ISSN 2631-4843

The British Astronomical Association

Variable Star Section Circular

No. 197 September 2023

BAA Office: PO Box 702, Tonbridge TN9 9TX

Contents

Cover Picture

Supernova 2023ixf in NGC 5457 (Messier 101)
May 20.938 UT 2023
Celestron 9.25 Edge HD f7, AP900 mount,
TRIUS PRO 694 mono CCD and Baader R, V and B photometric filters
Ham Observatory, Nr. Selsey, UK
Ian D. Sharp
See page 18

From the Director — *Jeremy Shears*

Section meeting on 2023 September 2

Well, it's almost here! I hope to see many of you at our Section meeting on Saturday September 2. It will be held at the Humfrey Rooms in Northampton, courtesy of the Northamptonshire Natural History Society. We have an excellent line-up of speakers on all aspects of variable star astronomy: further information elsewhere in this Circular. A light buffet lunch will be provided, as well as tea and coffee during the day. Entrance, including refreshments, is free of charge and no advanced booking is necessary.

Shaun Albrighton's 100,000th observation

Hearty congratulations to our Pulsating Stars secretary, Shaun Albrighton, on his 100,000th observation submitted to the VSS database! This is a remarkable achievement and I applaud his dedication.

We now have five observers that have achieved the 100,000 milestone since 1939.

I asked Shaun to write a few words about his observations. Shaun writes:

"At 22:00 hrs on Sunday 7th May, I logged my 100,000th observation onto the BAA VSS database. The star in question being R CrB, at mag 6.0.

Although I had been interested in astronomy since the age 5, it wasn't until I was bought a 60mm refractor in 1973, that I started observing and keeping a log of my drawings and observations. In 1975, at the age of 15, I applied to join the BAA and submitted my first VS observations in Jan 1976. Although my early estimates were made with a 115mm reflector, I quickly discovered the joys of binocular observing.

Initially using 10x50mm binoculars but then 20x80mm I took up a programme of under observed star, later expanding to include most of the stars suitable for my instruments. Why binoculars? Working shifts and then having a young family, meant shorter observing sessions. Add to that the wide field views and I was hooked. A consequence was that I quickly committed 100+ sequences to memory.

I am often asked which are my favourite stars. Although not easy to answer, they fall under two categories.

1) Old favourites, which include the semi-regular variables, U, RY, Cam, Z UMa and V UMi, and RV Tau stars, AC Her, U Mon and R Sct.

2) For the view e.g., SU, AD, KK and PR Per, which are in/near the Double Cluster in Perseus.

As for the future, I have a few years of data to upload onto the database and hope to continue to be surprised by the activity of stars which were once considered mundane, e.g., the recent bright maximum of Omicron Cet, S CrB and W And, or changes in the light curve, Z UMa."

T CrB

Anticipation is rising about the next eruption of the recurrent nova T CrB. As discussed by John Toone in the June VSS Circular, it has ended its super active phase, which began in 2015 and has now entered a pre-eruption dip. Prof. Bradley E. Schaefer (Department of Physics and Astronomy, Louisiana State University) has pointed out that the previous eruption of T CrB, in 1946, occurred a year after the end of the super active state. His latest prediction for the eruption is 2024.4 ± 0.3, i.e., 2024 February to August (Schaefer B., ATel 16114 (2023)). In a recent submission to *Astronomy Letters* (https://arxiv.org/abs/2308.10011), a team from the Sternberg Astrophysical Institute present their analysis of the long-term light curve and offers their prediction for the eruption: January 2024.

A VSS campaign is underway to monitor the nova (see the August *Journal*). Updates will be posted to the BAA Forum.

RW Cep

The cool hypergiant RW Cep has been undergoing an unusual fade. A recent paper accepted for publication in the Astronomical Journal (https://arxiv.org/abs/2307.04926) presents the first resolved images of RW Cep obtained with the CHARA Array interferometer. The researchers' reconstructed near-infrared images of the star show a striking asymmetry in the disk illumination with a bright patch offset from centre and a darker zone to the west. They say this is evidence for a recent mass ejection event that created a dust cloud which now partially blocks the stellar photosphere, thereby explaining the dimming. The paper cites spectroscopy obtained by Robin Leadbeater and Joan Guarro Fló.

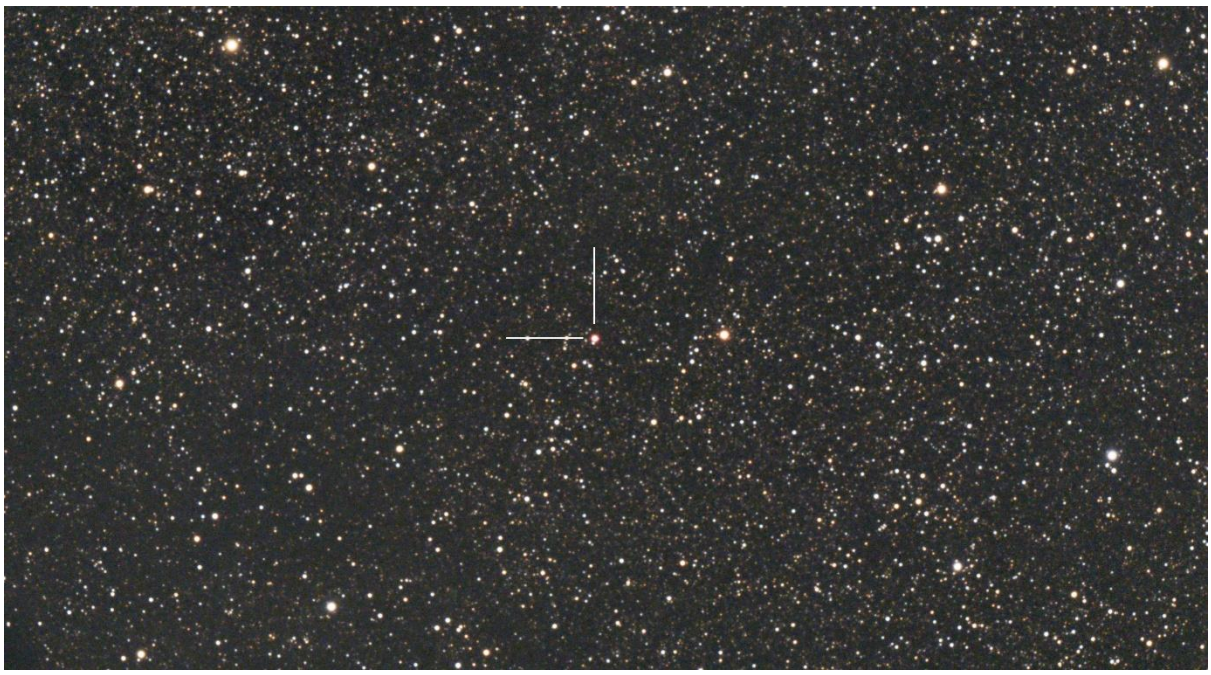
SN 2023ixf and profile of Koichi Itagaki

SN 2023ixf has been putting on quite a show in M101 - see the report by Ian Sharp in this Circular. This was the latest discovery by Japanese amateur astronomer Koichi Itagaki. I was contacted by *Science* magazine's Asia correspondent, Dennis Normile, who was seeking background information about the discovery. Dennis's article, which features photographs of Itagaki's highly impressive

observatories as well as describing his work, appears here:
https://www.science.org/content/article/amateur-astronomer-may-worlds-top-supernova-hunter

N Scorpii 2023 (V1716 Sco)

Mazin Younis managed to obtain an image of this southerly (Dec -41°) nova using his remote telescope in Morocco (latitude +30°; see his charming description of how he set up the observatory in the August *Journal*). The nova was discovered by Andrew Pearce in Australia on April 20 and reached magnitude 7.0.



Nova Sco 2023 May 4. Equipment: Esprit 100ED Pro, ASI 294MC-Pro. Exposure 14 x 300s. Field size 1°18' × 0°43' (*Mazin Younis*)

Alnitak: a new remote telescope

Speaking of remote observing, the BAA President, David Arditti, writes in the August *Journal* about making time available to members on a remote telescope in a good observing location. VSS member and observer, Maxim Usatov, has commissioned the Alnitak 0.43m Corrected Dall–Kirkham telescope system located in Sierra del Segura, Spain (https://www.alnitakobs.com/). Max has obtained a great deal of high precision photometry of the dwarf nova CG Dra in support of the VSS campaign on this object, so I am well aware of the capabilities of this instrument.

Alnitak CDK 0.43 m A1 telescope by Planewave Instruments

Although this as a commercial venture, Max has generously offered a certain amount of imaging time with it to BAA members free of charge, in order to support our scientific work. At the time of writing, the system is still in a testing phase. The Association will be making the telescope time we have been given available to observers pursuing projects approved by the Observing Sections. BAA Council will decide exactly how we do this, but at the moment you are welcome to contact David Arditti if you would like your project to be considered during this testing phase.

Database of eclipsing binary ephemerides and O-C files

EB observers will likely be familiar with the database of eclipsing binary ephemerides and O-C files collected by the late Dr Bob Nelson from Canada. Robert Jenkins, who worked with Bob for many years on updating the database and has been maintaining it subsequently, informs me that he has produced up-to-date master copies of all of Bob's O-C work.

The latest publicly available updates are hosted on the Southwest Research Institute website at: http://binaries.boulder.swri.edu/omc/.

Robert is also happy to provide the latest versions on request via email: mailto:robynnabara@ozemail.com.au

Observing Mira-type variables

Mira-type variables continue to be a mainstay of the Section's Pulsating Stars programme and are followed visually by many observers. I would just like to remind observers that it is generally sufficient to estimate Mira stars once per week. The reason is that their brightness changes rather slowly. Over observing a star can lead to observational bias. For example, you might be subconsciously expecting a star to brighten or fade when in fact it has stopped brightening or fading. Also from an efficiency perspective, rather than observing one star too frequently, it would be better to devote observational time to other stars.

Summer Solstice on the Lizard Peninsula

John Toone

enootnhoj@btinternet.com

Visual photometry of variable stars in the month of June from the darkest and southernmost point of the UK mainland is recounted.

Cornwall is the most coastal county in the UK subjected to clean air blown off the Atlantic Ocean and its geographical position is such that it is situated well away from the major population centres. The additional fact that the Lizard Peninsula in Cornwall is the only part of the UK mainland that dips south of $+50^0$ latitude makes it an attractive proposition for astronomy and in June 2023 I escaped the worst of the summer solstice twilight by spending a week on the Peninsula.

My plan was to observe from the Lizard Point visitor car park adjacent to the Youth Hostel and Lighthouse where I previously observed in 2020 and had been able to see RY Sgr at magnitude 10.2 despite a full moon lying in nearby Capricornus.

On the first night at Lizard Point I found that I had two issues. The first problem was the Lighthouse beam which swept the sky at -30^0 declination and illuminated my observing location, it had not been such a problem in 2020 under a full moon. The second issue was dew rapidly forming on the C8. The copious sea air moisture meant that I only had about 30 minutes observing time despite refitting the instrument cover as frequently as possible.

After two restrictive nights at Lizard Point, I switched to Kynance Cove from where the Lighthouse beam was obscured. The dew issue was also resolved by using towels to fully drape the C8 between making observations. Also, when the wind switched from a SW direction (Atlantic Ocean) to the SE (English Channel) the dew impact was much reduced.

With sea effectively in three directions restricting land based light pollution, conditions were excellent at Kynance Cove, the only artificial lighting emanated from ships scattered along the seaward horizon. The dark sky combined with clean air resulted in a C8 limiting magnitude exceeding 14 with the faintest observation logged of BL Lac (had to do a Lacerta observation from the Lizard) at magnitude 14.3 although I felt that I could have pushed it a bit further given more time. The C8 is now 42 years old and is yet to require re-collimation so it is still performing satisfactorily.

In the western sky in the evening, I made my latest apparition observations of R Leo, T Leo (independent super-outburst detection) & R Hya; and in the morning sky in the east, I secured my earliest apparition observations of T Mic, GK Per & R Tri. My main focus, however, was on the southern sky pushing to the limit low declination targets as they passed close to the meridian.

I made my first observation from the UK of a variable within the constellation of Lupus. HT Lup was exclusively observed by Albert Jones between 1990 and 2010 varying mainly between magnitudes 10 and 11. My observation had it at magnitude 10.9 and with a declination of -34^0 it became my most southerly positive observation of a variable from the UK.

AI Sco was seen for the first time by star hopping northwards from M7 which in itself is an observing challenge from the UK. To the south of M7 the sting of Scorpius could be seen including kappa Sco at declination -39^0. Elsewhere within Scorpius the Mira stars R & S Sco were close to maximum whilst RR Sco was near minimum.

