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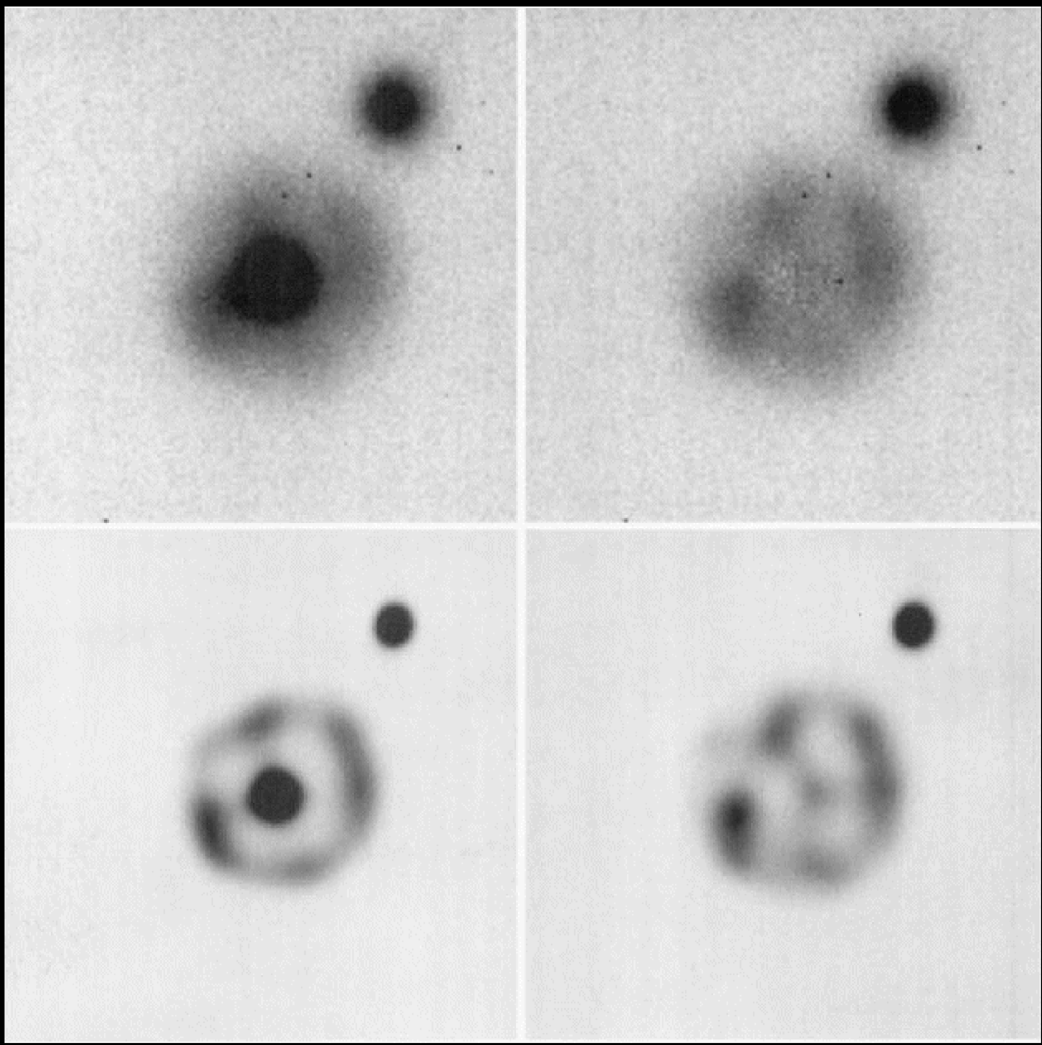
The British Astronomical Association

Variable Star Section Circular

No. 205 September 2025



BAA Office: PO Box 702, Tonbridge TN9 9TX

Contents

Cover Picture

Narrowband Hα + [NII] image of Nova Cygni 1975, with processed versions of the image.
Left column – with central star, and right, with star removed by point-spread function fitting.

From: A Sharpened Hα + [NII] image of the nebula surrounding Nova V1500 Cygni (1975)
Wade et el. Astronomical Journal, Vol.102, No.5 November 1991

BAA
VARIABLE STAR SECTION
MEETING

Saturday October 25, 2025

HOSTS: NORTHAMPTONSHIRE NATURAL HISTORY SOCIETY

The Humfrey Rooms
10 Castilian Terrace
Northampton, NN1 1LD

DOORS OPEN 10:00

MEETING 10:30 – 17:40

REFRESHMENTS AVAILABLE
FREE ENTRY

https://britastro.org/event/variable-star-section-meeting-2025

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From the Director – *Jeremy Shears*

VSS Meeting on Saturday 25 October 2025

Preparations for our Section meeting are well underway. We are very fortunate to have Northamptonshire Natural History Society as our hosts again. The venue is The Humfrey Rooms, 10 Castilian Terrace, Northampton NN1 1LD.

Doors open 10.00 am. The meeting starts 10.30 and finishes by 18.00. A light lunch will be provided, as well as tea and coffee. Booking is not necessary. Details and location map are available here: https://britastro.org/event/variable-star-section-meeting-2025

Preliminary Programme (subject to change):

10:00 – Doors open
10:30 – Welcome and introduction. **Director**
10:50 – **Gary Poyner** – *title tba*
11:20 – **Paul Leyland** – *Observing extragalactic variables*
11:50 – **Richard Sargent** – *Hinds Variable Nebula*
12:20 – **Chris Lloyd** – *Targets for Smart Scopes*
12:50 – Lunch
14:15 – **Brian Kloppenborg** (Remote) – *How AAVSO is adapting to the sky survey era*
14:45 – **David Boyd** – *Spectroscopy of the massive eclipsing binary VV Cephei*
15:15 – **Des Loughney** – '*Using the MAST Database to study eclipsing binaries'*
15:45 – Tea
16:15 – **John Toone** – *50 years of visual photometry*
16.45 – **Ingrid Pelisoli** (University of Warwick) – *Discovering and characterising white dwarf pulsars*
17:35 – Closing remarks – Director
17.40 – Close

Please note that we will not live stream the meeting. We are looking to record the talks for later viewing, but this is not guaranteed.

Observing campaign on X Persei

Alexander Salganik, a PhD researcher at the University of Turku, Finland, has requested observations from the VSS of the high-mass X-ray binary system, X Per. X Per contains a rapidly rotating Be star which expels material into a circumstellar disc. It is the optical counterpart of the X-ray pulsar 4U 0352+309.

X Per has previously exhibited X-ray outbursts approximately every seven years. However, after three such outbursts, the next anticipated outburst has not occurred. Instead, the X-ray flux has dropped to its lowest level in over two decades.

X Per is very bright with a visual range of magnitude 6 to 7, making it an ideal target for binocular observers to follow. A binocular chart and comparison star sequence is available here: https://britastro.org/vss/xchartcat/x-per-277.html

Alexander is especially keen to receive spectroscopic data. His main focus is on the Hα line at 6563 Å, with as high resolution the better, as he is particularly interested in profile changes over time. In addition, data on the helium lines would also be appreciated.

UBVRI photometry would also be helpful, with R and V bands the most important. R is especially valuable due to its sensitivity to emission from the circumstellar disc.

Observing campaign ZZ Piscium

As mentioned in the June *Circular*, Dr. Tim Cunningham of the Center for Astrophysics at Harvard has asked for assistance from VSS observers to monitor ZZ Psc. This is a variable white dwarf of the ZZ Ceti type, whose variability is associated with large-amplitude, non-radial pulsations caused by gravity waves. What is particularly interesting is that ZZ Psc is surrounded by a debris disc, which may have been created through tidal disruption of an exo-comet or exo-asteroid passing close to the white dwarf. The white dwarf is now accreting the debris.

Tim has requested time series photometry in support of his James Webb Space Telescope (JWST) programme to observe the star. Long ground-based photometric runs will allow him to keep track of the system's pulsations which have periods from 100 to 1000 secs.

Tim's next scheduled JWST observing periods is 2025 Nov 12 - 16. His top priority is for amateur observers to obtain ground-based photometry within this window. A week either side of that is the next highest priority. Beyond that, any long-baseline observations taken this year will also be extremely valuable. The object has a declination of +05 degrees, making it a favourable target from both hemispheres.

Updates on the campaign will be posted on the BAA VSS Alert email system. Please note that the JWST observing window is subject to change for operational reasons. Tim has a further JWST observing window scheduled for 2026 Jul 25 – Aug 3.

Cover picture: Nova Cyg 1975

As mentioned in the last *Circular,* August 29 marked the 50th anniversary of the eruption of this nova, **V1500 Cyg**. Gary Poyner describes how seeing this nova as a 17 year old launched his career in variable star observing in the August edition of the BAA *Journal*. It is fitting that this *Circular* carries an image of the star, post eruption, on the front cover.

Meeting on the History of Astrochemistry at Burlington House, London

Readers might be interested in this meeting held by the Historical Section of the Royal Society of Chemistry (RSC) with support from the RSC Astrochemistry Group, the RAS and the Society for the History of Astronomy. BAA members Peter Morris, Mike Leggett and the Director are on the organising committee. It takes place on Thursday 16 October 2025, 10.00 to 17.00.

There is a super lineup of speakers: Ileana Chinnici (Osservatorio Astronomico di Palermo), Helge Kragh (Copenhagen University), Simon Mitton (University of Cambridge), Jonathan Hare (University of Sussex), John Black (Chalmers University of Technology , Sweden), Jonathan Rawlings (UCL), Glenn White (OU and RAL Space), Mike Edmunds (Cardiff University), David Carty (University of Durham).

Attendance is free and open to all, though you do need to register to attend by October 8. More details here: https://www.rsc.org/events/detail/81869/history-of-astrochemistry

CV & E News

Gary Poyner

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Recent activity and light curves for the recently discovered Nova Ser 2025 (V691 Ser), along with details of the July outburst of the UGSU+E star HT Cas, recovery of the RCB star Z UMi and activity in the YSO V730 Cep.

Nova Ser 2025 (V691 Ser): 18:38:58.47 -03:51:49.5 (J2000)

V691 Ser was discovered on 2025 July 17.9085 UT by Kiril Sokolovsky (Dept. of Astronomy, University of Illinois), Stanislav Korotkiy (Astroverty, Russia and Vladimir Belousov (New Milky Way Survey) at magnitude 12.0CV, with a 135mm f/2 telephoto lens + STL-8300M CCD camera. Its original designation was TCP J18385851-0351482 after posting the discovery to Central Bureau's TCP website. [1]. Spectroscopic classification was reported by Tarasenkov et al. on Atel #17292, where they describe a red continuum and P Cygni profiles, including H alpha and H beta. Fe II lines were also detected, leading to an interpretation of a classical nova before maximum light affected by interstellar reddening [2]

First VSS observations were made on July 20 0 UT at 12.36V, from where the nova slowly faded to magnitude 15.7V by August 19.1, making the t3 around 24 days. (Figure 1)

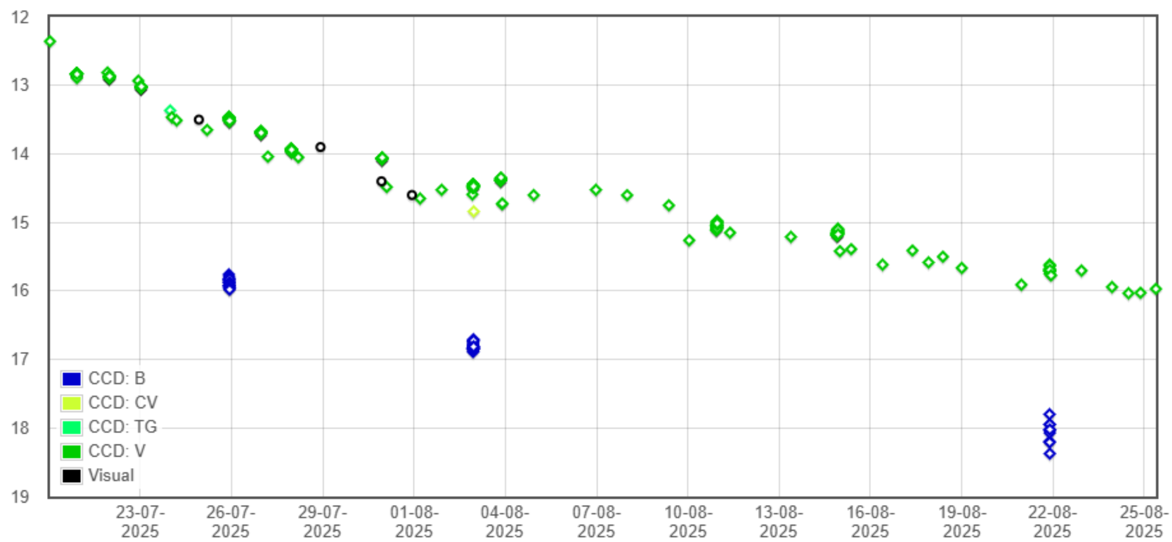

Fig 1. V691 Ser (Nova Ser 2025). July 20 – Aug 25. D. Boyd, M Mobberley, G Poyner, I Sharp, I L Walton (*BAAVSS Database*)

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HT Cas:

A superoutburst of this eclipsing UGSU star was detected by AAVSO observer Terry Benner on July 22:23 UT at visual magnitude 12.5. The previous outburst occurred in June, 2021.

Maximum lasted around 5 days with a slow gradual decline after 11 days to magnitude 13.7 mv. At the time of writing (August 13), 25 days into the outburst, HT Cas remains about one magnitude above its quiescent value of 16.5V

Figure 2 shows two eclipses as observed by Ian Sharp. The P_{orb} for HT Cas is 0.07365d or 106.052 minutes, with an eclipse duration of 15-18 minutes and a depth of 0.8-0.9 magnitudes.

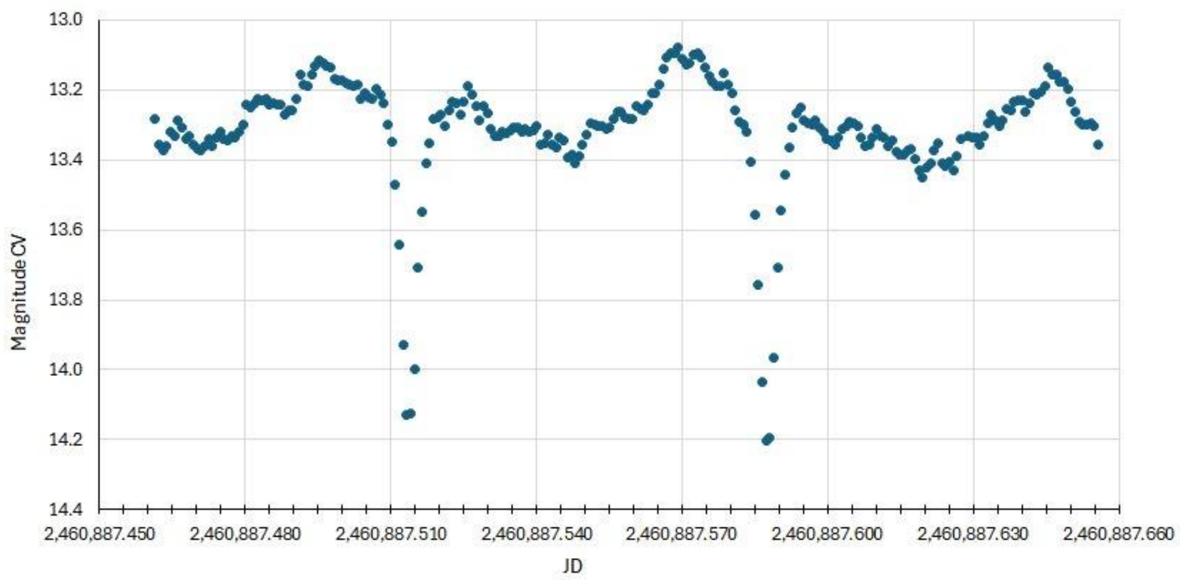

Fig. 2. Consecutive eclipses in HT Cas. Ian Sharp, 279mm SCT @f/7 and SX Trius 694 CCD camera. Measures made with infrared blocking filter on 2025 July 30-31, 23h – 03h 30m UT. Data from VSS database.

