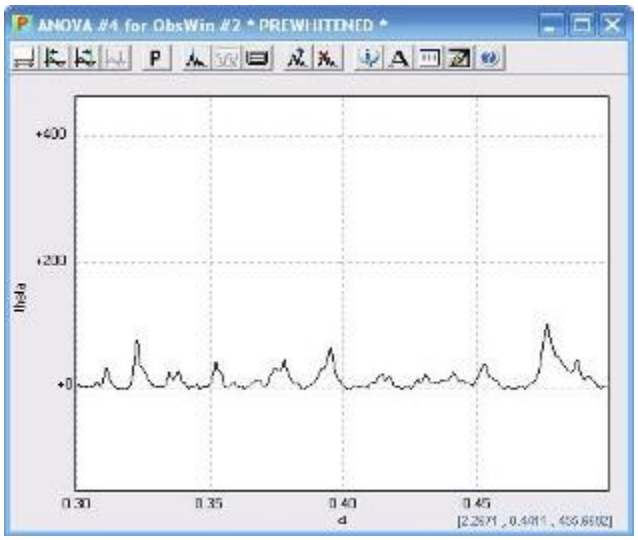
Tom did his own photometry. On the first night, the light curve as shown on the following page clearly indicated the system was not any sort of eclipsing binary. SR Ret is not an EB! Tom obtained twelve nights data between between September and November 2008. From the resulting data, he was able to reach the following conclusions:

SW Ret is definitely an RRd – probably a double mode RRd. The dominant period is 0.37487d. The ASAS-3 says 0.3548111d.



Tom folded his data about the previous dominant period and its aliases from a period plot to reveal a second period of 0.476518d. Szczygiel & Fabrycky had 0.4766242d.





Further Work.

Still to do, UX Hor, V0805 Ara; Refine V0687 Ara and SW Ret; And would really like some spectroscopy.

Lunch.

Lunch was a great time for lively conversation with like minded people – with two notable exceptions. I had a couple of burning questions which Tom Richards very kindly offered to attempt to answer. He suggested we seat ourselves in the couches by the fire. So with full bellies, comfortable seats, an open fire on a rainy Wellington afternoon, we sat down to discuss the growth of the electron degenerate core of WDs and the propagation of the cooling wave through the accretion disk of a CV as it comes out of outburst – now I can't speak for Tom, but I'm guessing that the combination of food, comfort, and open fire made us both anything but "lively".

To be Continued in November

A couple of views of an enthralled audience

And my thanks to Carl Knight, the well outfitted astronomer below, for the review of Colloquium 2009 and to Marc Bos who came to the rescue with the photos used.

Carl Knight with Telescope—a well padded-up visual observer—Carl writes.

"The telescope is a 12" Meade LX90 LNT. It has a Dew-Not dual channel dew heater, a Meade 1209 microfocuser with handset that I made - I found it better than using the Autostar handset. There's a StarGPS unit as well - my LX90 is an LNT and predates the GPS and ACF models. Other than that it's just the two dew heater strips 2" for the eyepiece, 13" for the corrector plate, and a dew hood."

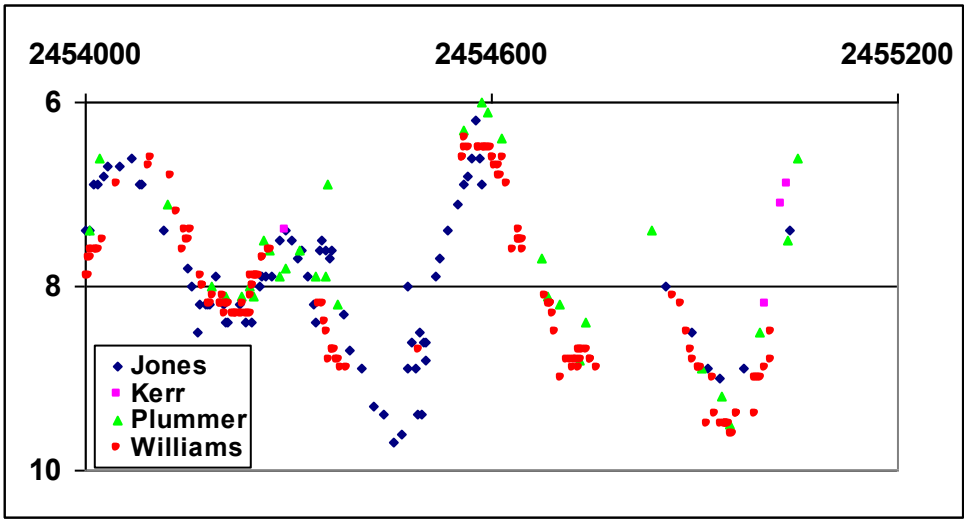
VISUAL MEASURES OF DUAL MAXIMA MIRAS

Stan Walker *Pulsating Variables Coordinator* *stan.walker@varstars.org*

Since announcing the project in February there has been some progress—mainly on the visual scene. Some of our members have been measuring the three main stars of the group—R Centauri, R Normae and BH Crucis—as part of their normal programmes, but have now added some of the others into their schedules.

