



Attendees at the Fifth VSS Symposium held at the YMCA Christchurch, New Zealand, in May 2018.

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From the Director – *Mark Blackford*

Welcome to the third newsletter issue for 2018, which comes a little earlier than normal due to our editor's travel commitments. I'm writing this column from the lounge deck of a cruise ship on the Douro River in Portugal, far removed from normal abode. My wife and I have been travelling for the last month, so my observing has been limited to a few brief naked eye glimpses of the moon, planets and brighter stars. I'm looking forward to returning home in early July and getting back to variable star observing again.

Whilst visiting the History of Science Museum in Oxford, UK, I was privileged to see one of the 7' focal length telescopes made by William Herschel. A fine example of leading-edge telescope design and construction from the 18th century (see image below). I wonder what he would have made of the telescopes available to amateurs today, let alone the equipment and techniques employed by professional astronomers.



May seems such a long time ago but the fifth Variable Stars South Symposium in Christchurch was a very successful meeting, as was the RASNZ conference that preceded it. We had 14 very interesting presentations from 10 speakers on topics ranging from asteroid photometry to theoretical modelling of nova light curves. For the first time in our symposia we had talks presented via the internet which, despite my worries leading up to the meeting, went very smoothly. I wish to thank Dr Yael Hillman and Carl Knight for agreeing to give these talks even though they could not make it to Christchurch themselves. Thanks also to the other presenters and attendees for making VSSS5 a great event.

In this Newsletter and coming issues we will have articles based on many of the symposium talks. Also, PowerPoint (or similar) files of most of the presentations will be available on the VSS website <https://www.variablestarssouth.org/5th-variable-stars-south-symposium-christchurch-2018/>

On a sad note, Steve Fleming recently informed us via the VSS Discussion forum of the passing of our variable star colleague Dr Terry Trevor Moon (Tex). Condolences to his family and friends.

Clear skies and good observing.



Vale Dr Terry Moon



It is with great sadness that I let you know that Dr Terry Trevor Moon (Tex) succumbed to cancer today in Scottsdale, Tasmania.

He was an prolific observer of variable stars, an inspiring mentor, and a keen advocate of bringing Citizen Astronomy into the realm of the ordinary person.

He will be sorely missed. Today, I lost a dear friend and mentor.

Steve Fleming.

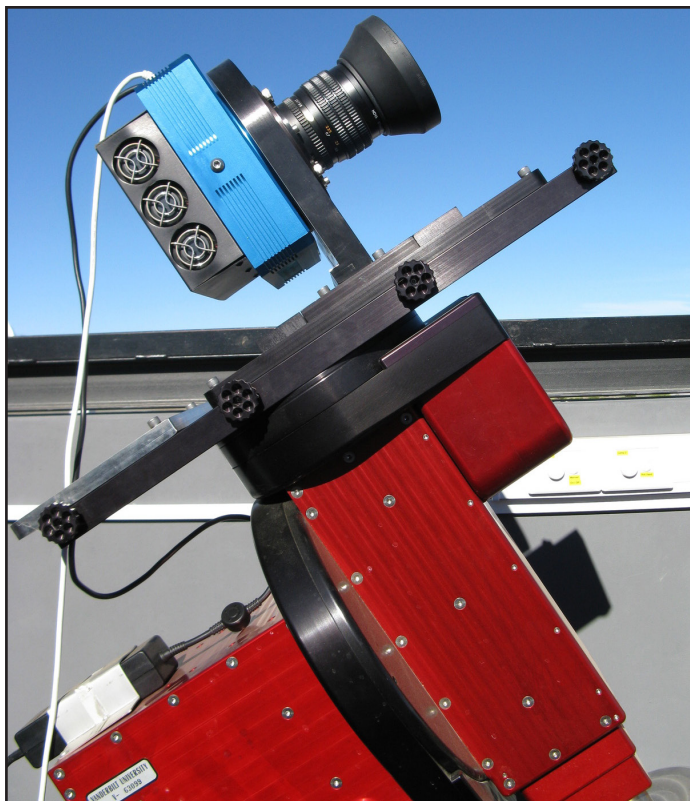
VSS's fifth symposium was held at the YMCA, Christchurch, following the 2018 RASNZ annual conference. It began with an evening session on Sunday 6 May on the theme of pro-am collaborations.

Phil Evans gave the opening presentation entitled “Confessions of an exoplanet junkie” covering his early work on transiting exoplanets using the Exoplanet Transit Database (ETD) website from his home in Rarotonga. This work led to an invitation to join the KELT (Kilodegree Extremely Little Telescope) exoplanet survey group. The invite came serendipitously as he began using his remotely operated scope in Chile. As well as observing KELT candidates he also spoke about testing Kepler K2 candidate planets and practice targets from the TESS Input Catalog. The TESS (Transiting Exoplanet Survey Satellite) was launched in April and is expected to begin full science operations in July this year. Phil is a member of the TESS SG1 group and will be checking candidates at milli-magnitude precision.

For the rest of the evening there were three presentations given remotely via Skype. First up was **Dr Yael Hillman** of Tel Aviv University in Israel who discussed her theoretical work on simulations of novae. She explained what novae were, the features of their light curves, how models help the understanding of observations and why long-term modelling was needed. Central to her studies is the dependence of luminosity on white dwarf mass and accretion rate from the companion star.

Following Yael there were two Skype presentations by **Carl Knight**. His first concerned his efforts to achieve greater precision in observing exoplanet transits. Carl has only recently begun to study exoplanets but has already submitted several high quality observation sets to ETD. He noted several major problems that he had to overcome: poor guiding from the Meade mount for his scope (still persists); poor periodic error control – solution was to write his own ASCOM driver for the Meade mount; difficulty guiding on defocused stars – used a locally made adapter ring and a precision helical focuser; poor polar alignment – solution was to use PEM Pro software for better alignment.

Carl's second presentation covered his collaboration with astronomers from the Pulkova Institute in St Petersburg with observations of the asteroid 4963 Kanroku. These observations lead to the conclusion that the rotation of the asteroid was precessing, likely as a result of there being a bound companion. The team published a paper in Planetary and Space Science (2017) Vol 153 pp 11-21.



The Kelt South telescope at Sutherland, South Africa. You can see that it is really extremely little.

Summary.

Sokova, I. A., Marchán, A., Franco, L., Pappalardo, R., Salvaggio, J., Palmas, T., Solari, E., Gortiz, J., Knight, C. R., Breen, M. (2017), 4963 Kanroku. Aisased with a possible precession of rotation axis, Planetary and Space Science xxx (2017) 1-11.

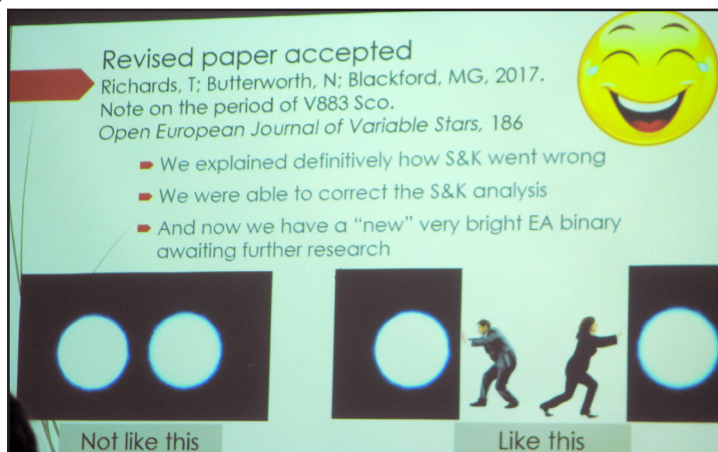
- Two periods are found for 4963 Kanroku:
 - Rotation (P1) at $2.616h \pm 0.001$
 - And a second period (P2) at $8.2017h \pm 0.0021$
- In exploring the causes of P2, the most likely thus far, phenomenon that best reproduces the observed light curve is that of a close companion to 4963 with "...an orbital period of $\approx 8.2h$ [that] yields a precession of the rotation axis of 4963 of $\approx 16.4h$." (Sokova et al. 2017)
- Mutual phenomena should be established to prove the existence of a satellite. There is a single light curve that supports the presence of mutual phenomena but that is too small a sample to be definitive. Until that result is definitive, free precession of 4963 remains a possibility.

Carl's work on 4963 Kanroku lead to the publication of a paper with his collaborators from the Pulkova Institute and elsewhere.

The seminar continued on Monday, opening with **Mark Blackford** discussing how he, Neil Butterworth and Tom Richards set about determining the correct ephemerides of the eclipsing binary V833 Sco. Existing literature showed the period to be 1.29484 days which predicted erroneous eclipse times from a given epoch. The team used archival data from ASAS, new data from INTEGRAL-OMC satellite and Neil's DSLR observations, along with VStar analysis software, to show that the actual period was 4.341164 days.

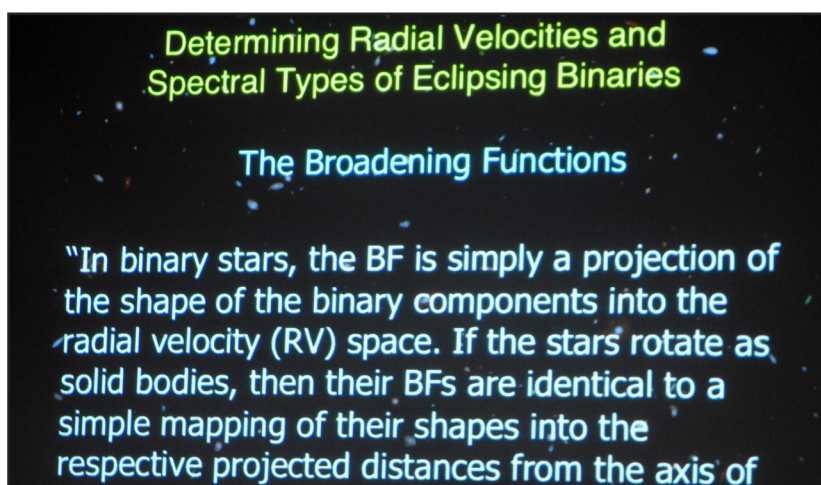
Tom Richards continued the talk on V833 Sco outlining the trouble the team had in getting their new value published. Tom likened it to a detective story and provocatively entitled it "When Homer Nods" – a reference to the suggestion by the Roman poet Horace that even Homer, the great author of the Iliad, could sometimes make a mistake. Tom reckoned it was the referees at the OEJV who were mistaken as they seemingly preferred the results of professional astronomers to those of the VSS amateurs. The team were able to convince the OEJV that Knigge and Strohmeier, the authors of the original publication, had mistaken the secondary eclipse for a primary and also had not realised that the secondary eclipse was displaced from phase 0.5 due to an elliptical orbit.

David Moriarty concluded the first half of the morning with a talk on his work using the Australian National University's 2.3 metre telescope and wide-field spectrograph. He explained how the use of Rucinski's broadening function was more efficient at finding radial velocities from spectra of eclipsing contact binaries than the more conventional cross-correlation function. The broadening function provided information on relative luminosities as well as velocities, and further was better suited to the analysis of the triple star systems that he has been working on for the past few years.



Job done for Tom and his team after they convinced the editors at the OEJV to accept their paper on V833 Sco.

