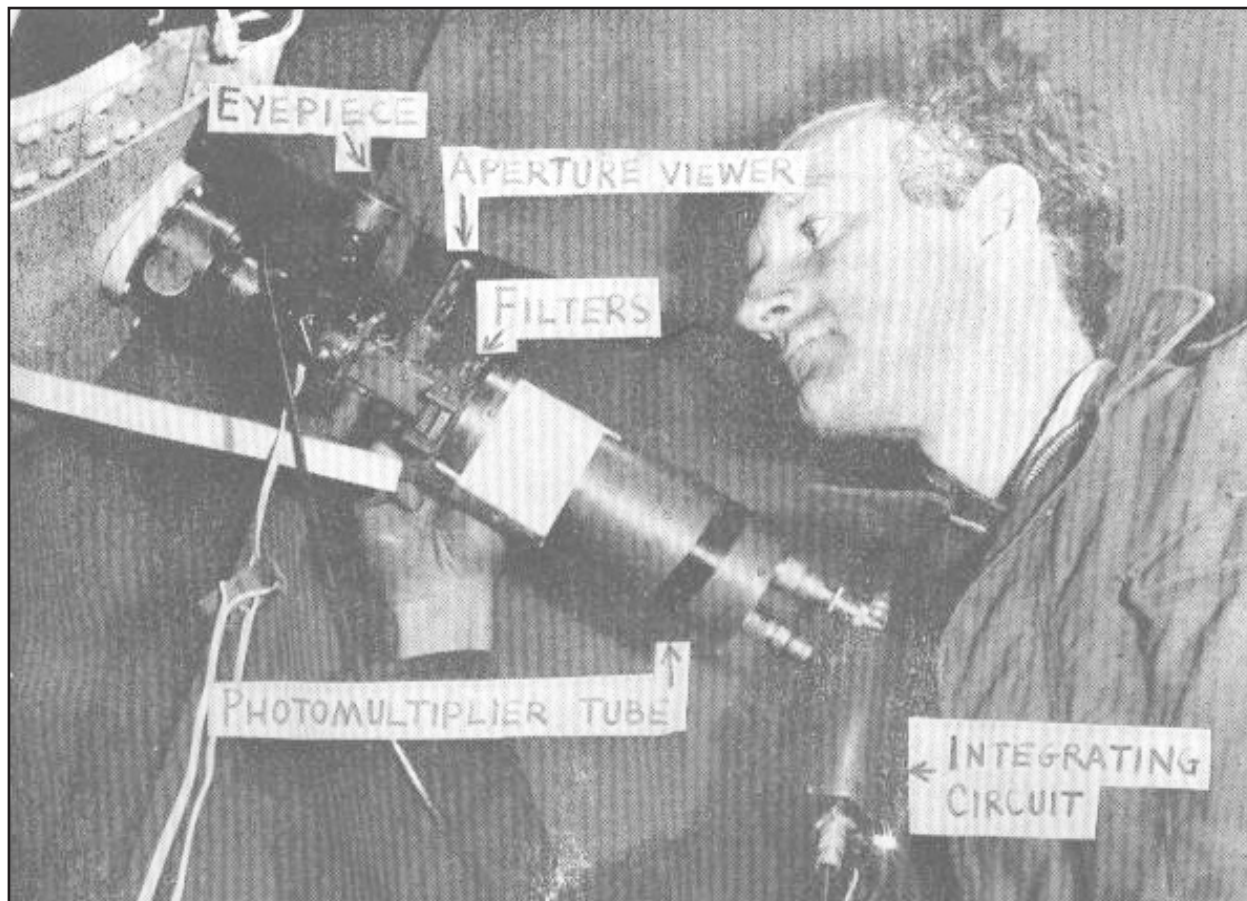




Clive Rowe at the CAS photometer. The respective parts of the photometer are labelled. See Stan Walker's page 3 article for details of 50 years of PEP measurements by members of the Auckland Astronomical Society.

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From the director – *Mark Blackford*

Happy New Year and welcome to the first VSS Newsletter for 2019. This issue marks the 10th anniversary of the appointment of Tom Richards as Director of Variable Stars South by the Council of the Royal Astronomical Society of New Zealand. Formally known as the Variable Star Section, VSS has a very long and proud history of observation and research of southern variables dating back to 1927. See Tom's article in the very first VSS Newsletter edition (February 2009) for an interesting summary of the resurrection of VSS and the goals Tom and others had for the organisation at that time. For a more detailed account see "The RASNZ Variable Star Section and Variable Stars South" by Albert Jones and Stan Walker (<https://www.aavso.org/apps/jaavso/article/2752/>).



Over the ensuing years Tom built the organisation into a respected, active and vibrant community of visual and electronic observers. In early 2015 he relinquished the directorship to Stan Walker who continued the great work until mid-2017 at which time I was coerced into taking on the role. I want to thank both Tom and Stan for their continued involvement in the society and mentoring they provided me personally over the years.

Amongst the many legacies of the old Variable Star Section are the written publications produced by the first Director Dr Frank M. Bateson. These were the Circulars of the VSS, RASNZ (199 issues from 1927 to 1974) and the Publications of VSS, RASNZ (25 issues between 1974 and 1999).

Following recent correspondence with Brian Skiff of Lowell Observatory, Mati Morel has completed the monumental task of scanning his personal collection of the publications. These electronic documents should be available on the VSS website by the time you read this.

Speaking of the VSS website, we have just renewed our web hosting service for three years at a cost of approximately NZ \$650. We had sufficient funds to cover this expense but our cash reserves are now quite low. The VSS annual membership fee was NZ \$20 up until early 2014 after which membership was free. It was hoped that occasional donations from members would be sufficient to pay our minimal expenses. However, very few donations have been received so we now need to consider reintroducing an annual fee, in the order of NZ \$10. Apart from improving our financial situation this would also allow us to clearly know who our members are. I'd love to hear your opinions on this before making any decisions.

Stephen Russell, chair of the NACAA Program Committee, has confirmed that the 29th NACAA will be held in the NSW regional city of Parkes over the 2020 Easter weekend, April 10-13. It will be hosted by the Central West Astronomical Society. Stephen has invited Variable Stars South to hold a meeting in conjunction with NACAA, as we have done on several occasions in the past. That would be 2 years after our very successful 5th Variable Stars South Symposium in Christchurch so I see this as an ideal opportunity to hold our 6th Symposium. It may seem like a long way away but it'll be upon us before we know it.

Another meeting that might be of interest to VSS members is the Remote Telescopes, Student Research and Education (RTSRE) Conference to be held in Melbourne in December 2019. Details appear later in this newsletter.

Meanwhile back at home Congarinni Observatory was out of action for several weeks due to damage to the roll-off roof caused by a strong wind gust in November. As a result of that and mediocre skies my tally of observations for the last quarter of 2018 was significantly lower than I would have liked. My article later in this newsletter should serve as a warning to others with similar observatory buildings.

Wishing you all clear skies, gentle breezes and good observing in 2019,

Mark Blackford

An interesting anniversary – *Stan Walker*

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Fifty years ago in January, 1969, we had two unexpected visitors at the Auckland Observatory. Bob Evans and someone who is less well known in this area, Stefan Mochnacki, then a student at the University of Canterbury.

Even in those days of no internet the grapevine still worked well and Clive Rowe had suggested they call in at Auckland during a holiday in that area and demonstrate the Clive Rowe photometer as in use at the Beverley Begg Observatory at West Melton. This visit was to have far reaching consequences.

Council of the Auckland Astronomical Society had been persuaded that we should become involved in photo-electric photometry, PEP, even if they were not clear exactly what it was. At that time we were heavily involved in flare star programmes with Bruce Slee of the CSIRO but the best telescope in New Zealand did not give the best results when relying on the eye as a detector. But these were great social occasions, even if the likelihood of a flare being real varied in inverse proportion to the number of observers and recorders around the telescope! Brian Marino and I, along with some of the more serious observers, realised that something more was necessary. Photography was painfully slow and not much more reliable than the eye - so was PEP the magic solution?

Some of us were slightly familiar with the most used techniques at that time from reading published papers: the 1P21 photomultiplier tube, unstable DC amplifiers, chart recorders and the laborious need to measure intensities and convert these into magnitudes, and so on! Was the game worth it? So the visit was extremely well timed. So let's look at the PEP requirements in the late 1960s - bearing in mind the state of electronic technology in those days. Let's look at the device in question. Figure 1 shows a later version but it was still much the same except this unit didn't need to be wrapped in black cloth to prevent light leaks!

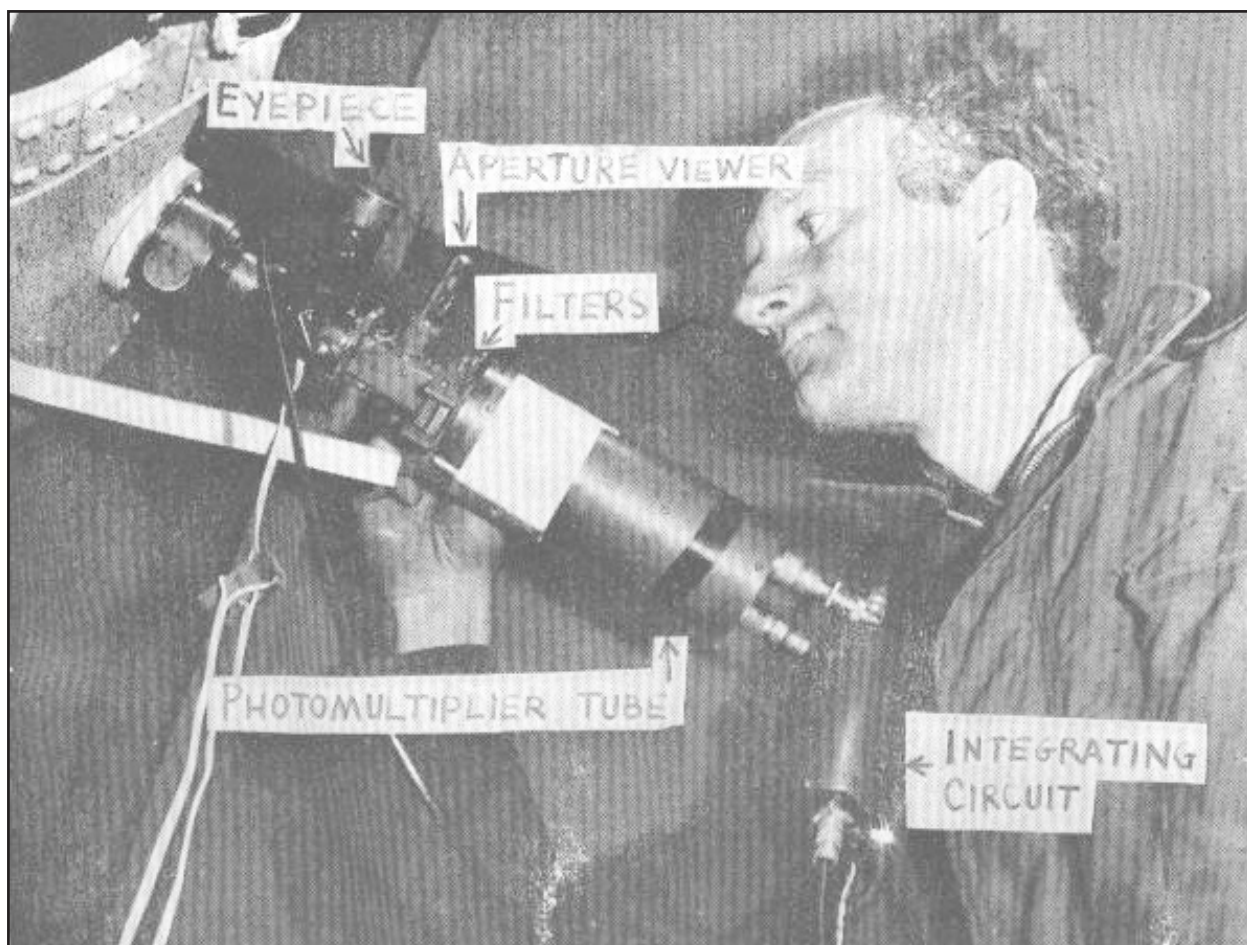


Figure 1. Clive Rowe at the CAS photometer. The respective parts of the photometer are labelled and discussed in the text.

What does a photometer do?

It's essentially equivalent to one pixel in a current CCD chip but does not have the in-built functions - these are supplied by the operator. The front field eyepiece allows centring of the target star and is then removed from the light path by a flip mirror. The starlight then passes through a focal plane aperture, usually about 30 arcseconds in diameter, to eliminate light from all but the target star and some sky background. The second eyepiece allows inspection and final exact centring of the target star before removing from the light path. The light then passes through a Fabry lens which turns the diverging light after the focal plane into a non-diverging beam which then passes through the selected filter in a filter changer before striking the light sensitive cathode of the photomultiplier tube.

This tube is exactly that - a single pixel of a modern CCD. Detected photons, about 20%, are then multiplied by a series of dynodes - in the case of the EMI tubes used by most southern astronomers 14 times - to produce a measurable electric current. It is then changed into a series of pulses by the 'integrator' in this figure which is an analogue to digital converter (A/D converter). These pulses then are fed into a digital frequency meter and displayed at intervals, usually 10 seconds.