Z UMi:

The most northerly of all RCB stars – Z UMi, has finally returned to maximum brightness following its fade to a deep minimum in the autumn/winter of 2024, where it reached 18.5V in late October. The decline began in early March 2024 (a value of 11.4 visual was set to mark the start and end of the fade) and reached minimum 100 days later. The recovery began very quickly – within 28 days – and has been a slower, but uninterrupted ride back to maximum brightness taking 242d. This is quite normal for RCB stars of course where the decline is faster than recovery. What is unusual about this minimum is the fast recovery rate. This is the second deepest minimum ever seen in Z UMi, following the <19th magnitude reached in late 2007. (Figure 3)

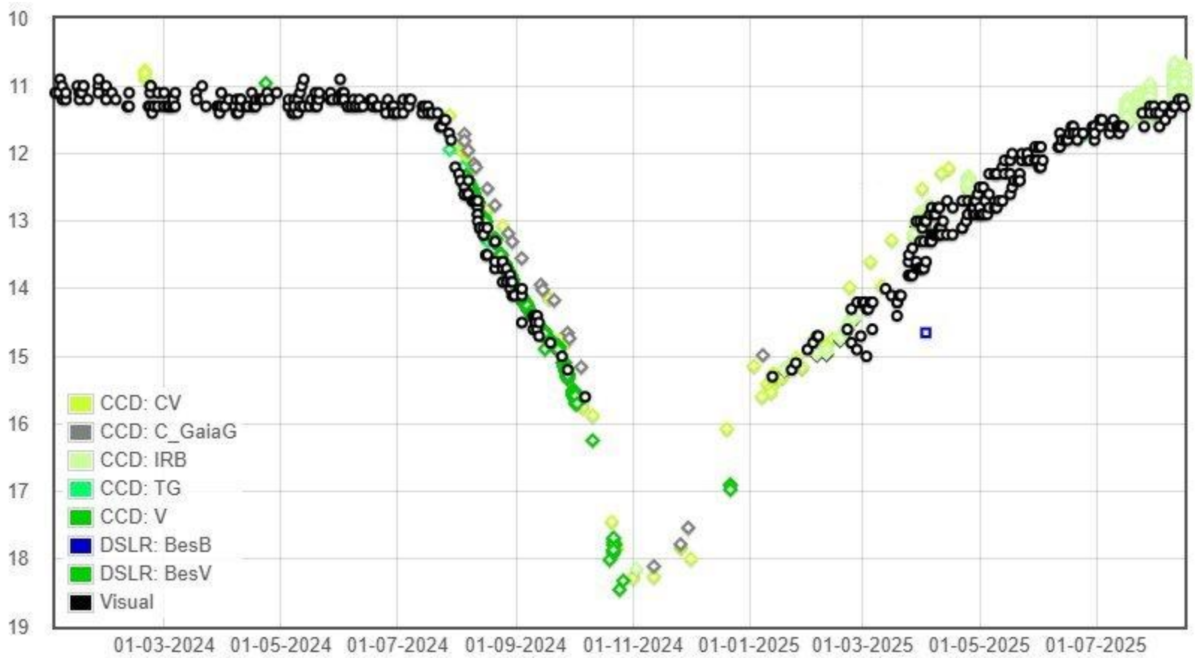

Fig. 3. Z UMi. Jan 1, 2024 – Aug 17, 2025. Observers: R C Dryden, N D James, W Parkes, R Pearce, M Phillips, G Poyner, G J Privett, I Sharp, J Toone, T Vale, I L Walton, P B Withers. *BAAVSS Database*

V730 Cep:

The CTTS/DIP (Classical T Tauri star which displays dips) star V730 Cep has made a dramatic recovery in brightness from a very low state on July 24 at 16.74V to 13.0V by Aug 11 – fading a little to just below 13.0mv by Aug 17 (Figure 4). The July 'dip' (presumably caused by transiting molecular clouds/debris) is the faintest ever seen since V730 Cep became a target for amateur monitoring in 2001 – when it was then known as Mis V1147 having been discovered by Seiichi Yoshida, Nobuo Ohkura and Ken-ichi Kadota as part of the MISAO project. [3]

The light curve for V730 Cep looks chaotic from a visual inspection (Figure 5) because the rate of variability can be very fast and totally unpredictable. The last three years have seen activity at a slightly lower level with the star generally fainter than the previous decade by around a magnitude. This recent recovery *may* signify a brighter phase returning.

If you haven't observed V730 Cep in the past, this might be a good time to start. Observations should be made on every occasion – and expect the unexpected!

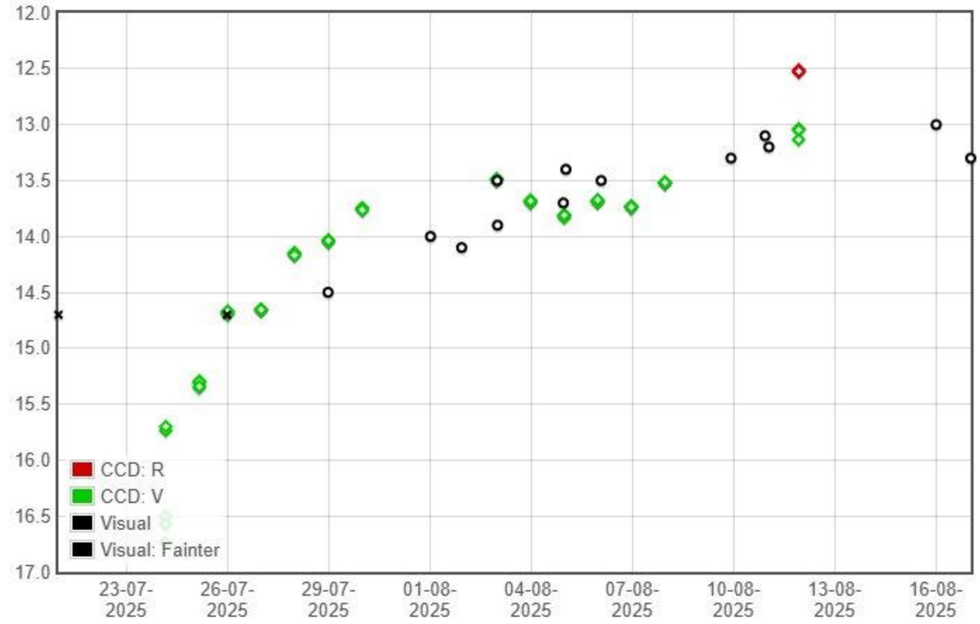

Fig 4. V730 Cep recovery – July-August 2025. M Phillips, G. Poyner, P B Withers. *BAAVSS Database*

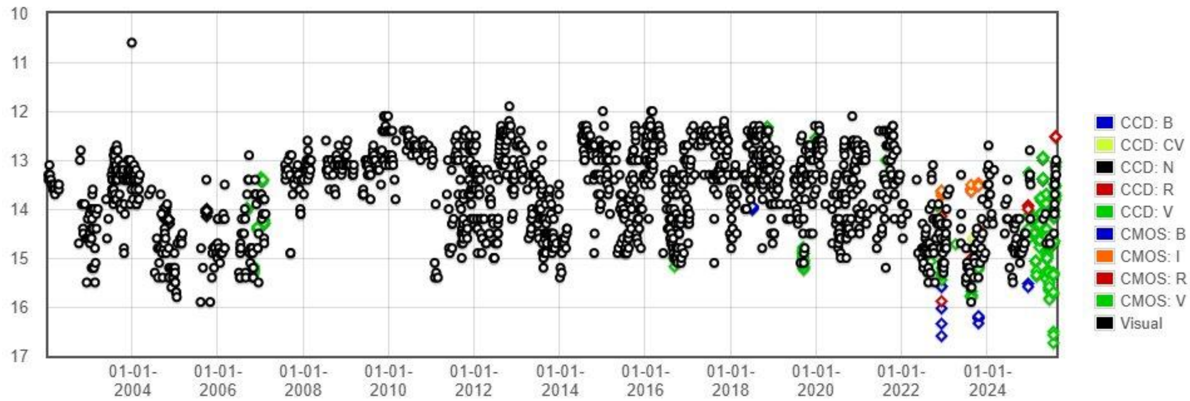

Fig 5. V730 Cep. Jan 2002-Aug 2025. Observers; R C Dryden, G Flemming, V Hull, R K Hunt, S Johnson, C P Jones, P C Leyland, M Phillips, R D Pickard, G Poyner, J Shears, I L Walton, P B Withers. *BAAVSS Database*

1: CBAT electronic telegram 5587

2: Atel#17292. Alexander Taraskenov et al, July 19, 2025

3: MISAO project – MisV1147 (*Not updated since 2020, but worth a look*).

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V598 Sco: A new Eclipsing Dwarf Nova

Rod Stubbings

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Long-term monitoring of the dwarf nova V598 Sco began in 2018. The aim of this monitoring was to study the outburst behaviour of the star system. Throughout this period, the observations ultimately led to the discovery and identification of V598 Sco as a new eclipsing dwarf nova. This was achieved through visual observations.

History

V598 Sco was discovered by H. H. Swope in 1943, as noted in the Harvard Annals (1943 Harv. Ann. 109). Petit later reported it in his catalogue of dwarf novae (1960 J. Obs., 43, 17). In total, five outbursts of V598 Sco have been recorded, as documented in IBVS 3716 (1992IBVS.3716….1C Page 1).

In March 1992, a spectrum was obtained over two nights using the 1.52 m ESO telescope at La Silla, Chile, as part of the observations documented in IBVS 3716. On the first night, V598 Sco was in a quiescent state, with a magnitude of approximately 17.0. The following night, it reached its maximum brightness at around magnitude 14.0. Initially, the spectrum did not correspond to a UG star classification.

V598 Sco is accompanied by a close neighbouring red star, which has a magnitude of 16.2 and is positioned 7 arc seconds away. Initially, this caused some confusion with the spectrum taken in March 1992. Subsequently, the classification was revised as reported in 2001A7A…373..608D to designate V598 Sco as the correct UG star.

T. Kato noted in vsnet-chat#8126 (2018) that V598 Sco was an active dwarf nova. He did not specify the subtype, as it was unknown at the time. In vsnet-chat #9283 (2023), it was identified as a Z Cam star. This is a type of cataclysmic variable star known for its unique behaviour. The International Variable Star Index (VSX) updated the classification of V598 Sco to a UGZ/IW: star. The star has a magnitude range of 14.9 to 17.0.

Observations

In light of the announcement regarding vsnet-chat#8126, I had decided to include V598 Sco on my observation list. My primary objective is to monitor active dwarf novae. I place particular emphasis on detecting outbursts and identifying any atypical occurrences. I conducted my initial observations of V598 Sco on September 2, 2018. Remarkably, just eight days later, I detected my first outburst from V598 Sco. It was recorded at a magnitude of 15.3.

The field of V598 Sco is very dense and challenging to observe visually. This has somewhat limited my depth of magnitude in the field. It only allows me to see the upper limit of the stars' brightness. Figure 1 presents the current visual light curve for V598 Sco. It covers the period from 2018 to April 2025. The light curve includes both positive (green) and negative (black) observations.

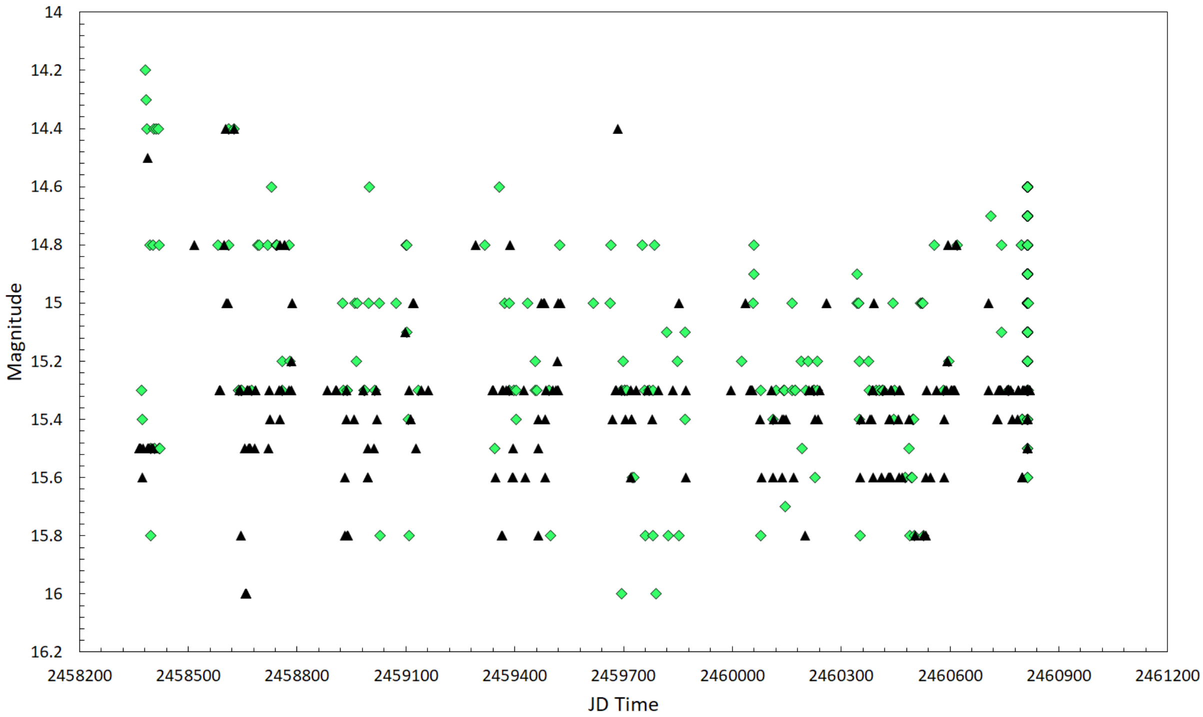

Figure 1. Visual light curve of V598 Sco covering the period from 2018 to April 2025

The light curve consists of 720 observations. I have identified V598 Sco as an active dwarf nova. I recorded a total of sixty-eight outbursts throughout the observation period. The intervals between these outbursts have varied between nine and thirty-seven days. The brightest recorded was 14.2. Generally, most outburst detections were at a magnitude of around 15.3. Outbursts last around 3 to 8 days. There are extended periods of 10 days or more during which a confirmed standstill occurs, followed by an outburst.

On April 30, 2025, I conducted my regular nightly patrols. During this time, I detected an outburst of V598 Sco at a magnitude of 14.8. These outbursts typically last a few days, and the outburst remained visible at the same magnitude on May 1. However, when I observed it again on the night of May 2 at 9:42 p.m. local time, I found that it was no longer visible. It was fainter than magnitude 15.6. This was unusual, as V598 Sco should still have been visible. An hour later, I revisited the field. I was surprised to find that V598 Sco was visible again at a magnitude of 15.4. My initial thought was that this would have to be an eclipse rather than the fading of the outburst.

