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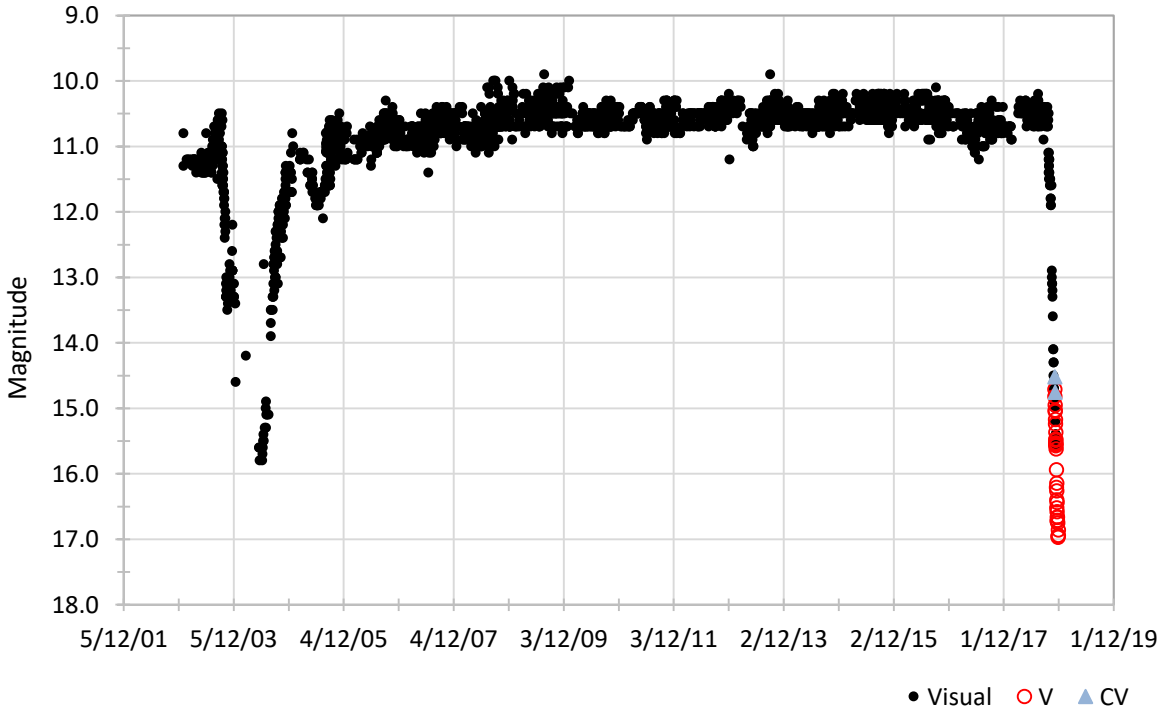
The British Astronomical Association

Variable Star Section Circular

No. 178 December 2018



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Cover Light Curve

Fade of the RCB star SV Sge. *BAAVSS Database*

From the Director — *Roger Pickard*

300,000 Visual Variable Star Observations!

Who can comprehend this sort of total? Well, read the reports by Rod Stubbings and Gary Poyner elsewhere in this Circular. Very many congratulations to them both on these amazing feats achieved only 5 days apart. But I must single out Gary, and I'm sure Rod won't mind, when I add that he does it just 5 miles from the north of Birmingham city centre with all its light pollution!

WINTER MIRAS

M = Max, *m* = min.

R Aqr	*m*=Jan
R Aql	*m*=Jan
V Cam	*M*=Dec/Jan
X Cam	*M*=Nov/Dec
	m=Jan/Feb
SU Cnc	*m*=Nov/Dec
	M=Feb/Mar
U CVn	*m*=Feb/Mar
RT CVn	*M*=Feb
S Cas	*M*=Feb/Mar
T Cas	*m*=Jan/Feb
omicron Cet	*M*=Nov/Dec
W CrB	*M*=Feb/Mar
chi Cyg	*M*=Dec
S Cyg	*m*=Jan/Feb
V Cyg	*m*=Dec
RU Her	*M*=Jan
SS Her	*M*=Dec/Jan
	m=Feb
RS Leo	*M*=Jan/Feb
	m=Nov/Dec
W Lyn	*M*=Feb
X Lyn	*m*=Dec/Jan
X Oph	*M*=Jan/Feb
U Ori	*m*=Dec
R Ser	*m*=Jan

Source BAA Handbook

The details for the 100K achievements can be found on JBAA for 2016 No. 126,2, page 88 but the 300K table on JBAA 126,2 page 89 will need updating to replace Danie Overbeek with Rod Stubbings

As you will see, 300,000 visual observations by a single observer is a rare event and until October 2018 had been achieved only by Albert Jones, Hiroaki Narumi and Taichi Kato. Rod has achieved the milestone in record time, taking only 25 years & 5 months.

Rod & Gary specialise in CV monitoring; Rod covering the southern sky and Gary the northern so between them we have good coverage of all relatively bright CV's.

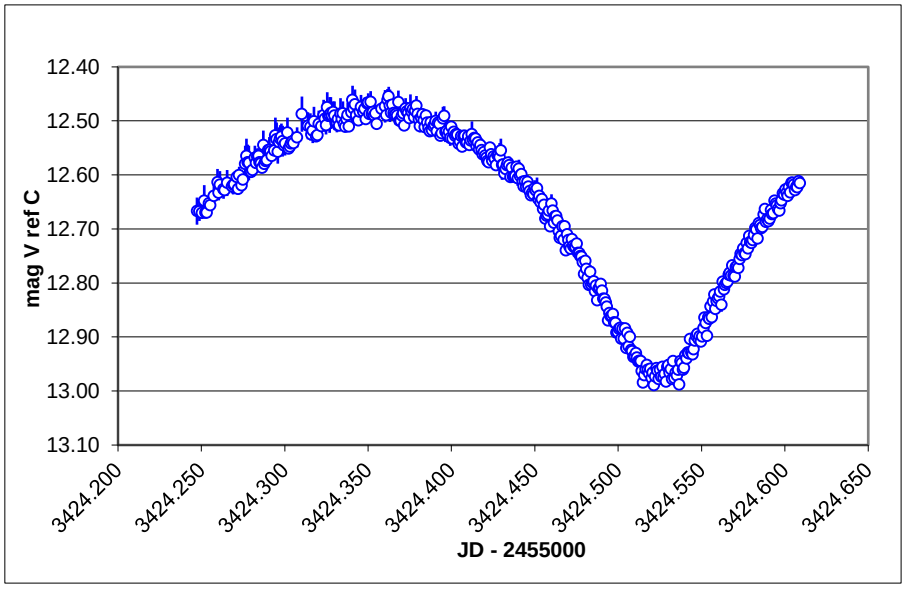
We are privileged to have such prolific and competent observers keeping a careful watch on the sky from opposite sides of the world and they are shining examples of how to undertake important amateur science through visual photometry, which shows it is far from being redundant.

New delta Scuti star

On the 17th September this year I had an email from Chris Lloyd advising me that Yenal Ogman had discovered a new delta Scuti star in Lacerta that needs more data than he (Yenal) can get.

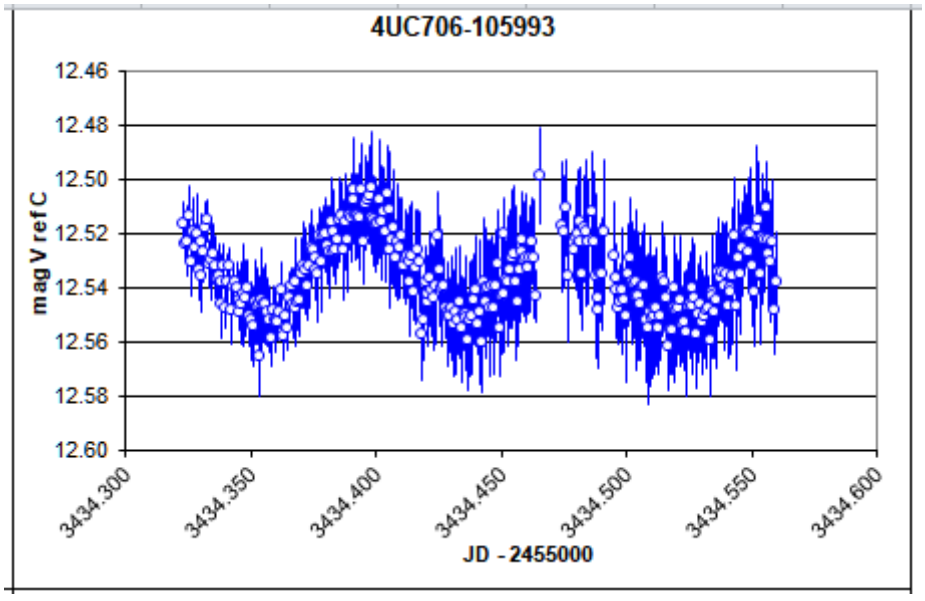
The star is UCAC4 706:105993 at 22 41 47.538 +51 04 08.78 and has V=12.53, so is relatively bright. It has a semi-amplitude of 0.015 mag and is multiperiodic, so the photometry needs to be really good.

In addition, there are several other variables in the FOV or close by and I show the light curve of one, VSX J224158.3+505603, below. This is an EB and from the data I've achieved so far looks to be correct with a period of 0.3450d a mag of 12.98 with an amplitude of 0.45 mag.



2018\11\01\VSX J224158.3+505603 Lac V

As for UCAC4 706:105993, I've achieved two long runs, but the weather, although appearing beautifully clear all night on the first night, deteriorated after midnight and the results were not so go. However, the skies remained better on 11th November when I achieved the following result, again, using a V filter.



There is actually at least one more variable close by, CR Lac, which is supposed to be an EA, but with a period of nearly 4 days. I've not found any variation yet!

TESS

John Fairweather has conveyed the following reports to me: -

Apparently, there is a new Citizen Science project (under review), which will mine TESS data, looking for Exoplanets - https://www.zooniverse.org/projects/nora-dot-eisner/planet-finders?utm_source=Newsletter&utm_campaign=pfbeta16oct2018

Zooniverse

John further advised that the "SuperWASP Variable Stars project" to be found at https://www.zooniverse.org/projects/ajnorton/superwasp-variable-stars went live at the beginning of September. This, you may recall was to quote "Help us identify and classify types of periodic variable stars from folded photometric lightcurves obtained by SuperWASP." In addition, they advise that "All 1.5 million+ folded lightcurves are now uploaded to the project and ready for classification." So, if you have nothing better to do . . . .

Additional Arguments that Aboriginal Australians Observed Variable Stars by Avery Schiff.

This comes from "Astrobites" which can be found at https://astrobites.org/. The article, in turn, comes from a paper by Bradley E. Schaefer of the Department of Physics and Astronomy, Louisiana State University, USA and was published in the Journal of Astronomical History and Heritage.

CV & E News

Gary Poyner

The Dwarf Nova CY CrB (SDSS J162212.45+341147.3) was detected in a rare outburst by G. Poyner on August 18.922 at magnitude 12.175CV using the 35cm SCT Open University COAST telescope at Observatorio del Teide (OT), Tenerife. This has proved to be the brightest outburst ever recorded in this system. The star has an active minimum varying by over two magnitudes of ~18.5-20.5 and was recorded at 18.56CV on Aug 10.99. The unfortunate absence of observations in that eight-day interval means we can't pin down the start of the outburst or the rate of rise. Following maximum CY CrB faded to magnitude 15.4 visual 21 days later by September 9. Another cloudy spell followed until a further CCD measure was obtained on Oct 2.89 at magnitude 18.09CV.