Following a short break for morning tea **David Moriarty** continued with details of his photometry and spectroscopic analysis of three star systems ST Cen, V775 Cen and TW Cru. He presented astrophysical models, built using Binary Maker 3 software, and further showed that they were likely triple systems based on his application of Rucinski's broadening function to the spectra he obtained with the ANU 2.3m telescope.



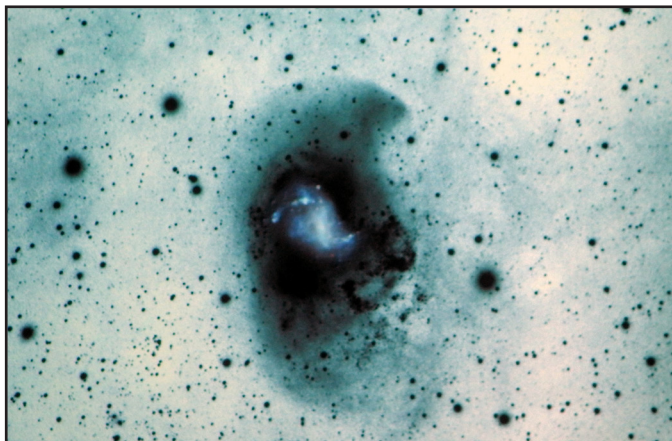
David's slide explains what a broadening function is.

this system is that the orbital period of the eclipsing system is 124 seconds short of six days which means that from a single observing longitude it would take 11.5 years to record the full light curve. Observations made by the BRITE-Heweliusz satellite have helped with the construction of a new mean light curve (MLC). Stan suggested that if the light curve of the eclipsing pair were to be subtracted from the MLC then information might be gained on the eccentricity of the other pair of stars. BRITE measures are expected to help with this.

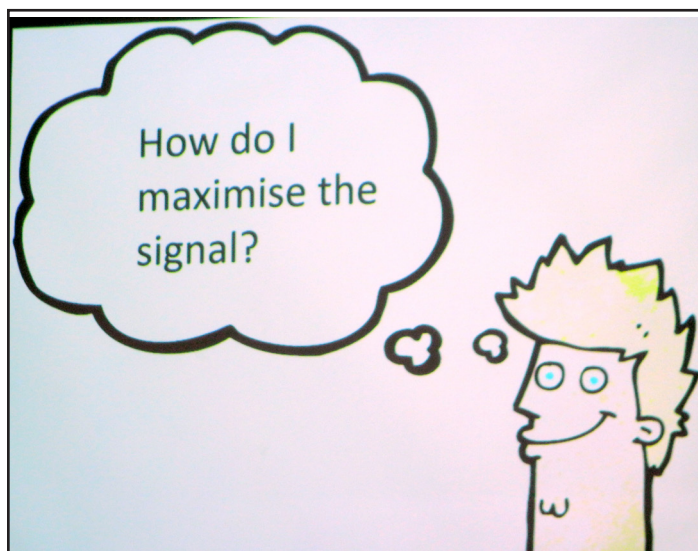
Observations of QZ Carinae have been carried out over a number of years and **Stan Walker** presented an update on this very interesting double binary system. One of the major difficulties with

Ed Budding presented a summary of data on two close binary systems V454 Car and HX Vel. Both of these systems are suspected of being triples at least. Ed used DSLR BVR light curves taken by Mark Blackford to help confirm the absolute parameters of both stars. The two main components of V454 Car have masses of $6.3 M_{\odot}$ and $5.86 M_{\odot}$ with temperatures of 19,000K and 18,500K respectively. V454 Car is suspected of being the major component of a multiple system whose other component is also a binary. The masses of the HX Vel pair were found to be $9.6 M_{\odot}$ and $5.6 M_{\odot}$ with temperatures of 25,000K and 17,000K. High resolution spectra have been taken at Mt John Observatory over the past nine years and **Roger Butland** assisted Ed in this talk with explanations of the radial velocity curves, obtained from the spectra, which show irregularities on timescales of days to weeks.

Outgoing RASNZ president **John Drummond** then gave us a “A completely disorganised talk” - his words! However there was nothing disorganised about the wonderful photographs he showed of a variety of interesting astronomical phenomenon. John owns six observatories and I forget how many telescopes but he obviously has put them to good use. He explained his attention to guiding, focus, processing using curves and levels and how he uses CCD Commander to setup a night’s observing session. It was not all



John showed some remarkable astrophotography - and my apologies for the colour of this photo of a slide of a photo.



Roy wonders if he can get more signal using the full sensor instead of just the green channel from his DSLR.

pretty picture stuff as he has been successfully involved for many years with MicroFUN, the follow-up network for OHIO State University’s microlensing exoplanet search.

Roy Axelsen presented data on his experiments to determine if the whole sensor of DSLR cameras could be used for non-transformed magnitude photometry. The Bayer matrix (usually 25% red, 25% blue and 50% green pixels) of a DSLR sensor means that using individual colours results in low efficiency and Roy wanted to see if data from the entire sensor, as white light, could be used as efficiently and accurately as, say, V data from a monochrome CCD camera. Roy tested his ideas on V703 Sco, a delta Scuti star comparing white light magnitudes with those from the green channel alone. Statistical analysis revealed no significant difference

between the two methods, leading Roy to conclude that white light DSLR photometry is a valid procedure for time-series observations when transformed magnitudes are not required.

The symposium was rounded off with a short talk by **Stan Walker** on R Cen, which he described as “an interesting and perhaps unique star”. Stan presented archival and recent data to show changes in the light curve shape, amplitudes (of the two maxima) and the pulsation period. He suggested that this star is quite different from other Mira stars. He then drew our attention to several other Mira stars which he felt were worth pursuing, particularly with DSLR cameras for B & V data, but also using CCD cameras for a fuller range of colours using BVRI filters.

The research reach of the modern amateur

Paper presented to NACAA 2018, Ballarat, Vic., AU and to RASNZ conference 2018, Christchurch, NZ. The Powerpoint presentation is [available on the VSS website](#).

Modern software is enabling the amateur astronomer to make significant, publishable research results - not just piling up observations. In the linked presentation we describe the research pipeline for eclipsing binary photometry-based research. The pipeline begins with dots on stellar image frames, and proceeds towards two types of publishable results: analysis of period and period change, and development of an astrophysical model of the binary system.

The pipeline set out in the presentation, though commonly used in this area of research, uses as a specific example the steps we took in developing our paper “A Photometric Study Of The Eclipsing Binary NSV 1000” ([JAAVSO 2018, 46:1](#)). For a full account of the research procedures involved visit the [Southern Eclipsing Binaries Project](#) website, in particular the [Research Activities](#) pages. Or get there from the [VSS website](#) under the Projects tab.

This short account does not discuss hardware or software requirements or brands. These can be found through the links above.

Initial pipeline stages A time-series of images of an eclipsing binary target is acquired during one or several nights, to capture eclipses (for period analysis) or entire phased light curve (astrophysical modelling). The image set is calibrated (a standard process known to all astro-imagers), then photometry is executed via software on the variable, a comparison star and a check star. The output is a table of differential photometry of the variable (Heliocentric Julian Date and Var – Comp magnitude).

Period Analysis pipeline The eclipse curve is analysed in software to obtain a time of minimum (as HJD) for the eclipse (Figure 1 illustrates). If three or more well-spaced primary eclipses are obtained (start and end of a season or successive years) an orbital period P can be obtained by linear regression (in software) using an existing catalogue period as an initial approximation. The regression can be used to correct one of the minima to provide an initial epoch of minimum $E0$. P and $E0$ comprise the binary’s *light elements*.

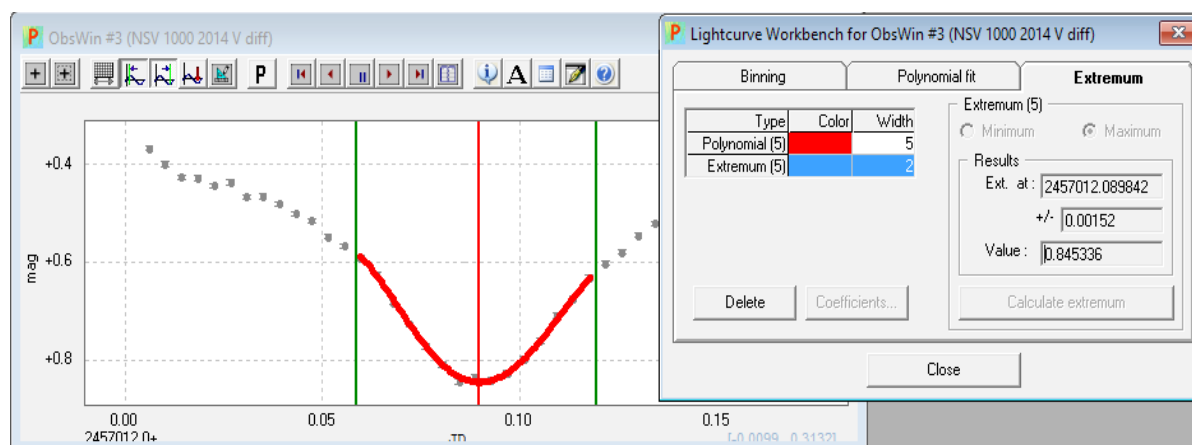


Figure 1. *Fitting a polynomial to an eclipse curve to find the time of minimum.*

Finally all existing minima estimates are collected (from a literature search) to construct an *O-C diagram*, a plot of the difference $O-C$ between observed minima times and those calculated from light elements using $E0 + nP$ where n is the number of orbital cycles since $E0$, against cycle number n . Any slope or shape to that plot other than horizontal tells of a different or changing period which can be calculated from the best linear or polynomial fit to the curve, and be highly significant astrophysically. See Figure 2.

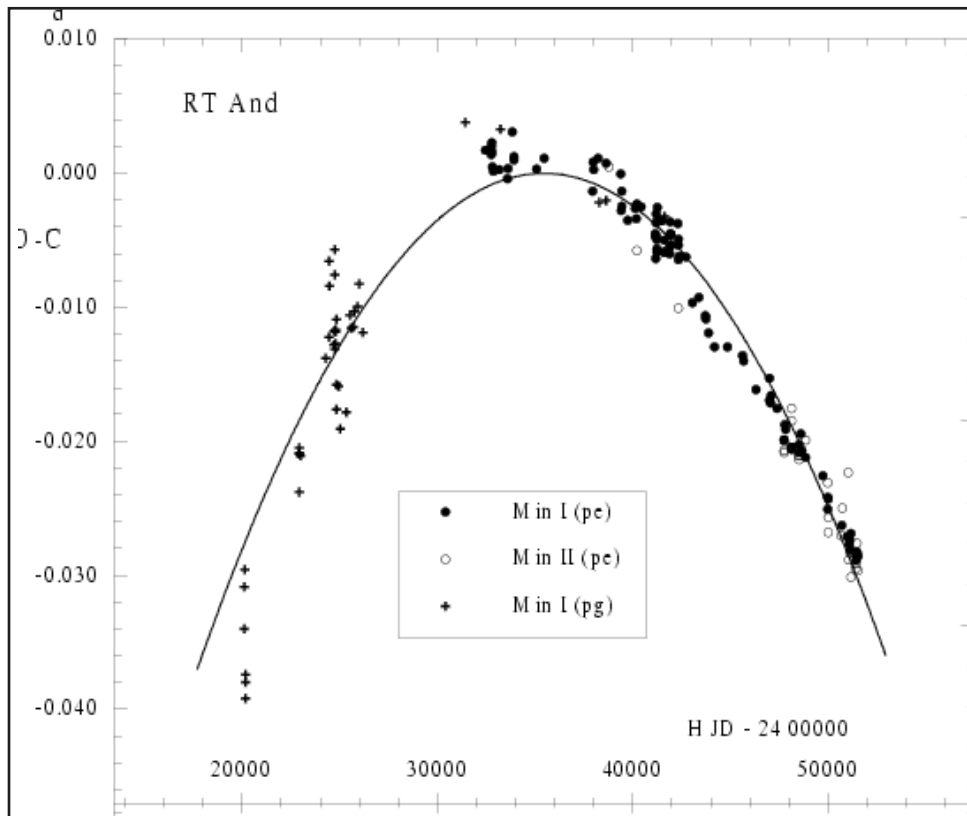


Figure 2. An example O-C diagram fitted with an inverted parabola, indicating constant period decrease. Abscissa is HJD, but cycle number is often preferred. Ordinate is in days. (From Erdem et al, 2001A&A...379...878E).

