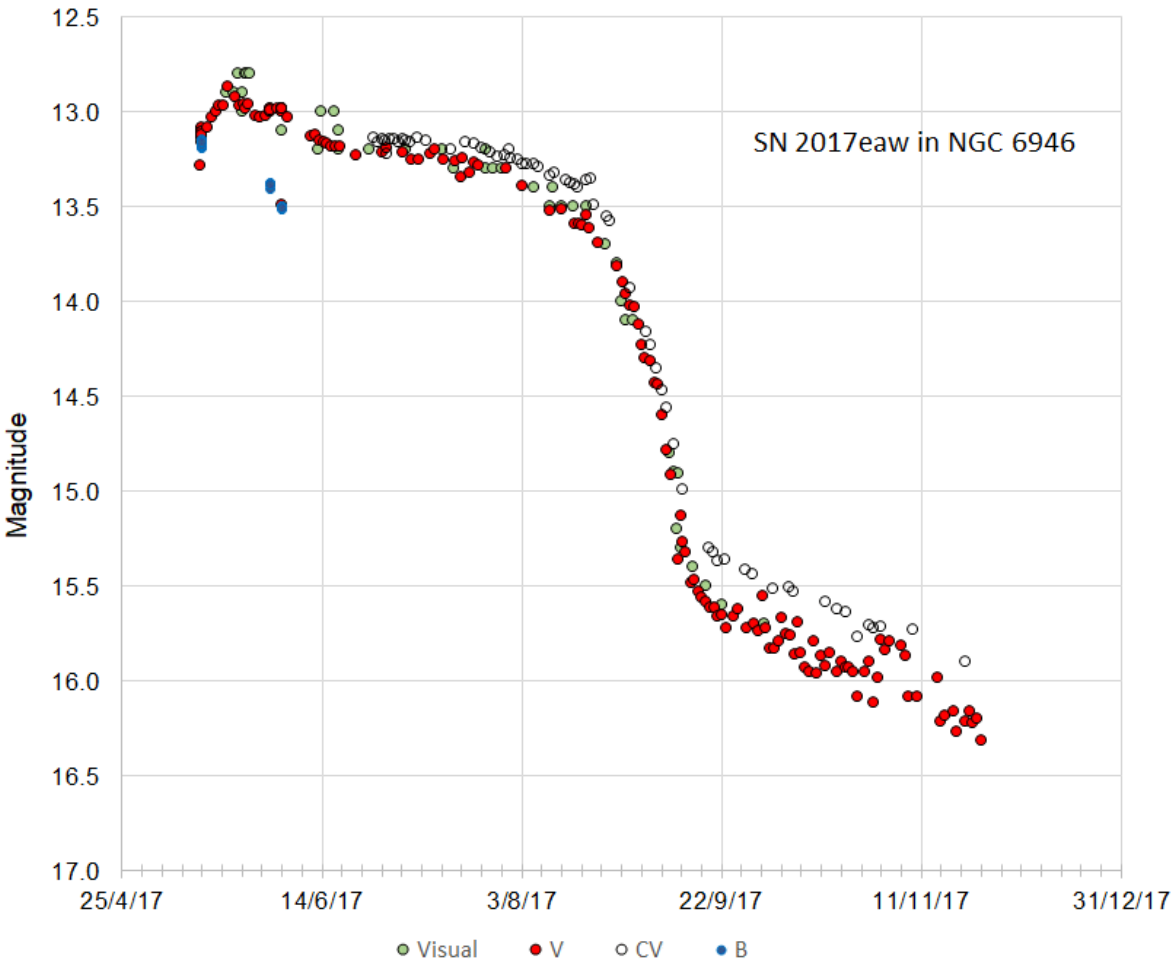
The British Astronomical Association

Variable Star Section Circular

No. 174 December 2017



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Contents

Cover Light curve: SN 2017eaw, May 14-Nov 26, 2017. *BAAVSS on-line database*

Editorial — *Gary Poyner*

Welcome to VSSC 174, and what an interesting and varied Circular we have this quarter. My thanks to all contributors for their excellent work, and especially for getting the articles and graphics to me in good time. Please keep it up!

Our cover light curve shows BAAVSS data for the interesting type IIP Supernova 2017eaw in NGC 6946 – the tenth supernova observed in this galaxy. Discovered on May 14.24 UT by Patrick Wiggins at magnitude 12.8C, the supernova is still visible around magnitude 16 at the time of writing – some 200+ days after discovery. Remarkably Martin Mobberley has reported V-band observations from remote observing sites on 117 nights during this period, with his first being on the same day as the discovery was made. Much emphasis is often given to the discovery of Supernovae (and Novae), with perhaps less attention given to the continued monitoring of transients for as long as possible after the event. It's good to see BAAVSS observers actively monitoring this Supernova for this extended period!

The winter period looks as if it will be an interesting time to be a Variable Star observer, with plenty to keep our eyes on over the coming months – R CrB in the morning sky (what will it do next?), the maximum of Mira around January time following its near record minimum at the end of September, and hopefully increased monitoring of the Blazar OJ287 during its current very low state (see page 21), and a whole lot more besides. Don't forget this is the place to write about your VS activities, whether it be with naked eye, binoculars or telescopes either visual or CCD. Tell us all about it!

Finally, some good news for CCD photometrists! Dave Boyd reports that his recent correspondence with publishers Willmann Bell regarding a new release for the popular photometry software AIP4WIN has proven timely. The software is now available for purchase again (v2.4), and details can be seen here. Good news indeed!

From the Director — *Roger Pickard*

VSS CIRCULARS

I hope you like the new PDF version of the Circulars? I've received some encouraging replies, so it would seem that, like me, you feel Gary has done a fine job.

JOHN TOONE & Z Cam

Back in September, John Toone wrote: -

"Tonight, I made my 4,000th observation of Z Cam which is the star I monitor most frequently. The first observation was made on the 23rd March 1982 which was 12,956 nights ago, so since then I have observed Z Cam on nearly 31% of all nights (including many away from home when I was unable to observe). My best month was April 2007 when I secured observations on 23 nights. Being circumpolar helps but it is a bit of a challenge in the C8 when at minimum in moonlight.

Incidentally, at the end of August I was 3 short of the Z Cam milestone and I found myself in a race with James Anderson (another product of Lancashire) who needed 3 wickets to reach the coveted

milestone of 500 test wickets. I lost that race!! [Melvyn would have appreciated the cricket reference]". Congratulations to John on another remarkable achievement.

REVISED VS STAR CATALOGUE 2017.1

Following the announcement in the last VSS Circular (No. 173 for September 2017) about extensive changes to the current Telescopic and Binocular Programmes, which are now to be called "Pulsating Stars" and "CV's and Eruptives" Programmes, the new revised Catalogues will be uploaded to the website at the end of the month (December)'. In summary, the changes to the CV's and Eruptives Programme are…

FR Sct and RZ Vul moved to pulsating stars programme

Dropped: - CG CMa, CG Dra, CP Dra, T Pyx, V745 Sco, V443 Sct, V1017 Sgr, V1172 Sgr and V3645 Sgr. Of course, we will still be happy to accept observations of any or all of these stars, it's just that they will no longer form part of the Main Programme.

Added: - ES Aql, V1057 Cyg, AO Her, V1117 Her, V742 Lyr, TCP J18154219+3515598 (Lyr), V476 Peg, RR Tau and NSV 2026 (Tau).

Also included are the five ROP stars ASASSN-15po (And), ASASSN-15ax (Her), ASASSN-14jv (Lyr), V529 Dra and SDSS J172929.47+005404.3 Oph as they had not been added to the previous programme.

The entire Polar Programme has been removed as this has now ended, but V884 Her has been retained within the CV&E programme as this is a particularly interesting star.

WINTER MIRA'S

M= Max *m*= min.

R And	*m*=Feb/Mar
W And	*M*=Feb/Mar
RW And	*M*=Dec
R Aql	*M*=Nov/Dec
R Aqr	*m*=Jan
X Cam	*M*=Feb
	m=Nov/Dec
SU Cnc	*M*=Feb
RT CVn	*m*=Jan/Feb
R Cyg	*m*=Dec
o Cet	*M*=Jan
T Dra	*m*=Jan/Feb
SS Her	*M*=Jan/Feb
W Lyn	*m*=Dec/Jan
X Lyn	*m*=Jan
R Ser	*m*=Jan/Feb
T UMa	*M*=Feb

Source BAA Handbook

Other changes. The "R" in the former Recurrent Objects programme, has been removed as each of these objects has been flagged as an 'alert when in outburst' star.

The range and type of the CV&E stars have been checked against the AAVSO "VSX" and updated accordingly.

Additions to the Pulsating Stars programme

30 New under observed stars suitable for binoculars (although a number require larger 80mm+) have been added. V370 And, RU Aqr, TU Aur, TW Aur, V428 Aur, DK Boo, FG Boo, RS Cam, RV Cam, T Cnc, V770 Cas, GN Dra, Z Eri, VY Eri, BM Eri, BR Eri, VY Hya, EY Hya, FF Hya, Z Leo, FY Lib, V352 Ori, PV Peg, SW Per, RT Psc, Y UMa, RZ UMa, FY UMa, IW Vir and V336 Vul. Also, pulsating stars from the former ICCE and telescopic programmes, (FR Sct and RZ Vul are now catalogued as type, L+EA and RVB respectively) have been transferred to the Pulsating Stars programme

In addition, many Mira and SR variables which were previously on the Sections program, and for which we have a database of several thousand estimates have been reintroduced. The majority of these stars can be observed whilst near maximum using binoculars. S Aql, R Ari, R Aur, X Aur, R Boo, S Boo, R Cam,

R Cas, S Cep, T Cep, U Cyg, R Gem, S Her, T Her, R Leo, R Lyn, W Lyr, RY Oph, R Peg, X Peg, R Per, V Tau, R Tri, R UMa, S UMa, R UMi, S UMi, S Vir and R Vul.

UW Dra and RX Vir have both been dropped from the VSS observing programmes as both are listed as constant in the current VSX catalogue.

Do take some time to study the new programmes as I'm sure you'll find some interesting new stars listed there.