I revisited the field of V598 Sco at regular intervals throughout the night to check for any additional fading events. At 1:29 a.m., I observed that it had faded again. I then continued my observations every two minutes, and it reappeared 12 minutes later. At that moment, I realised I had just discovered a new eclipsing star. I maintained my regular observations, and V598 Sco remained visible until 3:16 a.m., when clouds ultimately ended my session.

The next opportunity to observe the star was on May 5; however, observations during that night indicated it had faded. This fading suggested that the outburst was over. Over the following days, strong moonlight obscured the night sky, preventing my observations of V598 Sco for some time.

The next outburst of V598 Sco was detected on May 17. This occurred during the early morning hours. It was relatively bright at a magnitude of 14.7. I decided to conduct one-minute observations to monitor for another eclipse. The observations began at 3:16 a.m., with the star entering an eclipse at

4:03 a.m. It reappeared at 4:18 a.m., resulting in an eclipse duration of 15 minutes. Mid-eclipse was on Julian Date 2460813.25630. The light curve from this full eclipse duration can be seen in Figure 2.

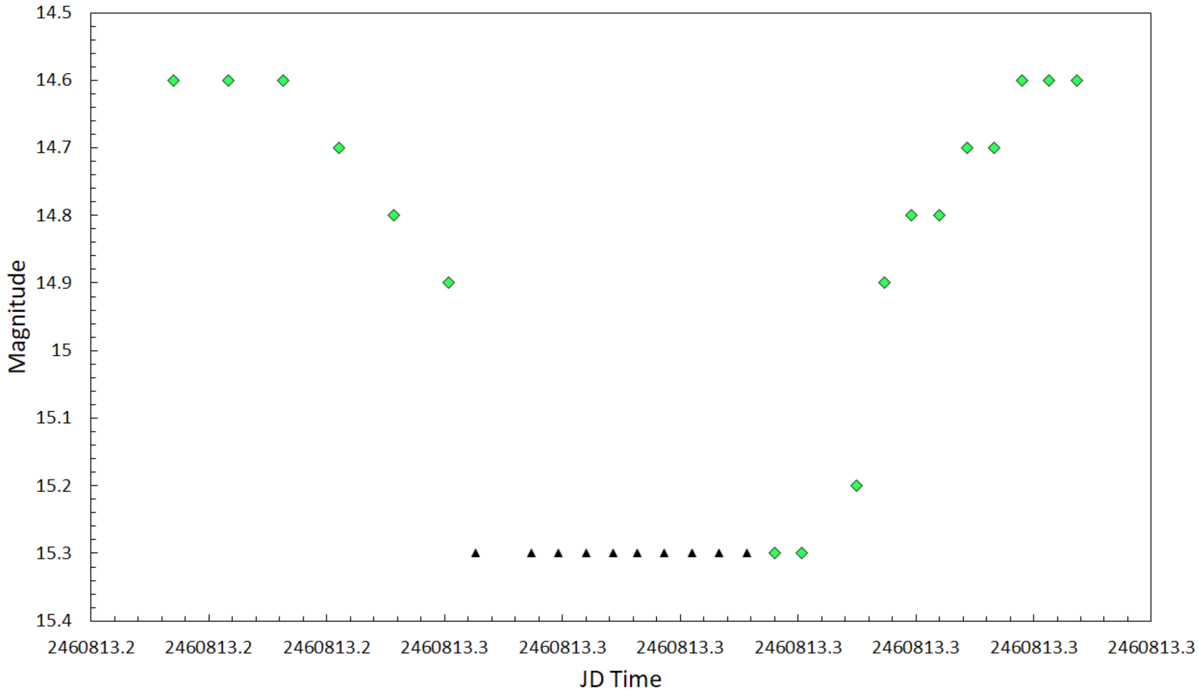

Figure 2. The first full eclipse was observed on 17 May 2025.

The following evening, on May 18, I embarked on a mission to identify consecutive eclipses. V598 Sco remained prominently visible, with a brightness of magnitude 14.8. Prior observations suggested that these eclipses transpired with a separation of over three hours.

I started my first observation at 7:16 p.m. and continued recording one-minute observations for 3 hours and 29 minutes. The next eclipse occurred at 10:44 p.m., with a duration of 16 minutes. The midpoint of the eclipse was at Julian Date 2460814.03505. The light curve for this eclipse is shown in Figure 3.

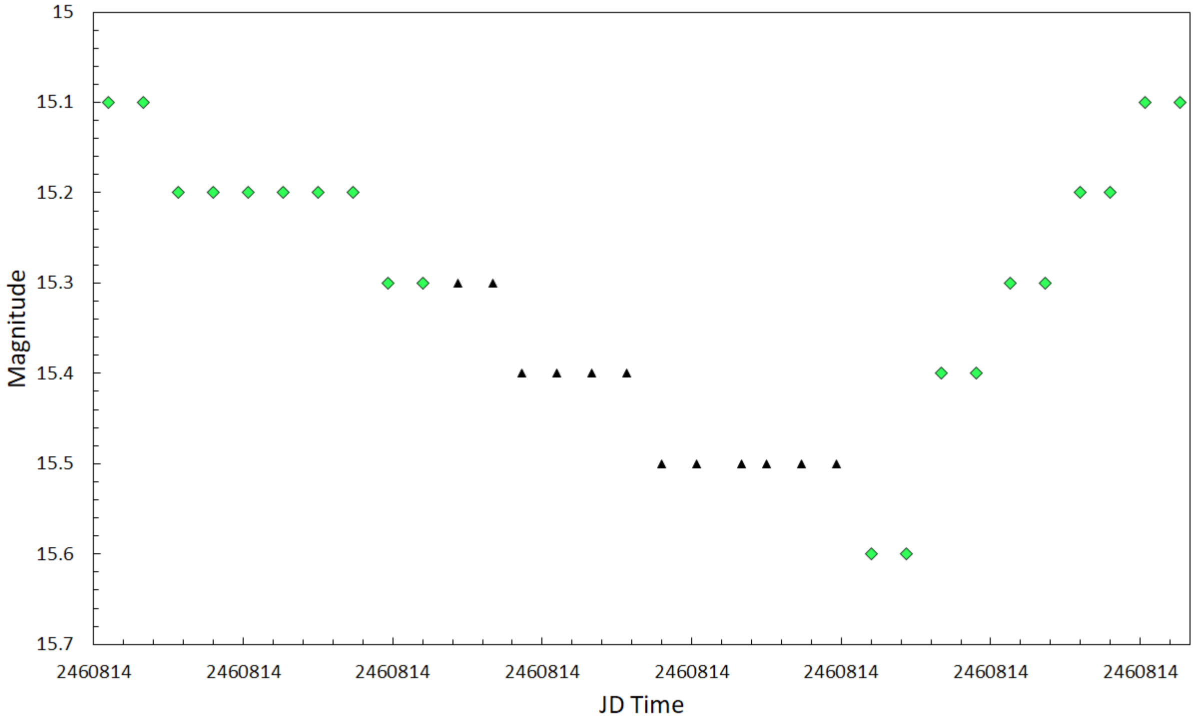

Figure 3. The first eclipse was observed on May 18, 2025.

The forthcoming eclipse was anticipated to be longer than three hours. I conducted observations again at one-minute intervals. These began at 2:07 a.m. The wait was minimal, as the subsequent eclipse began at 2:30 a.m. The duration of this particular eclipse was approximately 13 minutes. The midpoint of the eclipse was recorded at Julian Date 2460814.19135. The light curve corresponding to this eclipse is illustrated in Figure 4.

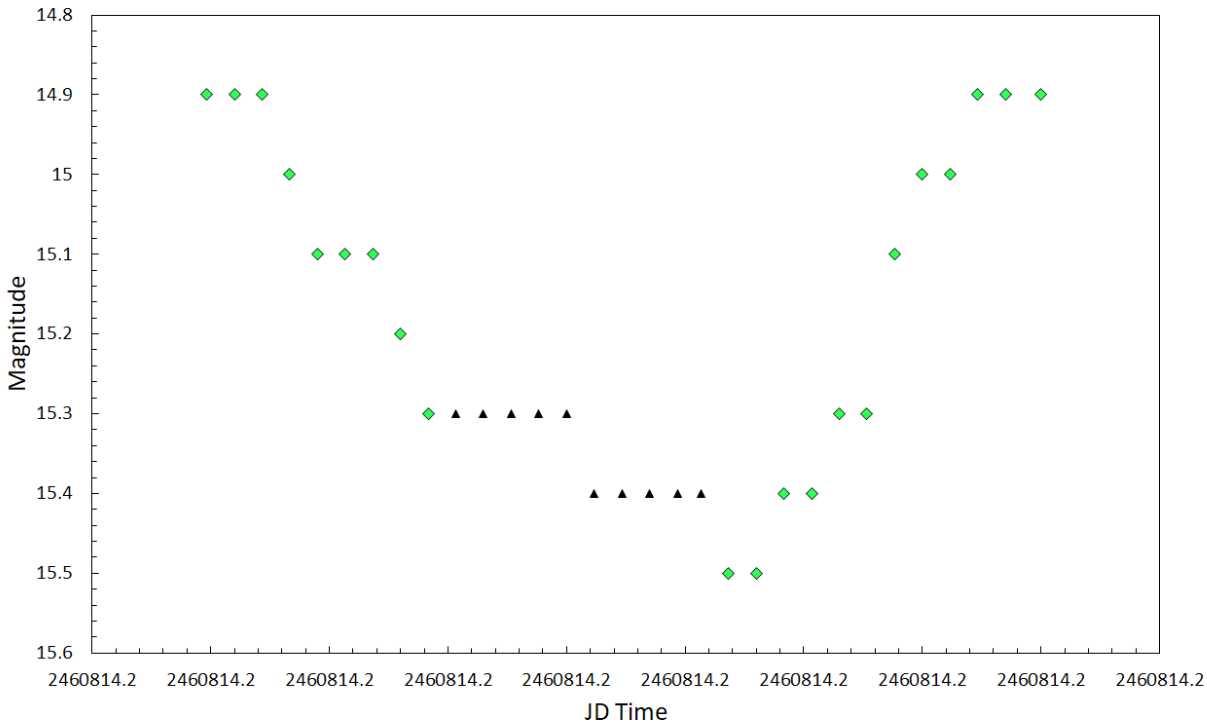

Figure 4. The second consecutive eclipse was observed on May 18, 2025.

Upon observing consecutive eclipses, I successfully determined the period to be 0.15630 days. I subsequently added this period of 0.15630 to the date of the first mid-eclipse, which occurred on Julian Date 2460813.22630, observed on May 17. I then compared this calculation to the first mid-eclipse observed on May 18, corresponding to Julian Date 2460814.03505. The resulting difference was 0.00275. I also added the period to the second consecutive mid-eclipse on May 18 at Julian Date 2460814.19135. The difference was again 0.00275.

The magnitude depth of eclipses is greater than 1.4 based on my visual observations. This also depends on the brightness of each outburst. It also depends on the limitations of my telescope and the prevailing seeing conditions.

Based on my findings, I have established the provisional epoch of the eclipse for V598 Sco.

Provisional epoch, 17 May 2025 (HJD 2460813.26163) + 0.15630 × E

Analysis

I sent all my eclipse data to Sebastian Otero of the American Association of Variable Stars (AAVSO). He oversees the AAVSO International Variable Star Index (VSX) database. Sebastian performed further analysis on all available photometry from all available data sources using my observations.

The star is shown to be very active, undergoing continuous outbursts. The light curve displays over 100 outbursts, as observed with ASAS-SN, ATLAS, and AAVSO data (Figure 5). My visual observations align well with other data sources.

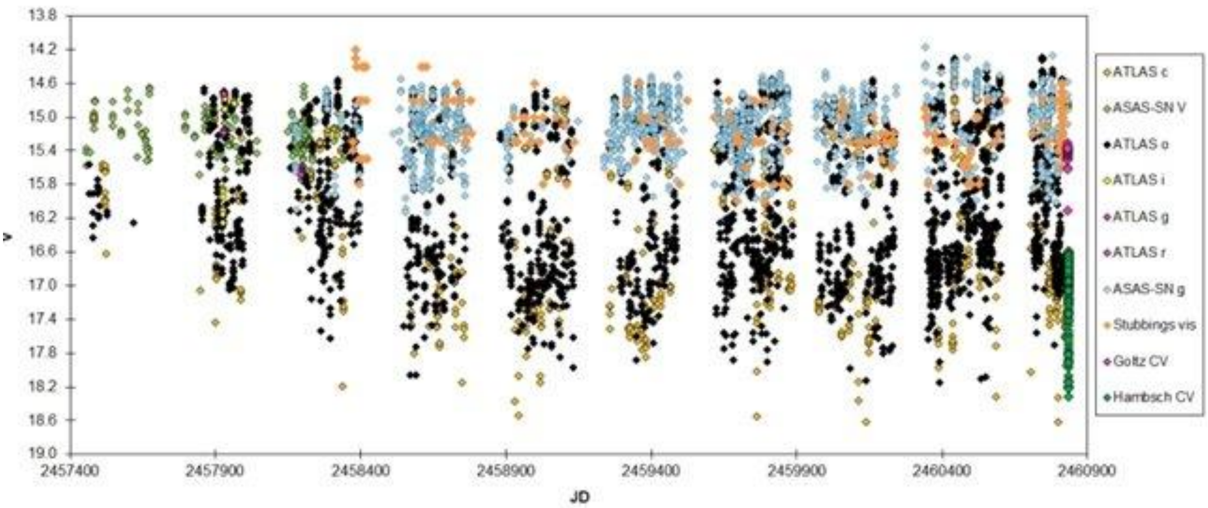

Figure 5. Over 100 outbursts with ASAS-SN, ATLAS and AAVSO data

Sebastian confirmed the UGZ/IW classification. A standstill, followed by an outburst in the years of data from ATLAS, ASAS-SN, and my observations is shown in Figure 6.

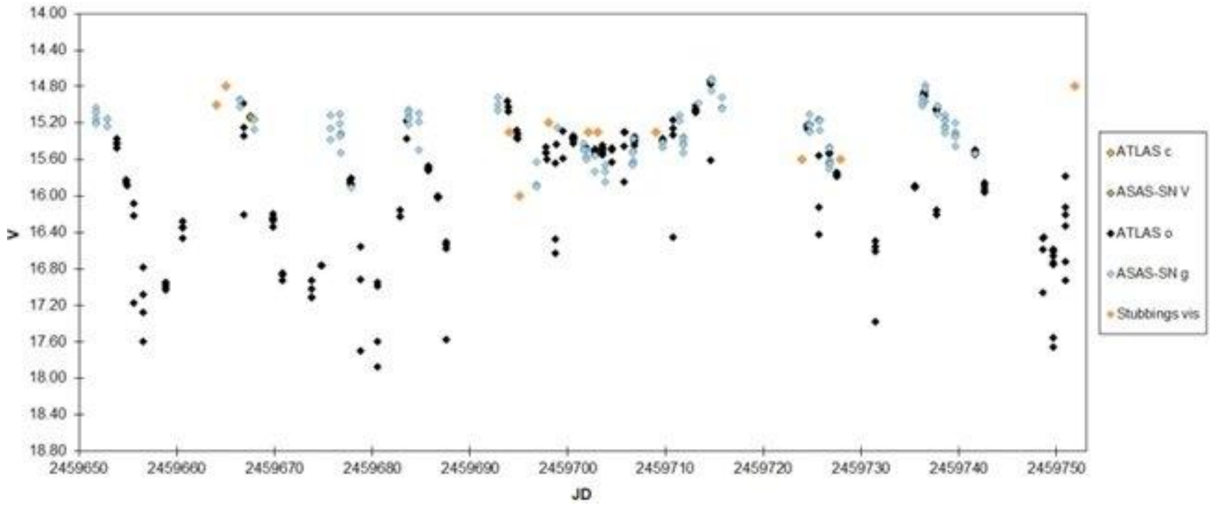

Figure 6. Light curve showing a standstill followed by an outburst with Stubbings, ATLAS and ASAS-SN data.