Astrophysical modelling pipeline For this process it is necessary first to transform the original photometric data to the standard photometric system to eliminate instrumental colour biases. The paper does not discuss this process, but see the page [Phased Light Curve](#) on the VSS website for references. Also an entire (transformed) light curve is needed that is phased on the orbital period, and preferably light curves in two or three bandpasses (filters).

The process of astrophysical modelling aims to derive size, shape and other astrophysical parameters (the output) by a software process of fitting a light curve determined by a set of input parameters to the observed phased light curve. Some of the input parameters can be found in catalogues and tables, but four of them must be guessed at by the analyst in a trial-and-error process. These are

- Orbital inclination to the observer (which affects the depths of both eclipses);
- Relative temperatures of the two stars (which affects the relative depths of the two eclipses);
- Fillout (a parameter that affects the “fatness” of eclipse curves);
- Mass ratio of the two stars.

These four are not independent, so changing one can upset the fits of the others. Mass ratio is the problematic parameter, and all one can do is try a range of values between 0 and 1 and for each get the best fit of the other three (measured by minimising the sum of the squares of the residuals between the observed and calculated light curves). The best overall result is taken as *the* mass ratio.

The trouble with this procedure is that there is no guarantee the best fit gives the correct result; but a careful fitting process can be regarded as giving a plausible result. Spectroscopy is needed, in concert with the photometry, to pin down the correct results by measuring orbital radial velocities – which requires a far larger telescope and high-resolution spectrograph. Moreover, the photometric model will only output dimensions for the system that are relative to the orbital separation of the two stars; but once the orbital radial velocity is known the orbital separation – and hence the other system dimensions – are determined absolutely.

Figure 3 shows a phased V light curve for NSV 1000. in red, and a fitted calculated light curve in blue. Figure 4 shows a 3D model of the system according to the calculated light curve.

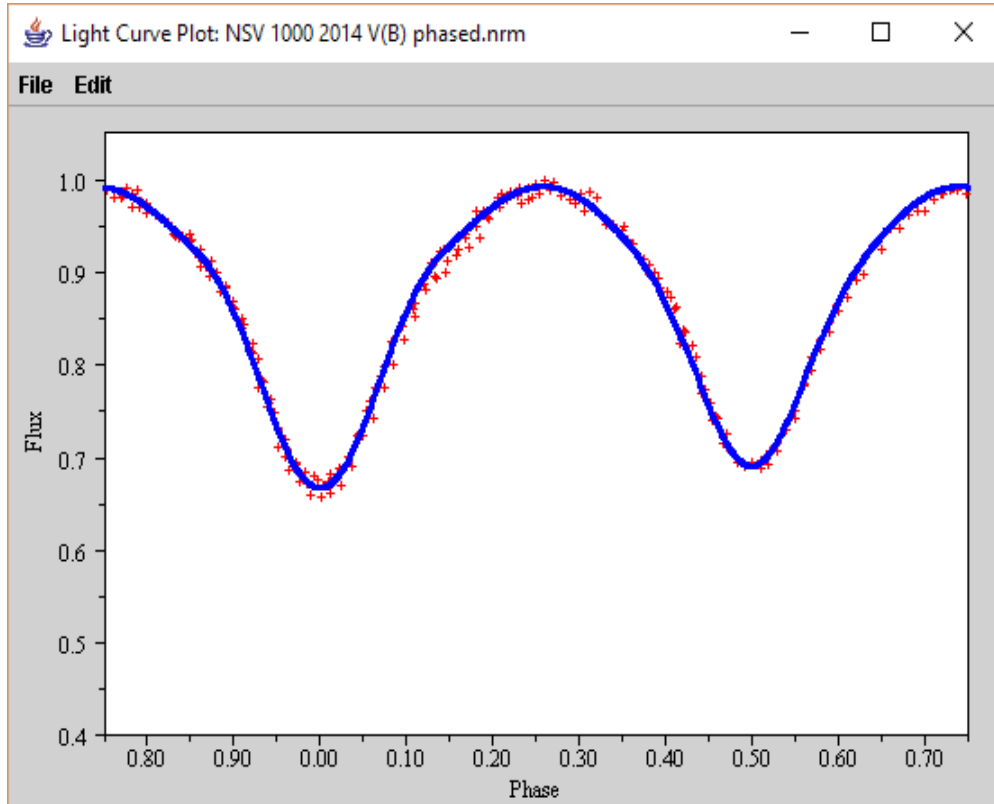


Figure 3. The V-band light curve of NSV 1000 in red, and a model light curve fitted to it in blue.

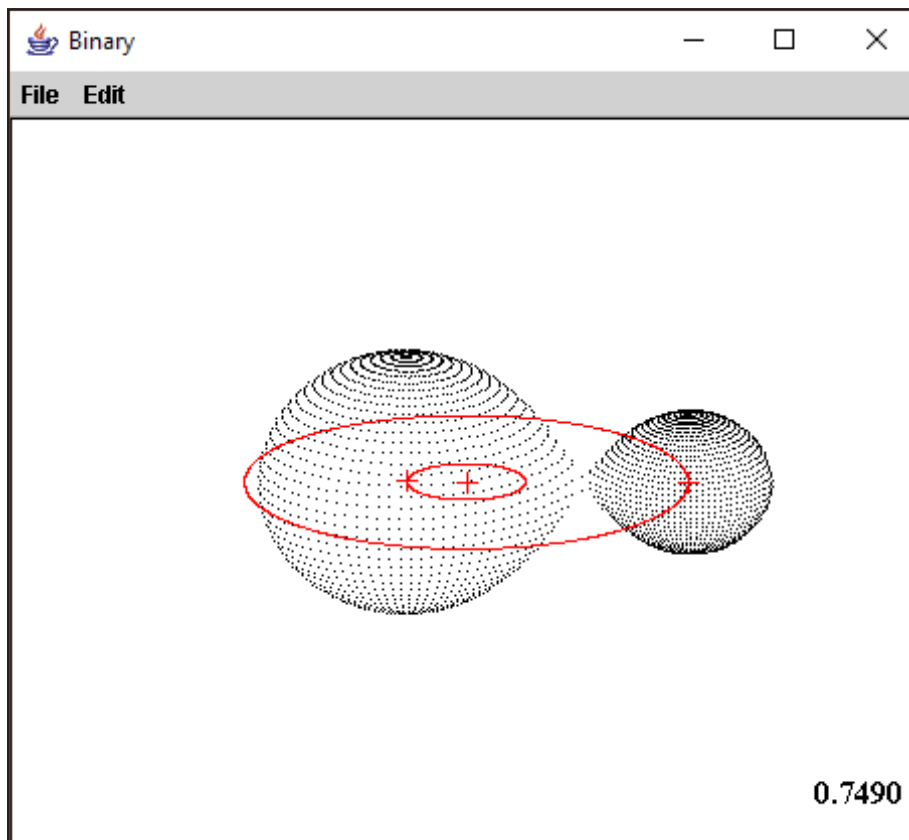


Figure 4. A 3D depiction of NSV 1000 according the model fit in Figure 3. Red ellipses and the crosses on them show the two (circular) stellar orbits and barycentres; the third cross marks the system's barycentre.

Abstract

By employing several recent all-sky survey catalogues (Pan-STARRS, Gaia DR1 especially) I have re-examined IR fields studied by Cohen (1975) who attempted to identify optical counterparts to IR objects in the RAFGL catalogue. Identities of several IR objects are clarified, as variable stars.

Introduction

The Air Force Cambridge Research Laboratories (**AFCRL**) survey was carried out by rocket-borne detectors in the early 1970s, to compile an all-sky list of IR sources. The initial catalogue was published by Walker and Price (1974). The final revised version (whose acronym is **RAFGL**) is due to Price and Murdock (1983). These are available online via VizieR as II/94 (main catalogue, 2970 rows) and II/95 (supplement, 810 rows).

From 1975 onwards different authors have attempted to find optical counterparts to these IR sources. Often, however, objects with a strong IR signal proved to be barely, or rarely, visible in the optical, and this hindered identification in the years before IRAS, 2MASS and the like. Possible identifications were often published in the late 1970s but some were very uncertain. Some objects were definitely variable. I decided to examine the list of 44 fields/objects by Cohen (1975), using Pan-STARRS data to test its suitability.

My experience, following a well-trodden path, proved that the task of correct identification of IR sources can be particularly tricky. A complete table of identifications is provided, and six finder charts (cutouts from DSS) are included.

Pan-STARRS

The Panoramic Survey Telescope and Rapid Response System is located at Haleakala Observatory, Hawaii USA, employing two 1.8-m telescopes to create a database of all objects down to -30° dec. The limiting magnitude was approximately apparent magnitude 24. The first telescope to be commissioned is known as **PS1**, and observations were made between Dec. 2008 and April 2014. Full time science observations began on May 13, 2010. Data was collected by imaging the sky at least twelve times through each of five Sloan filters -g,r,i,z and y. The released dataset, for PS1, is available online via VizieR as CDS II/349. While PS1 observations were compiled over 4 years, mean epoch is about 2012.0, referred to equinox J2000.0.

Transformations have been published, to enable one to extract UBVRcIc magnitudes. I have used formulae published by Jester et al (2005). For my purpose I only needed to consider three Sloan filters - g, r and i. “z” and “y” were not needed. An approximate V, to ± 0.1 m was adequate, with a reasonably accurate B-V. For detecting faint sources (carbon stars or stars with circumstellar shells) this was adequate.

From a perusal of one of the technical papers on the Pan-STARRS project (Magnier et al 2016) it is clear that their astrometry and photometry is tightly calibrated against 2MASS and Gaia, at least. For my own satisfaction I conducted my own quick comparison.

Comparing PS1 colours

By perusing the list of 44 stars cited by Cohen (1975), against APASS, I found 9 stars with V from 10.03 to 12.40, and B-V in the range 1.160 to 2.250. Stars with much larger B-V were excluded, as they were most likely to be beyond the range of the calibration curve. The selected stars were Cohen 3,4,7,10,16,22,28,29 and 42. Each was identified in PS1, and values of g, r and i compiled. Using the formulae by Jester et al, V and B-V were computed for each star, and residuals to be compiled, as

$$V_{\text{APASS}} - V_{\text{PS1}} \text{ and } B-V_{\text{APASS}} - B-V_{\text{PS1}}.$$

The results I have derived for the set of nine stars are as follows:

Mean B-V (APASS) : 1.855

Mean B-V (PS1) : 1.864

Residual V(mean) : -0.03 ±0.27

Residual B-V (mean) : -0.01 ±0.34

This comparison, though limited in scope, shows that (for these nine stars) PS1 yields values of V and B-V that hardly differ at all from APASS. However, the PS1 data are relatively noisy, but can be used to distinguish (highly reddened) carbon stars from other types.