Also, a reminder that the Pulsating Stars Programme is maintained by Shaun Albrighton and the CV's and Eruptives Programme by Gary Poyner.

UPLOADING OBSERVATIONS TO THE VSS DATABASE

It would seem that, at the moment, very few observers are uploading their observations either nightly or even weekly to the VSS Database, deciding for some reason to leave it to the end of the month or even later - or more probably sending their Spreadsheet to Bob Dryden to upload for them.

This has the effect that the Database is never up-to-date, always being at least a month or longer behind the current time. Consequently, when there is a need to check for the latest observations, the AAVSO Database has to be consulted instead as that is always up-to-date.

Another downside is, of course, it makes it very difficult to produce current light curves for the web page and also for the person doing the Sky Notes for the BAA meetings. Our Secretary, Bob Dryden, already has quite enough to do without uploading observer's observations who are more than capable of doing it for themselves. So, please bear in mind our poor Secretary as well as those Officers who are trying to produce up to date information for whoever may need it. Thanks for your help.

DIRECTOR REACHES 50 YEARS OF SUBMITTING OBSERVATIONS TO THE VSS

During a recent email exchange with Ian Miller, he added "By the way, hearty congratulations on reaching the '50 years of submitted observations landmark' in the Section's database. A quick check did indeed reveal that in October 1987 I had made my first VS observation! This was of W Cas on 7th October 1967 at 21:36 when I made it mag 9.6. It seems a very long time ago!

LISA spectrograph available

BAA member Andrew Smith, one of our more advanced spectroscopists, has very kindly donated a LISA spectrograph to the BAA for the Association to use in support of its initiative aimed at encouraging members to take up spectroscopy. We are looking to lend the spectrograph to people who have suitable projects in mind.

This is a sophisticated instrument capable of a wide range of variable star projects. It would for example make a nice step up for those already using an Alpy or Star Analyser, or offer a good opportunity for an experienced photometrist to become involved in spectroscopy. The LISA comes complete with a guide camera but no imaging camera. It is a reasonably heavy spectrograph, especially when combined with both imaging and guide cameras, requiring a solid telescope mounting and robust focuser. So, any applications should demonstrate that your existing equipment is capable of handling the weight, and you should already have an appropriate imaging camera, typically a mono chromatic CCD.

Those with a track record in spectroscopy and who have been submitting to the BAA Spectroscopy Database will be considered favourably, as well as experienced photometrists who submit their observations to the BAA VSS Database. All spectra taken with the LISA will need to be fully processed and submitted to the BAA Spectroscopy database. The results should also be written up and submitted to either the VSSC or the BAA Journal.

Any application for the LISA needs to be based around a good variable star project that would suit the LISA and the duration of the project should also be specified. This should include time to get familiar with the LISA, and spectroscopy processing software for anyone who is new to the subject. The following projects are intended as suggestions which could be used as the basis for the application, while all good project ideas will be considered.

- Spectroscopic monitoring of Mira stars over a pulsation cycle.
- Intense observations of bright novae to monitor their changing spectra over the duration of an outburst.
- Observations of Young Stellar Objects such as T Tauri and Herbig Ae stars. Monitoring these stars to see if changes in their spectra are visible over various time periods.
- Searching for Be stars.

If you are interested in borrowing the LISA spectroscope you are invited to submit your proposal to Roger Pickard by 31st January 2018. David Boyd, who already owns a LISA, will be happy to advice on suitability of equipment and to offer support to whoever uses it, as will Andy Wilson.
The applicant must be a member of the BAA VSS and have some experience in using a spectrograph or performing photometry.

Roger Pickard, David Boyd & Andrew Wilson

Chart News — *John Toone*

The following new charts are now posted to the VSS web site and are available in paper form from the Chart Secretary:

Telescopic Stars

338.02 T Cep
The 8 and 2-degree field charts replace chart 338.01. The only change from the previous charts is that comparison star L which was previously misidentified has been corrected.

353.01 GSC 1992 447 Com
No previous BAA VSS chart existed for this star which was confirmed to be variable in 2017 (see BAA VSS Circular 173, page 7). A 3-degree field chart has been drawn which includes a sequence from Tycho 2 Vj and APASS photometry.

349.01 R Leo
New 5 degrees and 1-degree field charts have been drawn. The sequence consists of HD, Tycho 2 Vj, Hipparcos Vj and APASS photometry. Previous VSS charts for R Leo range from EEM 1906 May 17 to JEI 1972 July. All previous sequences had adopted HP magnitudes which were not linear (too bright) at the faint end.

350.01 R Lep

No previous BAA VSS chart existed for this very red (known as Hind's Crimson Star) Mira star. 3 degrees and 1-degree field charts have been drawn and the sequence is drawn from HD, Tycho 2 Vj, SRO and APASS photometry.

351.01 T Tau

New 3 degrees and 1-degree field charts have been drawn. The sequence consists of Tycho 2 Vj and BSM NM measurements. Previous VSS charts for T Tau were JSG 1969 May and JEI 1974 Feb that had identical sequences largely aligned with the AAVSO sequence.

Binocular Stars

347.01 VV Cep

No previous BAA VSS chart existed for this long period eclipsing binary which is Variable Star of the Year in the 2018 BAA Handbook. A 6-degree field chart has been drawn which includes a sequence from Hipparcos Vj.

348.01 FY Lib

No previous BAA VSS chart existed for this star which has shown enhanced activity since 2014 (see BAA VSS Circular 163, page 18). A 6-degree field chart has been drawn which includes a sequence from Tycho 2 Vj.

295.02 BQ Ori & Y Tau

This 9-degree field chart replaces chart 295.01. Comparison star W has been amended from 6.6 to 6.7 on account of its colour compared with the rest of the sequence. Some cosmetic changes have been implemented in the vicinity of BQ Ori at the request of Tracie Heywood.

Thanks are due to Rod Lyon who drew the charts for T Cep, R Leo, R Lep & T Tau.

First Announcement

Joint BAA-AAVSO meeting, July 6-8, 2018, Warwick University

The hunt is on for the next eruption of an elusive Recurrent Nova

David Boyd

Located towards the north-east end of the Andromeda Galaxy, the nova M31N 2008-12a is intriguing professional astronomers. It is the most rapid recurrent nova discovered so far with a recurrence period of about one year, and possibly less. It is believed to consist of the most massive white dwarf so far found in a cataclysmic variable which is accreting matter at a very high rate from a red giant companion. With 1.38 solar masses, the white dwarf is close to the Chandrasekhar Limit. If it is a CO (carbon-oxygen) white dwarf, when it reaches that mass it is likely to explode as a type 1a supernova. Normally around 24th magnitude in quiescence, eruptions cause the star to brighten to around 18th magnitude for only a few days, well within reach of amateur telescopes.

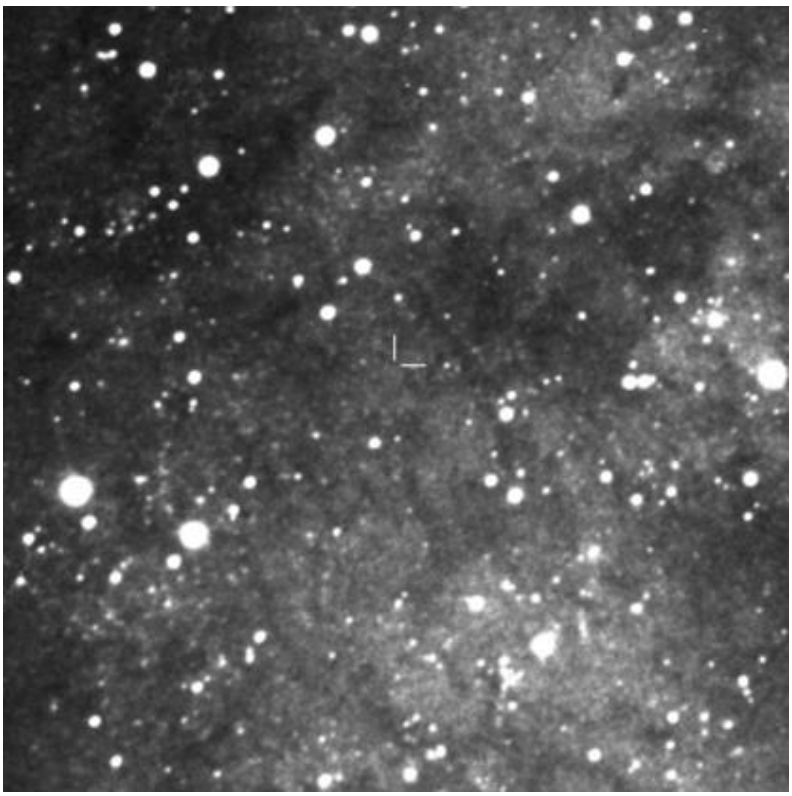
In order to catch the next eruption at the earliest opportunity, professional astronomers have established a global network of amateurs to image the field every clear night and alert them immediately so that a wide range of ground and space-based telescopes can be deployed to observe the eruption across the electromagnetic spectrum. Observations of upper limiting magnitudes for non-detection of the nova are being sent to the AAVSO database which is acting as the central data collection hub for the project.

I was fortunate to be one of the few amateurs who managed to image the last eruption in December 2016 during its brief appearance. Previously I had imaged the field and reported *fainter than* observations on over 50 nights that summer and autumn. The next eruption is predicted to occur sometime around now (November/December 2017). So far, I have imaged the field on 23 nights without success. I use a 0.35m SCT to record around 30 x 60 sec unfiltered exposures which are stacked using Astrometrica. I report the magnitude given by Astrometrica for the faintest clearly identifiable star in the vicinity of the nova on the stacked image as an upper limit. On a clear moonless night, I can detect stars fainter than 20th magnitude. The stacked image (below) of 37 mins taken on November 8th shows stars down to around mag 20.5. The position of the nova at RA 0h 45m 28.81s Dec +41° 54' 9.9" is indicated.