Despite being in the early stages of recovering from a deep fade, RY Sgr was clearly visible on three nights with estimates ranging between magnitudes 12.5 & 12.8. Also in Sagittarius, I made observations of the bright Cepheids W, X & Y Sgr for the first time since observing them from Tenerife way back in 1983.

I tried to secure observations of variables in Corona Australis since with binoculars I could pick up alpha, beta & epsilon CrA. It was not easy though and I failed in my attempt to see V CrA. The field of R CrA was located but the variable was fainter than magnitude 10.7. Nevertheless, at declination -37 ^{0} this became my most southerly negative observation of a variable from the UK.

Switching to the north I saw SS Aur in outburst on the evening of the solstice. Although lower in the sky than seen from Shrewsbury in the month of June, the sky background was dark so the observation was not that difficult. The shortest separation between RY Sgr and SS Aur is through Polaris at 166^{0} so here is a challenge; can anyone claim a larger angular separation between observations in a north/south direction? Such observations in an east/west direction are much easier to accomplish during the course of the night due to the Earth's rotation.

An excellent gauge of sky darkness is the visibility of the Milky Way and I could clearly see its full outline between 22:40 and 01:40 GMT from the Peninsula on the night of the solstice. In fact, the Milky Way was a glorious sight from Perseus right down into the gamma Sgr region. In the past I have seen the northern Milky Way at its best in August but I can now state that I have never witnessed it more prominent from the UK than at the Lizard Peninsula in the month of June.

Out of the seven nights on the Lizard Peninsula two were clear and three partly clear allowing me to record 695 minutes of productive observing time, much more than I could have achieved from Shrewsbury throughout a comparable week in June. The small three-degree latitude advantage made all the difference and it was a pleasure to experience dark sky conditions in June without having to travel beyond UK shores.

A personal project to observe some neglected SR and L Variables. 2

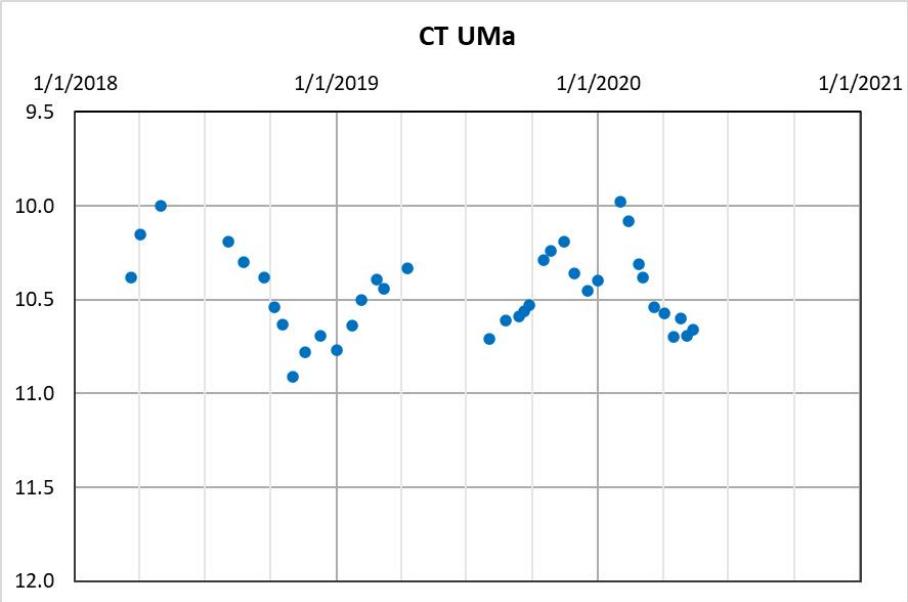
Don Mathews

don@mountainsandwildlife.co.uk

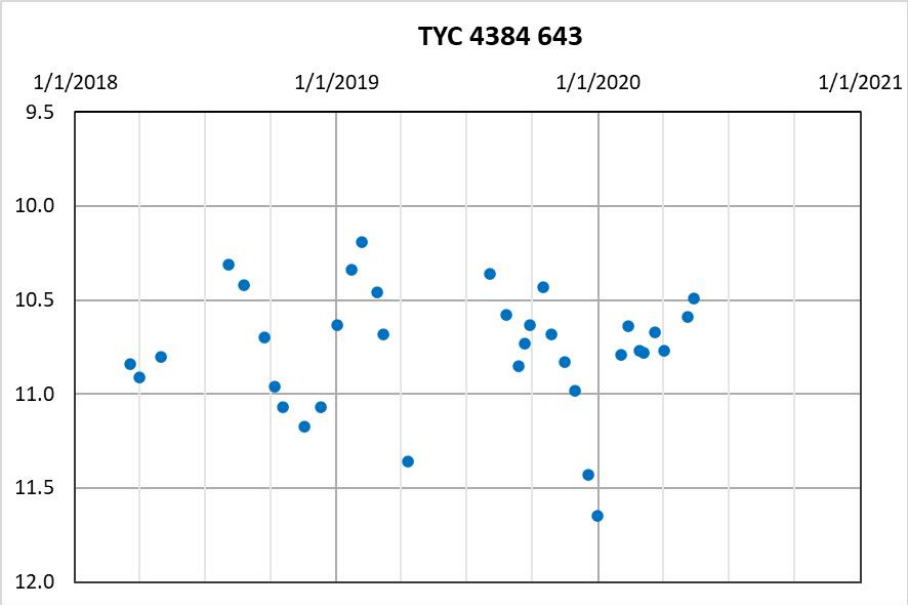
Over the last few years, I have undertaken a personal project to observe some SR and L type variables, mostly with few or no observations in the BAA or AAVSO databases, using a telescope / DSLR combination and ensemble photometry of the images. Part 1 of this article was included in BAAVSS Circular 196 of June 2023 and covered the introduction, methodology and references, which are not repeated here, together with the results for the observed stars in Camelopardalis. This Part 2 completes the article by covering the results for those stars in Ursa Major and Ursa Minor that were part of the project.

Ursa Major

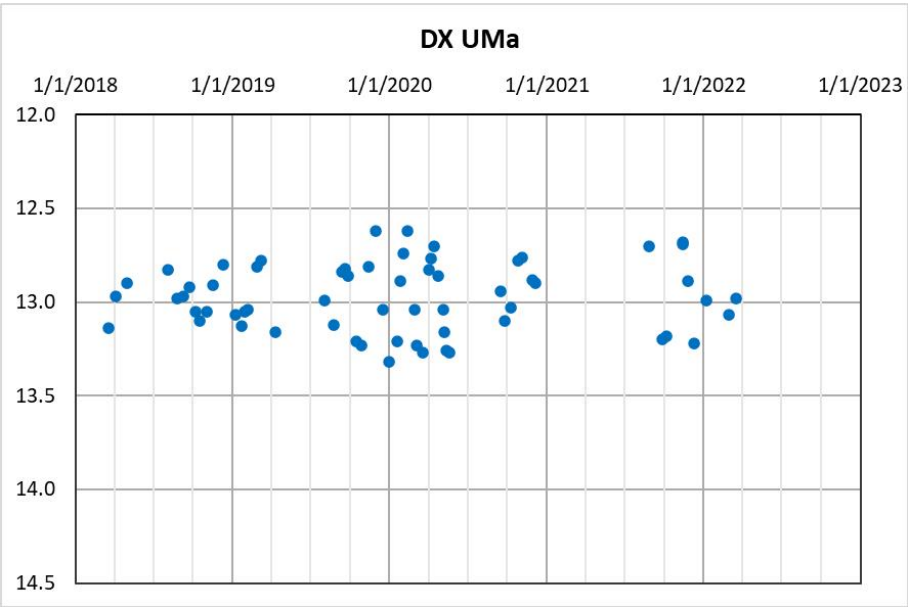
CT UMa:
Current information: VSX: LB; 10.5 - 10.9 p
No observations in the BAA database. The AAVSO database contains 29 visual observations between 1998 and 2008 and 10 TG observations in 2016/17, with magnitudes ranging between 9.6 and 11.8, much wider than the VSX range.
Project results: Between March 2018 and May 2020 CT UMa varied between 10.0 and 10.9 V in a rather erratic way, with no obvious period or perhaps with a complex of shorter and longer periods. VStar gave a possible period of approximately 280 days. The range in my observations is larger than the published 10.5 to 10.9 but not as large as the 9.6 to 11.8 in the AAVSO data.
Range appears to be larger than the 0.4 mag range given in VSX, at least 10.0 - 10.9 V; further observations would be beneficial.



While establishing a comparison star sequence it became clear that another star in the images, identified as TYC 4384 643, was variable in a similar way to CT UMa. Between March 2018 and May 2020 it was found to vary between 10.2 and 11.7 V. There appear to have been periods of around 4 months and perhaps around 7 months but with a somewhat unpredictable pattern.



DX UMa:
Current information: VSX: SRA; 14.2 - 15.3 p
No observations in either the BAA or AAVSO databases.
Project results: Between March 2018 and March 2022 DX UMa varied between 12.6 and 13.3 V. My V observations are 1.5 to 2 magnitudes brighter than the published 'p' range and are consistent with the APASS value of 12.76 V but my observed magnitude range of 0.7 is smaller than the published 'p' range of 1.1. Visually, there appeared to be a reasonably consistent periodicity of between 70 and 75 days, while the VStar analysis suggested a possible period in the 66 to 70 day range.
Observed V range was 12.6 - 13.3 V; period appears to be c.70d.



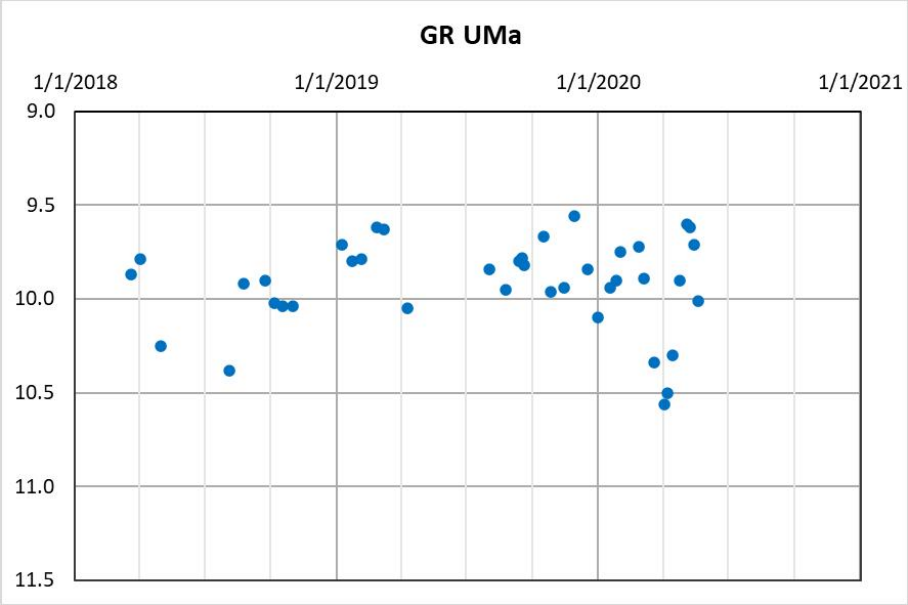
GR UMa:

Current information: VSX: LB; 9.36 - 9.94 Hp

No observations in the BAA database. Prior to this study the AAVSO database contained one record of 9.75 TG but a set of observations at around 9.6 V in 2020 has since been added.

Project results: Between March 2018 and May 2020 GR UMa varied between 9.6 and 10.6 V, somewhat wider than the published Hp range and compatible with the APASS magnitude of 10.44 V. Initial observations only picked up what appeared to be random fluctuations but a decision to make more frequent observations between September 2019 and May 2020 hinted at an apparent period in the region of 2 - 3 months. However, the VStar analysis was unable to establish any obvious period. This star was deleted from the project list in May 2020 as the variations were too fast for the observational limitations of this project.

Observed V range was 9.6 - 10.6 V.