Table of identified objects in Cohen fields (appended).

Table I. *All objects in fields 1-44 are identified. Some were recognized by Cohen as misidentified (ie not IR sources), and the apparent IR source has now been located. These corrections are usually incorporated in the table. For greater clarity refer to **Figure 1**, and the following notes.*

Field	Object Id.	RA (J2000)	Dec (J2000)	Other remarks
9	V370 Aur	05:43:49.680	+32:42:06.24	RAFGL 809
	9	05:43: 49.17	+32:42:15.1	Mismarked by Cohen (1975)
17	WR 112	18:16:33.474	-18:58:42.61	RAFGL 2104.
	17	18:16:37.53	-18:58:49.1	Wrong star, mismarked by Cohen (1975) and Lebofsky & Kleinmann (1976).
18	A	18:26:04.92	+23:38:38.8	Misid. by Lebofsky& Kleinmann (1976)
	B	18:26:04.89	+23:28:35.0	Close pair with "A".
	V1076 Her	18:26:05.838	+23:28:46.67	Very red. RAFGL 2155
	C	18:26:07.27	+23:28:43.4	Misid. by Cohen (1975). 16.6V, M2 V
19	A	18:31:38.62	-08:35:31.87	Mismarked by Cohen ('75), L-K (1976).
	NSV 24488	18:31:36.203	-08:35:14.52	RAFGL 2178. Current id. and position from RAFGL. Longmore et al (1976) report it "invisible". Allen et al(1977) report a new position, with endfigs 36.36s,30.3" which matches 2MASS J18313626-0835278 (J=11.668, Ks=5.176), only 15" south at 18:31:36.26 -08:35:27.8
21	V1839 Aql	19:15:53.968	+09:36:55.71	Mismarked by Cohen (1975).
37	37	22:19:13.500	+59:49:58.40	Wrong id. by Cohen (1975).
	B	22:19:36.76	+59:51:37.5	Wrong id. by Lebofsky & Kleinmann (76)
	NSV 25875	22:19:27.50	+59:51:22.0	RAFGL 2885. 2MASS object, J-K=9.55. Nothing in PS1 within 6.3" of this position. Companion star "A" lies just south, endfigs 27.786s,15.64", G-mag=18.013.

Conclusion

In conducting this exercise it soon became clear that early attempts to identify IR sources with optical counterparts were fraught with difficulty. This is now overcome with the use of data from surveys such as 2MASS and Pan-STARRS. All of the genuine IR sources in Cohen's list are now identified correctly. Identities of six variable stars are now clarified.

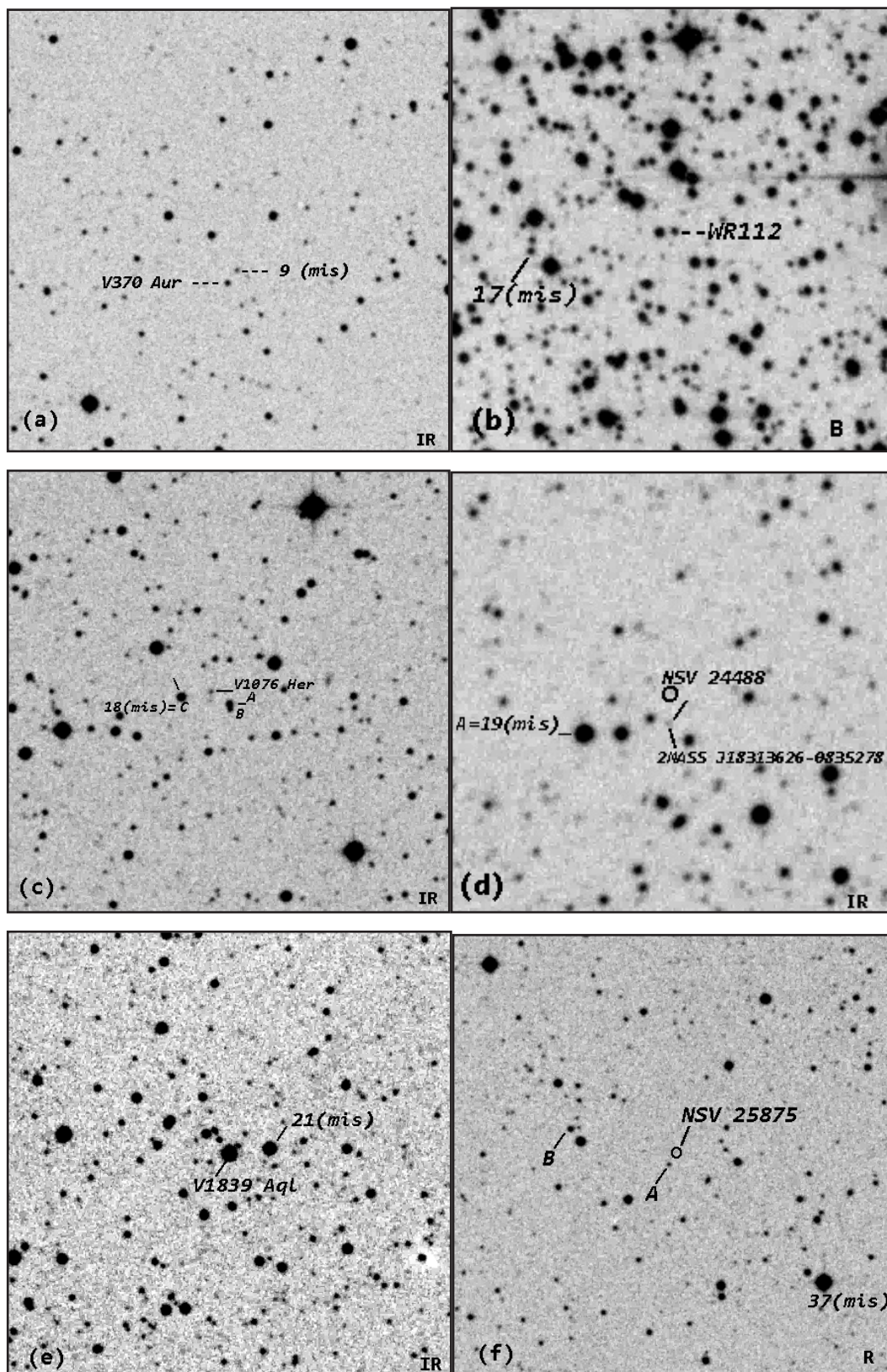


Figure. 1. DSS Charts for IR vars in Cohen fields 9, 17, 18, 19, 21 and 37. N at top. Each field is 5', except 17 and 19, which are 3'. "mis" means misidentified or mismarked.

TABLE 1. *Identifications of IR candidate stars found on field charts by Cohen (1975).*

No		RAFGL	RA (J2000)	DEC (J2000)	S	V	B-V	S	Spec.	ID/Other
1			00:27:21.834	69:41:10.07	GA	17.0	2.58	PS1		
2			01:12:31.106	63:22:12.33	GA	18.6	1.32	PS1		
3			02:09:22.753	46:9:58.69	GA	11.8	1.57	AP		
4			03:25:04.969	58:46:9.01	GA	10.1	1.99	AP		
5	X	490	03:27:38.746	58:47:0.02	PS1	20.0	2.66	PS1	Ae(2)	NSV 15690 (-)
6			04:28:13.037	41:56:3.52	PS1	16.3	4.51	PS1	C	NSVS J0428129+415603 (L):
7			04:35:30.969	43:25:56.39	GA	11.4	1.92	AP		
8			04:42:53.624	36:06:53.41	GA	19.8	7.04	PS1	e	V353 Aur (PN)
9	X	809	05:43:49.680	32:42:06.24	PS1	20.2		PS1		V370 Aur (M). J-K=5.60
10	R		06:53:33.092	-20:59:46.74	GA	12.2	1.95	AP	M3	
11	X		08:38:08.542	-10:24:15.36	PS1	17.2	1.46	PS1	M7ep	NSV 17942 (-)
12			08:56:17.149	32:20:59.91	GA	18.1	1.40	PS1		
13		1686	14:11:17.594	-07:44:49.88	PS1	18.3	2.13	PS1	M9 III	IO Vir (M)
14			16:03:04.958	42:18:38.36	GA	19.1	1.26	PS1		
15	R		17:05:35.189	-03:15:59.97	GA	9.7	3.02	AP	K7 III	BD-03 4082
16			17:36:20.003	33:14:38.78	GA	11.3	1.49	AP		
17	X	2104	18:16:33.474	-18:58:42.61	PS1	17.0	2.78	PS1	WC8	WR 112
18	X	2155	18:26:05.838	23:28:46.67	PS1	18	4.00	PS1	C	V1076 Her (M). See note.
19	X?		18:31:38.621	-08:35:31.87	PS1	16.5	2.73	PS1		NSV 24488 (faint) nearby.
20	X	2192 *	18:34:16.406	-11:29:29.37	PS1	17.6	2.90	PS1	M6:	NSV 24500 (-).CK76 give K7III
21	X	2350	19:15:53.968	09:36:55.71	PS1	18.9		PS1		V1839 Aql (LB). NSV 24725. J-K=3.706
22	R		19:17:49.154	11:53:26.34	GA	12.6	2.48	AP	K7 III	
23		2392	19:27:14.759	07:04:12.73	GA	16.0	5.57	PS1	C5-9e	V1421 Aql (M)
24			19:27:49.254	46:08:32.85	GA	15.0	0.73	PS1		E comp. of close pair
25		2425 *	19:39:00.740	-16:51:56.61	U4	15.2	1.75	PS1	M10 III	NSV 24833 (VAR)
26		2428	19:39:59.053	33:21:11.74	GA	15.7	2.97	PS1	C	
27			19:52:08.354	57:36:10.31	GA	16.5	0.73	PS1		
28		*	20:24:06.980	47:43:43.40	T2	10.0	1.82	AP	M3	NSV 25146(LB)
29			20:25:38.731	74:31:15.66	GA	12.1	1.59	AP		
30			20:34:58.102	38:17:42.73	GA	18.7	1.45	PS1		
31		2679	20:56:03.419	37:25:10.44	GA	17.0	4.76	PS1	C	V1888 Cyg (SRA)
32		2686 *	20:59:09.589	27:26:38.62	PS1	17.7	4.78	PS1	C8-9.5e J	V442 Vul (M)
33		*	21:02:18.690	36:41:40.90	U4	11.9	1.04	PS1	F5 lae	V1610 Cyg. Egg nebula.
34			21:11:52.701	17:23:11.22	GA	18.8	0.92	PS1		Np of faint pair
35			21:45:09.684	19:27:3.81	GA	19.0	1.16	PS1		
36			22:02:24.273	24:55:23.73	GA	18.7	1.00	PS1		
37			22:19:13.500	59:49:58.40	PS1	14.3	2.98	PS1	M0 III	Not RAFGL 2885.
38	R		22:38:49.519	-28:24:33.55	GA	16.8	1.30	PS1	M2	
39	F		22:45:35.363	-24:46:27.63	PS1	21.0				
40		2985	22:53:41.971	66:16:48.08	PS1	18.3	3.95	PS1	C8,4	NSVS J2253407+661641 (L)
41			22:58:11.789	-31:48:3.11	GA	18.6	1.41	PS1	K-M	
42			23:13:19.977	43:27:54.42	GA	10.4	1.87	AP		
43	F		23:17:00.690	-22:46:45.00	PS1					
44			00:00:40.249	74:41:56.07	GA	10.3	1.79	AP		Var 10.13 - 10.54V SRB

These letter codes appear in column 2 : “X” = Cohen chart mismarked. “F” = plate fault. “R” = rejected source (Allen et al 1977).