Many papers have now been published on this unusual object. There is a good short introductory paper by Matt Darnley summarising our current knowledge here

AAVSO Chart / VSX

M31N 2008-12a during outburst December 14th, 2016 at mag. 19.7C. 8x60 second exposures under full Moon conditions. *D. Boyd*



M31N 2008-12a November 8th, 2017 *D. Boyd*

The microlensing event TCP J05074264+2447555

Christopher Lloyd

On 2017 October 31 Tadashi Kojima of Gunma-ken, Japan, reported the discovery of a new transient on three frames taken using a Canon EOS 6D + 135-mm f3.2 lens with a limiting magnitude of 13.0C [1]. This particular star had been seen on 2017 September 2 at m = 13.0C and then again on October 25 at m = 11.7C and by October 31 it had brightened to m = 10.8C. Even at the time of discovery the transient was already known to have a relatively bright precursor which appears in all the major astrometric and photometric catalogues, the principal ones being GSC 01849-01566, UCAC4 574-013830, 2MASS 05074272+2447564 and SDSS J050742.71+244756.2. It also has APASS photometry [2] giving V = 14.09(9) and B-V = 0.91(10). The transient was nevertheless treated as a probable CV and given the working name of TCP J05074264+2447555 (CV:) by the CBAT [1]. The field around the transient is shown in Figure 1 with the left panel showing the DSS image and the right panel an image from the night of November 1/2

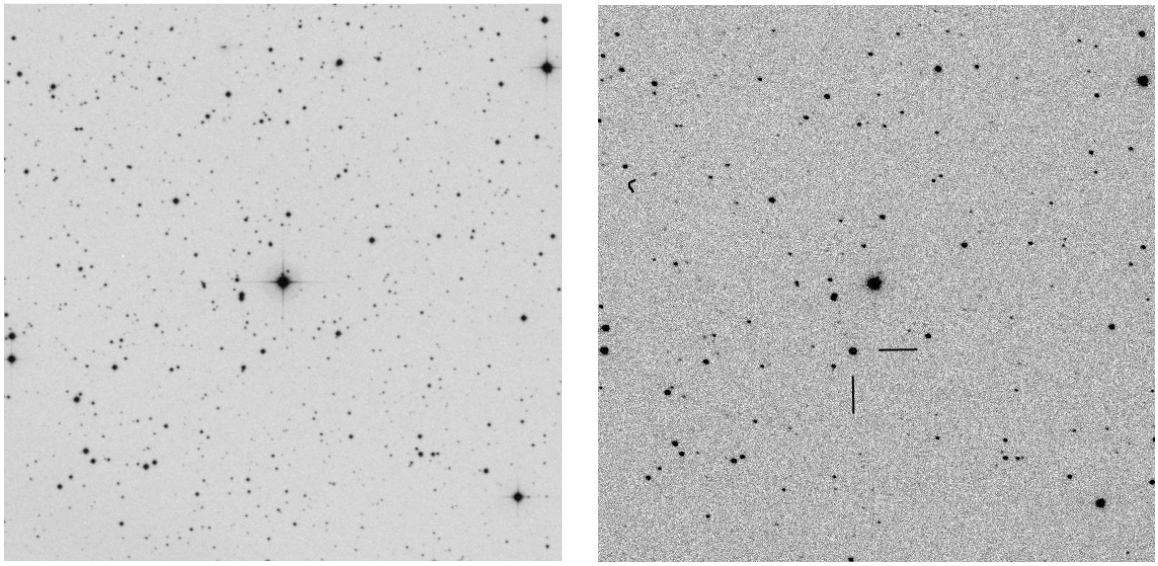


Figure 1a (left). The DSS B+R image taken in 1951 with the transient at magnitude ~ 14.1. Figure 1b (right). An image taken on the night of November 1/2 (JD = 2458059.6) showing the transient at m = 11.25CV by Nick James using a 28-cm SCT with an unfiltered KAF-6303 CCD.

Crucially on the same night as the discovery announcement Munari [3] reported that a spectrum he had just taken of the star showed nothing unusual, “Just a normal absorption stellar spectrum.”, which is not what would be expected of a potential CV. Even at this time it was becoming clear that the shape of the light curve strongly suggested that the transient was a microlensing event rather than a CV outburst and so within hours of discovery it had gone from a potential CV to a much more rare microlensing event with an albeit approximate predicted light curve [4]. These events have a very specific shape and once the basic parameters have been established the light curve should follow a predictable profile. Over the following days the photometry continued to support this interpretation, although the maximum was a day or so earlier and significantly fainter than initially thought, further spectra taken in the days after maximum by Leadbeater [5] and Berardi also confirmed that the star was an apparently normal F5 dwarf with reddening $E_{(B-V)}$ ~ 0.4 (see the ARAS Spectroscopy Forum page for details [6]).

Using the publicly available data from the ASAS-SN project [7], the AAVSO [8] and BAAVSS [9] archives the light curve as of November 14 is shown in Figure 2a with detail of the maximum in Figure 2b. The light curve shows the characteristic slow rise accelerating to a sharp maximum and then a symmetrical decline. The shape of the profile is basically determined by two parameters, the amplification or magnification of the lensed light source and the width of the profile, which is determined by a combination of the mass of the microlens and the relative velocity of the source and microlens across the line of sight. In addition, the unlensed brightness of the source and the time of maximum are required to fit the profile to the data. Given the limited number of free parameters the fit to the data is remarkably good. All the relevant theory is given by Gould and papers referred to there [10].

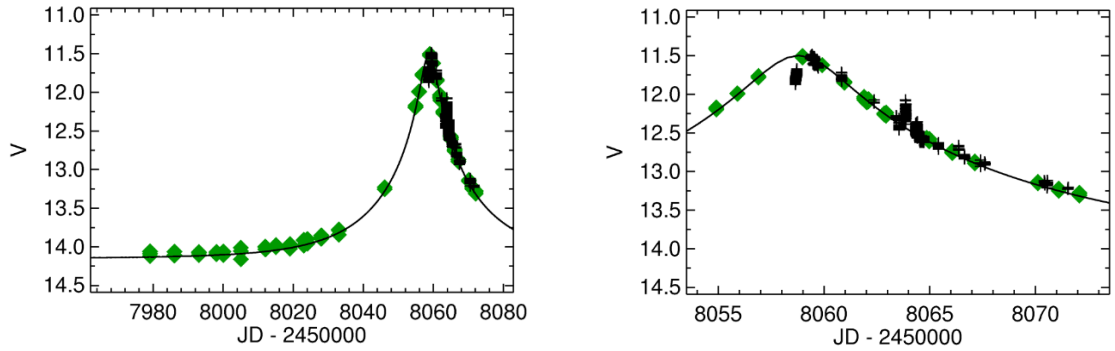


Figure 2a (left) The light curve of the microlensing event from mid-August to mid-November. Green symbols are from the ASAS-SN project and the others are *V* or *CV* time-series data. No offsets have been applied to the different data sets. The line is the fit to the data and is only marginally changed from the initial fit before maximum [e]. Figure 2b (right) The detail of the maximum which occurred on November 1/2.

The product of the microlens mass and the relative transverse velocity of the microlens and source can be used to construct the Mass-Distance diagram from which a likely figure of the microlens mass can be estimated. Firstly, the distance to the lensed star needs to be found. As it has $V = 14.1$ and assuming it is a normal F5V star then $M_V \sim 3.4$ and $(B\text{-}V)_0 \sim 0.44$. With a reddening of $E_{(B\text{-}V)} \sim 0.4$ this produces an observed $B\text{-}V \sim 0.85$ which is consistent with the observed value of 0.9. Taking the ratio of total to selective absorption, $R_V = 3.1$ then the total absorption in V, $A_V \sim 1.24$, then using the standard distance modulus relation, $m_V\text{-}M_V = -5+5\log(D)+A_V$ gives a distance of ~ 800 parsec. The canonical value of interstellar extinction is $A_V \sim 1$ magnitude/kpc so on this basis the extinction looks rather high but given the vagaries of interstellar material these approximate figures are relatively consistent.

Figure 3 shows the Mass-Distance diagram for the microlensing event for the likely range of relative transverse velocities. The most likely microlens mass is found by choosing the most likely distance to the microlens and the most likely transverse velocity. The shape of the curves come about because more mass is needed to produce the same effect near the source and near the observer, so mostly the microlens mass has only a small dependence on distance. The transverse velocity has a significant effect and probably lies in the region of 40 $km.s^{-1}$ but with a very wide uncertainty. With Gaia it should be possible to narrow down the space motion of the source but that of the microlens will remain in the realm of conjecture. Nevertheless, it seems most likely that the microlens is a low-mass star rather than a brown dwarf. An upper limit on the luminosity of the microlens itself would require very high-quality photometry and spectra taken when the event is over, but it could rule out more massive (> 1 M_{SUN}) normal stars.

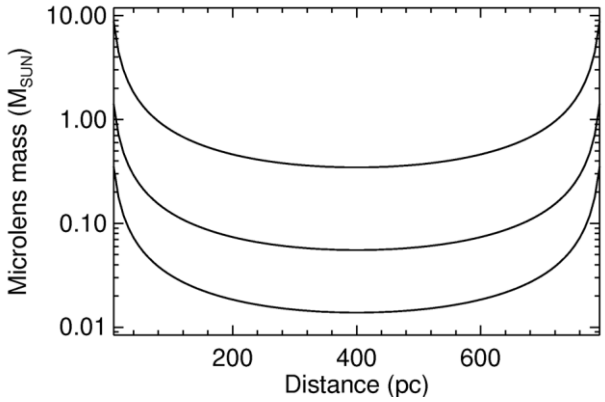


Figure 3. The Mass-Distance diagram for TCP J05074264+2447555 assuming a distance of 800 parsec to the source. The three lines correspond to relative transverse velocities of 50 (top), 20 and 10 km.s^{-1}. The most likely velocity probably lies between the upper two values which puts the microlens mass in the realm of normal low-mass stars rather than that of brown dwarfs.

For amateurs there is one encouraging aspect to this event and that is that despite the resource of the professional community this event was discovered by amateurs. The most likely project to have discovered this event is the ASAS-SN network which although nominally searching for supernovae has discovered some 350 new transients so far in 2017 including 107 supernovae. The ASAS-SN data form the backbone of the light curve in Figure 2 but the event, although captured, was presumably too slow to trigger an alert. That is unlikely to happen again.