Sebastian attempted to identify an eclipse period using my eclipse elements, utilising the survey data exclusively. However, he was unsuccessful in his efforts. Subsequently, he refined his search to focus on periods that were close to my calculated eclipse period. Yet he still encountered no significant findings. It was strange that there were no signs of eclipses. The relatively active nature of the star might be contributing to this. Unfortunately, there are no contemporaneous observations in the survey data.

A time-sensitive alert request was sent to the AAVSO forum for observations. This was necessary for time series observations, particularly during an outburst, and at a minimum state. The ephemeris from my data, along with the established provisional period, is anticipated to provide confirmation of the eclipses.

Eclipses were confirmed by AAVSO observers William Goltz and Josch Hambsch hours later on the same night. The in-house campaign proved to be successful, enabling Sebastian to accurately determine the period to seven decimal places. Furthermore, Josch's eclipse coincided with the star's minimum luminosity, as shown in Figure 7.

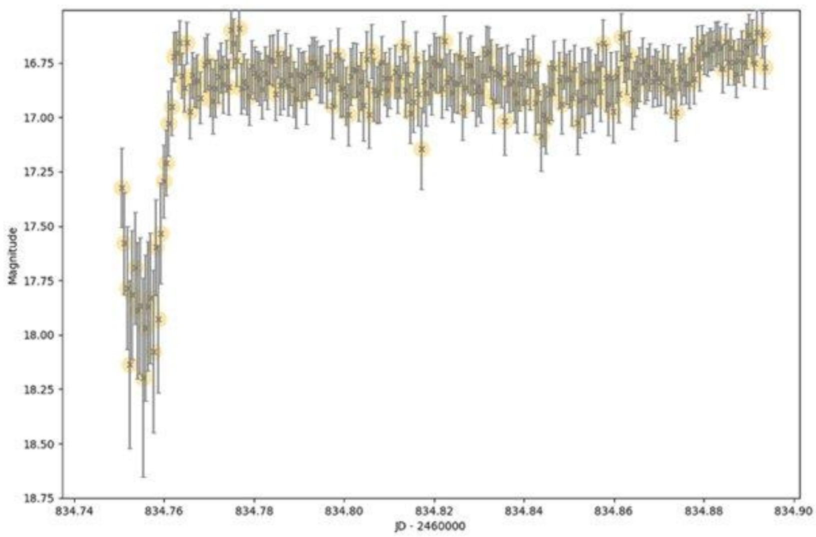

Figure 7. Eclipse profile from Josch Hambsch at minimum light.

By combining the eclipse observations with mine, Sebastian was able to determine a preliminary period. After plotting all the survey data together, he improved this period. The eclipse was not initially detected using only the survey data. However, now that we had a value for the period, it became quite evident. The new improved period is HJD 2460813.2652 + 0.15578541 × E.

Conclusion

The author has conducted visual monitoring of V598 Sco since 2018. It is recognised as a highly active outbursting dwarf nova. On April 30, 2025, an eclipse was detected during one of its outbursts through visual systematic observations. This significant discovery has subsequently been updated in the International Variable Star Index (VSX).

V598 Sco, a UGZ/IW+E star with a magnitude range of 14.2 to 18.6 V. This range is based on data from ASAS-SN, ATLAS, and Stubbings. Period, epoch, and eclipse duration from ATLAS, ASAS-SN and AAVSO (Stubbings, Hambsch and Goltz) data.

Epoch: 17 May 2025 (HJD 2460813.2633)

Period: 0.15578541 d (3.738850 h)

Figures 8, 9, 10, and 11 present a series of plots illustrating the eclipse of V598 Sco. These graphical representations are based on a comprehensive analysis of all available data sources conducted by Sebastian Otero.

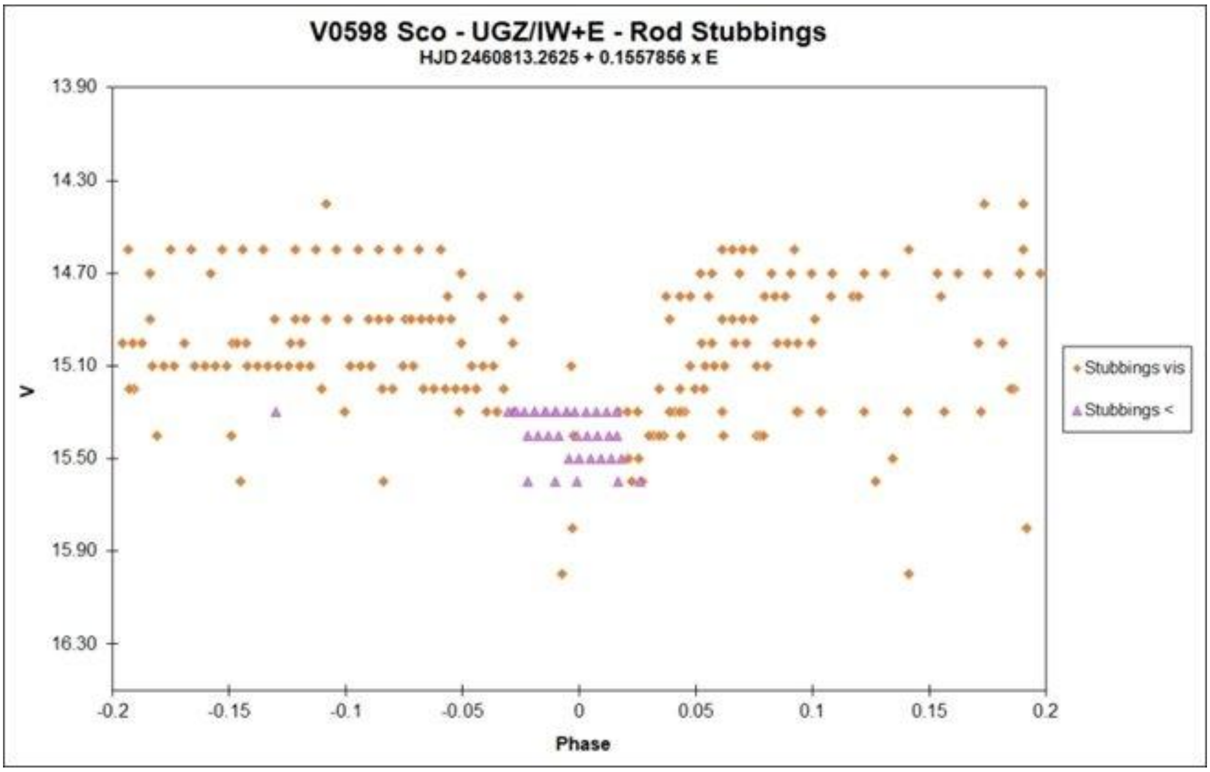

Figure 8. Phase plot with Rod Stubbings' data.

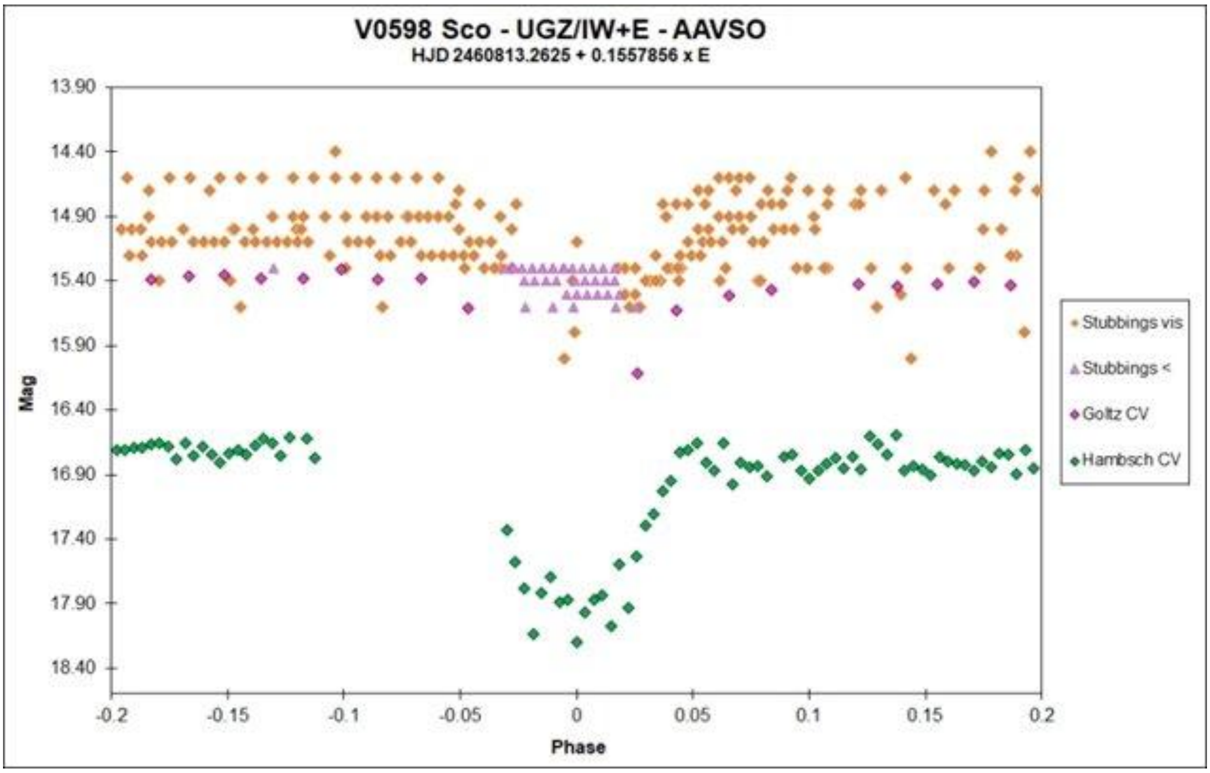

Figure 9. Phase plot with AAVSO data.

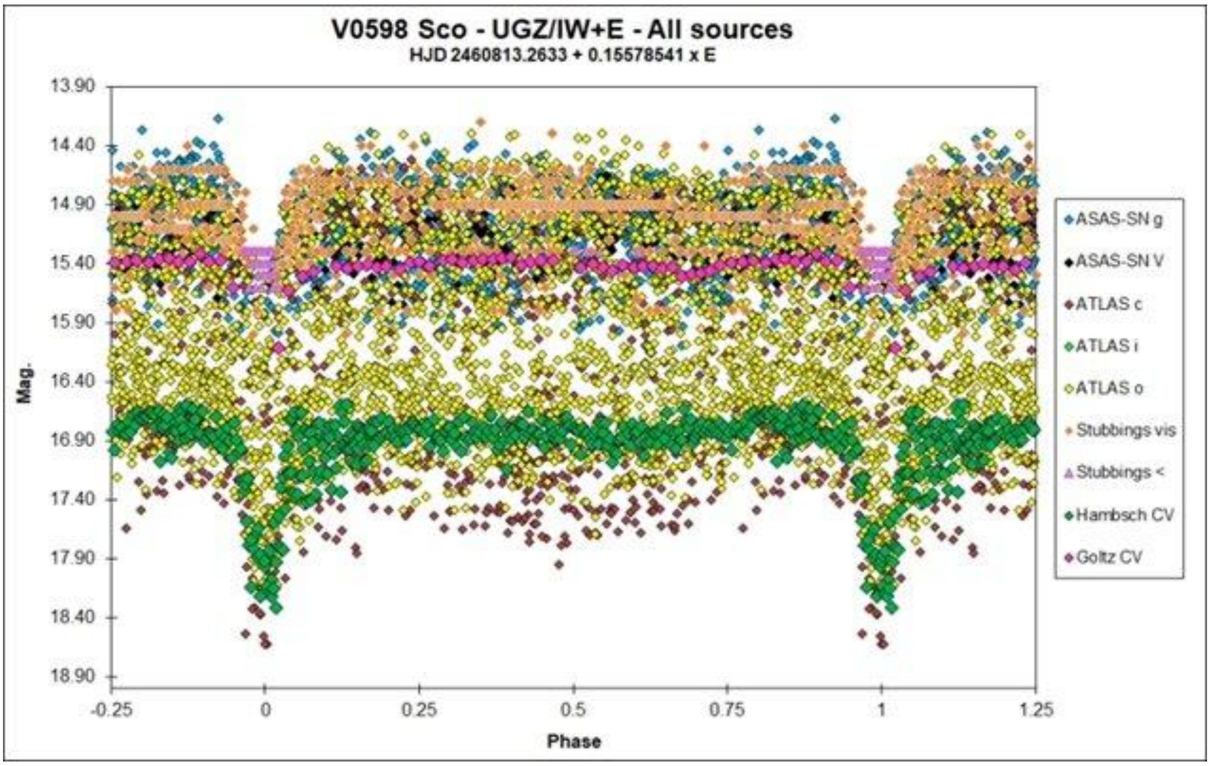

Figure 10. Phase plot with ASAS-SN, ATLAS, and AAVSO data.

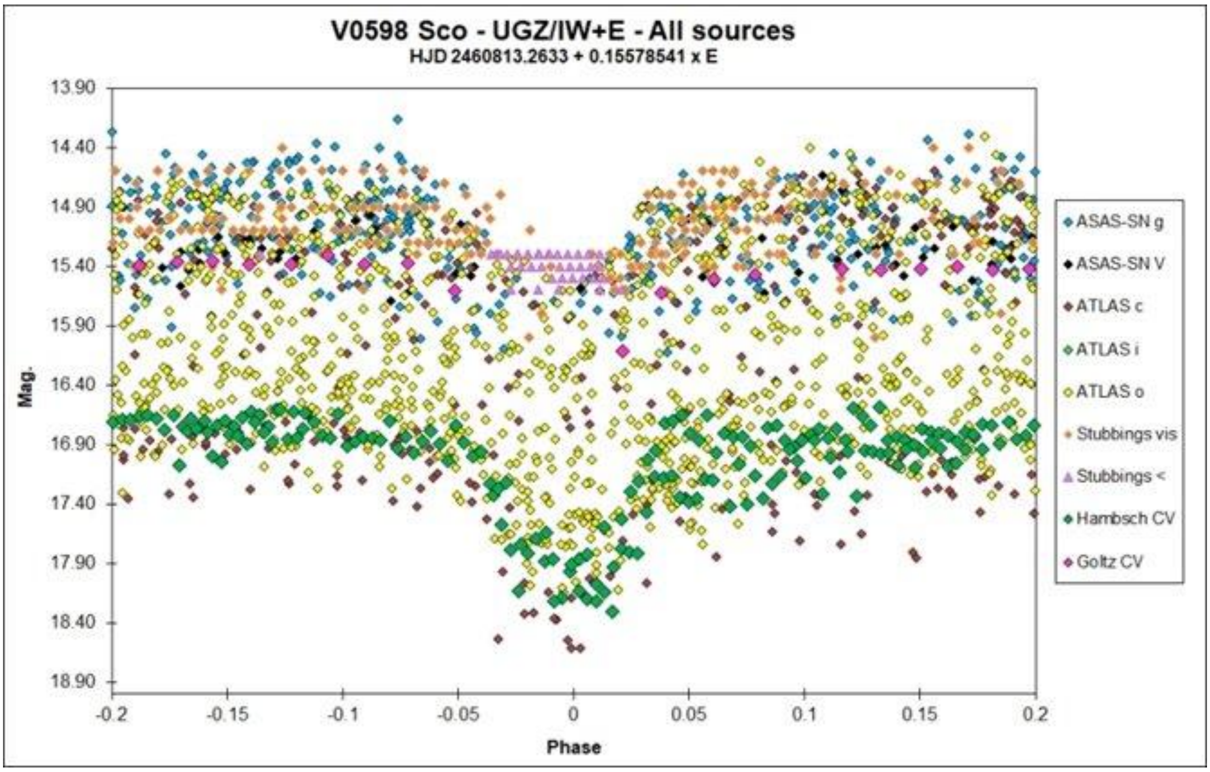

Figure 11. Phase plot zoomed into the primary minimum with ASAS-SN, ATLAS, and AAVSO data.