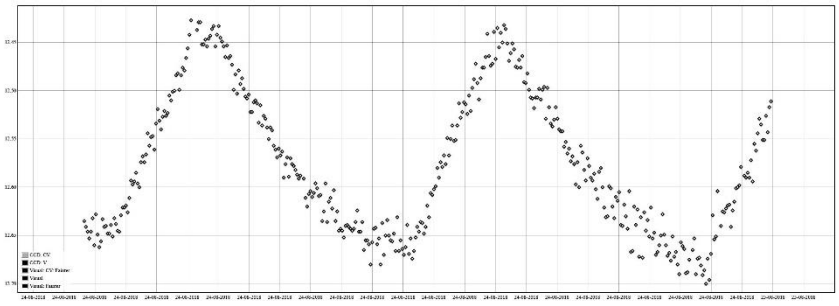


Figure 1: Superhumps Sept. 9, 2018 - BAAVSS database

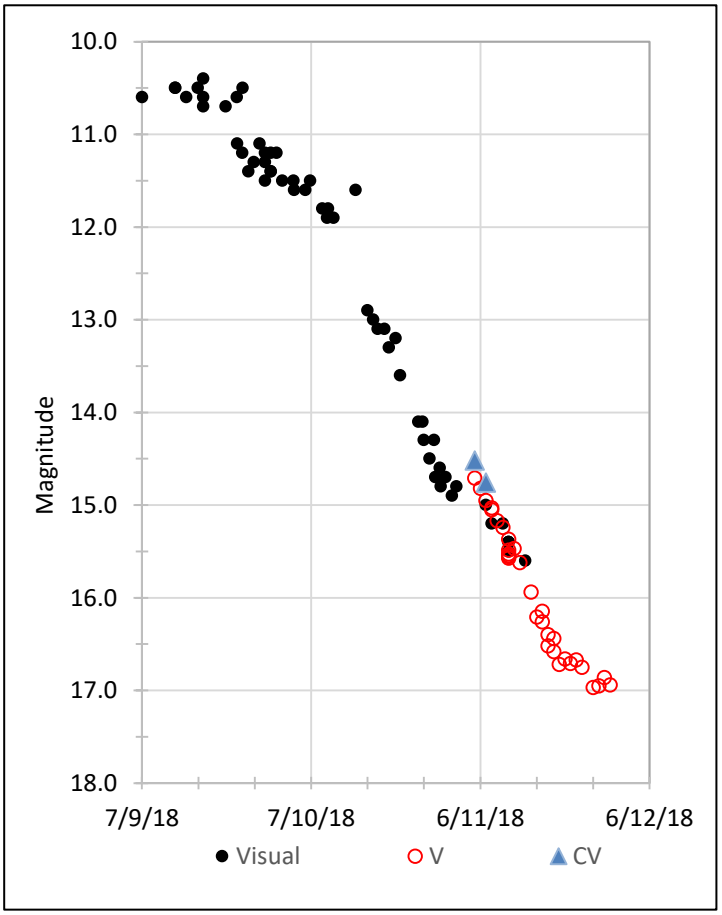
Originally classified as type UG, Tonny Vanmunster obtained CCD photometry on Aug 20/21 which revealed superhumps with a preliminary period of 0.066d +/- 0.002d and an amplitude of 0.17 mag.

revealing type UGSU for the first time (vsnet-alert 22433). Roger Pickard and Ian Miller also observed superhumps in both V and CV on the decline to September 9th – Figure 1.

CY CrB was first detected in outburst on three Moscow archive plates taken on March 8/9 1973 [Antpin, S.V 2012], and received it's VS designation in 2015 in the 81st name list part 1.

The extraordinary UGSU (or UGWZ?) star EG Cnc was detected in outburst by Patrick Schmeer on Oct 05.147 at visual magnitude 12.5. Patrick also detected the previous superoutburst on Nov 30, 1996. One further 'normal' outburst was recorded in October 2009, when EG Cnc peaked around magnitude 14.0. The 1996 outburst was notable for the series of remarkable 'post outburst brightenings' or 'echo outbursts' as they have sometimes been referred too – no less than six in total, each one reaching magnitude 13 or just below in just 70 days before fading back to it's quiescent level of ~18.0V. This phenomenon had been seen before in several systems, but not with this number! As I write these words (Nov 28), EG Cnc is now rising to rebrightening number 6. More information in the next Circular when the outburst is over.

In CV & E news in VSSC 177, I gave some notes on active RCB stars which were well placed for observation. Well, in late September another RCB star began a fade, and for SV Sge this is the first period of major activity detected since 2003. The fade was first reported on BAAVSS-alert by John Toone on September 28. Visual observers monitored the drop to magnitude 15.6 by November 14, after which CCD observers have carefully continued to monitor, recording a lower limit V-magnitude of 16.97V on Nov 26.058UT. Martin Mobberley in particular has been providing valuable nightly V-band data obtained from various iTelescopes in the US and Spain. This is the faintest positive V-value ever recorded for SV Sge – previously the faintest detected brightness was 16.4V obtained during the last major fade in April 2004 (AAVSO). The light curve on the cover of the circular shows the current and 2003/4 fade.



Observers: *Visual* M, Gainsford, M. Joslin, G. Poyner, J. Toone, T. Vale. *CCD-V* D. Boyd, M. Mobberley, R. Pickard. *CV* G. Poyner. Source BAAVSS database

Compared to the previous deep decline, this one has been rapid. In 2003/4 SV Sge took some 190d to fade from 10.7-16.5, whereas the current fade has dropped by the same amount in just 62d. Most previous minima for SV Sge have been quite short (~14d) followed by both slow and fast recovery rates. The most complex minimum occurred in 1998, when SV Sge faded to 14.5 vis. for around four months (March-July) before fading a further 1.4 magnitudes in 14d to 15.9 vis. before recovering to maximum slowly some 310 days later. The deep fade of 2003/4 took ~250d to recover to maximum brightness, whereas in 2001, when

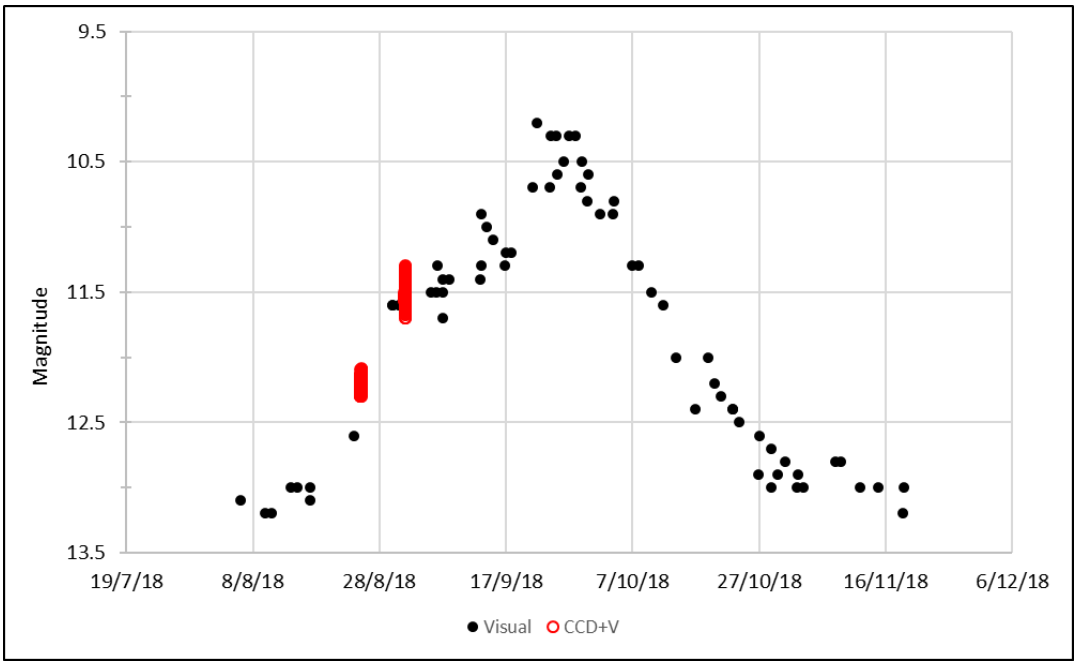
SV Sge faded to 15.2 vis. the recovery was short at just 54d. Quite apart from the speedy decline, CCD observers have been detecting short term small amplitude variations (0.08V) over several minutes. However, it's not been possible to compare this phenomenon with previous short-term activity in SV Sge, as the observations simply haven't been made!

As I write these words (Nov 29), SV Sge remains at 16.9V. Hopefully we'll be able to monitor the field long enough to establish whether a recovery will begin before the field is lost to twilight.

In August 2018, a now familiar outburst began in the old Nova GK Per (Nova Per 1901). These dwarf nova type outbursts began in the mid 1960's some 60 years after its Nova outburst and have continued to occur on average every 2-3 years or so since. The outbursts are not so dramatic as that first nova outburst of course (to magnitude 0.2), reaching around magnitude 10 or so before fading back to minimum – the whole event taking a couple of months or so.

The August '18 outburst attained a peak magnitude of 10.25 mean following a 31-day rise, spent 6 days at maximum brightness before fading back to its quiescent level of 13.0 mean visual magnitude some 31 days later. The previous outburst, occurring in March-May 2015 was the brightest yet recorded, peaking at 9.6 in April of that year. That rise to maximum was comparable to the recent event, taking 30-days. Monitoring the decline was however affected by the poor position in the evening sky during May, with the field lost during the middle of the month.

Although GK Per can be classified as an 'old Nova', X-rays from the system detected in the early 1980's meant that it is now also classified as a magnetic CV. These are generally described as Polars or Intermediate Polars depending on the strength of the magnetic field, with GK Per falling into the latter category which means the system has a truncated accretion disc which gives rise to the outbursts we have been seeing for the past 50+ years.



The 2018 outburst of GK Per. Source BAAVSS Database

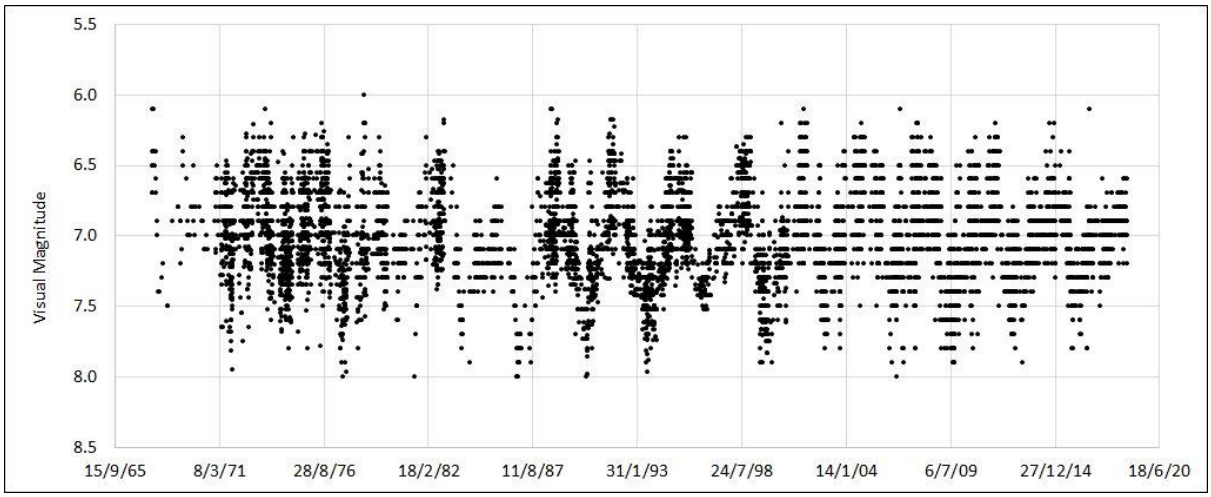
Observations of two Semi-Regular Variables
U Del & EU Del

Shaun Albrighton

This report covers 50 years of observations by BAAVSS observers of the two SRb variables U Delphini and EU Delphini. Being SRb stars they are giants of late spectral classes (M, C, S, or Me, Ce, Se) which show poorly defined periodicity, or may show alternating intervals of periodic and slow irregular changes. In addition, they often display two or more overlapping periods of light variation.

U Delphini

U Del is listed in the VSX as SRb, M5II-III, mag 6.14 -7.61 V, period 120d. A note ref Otero, Sebastian Alberto, gives a secondary period of 1163d. The GCSV team list a mean brightness variation, P=1100d. According to [P. Ralincourt, GEOS NC242, 1980], the mean period is more likely to be 160 – 180d rather than 110d. A 2006 JAAVSO article by J. Speil, gives a long period of about 1150d.
In total over 7,200 estimates for U Del have been analysed a full light curve of which is shown below.