The coordinates of stars 20,25,28,32 and 33 are preceded by asterisk, indicating they differ from VSX.

CODES (Column S)

AP	APASS DR9	CDS II/336
B1.0	USNO-B1.0	CDS I/284
GA	Gaia DR	CDS I/337
PS1	Pan-STARRS Release 1	CDS II/349
T2	Tycho-2	CDS I/259
U4	UCAC4	CDS I/322A
2M	2MASS	CDS II/246

Acknowledgements

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I also acknowledge the use of the Variable Star Index (VSX) database of the AAVSO, and also the use of the VizieR utility of the CDS, Strasbourg.

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I've been strictly a visual variable star observer over the past 35 years, however I have become increasingly impressed with the work performed by CCD observers both in VSS and the AAVSO. To an outsider, it appears very complex and quite a challenge to produce accurate results, which was the main reason for my admiration of the observers involved!

In 2017, I decided to dip my toe in the CCD photometry waters. This was not going to involve a significant capital outlay to replace my 30 year old 16" reflector, but rather using the online iTelescope facility as well as to see whether I could get some AAVSONet projects accepted on certain stars using the Mt John telescope and the various BSM telescopes. I decided that I would also test out and utilise the AAVSO's VPhot software for reduction of the observations.

As of May 2018, I have now produced nearly 1,000 CCD observations and I've learned a lot along the way and my admiration for CCD observers has only increased! Most of my targets have been some interesting Mira and RCB stars as well as a rapid response to capture newly discovered novae (and there have been a few in early 2018) for photometry and astrometry. I have had 3 AAVSONet proposal accepted which are covering the DY Per star, V487 Vel and two interesting Miras in KK Car and ASAS J143751-6454.9.

In general, I've found the VPhot software quite easy to use even for a complete novice such as myself. It gets a certain degree of bad press in the AAVSO Forums, but in general I believe this is a fantastic service provided by the AAVSO.

Early on, I did notice that I was following visually many of the stars I was targeting with CCD photometry. Often I was making visual observations within about 6-24 hours of the same stars with CCD. I became quite interested in the comparison between CCD and visual measures. This topic has been discussed and written about at length over the years. Landis (1977) even noted that some AAVSO visual observers are sometimes upset to discover that their visual estimates do not agree with photoelectric values! He produced a plot that clearly showed an increase in the difference between visual and photoelectric measures as the star's colour index increased.

However I was not aware of many studies that contemporaneously observed the same targets at these different wavelengths. I also noticed that the various targets I was observing, varied greatly in terms of colour index. This ranged from quite blue stars such as newly discovered novae to very red Mira and RCB stars with B-V in the 3 to 6 range. The advantage of almost simultaneous observations was to also use exactly the same comparison stars for the visual and CCD observations.

I then set about analysing these observations and performing a direct comparison when visual and CCD observations were made within 24 hours of each other such that there is no reasonable change in underlying brightness between the two sets of observations. I was especially wary of newly discovered novae that can change brightness quite rapidly. I realised that there were many variables that will impact the results, principally the quality of the comparison stars used in both CCD and visual observations.

Figure 1 provides an illustration of all my results thus far and displays the colour index (B-V) of all the targets measured versus the difference between the visual magnitude (Mv) and V magnitude.

As can be seen from Figure 1 there does appear to be a direct relationship and the best fit relationship can be expressed as:

$$M_v = V + 0.21 \cdot (B-V)$$

The average colour coefficient is 0.21 and the range is between approximately 0.16 and 0.26. It should also be recognised that there is still a 0.1-0.2 magnitude scatter in visual observations due to various constraints such as sky conditions, comparison stars used, etc. There does appear to be more of a divergence from the best fit relationship for stars with a colour index $(B-V) < 1.0$.

One would expect such a result considering the relationship of the response functions between B and V filters and the approximate response function of the human eye as shown in the Figure 2 (dashed line is approximate response function for the human eye).

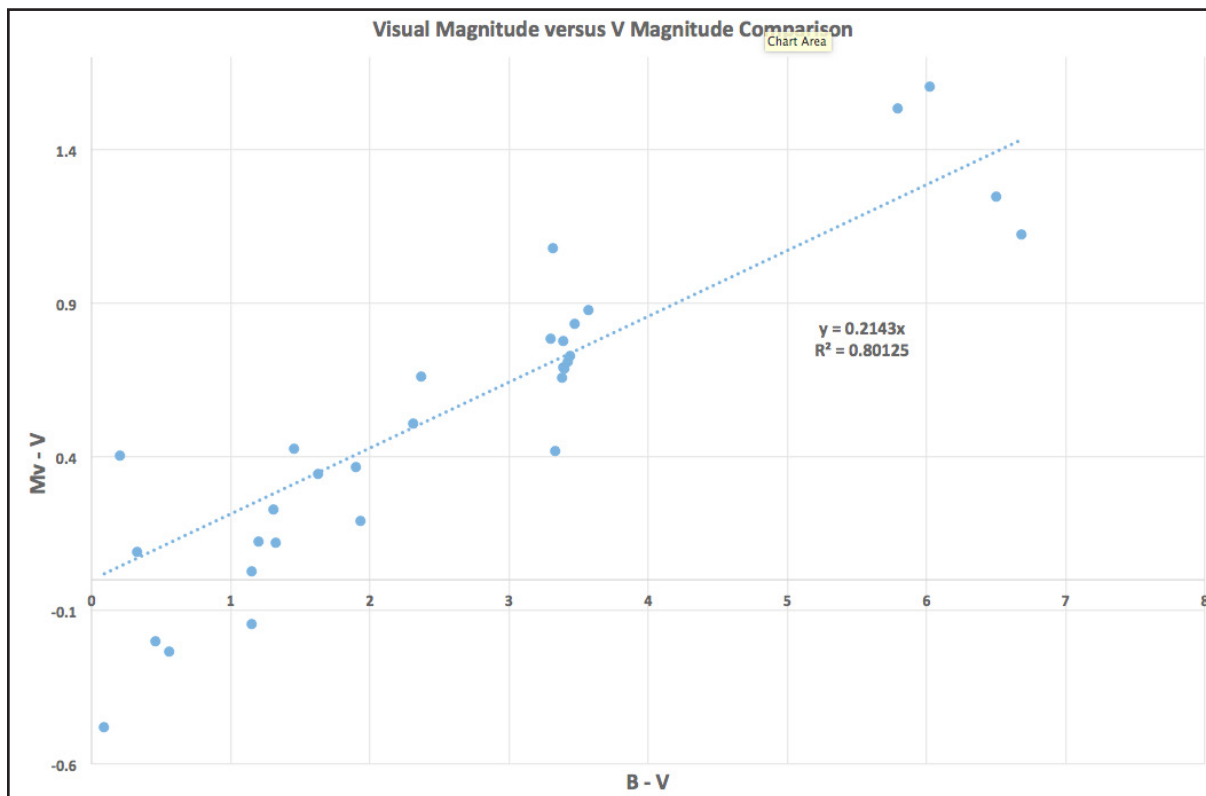


Figure 1 *Magnitude difference vs colour index.*

It is acknowledged that whilst the response functions for the various Johnson filters will be more or less constant across different filters and telescopes, the human eye response function will vary to a degree between different individuals and therefore the plot only shows an approximate response function. Similarly in the Mv - V versus B-V Figure 1 above, these results are obviously based on my own eyes and would be expected to vary somewhat for others.

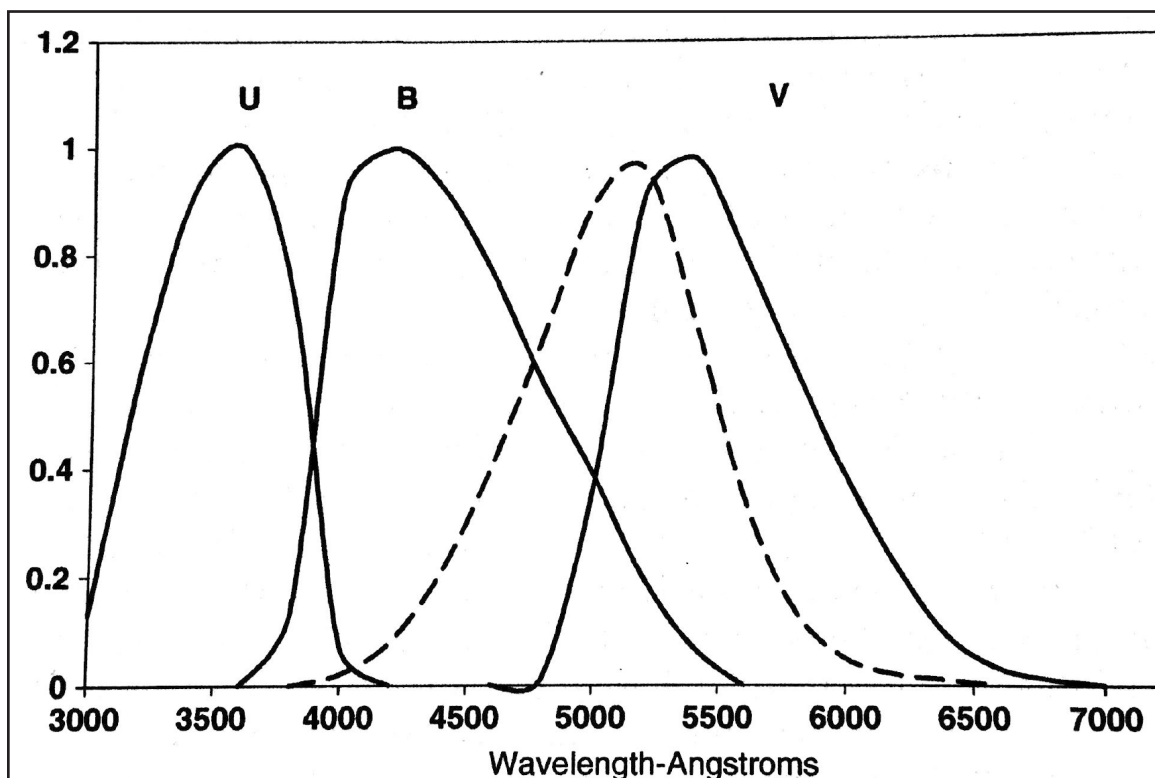


Figure 2 *Response functions of UBV filters & human eye.*

Stanton (1999), reporting on the results from an experiment involving over 60 AAVSO observers, measuring SS Cyg and he then analysed the observations which clearly showed the effect of star colour index on observed star magnitude and the range of observational scatter expected for observers. He concentrated on stars with a colour index between -0.03 and 1.9. He concluded that the visual magnitude scale can be accurately defined using a conversion from V and B magnitudes using the formula:

$$M_v = V + 0.21*(B-V)$$

This is exactly the same result as I obtained from my observations shown in the plot above. His colour coefficient of 0.21 is based on the average observer amongst the 60 observers who contributed data to the study. It's good to see that I compare well to an average observer! Furthermore his analysis shows that the age of the observer does not appear to be a significant factor, which gives hope to the older observers like myself!