Acknowledgments

I would like to express my gratitude to Sebastian Otero for his valuable input and thorough analysis of V598 Sco, utilising all available data sources. Additionally, I extend my appreciation to AAVSO observers W. Goltz and J. Hambsch for their prompt confirmation of eclipses through time-series photometry.

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Information Bulletin on Variable Stars, No. 3716, #1.

Petit (1960 J. Obs., 43, 17).

The International Variable Star Index © 2005-2025 American Association of Variable Star Observers (AAVSO) Version 1.1 [C]

172.30.5.116

T. Kato, 2018, vsnet-chat#8126

T Kato, 2023, vsnet-chat#9283

The nature of the recent transients ASASSN-25dc, TCP J16271026-1030020 and TCP J18513997+3522412

Christopher Lloyd

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ATLAS and other survey data support the conclusion that these transients are likely WZ Sagittae systems. All show no evidence of prior normal or superoutbursts since 2016, suggesting long recurrence time scales. ASASSN-25dc is an unusual system with a 1 magnitude dip after 9 days and a very long outburst of 36 d, and a very shallow decline rate. At the time of writing both this and TCP J16271026-1030020 are still some magnitudes above quiescence. TCP J18513997+3522412 shows a rebrightening event.

Introduction

The three transients discussed here are all recent, bright, and have large outburst amplitudes. All three also have extensive time-series data that reveal early superhumps indicating that these are WZ Sge (UGWZ) as opposed to SU UMa (UGSU) systems. Superoutburst of UGSU and UGWZ systems are broadly similar, but the principal distinguishing features are that UGWZ systems have recurrence intervals in the thousands of days as opposed to hundreds for the UGSU stars, and they tend not to show normal outbursts. Rebrightening events on or after the fade to quiescence are a distinguishing feature of UGWZ systems (see e.g., Kato, 2015, Tampo et al., 2020). There is considerable overlap in the decline rates during the plateau phase, but the UGWZ stars tend to be slower, typically < 0.1 mag d^{-1}, and similarly with the outburst amplitudes, where the largest tend to be the UGWZ systems. In time-series data UGWZ systems can show early superhumps, which are double-peaked modulations, very close to the orbital period, and are regarded as diagnostic. Additional data are taken from the Asteroid Terrestrial-impact Last Alert System (ATLAS) (Tonry et al., 2018), where most of the observations are made in the 'cyan' *c* (420–650 nm) and the 'orange' *o* band (560–820 nm). The data were downloaded from the ATLAS Forced Photometry web service (Shingles et al., 2021). Additional data are available from the Zwicky Transient Facility (ZTF) (Bellm et al., 2019, Masci et al., 2019) in the Sloan *g* (414–546 nm) and *r* (566–721 nm) passbands, that coincide with the blue halves of the *c* and *o* bands. The All-Sky Automated Survey for Supernovae (ASAS-SN) Shappee et al. (2014), Kochanek et al. (2017) also provides some data in the Sloan *g* band for the brighter systems.

ASASSN-25dc

ASASSN-25dc was discovered on 2025 July 13.1 (JD = 2460869.6) at *g* = 13.6 by the ASAS-SN project, but positive observations had also been made during the previous four days. ATLAS caught the outburst on the rise on JD=2460864.3 at *o* = 15.16. The pre-outburst counterpart is provisionally identified as Gaia DR3 6129070308813533568, with *G* = 21.0, and $G_{BP} - G_{RP}$ = 0.1, which is typical of UGWZ systems at quiescence. The transient is now listed in the AAVSO VSX as a UGWZ system under the ASASSN-25dc designation. The full light curve is shown in Fig. 1 and the detail of the recent outburst in Fig. 2.

In addition to the survey data, extensive time-series observations have also been made, and some of these are publicly available through the AAVSO International Database. Those shown here were made by Franz-Josef Hambsch, Peter Starr, and William Goltz, but other observations have also been made and these will all doubtless be analysed in detail elsewhere in the future. The means of these runs are included in Figs. 1 and 2. The observations by Starr are systematically offset from the others and have been aligned by an arbitrary correction of −0.14 mag.

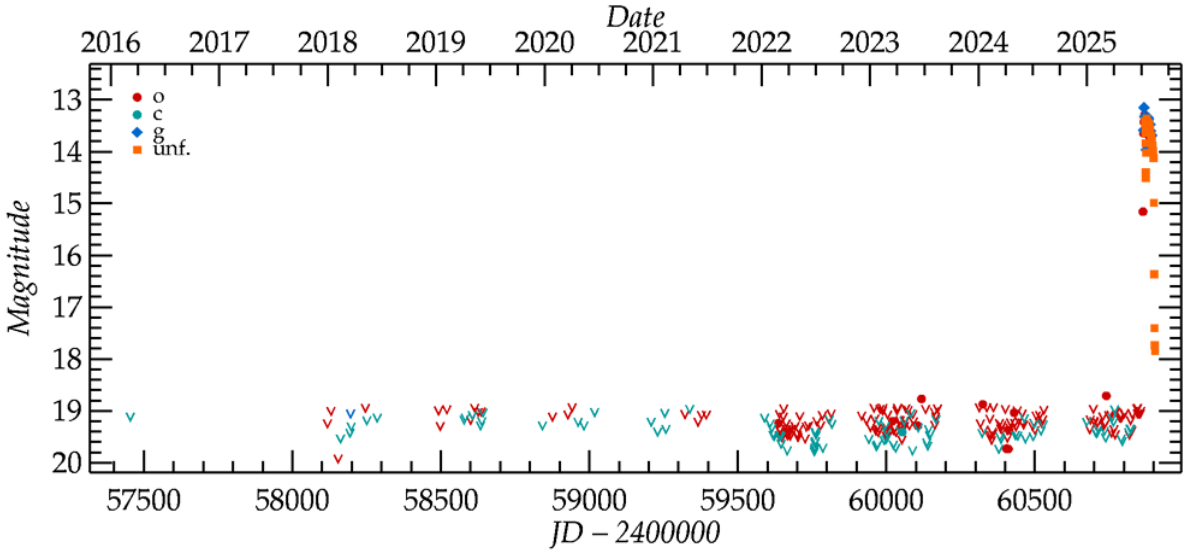

Figure 1: The full light curve of ASASSN-25dc showing the ATLAS *o* and *c*, and ASAS-SN *g* data, with the means of multiple positive observations (filled symbols), individual observations (open symbols) and upper limits fainter than *m* =19.0. The means of the time-series runs are also shown.

ATLAS data are available from 2016, but are relatively sparse prior to 2022, and the object is too far south to be observed by the ZTF. The full light curve is shown in Fig. 1, but only the upper limits fainter than *m* = 19.0 are plotted to avoid confusion. The recent outburst is obvious, but there is no indication of any previous activity. There are a small number of positive ATLAS detections at $o \simeq 19$ that may indicate variations of perhaps two magnitudes above quiescence. Fig. 2 shows that the outburst was caught rising at *o* = 15.2, and peaked at $g,o,c \simeq 13.3$, some 4–6 days later. Then followed a fade and recovery of about one magnitude over four days. The plateau phase continued close to maximum brightness at $g \simeq 13.4$ with small variations in gradient, and then after the gap in the data at JD $\simeq$ 2460889 the decline rate steepened to 0.048(1) mag d^{-1} over the final 10 days of the outburst and is 0.029(1) mag d^{-1} overall. In total the outburst lasted 36 days near maximum, with an additional 2–3 days in rise and decline. The quiescent magnitude of *G* = 21.0 and peak of *o* = 13.3

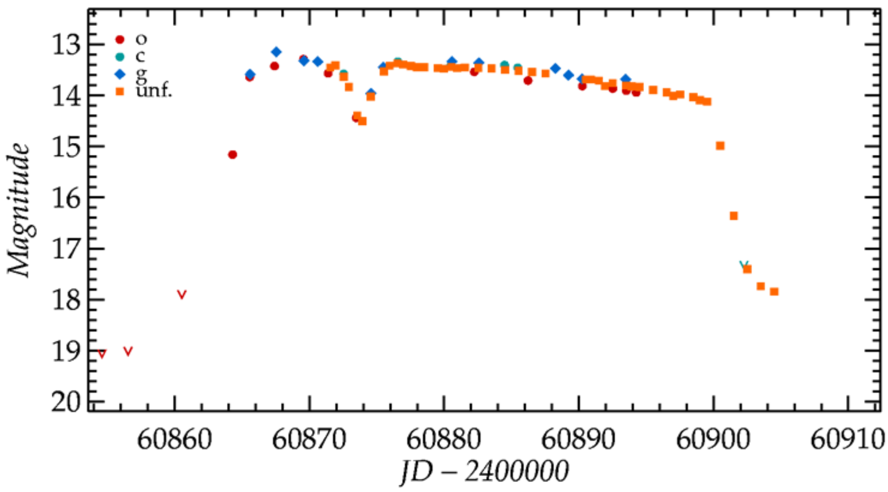

Figure 2: Detail of the recent outburst of ASASSN-25dc. The symbols are as before.

lead to a broadband amplitude of 7.7 magnitudes, which is typical of UGWZ systems. Interestingly, at the time of writing the final fade has slowed, and stalled at $m \simeq 17.9$, some three magnitudes above quiescence, so there may yet be some interesting developments.

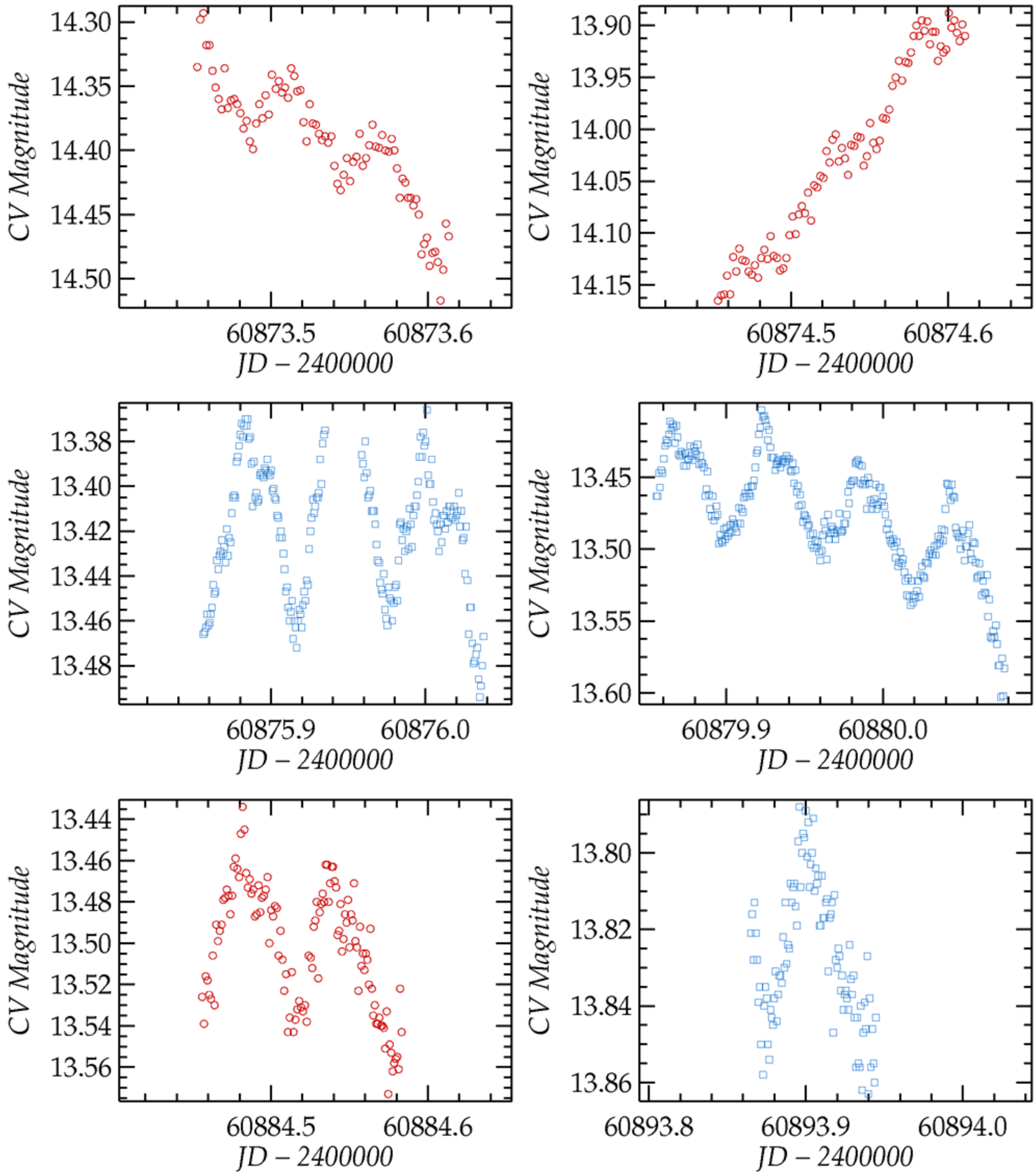

Figure 3: Evolution of the superhumps in individual time-series runs of ASASSN-25dc from different points in the outburst. The time axis has the same scale in all the panels, but the magnitude axis does not. The series starts about nine days into the outburst. The top two panels show very weak modulation during the ingress and egress of the early fade, the middle pair show the double humped variation near maximum brightness, and the last pair show the near sinusoidal superhumps from the latter part of the outburst. The maximum superhump amplitude is about $0^{m}.08$ and reduces only slowly through the plateau phase.

The time-series data are already reported to show superhumps with $P_{sh} \simeq 0.0595$ d, and selected runs are shown in Fig. 3. These illustrate the evolution of the superhumps from the early fade through the plateau phase. Superhumps are present in the first time-series run and persist through the early fade, but become very weak as the system brightens again, then quickly develop into strong double-peaked modulations when the system returns to near maximum brightness. Through the rest of the outburst they become more sinusoidal. The maximum superhump amplitude is about $0^m.08$ and reduces only slowly through the plateau phase.

The outburst of ASASSN-25dc shows a number of unusual features. Notably there is a dip in brightness about nine days into the outburst, which in itself is about the (minimum) duration of some SU UMa outbursts, but equally is rather long for a precursor. Whether this is seen as a double outburst, or a precursor, or a very early rebrightening is open to interpretation, but it is unusual. WZ Sge systems are recognized as having very long outbursts, and at 36 d this is among the longest, but not as extreme as some, like PQ And at 53 d. WZ Sge systems also show shallow decline rates during the plateau phase, and again in this outburst is amongst the lowest. The standstill on the fade to quiescence is also unusual and points to a complex decline. The superhump amplitude is also low, and points to the system being a 'period bouncer', where the period starts to increase again after reaching the system's period minimum.