Being a single channel device the sky background requires separate measuring in an area free of stars. Then the comparison and check stars similar measuring. Hence it's also known as sequential photometry. The limiting factor as far as faintness is concerned is the human eye which needs to centre the star in the focal plane aperture. In practical terms this limits the measures by about two magnitudes. But the range of the system is considerably larger than the CCD where it is usually fixed at 2^{16} . The amplification produces photon cascades in the pm tube so individual photons can be measured thus giving better time resolution. This needs high quality and very fast response resistors and capacitors.

The Auckland photometer

This visit had immediate effects. Harry Williams was persuaded to go with the more modern EMI tubes and the digital concept. The specifications for the Mark I photometer were set out by Brian Marino and the author and construction began. About this time we were approached by Bob White and Alec Chisholm of the University of Auckland Physics Department who were interested in seeing a cooperation develop with the Auckland Observatory - they helpfully arranged the permanent loan of a high voltage power supply, a digital frequency meter and testing of the two pm tubes we purchased. The photometer is shown in Figure 2. So well did it perform we never built the Mark II version but merely modified the Mark I a few years later to take an extra set of filters - uvby - as well as the original UBV filters!

Early results

Getting the system to operate effectively was not as easy as expected. We listened to too many so-called experts and as a result we almost despaired of ever getting reliable data. We began by measuring VW Hydri in the hopes of determining an orbital period from eclipses. But the system was unstable and noisy with the dark current increasing dramatically once it had been operating for an hour or more. The problems were identified one by one. A visiting 'electronics expert' had decided the resistors in the pm tube socket which provided a set of voltage steps were too close together and had moved them apart, thus cracking some of the end cap joints in these resistors. Then we were advised to use petrolatum as an extra safety to avoid similar arcing across the resistors. This worked OK in Canterbury's cooler climate but in Auckland was a gooey mess. Finally we had been advised by Clive Rowe that 2000 volts was needed for best results. We managed to track down the pm tube specifications, discarded in error by the AAS President who had arranged the purchase of the tubes from EMI and discovered the the operating voltage to get 2000 amps per lumen was 1320 volts. Running at 50% overvoltage was causing much of the problems of instability. A little thought indicated that 100 volt differences between adjoining resistors was too little to cause any arc across the chain so we cleaned up the base, put in a new set of resistors, and tried again. A great result: 0.1 nanoamperes dark current and very stable. This produced a negligible count of 1% of the sky background on a dark night.

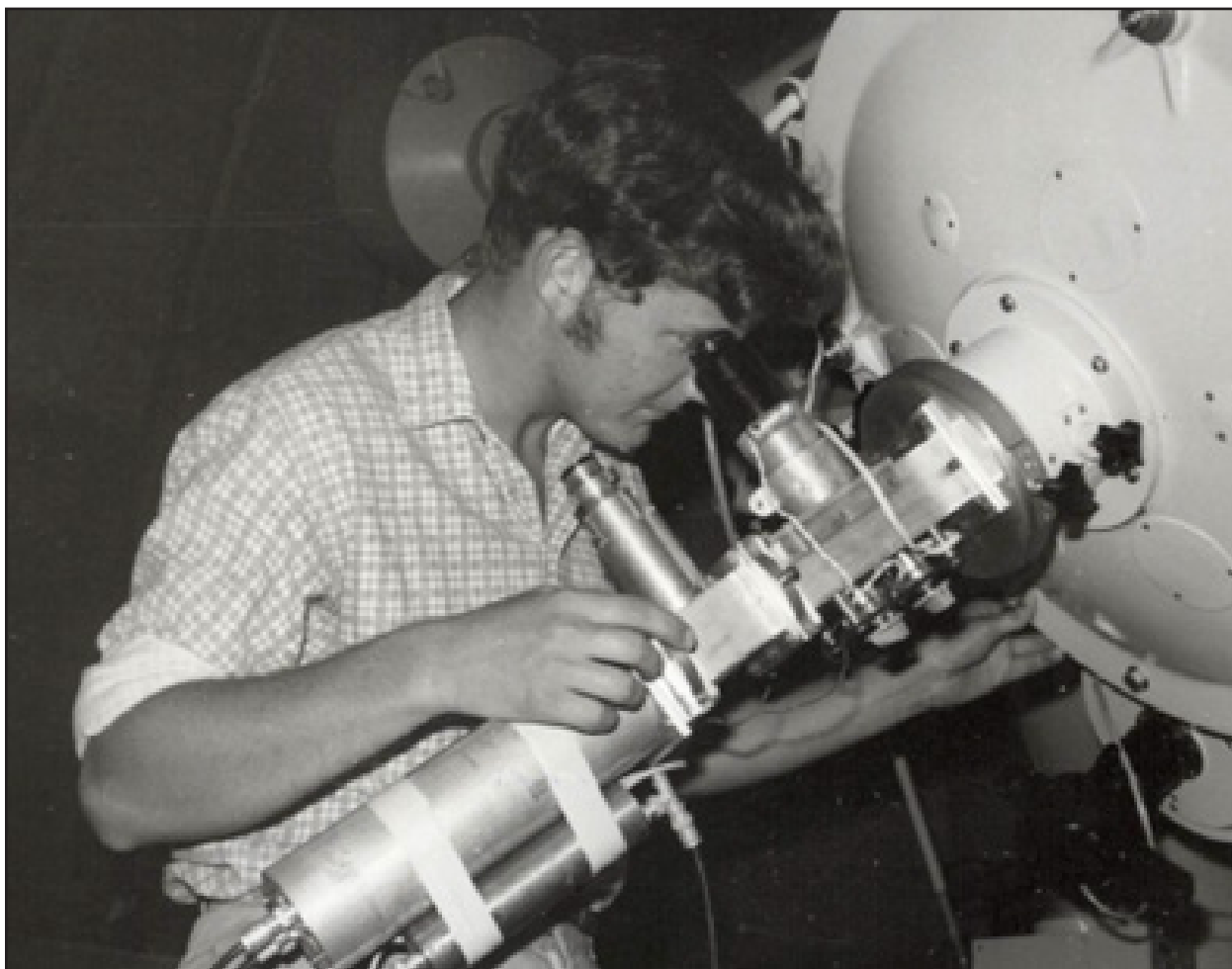


Figure 2. Taken about mid 1970 this shows Roger Feasey using the AO Mark I photometer. The layout is similar to the Canterbury unit but a few extra items are visible - rheostats underneath to control the brightness of the cross hairs in the field eyepiece and of the illuminating of the edges of the focal plane aperture. The small lever between the two eyepieces selects the aperture 10", 20", 31", 62", or 104". The 31" aperture was almost always used - the currently popular FWHM does not provide consistent results in sequential photometry. Roger's finger is on the filter selector. The cylinder underneath is the Rowe A/D converter using Schmidt trigger circuitry to convert the current to pulses at a frequency matching the brightness of the star in a linear manner over more than seven magnitudes.

Over the years we had no further troubles of this kind. But the Auckland atmosphere is still humid and very occasionally we noticed an increased and unstable dark current - still at a very low level - and found that condensation had allowed moisture to collect in the back end of the tube housing! This necessitated shutting off the voltage, unscrewing the retaining ring to allow the water to escape, a quick wiping out of the lower parts of the housing and back into action - a 15 minute repair needed once or twice a year!

So on to results. I have some measures of VW Hydri in June, 1969, but these show the problems with instability. By October that year these had been resolved and we participated in the international flare star programme on UV Ceti. Some results are shown in Figure 3. Note the two very spectacular flares at the right - 3 magnitude or 16 times increase in brightness in 10 seconds!

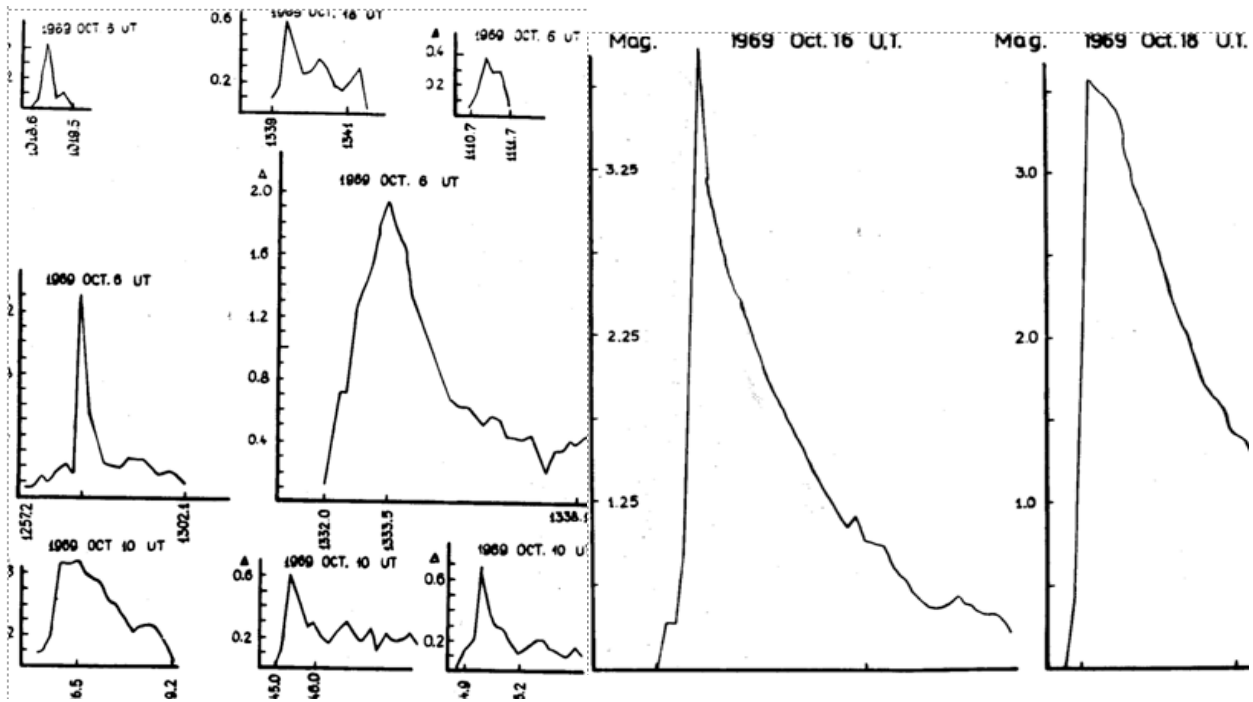


Figure 3. Flare stars were the big excitement in 1969 and in this figure we show some early results from the October international programme. Monitoring was with the blue filter with measures at 10 second intervals. These plots show magnitudes on the vertical scale, time in minutes on the horizontal scale. The rises are usually quite sharp - the two on the right showing a brightening of three magnitudes, or about 16 times, in 10 seconds. Very dramatic! Others were slower but still very fast by astrophysical times.

Another star we looked at was RS Columbae, a longish period W Ursae Majoris object discovered by Bond and Landolt but assigned an incorrect period by them of around 10 hours.

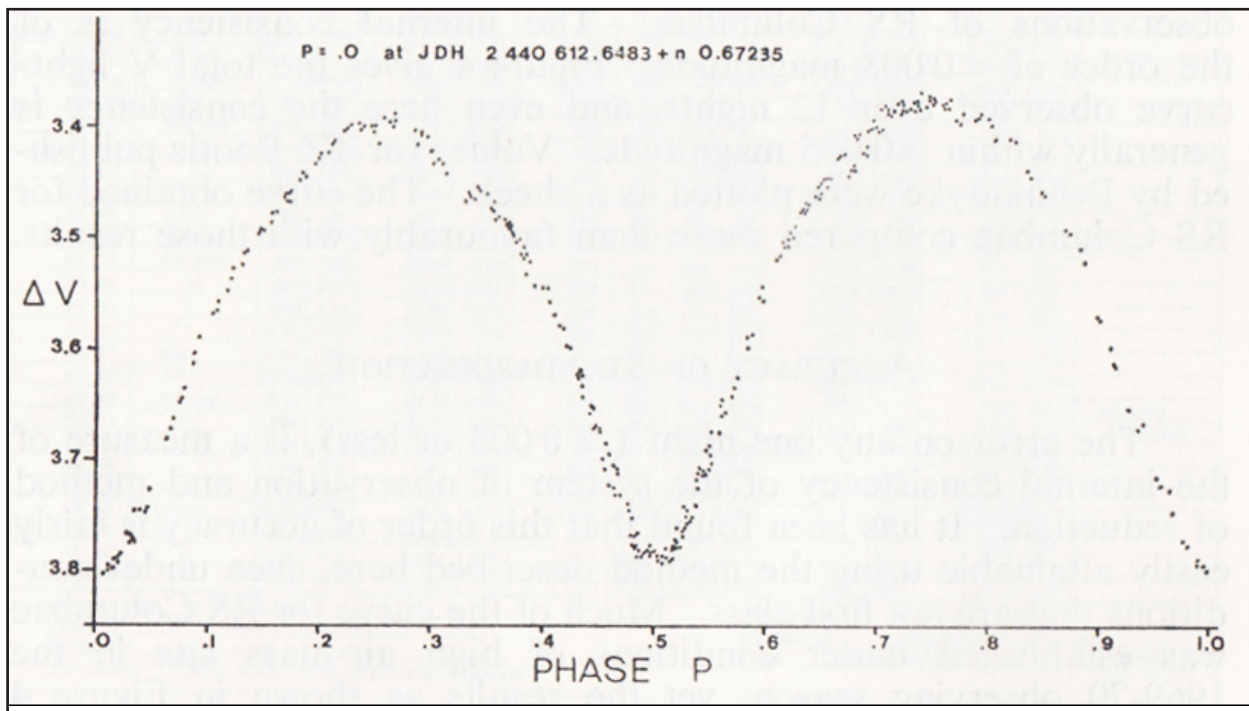


Figure 4. The V light curve of RS Columbae measured in January, 1970. The scatter in the upper regions of the light curve fit well with expectations of the models prevalent at that time.