Results agree closely with the quoted range, finding an extreme range of approx. 6.2 – 7.9. Analysis using AAVSO V Star program reveals the top 6 hits for periodicity as follows

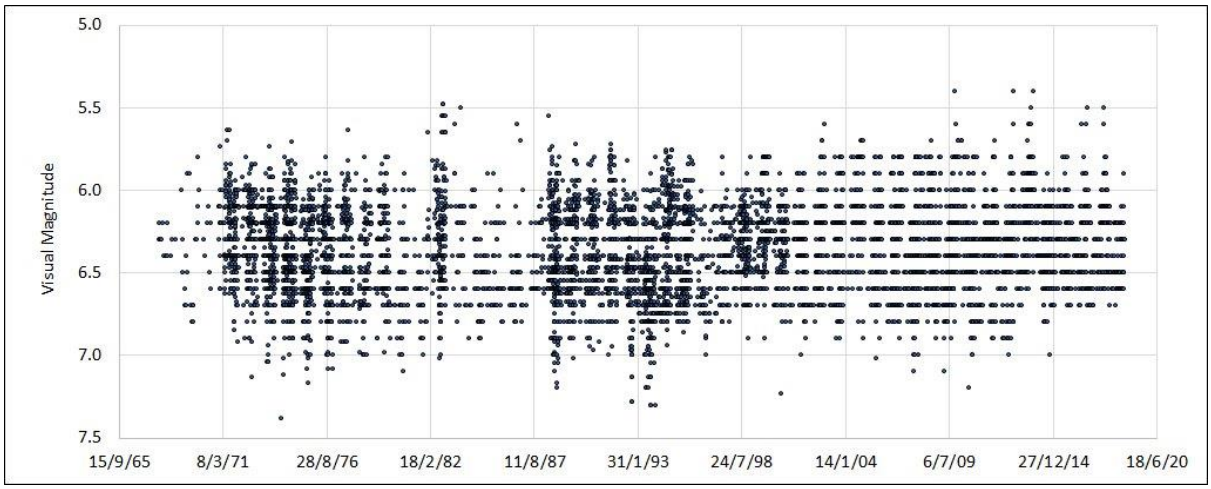
Period (days)	Power
1160	1043.9
536	207.1
277.6	165.6
1415.5	107.3
2831	90.57
119.2	64.78

As will be seen the dominant period is for 1160 days, which corresponds very closely to the previous quoted longer periods given in the range of 1100 – 1163 days. This period is clearly seen in the light curve and is the most prominent feature. The period of 119.2 days is also to be found, which closely fits the VSX period of 120 days. However, this is a weak feature, no doubt due to its smaller range and scatter by observers. There are suggestions of other potential periods, which merit further investigation.

VSS Chart / VSX

EU Delphini

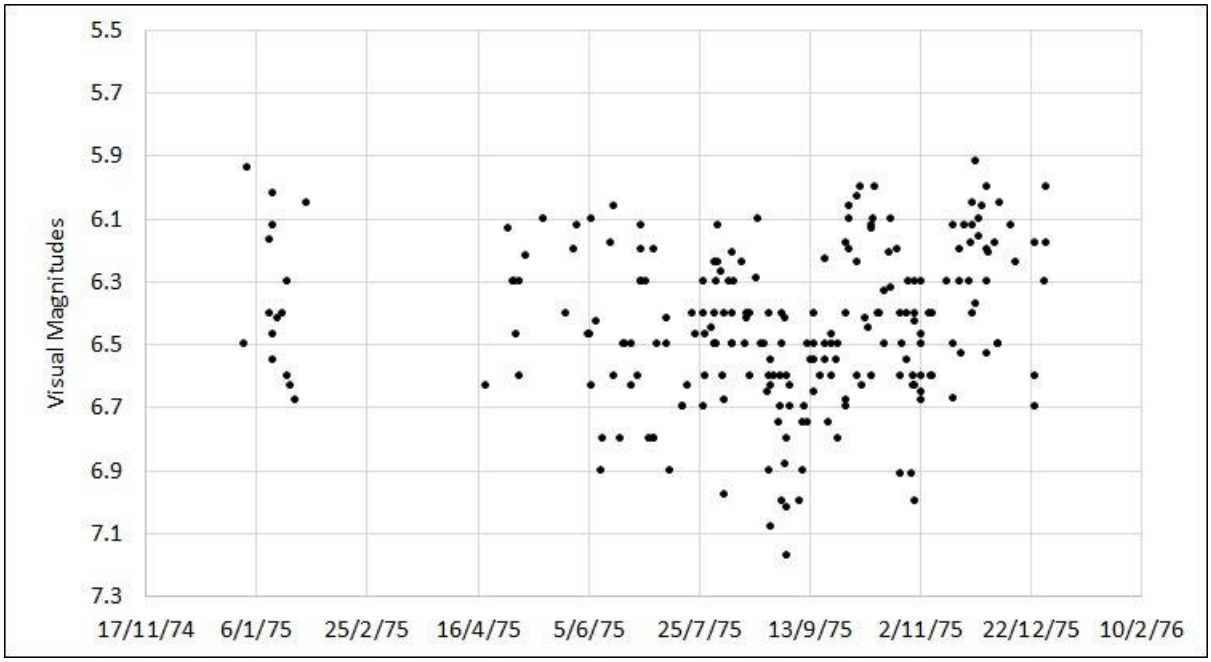
VSX lists EU Del as SRb, M6III, with a range of 5.41 – 6.72 and period of 58.63 days. Remarks listed detected periods of 44.0, 60.8, 67.3, 132.6 and 235.3d [2009arXiv0908.3228T].
This report is based on 7,308 observations submitted between 1967 and 2018 and entered onto the database. From the light curve below, it will be seen that the extreme range appears displayed slightly lower at approx. mag, 5.7 – 7.1.



Analysis using AAVSO V Star program yields the following results

Period (days)	Power
62.22	120.35
62.71	85.70
17763	71.07
1615	70.89
473.7	68.69

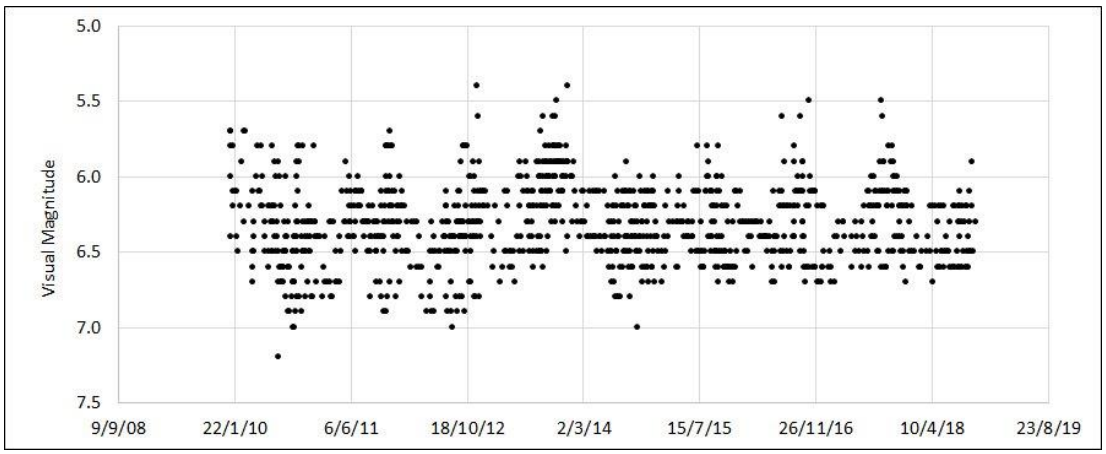
Compared to the quoted VSX period of 58.63 days, we find two slightly longer possible periods of 62.22 and 62.71, which could result from changes over the 50-year time frame. The result of 17,763 days is probably down to changes in the sequence. There are two possible longer periods which require further investigation, neither of these correspond to those listed in the VSX notes. The plot below from 1975 shows typical scatter in observations, although there are hints of this 62-day oscillation.



To analyse the main period of approx. 62 days further I have completed a series of studies for each decade. The results for the top three periods are listed below.

	Period 1 (days)	Period 2 (days)	Period 3 (days)
1970-1980	62.08	63.75	5,929
1980-1990	62.65	61.19	5,890
1990-2000	62.22	1,412	58.90
2000-2010	639.3	374.21	62.88
2010-2018	458.0	686.0	1,373

As will be seen the period of over 62 days fluctuates slightly between 1970 and 2000, however the main feature is that this short period has disappeared completely during the time frame 2010-2018. From the results it will be seen that the dominant period is now approximately 450 days. There is some evidence in the plot below for this longer period. Whether this is a genuine and permanent feature requires a longer timeframe of observations.



VSS Chart / VSX

OJ287: Waiting for the big one

Mark Kidger

European Space Agency
European Space Astronomy Centre

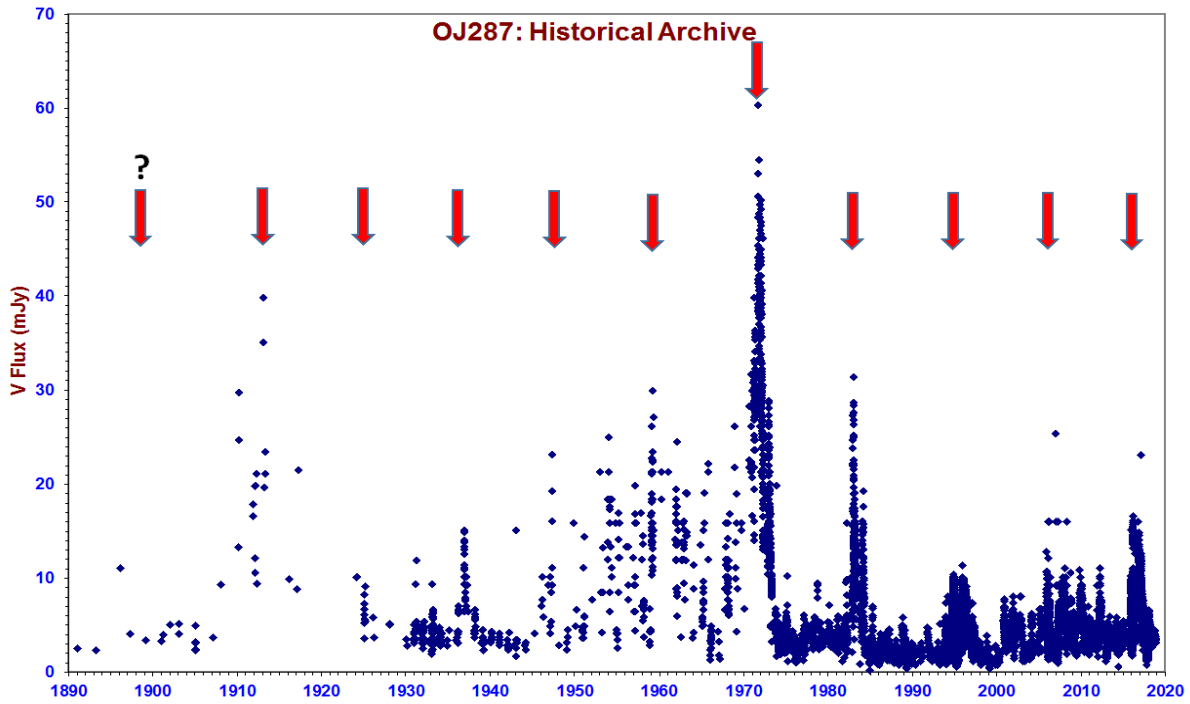
Back in 1987, a Finnish Ph. D student who was compiling a historical light curve of OJ287 from the plate collection at Turku Observatory, took his results to his supervisor, suggesting that he could see a regular sequence of eclipses in the light curve since the start of the 20th Century. His supervisor, a distinguished theoretician at Turku, Mauri Valtonen, looked at the evidence and replied to his student, Aimo Sillänpää, “I cannot see eclipses, but I do see what appears to be a regular series of outbursts”. He showed that about every 11.6 years, the quasar would brighten by a factor of ten. The rest, as they say, is history.