The setup used in this discovery is a good quality digital camera and a modest telephoto lens. It is essentially a modern equivalent of the UK Nova Patrol Programme [11] and other similar surveys of the 1990s, and has been very successful with discoveries of several CVs. There is still a place for this type of search patrol.

References

[1] CBAT Transient Object Follow up Reports TCP J05074264+2447555
[2] Henden, A. A., et al. 2016, VizieR Online Data Catalog NASA/ADS VizieR
[3] Munari, U., BAAVSS-Alert 4817
[4] Lloyd, C., BAAVSS-Alert 4819, 4820 and 4821
[5] Leadbeater, R., vsnet-alert 21563
[6] ARAS Spectroscopy Forum TCP J05074264+2447555
[7] ASAS-SN Project Web site
[8] AAVSO Data download
[9] BAAVSS Online database
[10] Gould, A., ApJ, 606, 319 – 325 (2004) NASA/ADS
[11] Hurst, G., J.BAA 114, 155 – 157 (2004) NASA/ADS

Recovering George Alcock's observations of his first three Nova discoveries

Tracie Heywood

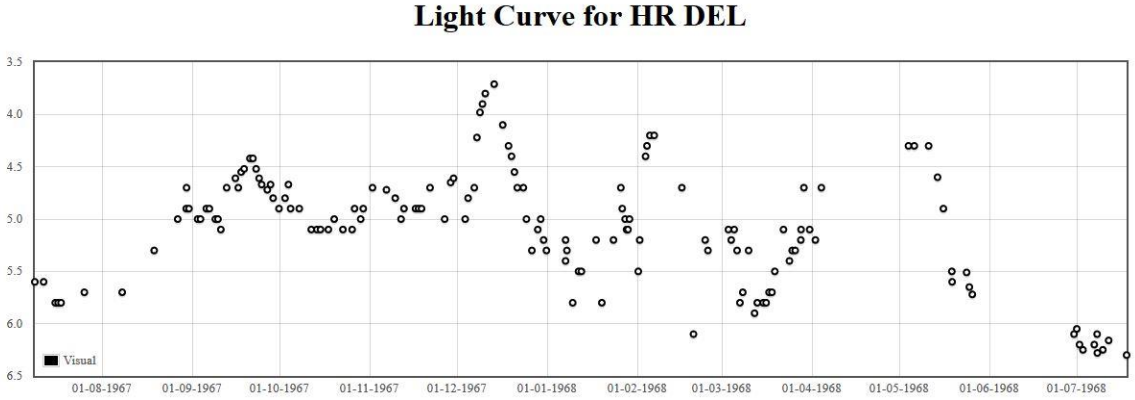
In his talk at the joint meeting of the BAA VSS and *The Astronomer* (TA) magazine in October 2012, Roger Pickard flagged the sparsity of George Alcock's observations of his own nova discoveries in the BAA VSS database.

Although there were 72 observations of Nova (HR) Delphini 1967 by Alcock, these only covered the period from late August 1967 to early January 1968. In particular, there were none covering his discovery of the nova in early July or its behaviour over the following six weeks. For his next two novae, Nova (LV) Vulpeculae 1968 No 1 and Nova (V368) Scuti, the situation was even worse with the database containing none of his observations. Indeed, closer inspection showed that there were no observations of these latter two novae by any observer.

Tracking down the missing observations of these novae after several decades might seem unlikely, but there was a possible partial solution. The pages of *The Astronomer* magazine from these years contain many observations of these novae by Alcock and other observers. In most cases, these merely contain dates and magnitudes, and lack light estimates or sequence information. However, it is better to make use of these limited reports than to have gaps in light curves or no data at all.

Nova (HR) Delphini 1967

Having keyed in the TA data, Alcock's reported observations now total 148 and the interval covered now extends from his discovery observation, on 1967 July 8, through to 1968 July 18. The lack of later reports to TA may relate to his comment that his observations from late July "use a star not on the VSS sequence, and are unreduced". His updated light curve is shown below:



Symbol Key: **Crosses** = Negative observation, **Triangle** = Brighter than, Otherwise: **Circle** = Visual, **Diamond** = CCD, **Square** = Everything else

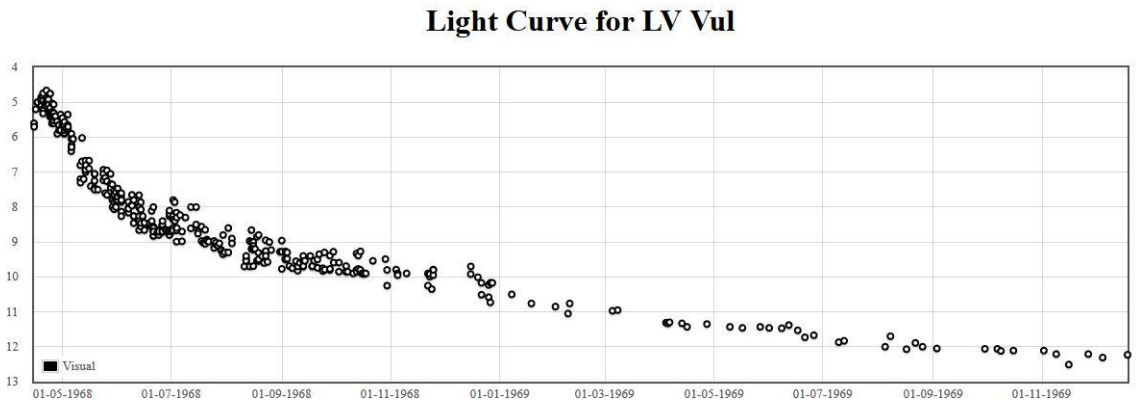
Contributors: G E D Alcock

As can be seen, gaps start to appear in spring 1968. The May and July issues of TA contained no observations from Alcock. Most likely he did make observations during the preceding month, but presumably did not report these to TA (or missed the deadline for submissions).

Closer inspection of the TA issues from these years revealed yet more HR Del observations that were missing from the BAA VSS database. These have now also been keyed in. Most intriguingly, many of these "missing" observations had been forwarded to TA by BAA VSS Director John Glasby!

Nova (LV) Vulpeculae 1968

As previously mentioned, the database contained no observations of this nova by any observer. Many that were published in TA during 1968 and 1969 have now been keyed in. The resulting light curve is shown below:



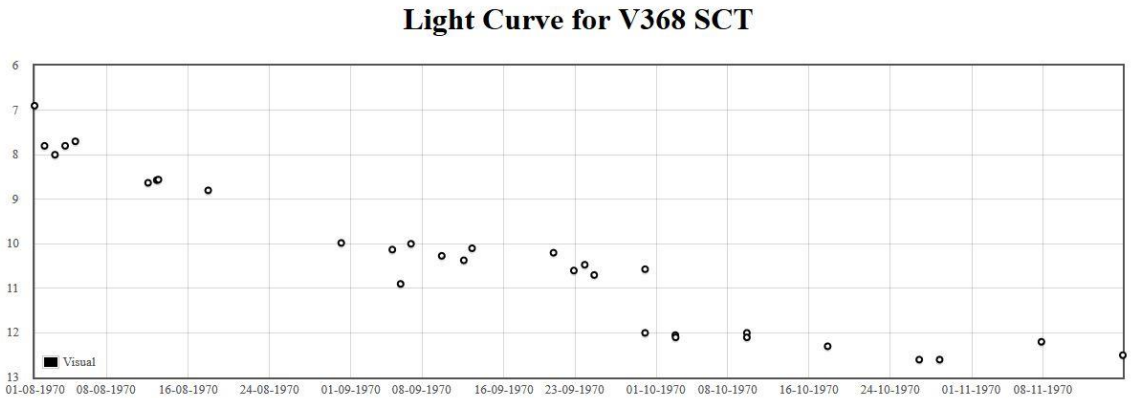
Symbol Key: **Crosses** = Negative observation, **Triangle** = Brighter than, Otherwise: **Circle** = Visual, **Diamond** = CCD, **Square** = Everything else

Contributors: G E D Alcock, B A Carter, A E J Forno, M French, M J Gainsford, J E Isles, O J Knox, R S Lomas, K J Medway, J Muirden

Alcock's reported observations total 52, but come to an end on 1968 July 26. This ties in with a comment he made in the 1968 September issue of TA, saying that he was unhappy with the comparison star sequence that he was using.

Nova (V368) Scuti 1970

This was the faintest of Alcock's novae and faded more quickly than the first two. Once again, no observations by any observer were present in the database, but it has been possible to retrieve some from the reports submitted to TA. Alcock's reported observations total six and cover the interval from his discovery on July 31 through to his final report on September 5. The resulting light curve is shown below:



Symbol Key: **Crosses** = Negative observation, **Triangle** = Brighter than, Otherwise: **Circle** = Visual, **Diamond** = CCD, **Square** = Everything else

Contributors: G E D Alcock, B A Carter, I D Howarth, A L Smith

Later Alcock novae

For Nova (NQ) Vulpeculae 1976, Alcock's only observation in the database is his discovery report from October 21, but there is good coverage by other observers. By 1976, the policy in TA had changed such that only daily means were published rather than individual observations. Hence, there is no scope for securing additional observations of this or later novae from TA.