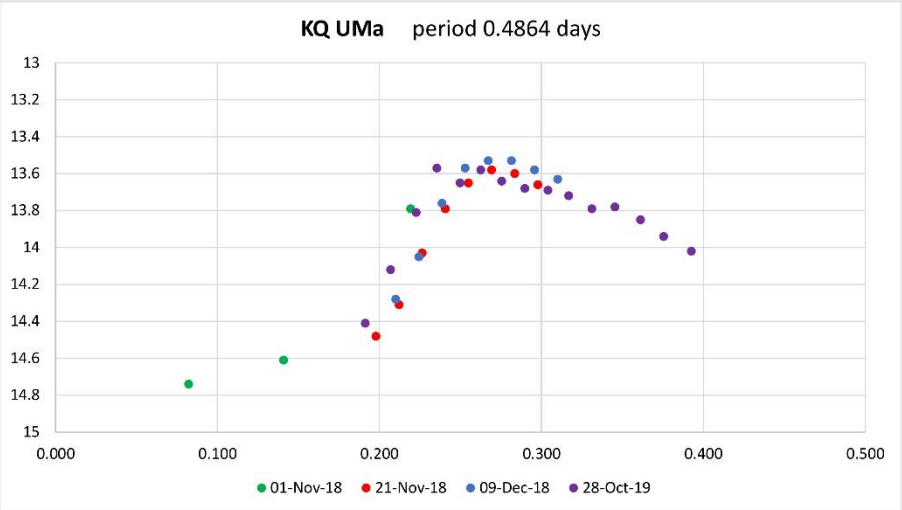


KQ UMa:

Current information: VSX: RRAB; 12.9 - 14.4 V; 0.48599 d

No observations in the BAA database. The AAVSO database contains several sets of observations in 2018 varying between 14.05 and 15.2 V and another set in 2019 showing a rise from 14.95 to a peak at 13.89 V.

Project results: This RRAB star was included in the project by mistake. However, sets of images taken at 10-minute intervals around maxima on 21 November 2018, 9 December 2018 and 28 October 2019 enabled a combined phase diagram to be assembled. This gave a good fit to the data if the published period of 0.48599 days was increased by about 0.0004 to 0.4864. The observed magnitude range was 13.5 to 14.8 V, slightly fainter than the VSX range and broadly compatible with the observations in the AAVSO database.

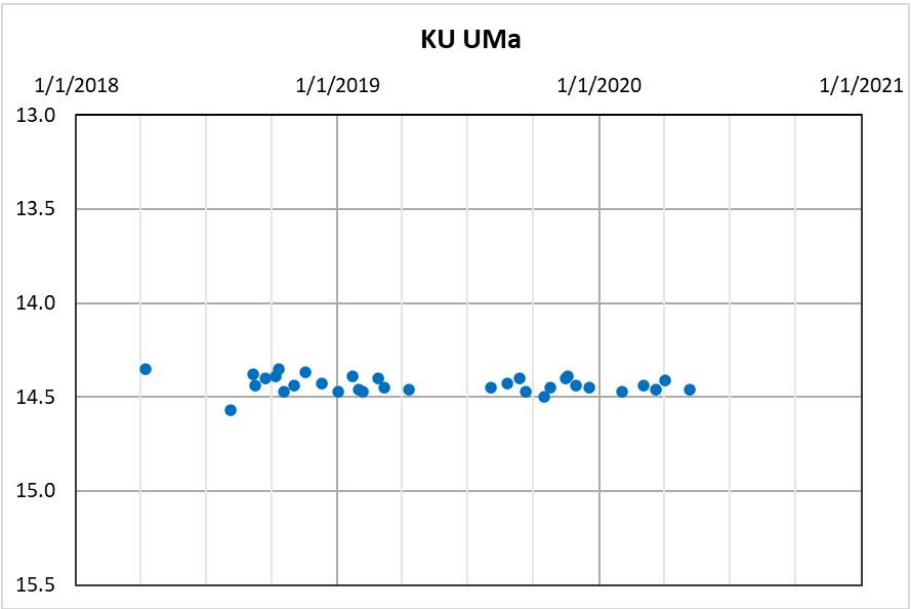


KU UMa:

Current information: VSX: SR; 14 - 14.8 V

No observations in either the BAA or AAVSO databases prior to this project.

Project results: Between April 2018 and May 2020 KU only varied between 14.3 and 14.6 V, with all except one observation in the narrow range of 14.35 to 14.50 V, matching the APASS magnitude of 14.39 V. Assuming that I have been looking at the right star, I have seen nothing to match either its 'SR' designation or its 0.8 magnitude range. The VStar analysis was unable to establish any obvious period.



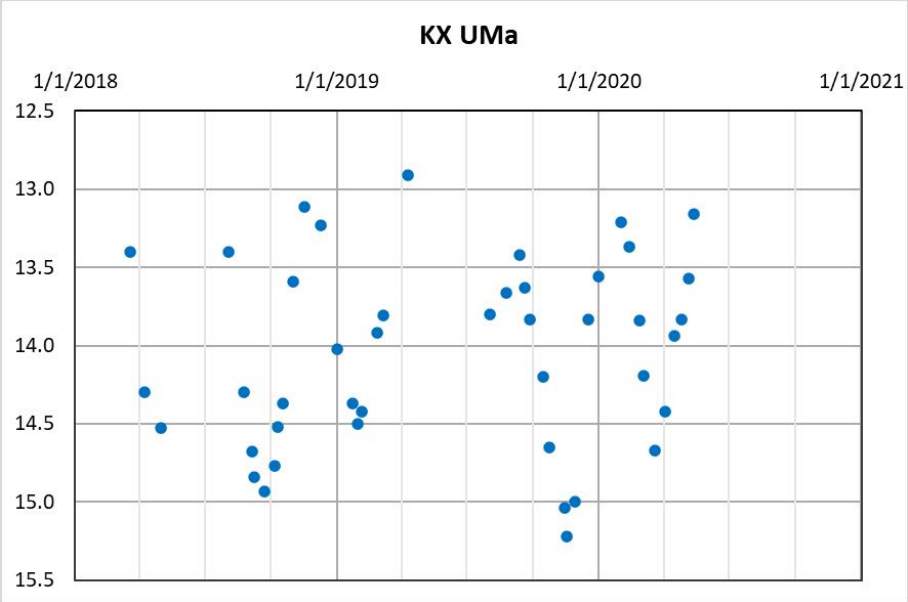
KX UMa:

Current information: VSX: SRA; 13.3 - 14.6 V; 143d

No observations in the BAA database. The AAVSO database contains only one record, a negative visual record at magnitude <15.1 in 2016.

Project results: Between March 2018 and May 2020 KX UMa varied between 12.9 and 15.2 V, a wider range than that in VSX. The observed maxima and minima were broadly compatible with the published period of 143 days and the VStar analysis gave a period of 138 days.

Observed V range was 12.9 - 15.2 V.



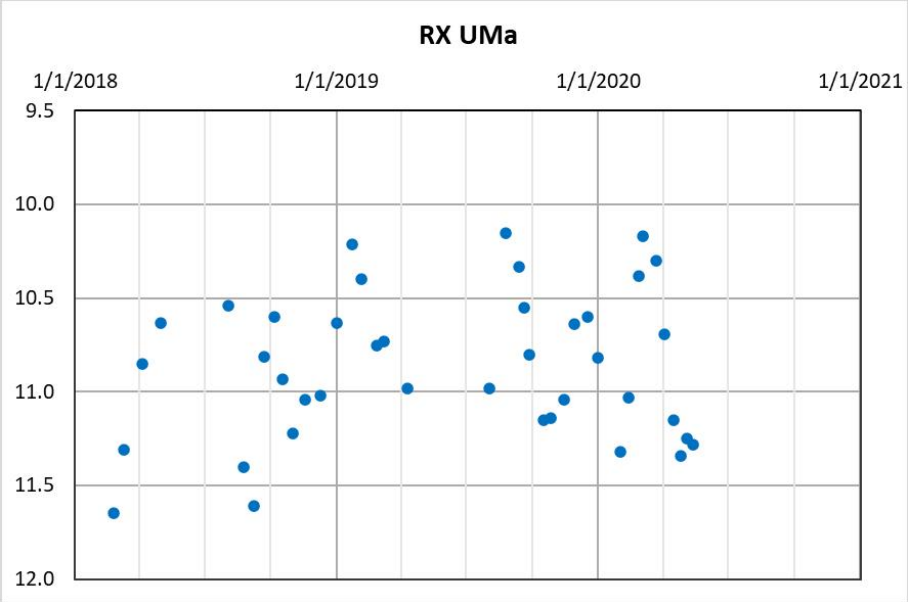
RX UMa:

Current information: VSX: SRB; 9.8 - 12.2 V; 195d

No observations in the BAA database. The AAVSO database contains quite a lot of visual observations. the first group between 1928 and 1955 and the second between 1979 and the present day. There are also V and TG observations between 2007 and the present day. The visual AAVSO observations show the star in the range 9.1 to 12.6 and the V / TG observations between 9.4 and 12.2.

Project results: My observations between February 2018 and May 2020 showed a range of 10.2 to 11.6 V, within the published range and smaller than that displayed by AAVSO data. Recent AAVSO observations appear to show potential periods of around 3 months and 6 months and my observations are compatible with the 3-month period, the VStar analysis of my observations giving a period of 102 days.

RX UMa was deleted from the project scope in May 2020 as it was being monitored by AAVSO observers and I was not adding significant additional information.



RZ UMa:

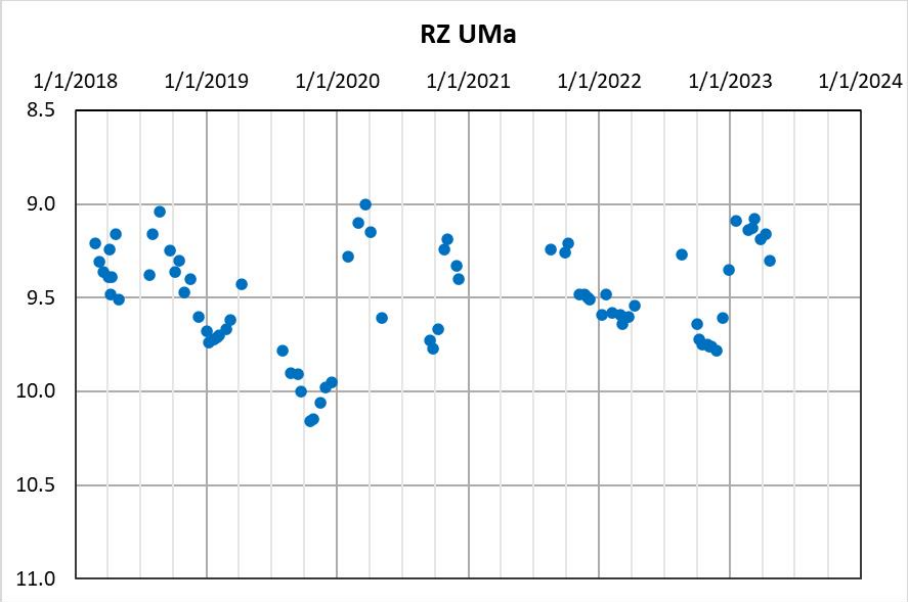
Current information: VSX: SRB; 9.7 - 11.9 p; 115d

At the start this project, there were 19 observations in 1997/98 in the BAA database and one observation in 2016, all magnitudes being between 9.2 and 9.9. More recently, other BAA observers have been contributing V observations to the BAA database, increasing the bright end of the range to 8.9. The AAVSO database contains a long sequence of observations (mostly visual) between 1935 and the present day, showing the star in the range 7.6 to 11.0. There are also V and TG observations since 2004, with the V magnitudes ranging between 8.7 and 10.4, smaller than the range of visual observations. There is a clear periodicity in the AAVSO data, with the most obvious period appearing to be around 9 months (270 days) or sometimes perhaps about half of this.

This star is included in the BAAVSS Pulsating Star Programme.

Project results: My observations between February 2018 and April 2022 ranged between 9.0 and 10.2 V, within the range of the AAVSO V data. My observations are also visually compatible with the period of around 9 months apparent in the AAVSO data but the VStar analysis of my observations didn't yield any clear period, there being a suggestion of multiple periods in the 250 - 290 day range. There was no support in my observations for the catalogued 115 day period. A wider analysis of AAVSO data might clarify the period(s) better than my limited project. I am continuing to make observations of RZ UMa as it is in the BAAVSS Pulsating Star Programme.

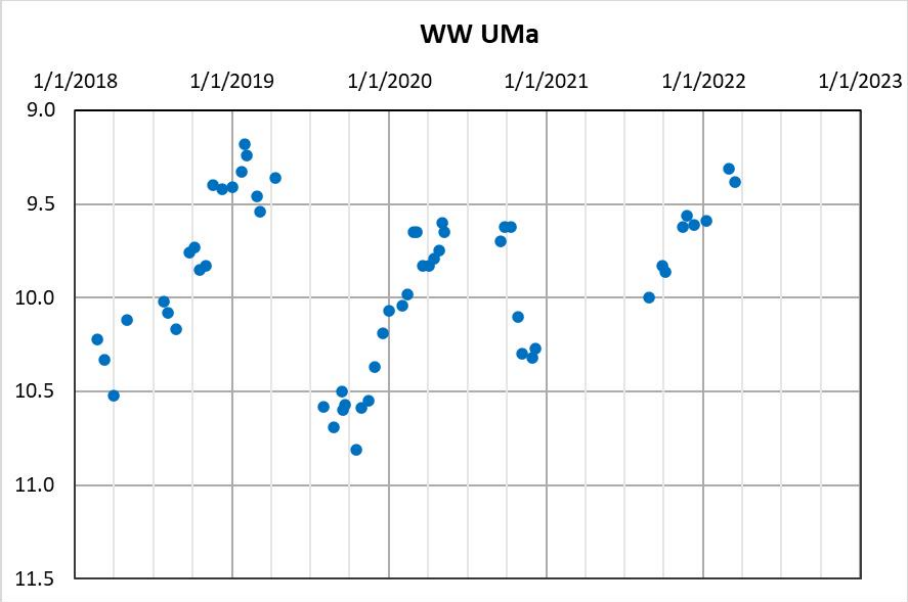
My observed V range was 9.0 - 10.2 V but AAVSO data suggest 8.7 - 10.4 V would be better.