This brings Stefan Mochnecki back into the picture. He was part way through a degree at the University of Canterbury involving these stars and the minor dips and humps near maximum were of considerable interest. Stefan suggested that it was essential to standardise our system so the measures would be true U, B and V. This we duly did. Regretfully many amateurs in the present day do not manage this well and their measures suffer in value through this fault.

A year or two later Stefan passed through Auckland on his way to work at Kitt Peak or one of the other observatories in the US south west to participate in an investigation of PEP arrays. We wondered at the value of this - but in its present developed form a PEP array is a CCD chip! How things change! He then moved on to the University of Toronto where he still is, I believe.

Looking back at these times we can see that in spite of the drawbacks of sequential photometry it was possible to produce high quality measures, even in the bright and polluted Auckland skies of that time. We had problems with smoke from the nightly burning of materials at Green Lane Hospital or the weekly fires lit by school caretakers. But the clean air legislation of the 1970s resolved much of this. CCDs should avert much of the sequential problems but I wonder whether flat fielding really removes sensitivity problems. Is the A/D conversion rate similar in each pixel so that each has the same linearity or is it merely a zero point correction which only relates to a certain magnitude or signal level?

So it's interesting to look back 50 years to the beginnings of PEP in Auckland. Now the main observational strength has shifted away from Auckland Observatory to small private observatories using CCDs and producing many more good quality measures. But what was started in Auckland then spread to the rest of the country and to amateur astronomy in Australia as well. A long and interesting road which now sees us using measures from satellites to understand stars such as QZ Carinae, identified as variable at Auckland in early 1971 and now about to complete one orbit of the two massive binary pairs around each other.

QZ Carinae - what is happening with the data? – *Mark Blackford, Stan Walker & Ed Budding*

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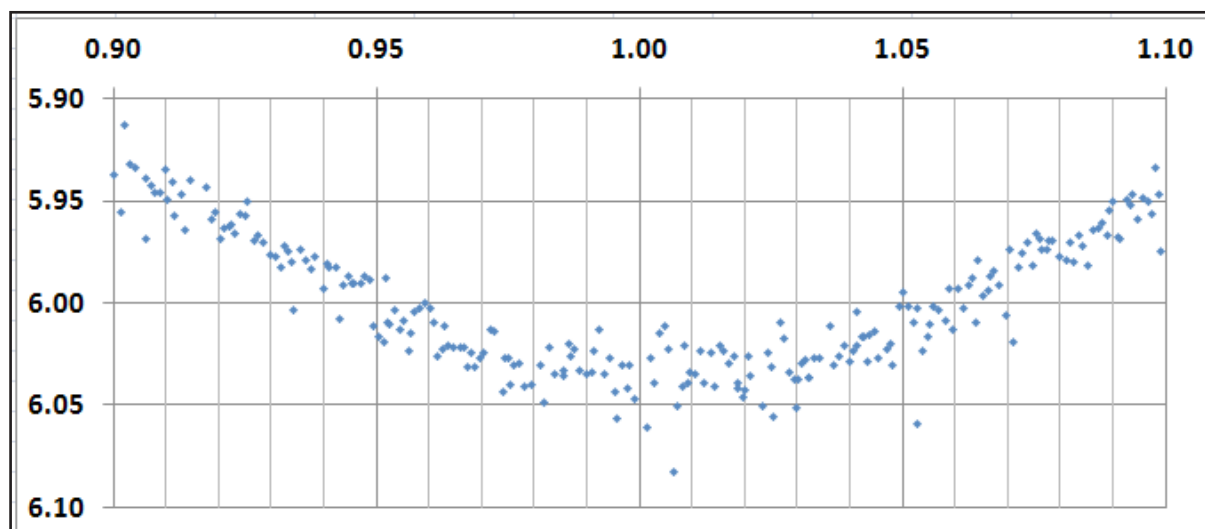
The simple answer is that in spite of everyone's efforts we need another season's measures. We have very good measures from the BRITE satellite in 2017 and 2018 and have determined a much better mean light curve than what had previously been available. This has allowed us to recalculate seasonal epochs from 1971 to date from the available data.

One surprise, which should have been apparent to everyone making measures but was clearly overlooked, is that measuring during eclipses is not particularly helpful in determining epochs of central eclipse.

Why is this? Opposition is on 2 March so a useful time to observe is at the autumn equinox when there is about 10 hours of dark sky. But the length of the total phase is 5.76 hours so only 2.12 hours - or 0.014 phase - of ingress and egress can be covered. During this interval the brightness changes by only 0.025 magnitudes. So it's difficult to determine the beginning and end of totality. A more useful approach is to measure the ingress and egress points separately with the measuring spread maybe 2:1 between ingress/totality and 1:2 for totality/egress.

From a single site, however, this means measures several years apart which then introduces another factor - the changing light time effects as the two pairs orbit each other. This shifts the time of central eclipse so that in determinations of this point from measures of either the second or third contact points alone the duration of totality is a critical value. The BRITE measures are good but due to the need to average a large number of individual measures to determine each point the duration of totality cannot be determined from that source.

Why not? The simple answer is that the BRITE satellite was designed for another purpose - observing very bright stars - and during eclipse QZ Carinae at 6.43 is at the limit of the equipment. The measures are ideal for determining the mean light curve but lack the time resolution to determine the critical second and third contact points. An illustrative curve from all of the 2018 measures appears below. The magnitude scale is in uncorrected R magnitudes.

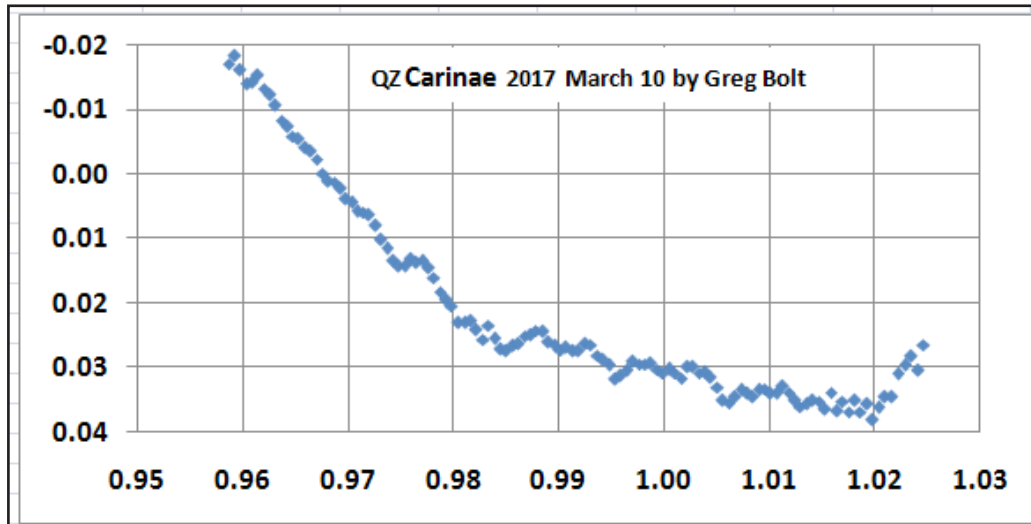


Extra smoothing does not help. In another area we have been puzzled by some features in the historical measures but these are clearly apparent in the satellite measures. So they appear real. More about these in the forthcoming paper.

This year QZ Carinae is ideally positioned for a different approach - the determination of the second and third contact points from two locations separated by a longitude/time interval similar to the time of totality. There are two sites which provide this separation, New Zealand at ~175E and Perth at ~116E: a separation of 59 degrees or 3.93 hours.

A time prediction of the events takes into account the eastward motion of eclipses at ~ 2.5 minutes a cycle. Measures spanning the interval from 2015 to 2018 show an LTE change of -0.021 per year which should also be incorporated in predictions. So for eclipse 2923 we predict central eclipse at JD 2458567.100 - early in the morning of 24 March, 2019. Totality begins near 58566.98 and ends around 58567.22.

To illustrate all of this we show measures by Greg Bolt of Perth on 10 March, 2017. A 20 point running mean was applied to 2452 measures over 0.41113 days. The magnitude axis uses differential magnitudes. The slope is real as similar features have been observed at other times by other observers, including BRITE. This slope, however, made it difficult to establish the exact time of the change from ingress to totality. So there is still uncertainty about the eclipse duration and the time of mid-eclipse. Note also that the vertical divisions are 10 mmags and the standard deviations of the individual points in this graph are 1.6 mmags with a time resolution 5 minutes or 0.0035 days. The LTE derivations are not quite as good.



For best results we need at least three and preferably five full night measures from New Zealand and Perth. There is no need for the observations to be on the same night. The preferred comparison stars are shown in the table below.

We appreciate that with a V magnitude of ~ 6.4 these stars are too bright for normal measures and will require short exposure times and maybe some stopping down. This is overcome by employing multi-point running means so whilst the measures may look poor initially they can be improved by this as we show with Greg Bolt's light curve above.

Star	Identity	R A	Dec	V	B-V	V-R	V-I
AUK A	HD 93131	10h44m31.840s	-60°12'23.54"	6.448	-0.011	0.119	0.234
AUK C	HD 93695	10h48m24.633s	-59°57'52.44"	6.427	-0.121	-0.048	-0.092
CCD 1	HD 93191	10h44m27.532s	-59°53'05.41"	8.537	-0.004	0.000	-0.072
CCD 2	HD 305523	10h45m09.241s	-60°02'37.99"	8.543	0.185	0.167	0.382
CCD 3	HD 93222	10h45m15.964s	-60°10'48.79"	8.119	0.094	0.120	0.266
CCD 4	HD 93028	10h43m54.777s	-60°17'23.43"	8.375	-0.019	0.039	0.065
DSLR 2	HD 93403	10h46m24.388s	-59°29'48.64"	7.265	0.234	0.198	0.435
DSLR 5	HD 92741	10h41m51.592s	-60°03'43.10"	7.241	-0.008	0.014	0.031
DSLR 6	HD 93843	10h49m18.064s	-60°18'47.49"	7.311	-0.021	0.043	0.098
DSLR 7	HD 93683	10h48m18.800s	-60°42'25.00"	7.889	0.128	0.161	0.373

Table of measured V magnitudes and colour indices of some selected stars. For CCD observers CCD 3 and CCD 4 are the recommended comparison and check stars, respectively.

Abstract

While checking the published VSX position for X Phe I have found a great incongruity between the astrometric positions in USNO-B1.0 and GSC2.3 catalogues and what is seen on the original survey plates. The astrometric positions appear to be spurious. X Phe remains lost.

Introduction

Wood (1920) reported a new variable in UOC48 with the following remark:

“1904 Oct. 7, triple image plate, has but one partial image, other two images missing, no defect of film visible; on other plates normal; Algol-type?”

Precise details are scant for X Phe, but it is implied that the variable was near the plate limit (15.0p), but no magnitude was given. Rapid variation was also implied. From a perusal of UOC48 it appears that the region of X Phe was covered on pairs of Sydney Obs. **pm** plates over an interval of 11.0 years, from 1895 to 1906 approx. Triple images were recorded on each plate, each exposure being 30min long (Wood 1920, p42). X Phe is also called 28.1920 (AN 1920).

Observations

The field of X Phe is very sparse, with few bright stars, including those at the 14-15 mag level. Using the VSX position (J2000) 01^h23^m27.90^s -52°29'49.3" I focused on examining the images from UK and ESO Schmidt telescopes, from which astrometric positions were derived, and assumed to belong to X Phe. The following image cut-outs (10' square) were downloaded from the PMM and Catalogue Archive (PICA), and the region within $r=1'$ of X Phe studied.

Series	Type	Field	Date	Exp. (min)	Limit	Detections, >21 ^m
SERC J	IIIaJ (blue)	151	1977.7728	75	21	Invisible
ESO R	IIIaF (red)	151	1981.8001	120	21	Invisible
SERC J	IIIaJ (blue)	152	1977.9179	75	21	Invisible
ESO R	IIIaF (red)	152	1984.8939	120	21	Invisible
SERC J	IIIaJ (blue)	196	1979.8754	65	21	Invisible
AAO R	IIIaF (red)	152	1997.6057	60	21	Invisible
AAO R	IIIaF (red)	196	1996.7707	60	21	Invisible

Table 1. Downloaded plates from PICA.

Result

Nothing can be seen near the position of X Phe, supported by images from **MAST** and **SuperCOS-MOS**. Nothing can be seen on IR plate. There is no obvious star or any other object near the stated position. The GSC2.3 records a star ($R=20.54$) at the following J2000 position:

01^h23^m27.54^s -52°29'47.7" Ep 1996.771, as GSC-2.3 **S1AO003777**.