Mauri Valtonen reasoned that, if you see regular outbursts, you are seeing orbital motion of some kind. OJ287 is a blazar with a red shift of z=0.306, translating into a distance of about four thousand million light years. What could cause a quasar at this distance to brighten suddenly by a factor of ten in such a regular fashion? Mauri Valtonen reasoned that this was most likely to be orbital motion and, with a group of collaborators, calculated the orbital parameters of the system required to fit the light curve: it turned out to be a binary supermassive black hole with a primary of 5×10^9 Solar Masses and a secondary of 20×10^6 Solar Masses, with an eccentric orbit of 9-year period that, by time dilation, becomes a 11.6-year observed period (Sillänpää et al., 1988, ApJ, 325, 628).

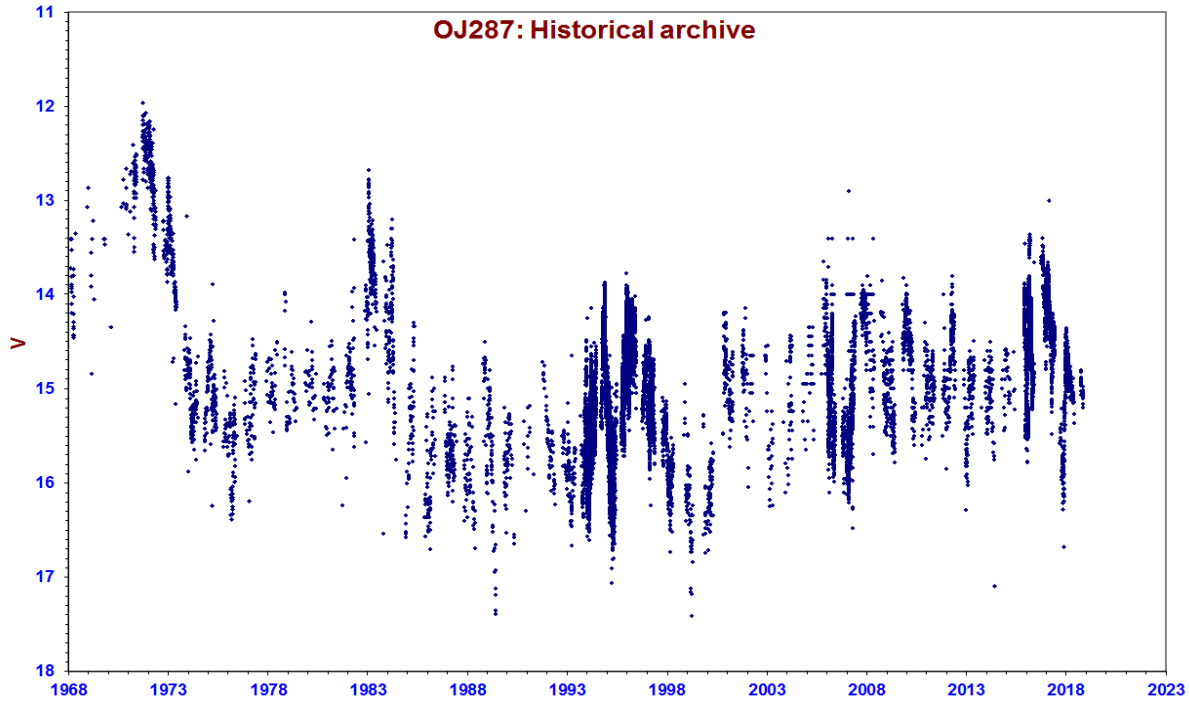
The model made a firm prediction that OJ287 would have a new outburst in 1994. An international project was set up to observe OJ287 through 1993-1995 and detect the outburst. Although OJ287 was disconcertingly faint in early 1994 – around V=16 – after rising progressively for several months, with mounting excitement as we watched the light curve build up, it did reach V=13.9 in mid-November 1994. Prediction confirmed!

Mauri’s model called for two maxima to appear, separated by a little more than a year, although the interval can vary quite widely according to the rapidly changing geometry of the orbit and, in one case, is as much as three and a half years. He reasoned that the outbursts would be caused by the secondary black hole passing through the accretion disk of the primary and causing a massive fall of material onto the primary. There would be an outburst at descending node and then, a second one as the secondary blasted through a second time, at ascending node. Would OJ287 oblige? Yes, it would! A second outburst to V=14 occurred in mid-December 1995. This was very satisfying.

There, things rested a little. A new outburst was expected in 2005. This time there was no international monitoring programme, but the BAA-VSS made a big effort to monitor OJ287 for Mauri, supplemented with some data that I and a few other professionals could obtain, and the outburst was duly detected in late 2005. These observations allowed the parameters of the binary black hole to be refined still further: how often, I wonder, have backyard telescopes measured accurately the mass of a pair of supermassive black holes?



The historical light curve of OJ287 in V. Magnitudes have been converted into fluxes in milli-Janskies to make the outbursts more obvious. Although there is evident activity at other times, particularly in the 1950s and '60s, the regular series of outbursts is quite obvious.

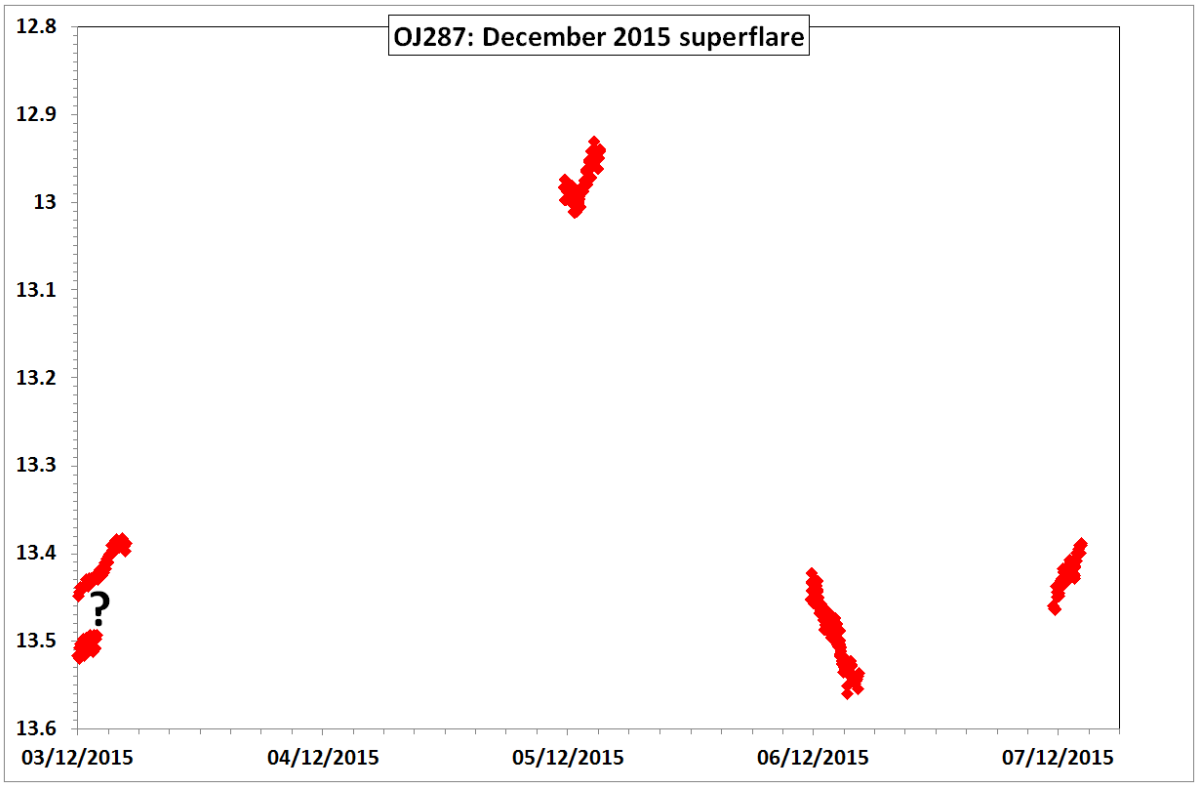


The recent light curve of OJ287, since it was recognised as a quasar in 1968. Note the extraordinary outburst that lasted about four years around 1972: OJ287 has never reached a comparable brightness in all the hundred and thirty years of data that we have available. There is an obvious modulation in the amplitude over a cycle of approximately sixty years. For the period from 2004-2008, all the data is from the BAA-VSS, showing the value of the efforts of the Section in keeping tabs on this object.

As more and better data has been accumulated, the aims of the monitoring of the outbursts has become more ambitious. It was recognised that the amplitude of outbursts shows a long-term modulation. Particularly large outbursts were seen in 1913 and 1972, while the outbursts in 1937 and 1994 are much smaller. Then, since 1994, the outbursts have started to increase in amplitude again. The reason for this cycle is that we are seeing viewing geometry. Due to the huge mass of the two black holes, there is a huge advance in the pericentre with each orbit: instead of Mercury's 10 arcseconds per year, we see an impressive 28 degrees per orbit!

With each new outburst, the masses of the black holes have been better constrained to the point that now, the values of the masses are not going to change any further and it has been the value of the amount of pericentre advance has been the one that has been refined with each successive outburst until reaching a stable solution: the current value of 28 degrees per orbit is no longer going to vary. However, the complete model has, more than a dozen parameters to fit and we can start to fine-tune these smaller effects too in the model.

The 2015 outburst has been particularly important in this. This has seen the heaviest international monitoring ever. By now, the prediction of the date of the maximum has got down to plus or minus about three days. The absolute peak of activity is the peak of a brief, so-called superflare, superimposed on the background brightening. In December 2015, Spanish amateur, Faustino García was one of the observers supporting this campaign; this is what he saw:



R-band data from amateur CCD monitoring of OJ287 between December 3rd and 7th 2015. For a few hours on December 5th/6th, OJ287 showed a half magnitude increase in brightness at the peak impact of the secondary black hole on the primary's accretion disk.

Combining Faustino's data with professional monitoring has allowed this outburst to be timed very exactly and gives a similarly exact prediction for the second outburst, which is expected on July 31st, 2019, with an uncertainty of only about a day.

This is very unfortunate because, in July 31st, 2019, OJ287 will be around 4 degrees from the Sun. It is doubly unfortunate because, if we can manage to time the peak of this outburst to ±6 hours, we can make a first test of a fundamental theorem of black holes: The No Hair Theorem.