TZ UMa:
Current information: VSX: SRB; 9.8 - 10.6 p; 116d
The BAA database contains a small number of observations with magnitudes ranging from 8.0 to 9.6. The AAVSO database contains a lot of observations, mostly visual, between 1956 and the present day, mostly showing the star in the range 7.6 to 10.6.
Project results: Eleven observations between March and November 2018 gave magnitudes between 8.6 and 9.2 V. However, photometry wasn't wholly satisfactory because of the brightness of the star and TZ UMa was therefore deleted from the project list in November 2018.

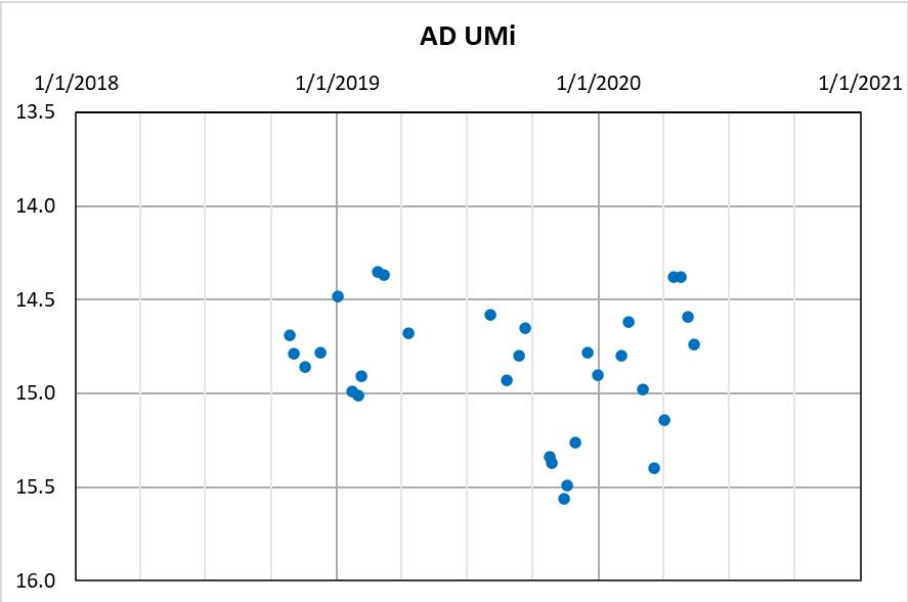
UW UMa:
Current information: VSX: LB; 11 - 11.9 V
No observations in either the BAA or AAVSO databases.
Project results: My observations between February 2018 and April 2019 showed UW UMa varying between 9.9 and 11.8 V, wider than the published range. However, photometry was unsatisfactory when the star was at its brightest as the 10th magnitude comparison stars were too far away and UW UMa was therefore deleted from the project list in April 2019.

WW UMa:
Current information: VSX: LB; 9.1 - 10.4 V
No observations in the BAA database prior to the start of this project. The AAVSO database contains 4 observations in 1983/84 and a mix of visual, CV and V observations between 2006 and the present day. These show the star in the range 8.6 to 11.3 and with an apparent period of around 16 or 17 months.
Project results: My observations between February 2018 and March 2022 showed WW UMa varying between 9.2 and 10.8 V, within the range of the AAVSO data. There appeared to be a saw-tooth style variation in my data, with a periodicity roughly matching the 16-17 month period apparent in the AAVSO data. The VStar analysis of my observations generated a clear period of 522 days.
Type appears to be SR, possibly SRa; my observed V range was 9.2 - 10.8 V but AAVSO data suggest a slightly wider range than this; my observed period was 522 days and this appears to be broadly compatible with AAVSO data.



Ursa Minor

AD UMi:
Current information: VSX: LB; 12.78 - 13.324 R1; >140d
No observations in the BAA or AAVSO databases.
Project results: My results until September 2019 were between 14.3 and 15.0 V, about 1.5 magnitudes fainter than the VSX 'R1' range, and compatible with the APASS magnitude of 14.61 V. However, in October 2019 it faded further, reaching 15.6 in November before recovering in December and dropping again to about 15.4 in March 2020, indicating a larger range of variation than suggested by the VSX entry. Visually, there was a hint of a possible period of either around 2½ months or around 5 months in my data but this was not supported by the VStar analysis.
Deleted from this study in mid-2020 as its faintness, especially around the deeper minima, gave poor signal to noise ratios. A larger telescope or darker skies would be needed to cover the full range of variation.
Observed V range was 14.3 - 15.6 V.



RY UMi:

Current information: VSX: LB; 10.8 - 11.5 p

No observations in the BAA database at the start of this project but a set of TG observations was added in 2018, these ranging between 8.9 and 9.8 TG. Additional sets of visual and CV observations in the AAVSO database mostly show the star in the range 8.6 to 10.1 with no clear periodicity.

Project results: My results between January and August 2018 were between 8.7 and 9.1 V and compatible with AAVSO observations.

Dropped from my programme in August 2018 as it was much brighter than my target magnitude range. This star is probably better suited to direct DSLR observation without a telescope.

CV & E News

Gary Poyner

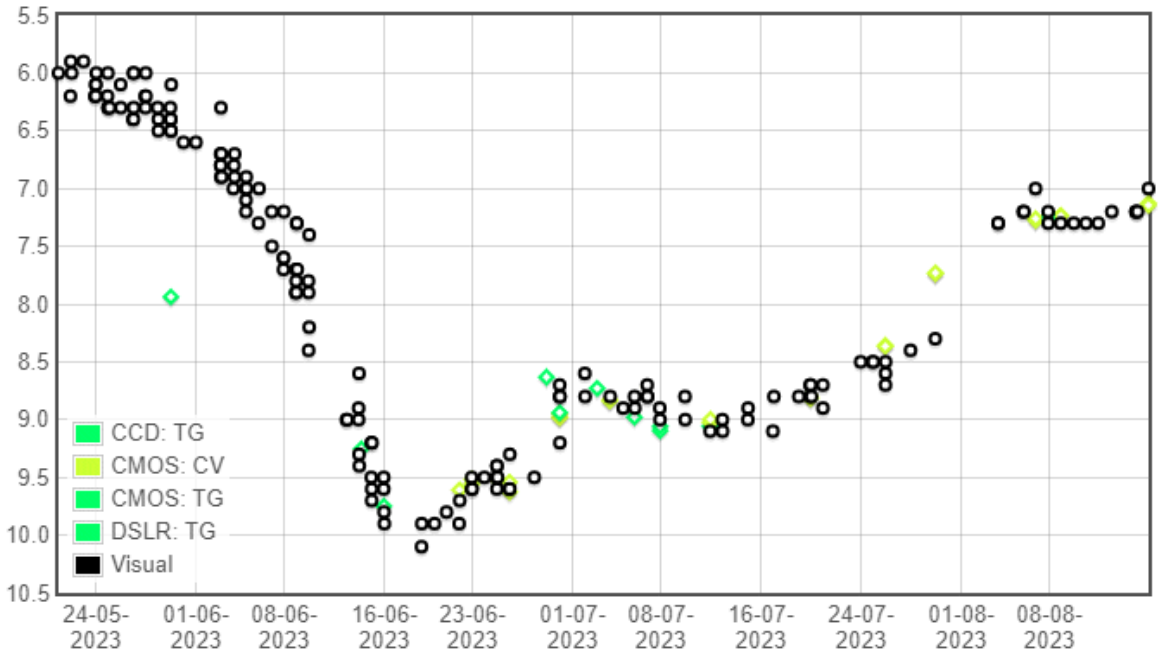
garypoyner@gmail.com

Details of the recent fades of the RCB stars ES Aql & R CrB are given, along with an update of the RCB star V482 Cyg, which is recovering from its 2022 deep fade.

RCB stars are in the news once again, with two stars undergoing fades since the last Circular.

R CrB

Just prior to VSSC 196 being released (around May 25), R CrB became active again with a reasonably rapid fade to magnitude 10.0 in just 25 days. Almost immediately a recovery began which halted at magnitude 8.6 around July 2, dipped slightly to magnitude 9.2 by the 12th July then brightened to magnitude 7.0 by Aug 8, At the time of writing (Aug 18), R CrB has been fluctuating between 7.0-7.3mv. This light curve will undoubtably change before this Circular is released (up or down?), so observers are asked to monitor R CrB at every opportunity and report to the BAAVSS database as soon as possible in order that an up to date as possible light curve can be shown in the December Circular.



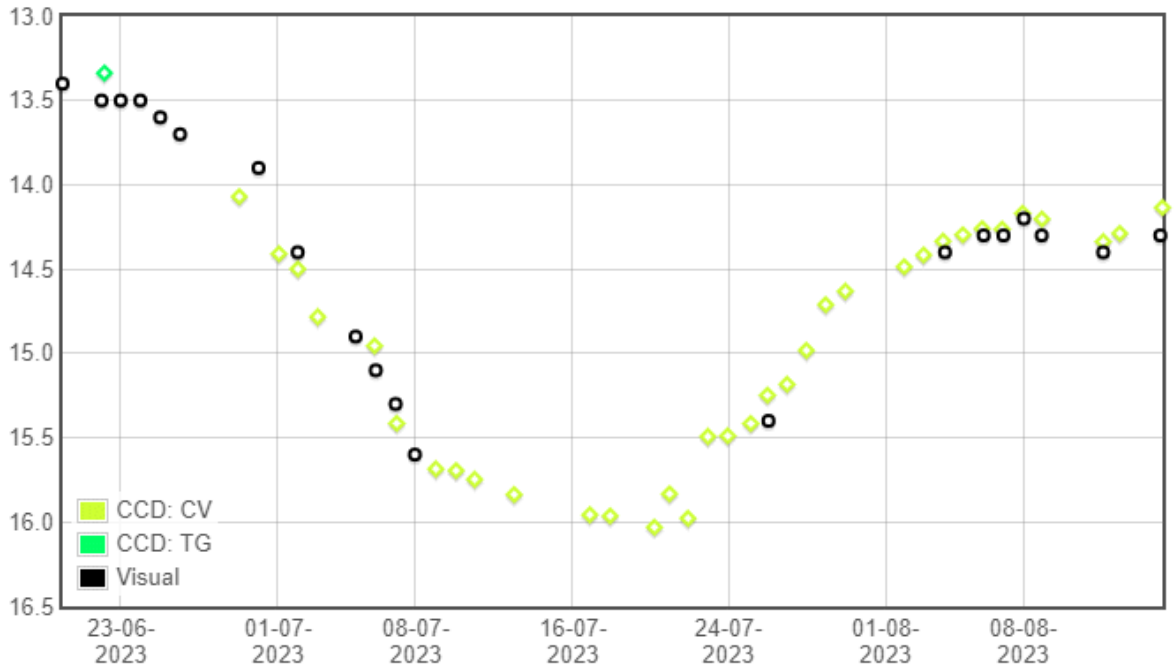
R CrB May 21 – Aug 18 2023. Observers; SW Albrighton, LK Brundle, TL Heywood, J Hilder, W Parkes, R Pearce, G Poyner, AR Pratt, JD Shanklin, S Shepherd, J Toone, T Cale, PB Withers. *BAAVSS Database*

ES Aql

This very active RCB star was first reported to be fading by Yutaka Maeda in June 2023, and reported on Vsnet. This is the first fade observed since the historically deep fade in 2021 (VSSC 188)

The early part of the fade (magnitude 12.0-13.0) was unobserved from the UK until it was picked up on June 20.1UT at 13.4 mv, since when the fade slowed and halted at magnitude 16.3CV on July 18. Little time was spent at minimum (usual for ES Aql), and by July 27, ES Aql was already one magnitude brighter. At the time of writing (Aug 18) the fade seems to have stalled somewhat, varying between magnitudes 14.0-14.5 for the last 10 days.