This cannot be found either. It may be the same plate as AAO R, field 196. A plot of Gaia DR2 stars, to <21G, shows nothing here. In fact, there is only *one* star in the general vicinity which could have been mistaken for X Phe (Wood's reference to plates with “normal” images). This is GSC **8039-00393** (star B on **Figure 1 overleaf**), at (J2000) 01^h23^m41.56^s -52°28'39.4", $V=14.278$ $B-V=1.068$ APASS DR9. It lies ~10" following Wood's position and 2' north. Not variable.

Astrometric positions

VSX has adopted the position of star B1.0 **0375-0014926**, with following magnitudes:-

B2 = 15.24; R2 = 19.21; I = 18.91. B2 relates to plate SERC J of 1979.8754, and R2 to AAO R of 1996.7707. The GSC2.3 star is for epoch 1996.771, from the same AAO R plate as USNO R2, with rounded epoch. The GSC2.3 position is slightly different, but no star can be seen on the original plate, although there may be “something” there (B. Skiff, priv. comm.).

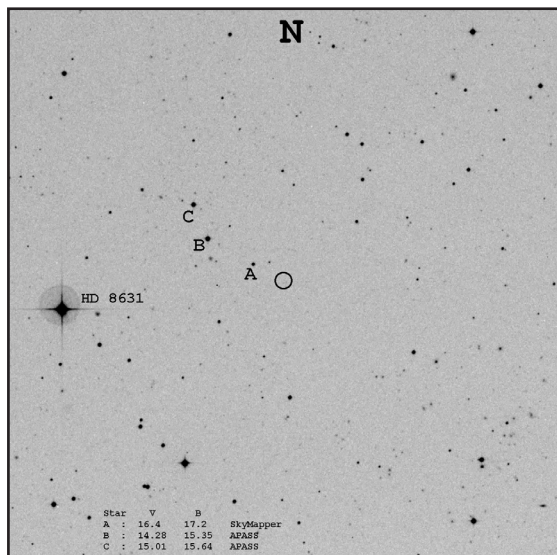


Figure 1. Finder chart, 15' field. UKS blue plate. VSX position for X Phe is the open circle.

Discussion

Study of the original Schmidt plates fails to confirm the positive measurements (three in USNO-B1.0 and one in GSC2-3). They are unconnected to the claimed position of X Phe. An enquiry overseas has failed to resolve the discrepancy. A true mystery. As for Wood's original report, he may have looked at a nearby star, GSC **8039-00593**, when he reported its brightness as “normal” on other plates of this star-poor region. His plates cover the years 1895-1906. Deep Schmidt plates from the last quarter of the 20th century do not provide a convincing candidate. A defect on the old Sydney plate cannot be ruled out.

Conclusion

I conclude that a plate defect is responsible for Wood's “variable” sighting. A misidentification with GSC **8039-00593** is likely responsible for Wood's other sightings of his star, even though it lies about 2.4' from his stated position.

The multiple measurements for B1.0 0375-0014926 are **not** supported after studying the plate archive. They should be disregarded. X Phe is still a lost variable.

Acknowledgement

This research has made use of the PMM Image and Catalogue Archive (PICA) operated by the MIT Planetary Astronomy Lab. (<http://astronomy.mit.edu/fchpix/>).

References

Wood, H.E. 1920 Union Obs. Circ. 48, 51

Light element determination from survey data using scatter minimisation – *Jeff Byron*

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Introduction

Very often data from the All Sky Automated Survey – “ASAS” (Pojmański, 1997) or similar survey is used for determination of light elements of eclipsing binary targets for either planning observations or determination of historic conditions. The method described below, based on a simple (although computationally intensive) scatter minimisation computer algorithm (PeriodFinder) written by the author, has been found to be highly effective and to find correct periods where other period search algorithms fail (Blackford, 2018).

PeriodFinder was initially written in 2013, but has been recently updated. It is currently freely available as a Windows Command Prompt programme (with a simple spreadsheet interface) by request to the author. A detailed User Manual and spreadsheet template are also available. Testing of a version running as a module within VStar (Benn, 2019) is currently underway.

The algorithm determines the underlying period of the target by measuring the scatter in a phase-folded plot for each test period in a range from a user-selected minimum, to a user-selected maximum, in period steps of some user-selected value.

This paper summarises the usage of this type of algorithm, but for details of using PeriodFinder for this purpose the reader is referred to its User Manual.

Data sets

ASAS datasets typically consist of several hundred to just over one thousand observations (time and magnitude). All but the A grade should be discarded.

There are also other surveys providing many thousands of such observations. In these cases, it may be suitable to initially make up a smaller dataset by sampling each n^{th} observation of the large set, and using this to determine the period as described below (Blackford, 2018). This would avoid the large computation times that using the full dataset would involve. Then if necessary, with the full dataset, test over a very small period range to further refine the period.

ASAS data for BM Phe and TZ Cru have been used for illustrative purposes in this paper.

Initial (coarse) period determination

Unless a good initial estimate of the period is already known, the algorithm is used to scan over a large period interval with a medium step size (typically 0.000001 days). The period interval for this run will depend upon what (if any) prior knowledge the user has of the period.

An examination of a plot of scatter against period is used to determine whether there is one clearly dominant period – or are there numerous dips – a bit like a hair comb? In the latter case, the deepest dip is probably the one required, but unfortunately the user may have to check a few which are of similar depth in some cases, by using those periods to phase-fold the observational data and see which works best. Note that these multiple matches to the data are called ‘aliases’ and will correspond to, for example, frequencies (inverses of periods) which are a linear combination of multiples of the actual frequency and multiples of the observation frequency.

For example, Figure 1 shows the scatter chart for BM Phe data being scanned from 0.1 to 1.0 days. The strong dips in scatter correspond to periods of 0.206807, 0.413613, 0.620419 and 0.827225 days. It can be seen that these periods are all multiples of the smallest – 0.206807 days.

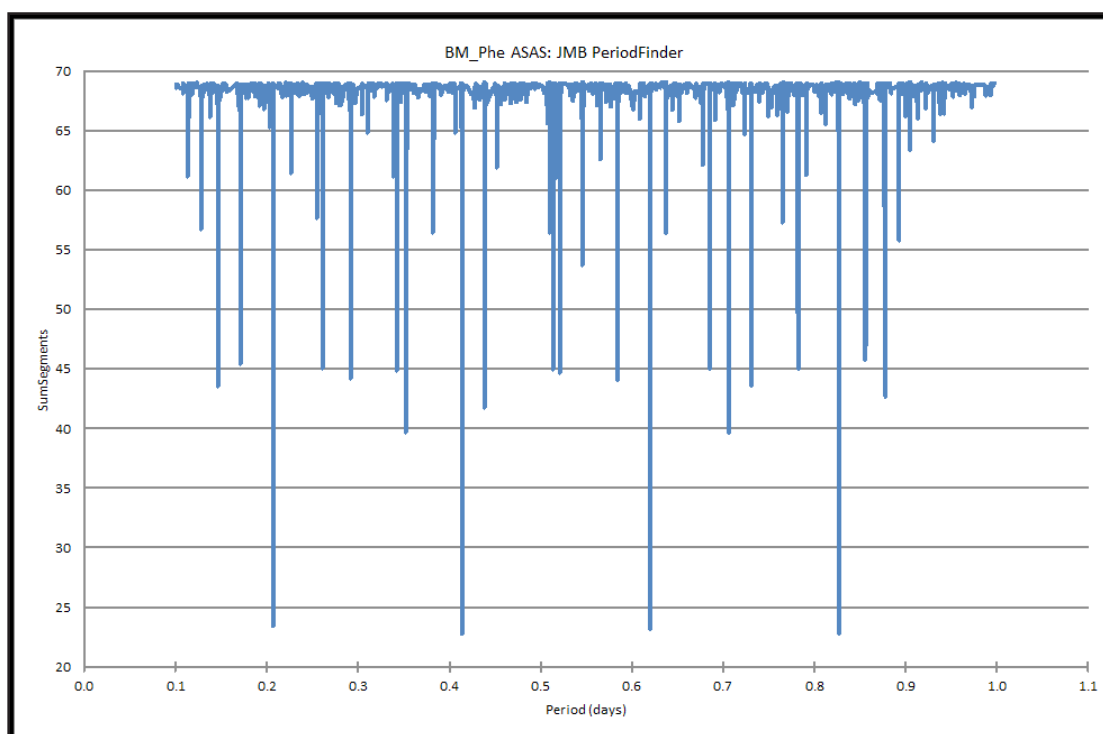


Figure 1. *BM Phe period search from 0.1 days to 1.0 days*

As shown in *Figure 2*, using this smallest period to phase-fold the ASAS data results in a light curve with only one maximum and one minimum per cycle. Similarly, the periods of 0.62019 and 0.827225 days give three and four maxima and minima per cycle light curves respectively. These are all physically unlikely. However, 0.413613 days gives a two maxima and minima per cycle light curve as expected.

From *Figure 2(b)* (data phase folded with the correct period of 0.413613 days) it can be seen that primary and secondary minima are very similar, which has caused the half period (0.206807 days) to be strongly suggested by a mathematical analysis of the data.

Other dips in *Figure 1* are aliases caused by the mathematical mixing of the light curve frequency with the sampling frequency etc. For example, as many ASAS observations of the target are separated by approximately an integral number of days, 1 cycle/day is mixed with $(1/0.413613)$ cycles/day (= 2.417 cycles/day) to give 1.417 cycles/day - corresponding to a period of $(1/1.417) = 0.706$ days – which is one of the strongest of these other dips.

If it is desired to investigate these further, it is advisable to also make a chart plotting scatter against frequency (i.e. $1/\text{period}$) rather than against period. Then aliases caused by, for example, a daily sampling frequency will appear as a series of equi-spaced dips with 1 cycle/day separation.

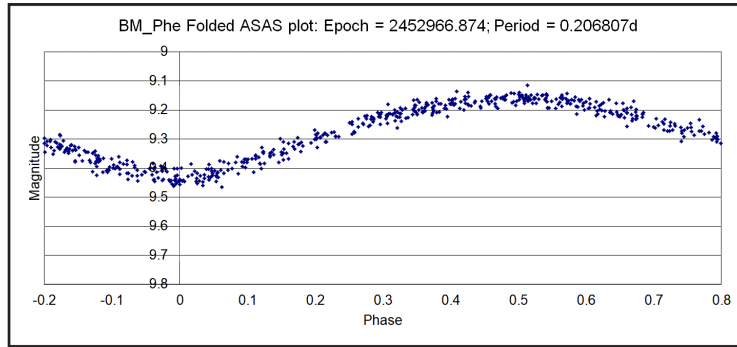
However, in this case these dips are clearly not as strong as the first four discussed and therefore do not give as neat a phase-folded result - much higher scatter. They thus need not be considered further.

Final period determination

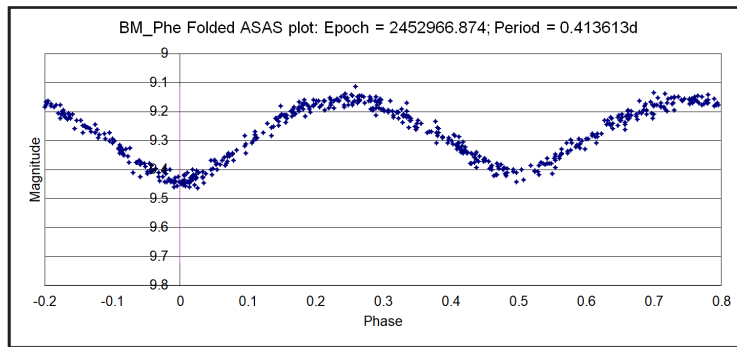
Once a good first estimate of the period is determined, the algorithm is used to re-scan over a small period interval with a small step size (typically 0.0000001 days).

For example, for BM Phe, having established that the required frequency is approximately 0.4136 days, a final scan from 0.4135 to 0.4137 days is made. The resulting plots of the output are shown below in *Figure 3*.

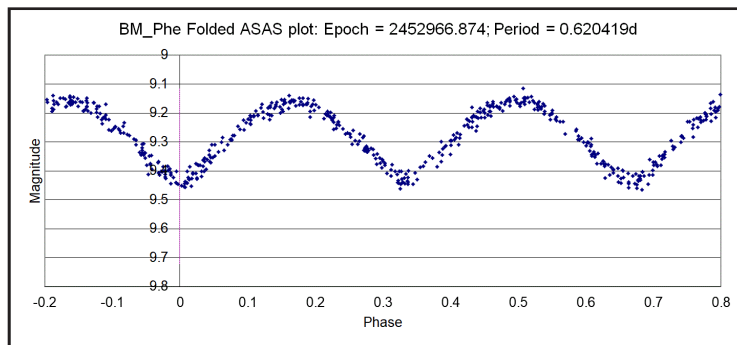
A visual inspection of the zoomed in graph of *Figure 3(b)* is used to establish the smallest period interval which is bounded by periods of approximately equal scatter such that, outside of that period interval, the scatter is unambiguously increasing. This can be taken as the 95% confidence interval: plus or minus two standard deviations.