TCP J16271026-1030020 = AT 2025sdf

TCP J16271026-1030020 was discovered by Tadashi Kojima on 2025 July 25.520 (JD=2460882.020) at an unfiltered magnitude of 13.8, and follow-up observations a day later gave $V = 13.76$, $B - V = 0.20$ and $V - R = -0.13$. See the CBAT report. However, the initial rise and maximum had also been caught by ATLAS and ASAS-SN, where it peaked at $o,r \simeq 12.5$ about two days earlier. The counterpart has been identified in the Pan-STARRS survey at $g = 22.06(15)$ and $r = 21.66(8)$, and in the Sloan Digital Sky Surveys (SDSS DR16) at $g = 22.35(9)$ and $r = 21.72(10)$. A small number of ZTF detections give $zr = 21.3$. The outburst amplitude in g is then a substantial 9.7 magnitudes. Time-series observations from shortly after discovery show clear double-peaked superhumps with $P_{sh} \simeq 0.0639$ d, identifying it as a WZ-Sge system, and it is listed as such in the AAVSO VSX under TCP J16271026-1030020.

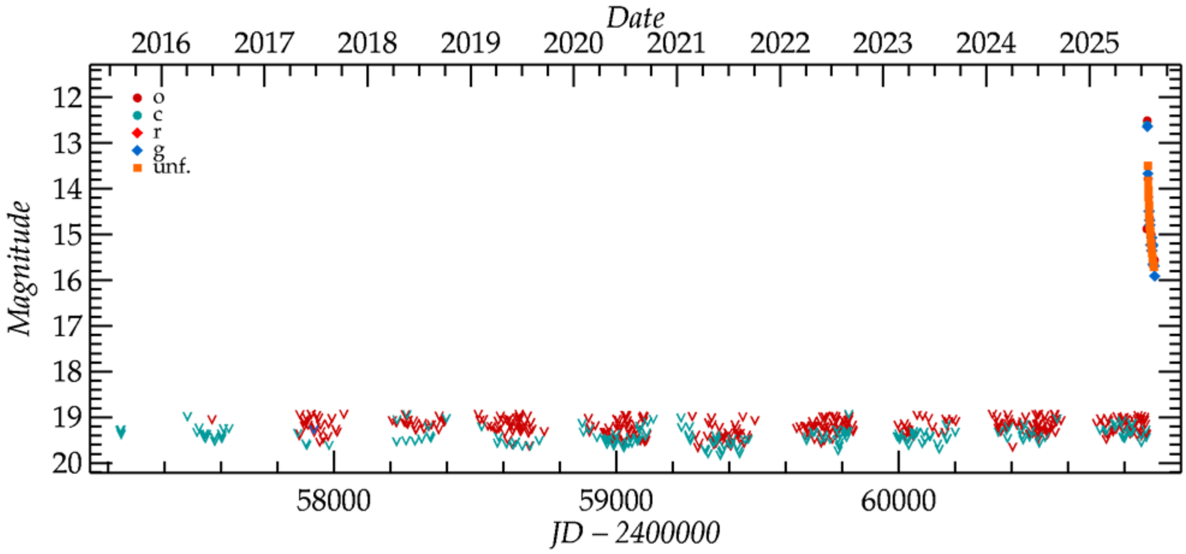

Figure 4: The full light curve of TCP J16271026-1030020 showing the ATLAS, ASAS-SN and time-series data.

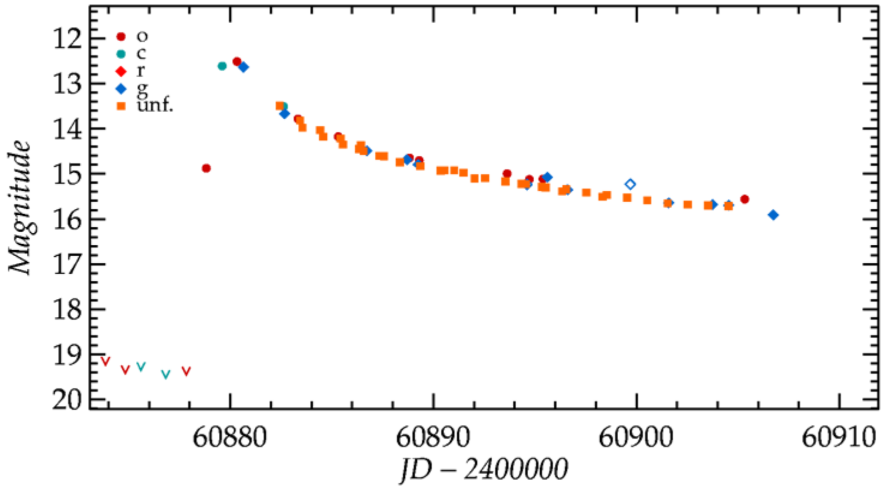

Figure 5: Detail of the outburst of TCP J16271026-1030020. The symbols are as before.

The full light curve is shown in Fig. 4 and there is no indication of any previous activity. The small number of ZTF *zr* observations lie below the plot and are not shown. The detail of the outburst is shown in Fig. 5 where the decline gradually flattens from a relatively steep rate of 0.39(3) mag d^{-1} during the first five days, to 0.044(1) mag d^{-1} over the final ten days. Profiles like this are not uncommon in large amplitude outbursts. At the time of writing the outburst has been in progress for 27 days and it is still 6 magnitudes above quiescence.

Time series observations have been made by Franz-Josef Hambsch, Tonny Vanmunster, Stephen Brincat, and William Goltz, and are available from the AAVSO International Database. The means of each run are included in Figs. 4 and 5, and two of the clearest examples of the early superhumps are shown in Fig 6. The double-peaked variation is clear with an amplitude of $\simeq$ 0.06, but the modulation becomes progressively less visible as the outburst fades.

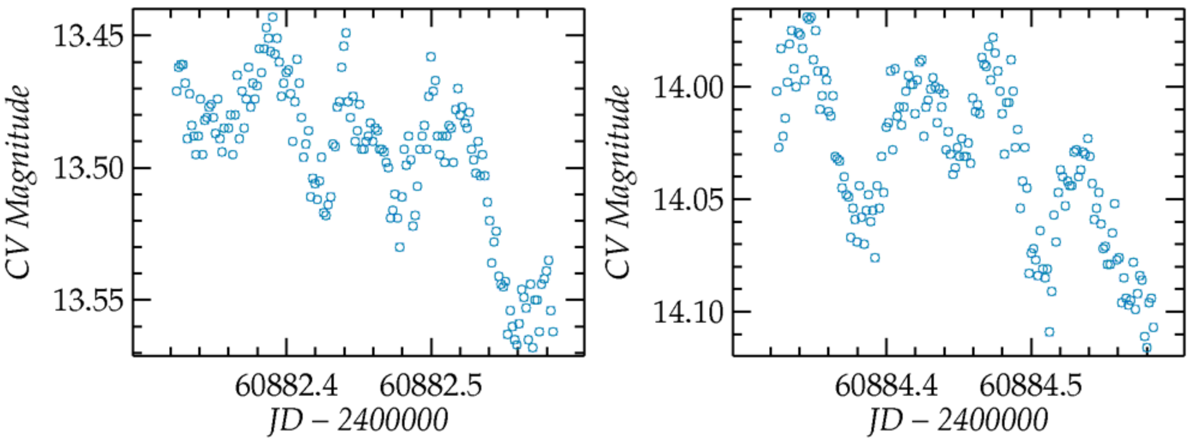

Figure 6: Two runs showing the early superhumps in TCP J16271026-1030020. The maximum superhump amplitude is about $0^m.06$ and reduces only slowly through the plateau phase.

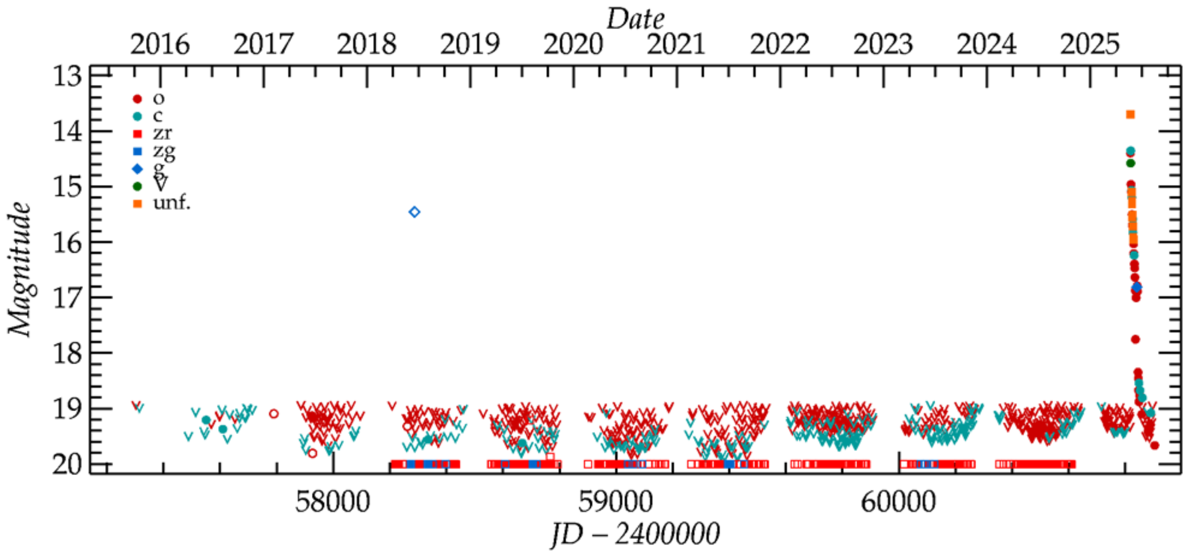

Figure 7: The full light curve of TCP J18513997+3522412 showing the ATLAS, ZTF, ASAS-SN and time-series data.

TCP J18513997+3522412

TCP J18513997+3522412 was discovered by Yuji Nakamura on 2025 May 22.72 (JD = 2460818.22) at an unfiltered magnitude of 13.7. Follow-up observations made within a day gave V = 14.58, $B - V$ = 0.17 and $V - Rc$ = −0.08. See the CBAT report. The counterpart is identified as Gaia DR3 2093166540936884992 with G = 21.6 and $G_{BP} - G_{RP}$ = 0.39, while Pan-STARRS gives g = 20.53(4) and r = 20.55(3), and the substantial number of ZTF observations give zr = 20.7(2). Taking the maximum as magnitude 13.7 then with the quiescent magnitude at $g,r \simeq 20.5$ then the outburst amplitude is a relatively modest 6.8 magnitudes. The system is listed in the AAVSO VSX under TCP J18513997+3522412.

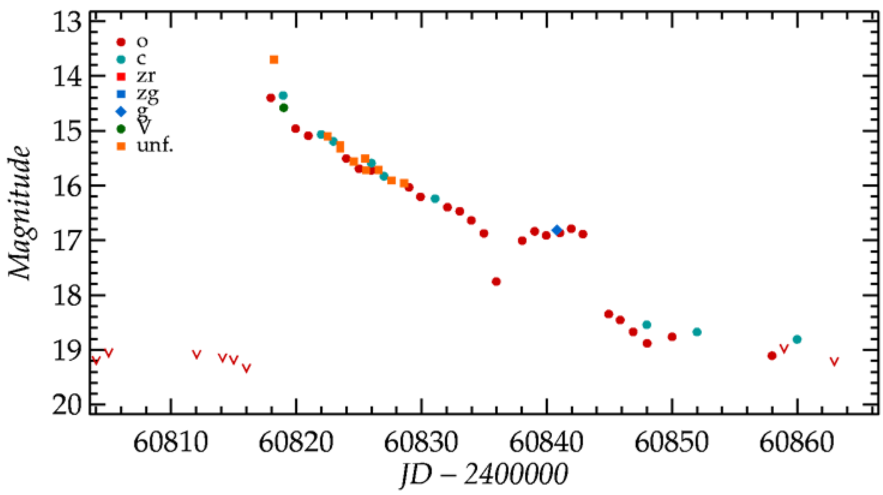

Figure 8: Detail of the outburst of TCP J18513997+3522412. The symbols are as before.

The full light curve is shown in Fig. 7 and despite the spurious ASAS-SN detection there is no indication of any previous activity. The substantial number of ZTF zr and few zg observations all lie below the plot but are shown at magnitude 20.0. The detail of the outburst is shown in Fig. 8. There appears to be a very sharp maximum and rapid initial fall, followed by a regular decline at a rate of

0.126(4) mag d^{-1} over the following 15 days. There is then a rebrightening episode over 3 days, with another drop after 5 days, and a final slow decline to quiescence. These positive observations suggest continuing, low-level activity at the end of the outburst, but there are no indications of any other rebrightening events.

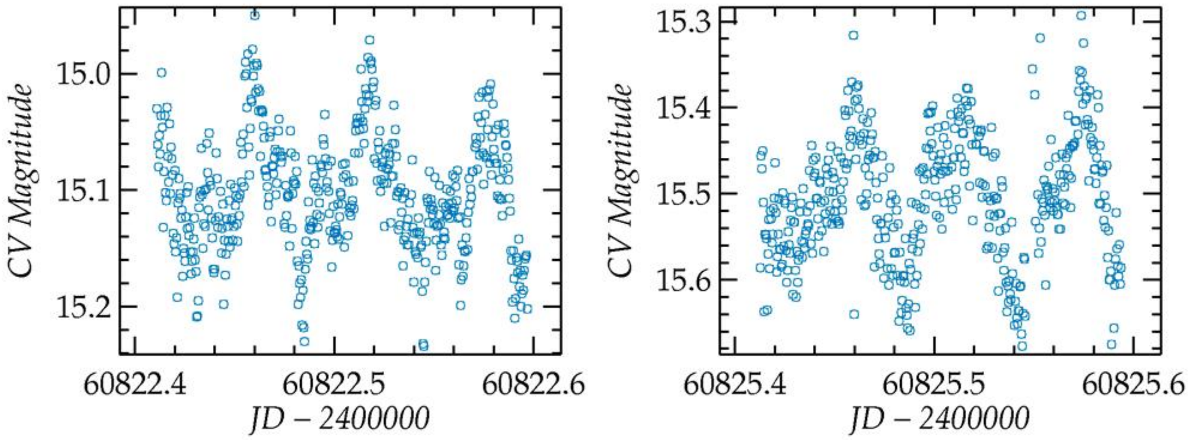

Figure 9: Two runs showing the superhumps in TCP J18513997+3522412. The left panel shows double-peaked early superhumps, with $P_{sh} \simeq 0.0563$ d, and a relatively large amplitude of $\sim 0^{m}.15$, and the right panel from later in the outburst, shows larger ordinary superhumps.

The rapid initial fade and relatively steep decline limited the time-series observations, but Sjoerd Dufoer and Robert Smith provided data to the AAVSO. Two sample light curves are given in Fig. 9 that show double-peaked early superhumps, with $P_{sh} \simeq 0.0563$ d, and a relatively large amplitude of $\sim 0^{m}.15$, and later in the outburst, larger ordinary superhumps.

Acknowledgements

The author is pleased to acknowledge use of NASA's Astrophysics Data System Bibliographic Services. This research has made use of the SIMBAD database and the VizieR catalogue access tool operated at CDS, Strasbourg, France. The author gratefully acknowledges use of the AAVSO Variable Star Index (VSX), and the AAVSO International Database. This work has made use of data from the Asteroid Terrestrial-impact Last Alert System (ATLAS) project. The ATLAS project is primarily funded to search for near earth asteroids through NASA, Kepler/K2 and STFC grants.