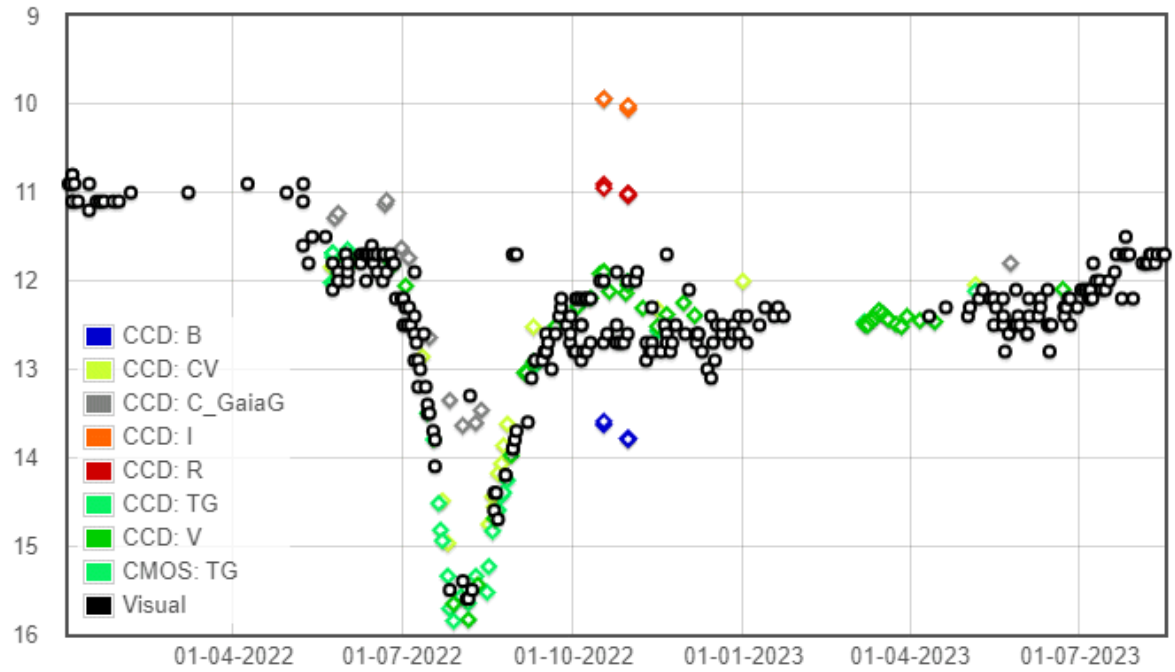
What is surprising is that despite regular coverage in these circulars and being one of the most active RCB stars around, there are no new observers reporting observations, with only three observers reporting data in the past decade. So, can we have a few more observers please for ES Aql – it really is too interesting to ignore!



ES Aql. June 20-Aug 18 2023. Observer G Poyner. *BAAVSS Database*

V482 Cyg

Details of the 2022 rare fade of V482 Cyg was covered in VSSC 193. Since the deep minimum of last August, V482 Cyg has recovered to magnitude 11.6 mean, which is around 0.5 mag from maximum brightness. Numbers of observers seem to have fallen this year for some reason, with only five observers contributing to the database in 2023 compared to thirteen from 2022 which covered the fade. Please keep this star on your target list and observe on every night possible, even if/when maximum magnitude is reached. We all know that fades for RCB stars can happen at any time, regardless of past activity.



V482 Cyg Jan 01 2022 – Aug 18 2023. Observers: PG Abel, LK Brundle, DG Buczynski, RC Dryden, ND James, M Mobberley, RAH Paterson, R Pearce, M Phillips, G Poyner, S Shepherd, IL Walton, PB Withers

Supernova SN 2023ixf in M101

Ian Sharp

Ian.sharp@astrosharp.com

A light curve covering nearly 90 days in three (RVB) photometric bands is presented and discussed.

On May 19, 2023, supernova was observed by Koichi Itagaki [1] inside the beautiful Pinwheel Galaxy M101. This was rapidly classified as a Type II core collapse supernova and at less than 21 million light years away is one of the closest ever observed in detail.

The proximity and brightness (peaking slightly brighter than mag. 11) has allowed many amateurs to follow this supernova with modest equipment. I started measuring its brightness on 2023 May 20 with Johnson/Cousins R, V and B filters at roughly mag. 12 - before it reached peak brightness and I have been observing it with two telescopes ever since and I now have magnitude measurements covering nearly 90 nights.

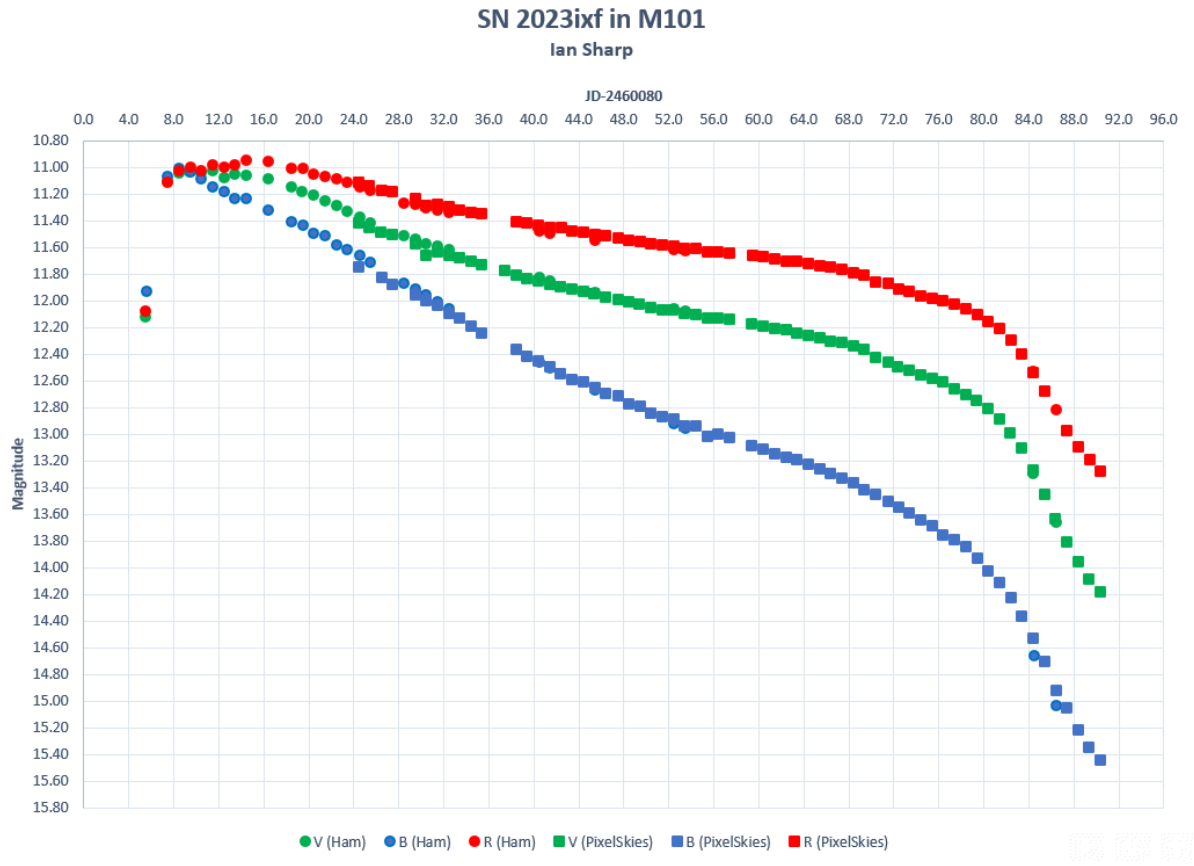
At the time of explosion, the weather here on the South Coast of England was very good with a very lengthy spell of clear nights. This enabled me to observe very regularly during the period when my second system in Spain was clouded out! It was very fortunate that, when the clear spell in the UK finally ended, the weather in Spain had cleared and I have only missed a handful of nights overall.

The two telescope systems are very similar and have yielded photometric magnitudes in very close (but not exact) agreement. The OTA in my observatory in the UK (Ham Observatory) is a Celestron C9.25 Edge HD operating at f/7 and the one at PixelSkies in Spain is slightly larger – a C11 also at f/7. Both use the same model of CCD camera – an SX694 Trius Pro from Starlight Xpress. The manufacturers of the three RVB photometric filters are different and I suspect this may be the cause for the slight differences in magnitudes. I have not yet performed and standard photometric transformations (but intend to do so) and so these are all instrumental magnitudes presented here. The light curves are shown in the figure below. The observations from here in Ham are shown as circles, those from Spain as squares.

The initial set of three points taken before the peak show the supernova was brightest in the B filter, and so the B-V value was negative at that time. However, at around the time of peak brightness it is hard to distinguish the values between the three colours. The striking trend after the peak is the widening of the three colour bands with the B magnitudes dropping the fastest – a clear sign of cooling. Indeed, the supernova was very blue in RGB images early on and has been slowly reddening since.

There are spells in all the three colours where the rate of magnitude decay has subtly changed, but most recently there has been a dramatic change and now the object is fading at a much faster rate. Interestingly, the B magnitudes have faded by about 5 magnitudes or a factor of about 100.

This graph represents a snapshot at the time of writing (2023 Aug 13) and I am still observing this on a nightly basis. I hope to follow this until M101 becomes too low for reliable photometry in the coming weeks.



References:

1. Itagaki, K. 2023, Transient Name Server Discovery Report, 2023-1158, 1

The 2023 eclipse in the Symbiotic Nova V1413 Aql

Gary Poyner

garypoyner@gmail.com

Visual and CCD observations of the Summer 2023 eclipse in the Symbiotic Nova V1413 Aql are shown, with mid eclipse timing in good agreement with the published ephemeris. Comparisons with a previous eclipse observed in 2011 are also made.

Introduction

V1413 Aql is an eclipsing symbiotic system containing an M type giant and a hot compact companion non degenerative star – very probably a rapidly expanding and cooling white dwarf. Although discovered in 1950 by Merrill & Burwell on plates taken at mount Wilson, its symbiotic nature was not identified until 1984. Observations by the author cover a 30 year period from 1993 to present, which includes three major outbursts and fifteen eclipses – which occur every 434.1d [1]. The systems magnitude range (outside of outbursts and eclipses) is almost constantly changing, with a two magnitude amplitude between 12.0-14.0 mv and spending very little time at quiescence, which is very unusual in a Symbiotic Nova (Fig.1).

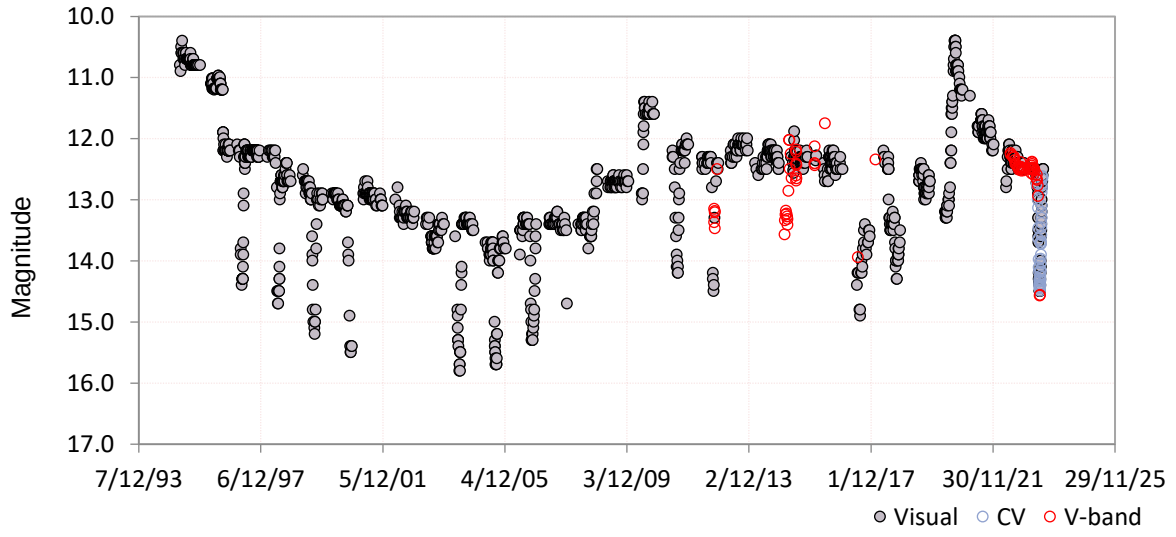


Figure. 1 V1413 Aql 1993-2023. Outbursts, constant variability and eclipses – this star has it all.