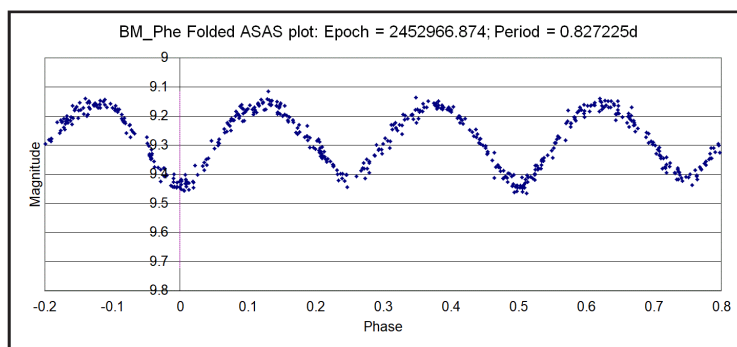
(a)



(b)



(c)



(d)

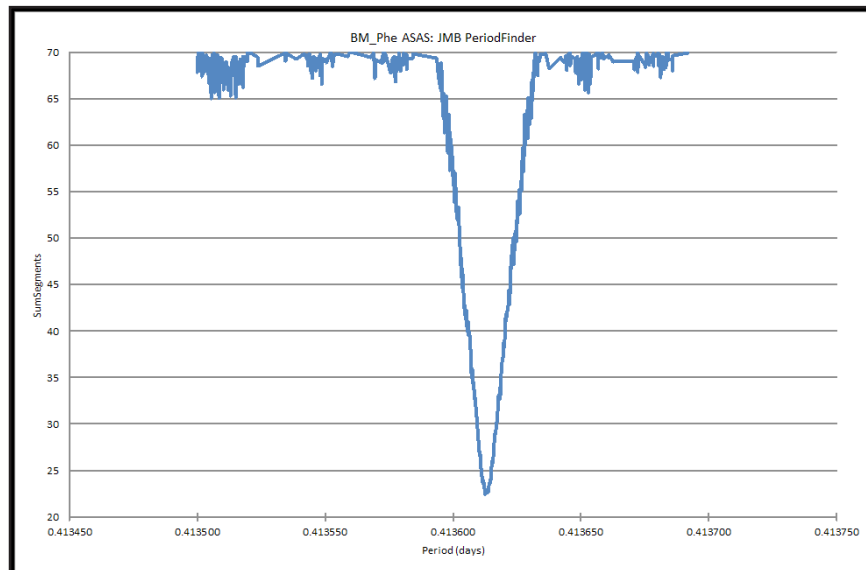
Figure 2. *BM Phe ASAS data phase-folded with periods of (a) 0.206807, (b) 0.413613, (c) 0.620419 & (d) 0.827226 days*

In this case, this procedure gave an estimated period of 0.413613 days with an estimated 95% confidence limit of 0.000002 days. This corresponds to a one sigma estimated error of 0.000001 days.

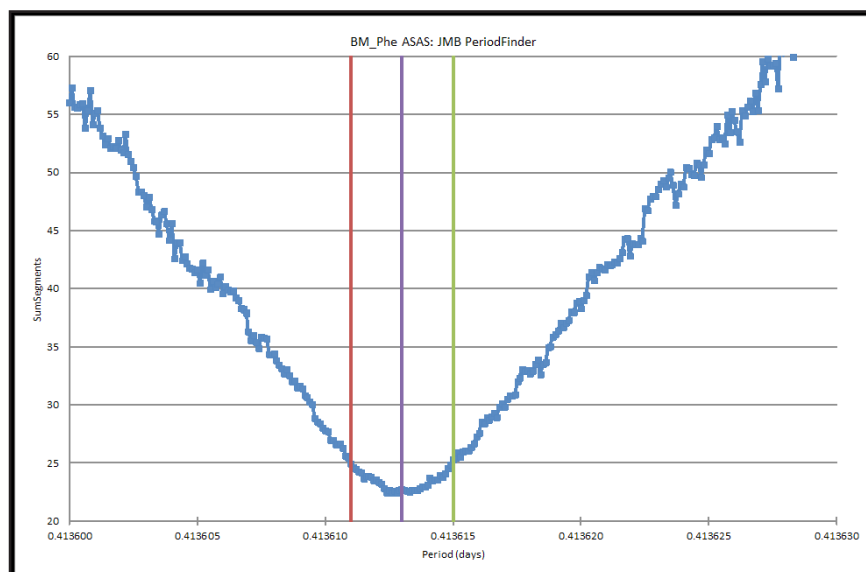
Note that it is slightly coincidental that the final value is identical to the minimum scatter value found

from the intermediate (0.000001 day step size) scan. That is not always the case!

Not all ASAS data sets give such a “clean” scatter plot as does BM Phe. As an example, consider Figure 4 below which shows the scatter for TZ Cru ASAS data. Following the above procedure gave a period of 2.091140 days with a much larger one sigma estimated error of 0.000035 days.



(a)



(b)

Figure 3. (a) A scan from 0.4135 days to 0.4137 days with a step size of 0.0000001 days and a threshold of 70. (b) The same PeriodFinder output data as in (a) but with the Excel graph axis limits changed to zoom in on the minimum scatter. The red and green markers define an interval of period between two points of roughly equal scatter and beyond which the graph unambiguously increases - thus representing the 95% confidence interval (2 sigma) for estimating the period. The purple marker is the mid-point and represents the best estimate of period.

Establishing the epoch

It seems to be conventional to establish the epoch for an ASAS-data-derived time of minimum value to be close to the first observation date. Doing that with BM Phe, the epoch chosen will be approximately 2451868.7315 and the phase folded plot will be as shown in Figure 5.

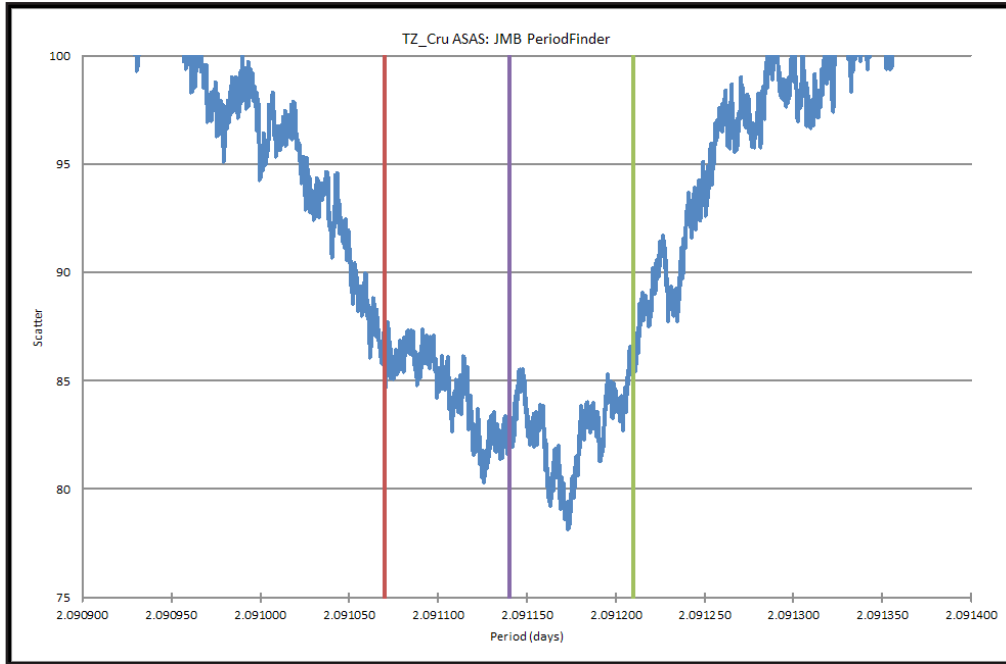


Figure 4. *PeriodFinder scan for TZ Cru using ASAS data. The graph is much less clean than for BM Phe giving a much larger uncertainty of period.*

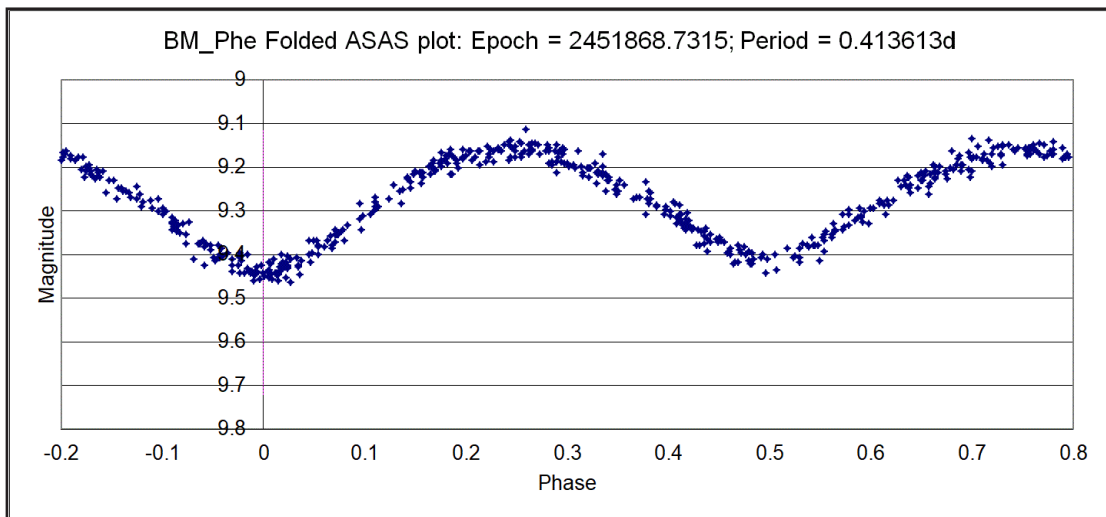


Figure 5. *Phase-folded plot using epoch close to first observation date and best estimate of period*

However, note the effect (shown in Figure 6) of changing the period by 0.000002 (the uncertainty): It can be seen that, as well as the expected increase in scatter, there is also an easily discerned phase shift to the left. This phase shift equates to about 0.006 days.

On the other hand, consider choosing an epoch close to the median date of the observations. For BM Phe, that epoch will be approximately 2452966.874 and the phase folded plot will be as shown in Figure 7.

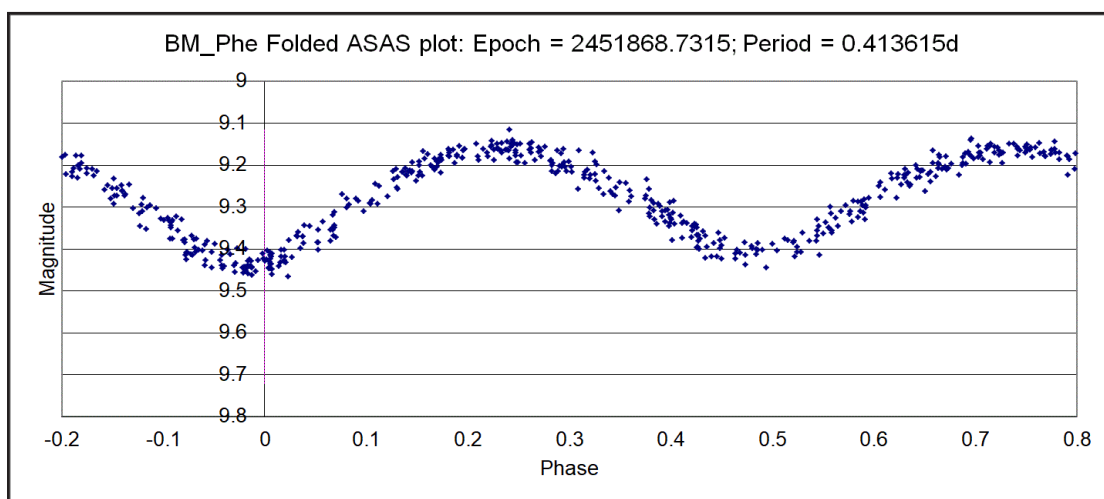


Figure 6. Phase-folded plot using epoch close to first observation date and period offset by the (2-sigma) uncertainty

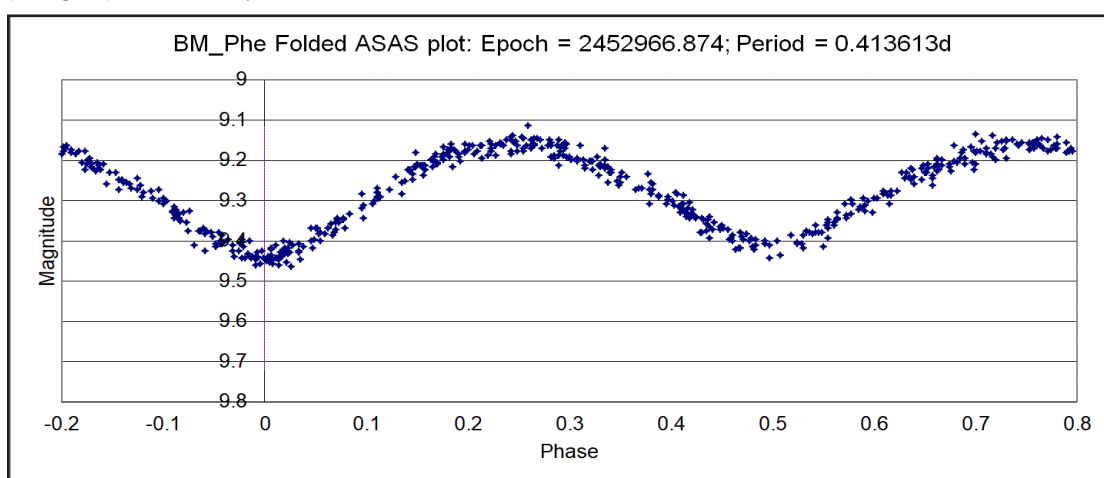


Figure 7. Phase-folded plot using epoch close to median observation date and best estimate of period

Unsurprisingly, this is the same graph as for an epoch of 2451868.7315 (with period of 0.413613 days).