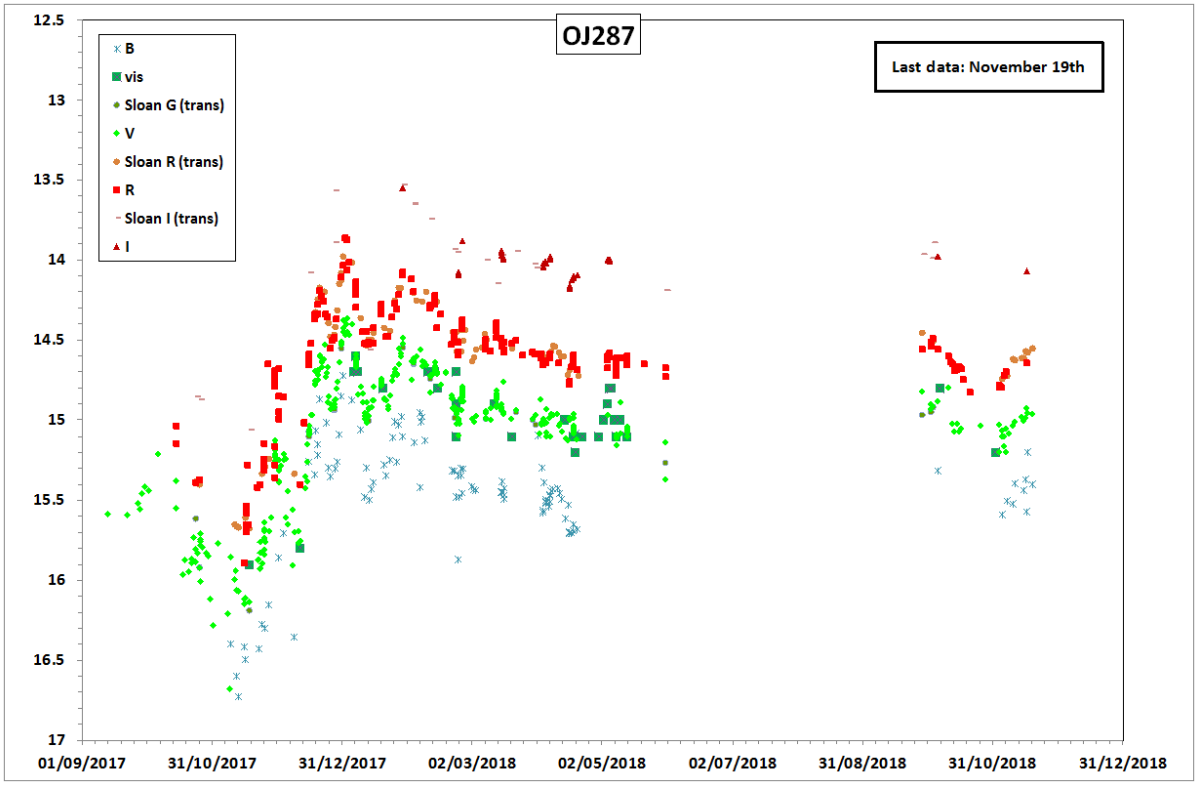
The theorem states "black holes have no hair". Translated into everyday language, this means that they are really very simple objects and that any black hole can be described completely by just its mass, its spin and its electric charge: no wig and false whiskers for your bald singularity. If we can time the July 31st maximum exactly, we can prove the No Hair Theorem to ±10%. By then managing similar exactitude with the maximum, in 2026, the No Hair Theorem can be proved to ±3%.

So, how do we observe something that is unobservable?

Earth-bound telescopes can pick up the start of the rise to maximum if observers can keep following OJ287 through into late June, as it dips into evening twilight and they can observe the decline by recovering it in early September, low in the dawn sky. That though will tell us that the outburst has happened, but not *when* it has peaked. For that, we have two telescopes in deep space: Spitzer, which used to be at L2, but which has now drifted well away and so sees OJ287 from a much more favourable perspective and STEREO-B. OJ287 becomes visible to Spitzer on July 31st, as it gets far enough away from the Sun to observe, so we have requested and been granted a series of observations in the infrared over several weeks, with observations several times a day at the predicted maximum, decreasing to twice a week in September. Nearly as interesting is the STEREO-B satellite. Although designed to observe the solar corona it can, *just*, observe stars down to about magnitude 13. Probably we cannot calibrate the data to get accurate magnitudes below about magnitude 11-12, but we can see if OJ287 briefly becomes visible at the right time and can use the images to make a good estimate of the moment when the peak has occurred from when we start to see it and then when we lose it again. Our second option is thus to request a special pointing of STEREO-B, requesting that it deliberately turn its back on the Sun for two or three days in an attempt to detect this outburst, however weakly.

I have no doubt that Mauri's prediction will be proved right, once again, although, right now, eight months before outburst, OJ287 is being very boring, as the latest light curve demonstrates:

However, this nice, quiet period in the light curve should not last much longer. Previous outbursts have been marked by slow and erratic rises that have lasted for anything from a couple of months to the best part of a year, before the final, brief superflare that marks the moment of impact of the secondary on the primary's accretion disk. We should see things starting to happen in Spring 2019.



The recent light curve of OJ287 from amateur CCD and visual monitoring. The light curve is quite boring at present, with no great hints that a big outburst is in the offing. This though should start to change in the new year if previous outbursts are anything to go by.

VSS Chart / VSX

Editor's note: The BAAVSS light curves for the 2005-2007 observing campaign are still available to view on the web at www.britastro.org/vss/oj_camp.html

AstroImageJ

David Smith

As a relatively new variable star observer, I have been searching for a reliable method of analysing my results. Many years ago, I attended an excellent Open University Practical Astronomy week in Majorca. (Well someone had to!) There we used MaximDL as an astrometry tool. So, when starting variable star observations, I tried that but heard that it wasn't much favoured. Most people seemed to be using AIP4WIN which didn't seem to be readily available. I was recommended Muniwin as a free alternative. That worked fine until I was finding that it would reject readings for no apparent (to me) reason. There were some settings that could be changed and sometimes it was possible for it to accept all the readings. To me it seemed a bit of pot luck as to how effective it was and on a recent observing session involving some 400 points it would either miss out readings near the end of the session or when the settings were tweaked it missed out those at the beginning.

It was at this point that AstroImageJ came to my attention.

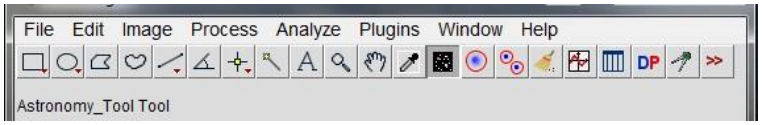


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Fig 1: AstroImageJ

There are a number of tutorials/help files available (see below)

AIJ seemed very logical and it was transparent as to how it was doing the job. Fairly soon I was able to produce a graph of all my readings (V593 Lyr for Patrick Wils HADS project).

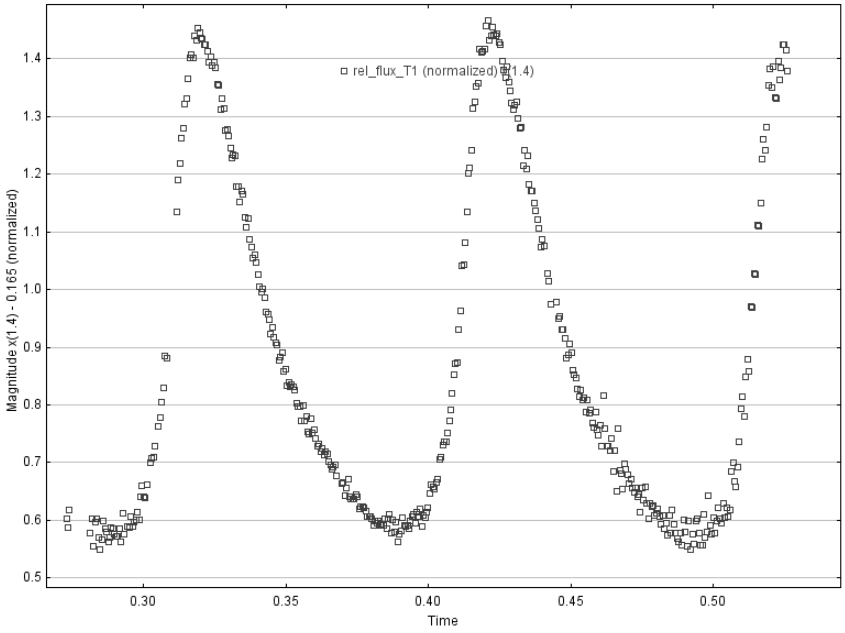
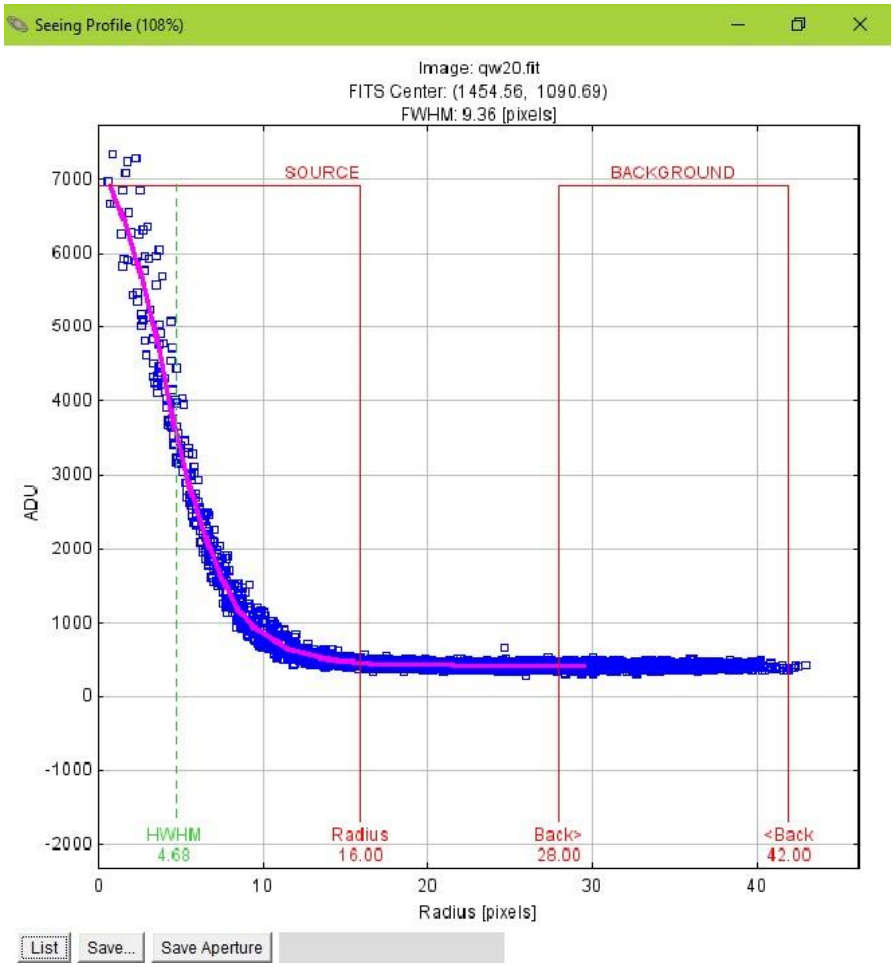


Fig 2: example readings

Problems started when trying to import the data into the BAAVSS spreadsheet. Up came an error message basically saying contact Andy Wilson or Richard Lee.

It was quite a bit of fun sorting out that problem which in part was made worse by me pushing wrong buttons that froze AIJ even when reinstalled and even after doing a totally unnecessary system restore. After much help from Richard the problem was finally solved and came down to two main points.



When AIJ is first installed you must update to version 3.2.1 (or later). In the help drop down tab go UP to Daily Build. The second point was that I use Sequence Generator Pro (SGPro) to capture the images and in SGPro the saved files have EXPOSURE in the FITS header to indicate the exposure time, whereas AIJ and the BAAVSS spreadsheet both look for EXPTIME. Before running AIJ the first time only, users of SGPro need to change the Keyword list on the Aperture settings page (about half way down) to EXPOSURE in place of EXPTIME. Richard has altered the spreadsheet to accept either term in versions B2.05d or later.

Figure 3: Seeing Profile

Another problem I came across was how to get AIJ to deal with a meridian flip. I find the best solution, for me, is to plate solve all the images as is indicated in the instructions and then it is all plain sailing. If the images are not closely aligned the plate solving deals with that also. It is far more efficient to have the plate solver installed locally on the computer.

AstroImageJ also has a neat facility to avoid taking images out of the linear range of the CCD. The user can choose the levels that suit their camera. The software has a column which has zero if the level is OK and non-zero for out of range images. It is up to the user to remove those from the stack.

Better still is a facility to see a full profile of any star in the image and so exposure times can be chosen such that there is no chance of saturating any part of the star image.

Another feature that I find very useful is the ability to hover the curser (+shift) over a point on the graph and be presented with the image responsible. So useful when there is some cloud interference. One click, and that point can be deleted.

All in all, an excellent package and at a good price!