Observing V1413 Aql

Lying at RA 19 03 46.84 +16 26 17.0 (J2000.0.), V1413 Aql can be found just 1.6 degrees NE (PA 35.7 degrees) of epsilon Aql at magnitude 4.1, very close to the border of Saggita. The field is easily found by locating the 7th magnitude star SAO 104431 (easy in a finder), which lies just 4 arc minutes east of the variable. Charts to suit your telescope type can be downloaded from the AAVSO VSP. [2]

Visual observations may be hindered by the presence of a 13.1 magnitude field star, lying just 12 arc seconds NE (PA 23 degrees). This might be problematic with smaller apertures, but I have always

found that magnitude estimates can be made easily with a 20cm telescope with the right magnification. (Fig. 2)

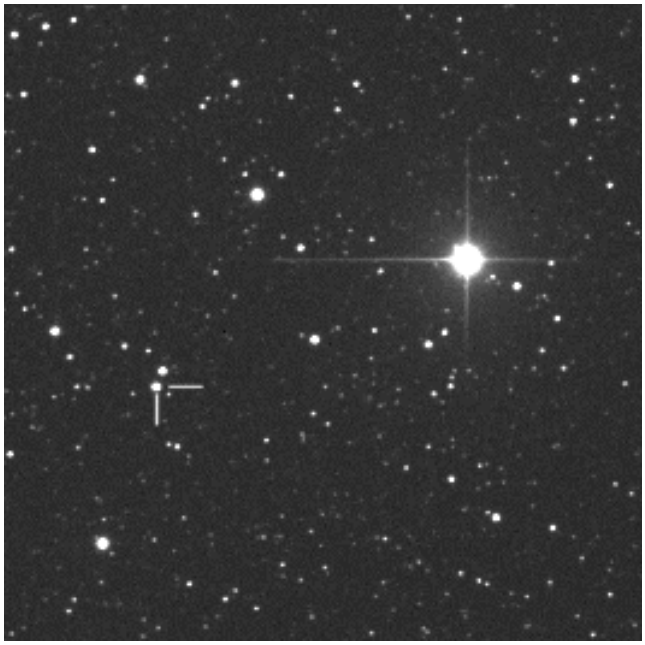


Figure. 2. V1413 Aql (highlighted), its close 13th magnitude field star and the 7th magnitude star SAO 104431. Field 7.5 arc minutes North top and West to left. Truncated V-band image from OU COAST, April 14 2023.

The 2023 eclipse

The duration of eclipse is such that more frequent than once nightly visual observations can suffer from bias, as the ingress and egress are quite slow. One single shot unfiltered CCD measure was also obtained each night (weather permitting), regardless of whether Birmingham skies were clear, in order to get the best coverage possible. Very often the Tenerife telescopes are kept closed on clear nights when dust levels in the atmosphere are measured to be high – which is highly frustrating for this user – so a visual observation was obtained regardless of sky conditions.

Visual observations were obtained with a 22cm f6.2 Newtonian Dobsonian and 51cm cm f4 Newtonian dobsonian from Birmingham, and unfiltered CCD measures using the CDK-17 SLOOH C2 telescope on Tenerife. Two V-band measures were obtained with the OU COAST telescope just prior to eclipse before COAST developed a faulty drive and was closed down awaiting repair. Two further V-band measures were received from OU PIRATE close to mid eclipse, but so few in number were these that they have not been included in this report. A request to use the AAVSOnet telescope network was made and accepted in May, but observations were not forthcoming from any telescope on that network until after the eclipse had ended and my target dates had lapsed.

Determining the time of ingress has always been a little hit and miss with this star, as the non-degenerate hot component has an ever changing temperature and radius depending on the state of accretion from the surrounding nebula. This results in each eclipse being somewhat different from the last, in particular the duration, and adds much interest to observing the eclipses as well as any general variability within the system. This does however give some difficulty in determining when the eclipse begins. Fortunately, in 2023 I had been able to commence observing as early as February, which gave me a good idea as to the intrinsic brightness of V1413 Aql leading into eclipse. From the first observations of the season which began on February 13, the V-band range had been 12.38-12.59, and the visual range 12.4-12.6. As we approached the time where experience told me the

eclipse might begin, I looked for any larger drop in magnitude than had been previously seen. From this, I estimated the eclipse to have begun on May 17.1 UT (JD 2460081.6, magnitude 12.8 mv), and all timings were taken from this point. Eclipse end was assumed when the magnitude had reached the same brightness as the start, and the brightness of the system returned to pre-eclipse levels suggesting an unchanged state in the hot component during the event.

The light curves in figure 3 below show separate visual and CV (unfiltered CCD measured from a V band comparison star), with a best fit curve fitted for each plot. The x axis is shown in days from the estimated start of the eclipse through to the end.

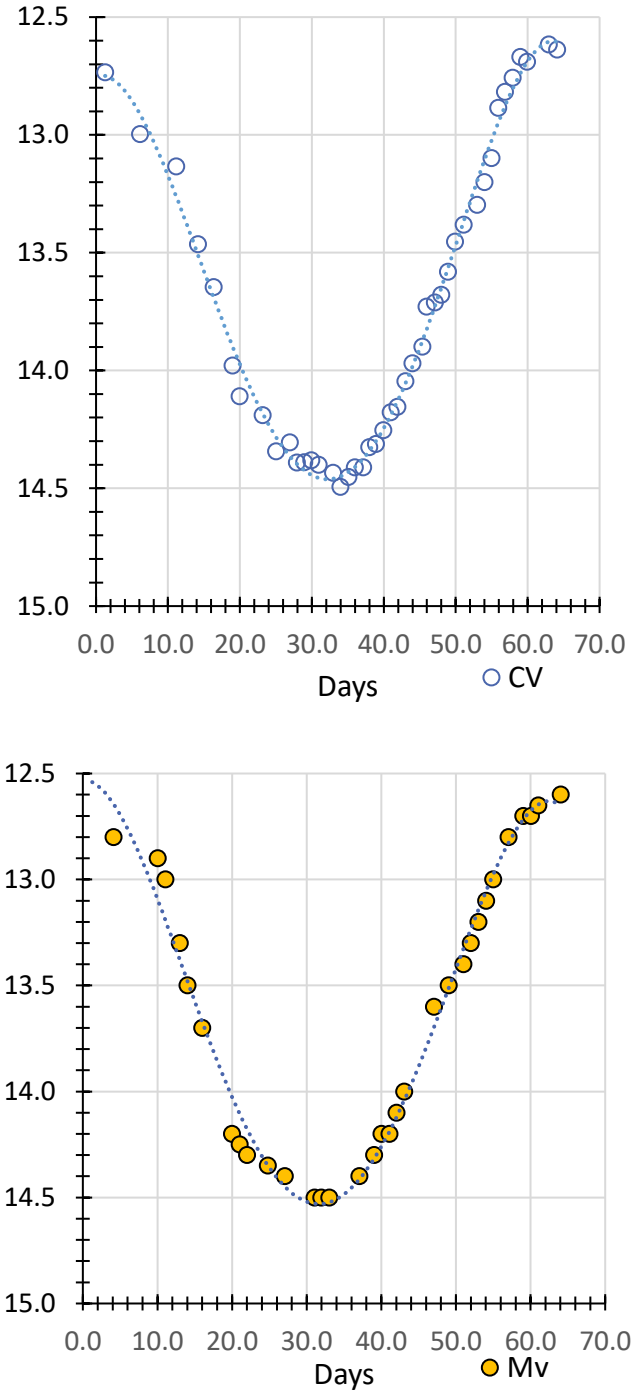


Figure 3. CV and visual light curves of the 2023 eclipse.

Details of ingress (time from maximum to minimum brightness), egress (time from minimum to maximum brightness) and duration of the eclipse are given in table 1 below. The timings were taken from the CCD data only, as the first visual observation was made four days after the eclipse had begun, and CCD coverage was more complete during mid-eclipse. Coverage throughout the event was good, with 43 CCD and 32 visual observations obtained during the 58 day eclipse. Just ten days were lost to adverse conditions in both Birmingham and Tenerife. The mid eclipse timing lies well within the error of the published epoch [1]

Ingress	35 days
Egress	23 days
Depth	1.7 magnitudes
Duration	58 days
Mid eclipse	JD 2460111.5 (June 15.9 UT)

Table 1. Eclipse timings from CCD data for the 2023 eclipse

A previous attempt has been made to compare eclipses during differing intrinsic states of the system from purely visual observations [3], and it's tempting to compare this eclipse with one where V1413 Aql entered eclipse at a similar (but not exact) intrinsic brightness in the past 30 years. Two eclipses fit the bill – 1996 & 2011. The former however was poorly covered due to weather, but the 2011 eclipse received quite good visual coverage from Birmingham. The intrinsic brightness of V1413 Aql was around 0.5 magnitude brighter than in 2023, so assuming that the radius and temperature of the hot eclipsed component was marginally different to the 2023 eclipse, it's an interesting comparison to make (Table 2).

Ingress	45 days
Egress	40 days
Depth	1.8 magnitudes
Duration	85 days

Table 2. Eclipse timings from visual data for the 2011 eclipse.

Future eclipses

Using the epoch given in reference 1 (*T* 2446650 (+/-15) +434.1 (+/-0.2), the dates for the next three eclipses are shown in table 3, the first two being the most favourable for observation from the northern hemisphere.

JD 2460541.2	18 August 2024
JD 2460975.3	26 October 2025
JD 2461409.4	3 January 2027

References

1. Studies of symbiotic stars VI. The eclipsing symbiotic nova AS 338. U. Munai, Astronomy & Astrophysics 257, 163-176 (1992)

2. AAVSO Variable Star Plotter: https://app.aavso.org/vsp/

3. Eclipse comparisons of the Symbiotic Nova V1413 Aql from visual photometry. G. Poyner JBAA Vol. 122, No. 6. (2012)

Eclipsing Binary News

Des Loughney

desloughney@blueyonder.co.uk

Formation of Binaries/ Eclipsing Binaries

When our Handbook was first written in 2011 it was asserted that over 50% of stars were in multiple systems - and possibly 65%. Current literature seems to be saying that over 85% of stars will be in multiple systems with a certain proportion being eclipsing binaries as seen from Earth. It seems that the greater proportion is due to the greater detecting sensitivity of orbital telescopes. Previously hidden, faint, red dwarf binaries have been discovered. Many binaries and eclipsing binaries probably still remain undetected when the distance between the components is relatively large. Their periods are months or years rather than days.

It may have been thought that binaries were largely created by gravitational capture but according to Wikipedia this is not the case.

" While it is not impossible that some binaries might be created through gravitational capture between two single stars, given the very low likelihood of such an event (three objects being actually required, as conservation of energy rules out a single gravitating body capturing another) and the high number of binaries currently in existence, this cannot be the primary formation process. The observation of binaries consisting of stars not yet on the main sequence supports the theory that binaries develop during star formation. Fragmentation of the molecular cloud during the formation of protostars is an acceptable explanation for the formation of a binary or multiple star system."

Elsewhere on Wikipedia, in the section on 'Molecular Clouds' it is explained what is meant by the fragmentation of the molecular cloud. A Giant Molecular Cloud can have a mass equivalent to ten million solar masses. The Cloud will have a substructure composed of a complex pattern of filaments, sheets, bubbles, and irregular clumps. Filaments are truly ubiquitous in the molecular cloud. Dense molecular filaments will fragment into gravitationally bound cores, most of which will evolve into stars. The influence of new giant stars, continuous accretion of gas, geometrical bending and magnetic fields may control the detailed fragmentation of the filaments.

Gravitationally bound cores may then evolve into stars that will later be seen as binaries or multiple systems. The early evolution of these binaries is difficult to observe because the protostars are hidden by the cloud of dust and gas.