But now, changing the period by 0.000002 days to yield Figure 8, shows that the result is once again the same as for the epoch of 2451868.7315 with that same period change (Figure 6), *except* the phase shift is much less! (About 0.001 days instead of 0.006 days.)

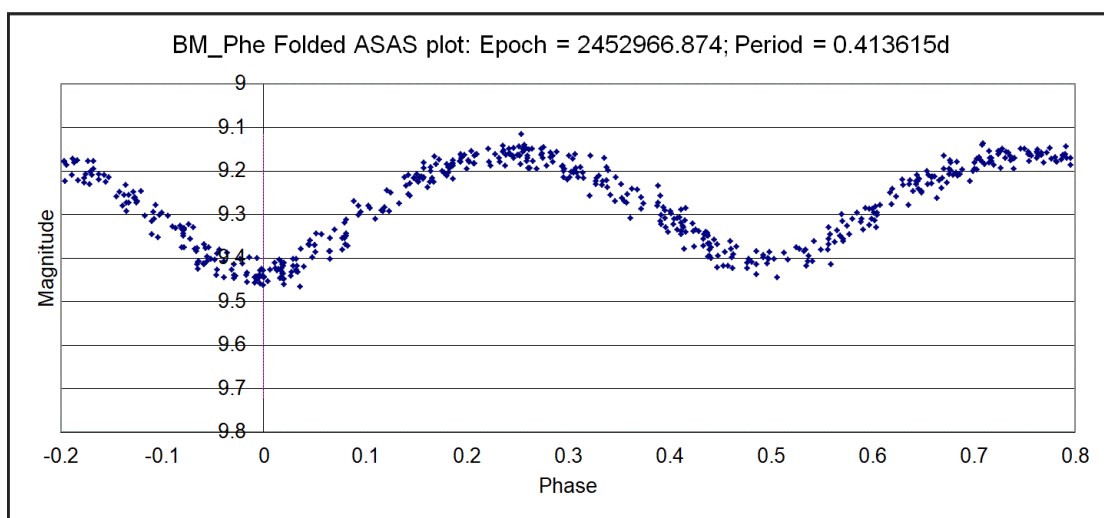


Figure 8. Phase-folded plot using epoch close to median observation date and period offset by the (2-sigma) uncertainty

Thus for this example, when quoting the derived light elements, the epoch uncertainty can be quoted as 0.005 days *less* if using an epoch close to the median date compared to an epoch close to the initial date.

A similar result applies to the general case (there is a larger difference for TZ Cru for which the period uncertainty is greater) and it is thus strongly recommended to always use epochs close to the median date.

It may be possible to go one step further and, rather than just using an epoch close to the median observation point, a value could be chosen such that there was virtually *no* change in phase of minimum for a small period change. That is a matter for future study.

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Congarinni observatory, an update – *Mark Blackford*

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In the October 2017 issue of this Newsletter (2017-4) I concluded a three-part series of articles describing the construction of my Congarinni Observatory. Over the following year it has served me well, however on November 22nd, 2018 a design flaw was exposed by a particularly strong gust of wind which caused one half of the roof to flip up-side-down. Fortunately it ended up on top of the other half of the roof and not on top of my telescopes.

The roof was in its closed position as shown in Figure 1, and the two roof sections secured to the wall frames with six hasp and staple fasteners (see Figure 2 in “Congarinni Observatory – Part 3”, VSS Newsletter 2017-4). However I’d become complacent so had not used the ratchet tie downs straps – big mistake!

I wasn’t home when the wind gust occurred so didn’t witness the roof section flip over but it would have been an impressive, and noisy, spectacle. My guess is that the southerly wind displaced the rubber weather seal strip and caused a pressure increase inside the observatory. Then a strong gust caught under the overhanging colorbond sheets on the southern roof section (left side in Figure 1) causing it to lift with enough force to break the two hasp and staple fasteners at the southern end. The north end of the southern roof section was held down by two other hasp and staple fasteners as well as the north roof section. This caused the southern roof section to flip over and land on top of the northern roof section as shown in Figure 2, in the process breaking the remaining hasp and staple fasteners.



Figure 1. *How the roof sections should look.*

The northern roof section was displaced sideways so that the west side rested on top of a water tank next to the observatory. Fortunately the casters on the east side, although displaced from the angle iron track, were still supported by the top of the observatory wall. Had they moved another few millimetres the whole roof may have crashed down onto the telescopes and things would have been a whole lot messier and expensive!



Figure 2. *Not how the roof sections should look.*

My immediate concern was to secure the roof in place with wooden bracing and ratchet tie-down straps to ensure it did not move any further. The three telescopes and mounts were then dismantled and removed from the observatory for safekeeping while I pondered how to flip the southern roof section back over and get both sections back on their respective angle-iron tracks.

This pondering continued for two weeks, in which time my wife and I made a quick trip to New Zealand to meet our newest granddaughter, born just a few days after the windstorm that damaged the observatory – just a coincidence or a portent of what's to come?

On returning home, and with the help of my friend Danny, we set about carefully sliding the up-side-down section down onto the top of the observatory walls. The colorbond sheets and side panels were then removed to reduce the weight as much as possible, but the aluminized plastic insulation was left in place. With some effort the roof section was lowered down onto the ground, carefully flipped over then lifted back onto the angle-iron tracks where the colorbond sheets were reinstalled (Figure 3). Believe me; it wasn't as easy as it reads.

To minimize the chance of a similar incident happening again I replaced the broken hasp and staple fasteners and installed heavy-duty ratchet tie down straps at six positions around the roof frames. When the roof is closed these attach to anchor points screwed into the wall frames (four outside and two inside the observatory) or to anchor points in the gantry frame when opened for observing. There will be no complacency in future, all fasteners and ratchet tie downs will be used at all times other than the few minutes it takes to reposition the roof sections.



Figure 3a. *Removal of roof section*



3b *reinstallation of colorbond sheeting*



Figure 4. *Roof sections secured in closed and open positions.*

I intend redesigning the roof with a physical restraint that prevents sideways and upward movement. I have a few ideas in mind but that will have to wait for another time.

Telescopes were reinstalled by mid-December and I'm back observing again, but with a wary eye on Bureau of Meteorology wind warnings. I hope you never have to experience a similar situation.

“We are just guessing”

Finding the orbital period of eclipsing binaries, which repeat their light variations with great regularity and closeness, should be simple. Find a few eclipses, measure their times of (primary) minimum, make a guess at a period – probably from an online database such as the *General Catalogue of Variable Stars* (Samus *et al* 2017) – refine to fit, and *viola*!

That’s a very useful thing to do, as well. Periods can change, and from robust estimates of period change can be derived values for mass transfer from one star to its companion, or indeed mass loss from the system entirely – a most valuable astrophysical result. But few professional astronomers, required by their paymasters to get quick publications, take on this sort of long term duty of collecting years of minima data. Most of the light elements (a measured time (*epoch*) of a primary minimum and an orbital period) recorded in the GCVS were derived well over half a century ago, usually by photographic methods which yield only approximate results by modern CCD standards; so one is always looking for corrections and improvements. And forget visual estimates of fast-changing binaries!

Take the case of HI Pup, a bright W UMa type eclipsing binary. The GCVS supplies light elements, which can be used to plan observing runs (on what nights can I expect to observe an eclipse?). In this way I obtained and measured epochs of seven primary minima of HI Pup over the years 2015-2019.

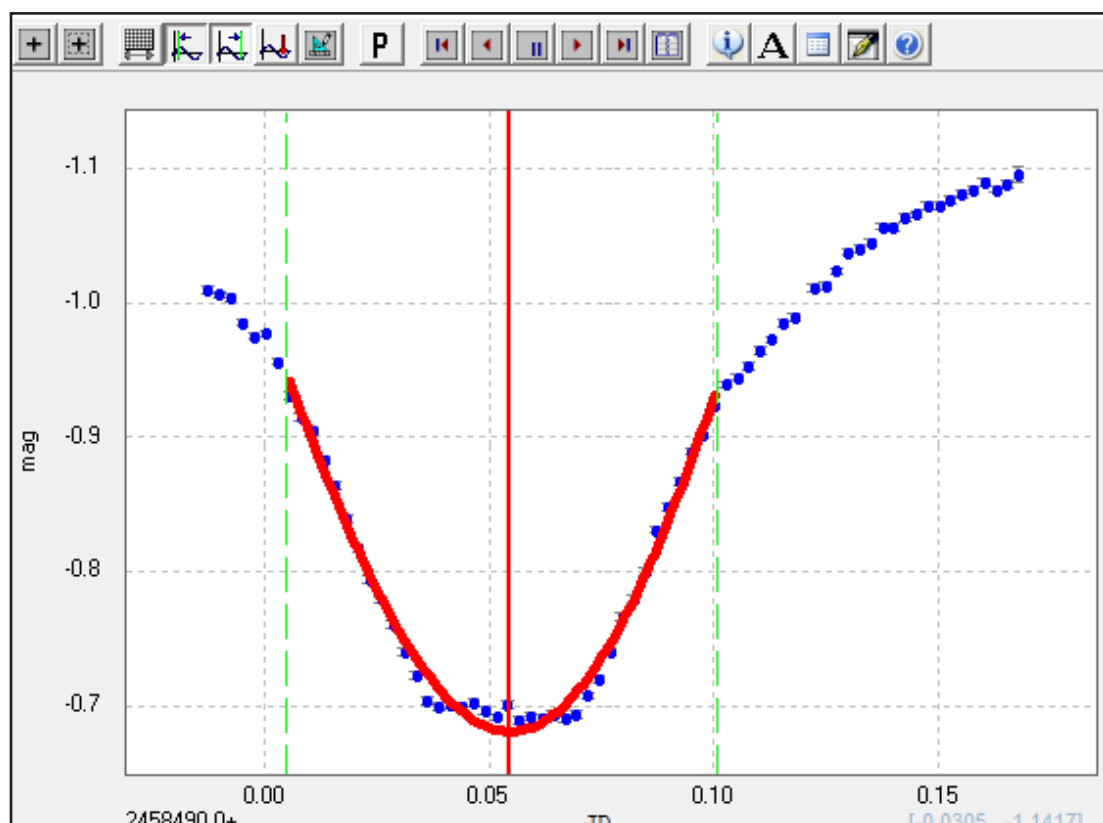


Figure 1, One night’s magnitude measures (blue dots) of HI Pup obtained by the author at Pretty Hill Observatory on 2019-01-06. The red curve is a 5th-order polynomial fitted to the data points. The solid vertical line is the minimum of the polynomial – which is taken as proxy for the minimum of the eclipse (or would be if the eclipse weren’t total with a flat bottom). This is actually not a very good data set, hence illustrative of measurement problems. Software is PERANSO. (Vanmunster 2015).

Using as a starting point the GCVS period of 0.4326510 days (no uncertainty given!) I could derive by linear regression a new period to fit my minima data better. That was $0.4326124 \pm 5\text{E-}7$ d. Figure 2 shows those seven data points, with error bars. (The Figure 1 measure is the rightmost.) The abscissa is the number of orbital cycles since the epoch of my first minimum. The ordinate shows the deviations of my

Observed minima times from those Calculated by the regression (hence O-C) and measured in days. The calculated regression line lies within the error bars of all but one epoch, and that one only just misses. So that's a pretty good linear regression.

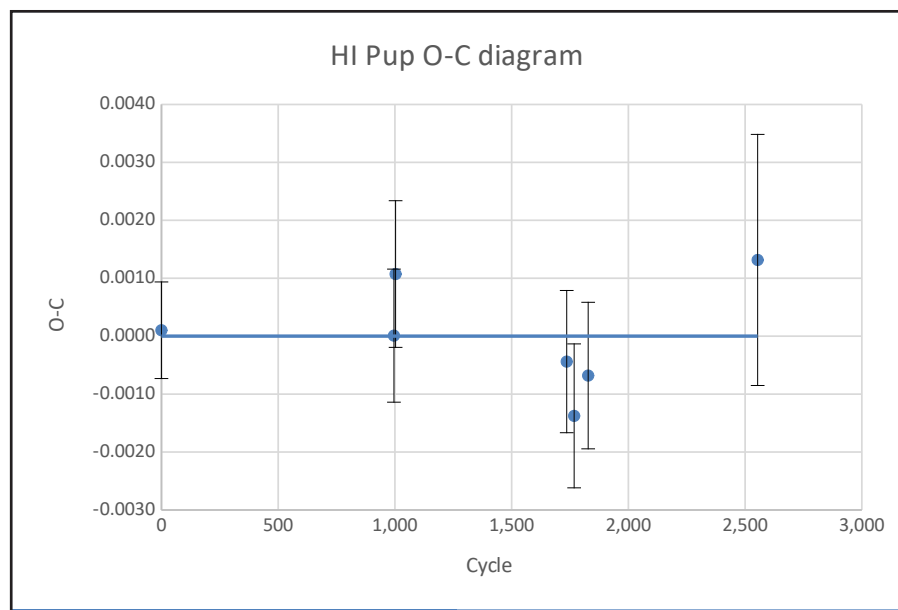


Figure 2. *O-C plot of my minima data against the linear regression derived from them. The vertical axis shows deviations of my minima from those predicted by the regression model, in days.*

However my period is a bit shorter than the GCVS one, suggesting a decrease in orbital period since the GCVS epoch, which was long ago in 1952. So, hoping to work out a value for period change, let's include the GCVS epoch in the plot. The result is Figure 3. My data is marked as TR, and correspondingly for the GCVS point.