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https://www.astro.louisville.edu/software/astroimagej/guide/AstroImageJ_User_Guide.pdf

https://britastro.org/sites/default/files/Tutorial_AIJ_Photometry_v2.06.pdf

AstroImageJ forum.

http://astroimagej.1065399.n5.nabble.com/

HADS Project

https://tinyurl.com/y9hvlfvv

Visual VS landmark – 300,000 observations

Rod Stubbings and Gary Poyner

In October 2018, two visual observers on opposite sides of the world passed the 300,000 visual observations landmark within a few days of each other. Here's how they did it…

Twenty-Five Years in The Making – Rod Stubbings

My interest in Astronomy all began in 1986 when I spotted an advertisement in a magazine, 'For sale! 65mm Tasco telescope. View Saturn's rings and Jupiter's belts!' I decided to purchase the telescope and ventured out into the night. After pointing the scope up at the sky, I managed to see a few bright stars, but there was no sign of Jupiter. Honestly, I didn't have a clue where anything was meant to be. So, I bought a book titled 'Astronomy without a Telescope' which taught me to recognise the brightest stars, the constellations they belonged to and finally, where to find Jupiter and Saturn! Although, it was not a real passion at first, astronomy soon became my obsession.

I was introduced to variable stars by Peter Nelson who was Director of the Astronomical Society of Victoria, Variable Star Section. Armed with a beginner's book on 'The Observations of Variable Stars' from the Royal Astronomical Society of New Zealand (RASNZ), I learnt how to make an observation on a variable star. I made my first observation on May 18, 1993 on the Mira star R Centauri using 8X50 binoculars. A total of 10 observations were made for the month which was sent to the RASNZ variable star section (VSS).

Over the next few years I gravitated towards observing cataclysmic variables whilst progressing through 6cm, 15cm, 25cm, 32cm and 40cm telescopes. I started to monitor the dwarf novae class of variable stars for outbursts. My observations were kept in a log folder and sent to the RASNZ- VSS every month. With the internet becoming more popular, I came across the

Variable Star Network (VSNET) alert mailing lists which reported outbursts of dwarf novae stars. I realised that there was an opportunity to contribute further, so from early 1997 I started submitting all my outburst detections to VSNET. This drew the attention of the VSS Director Dr Frank Bateson (1909-2007) who sent the following email in April 1997:

'*You may receive e-mail messages resulting from your alert messages requesting additional data. If you do, I suggest you tell the enquirer to contact me, so they can obtain our complete record including observations from other observers. I have already received such requests from those who know you are one of our observers, but others may not know of this connection.*'

Two months later Frank emailed me again informing me that my alert notices were being well regarded world-wide and to keep up the good work. My involvement with the American Association of Variable Star Observers (AAVSO) began in July 1997 when the former Director Dr Janet Mattei (1943-2004) contacted me regarding my alert notices. She informed me that the AAVSO had been following my work through VSNET and that they would be interested in receiving my observations directly to include them in the AAVSO News Flashes. This was further encouragement to continue observing, especially coming from Janet.

To further enhance my observations of dwarf novae I searched through all the catalogues and added the unstudied and fainter dwarf novae to my list. Soon I was recording up to 1400 observations on a good month and 30-50 dwarf novae detections each month. With constant monitoring I was able to record information that was previously unknown such as the maximum brightness, frequency, duration and follow the rise and fall of outbursts. Many of these outbursts posted to the VSNET alert system delivered some interesting results, mainly due to some of these stars belonging to the exclusive SU-UMa and WZ-Sge type dwarf nova. Over the years, my new obsession led to a number of stars being visually detected in outburst for the very first time. Some notable ones were:

- SV Ari; first detection in 106 years
- GR Ori; first detection in 97 years
- CG CMa; first detection in 65 years, misidentified.
- V359 Cen; first detection in 65 years
- V591 Cen; first detection in 59 years, listed as a non-CV.
- EG Aqr; first detection in 47 years
- FL TrA: first detection in 35 years, misidentified.
- GW Lib; first detection in 24 years
- VX For; first detection in 19 years

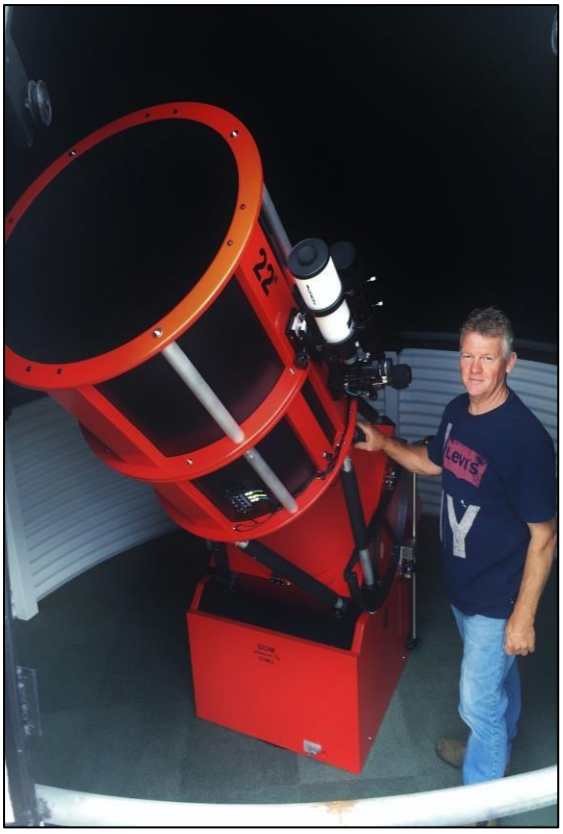


Figure 1: Infinity, a custom made 22" f3.8 Dobsonian telescope inside the 3.8-meter traditional domes observatory.

Fast forward to 1999 and during this year I recorded over 17, 500 observations. The year turned out to be very 'explosive' for me, as it proved to be the year of many important outburst detections. One in particular was the outburst of V4641 Sagittarii, a black hole binary system. The star had just exploded to magnitude 8.8. Visually, this outburst lasted less than 8 hours and then it was gone. To this day I'm the only person to have visually seen an 8th magnitude outburst in this system.

On June 8, 2002, my 9th year of observing, I was the first Australian observer to reach a total of 100,000 visual observations, something that I never thought would be possible when I first started. This achievement was made on a star called KK Telescopium, a SU-UMa type dwarf nova. On January 24, 2012 I recorded my 200,000th visual variable star observation on the recurrent nova T Pyxidis, which was in eruption at magnitude 12.5. On February 6, 2014 in the early hours of the morning, another notable detection was caught on the recurrent nova V745 Sco at magnitude 9.0. This was the third recorded outburst since discovery in 1937 and the first visual detection of an outburst of V745 Sco.

In 2015 I decided it was time for an upgrade and later that year the family welcomed the fifth child, a custom made 22" f/3.8 Dobsonian telescope, aka 'Infinity' (**Figure 1)**. After adjusting to the deeper fields and fainter comparison stars my variable star output has actually increased to making up to 5 observations a minute and now seeing stars to magnitude 17.5.

On October 6, 2018 a very special observation was attained on the symbiotic star AR Pav, which marked my 300,000th visual variable star observation. This milestone has been achieved in 25 years and 5 months, with an annual average observation of 11,765. I had an exceptional month leading up to my 300k with September bringing a total of 24 observable nights, 2894 visual observations and 106 detected dwarf novae outbursts. This set the scene to reach my milestone. The previous night, I had already recorded 220 visual observations, but clouds were approaching, and I decided to save the moment for the next night. Afterall, fine weather was predicted, and I wanted the symbiotic binary AR Pav to be my 300k observation. AR Pav was special to me because it was one of the stars that Albert Jones had asked me to observe for him as he wanted the visual historical light curve to be continued.

On my 300,000th observation AR Pav had just entered into its 604.5-day eclipse cycle (**Figure 2)**.

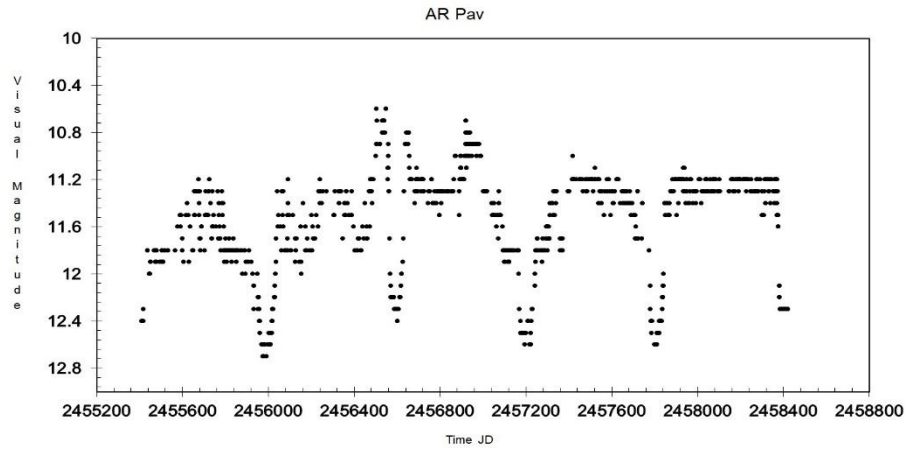


Figure 2: Visual light curve of the eclipsing Symbiotic Binary AR Pav since 2010

Over the years I have been honoured to receive many requests from astronomers around the globe for notification on specific stars that went into outburst to assist their research programs. It is surreal to think that my observations have directly triggered satellite observations with the EUVE and XTE satellites, European X-ray satellite BeppoSAX, Hubble Space Telescope, Chandra satellite, Fuse satellite, XMM-Newton and Swift satellites. A recent example of this was the program on VW Hydri (8.4-14.4V) for a request for a radio trigger on VW Hyi's next outburst around July 2018. There was a suggestion that even a single visual observation could do this in principle. On August 5, I noticed VW Hyi was slightly brighter at magnitude 13.2 and so I stayed with it and it continued to rise to magnitude 12.7. I sent off a notice to all the principle investigators with an instant response of excitement. A few hours later another notice was sent as it brightened to magnitude 12.4; the outburst was underway. This caused a flurry of emails and within 4 hours we had the Australian Telescope Compact Array, the MeerKAT Telescope in South Africa, the Chandra X-ray observatory, The Southern African Large Telescope (SALT) and the Swift X-Ray Telescope locked in to observe VW Hyi. The opportunity to be a part of the email exchange that triggered all the telescopes on the night was just as exciting as catching the rising VW Hyi.

Despite these achievements and milestones, my visual observing experience has not always been a smooth process. Whether it's huntsman spiders that keep me company in the dome, bats that like to flutter around my head and make me jump or my adult children who very vocally demand I pay them more attention than the stars. On one memorable occasion, I thought someone was in the observatory when the telescope suddenly moved, but then the whole ground started trembling. It turned out that the alleged intruder was an earthquake. I waited for the inconvenient quake to finish and carried on with my observing. The most current and pressing issue would have to be the backlog of data due to spending more time outside than typing up my observations. As a result, I currently have a backlog of over 35,000 observations yet to be entered, which equates to over 488 pages. Each page holds 72 observations and takes about 20 minutes to type up and write in the Julian Date (**Figure 3)**. With over 7 folders of original handwritten data, I hope to one day get all of it digitised

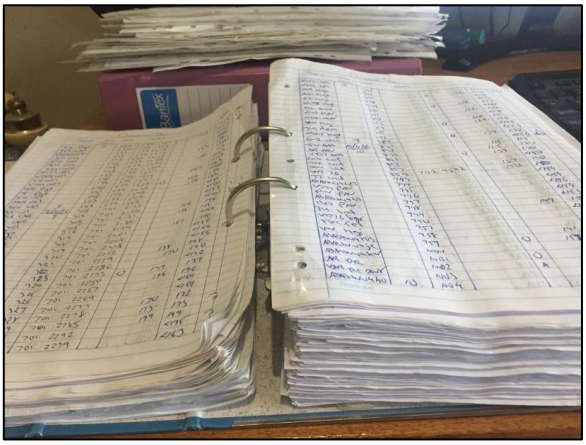


Figure 3: Log folder showing the backlog of observation pages on the right-hand side dating to December 2016.

The year 2018 continues to be productive and it has delivered two new personal bests, with 2894 observations in one month and my annual visual observations set to exceed 19,000. I think it goes without saying that I am as obsessed as ever, and astronomy is more of a life choice than a hobby. I will eventually open my observatory up to the public and I already have school groups that visit or the occasional couple who want to see the star they have dedicated to their partner. However, I'm reluctant to expand this type of observing at the moment because I struggle with giving away those precious hours of clear night skies. Perhaps one day when I retire, I will welcome the community to my humble abode, but for now I better get back outside!