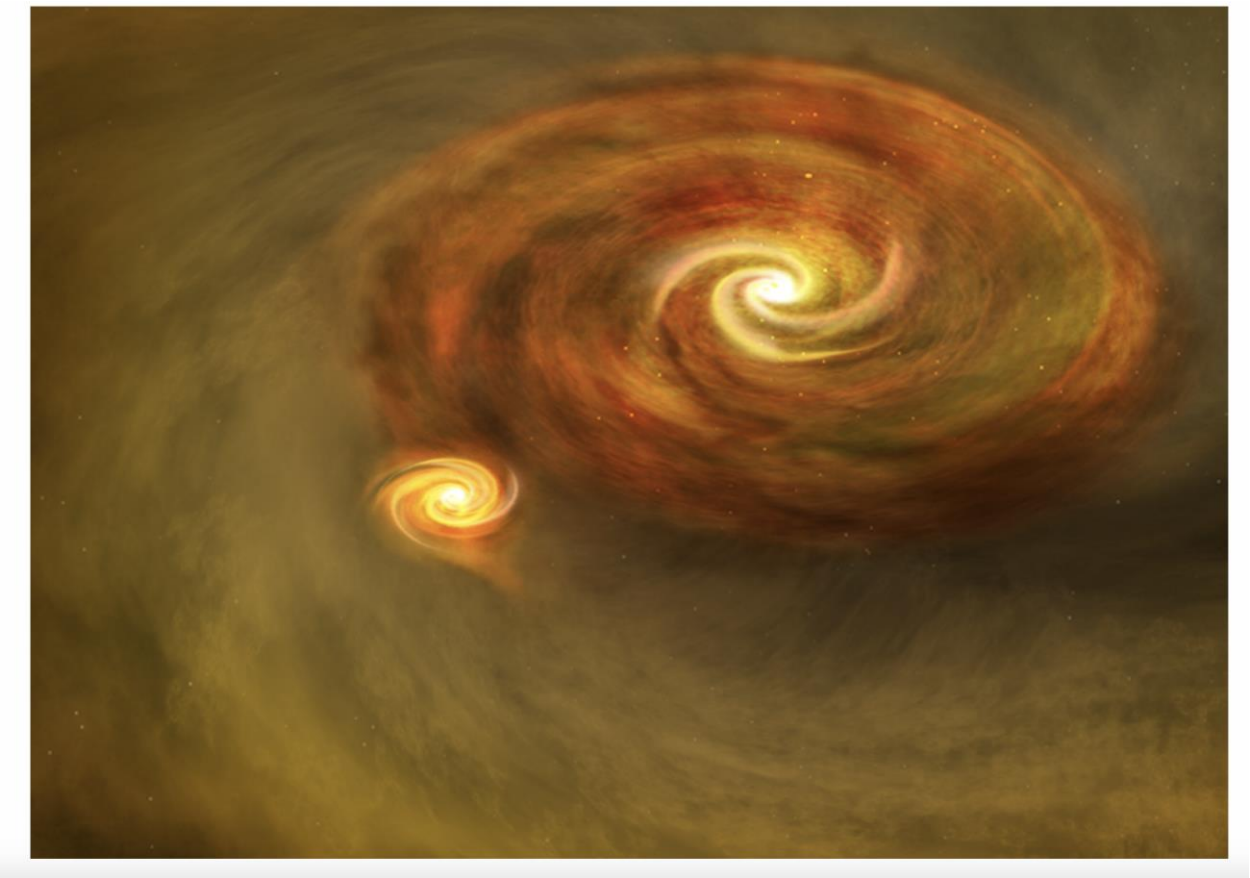
Some sources describe 'Turbulent Fragmentation' where Turbulence within a single core leads to multiple dense clumps. These clumps independently collapse to form stars that orbit each other, and 'Disk Fragmentation' where gravitational instabilities in a massive accretion disk cause the formation of a smaller, secondary disk within the first, resulting in two stars that orbit each other.

Bok Globules

Some sources state that the fragmentation of filaments is the main source of binaries, but others refer to Bok Globules, which are dark nebulae of 2 to 50 solar masses, as a common source of binaries and multiple star systems. One Bok globule, which is relatively near us (407 light years) and is called Barnard 68 is apparently on the verge of gravitational collapse. It is opaque to visible light but can be

observed at infra-red wavelengths. Thus, we may actually see the process of binary formation except it may not start for 200,000 years.

The National Radio Astronomy Observatory has produced an artist's impression of binary star formation within a fragmented disk/ filament.



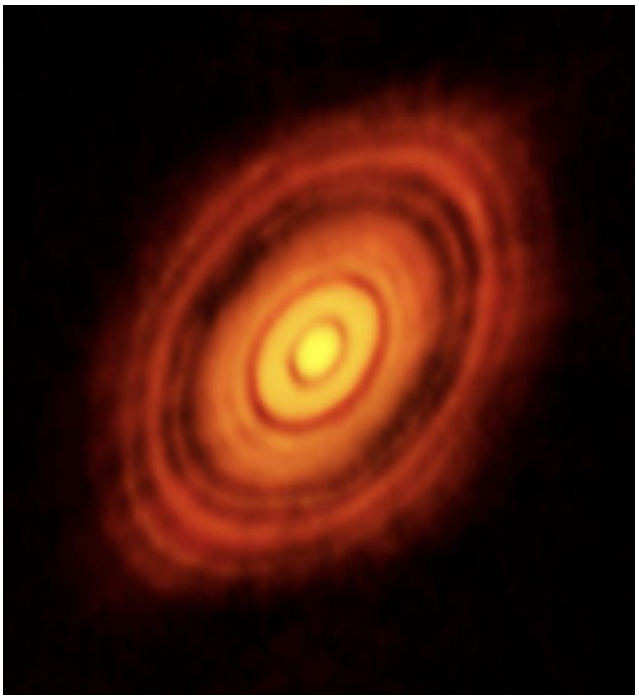
HK Tauri

The entry in Wikipedia describes a young binary system, or protostars, which is part of the Taurus Molecular Cloud, which is a stellar nursery of hundreds of newly formed stars. The study of these clouds has been revolutionised by the greater infra-red capability that we have today. The artist's impression below is of the two components of a binary which are still contracting towards the main sequence. Their ages are probably 10 million years but cannot be estimated with any accuracy because both stars are strongly obscured by what is thought to be protoplanetary disks.

Artist's impression of the misaligned disks around the young binary stars in HK Tau. New simulations suggest that if we can measure the orientation of stars in binary systems, we may be able to determine how they formed. [NASA/JPL-Caltech/IPAC/R. Hurt]

One of the instruments that allows the study of very young binaries is the Atacama Large Millimeter/ submillimeter Array (ALMA). Below (from the ALMA website) is one of its images illustrating planetary formation. The use of ALMA, showing its capability, applied to a protobinary system, is referred to in a paper titled:

'The Physical Properties of the SVS 13 Protobinary System: Two Circumstellar Disks and a Spiraling Circumbinary Disk in the Making' [1].



Reference

1 2022 The Astrophysical Journal, Volume 930, issue 1, id 91, 47pp

Light curves and phase diagrams of two Eclipsing Binaries using an online telescope.

David Conner

david@somerbyconners.plus.com

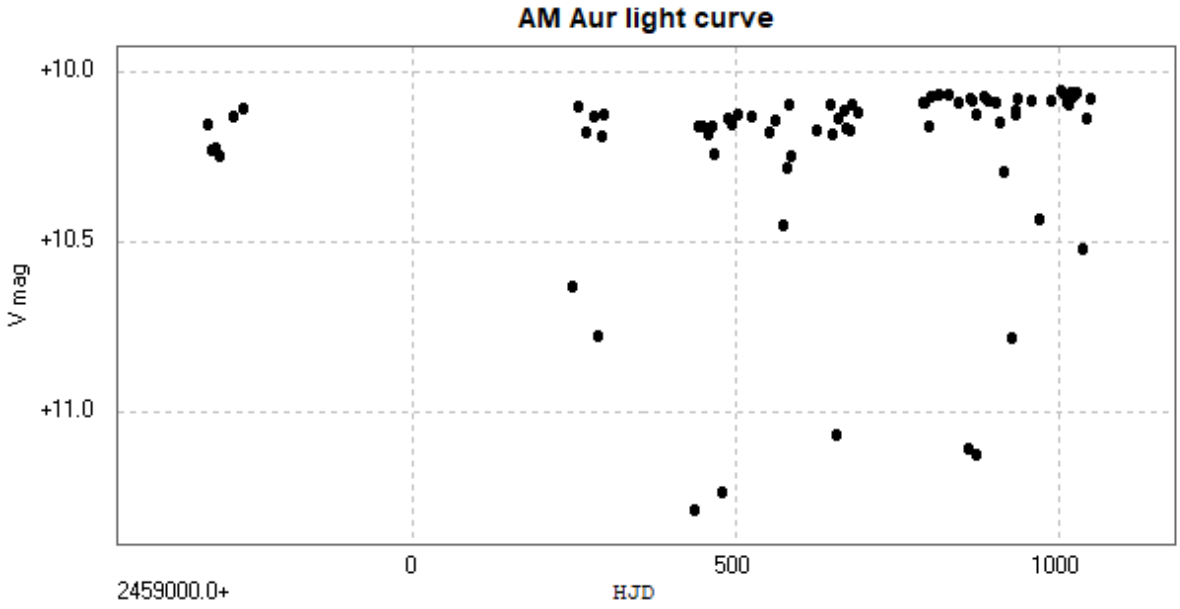
Long term observations of two eclipsing binaries using an online telescope are presented, illustrating the suitability of this method for obtaining complete phase diagrams.

Observations of two eclipsing binaries using an online telescope; AM Aur, with a period of 13.6 days, and OW Gem, with a period of 1259 days. Particularly in the case of OW Gem, but also in the case of AM Aur, this method is well suited to obtaining the complete phase diagrams of 'long period' systems without concentrating on the minima to the detriment of the rest of the light curves. It does, however, lead to fragmented light curves and times of minima that can be adversely affected by O-C activity.

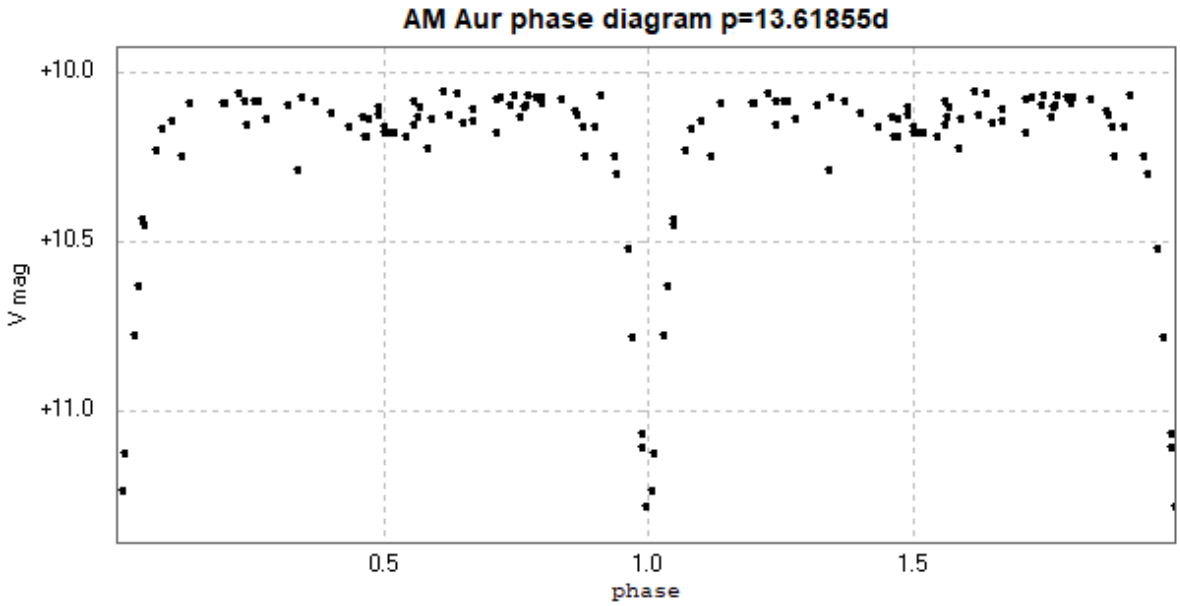
AM Aur

Light curve and phase diagram of the EA/DS type eclipsing binary AM Aurigae.

The data was obtained from photometry of 75 images taken with the Open University COAST telescopes between 2019 July 19 and 2023 April 14. The images were taken using a V filter.



The following phase diagram has been plotted to the catalogue period of the star, which is 13.61855 days (GCVS, AAVSO VSX, accessed 2023 August 12).