It is interesting to note that Stanton's study only focused on a colour index range of -0.03 to 1.9 as he argued that transforming between systems typically becomes non-linear and multi-valued for very red stars ($B-V > 2.0$). However my results extended out to a maximum colour index of 6.5. Even though my data is sparse for $B-V > 3.5$, it does appear to indicate that the linear trend does indeed continue out to these very red stars. However further data will be required to categorically confirm that.

I hope to continue this comparative analysis and build up further data particularly to firm up the relationship for stars with larger colour indices.

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Note on the periods of V901 Cen and SZ Hor – *Tom Richards*

tomprettyhill@gmail.com

This article is a brief discussion of period anomalies in two eclipsing binaries which I am currently researching. In both cases it was apparent that there are problems with existing information about minima and periods. I have not so much solved those problems here as explored them and pointed to what's needed for resolution – often a lot more observational work.

V901 Cen

VSX (Watson et al. 2006) lists V901 Cen as an EW (W UMa type) contact binary with V mag = 11.94 to 12.30 and period $P = 0.354229$ d. I have acquired three seasons of time-series data (2016-18) from which I have measured six minima, three primary and three secondary. Together these yield a slightly different period of $0.3542330(6)$ d.

Plotting these minima on an O-C diagram including the VSX epoch in 1991 shows my minima have residuals from the linear regression line of up to 0.01 d, way outside the uncertainties in my minima estimates. See Figure 1.

However the fact that my minima estimates lie pretty much in a line crossing the regression line at about right angles suggests that the simplistic linear regression is not telling the full story. Fortunately a little help is at hand – a set of minima obtained about halfway in time between VSX and my data (Brat et al. 2011). They lie well away from the Figure 1 regression; a parabolic fit is now much better, as in Figure2.

You can fit a parabola to any three points which is effectively what we have here, and this one says the period has increased steadily. But you could equally well fit two straight lines, one going down from the VSX point to the data cluster around cycle 19000, and another going upward from there to my data. Or arbitrarily many other pairs of straight lines. That would say there were two steady periods with an abrupt increase at some point in time. Steady period increase – represented by the parabola – can be due to mass loss from the system, for example by a stellar wind. The need now is to keep monitoring this system to see if the period keeps increasing at the rate indicated by the parabola.

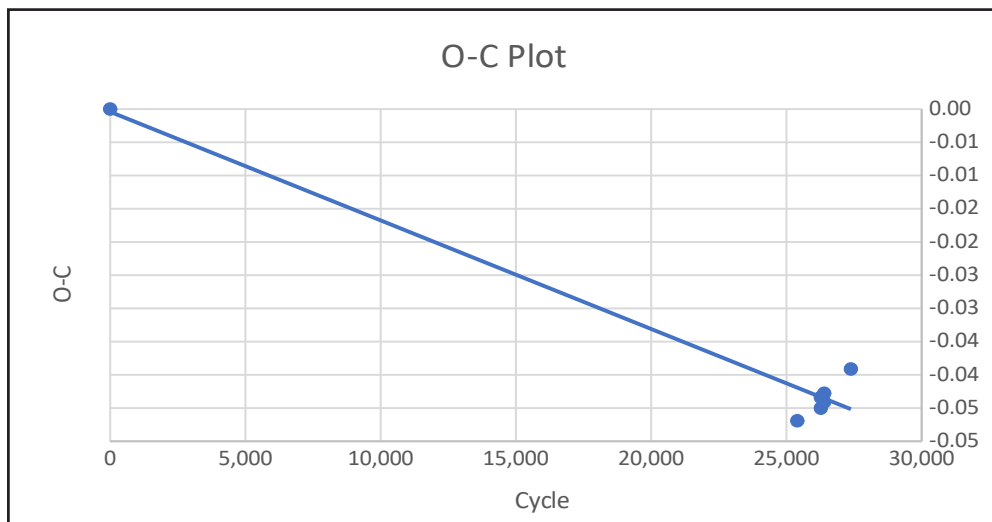


Figure 1. *O-C diagram of the VSX epoch (left) and my minima estimates, with linear regression line.*

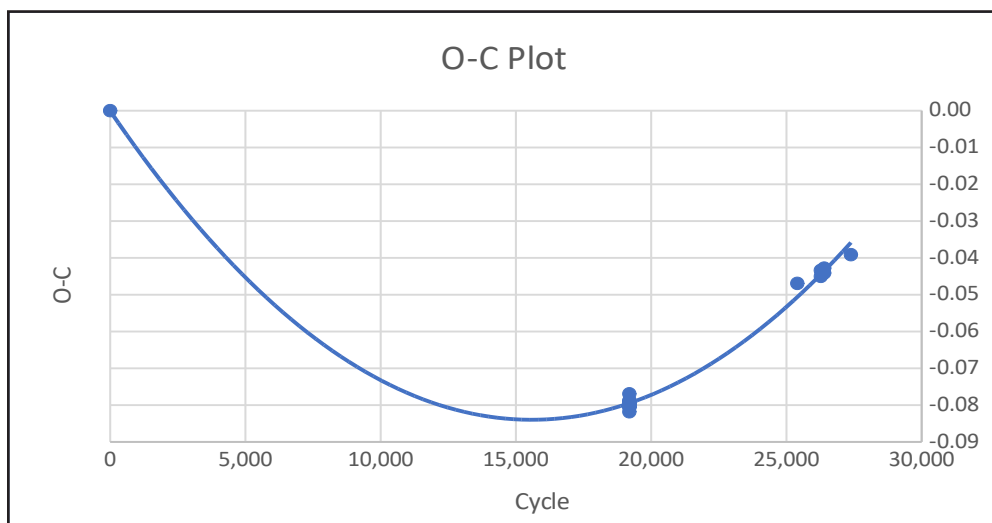


Figure 2. *O-C plot with the Brat data added around cycle 19000. VSX epoch on the left, and my epochs on the right.*

SZ Hor

VSX lists this as an EW/KW system (cool over-contact binary, i.e. with a shared hourglass-shaped photosphere) of V magnitude 11.0-11.8. Its period of 0.625102 d is confirmed by the ASAS-3 phased light curve in Figure 3 (Pojmanski, 2002); but the light curve is of an EB binary (close but not in contact, ellipsoidal stars).

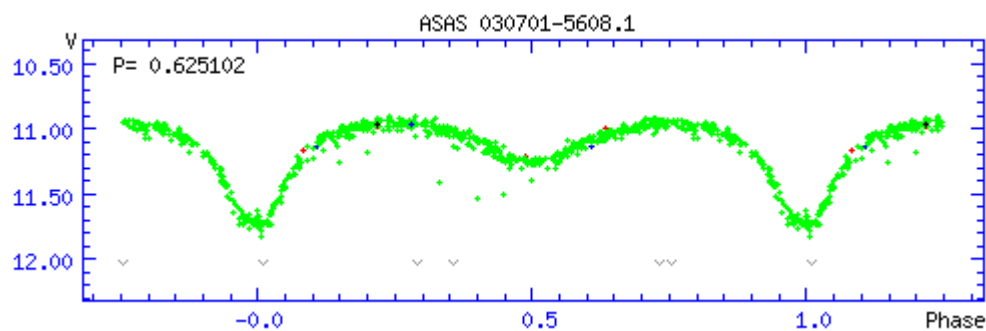


Figure 3. *The light curve of SZ Hor, generated from ASAS-3 V photometry and folded on a period of 0.625102 days.*

The GCVS however (Samus *et al* 2017) gives its period as 0.4804562 d, quoted from the discovery study by Strohmeier (1967). How did Strohmeier get it so wrong?

A preliminary O-C analysis of his minima data using the VSX ephemeris shows his minima lie in two ranges, above and below O-C = 0.1

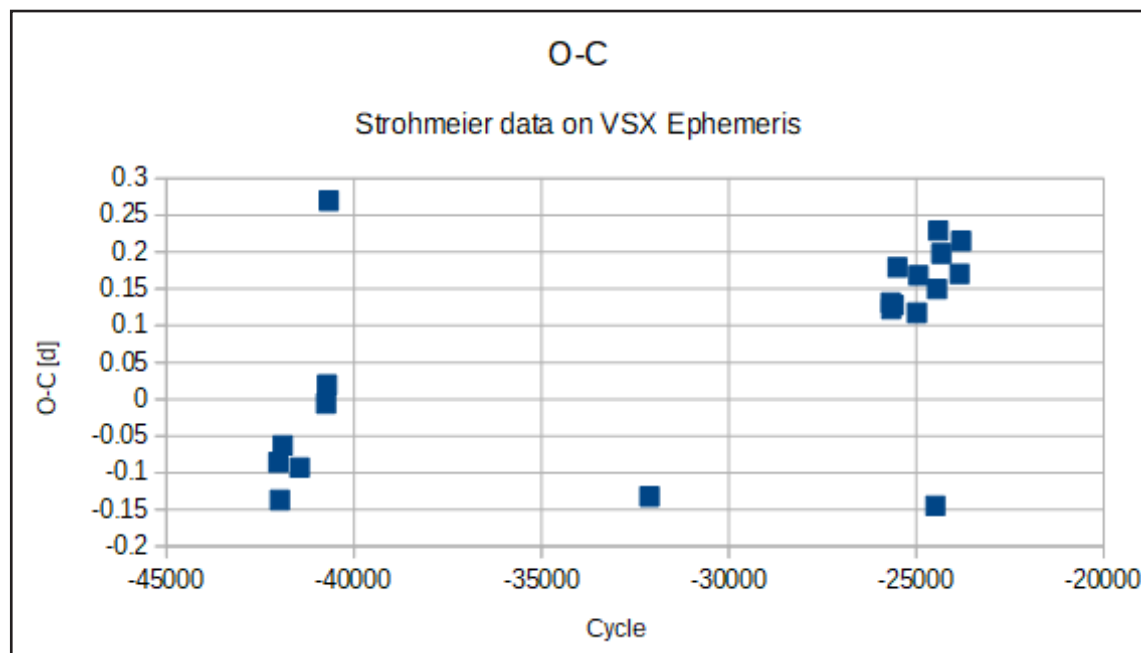


Figure 4. Preliminary O-C diagram of Strohmeier's minima data using the VSX ephemeris.

On the right side around cycle -25000, the time difference between the cluster and the lower point is ~ 0.3 d, as (more roughly) is that between the lower cluster on the left and the upper point. That is half a VSX period, suggesting that the upper points are of a secondary minimum and the lower of a primary. Strohmeier assigned primary and secondary minima identifications differently, which appears to have led to his incorrect period. This situation is much the same as in our analysis of Strohmeier's work on V883 Sco (Richards, Butterworth and Blackford 2017) where we demonstrated that his period errors were due to incorrect identifications of primary and secondary minima – though in that case the depths were very similar. In that connection, Strohmeier remarks of SZ Hor there was a “very deep ($\frac{3}{4}$) secondary minimum” - contrary to the ASAS- light curve (which of course came later).

In Figure 4, regression lines for the upper (secondary) minima and the lower, if inserted, would show a slight and parallel downward slope, suggesting that the period (at that time at least) is very slightly shorter.