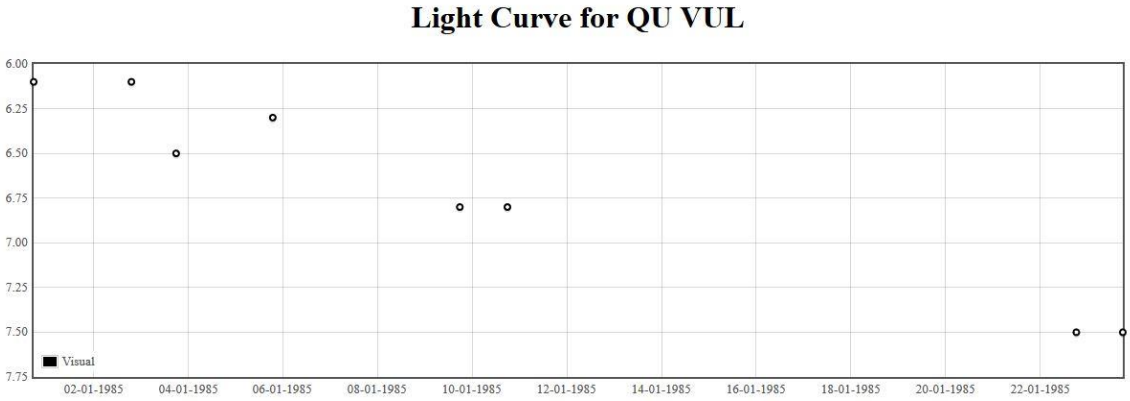
The database contains no observations by Alcock of his final discovery, Nova (V838) Herculis. The April issue of TA merely reports that Alcock discovered it as a magnitude 5 object in a twilit sky at 04:35 UT on 1991 March 25. The database does, however, contain nine observations by Gary Poyner and Martin Mobberley that document its very rapid fade.

Nova observations: can you fill in the gaps? *Tracie Heywood*

The coverage of historical novae in the BAA VSS database is rather patchy. Most novae from more than half a century ago have no observations stored. Notable exceptions are Nova (DQ) Herculis 1934, Nova (V533) Herculis 1963 and Nova (HR) Delphini 1967. Observations of other novae were certainly reported, however. The 1936 July JBAA, for example, includes a report on observations received of Nova (CP) Lacertae 1936, but it appears that none of these observations subsequently made it into the database. The situation improves with Nova (V1500) Cygni of 1975 and subsequent novae up to Nova (PW) Vulpeculae 1984 No 1 are well covered. For later 1980s novae, however, the position is rather varied.

Nova (QU) Vulpeculae 1984 No 2

This nova was discovered just before Christmas 1984, but the only observations in the database are a handful by Jonathan Shanklin from January 1985.

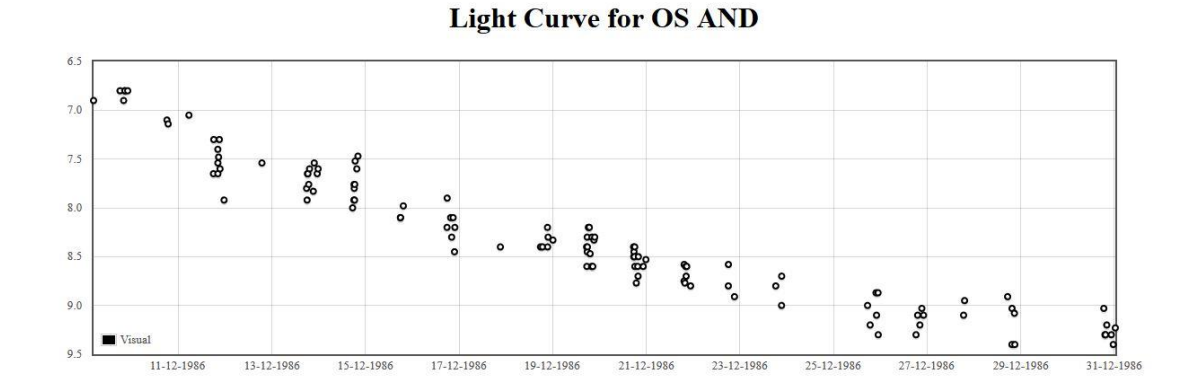


Symbol Key: **Crosses** = Negative observation, **Triangle** = Brighter than, Otherwise: **Circle** = Visual, **Diamond** = CCD, **Square** = Everything else

Contributors: J D Shanklin

Nova (OS) Andromedae 1986

Here, the coverage might seem quite good – but it ends suddenly on 1986 Dec 31. The nova did fade quite rapidly during the first week of 1987, but there were a good number of reports to TA that documented this fade. Thus, it seems probable that observations from early 1987 were submitted to the BAA VSS but later went astray.

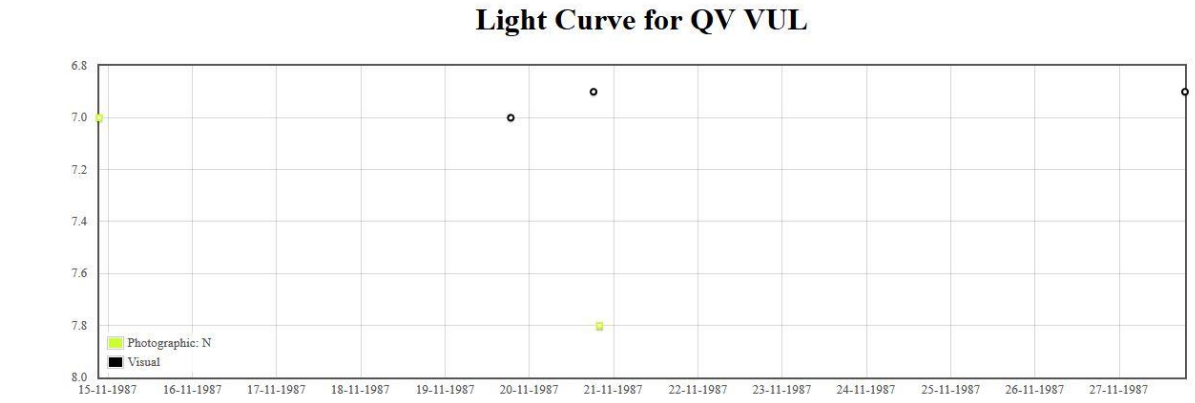


Symbol Key: **Crosses** = Negative observation, **Triangle** = Brighter than, Otherwise: **Circle** = Visual, **Diamond** = CCD, **Square** = Everything else

Contributors: S W Albrighton, L K Brundle, R C Dryden, R B I Fraser, J J Howarth, D Hufton, G M Hurst, A Hutchings, S J Lubbock, T Markham, M J Nicholls, G Ramsey, D Stott, T Tanti, M D Taylor, W J Worraker

Nova (QV) Vulpeculae 1987

Only four observations of this nova are present in the database.



Symbol Key: **Crosses** = Negative observation, **Triangle** = Brighter than, Otherwise: **Circle** = Visual, **Diamond** = CCD, **Square** = Everything else

Contributors: T Markham, M Mobberley

Do you have any observations of these novae that will fill in the gaps? If so, please do submit them.

Guy Hurst always encouraged observers to report their observations to the BAA VSS as well as to TA, so it shouldn't be the case that the BAA VSS was seen as being in competition with TA and "lost out". With newly discovered novae not obviously being part of the Main Programme or the Binocular programme, maybe there was simply no clear policy as to how such observations should be filed long-term?

The variability of GSC 01992-00447

Christopher Lloyd

In the previous issue of the Circulars John Toone [1] reported his discovery of a suspected variable GSC 01992-00447 which is listed in Simbad under BD+27 2152. His instincts and suspicions were correct but unfortunately the star is already listed as a suspected variable, NSV 19434 with a V magnitude range of 9.25 - 10.06 [2]. The star is also catalogued as a variable by the ASAS3 survey with a period of 92 days [3] although the VSX gives periods of 126 and 101 days [4]. The ASAS3 light curve is shown in Figure 1.

The spectral type of the star is given variously between M7 and M9, usually with no luminosity classification, but where this is given it is class III. However, these modern spectral types are derived from photometric fitting so there are probably no modern spectra of this star.

According to Simbad GSC 01992-00447 is a member of the open cluster Melotte 111 which lies at a distance of 96 parsec towards the North Galactic Cap. If the star is a member of this cluster then with V ~ 10.3 and m-M = 4.95 its absolute luminosity M_V ~ 5.5, which is ~ 10 magnitudes brighter than a late M-type dwarf, so something is clearly not right. On the other hand, if the star is a giant then M_V ~ 0 so then m-M ~ 10.3 and the distance to the star is just over 1 kpc. So far from being a member of the cluster the variable is most likely a halo giant.

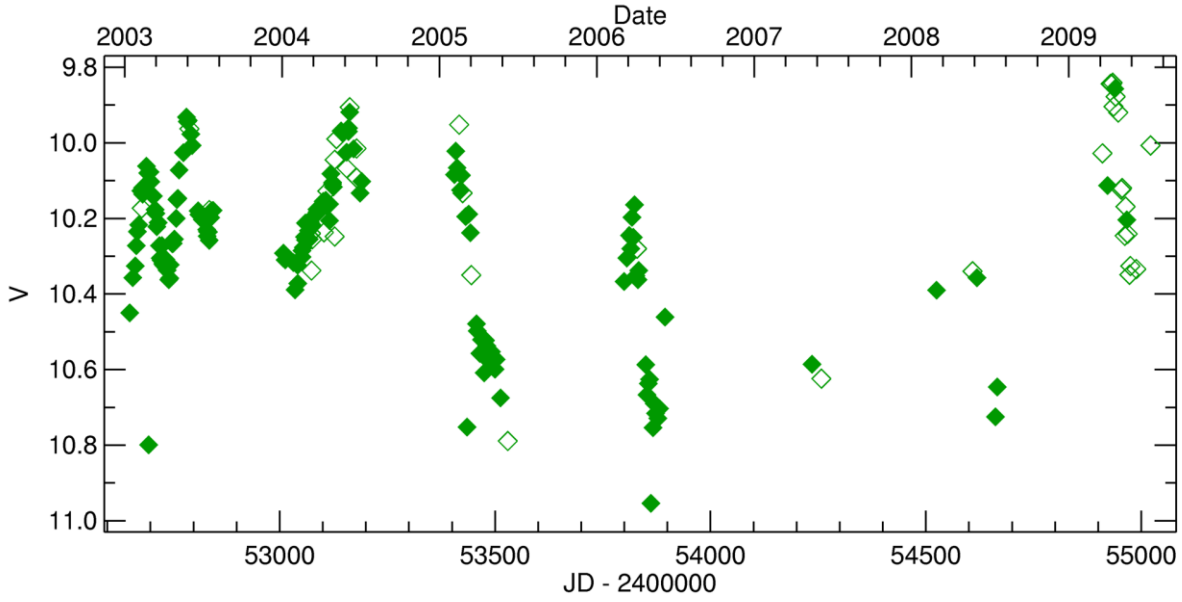


Figure 1. ASAS3 V-band light curve of GSC 01992-00447. The dominant period is ~128 days but there is coherent variation on both longer and shorter time scales. Open symbols are less reliable data.