300,000 and counting – Gary Poyner

At the beginning of 2018 my spreadsheet was informing me that my lifetime total of visual variable star observations stood at 292,606, meaning I required another 7,394 to reach the 300,000 milestone which is, I guess, a landmark for any visual observer. For a UK visual observer with our notoriously cloudy skies, it was one I couldn't have imagined when I started this variable star adventure with Nova Cygni way back in the mists of time in 1975. Yet here I was with just a few thousand to go. How on earth did that happen?

For the first half of 2018 (Jan-Jun) observing conditions were pretty good from my location in North Birmingham with 58 clear or partially clear nights, and with 4,043 observations taking me to the end of June, I was fairly confident that I could get the remaining 3,000 odd observations by the end of August if the weather gave me the opportunity. Unfortunately, I managed to go down with a very nasty food poisoning virus in early July (just in time for the BAA/AAVSO meeting) which severely curtailed my night time activities for the next three months, and so it looked like October would be the month when I might get to that magic number! As September rolled into October, I needed just 457 observations – or three clear nights. I had 110 minutes at the telescope in a partially clear sky on Oct 3/4 (65 obs), and 340 minutes (201 obs) in clear skies on Oct 6/7. Two further cloudy nights followed before Oct 09/10 gave me the clear skies I needed before cloud finally advanced a couple of hours after midnight on the 10th. Although clear, the sky was poor with hazy conditions and unsteady atmosphere, and there was no improvement as the night progressed as I was struggling to get into the mid 15's with the 51cm. It was disappointing as I was sure my 300,000th observation would be a negative one, and I didn't really want that to happen. At 01.45 UT on Oct 10 the cloud rolled in, and I went back indoors and counted the observations in my notebook – 195 – and the 300,000th observation was a positive one after all - the Blazar S50716+71 – Oct 10.069 UT at mag. 13.3. This Blazar is one of the most active objects in the sky, so I was delighted that I had made it with a positive sighting of a variable object, if not a 'star'.

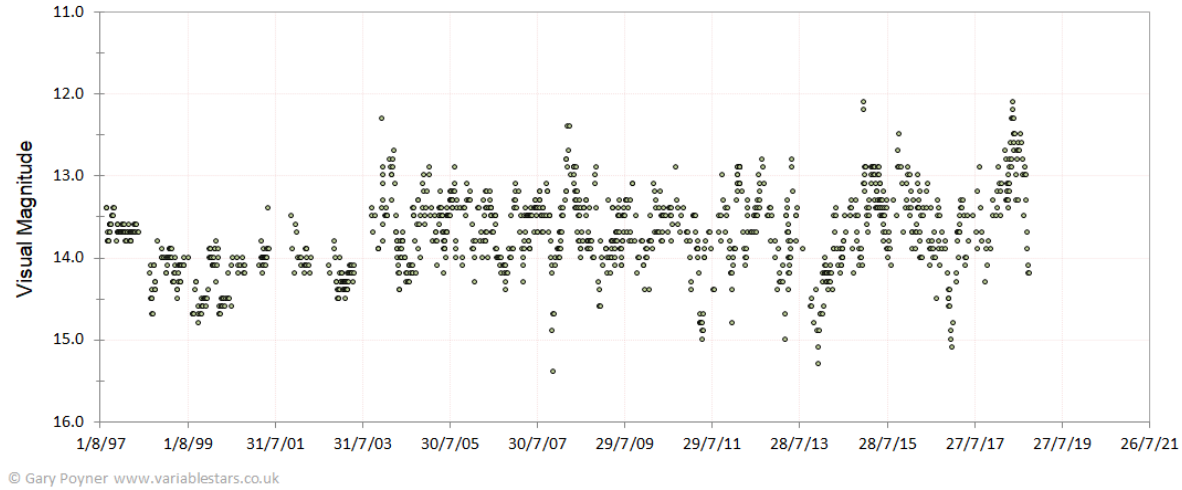


Figure 4: S50716+71, 1997-2018

The last 100,000 observations have taken 11 years and 6 months (4,194d), over 1,098 clear and partially clear nights – equating to an average of 91.1 observations on each useable night and a yearly average of 8,696.

Over that time period, I have averaged 94.9 observable nights per year – of which ~95% have been used to make some VS observations. All but a few observations have been made from my observatory in north Birmingham (occasionally I will steal a telescope from a deep sky observer at my astronomy club in North Warwickshire to make a few VS observations, before the weeping gets too loud and I have had to hand it back). From 2007-2010 my main telescope was a Meade LX 200 35cm SCT, which I changed for a 51cm f4 Dobsonian in September of 2010. Star hopping with a manual telescope is quicker and less frustrating than with a computer-controlled mount! My trusty 22cm Dobsonian has also been used in this time, along with 30cm and 25cm Dobsonian telescopes at my club – the Heart of England AS. About 99% of the observations are telescopic, with just a few old faithful binocular stars monitored.

Since my first VS observation was made in 1975, the progression of observations is as follows – the first 50k was completed by 1993 (very slow, as I was observing a small number of stars as charts for CV's were very difficult to get hold of), yet the second 50k only took 5 years (100k reached in 1998) as many more CV's were added to my observing programme in the late 1980's thanks to a programme to monitor dozens of them alongside ROSAT!. The second 100k took 9 years (yearly average 11,111) with that milestone being reached on April 17th 2007 with an observation of the CV DW Cnc (VSSC 132, June 2007). I have every observation made since 1993 in digital format on my PC (~251,000), along with some data going back to 1975 also in digital format which has been entered specifically for compiling light curves. Hopefully one day I'll manage to type it all in!

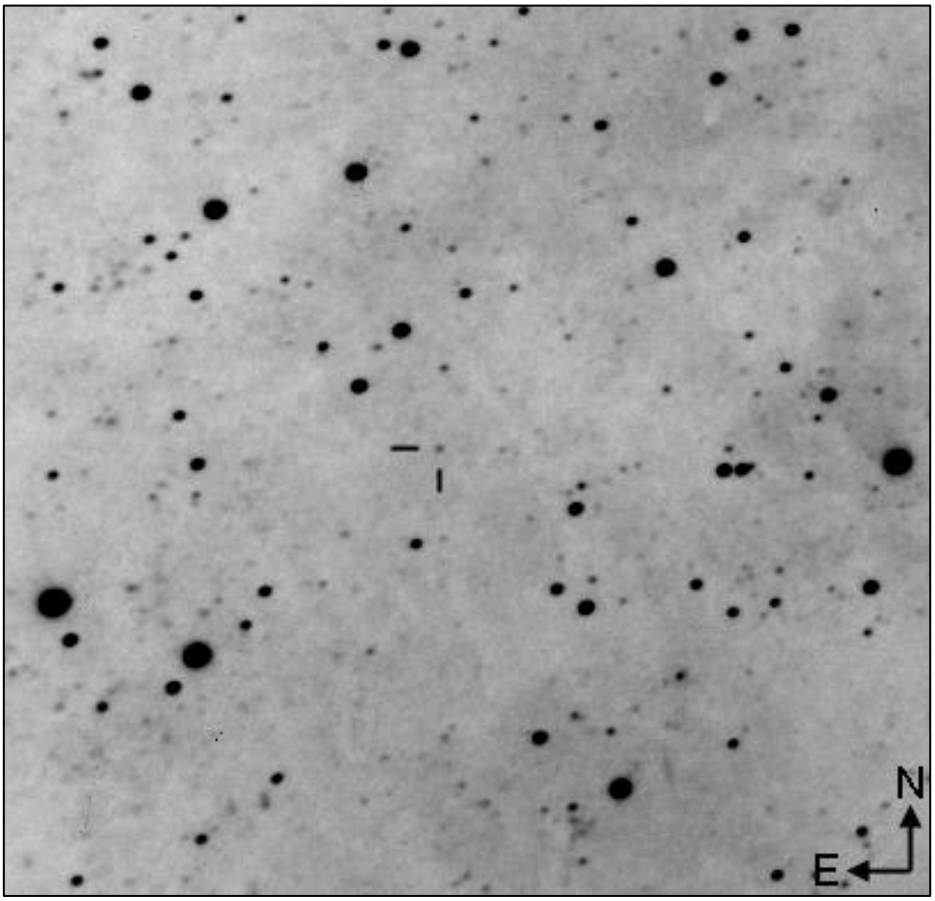
The annual decline in the observation average totals from 1998 to 2018 is certainly due to a decline in the number of clear nights obtainable from my observing location. I have detailed weather observations going back to the mid 1970's, so I can make accurate comparisons. Light pollution has also increased during this time, to the point where now it is ever more difficult to reach magnitude 16 visually, and LED streetlights have brightened the background sky to such an extent that I haven't seen the Milky Way naked eye from my observatory since August 4th, 2014. This is especially worrying, as the vast part of my observing programme are faint CV's. I have a feeling that the next 100,000 observations will be quite difficult to achieve and will probably require a re-jig to the type and magnitude of the stars which I observe over the coming years.

Fast Recurrent Nova M31N 2008-12a in the Andromeda Galaxy Outbursts again

David Boyd

I wrote an article in the December 2017 Circular about the global effort to detect the next outburst of this recurrent nova which has the shortest known recurrence time of around one year. After observing the field of the nova in M31 on 44 nights since August 2017, I was fortunate to be the first to observe the expected outburst on New Year's Eve and wrote a short article about this in the February 2018 BAA Journal.

The December 2017 outburst happened much later than expected which made predicting the date of the next outburst difficult. Professional astronomers analysing the behaviour of the nova suggested the next outburst would occur sometime during November or December 2018. It was actually detected early in the expected window on November 06.80 UT by the Liverpool Telescope on La Palma and reported in ATel 12177. I was clouded out completely on that night but between clouds on the following night managed to record two time series of 60sec unfiltered exposures centred on November 07.79 UT and 08.00 UT using a 0.35m SCT and SXVR-H9 CCD camera. These images were stacked in groups of 10 to enable me to measure 5 magnitudes from the first run and 10 from the second with good signal to noise. The mean magnitudes in these two runs were 18.67±0.04C and 18.66±0.04C. From other observations reported to the AAVSO, it appears that I was observing it close to its maximum brightness. Each outburst only lasts a few days. The following image is a stack of 20 exposures centred on November 07.69 UT.



KIC 9832227 – probably not a potential Luminous Red Nova in 2022

David Boyd

No sooner had my article on this mysterious object appeared in the last issue of VSSC than a paper was published in the free preprint server arXiv.org claiming that this interpretation of the data was incorrect. *KIC 9832227: Using Vulcan Data to Negate The 2022 Red Nova Merger Prediction* by Socia et al. (2018) argues that an observation in 2003 as part of the NASA Ames pre-Kepler Vulcan Project to search for transiting exoplanets does not agree with the exponential decay model previously published by Molnar et al.

The Vulcan Photometer was a 10 cm aperture ground-based instrument at the Lick Observatory designed to detect Jovian-size planets around Sun-like stars. The area of sky surveyed by Vulcan partially overlapped the Kepler satellite field of view. The Vulcan data included an eclipse of KIC 9832227 in 2003. The usefulness of this new eclipse timing measurement depended on confirming the accuracy of the Vulcan project timing back in 2003. They were able to do this by analysing eclipses of another eclipsing binary with a very well-defined ephemeris which was observed by Vulcan. This confirmed Vulcan timing was accurate to within 20s and led them to re-evaluate the other early epoch non-Kepler data sets, the Northern Sky Variability Survey (NSVS) and Wide-Angle Search for Planets (WASP) survey. They found that the WASP times were in good agreement with the previous prediction, but the NSVS eclipse time differed by nearly an hour. The very large disagreement of the Vulcan and NSVS eclipse times with the exponentially decaying model of Molnar et al. forced them to reject the merger hypothesis.

Figure 1 show the O-C diagram from the Socia et al. paper (their Figure 4) with all the available timing data including the Vulcan data point (in blue) and their corrected NSVS data point (in green). This diagram is based on the ephemeris

$$T0\ (BJD) = 2454953.48885(9) + 0.45794896(8) * E$$

The dotted lines represent possible tertiary star solutions. These clearly do not fit the data.