Before looking at these in detail might I suggest that attempts be made by our more southern observers to follow these through complete cycles—there is a noticeable lack of measures when they are poorly placed. It is becoming clear that the bumps and humps which occur on a number of other LPV stars are related in some manner to the dual maxima phenomenon. More about this below.

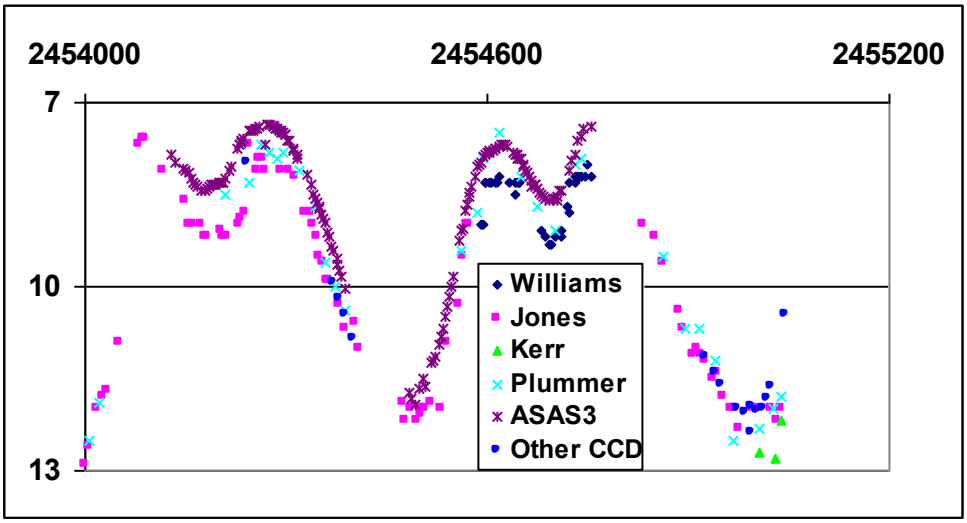
Let's begin with a light curve of R Centauri since JD 2540000. This shows measures by four members of Variable Stars South over this interval. The gaps mentioned above are quite clear here. The star is just approaching first maximum so measures would be very useful. There are indications that the second maximum is strengthening again but only time will answer this speculation. There are no colour measures available—poor weather, a fault in my photometer and other things have precluded these. But they will come.



Members with larger telescopes might care to follow stars with faint minima through these. A table listing both maxima and minima appears below. With some of the less regular stars these values are probably well out.

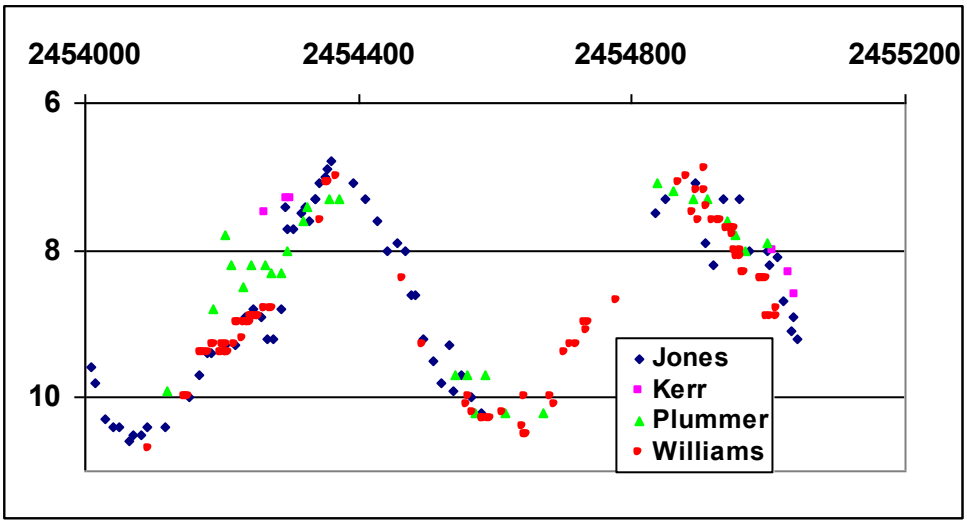
Star	Min	Max I	Max II	Star	Min	Max I	Max II
V415 Vel	55300	55340	55120	TT Cen	55130	55210	55330
BH Cru	55110	55200	55390	UZ Cir	55120	55220	55400
R Cen	55410	55100	55280	FK Pup	55125	55220	55480
R Nor	55000	55120	55300	CK Car	55350	55430	55180
BX Car	55310	55460	55170	CL Car	55100	55220	55500
BN Sco	Not available						