References

BAAVSS Chart / VSX

[1] Toone, J., VSSC No. 173, 7, (2017)
[2] Kižla, J., Issled. Solntsa i Krasnykh Zvyozd No.16, 28 - 36, (1982)
[3] Pojmanski, G., Acta Astron., 52, 397 - 427, (2002)
[4] AAVSO Variable Star Index

HOYS-CAPS – Hunting Outbursting Young Stars with the Centre of Astrophysics and Planetary Science

Dr. Dirk Froebrich

The University of Kent runs the HOYS-CAPS citizen science project since October 2014. The aim of the project is long term, multi-filter optical photometric monitoring of young (age less than 10Myr), nearby (distances typically within 1kpc) star clusters or star forming regions visible from the northern hemisphere. There are no restrictions given to the participants in terms of observing cadence, target priority, field of view, integration times or filter selection. The data is being used to study star formation and the formation of (terrestrial) planets in the disks surrounding young stars.

The project currently involves about 10 amateur astronomers from the UK, as well as from Europe and is supported by some additional professional observatories. The participants take images of objects on our target list, perform a basic data reduction (flat-fielding and dark/bias correction) and submit these reduced images for inclusion into our database via our newly developed web- interface http://astro.kent.ac.uk/HOYS-CAPS/. This interface will soon also allow participants to plot and study light-curves of any star imaged by the project.

At the time of writing our target list contains 17 young clusters/regions as well as several additional targets selected from the Gaia Photometric Alerts http://gsaweb.ast.cam.ac.uk/alerts/alertsindex, some of which are within the 17 target regions. More than 3100 images have been taken for the project so far, with a total of about 960hrs of observing time. So far, the data has been included in one refereed paper, an Astronomers Telegram and a second paper is currently in preparation.

We are now aiming to increase the participation in HOYS-CAPS to a much larger number of amateur societies across the entire UK. Thus, if your society is interested in receiving a talk presenting in detail the scientific goals and results of this project and how to participate then please contact the PI (Dr Dirk Froebrich df@star.kent.ac.uk). We have secured travel funding from the University to support these talks, but would of course welcome a contribution to the travels cost in order to stretch the budget to as many talks as possible. We aim to give all these talks from April-December 2018. Hence, in your reply please let us know the following:

i) Name and location of your Society;
ii) ii) List of possible dates for the presentation;
iii) iii) Number of members and number of people who would attend such a talk;
iv) iv) Amount or fraction of the contribution your society would be able to make to the travel costs. We will aim to make a schedule for these talks during the early parts of 2018. The selection of societies we will visit will only depend on the available dates. We only request the number of members for dissemination and the potential financial contributions for planning purposes.

Thank you very much for your interest in this project.
Dr. Dirk Froebrich, HOYS-CAPS PI

Eclipsing binary news

Des Loughney

RT Andromedae

This system is described as an active eclipsing binary (1). It is classified as an EA/RS system. The reference does find evidence that it is an RS system with randomly occurring star spots which can be detected in the light curve. The system has had period jumps which may be related to mass transfer events. Although it is classified as an EA system because of the shape of its light curve the components are very close together. The period is only 0.63 days.

Below is the light curve as described in the 2000 paper (p171)

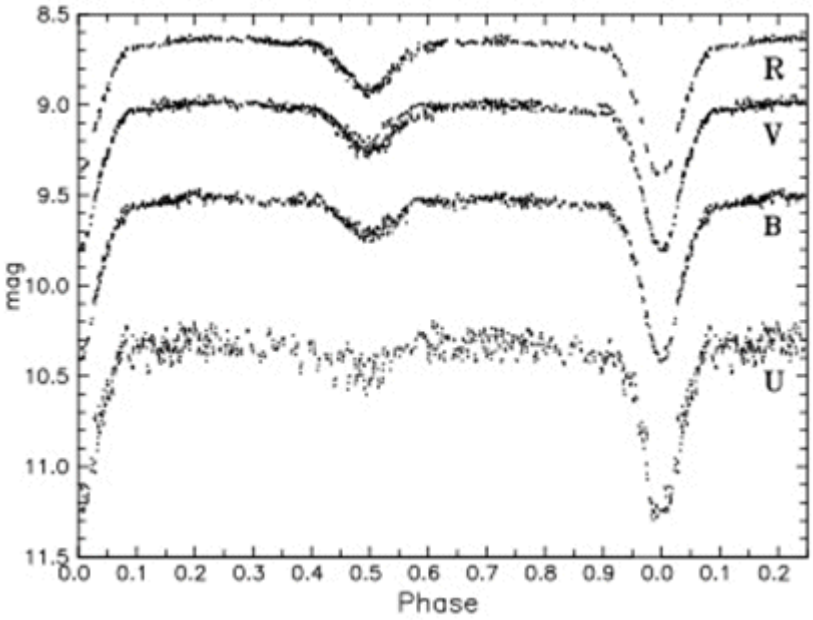
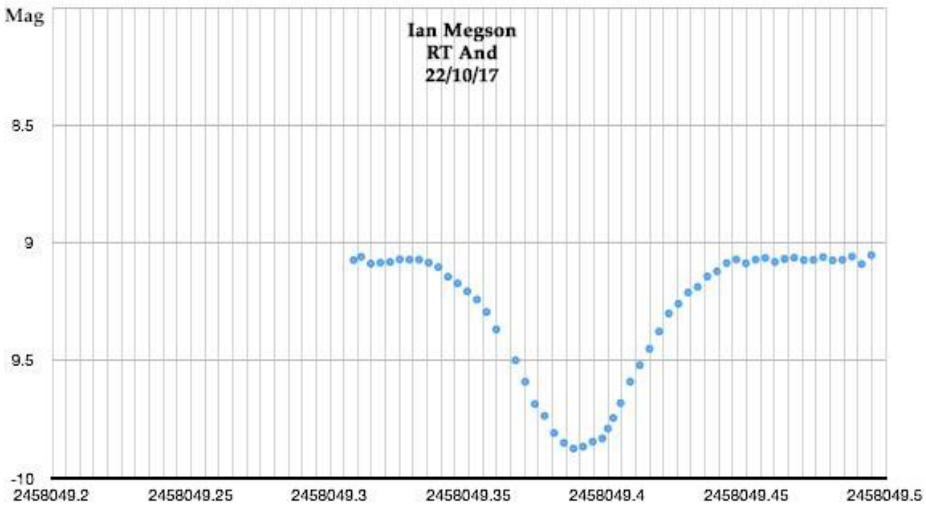


Fig. 1998 U, B, V observations at the Stara Lesna observatory, and B, V, R observations at the Skalnate Pleso observatory.

Ian Megson was able to obtain an excellent light curve, derived by CCD measurements, for the eclipse that occurred on 22nd October 2017. The bottom axis is HJD times.

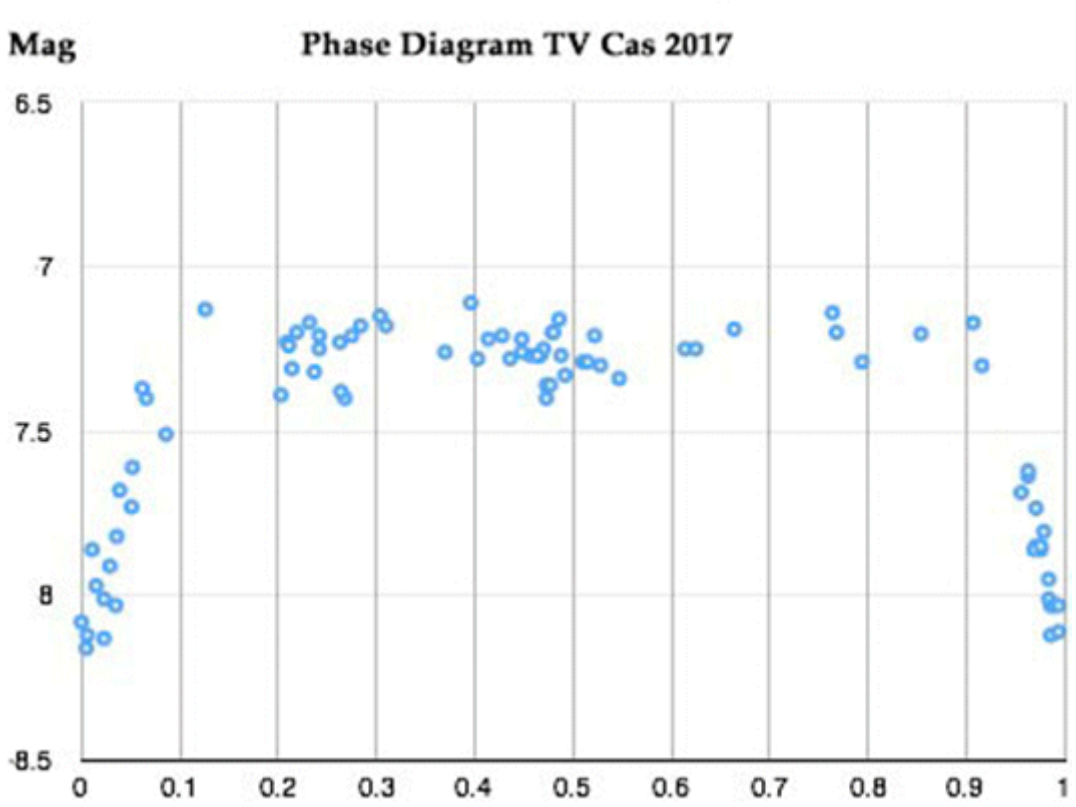


It can be seen that the 2017 light curve, around the time of the primary minimum, is similar to the light curve of 2000. The time of primary minimum seems to be more or less exactly as predicted by the Krakow database. This suggests that there have not been any recent jumps in period. CCD measurements should be able to detect any evidence in the light curve of star spots by studying the system out of eclipse.