There is much further work to do here, especially a more careful O-C analysis, and a literature search for other minima estimates. More minima observations are needed over coming years. Additionally a complete multi-band light curve could be investigated to settle the astrophysical nature of this system, in particular whether the two stars are in contact or not.

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Reconciling our period analysis of V883 Sco with history

This is a moral tale about what it takes to reject widely accepted results from outstanding researchers. This note summarises a presentation of this name at VSSS5, Christchurch 2018, and available on the VSS website (<https://www.variablestarssouth.org/5th-variable-stars-south-symposium-christchurch-2018/>). The issue arose from our work on V883 Sco, an eclipsing binary for which our results could not be reconciled with catalogue data. From establishing our correctness against the catalogues, we drew some conclusions about care, completeness and convincingness. They may be found on the last slide, available for anyone wishing to publish such analyses, especially when taking on authorities. Anyway it was a fun ride.

V883 Sco, a 7th magnitude star, was originally described in (Strohmeier & Knigge 1973; hereafter S&K). From 26 plates at Sonneberg and Mt John over the period 1963-1972 they concluded it was an EB eclipsing binary with a period of 1.294 745 d and epoch HJD 2443285.794, light elements which have been widely copied since.

But six minima obtained by NB over 2015-17 simply could not be reconciled with those light elements. An analysis of ASAS3 data (Pojmanski 2002) and INTEGRAL-OMC data (Alfonso-Garzon 2012) by MB demonstrated a far longer period of 4.34119 d (Figure 1), and clearly an EA configuration (detached or semi-detached pair).

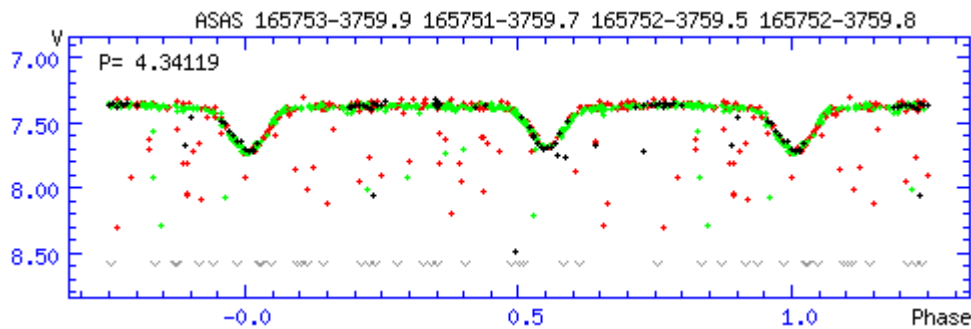


Figure 1. ASAS3 light curve of V883 Sco folded on our period of 4.34119 d.

When we submitted a draft paper on the new period to the *Open European Journal of Variable Stars* some referees very reasonably responded that we had not shown that the original S&K light elements were wrong, hence they were sceptical of ours. We could have studied the wrong star (or S&K could), or we could have made any number of careless errors in our analysis pipeline. After all, we were disagreeing with a team with a formidable reputation in the field.

But we now had two clues: as an EA not an EB it could have an eccentric orbit – something S&K would not have considered since they had too short a period – and indeed as Figure 1 shows the secondary minimum is offset. Secondly we could see, and S&K could not, that the primary and secondary minima were of very nearly equal depth so easily confused without the benefit of electronic sensors.

Because of the eccentricity, we derived light elements based just on our *primary* minima plus those found in the ASAS3 and OMC data, viz. $\text{MinI}_n = \text{HJD } 2457283.917(5) + 4.341164(11)n$. Using those light elements we produced an O-C diagram of all minima. The editor of *OEJV* kindly emailed us a copy of the original S&K article, unavailable online, for us to study. Including the S&K minima data from that article in our diagram completely explained the anomaly (Figure 2).

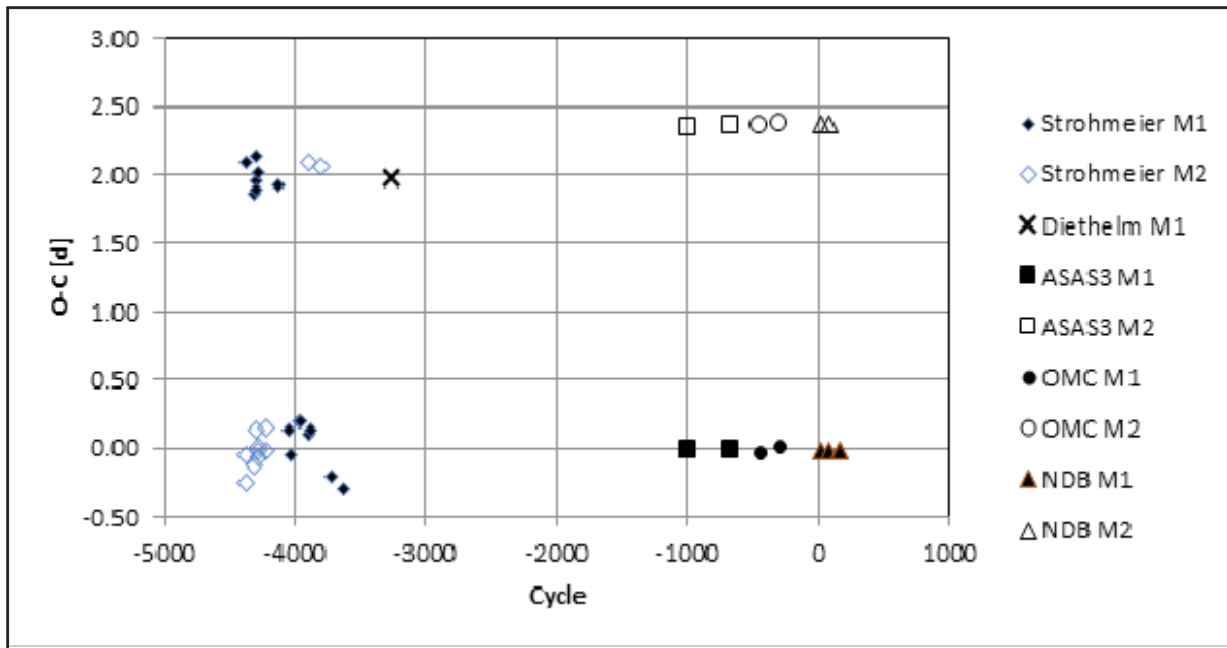


Figure 2. An O-C diagram of all V883 Sco minima data folded on our light elements for primary minima (see text).

The first thing to note is that the plot neatly distinguishes primary minima data (around O-C = 0.0) from secondary minima data (around O-C = 2.0 to 2.4), with a suggestion of period change for the secondary minima. The second thing is that S&K distinguished primary minima (filled diamonds) and secondary (empty diamonds) incorrectly, but understandably. Correcting their assignments of primary and secondary to their minima data explained where they were misled. (It's also interesting to note the scatter in the S&K data points, no doubt the result of the exposure times needed plus the 26 imaging dates spread irregularly over eight years. This does indicate the likely large inaccuracy in general in such photographically-derived data.)

When we re-submitted the paper with this explanation of the S&K data, it was accepted and published (Richards, Butterworth & Blackford 2017). Because of what we learned of the need to justify our somewhat dissenting conclusions sufficiently for publication, we thought this “Homer nods” presentation might be of use to other humble researchers in the field.

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Photo: Aladin Sky Atlas

The variable star observing programme from Linden Observatory prioritizes the Large and Small Magellanic Clouds. These are far and away the richest fields in the sky, the most demanding, and contain some of the most astrophysically important observing targets.¹ The current programme includes all the Luminous Blue Variables, also called S Doradus stars, plus the so-called ‘candidate’ LBVs, in the Magellanic Clouds. There are only 16.²

Also in the Magellanic Clouds programme are a couple of long period variables, several cataclysmic variables, an X-ray nova, one R Coronae Borealis star, and two supersoft X-ray sources. Not one of these stars is observed by even a handful of people, and for most you could count the observers on one finger!³

The observing night of the 7th of April saw the SMC getting a bit low, so I only observed the Large Cloud. A 40cm f4 Newtonian telescope was used. Here’s the LMC sequence and observations.

We start with the 7x50 finder scope on ϵ and δ Doradus and locate the U Dor field (target no. 1 on Figure 1). This is a foreground star, not 160,000 light-

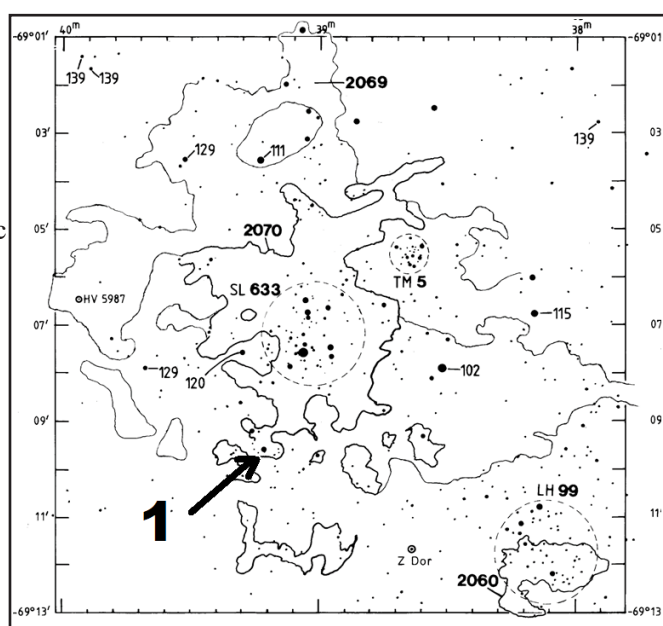


Figure 1. The U Dor field with the location of the Mira variable U Dor, our target No 1.

¹ Visual observations of these stars are routinely used in professional journals. For instance, Walborn et al 2017AJ...154...15W, Mehner et al A&A 608, A124 (2017), and Campgnolo, Fernandes, et al Dec 2017 A&A <https://arxiv.org/abs/1712.01972>

² The number of these stars is arguable. As far as I know, this is correct.

³ Since writing, I’ve added a good handful of new LMC targets, several red supergiants, a couple of maybe-LBVs, and a recent nova ASASSN-18jj.

would get target and sequence stars all, but for V2303 we need to see 12th mag well. We need to nudge the scope around these clusters using the 25mm eyepiece to estimate this one – at 11.6 mag on this night.

Now that we're in the LMC proper we can star-hop with the eyepiece alone. Moving a degree or two to the southeast, we find a complex field of 10th mag stars and fainter, multiple clusters and nebulas. LMC V3068 and LMC V2756 are two currently active LBVs, and HD 269687, a candidate LBV, are all close together in the sky. In the picture, numbers 4, 6, and 5 respectively. V3068 was 11.0 mag and V2756 10.7 mag this night, and HD 269687 was 11.7 mag. Despite the fact that these stars are quite bright, a 15mm eyepiece giving 120x and a smaller 0.42° fov is needed because of the tight field. Again, an embarrassment of riches. V2756 is located tight against the cluster NGC 1983, with three compact clusters NGC 1994, 1984, and 1967, 10 arcminutes to the south. Seven odd arcminutes to the north is the bright nebulous object NGC 1962 with its close stellar neighbour NGC 1953, and a touch to the east is the stellar association NGC 2001. Not to mention the lesser clusters SL 499, 488, 478, 507, 459, and nebula SL 476. Not bad for a 0.5° field.