As far as visual measures go I would appreciate a list by email each month in whatever format you submit to AAVSO in. It's easy enough to extract the JD and magnitude for the project purposes. Don't worry about conversion to HJD—it's hardly relevant for these stars. Alan Plummer mentions that R Normae is also brightening quickly so keep an eye on that star as well. Measures of R Normae by the same observers are shown immediately below, which also allows a comparison with ASAS3 and some other V measures from the International Database. It's noticeble that the ASAS3 measures look good, but are consistently brighter than the visual and, indeed, the other CCD V measures. There were a few BRI measures available as well, but in this context they would only be confusing if shown. There is obviously a substantial difference between ASAS 'V' and the eye—a good reason for continuing traditional measures.



BH Crucis continues to surprise. A graph of the same period from the same four observers appears below. It is clear that people's eyesight is such that each sees it a little differently but apart from that the visual amplitude is larger than the range through a V filter and at minimum it appears fainter to the eye by about half a magnitude.

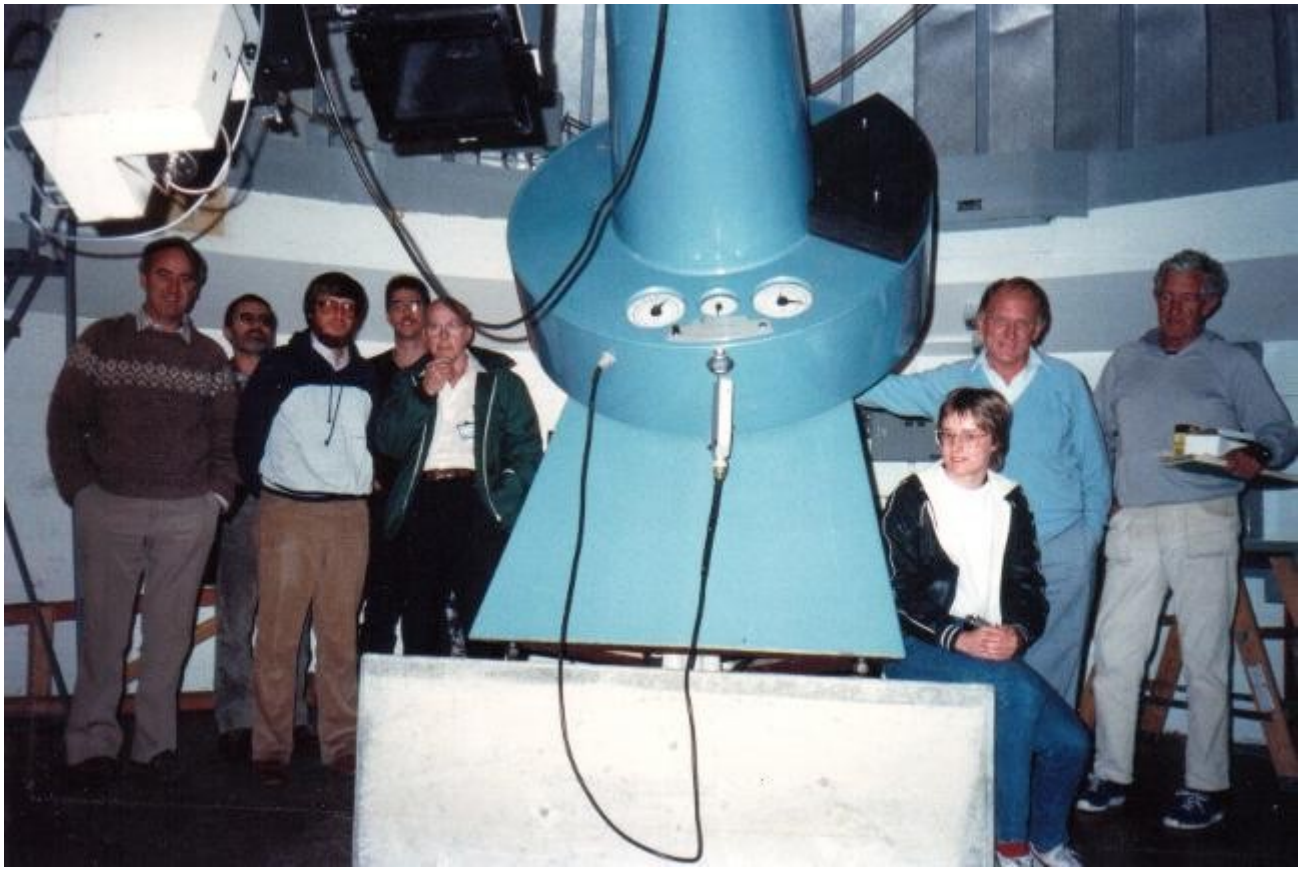
Further analysis of UBV measures made at Auckland reveals that the original first maximum was still present well after the star had become an apparently single maximum Mira with a bump on the rise. What has happened is that the overall brightness of the star has increased by ~30% in V, but this is seen as an enhancement of the second maximum with the first still much as previously. Along the way the colour has reddened, suggesting a cooler and larger star. This is not clear from the last two observed cycles as the critical region either lacks observations or they are confusing. So put this on the agenda—particular the rising light curve from about January onward.