TV Cassiopeiae

Here are my 2017 measurements of the EA/SD system TV Cas. The measurements were made with the DSLR Canon 550D camera plus a Canon 100mm lens using a 5 seconds exposure and settings of f3.2 and ISO800. Each dot represents the analysis of an image formed from stacking 20 images using AIP4WIN. The diagram shows that the time of the midpoint of primary minimum was as predicted using the latest elements from the Krakow database.

It had been hoped that the measurements would illustrate the secondary minimum which has an amplitude of 0.1 magnitude. It seems that this is too much to expect from measurements obtained from suburban Edinburgh at a height of 100 metres in generally windy conditions.



V766 Centauri

A letter to the editor (2) describes the supergiant eclipsing binary V766 Cen. The system consists of 27-36 solar masses red supergiant plus a close eclipsing companion which is also a supergiant but smaller than the other supergiant. They both seem to share an 'envelope'. The VLTI-Pioneer was used to image the system. Below is an artist's impression of the eclipsing system (from the Wikipedia entry). These two orbit in 1,304 days. To give you some idea of scale the primary star is the same size as the orbit of Jupiter.

The system contains at least 3 stars. The third is also a supergiant which is separated from the other two by about 35,000 AU. The system was originally thought to be a Rho Cas type of star which is a potential imminent supernova. Compared with Rho Cas the consequences of a supernova explosion would be even more spectacular given the likely effect on the other two companions.

References

[1] Active Eclipsing Binary RT Andromedae Revisited: Astron.Astrophys.326, 169-188 (2000).

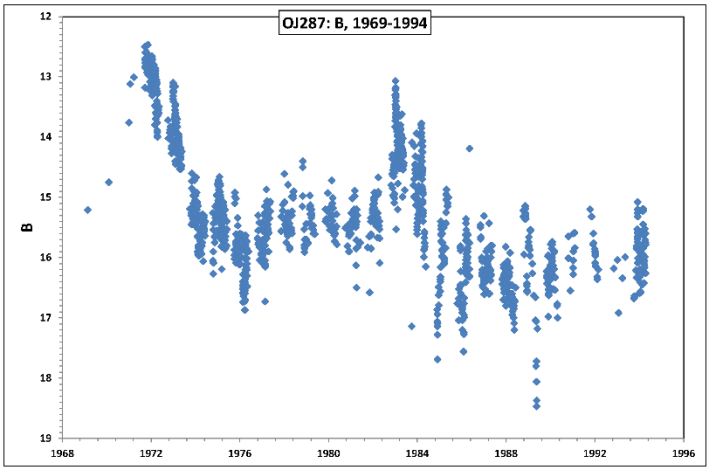
[2] Astronomy & Astrophysics Manuscript No 31569, September 28, 2017 'Multi-epoch VLTI-PIONIER imaging of the supergiant V766 Cen'.

For EB predictions and where to find them, see here

OJ287: A great test laboratory for relativity

Mark Kidger

When, in 1968, the astronomers at the Ohio Radio Survey first detected a quite weak source at 1415 MHz, they little-realised its significance. It was catalogued as "OJ 287" – "O" for Ohio, "J" to indicate that it was between 8 and 9 hours Right Ascension[1], "2" because it was in the strip of sky between declination +20° and +30° and "87" for the decimal hours of Right Ascension. First identified early in 1969 with a 15th magnitude object, it seemed to be just another typical quasar, save that it had a featureless spectrum: we know now that this is the case because the relativistic jet emitted from the poles of the accretion disk is well-aligned with our line of sight – effectively, the light of the clouds a few light years from the black hole where quasar spectral lines are emitted is drowned out by the brilliance of the central singularity, beamed at us like a lighthouse beam.

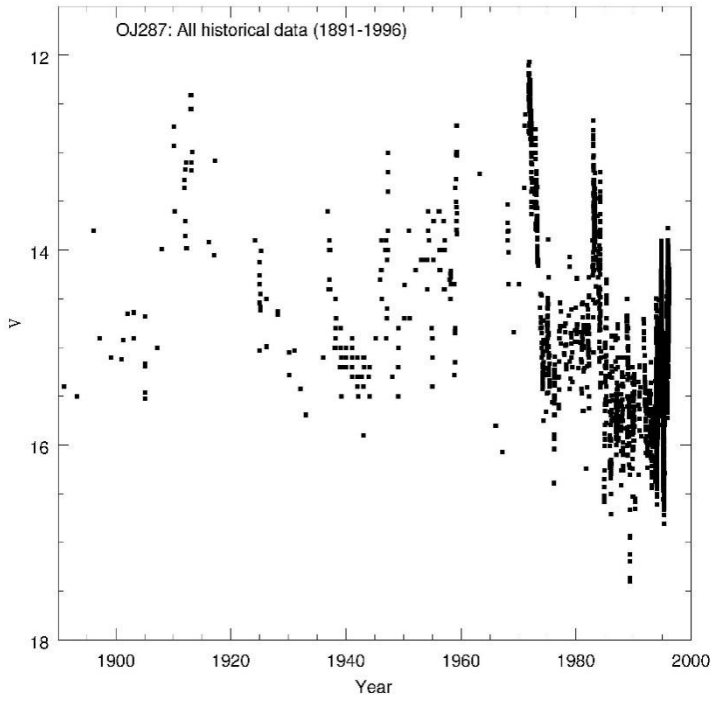


What drew attention to OJ287 was the observation made just after New Year 1971, that OJ287 had brightened considerably. This brightening continued until, by the Autumn, it had reached V=12.0, one of the brightest magnitudes ever measured for a quasar. It would not return to its pre-outburst brightness until almost the end of 1973. Astronomers started to get interested in this object, especially when various groups reported that it showed rapid variability with periods

[1] 0-1 hours was B, 1-2 hours was C, etc.

from 15-40 minutes found at different times in different studies; it became one of the most intensely observed sources in the sky. This revealed that OJ287 had an unusually large range of variability. In B, the natural band for (mostly) photographic historical photometry, the range of variability was from 12.5-18.5!

OJ287 was bright enough to have been observed hundreds of times by sky survey images since the late 19th Century, with the first known images taken as early as 1891. Looking at the historical series of data it was obvious that it showed multiple outbursts of 2-3 magnitudes that Mauri Valtonen at Tuorla in Finland noticed seemed regularly spaced and suggested that there was a period of ≈11.6 years.

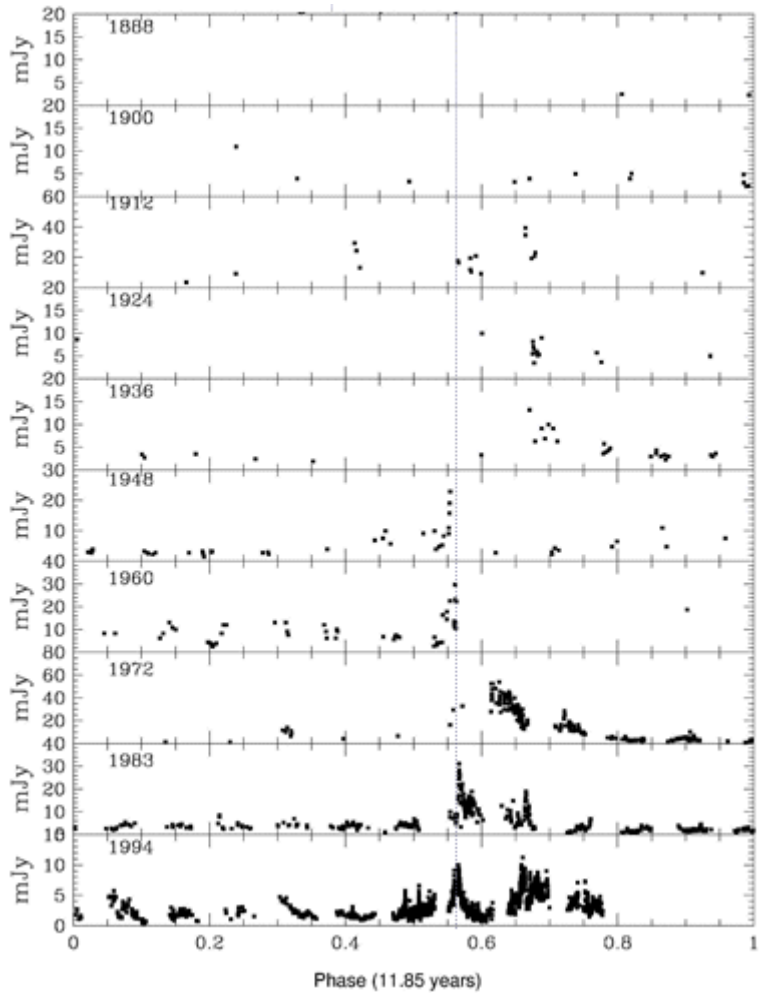


Any periodicity in an astronomical object suggests either a regular pulsation, rotation, or orbital modulation. This allows you to understand size, mass and/or the physical constants of the object.

Phasing the observations of OJ287 around a period of 11.85 years, we see something interesting: the outbursts in 1948, 1960, 1972, 1983 & 1994 line up just about perfectly, although we only see the start of the 1972 outburst. However, we do not see outbursts before 1948 when we would expect to. We can also see clearly, especially recently, that there is a second outburst approximately 18 months later, but these do not seem to line-up either.