Object	RA (J2000)	Dec (J2000)	Type	Class	Mag
U Dor	05 10 08.85	-64 19 04.3	Mira, p=394.4d	M7-M8IIIe	8.2-14 V
V3434	05 35 41.01	-66 51 53.5	HMXB/XP+XN		12.8-15.2 B
V2302	05 22 59.78	-68 01 46.6	SDOR(?)	Ofpe/WN9	11.25-11.62 V
V3068	05 30 51.47	-69 02 58.6	SDOR	B9I-G	9.7-11.03 V
HD 269687	05 31 25.53	-69 05 38.6	WR(?)	WN11h	11.84-12 V
V2756	05 27 52.66	-68 59 08.5	SDOR	B1-WN10h	10.3-12.8 V
S Dor	05 18 14.35	-69 15 01.1	SDOR	B8-F01	8.8-10.8 V
V1338	05 10 22.78	-68 46 23.8	EA+SDOR		9.4-10.85 V
V1577	05 13 30.78	-69 32 23.6	SDOR	B7I-A/F	9.55-10.93 V
V1612	05 13 54.27	-69 31 46.7	SDOR(?)	Ofpe/WN9+M2Ia	11.7-12.1
V1941	05 17 56.07	-69 16 03.8	SDOR(?)	B5I	10.37-11.87

Table 1. The locations of stars of interest in the LMC visual observing programme.

Now we change to the 40mm eyepiece, giving 0.93° fov and 45x, and star hop a degree or so to the west, to S Dor itself, target no. 7. This is the class prototype LBV. Presently at maximum light, 9.4 mag this night, the sequence stars used are over a degree to the north in and around the open cluster NGC 901, itself just to the north of the LMC bar. S Dor is the brightest star in line of sight to the open cluster NGC 1910, and this is the brightest patch in the bar of the LMC when using the 50mm finder scope. (The Tarantula Nebula being off the bar to the north.)

In the picture you can see the 'S' shaped emission nebula N119 that permeates the cluster, but I've never seen it. (A challenge to the imagers...) Within the 0.93° fov there are too many deep sky objects to list, let alone describe.

Almost a degree to the west is target no. 8, LMC V1338, which was 10.6 mag on the night. V1338 lies in the top gap of a 'Y' formed by compact open clusters NGC 1858, 1865, and the three globular clusters NGC 1856, 1854, 1850. This field covers 0.5° or more, all objects named clear as a bell in the wide field eyepiece, and is simply glorious.

A nudge to the south is the confirmed LBV LMC V1577, target no. 9, shining at 9.6 mag at the moment, and the adjacent candidate object V1612, no. 10, a faint and fuzzy 12.5 mag within the small and indistinct open cluster SL 328. This last needs a 9mm eyepiece giving 200x and a 0.25° fov, or even the 6mm. We swap eyepieces for a moment so we can star hop back into NGC 1910, and with now with the 15mm we pick out LMC V1941 from a very tight triple configuration, to find it at 10.9 mag.

This series of observations took 20 minutes, but that has taken a lot of practice. It is crucial that the 40, 25, 15, 9 and 6mm eyepieces be par-focal for quick and easy interchange, and all long eye relief so I don't have to take my glasses on and off.

Next newsletter we'll plunge deep into the Tarantula Nebula and surrounding fields, and cover the eastern half of the LMC. See you then....

Introduction

The thirty-first eclipse since Henrietta Swope's analysis of this long period eclipsing binary will occur at JD 2458426.491 or 3 November, 2018 - time of central eclipse. Whilst not ideally placed it will be possible to observe ingress. Due to the uncertainty of the exact duration of totality and also ingress and egress this will require measures as widely spaced in longitude as possible and over the period 4 to 9 October. With meridian transit occurring at 4.44pm this results in an air mass of ~ 1.9848 at 35S at 0.00 hours UT (midnight) which would allow about 4 to 5 hours each night during which up to three separate data points might be measured.

Why are these measures needed?

Whilst measures go back to 1889 the durations of ingress and egress are still uncertain. Thus we have no useful measures of the relative diameter of the hot blue component being eclipsed. A variety of spectral types have been quoted for this star but none of these match the UBV measures. These show eclipse depths of 0.080 in V, 0.333 in B and 1.438 in U. More confusing is the difference of 2.738 magnitudes or 12.41:1 in luminosity. Bolometric corrections would not change these values greatly. If we accept Allen's Astrophysical Quantities, 2000, values of -5.8 for a K0Ib supergiant and -0.75 for an B7V blue star as some of the literature suggests the luminosity relationship is close to 100:1. Thus the blue star may well be a B7III giant or a much hotter main sequence star. A good relative diameter would resolve this issue.

Observing

Our campaign in 2016 allowed determination of a revised period and a better current epoch. But it suffered from the variety of comparison stars used and the lack of standard values for these. So we have selected nearby stars of appropriate colour and magnitude, given that V777 Sagittarii is ~ 8.6 in V uneclipsed. These are shown in Figure 1, with values from Guide 9 in Table 1. Use star 3 as the main comparison, star 2 as a check. Ensemble photometry is not recommended but if you need to resort to this note the stars used. In this latter case do not use star 2 as part of the ensemble.

All of the stars are reddened somewhat which suggests that none are foreground objects. Nothing can be done about this and they tend to match V777 which itself is strongly reddened. Prior to the beginning of eclipse we will circulate values for the comparison stars linked to the standard E Region system. It would also be valuable to make a few measures a week or two prior to the beginning of eclipse. There is a last quarter moon on 2 October so that is not a problem. Interestingly, the galactic coordinates are $L=2.43$ and $B=1.27$ with the star about 3 degrees from where the galactic equator crosses the ecliptic.

Star	Identity	V	B-V	Spec	Star	Identity	V	B-V	Spec
1	6836 976	10.159	0.446		5	6832 724	9.118	0.232	A0
2	6836 865	9.666	1.418		6	6836 892	9.711	0.297	B5
3	6836 174	9.075	0.195	B8	7	6836 1022	9.938	0.430	A2
4	6836 971	8.426	0.448	A5					

Table 1. Comp and check stars to be used for V777 Sag. Data from Guide 9 software.

All of these values are from Tycho and better ones will be determined and published on the Google group by mid-September. Do not attempt to use the AAVSO chart and photometry sequence - the latter covers a V magnitude range of 11.9 to 14.0 which are completely unsuited to a star with V of 8.6 and a range in V of 0.08 magnitudes. Other magnitudes in the literature are discordant so problems will be avoided if we all use the same stars and values.

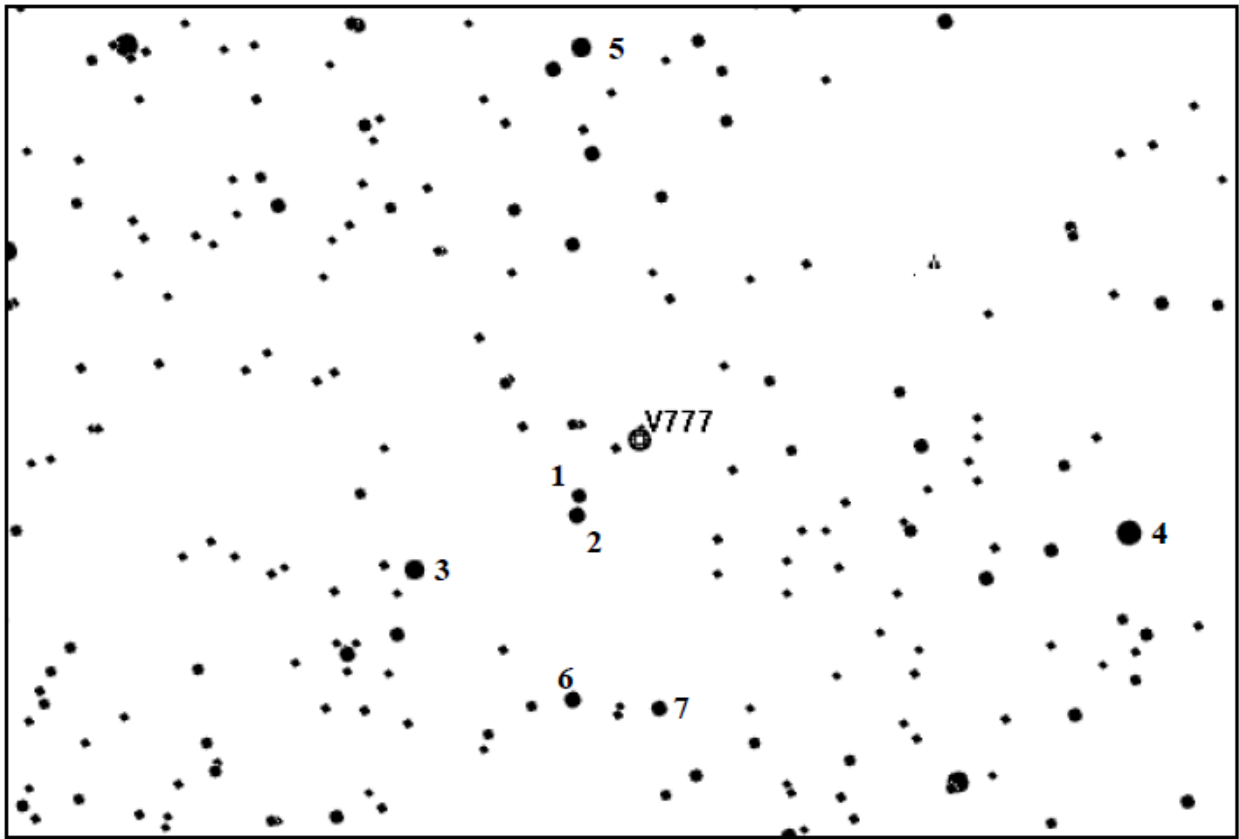


Figure 1. The V777 Sagittarii with comparison stars marked. The 2000 coordinates of V777 are 17 46 26, -26 11 48.

Eclipse information

With ranges of 0.08 in V, 0.33 in B and 1.43 in U the hourly rates of change during ingress will be 0.003, 0.014 and 0.060 respectively for a one day ingress - half that for a two day ingress. So we are dependent upon high quality measures spread over a wide longitude range - and, of course, friendly weather. A measure at the start of the evening and one at the end are probably the best with enough images taken so that your accuracy limit is reached.

A few of our members have U filters and in spite of the poor responses in these the extra depth of eclipses is worth the time it takes to get reliable measures. The measures in 2016 which are described in detail in a shortly to be published paper have an uncertainty of perhaps half a day in mid-eclipse and the duration of ingress/egress lies somewhere between one and three days. If this latter can be established then the overall system can be modelled in detail.

Egress will see the star very low in the sky in the 28 November to 4 December range. This is probably not observable but weekly measures during the early part of the eclipse will be useful.

DSLR photometry is valuable and V777 is easily in range of these in V. A disparity between CCD B and DSLR B is expected, given that the B of these cameras is displaced toward longer wavelengths but the measures are still very useful in determining the duration of ingress.

Perhaps we should compile a list of difficult binaries? QZ Carinae with its six day period is one and now V777 with a period of 2.56 years and a slow drift to later in the year with each widely spaced eclipse is another. The next well placed eclipses occur about 27 May, 2021 and 26 July, 2026.

About

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

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

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

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

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

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

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

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