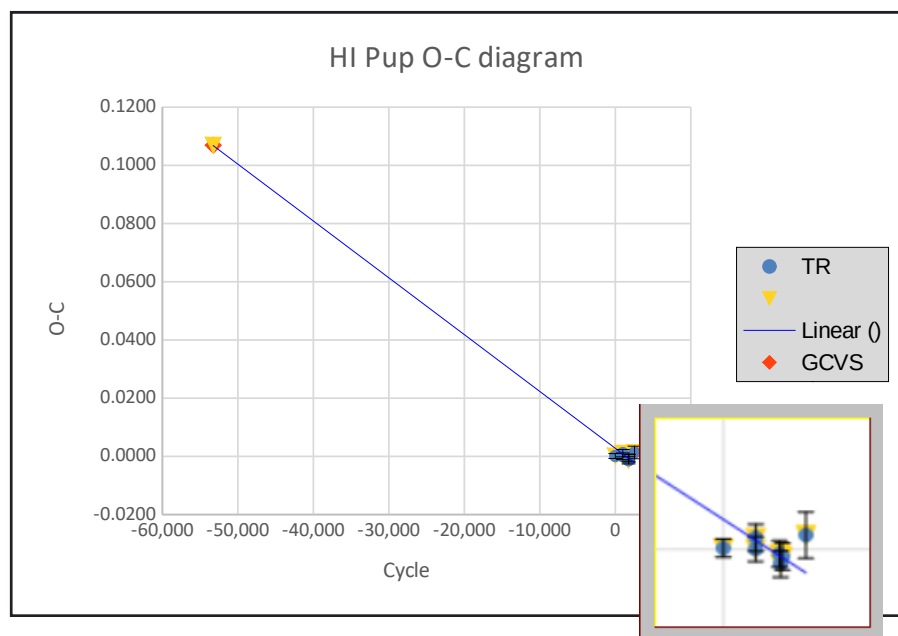


Figure 3. *The O-C plot now includes the GCVS epoch. The new linear regression line marks the assumption of a different but constant period. The inset shows the regression line passing through my cluster of data points and missing most.*

The GCVS epoch misses the trend line from my data ($O-C = 0.0$) by over 0.1 days. That seems too big to be explained by an error in the GCVS epoch. The new linear trend line, though sloping, is the regression for a (new) constant period fitted as best it can to all the data points. However as the enlargement around my data points shows, it does not provide a plausible regression model for my data.

So, the period may have changed since the time of the GCVS measurement. A constantly changing

period is shown by a parabolic regression line. In Figure 4 one is added, and it fits my data points nicely, as the inset shows.

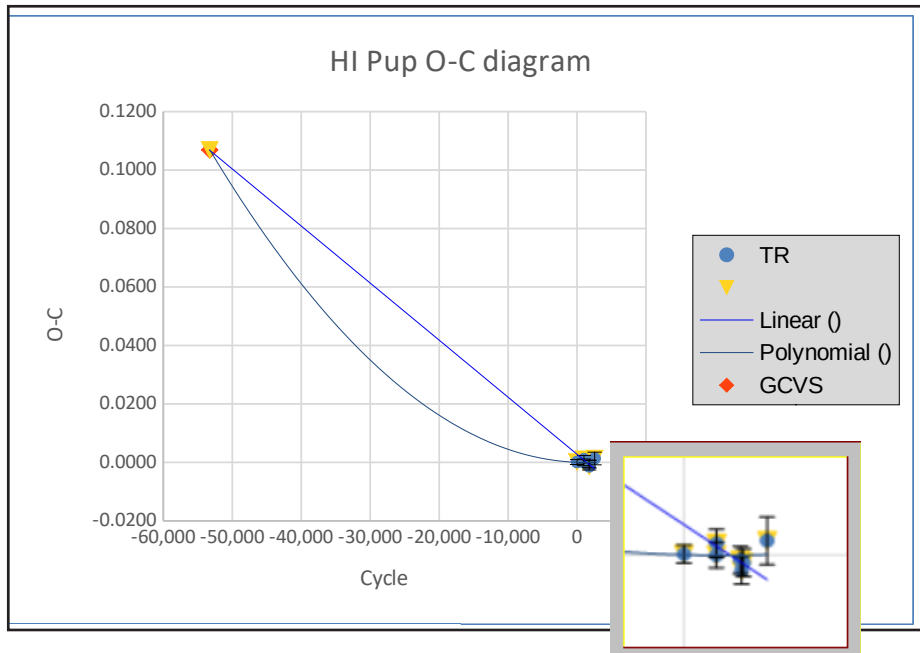


Figure 4. A polynomial (order 2) regression line is added, which models a period that is changing at a constant rate.

But it's an awful long time from 1952 to the present day without any intermediate data at all to confirm the constant-change model. It would be good to add to our O-C diagram some minima from the literature, and hope they lie on the parabolic regression line. Kern & Bookmyer (1985) report a tight bunch of photoelectric measures from 1981 – thanks to Bob Nelson for drawing my attention to them. They're in Figure 5 above the linear regression line as IBVS 2693.

There's a cluster towards the bottom of that figure. Highest is an estimate I made from ASAS3 data (Pojmanski 2002) using a robust method to determine an epoch and its uncertainty. Close to it is the epoch recorded in the AAVSO's VSX database (Watson, Henden & Price, 2016), which also uses ASAS3 data but without a reliable method of estimating an epoch. It is nearly hidden by two estimates by Anton Paschke, recorded in the *O-C Gateway* (Paschke & Brat, 2006). At the bottom is an Hipparcos measure (ESA 1997).

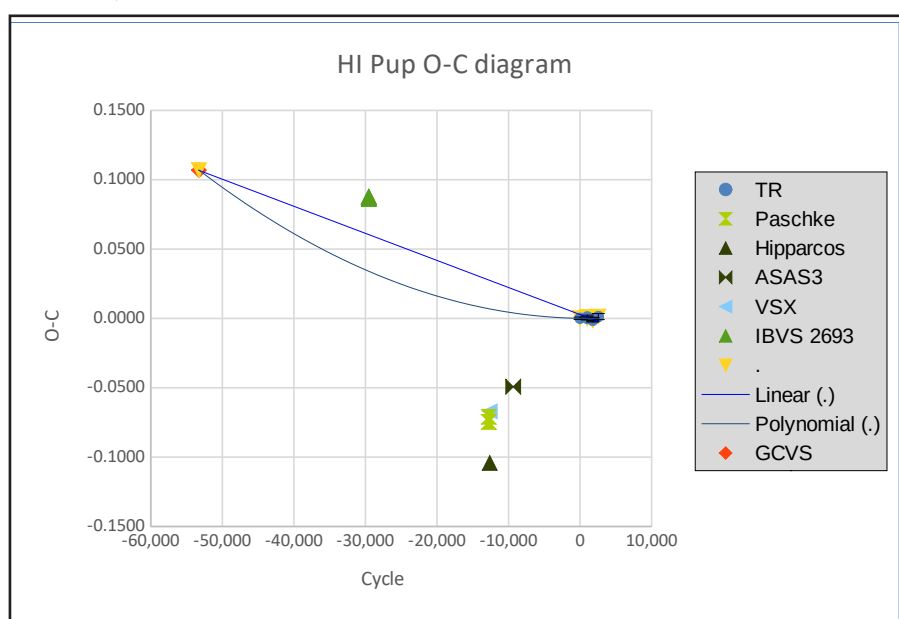


Figure 5. The O-C diagram with further additions as in the legend and text.

It is apparent from Figure 5 that you can forget those two regression lines. A well-fitting parabolic regression could be made though my data and all the lower bunch, but then where on that curve would the upper two lie (GCVS and IBVS 2693)? Plainly not at any physically (or observationally) meaningful place, somewhere around minus infinity! So how do we explain them? The author of the GCVS epoch (Cuno Hoffmeister) used photographic methods, but was an observer of the highest reputation, so big errors are unlikely. The mistake (if any) in the IBVS 2693 points must be systematic, since they all lie so close together.

There are ways of fudging data changes to make an epoch point lie on a parabolic model line, such as changing its cycle number. Or try assuming sudden period changes from one constant period to another. But this way lies arbitrariness and circularity: if all the historical epoch data are in for HI Pup there is no way to confirm sudden period change.

At this stage I don't know how to draw an astrophysically meaningful conclusion from all this data, or which data (if any) to reject out of hand (and why). It will take many years more to gather enough epoch data to get a definitive future-only regression model – and by then the system may have changed its orbital behaviour anyway! As Ed Budding said to me in discussing this binary, “But the stars themselves know what they are doing – we are just guessing.”

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The KELT false-positives catalogue – *Phil Evans*

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The Kilodegree Extremely Little Telescope project began operating in the northern hemisphere in 2006 and in 2009 commenced operations in the southern hemisphere.

Each of the two KELT telescopes consist of an 80 mm Mamiya 645 lens attached to a 9μ 4096 x 4096 Apogee CCD and mounted on a robotic German equatorial mount. This gives them a field-of-view of 26° x 26° and pixel scale of 23" / pixel.

Light curves produced of regions of the sky are automatically scanned for box-like transit signals, subjected to various statistical cuts and finally vetted by a science team. The resulting candidates are then published on the private KELT transit website to be available for members of the KELT Follow-Up-Network (KELT-FUN). Many amateurs are team members.

To date the survey has found 22 confirmed exoplanets. It has also found a very large number of false positive (FP) stars – stars whose signature in the KELT pipeline mimics that of an exoplanet transit.

Mimicry occurs because:

- The star is an eclipsing binary where the primary eclipse depth dilutes a possible transit signal.
- A pulsating or rotationally variable star
- A star that is blended with a nearby eclipsing binary
- A giant star in a binary where the second star is sufficiently small that the primary eclipse is shallow enough to mimic an exoplanet transit

- A grazing eclipse binary system where the primary eclipse is shallow enough to mimic an exoplanet transit
- Instrumental or systemic noise.

There are over 60 members of KELT-FUN with telescopes ranging from 0.25m to >1m aperture, many are amateurs. The much lower pixel scale ($\sim 1''/\text{pixel}$) of these compared to KELT's $23''/\text{pixel}$ means that they are more easily able to distinguish between genuine exoplanet transits and false positives. Candidates that survive follow-up observations are then passed on to the spectroscopic team for radial velocity or Doppler tomography.

With over 1100 FPs now accumulated the KELT team has decided to release these to the public in the form of a machine-readable catalogue (Collins et al 2018).

Although the catalogue has been published it is behind the Astrophysics Journal paywall. However a copy is available at https://filtergraph.com/kelt_false_positive_catalog

You can download the full catalogue by selecting “Table” then “Download” as follows:

The screenshot shows the web interface for the KELT_False_Positive_Catalog. The URL in the browser is https://filtergraph.com/kelt_false_positive_catalog. The interface includes a navigation bar with various project names (Apps, MORC, ULMT, LCO, Astro, AU, KELT, TESS, TOI, CFA, Vandy, Home). The main content area is titled "KELT_False_Positive_Catalog" and features a "Filter the data" button and a "More" dropdown. A "Table" dropdown menu is circled in pink. Below this, there are sorting options (Sort, Order, Rows) and a "Show columns" section. The "Download" button is also circled in pink. The table itself displays columns: KELT_ID, 2MASS_ID, TIC_ID, In_CTL, and TESS_ID. The first few rows of the table are visible, showing data for various KELT IDs.