MEETINGS HERE & THERE

The **IAU General Assembly** was held in Buenos Aires early in August—always a large and complex gathering. One of the more interesting results was that Karen Pollard, Professor of Astronomy at University of Canterbury—and a long time supporter of the old RASNZ VSS and the RASNZ Photometry Section, which were in effect Variable Stars South's precursors—was made Vice-President of Commission 27, Variable Stars. From PEP3 in Blenheim about 1987 we see a group clustered around the Boller & Chivens of Carter Observatory at Black Birch. All of us, including Karen, were a lot younger then!

Perhaps in the future we'll see the PEP type meetings begin again—with both professional and amateur support. Whilst the 'on-line age' as mentioned below is with us, there's no substitute for face to face meetings of this type—Wellington, Auckland, Blenheim, Hanmer, Toowoomba were venues—to stimulate various avenues of research. And travel costs now, when referred back to 1987 dollars, are much lower.



NACAA XXIV will be hosted by the Canberra Astronomical Society in Canberra over Easter, 2010, from 2-5 April. The theme will be 'Astronomy in the On-Line Age'. Presentations close on 27 November, 2009, so we are bringing this to your attention early—the November Newsletter won't give you much time for getting one together! The website (http://www.nacaa.org.au) has more detailed information. I even hope to attend myself.

Annual Conference of the RASNZ in 2010 will be held at Dunedin on 28-30 May, 2010, at the Otago Museum. The Dunedin Astronomical Society will host the conference. Details will later appear on the website (http://www.rasnz.org.nz)

CONTACT INFORMATION

Director	Tom Richards	Tom.Richards@varstars.org
Treasurer/Membership	Bob Evans	Bob.Evans@varstars.org
Editor	Stan Walker	Stan.Walker@varstars.org
Cataclysmic Variables	Paddy McGee	Paddy.McGee@varstars.org
Eclipsing Binaries	Tom Richards	Tom.Richards@varstars.org
Pulsating Variables	Stan Walker	Stan.Walker@varstars.org
Visual Research	Alan Plummer	Alan.Plummer@varstars.org

Website	http://www.varstars.org
Webmaster	Tom.Richards@varstars.org
VSS Members' email group	http://groups.google.com/group/vss-members

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. It needs to be expanded a lot more however, and suggestions should be sent to the webmaster.
All VSS members should belong to the VSS-members egroup, as that is the main channel of fast communication between members. If you're a VSS member and still haven't signed up to it, email Tom Richards to get an invitation.

MEMBERSHIP

New members are welcome. The annual subscription is $20NZ, and the membership year expires on April 30th. Find out how to join by visiting the VSS website at http://www.varstars.org/Join-VSS.html. There you will find out how to join by post, email, or directly online. If you join by email or online you will get a link to pay by Pay-Pal's secure online payment system, from your credit card or bank account.

After you've joined and received your membership certificate, do please sign up to the VSS-members egroup (see above). In its personal information section, it would help everyone if you added information about your telescope and equipment, your astronomical interests and anything else you consider appropriate.