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Call a star a Mira and it immediately gets the hump: Z UMa revisited

John Greaves

The BAAVSS visual magnitudes for Z Ursæ Majoris from JD 2459000 to JD 2460900 were examined for periodicity and compared to a previous BAAVSSC analysis.

Introduction

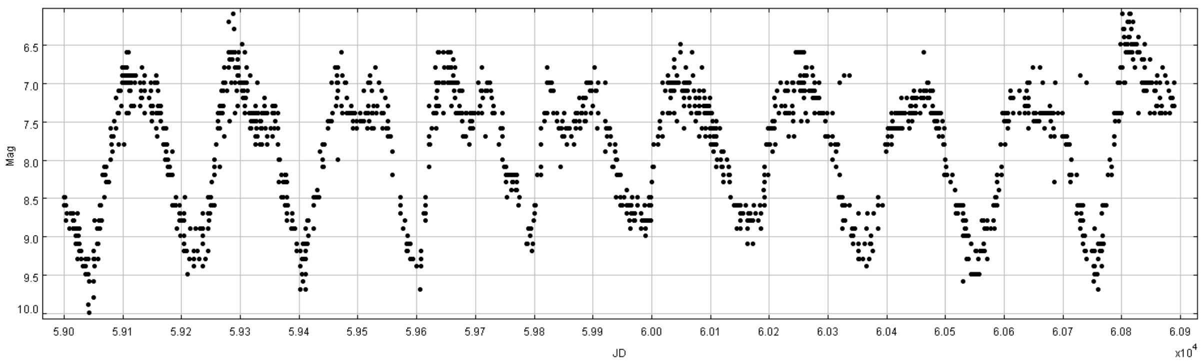
In Greaves 2020 the catalogued as SRb variable Z Ursæ Majoris BAAVSS visual lightcurve was examined with respect to periodicity and long term behaviour.

The conclusion reached was that the star was initially a doubly periodic SRb variable trending towards a monoperiodic SRa variable subsequently being followed by an amplitude increase sufficient to justify classifying it as a Mira variable, up to at least the end of JD 2459000.

Further BAAVSS visual observations reveal that monoperiodicity was likely merely a short flirtation.

Results

BAAVSS visual lightcurve from JD 2459000 to very nearly 2460900 data were obtained from the online BAA Photometric Database at https://britastro.org/photdb/data.php as shown in Figure 1.



It can be immediately seen that post JD 2459000 the star decided to return to be multiperiodic, albeit retaining sufficient magnitude to be considered a Humped Mira for some cycles yet at others just dipping below the minimum amplitude of 2.5 for traditional Mira lightcurve definition and appearing more akin to an SRb variable. The Hump migrates, which is not unknown in Mira types stars, and at times the star has a double maxima, although the amplitude at these times is more equivalent to an SRb variable than a double-maxima Mira.

The duration of 19000 days has only covered 10 minima and 10 maxima with only 9 full cycles having occurred which alongside the stochastic scatter in cycle to cycle periodicity for red long period variables means a representative period is harder to tie down, however a check for periodicity was attempted, nonetheless.

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The main period appeared to be 190.4 days with a semi-amplitude of very nearly 1 magnitude. When this periodicity was removed from the lightcurve data a secondary period of 212.3 days with semi-amplitude 0.15 days was derived and this did not appear to coincide with either an annual pseudo alias or a pseudo alias between the main period and the duration of the data. On the other hand a periodicity of 171.0 days and semi-amplitude 0.18 magnitude was also revealed which again did not appear to be a pseudo alias. However these ought to be independently checked in case of analysis error. The raw lightcurve is evident enough of multiperiodicity being involved and it would be strange for a pseudo alias of the main period to be of higher amplitude than any other potential period, and in fact no other strong periodicity was found.

Note that the period ratios do not fall in the canonical range of 1.5:1 to 1.9:1, mostly commonly around 1.7:1, usually found for doubly periodic SRb variables. There may be some triply periodic variables usually have lightcurves so messy that they used to be called Irr. for Irregular Variables but are now more likely to be referred to as Lb, meaning red variables of no evident periodicity, as Irr. is more often used for Young Stellar Objects nowadays.

Discussion

"Dredge up," whether first, second or third, is a long standing paradigm in long period variables used to suggest that changing nature long period variables, especially those with monotonically changing periodicity, are an indication of the star's evolution. Models initially predicted these matters to take at least centuries, which fitted well with the handful of known cases (eg R Hya, R Aql) with a long history of visual estimates. However some long period variables will dramatically change their nature in a few cycles, sometimes from one cycle to the next!

A simpler outlook is that various gas laws in these tenuous atmospheres, in combination with the ionisation and reionisation and light scattering energy transference to the atmospheric particles that drive the pulsations of these red giants, as well as the actual condensation of materials into solids during the times of a cooler atmosphere, results in not only global but also local variations, possibly on multiple scales, in the atmospheric energy distribution. Some particular set of values lead to harmonics or twin periods and mutual interference, whilst other objects are more stable, for whatever mix of reasons per particular star. It is long known that the shorter period a Mira is the more symmetric the lightcurve and the more stable the periodicity.

Cases like this star which readily varies in its nature of variability and jumps from one nature to another in just handfuls of cycles are more simply considered a result of resulting from the interplay of cycle to cycle varying physical forces during the heat transport through a tenuous gas. More a variation in weather than a drift in climate due to specific genetic events like a dredge up.

In the prior paper the assumption of future simple Mira type variability for this star was enough to immediately give it the hump!!!

Conclusion

On being expected of having developed a lightcurve indicative of monoperiodic Mira type variability in Greaves 2020, Z Ursæ immediately commenced returning to at least being doubly periodic from the very next cycle following on from the end date of the data duration of that prior analysis, demonstrating a mix of Humped Mira cycles followed by SRb cycles and returning to Humped Mira.

Analysis suggests that the main period has changed only slightly to 190.4 days since the end of the previous analysis, safely rounded to 190 days, but is now joined with either a 212 days lower amplitude period or a both 212 day plus a 171 day lower amplitude period.

The timescale of these variations in nature is two to several orders smaller than those predicted from evolutionary models bas on dredge up hypotheses and longer term monitoring of such variables, including continued use of traditional and some may feel old fashioned simple visual observations, residual reveals more outlier examples not covered by assumed observable slow evolutionary change in such stars.

Acknowledgement.

Such analyses of course would not be possible without the work of BAA VSS and other observers, past and present, who make visual observations of variable stars, especially long period variables. The BAA Photometric Database was also crucial for the ready access to this archived data.

Reference.

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OJ287 in 2024/25: the Great Minimum shows no signs of ending.

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OJ287 is well known for its pseudo-periodic outbursts every ≈11.8 years and for its anomalous colour behaviour: unlike other blazars, it does not get strongly bluer at brighter magnitudes. Less well known and studied are its occasional, deep minima, which see the magnitude fade below V=16, occasionally reaching V=17, at which point the underlying galaxy starts to contribute significantly to the total light. The current minimum, seen in BAA-VSS/TA/Spanish data, started in mid-2022 and, at present, shows no signs of ending. Multiple flares are seen in the 2024/25 light curve, with a typical interval of ≈33 days.

While outbursts of objects such as OJ287 are well-known and comparatively easy to study, instrumental limitations have impeded the study of deep minima. An outburst can be picked-up casually in archival sky survey plates, but these were typically limited to magnitudes around 15-16. To study deep minima requires systematic monitoring to much fainter limiting magnitudes than were possible historically photographically: these minima have only been observed since systematic CCD monitoring has been possible.

The last prolonged, deep minimum of OJ287 reached V≈16.8 in Spring 1999, before recovering progressively to reach magnitude V=15 at the end of 2000. From late 2000 until late 2022 the magnitude has oscillated around the level of V=15 (see Figure 1), which seems to have been the typical level over the more than a century of monitoring of OJ287. A new fade to a deep minimum started towards the end of 2022, with the light curve's base level dropping progressively, although the fade was punctuated both by large flares in October 2023 and April 2024 and also by large antiflares (e.g., in April 2023 and in June 2024).

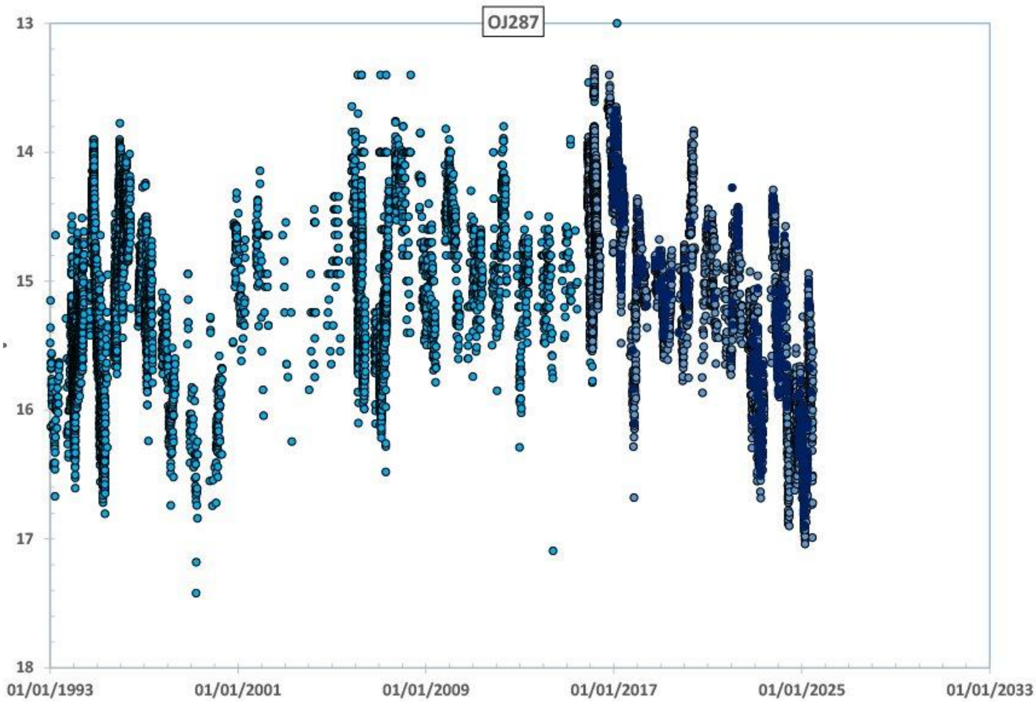


Figure 1: The light curve of OJ287, 1993-2025 from BAA-VSS/TA/Spanish data.

Particularly heavy light curve coverage is available for late 2022 to mid-2025 (Figure 2). We can see that flaring activity in 2023 caused an apparent recovery before the base level of the light curve dropped rapidly and suddenly in Spring 2024.

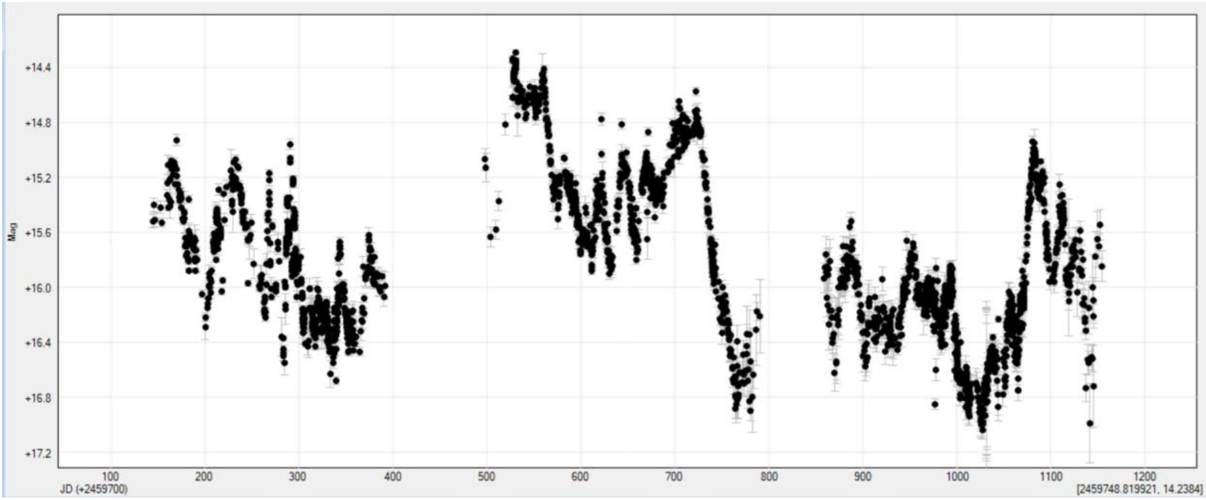


Figure 2: Peranso light curve of OJ287, 2022-2025 from BAA-VSS/TA/Spanish data.

A feature of the rapid fade in Spring 2024 is the absence of microvariability (flickering) in the light curve. The fade reached V≈17 just before the mid-June 2024 solar conjunction gap. On post-conjunction recovery, in September 2024, the level had recovered to V≈15.9, suggesting that the light curve was exiting the prolonged minimum. However, the fading trend resumed after conjunction, and, by mid-February 2025, the level had reached V=17 again. This is shown in more detail in Figure 3, in which the BVR & I light curves are plotted.

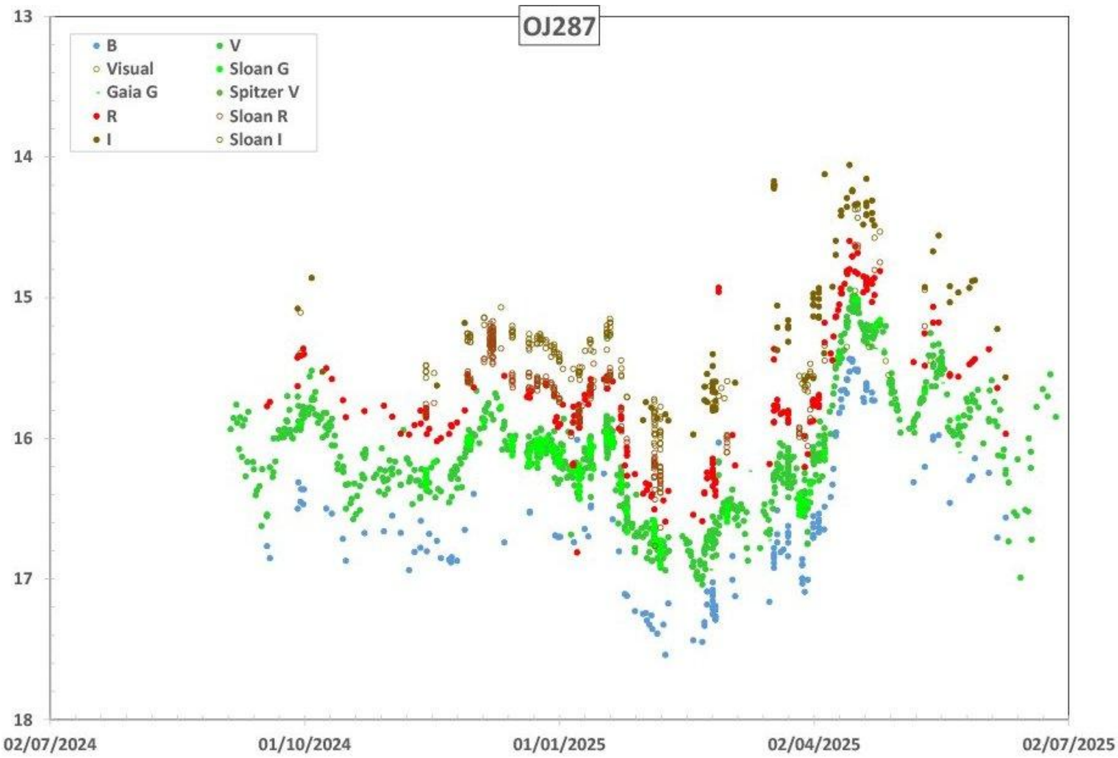


Figure 3: BVRI light curve of OJ287, for the 2024/25 observing season, from BAA-VSS/TA/Spanish data.