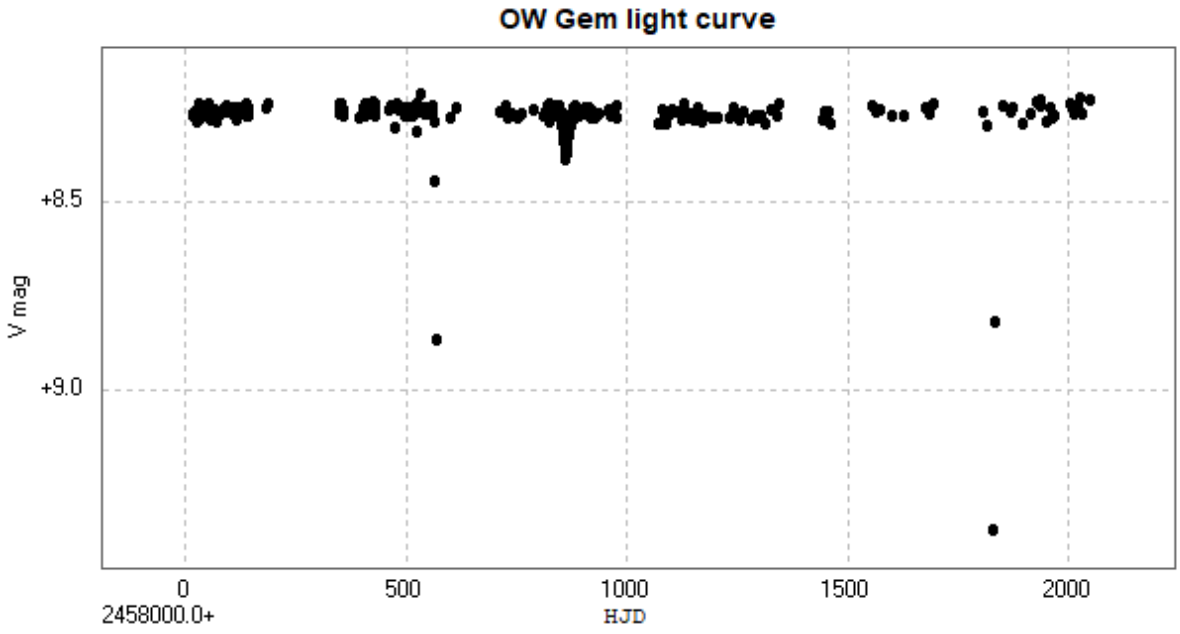


There is significant O-C activity with this system (Kreiner, accessed 2023 August 12), which will affect the accuracy of the phase diagram. Consequently, this system has now been dropped from my observing program.

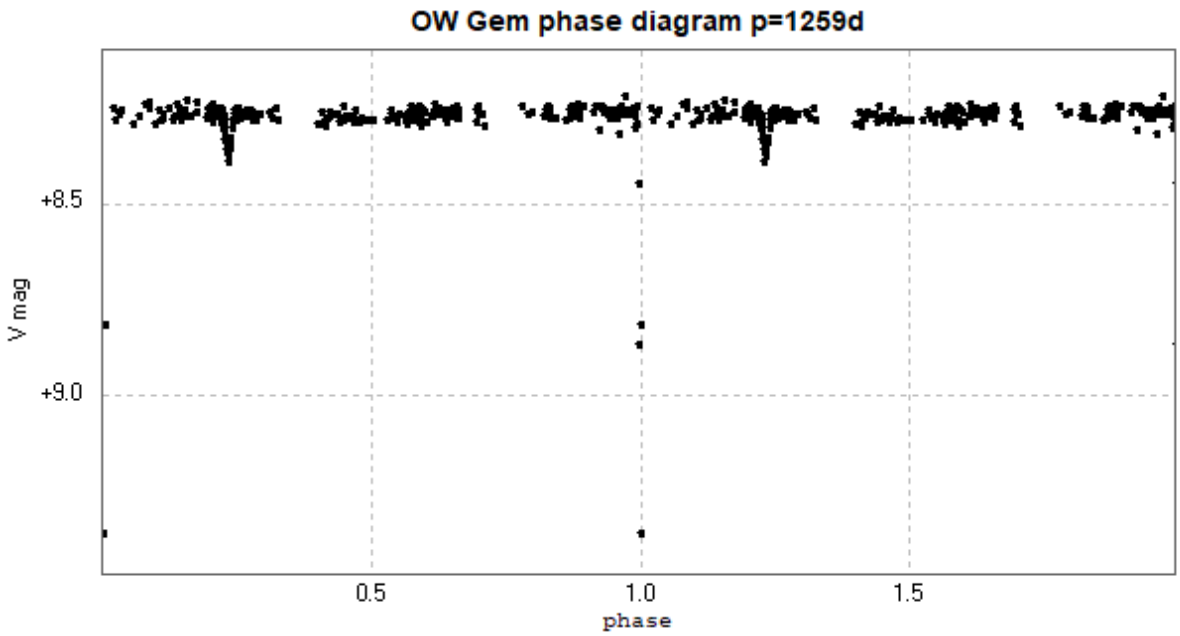
OW Gem

Light curve and phase diagram of the EA/GS type eclipsing binary OW Geminorum / OW Gem, constructed from photometry of 303 images taken with the Open University COAST telescope between 2017 September 22 and 2023 April 7 through a V filter.

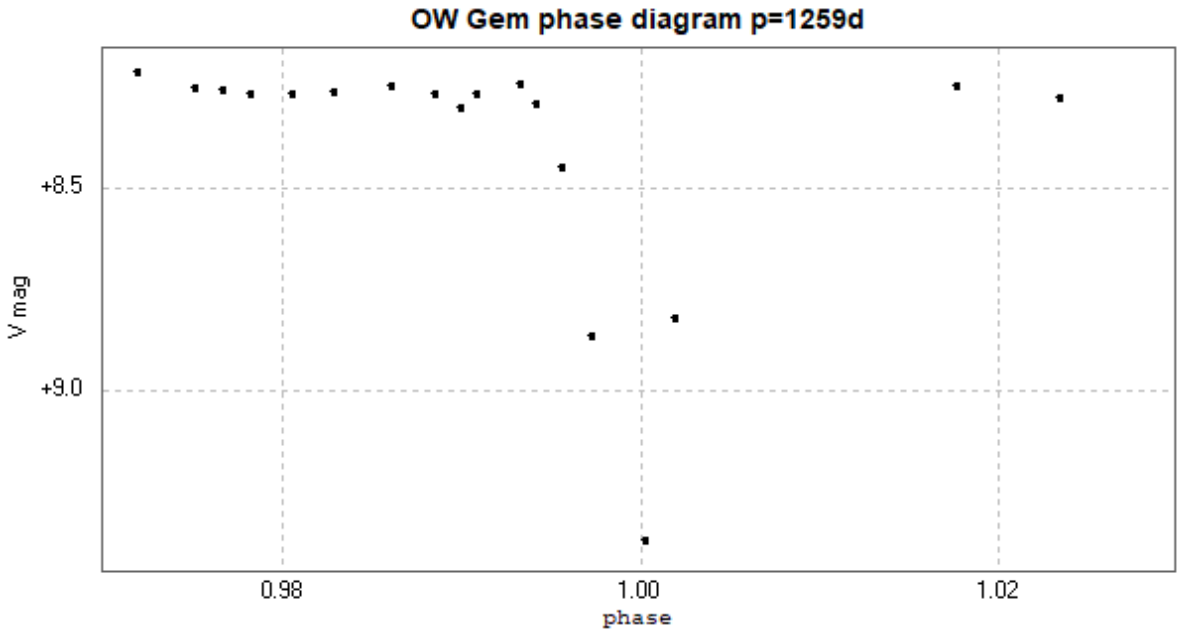
Observations of this system were discussed in VSSC 184, when they did not cover one complete orbit of this 1259 day system. This has now been rectified with more recent observations. Note that these now include a total of 4 observations of the primary minimum!



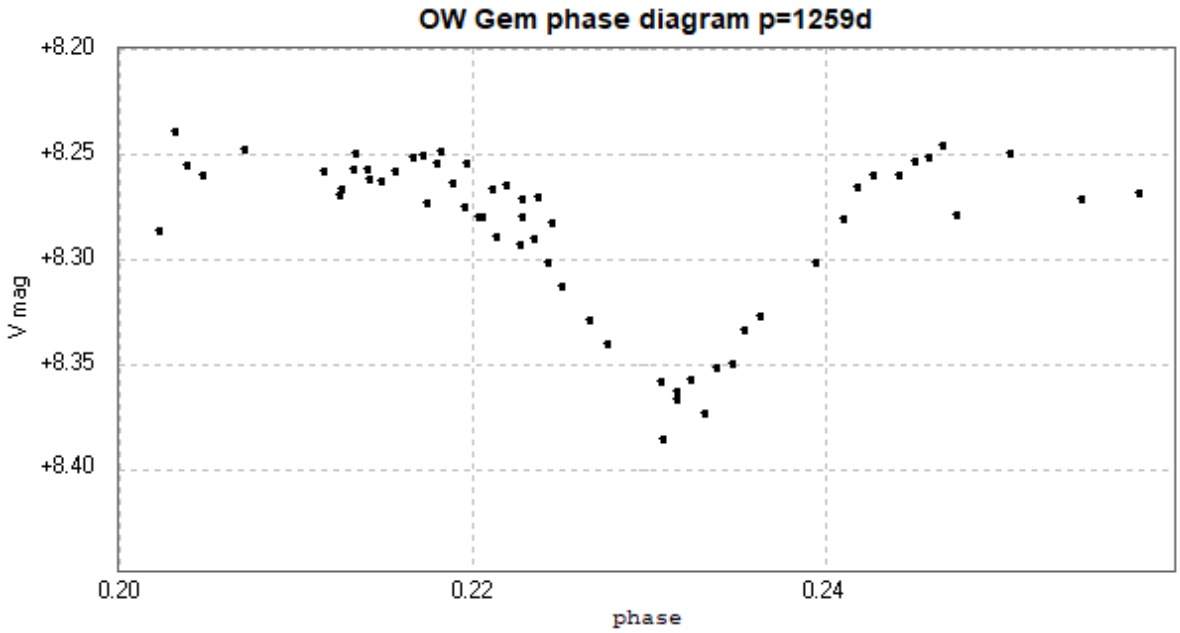
The catalogue period for this star is 1258.59d (AAVSO VSX) (The GCVS gives no period. Sites accessed 2023 August 12.)



Due to poor weather at the observatory, the primary minimum is not well covered, but an enlargement appears below.



The secondary minimum was better covered, and an enlargement of this section of the phase diagram appears below. (Note the differing scales between the enlargements of the two minima.)



Note that the phase of the secondary minimum is at approximately 0.23, not 0.5, due to the eccentricity of the orbits. This methodology could potentially detect changes to the phase of the secondary minimum, and this system remains in my online observing program.

An article about this intriguing system can be found at *Terrell et al (2003)*.

Section Publications

Hard Copy Charts	Order From	Charge
Telescopic	Chart Secretary	Free
Binocular	Chart Secretary	Free
Eclipsing Binary	Chart Secretary	Free
Observation Report Forms	Director/Red Star Co-ordinator	Free
Chart Catalogue	Director	Free
Binocular VS charts Vol 2	Director or BAA Office	Free

Charts for all stars on the BAAVSS observing programmes are freely available to download from the VSS Website www.britastro.org/vss

Contributing to the VSSC

Written articles on any aspect of variable star research or observing are welcomed for publication in these circulars. 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. Authors are asked to include a short abstract of their work when submitting to these circulars.

Please make sure of your spelling before submitting to the editor. English (not US 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.

Email addresses will be included in each article unless the author specifically requests otherwise.

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.

Deadline for the next VSSC is November 15th 2023.

BAA www.britastro.org
BAAVSS www.britastro.org/vss
BAAVSS Database https://www.britastro.org/photdb/
BAA Spectroscopic Database https://britastro.org/specdb/
BAAVSS Circular Archive http://www.britastro.org/vss/VSSC_archive.htm

Section Officers

Director
Prof. Jeremy Shears
Pemberton, School Lane, Tarporley, Cheshire CW6 9NR
Tel: 07795 223869 E-mail bunburyobservatory@hotmail.com

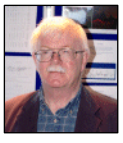
Secretary
Bob C. Dryden
21 Cross Road, Cholsey, Oxon OX10 9PE
Tel: 01491 201620 E-mail visual.variables@britastro.org

Chart Secretary
John Toone
Hillside View, 17 Ashdale Road, Cressage, Shrewsbury SY5 6DT
Tel: 01952 510794 E-mail enootnhoj@btinternet.com

Pulsating Stars Co-ordinator
Shaun Albrighton
4 Walnut Close, Hartshill, Nuneaton, Warwickshire CV10 0XH
Tel: 02476 397183 E-mail shaunalbrighton93@gmail.com

CV's & Eruptive Stars Co-ordinator, Circulars Editor & Webmaster
Gary Poyner
67 Ellerton Road, Kingstanding, Birmingham B44 0QE
Tel: 07876 077855 E-mail garypoyner@gmail.com

Nova/Supernova Secretary
Guy Hurst
16 Westminster Close, Basingstoke, Hants RG22 4PP
Tel: 01256 471074 E-mail guy@tahq.org.uk



Eclipsing Binary Secretary
Des Loughney
113 Kingsknowe Road North, Edinburgh EH14 2DQ
Tel: 0131 477 0817 E-mail desloughney@blueyonder.co.uk

Database Secretary
Andy Wilson

Tel: 01934 830683 E-mail andyjwilson_uk@hotmail.com

Telephone Alert Numbers for Nova and Supernova discoveries telephone Guy Hurst. If answering machine leave a message and then try Denis Buczynski 01862 871187. Variable Star alerts call Gary Poyner or post to BAAVSS-Alert – **but please make sure that the alert hasn't already been reported**.