The conclusion of Socia et al. is that the exponential model of Molnar et al. and its prediction of a luminous red nova in 2022 are wrong and that, while the physical cause of the period changes in KIC 9832227 remains unexplained, a third star scenario is also unlikely.

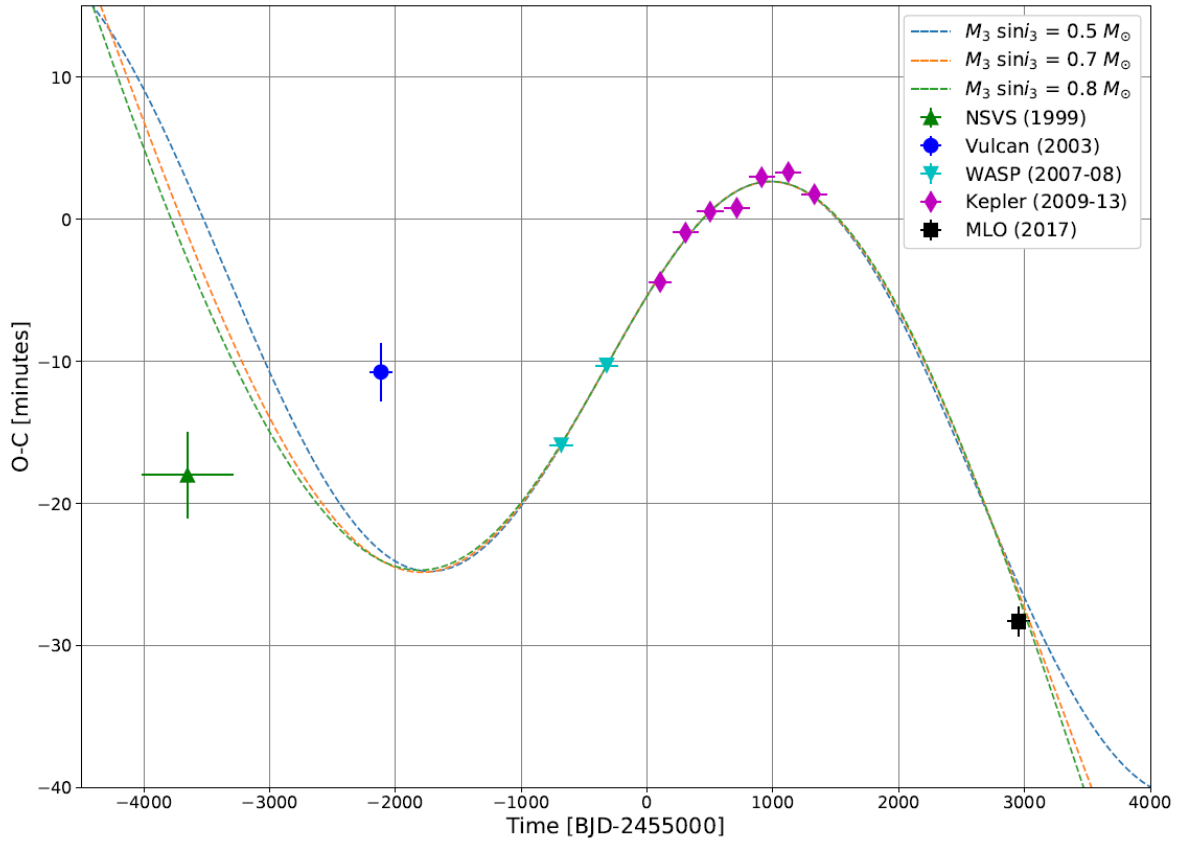


Figure 1. O-C diagram from Socia et al. showing all available eclipse timings and possible tertiary star solutions (dotted lines). The behaviour of the observed variation is currently unexplained.

References

Socia Q. J. et al., https://arxiv.org/abs/1809.02771v1 (2018)
Molnar L. A. et al., https://arxiv.org/abs/1704.05502v1 (2017)

Project Melvyn – 365 not out

Alex Pratt

A year has passed since we started working on Melvyn Taylor's archive. The unrecorded visual estimates of the following stars have now been identified and scanned and the PDFs were distributed to the original observers or volunteers to add them to the VSS database.

RS And			
RX Boo			
V CVn			
AR Cep			
U Del	EU Del+		
BN Gem	BQ Gem	BU Gem	NQ Gem
ST Her			
RV Mon	SX Mon		
Z UMa			

(+ EU Del is almost completed. All scanned folders have been handed to the Section Director for the VSS archives).

This has recovered 14,457 unrecorded observations on 1,500 report forms submitted by 126 observers. The 5 most prolific contributors were: - Ian Middlemist (1,841 estimates), Melvyn Taylor (1,301), Shaun Albrighton (1,280), Rhona Fraser (950) and John Toone (926).

Occasionally, the details on the paper report sheets were incomplete, which hindered the task of collating observers' estimates. For example, some forms had a blank year field, or the observer's name was missing, so a bit of detective work was necessary to identify the correct year or to match a form with examples of observers' handwriting. It's unfortunate that the recorders didn't resolve these issues on receipt of the observations.

In addition to these paper records, Melvyn's thousands of unrecorded estimates in doc and txt files are being processed by Tracie Heywood, whose year of hard work has increased Melvyn's database tally from 36,394 estimates to over 71,000; an amazing achievement.

The finish line certainly isn't in sight yet, but a great deal has been achieved during 2018. Grateful thanks are expressed to Tracie Heywood, the Section Director Roger Pickard and the data entry volunteers for their commitment to this project.

Eclipsing Binary News

Des Loughney

Zeta Aurigae - 2019 Eclipse

Conditions in 2019 will be favourable for observing this eclipse.

Zeta Aurigae is a well known eclipsing binary which has a period of 972 days. The eclipse lasts about 37 days and is somewhat unusual because a small very hot blue star passes behind a supergiant red star. Ingress and egress last about 1.5 days. There are no sharp boundaries to the eclipse as the smaller star continues to shine, during ingress and egress, through the tenuous outer atmosphere of the larger star.

The midpoint of the 2019 eclipse is scheduled for 13th November 2019 which means that ingress will be around 25th October and egress around 2nd December. Out of eclipse magnitude has been found to be 3.75V. The eclipse magnitude is 3.99V.

There are differing views of the depth of the eclipse. GCVS states it to be 0.27V and Krakow 0.6V. In the 2009 eclipse the depth was found to be 0.15V. In 2017 the depth was found to be 0.22V.
The eclipse is a good target for DSLR photometry. V magnitude measurements are required. The transformation correction changes during the eclipse because we are only observing the primary red star rather than the combined light of the two stars in the system.

AR Aurigae

AR Aur is a bright EA system that is on our observing list. It is featured on chart 283.01. It is very easy to find in Auriga as it is part of a distinctive asterism. The out of eclipse magnitude is 6.2V and the primary and secondary minima are of equal depth at around 6.8V. The length of each eclipse is about 7 hours. The period of the system is 4.134692 days. Predictions of the mid minima of the primary and secondary eclipses are available on the Krakow website.

It is the only eclipsing binary system with a star relatively rich in mercury and manganese.
I have been doing DSLR measurements of the system using three comparisons on the chart. One is comparison A which is listed at 5.4 magnitude. I use the Hipparcos value which is 5.38V. I also use D which is listed at 6.5. The Hipparcos value is 6.49V. I also use G which is listed at 7.1. The Hipparcos value is 7.04V.

The light curves of the primary and secondary minima are both curved showing that the eclipses are actually partial (nearly total).

The reason that the system is on our list is because the period varies due to the presence of a third body around which the AR Aur revolves with a period of 23.8 years. The third body is at a distance of 11AU from the eclipsing binary. The paper about this is called “The Triple Star AR Aurigae”. The paper was published in January 2011 (1). The variations in the period show a light time effect which is illustrated in a diagram taken from the paper.

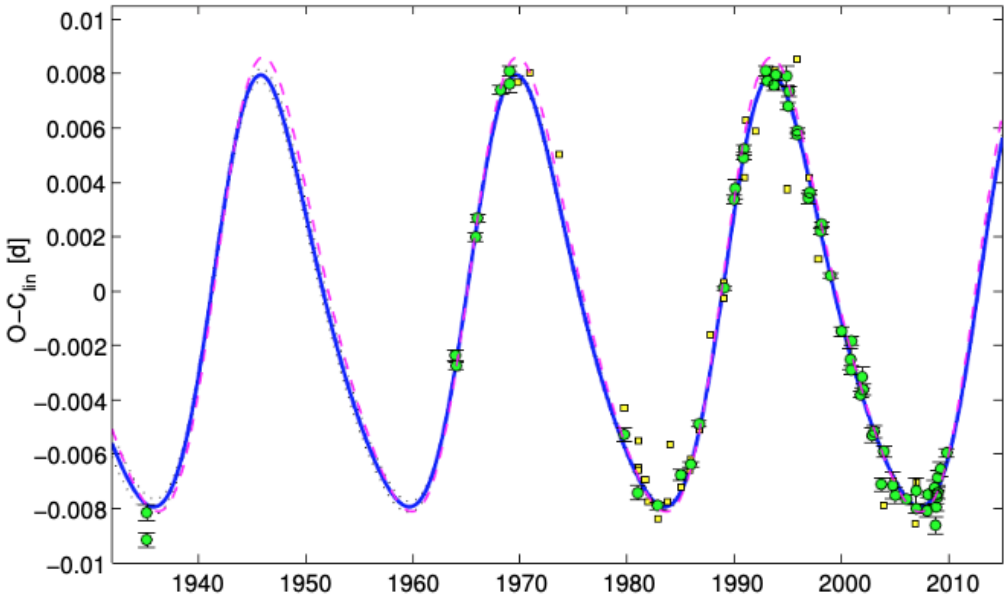


Figure 1: O–C diagram of AR Aur. Full line: our solution (Table 1), dashed line: Albayrak et al. (2003), dotted line — uncertainty of the solution. Circles — minima times computed by our method, squares — minima times adopted from literature.

The diagram shows that the period of the eclipsing binary, within the 23.8 years it takes to go around the third body, can vary by up to plus or minus 48 minutes. It should be possible to study this ongoing variation through visual observation and through DSLR photometry. The period may not seem to change much within a particular year, but the regular change should be picked up after a couple of years.

It is hoped that each year there will be several precise timings of the mid minima to confirm the light time effect or to pick up any changes.

1. MIKULÁŠEK, Zdeněk, Jozef ŽIŽNOVSKÝ, Miloslav ZEJDA, Juraj ZVERKO, Swetlana HUBRIG, Jiří KRTIČKA, Pavel A. DUBOVSKÝ, Kosmas GAZEAS, Stanislaw ZOLA, Waldemar OGLOZA, Berhaditin ALBAYRAK, Marek CHRASTINA, Tomáš GRÁF, Jan JANÍK a Igor KUDZEJ. The Triple Star AR Aurigae. In I. I. Romanyuk, D. O. Kudryavtsev. Magnetic Stars. Proceedings of the International Conference, held in the Special Astrophysical Observatory of the Russian AS. Moskva: Special Astrophysical Observatory of the Russian AS, 2011. s. 431-434, 4 s. ISBN 978-5-7422-3156-1.

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Written articles on any aspect of variable star research or observing are welcomed for publication in this Circular. The article must be your own work and should not have appeared in any other publication. Acknowledgement for light curves, images and extracts of text must be included in your submission if they are not your own work! References should be applied where necessary.

Please make sure of your spelling before submitting to the editor. English (not American English) is used throughout this publication.

Articles can be submitted to the editor as text, RTF or MS Word formats. Light curves, images etc. may be submitted in any of the popular formats. Please make the font size for X & Y axes on light curves large enough to be easily read.

Deadlines for contributions are the 15th of the month preceding the month of publication. Contributions received after this date may be held over for future Circulars. Circulars will be available for download from the BAA and BAAVSS web pages on the 1st day of March, June, September and December.

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Deadline for the next VSSC is February 15th, 2019

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