From Collins et al, 2018:

“Photometric false positives are separated into five categories labeled EB1, EB2, BEB, Variable, and NEB in the catalog. The EB1 category is assigned if the deblended transit depth in the follow-up photometry is too deep, relative to the host star’s estimated radius, to be consistent with a transiting planet companion. The category EB2 is assigned if even numbered orbits have a depth different from the odd numbered orbits, indicating primary and secondary eclipses of an EB or blended EB system. If significantly different transit depths are measured in blue and red filters, the BEB category is assigned. Eclipses showing depth chromaticity can be caused by EBs blended with the target star or a hierarchical stellar system in the follow-up observations photometric aperture. This can also be caused by an unblended eclipsing binary system consisting of two stars with different surface temperatures, and where the light from the secondary is not negligible compared to the primary. In some cases variable stars that are not in eclipsing systems cause a KELT detection. We categorize those FPs as simply Variable. The most common photometric FPs result from transiting candidate host stars with nearby eclipsing binary systems, or NEBs, that are blended with the target star in the KELT aperture, but are not blended in the follow-up aperture.” (Collins et al, 2018)

Category	Type	Description	Total
Spectroscopic FPs			
SB1	1	Single-lined binary (RV > ~1 km/s)	307
SB2	2	Multi-lined binary	140
RV0	3	No significant RV detected	13
Giant	4	Spectroscopic Giant	29
Photometric FPs			
EB1	5	Too deep in follow-up	130
EB2	6	Different primary & secondary depths	25
BEB	7	Blend in follow-up aper. (chromaticity)	90
Variable	8	Variable star caused KELT detection	16
NEB	9	Nearby EB (Blend in KELT aperture)	378
Total			1128

Table 1. *KELT False positives by Category/Type (Collins et al)*

Column Name	Description
KELT ID	KELT Survey candidate ID
2MASS ID	Two Micron All-Sky Survey ID
TIC ID	TESS Input Catalog ID
In CTL	Flag: star is in TESS Candidate Target List
TESS priority	Priority from TESS Input Catalog
FP type name	False positive type name
FP type	False positive type number
RA hours	Right ascension in hours (J2000)
RA deg	Right ascension in degrees (J2000)
RA hms	Right ascension in sexagesimal (J2000)
Dec dms	Declination in sexagesimal (J2000)
Dec deg	Declination in degrees (J2000)
Galactic long	Galactic longitude in degrees
Galactic lat	Galactic latitude in degrees
Ecliptic long	Ecliptic longitude in degrees
Ecliptic lat	Ecliptic latitude in degrees
Vmag	V magnitude of star
Tc	Transit center time in BJD TDB
Tc err	Uncertainty in Tc
Period days	Period of transit in days
Period err	Uncertainty in period
Duration hrs	Duration of transit in hours
KELT depth mmag	Depth of transit in KELT aperture in mmag
EB K km/s	RV semi-amplitude of EB in km/s
EB depth mmag	Depth of EB transit in mmag
NEB RA	Right ascension of nearby eclipsing binary
NEB Dec	Declination of nearby eclipsing binary
NEB dist text	Distance from target star to NEB
NEB dist arcsec	Numeric distance from star to NEB in arcs
NEB dist is approx flag	Flag: distance to NEB is approximate

NEB direction	Direction from star to NEB
NEB depth text	Depth of NEB transit
NEB depth percent	Numeric depth of NEB transit in mmag
NEB depth is approx flag	Flag: NEB depth is approximate
NEB depth is lower limit Flag:	NEB depth is a lower limit
NEB obs epocha Date	NEB was observed
NEB obs filter	Filter used to observe NEB

Table 2. Description of False Positive Catalog Data Columns (Collins et al, 2018)

You can see from the totals in table 1 that the majority of these are eclipsing binaries, some of which have not been previously categorised as EBs and are prime material for VSS members. Figure 2 below shows my observations of one entry from the FP catalogue.

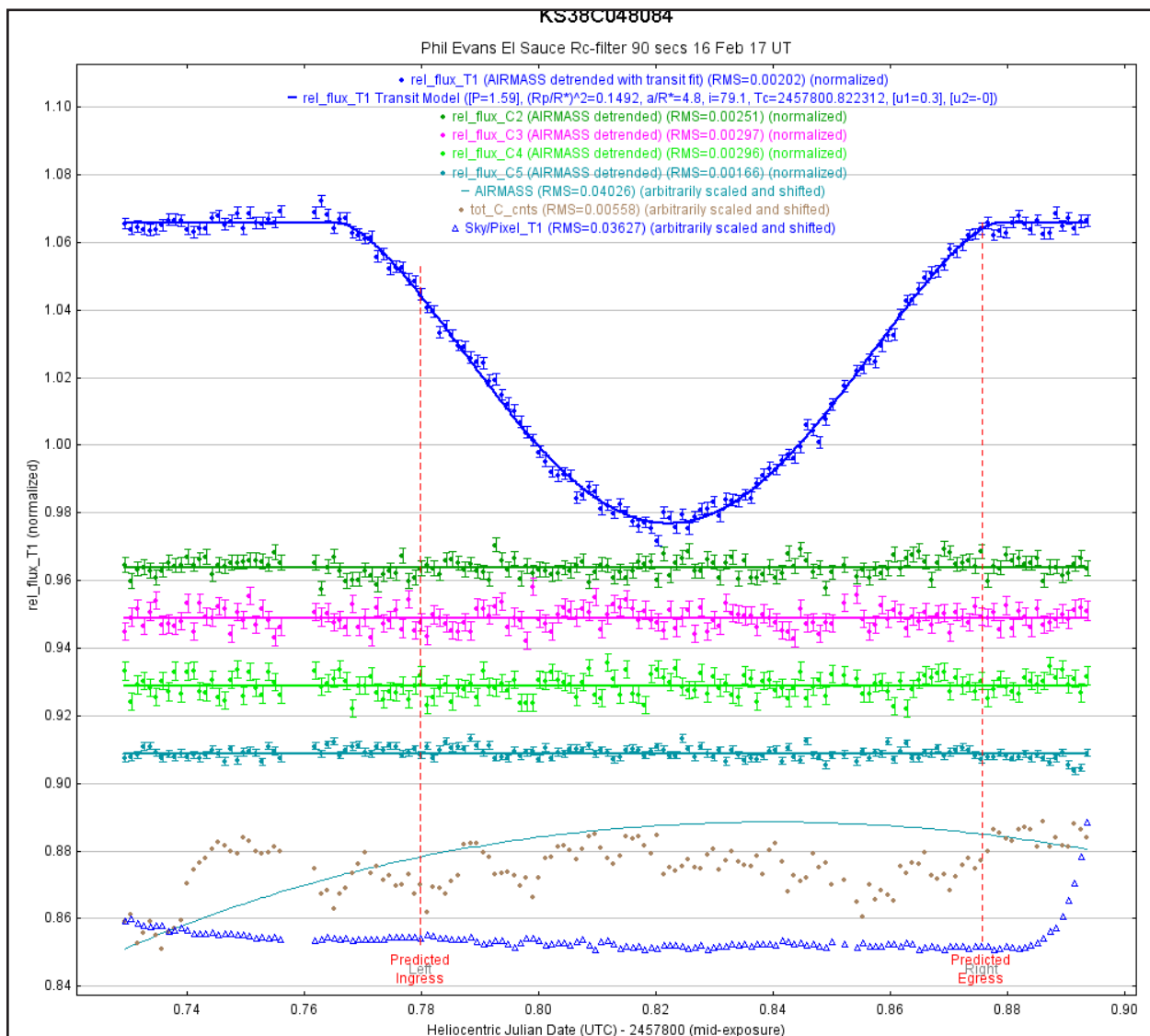


Figure 2. KS38C048084 which I observed in February 2017 is classified as an EB1.

Those observations were taken at my remote observatory at El Sauce, Chile. Processing was carried using AstroimageJ v3.2. At 94 mmag deep the eclipse is much too deep to be due to an exoplanet.

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Remote telescopes, student research and education (RTSRE) conference

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Carl Knight (VSS Education Liaison) and I were recently contacted by AAVSO director Stella Kafka regarding a conference being organised in Melbourne on remote telescopes, student research and education (RTSRE) in December 2019. The venue for the main part of the conference will be Melbourne University, with some related events at the Deakin Downtown campus.

Stella wrote:

“This is the third conference in a series; the other two took place in San Diego (2017) and Hawaii (2018) respectively and attracted a lot of interest from educators who want to introduce astronomy to their students. A preliminary web page for the 2019 meeting is already live (<https://rtsre.net/>) although not very well populated. If nothing else, it presents the scope of the meeting and the dates it will take place.

The organizer, Dr Michael Fitzgerald, is very keen on having the local non-professional astronomical community involved in the conference. Considering that citizen astronomers contribute substantially to science, education and outreach nowadays, I think that adding a section to the conference (perhaps on Dec. 12?) where we talk about using variable star astronomy in the classroom is quite appropriate. We can share ideas, connect with like-minded people and brainstorm on how to do more/different. Also, I know that many AAVSO and VSS members are very interested in working with students, so it would be a great opportunity to bring the educational and variable star community together.”

It looks to be a quite interesting meeting and I think VSS could be involved in the proposed section on variable star astronomy in the classroom. The mentoring work Carl has been doing with Tessa Hiscox and Joseph Chamberlain (see previous Newsletters) is an obvious fit with the theme of the conference. VSS could benefit through broader contacts in the professional astronomy community, and possibly attract new members (both professional and students).

PDFs of papers from the first conference in the series (2017) are available from <https://rtsre.net/ojs/index.php/rtsreconfproc/issue/view/1> and according to Dr Fitzgerald the 2018 proceedings articles will go up one by one as they come through review and copy editing. There are a few at the copy editing stage, so they will start trickling up soon.

Let me know if you are interested in participating in this conference.

Publication watch

Phil Evans is a co-author two exoplanet publications in the arXiv since the last newsletter.

Ephemeris refinement of 21 Hot Jupiter exoplanets with high timing uncertainties

M. Mallonn, et al. 2018arXiv181205882M (Submitted on 14 Dec 2018 (v1), last revised 4 Jan 2019)

Abstract

Transit events of extrasolar planets offer a wealth of information for planetary characterization. However, for many known targets, the uncertainty of their predicted transit windows prohibits an accurate scheduling of follow-up observations. In this work, we refine the ephemerides of 21 Hot Jupiter exoplanets with the largest timing uncertainty. We collected 120 professional and amateur transit light curves of the targets of interest, observed with 0.3m to 2.2m telescopes, and analyzed them including the timing information of the planets discovery papers. In the case of WASP-117b, we measured a timing deviation compared to the known ephemeris of about 3.5 hours, for HAT-P-29b and HAT-P-31b the deviation amounted to about 2 hours and more. For all targets, the new ephemeris predicts transit timings with uncertainties of less than 6 minutes in the year 2018 and less than 13 minutes until 2025. Thus, our results allow for an accurate scheduling of follow-up observations in the next decade.

HATS-71b: A giant planet transiting an M3 dwarf star in TESS Sector 1

G. Á. Bakos, et al, 2018arXiv181209406B (Submitted on 21 Dec 2018)

We report the discovery of HATS-71b, a transiting gas giant planet on a $P = 3.7955$ day orbit around a $G = 15.35$ mag M3 dwarf star. HATS-71 is the coolest M dwarf star known to host a hot Jupiter. The loss of light during transits is 4.7%, more than any other confirmed transiting planet system. The planet was identified as a candidate by the ground-based HATSouth transit survey. It was confirmed using ground-based photometry, spectroscopy, and imaging, as well as space-based photometry from the NASA TESS mission (TIC 234523599). Combining all of these data, and utilizing Gaia DR2, we find that the planet has a radius of $1.080 \pm 0.016 R_J$ and mass of $0.45 \pm 0.24 M_J$ (95% confidence upper limit of $0.81 M_J$), while the star has a mass of $0.569 \pm 0.042 \pm 0.069 M_\odot$ and a radius of $0.5161 \pm 0.0053 \pm 0.0099 R_\odot$. The Gaia DR2 data show that HATS-71 lies near the binary main sequence in the Hertzsprung-Russell diagram, suggesting that there may be an unresolved stellar binary companion. All of the available data is well fitted by a model in which there is a secondary star of mass $0.24 M_\odot$, although we caution that at present there is no direct spectroscopic or imaging evidence for such a companion. Even if there does exist such a stellar companion, the radius and mass of the planet would be only marginally different from the values we have calculated under the assumption that the star is single.

Alan Baldwin has forwarded the following note on V386 Ser for publication.

Electronic Telegram No. 4603

Central Bureau for Astronomical Telegrams
Mailing address: Hoffman Lab 209; Harvard University;
20 Oxford St.; Cambridge, MA 02138; U.S.A.
e-mail: cbatiau@eps.harvard.edu (alternate cbat@iau.org)
URL <http://www.cbat.eps.harvard.edu/index.html>
Prepared using the Tamkin Foundation Computer Network

V386 SERPENTIS = TCP J16103359-0102227

S. Nakano, Sumoto, Japan, forwarded a report from Hideo Nishimura (Kakegawa, Shizuoka-ken, Japan) of Nishimura's discovery of a variable star of mag 10.4 located at R.A. = 16h10m33s.59, Decl. = -1d02'22".7 (equinox 2000.0) on three unfiltered CCD 30-s exposures (limiting mag 16) taken on Jan. 18.843 UT with a Canon EOS 6D digital camera (+ 200-mm-f.l. f/3.2 lens).

Nishimura, who notes that nothing was visible at this position brighter than mag 16 on Jan. 17.841, has posted an image of the variable at website URL <http://www.oaa.gr.jp/~oaacs/image/TCP201901inSer.jpg>. The object was given the provisional designation TCP J16103359-0102227 when it was posted on the Central Bureau's TOCP webpage. Nakano also reports that T. Noguchi (Chiba-ken, Japan) observed magnitude 11.1 and position end figures 33s.60, 23".1 on Jan. 19.828.

Nakano notes the presence of the cataclysmic variable V386 Ser in the AAVSO Variable Star Index with position end figures 33s.63, 23".2 (and stated magnitude range 10.4-19.2). P. Schmeer, Saarbruecken-Bischmisheim, Germany, notes that S. Yoshida reported that M. Mukai also detected an outburst of V386 Ser at mag 10.7 on Jan. 18.839 UT, adding that it was "faint" on Jan. 17. Schmeer writes that "this is the first recorded outburst of V386 Ser, likely a 'WZ Sge'-type dwarf nova. Time-resolved photometry is urgently required."

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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.

Who's who

Director Mark Blackford

Treasurer/Membership Bob Evans

Newsletter Editor Phil Evans

Webmaster David O'Driscoll

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

Membership

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

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

Newsletter items

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

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

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