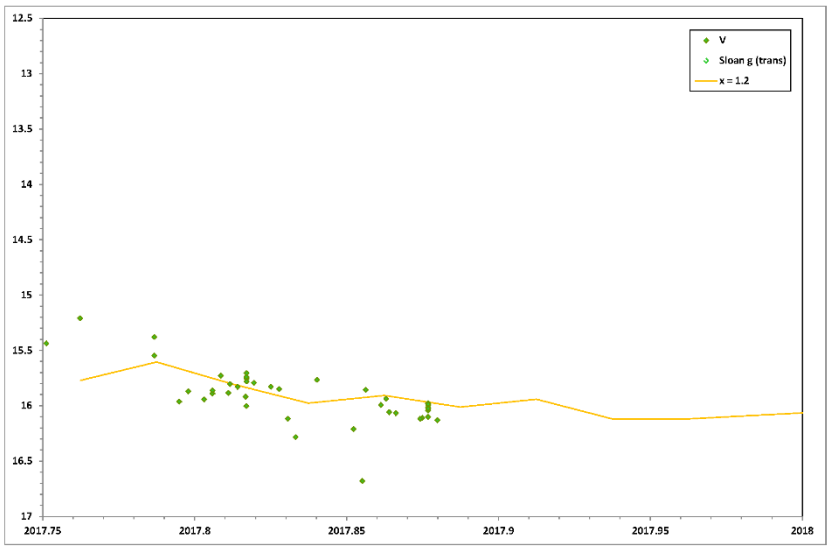
What is happening?

What Mauri Valtonen realised was that OJ287 is a (probably) unique object in which two supermassive black holes are orbiting each other in an eccentric orbit. When the secondary, with a mass of a mere 140 million solar masses, passes through the accretion disk of the primary (18.2 billion solar masses), which it does twice in each orbit at ascending and descending nodes, it sends a huge shower of material onto the primary, causing an outburst. Due to relativity, the system is precessing by 39° per orbit – the equivalent amount for Mercury's perihelion advance is 0.1" per orbit – so, approximately every 5 orbits, the precession reaches 180° and the phase of outbursts in the light curve flips. Mauri calculates that the light curve repeats approximately after about a century and exactly only every 900 years due to this precession. Modern light curve coverage has much greater density and superior quality, allowing the parameters of the system to be fine-tuned with each new outburst to the point that the maximum of the 2015 outburst was predicted to within 3 days: a Spanish amateur was one of the astronomers to capture the exact moment of maximum.



OJ287: Historical light curve periodicity?

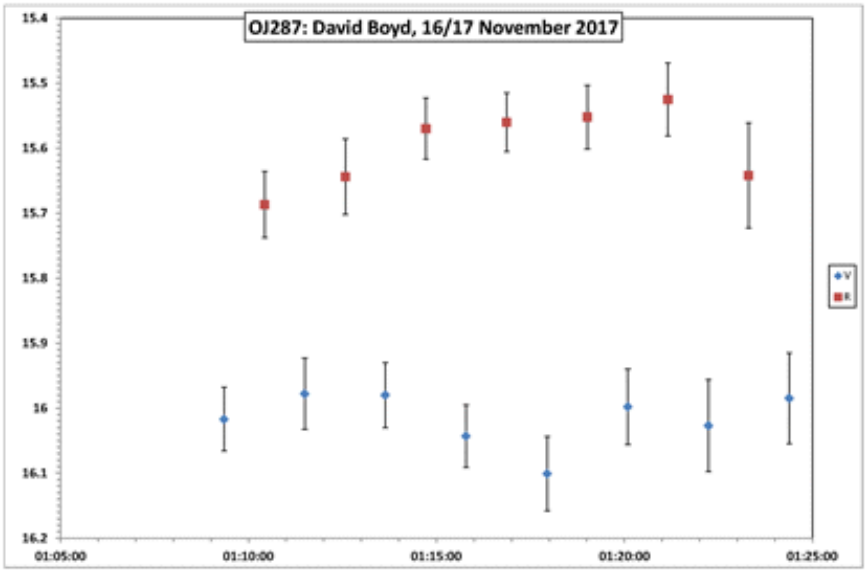
The high-quality observations of the 2005 outburst – a campaign in which the BAA VSS had an important presence – allowed the spin of the primary black hole to be measured to be 0.31±0.01.



This value though could be refined further by the very exact timing of the 2015 outburst: the exact date of the final rise to maximum is critically dependent on the spin, with the date advancing the faster the singularity is spinning. The new value derived, of 0.372, shows that the singularity is still spinning quite rapidly, despite the natural tendency of black hole spin to slow with time. These observations also produced a first hint of the validity of the “no hair” theorem (“black holes have no hair”) that states that a black hole can be completely and exactly

defined by just three numbers: its mass, its spin and its electrical charge. The 2005-2008 observations confirmed this hypothesis to 10%: observations of the 2015 outburst have reduced this to around 3%. Observations of the predicted 2026 outburst could potentially confirm the no hair theorem to better than 1%. This is one of the few occasions that amateur astronomers will ever have to second-guess Einstein!

OJ287 is currently declining still from the last maximum. The model (line through the data, above) suggests that this decline may go on for some months still. What is interesting is the very faint points in the V light curve – mostly measured by Gary Poyner – these are due to the secondary black hole, now moving away from pericentre, perturbing the beam of the relativistic jet and moving it away from our line of sight. In 1989 the minimum was so pronounced that, for about two weeks, OJ287 faded down to V≈17.5. Interesting things happen in these episodes: the colour of OJ287 reddens considerably, hinting at the presence of the underlying giant elliptical galaxy, normally completely overwhelmed by the brilliance of the quasar. An HST observing campaign hopes to exploit the current faintness of OJ287 to image the underlying galaxy in the visible for the first time.



As David Boyd's photometry shows (above), variations of 10-20% in a few minutes are far from unknown and can be fast enough and of large enough amplitude to be detected visually, as Gary Poyner has done on several occasions.

OJ287 is a fascinating object and the current minimum is helping to refine the models, both of the quasar itself and of its host galaxy. Observations, particularly sequences of data in more than one filter are particularly useful, but any contribution helps with the study of this singular system.

BAAVSS Chart / VSX

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ASASSN-17hx (Nova Sct 2017)

Gary Poyner

Discovered on June 23.47 at magnitude 12.5V by the All Sky Automated Survey for Supernovae [1], and announced on Atel 10523 as ASASSN-17ib [2], later revised to ASASSN-17hx, the transient was soon identified as a pre-maximum galactic FeII nova with strong Balmer and FeII emission lines with no significant He lines [3]

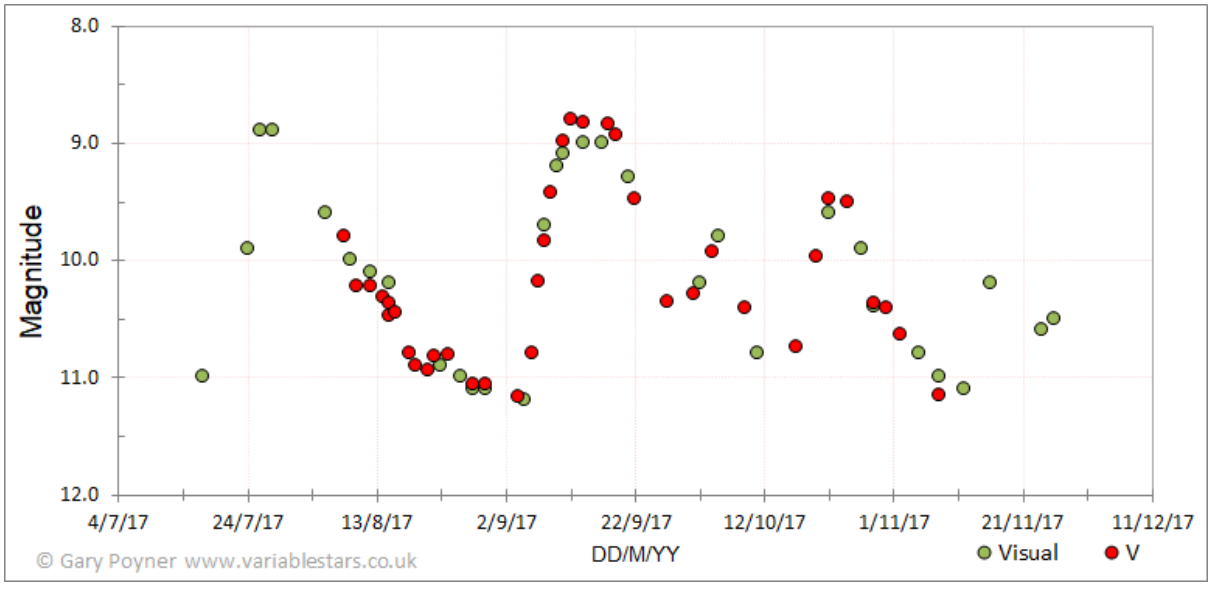
Located at 18:31:45.918 -14:18:55.57 in Sct (40' NE of gamma Sct), the field is always a tricky prospect for UK observers (especially for those of us who live north of a large city) but being bright at magnitude 12.5 it was an easy target for my 22cm. This telescope can reach parts of the sky my 51cm can't, as I can raise it up on boxes, stools etc. to get it to see over the fence and bushes! Because of the poor weather, I had to wait until July 17th for my first observation – mag 11.0 vis, and I was delighted to see it rise even further to magnitude 8.9 by July 26, 16x70 binocular territory! As the nova began to fade in August I decided to add it to my target list with COAST, reserving 20 second exposures in V-band with the 35cm SCT on mount Teide. I knew that I wouldn't be able to follow this nova to a faint level from home as the light pollution at this low declination is very bad, so COAST provided the perfect opportunity for me to continue to monitor it for an extended period. The nova faded to 11.2 vis by Sep 04 then amazingly brightened by 2 magnitudes to 8.7V in just 13 days where it remained for 7 days before fading once more, this time by just 1.5 magnitudes before rising again, this time to 9.8 vis before once again fading. A third brightening event to magnitude 9.5V occurred 17 days later for just three days before fading to 11.2V 14 days later. I have to admit that I thought the excitement was over with this fade, but of course I was proved wrong in that a fourth post maximum brightening occurred a week later, and as I write these words (Nov 26) the Nova has faded from 10.2 on the 16th to 10.7 by Nov 24 and brightened slightly to 10.5 by the 26th.

It's a pity that Nova Sct has slipped 'under the radar' for UK observers, as it has proved to be a most extraordinary event to monitor. I've observed quite a few Nova since my first in 1975, and this one is probably the most interesting yet!

References

[1] All Sky Automated Survey for Supernovae web site
[2] Stanek et al, Atel 10523
[3] Munari et al, Atel 10736

AAVSO Chart / VSX



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