The full light curve of 1195 observations, transformed to the equivalent broadband V magnitude, with data plotted by observer/instrument/filter combination, is shown in Figure 4. The absolute light curve range registered through the observing season is from V=17.04 (2025/02/21, Poyner) to 14.94 (15/04/2025, Poyner). Observations by multiple observers in June 2025, made at low altitude in bright twilight and with large errors, show another rapid light curve dip to close to V=17.

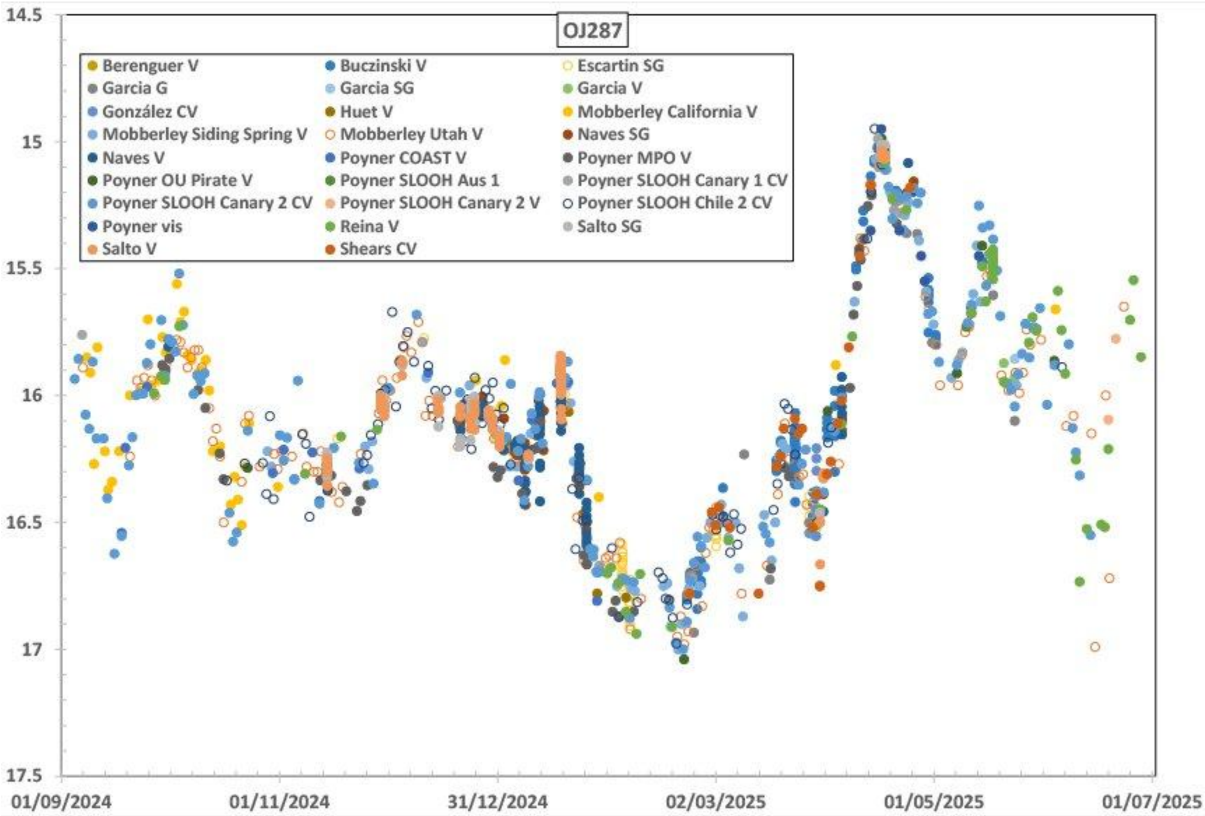


Figure 4: The light curve of OJ287, for the 2024/25 observing season, identified by observer/instrument/filter combination, from BAA-VSS/TA/Spanish data.

The 2024/25 light curve was detrended in Peranso using a 2nd order polynomial (tests were made with polynomials up to 5th order, but 2nd and 3rd order gave almost identical results, while higher orders showed extreme behaviour at the limits of the light curve). Multiple studies have shown that the pre-treatment of light curve data can substantially vary the results of periodicity analysis, even though, in theory, pre-treatment only removes the slowest trends in the light curve (technically, detrending removes the lowest frequency components in the period spectrum). **Best practice is, thus, to use the lowest order that gives a satisfactory fit to the light curve to avoid the danger of adding artefacts to the detrended data.** The result of this detrending is shown in Figure 5.

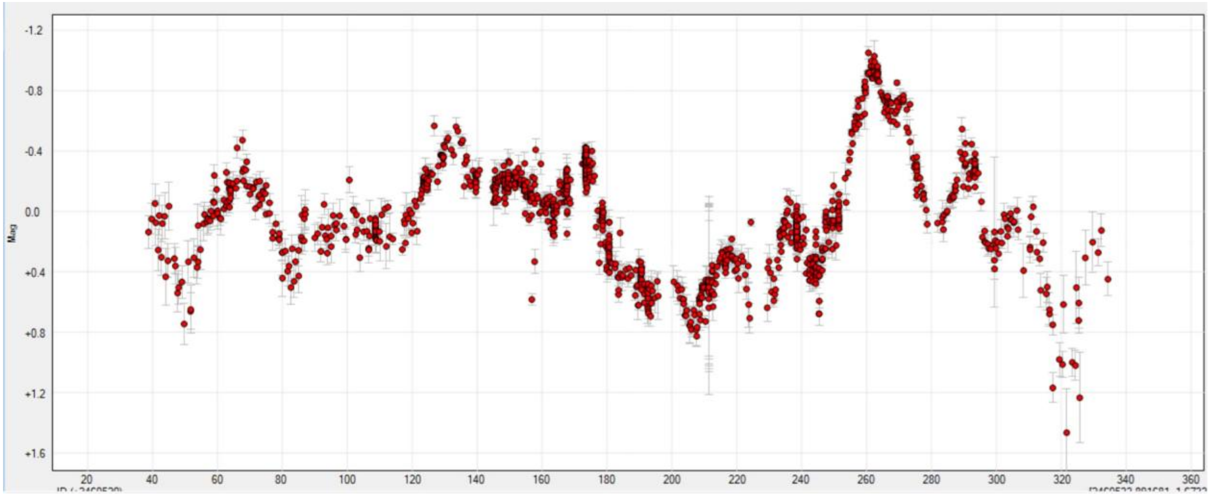


Figure 5: Peranso detrended light curve of OJ287, 2024/25, from BAA-VSS/TA/Spanish data. A 2nd order polynomial has been subtracted from the data.

We see multiple flares in the detrended light curve, including a particularly large and sustained event that peaked on April 16th, 2025, and which is seen to be double, with two maxima separated by 8 days.

As a matter of procedure, the detrended data were analysed by Peranso for possible Quasi-Periodic Oscillations (QPOs). QPOs are not true periodicities but, rather, semi-stable, typical timescales of variation, with limited predictive power. This analysis produced unexpected results.

Multiple methods were used to analyse both the raw and the detrended light curves. The basic method is Deeming analysis, in which a power spectrum and spectral window are generated. The spectral window reveals that patterns in sampling that could mimic periods in the light curve data. Historically, this was important because photographic and visual data were not possible for faint objects either when in lunar conjunction (every 27.3 days) or at Full Moon (every 29.5 days). In CCD data, most objects can be followed through Full Moon, so the spectral window is of lesser importance, but the light curve still must be checked for unexpected patterns in the data that can generate false signals, although nothing unexpected was found in the OJ287 spectral window.

Sampling periods are important if we have a strong periodic signal in the Fourier Transform. For example, if we have a sampling period at 27.3 days (something that we expect in OJ287 as it is close to the ecliptic and has 3-4 days of Moon avoidance gap each lunar month) a true period should reveal itself by giving secondary peaks at the period ±27.3 days. So, for example a genuine periodicity at 300 days in the Fourier transform should show two wings at 272.7 and at 327.3 days. This effect is important when studying longer light curves with periods of months or years in the data.

Multiple other methods of analysis apart from Deeming are available in Peranso, each optimised to a particular type of object and light curve. In general, the results from Deeming analysis were checked against FALC, Lomb-Scargle and CLEANEST analysis to ensure that the results obtained were consistent with the different techniques.

All the analysis methods tested showed a broad peak in the power spectrum of the raw data at a period of 32.7 days (Figure 6). With a total light curve length of 296 days, a *hypothetical* period of this length would show almost exactly nine cycles. The fewer the number of cycles of a potential period in a light curve, the greater the probability that random alignments of light curve events (maxima or minima) can imitate periodic signals. Nine cycles is a sufficiently large number for a period to be potentially genuine.

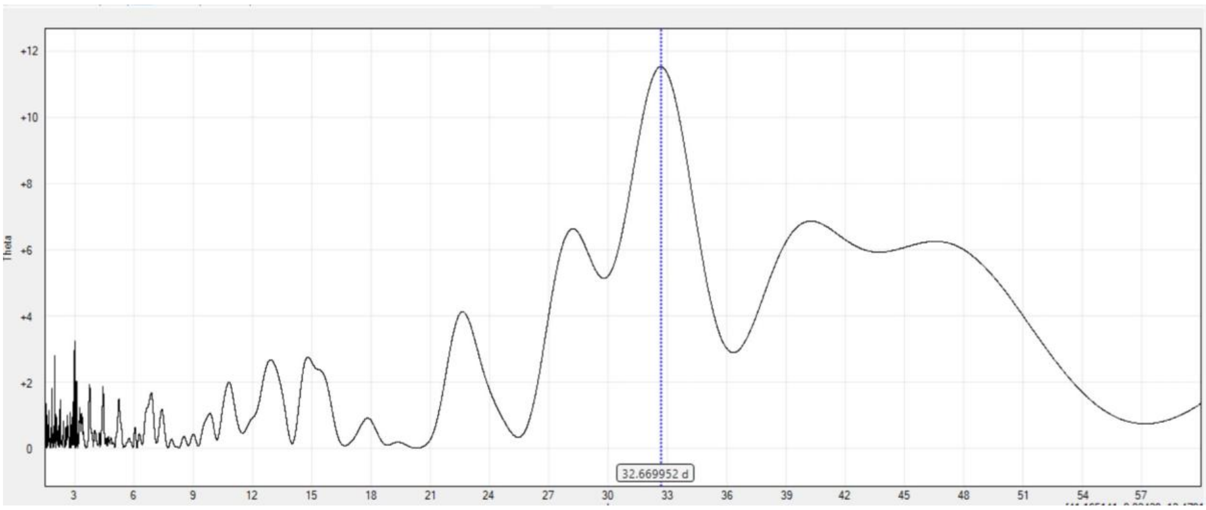
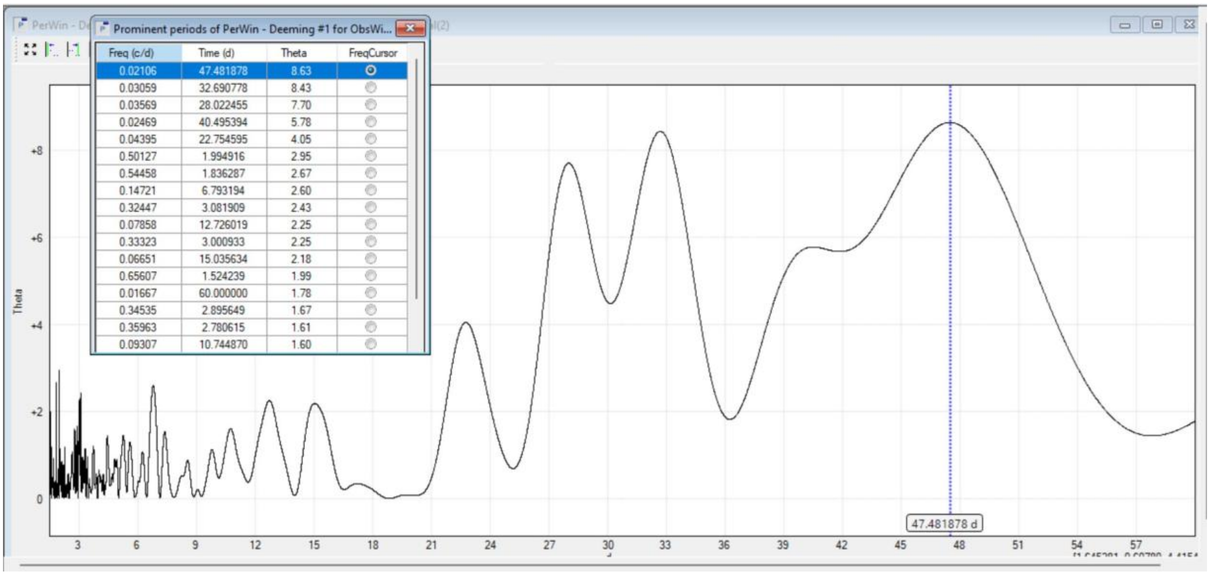


Figure 6: Peranso Deeming analysis of the raw light curve of OJ287, 2024/25, from BAA-VSS/TA/Spanish data.

When the same test was applied to the detrended data, significantly different results were obtained. While the signal at 32.7 days was still present, Deeming analysis now found a stronger, but broader signal at a period of 47.5 days (Figure 7). Other methods gave comparable results, although with variations in the exact period found. Note that 47.5 days is close to 3/2 of 32.7 days, i.e., 3 periods of 32.7 days are almost the same as 2 periods of 47.5 days, suggesting that random alignments of maxima and minima cause one or other period to be a better fit to the data according to its pre-treatment applied to the data.



Freq (c/d)	Time (d)	Theta	FreqCursor
0.02106	47.481878	8.63	
0.03059	32.690778	8.43	
0.03569	28.022455	7.70	
0.02469	40.495394	5.78	
0.04395	22.754595	4.05	
0.50127	1.994916	2.95	
0.54458	1.836287	2.67	
0.14721	6.793194	2.60	
0.32447	3.081909	2.43	
0.07858	12.726019	2.25	
0.33323	3.000933	2.25	
0.06651	15.035634	2.18	
0.65607	1.524239	1.99	
0.01667	60.000000	1.78	
0.34535	2.895649	1.67	
0.35963	2.780615	1.61	
0.09307	10.744870	1.60	

Figure 7: Peranso Deeming analysis of the detrended light curve of OJ287, 2024/25, from BAA-VSS/TA/Spanish data. A 2nd order polynomial was subtracted from the raw data.

Given that the clearest signal is the one seen in the raw data at 32.7 days, a trial was made to see if there was any evidence of flares repeating typically at this interval in the detrended light curve (Figure 8). While, initially, it seems that the peaks of flares do follow this interval, the last few events in the light curve deviate increasingly from the expected timing. In such a long cycle length and so few cycles, it would be premature to suggest that this is a genuine QPO in the light curve.

Conclusion:

The light curve of OJ287 was extremely active in the 2024/25 observing season, peaking just brighter than V=15, but dipping twice to the extremely rarely observed level of V=17. So far, there is no unambiguous evidence that this prolonged minimum in the light curve is ending. There is a typical interval between flares of 33 days, but it is far from clear that this is a genuine QPO and may simply be a light curve artefact caused by random alignment of maxima and minima.

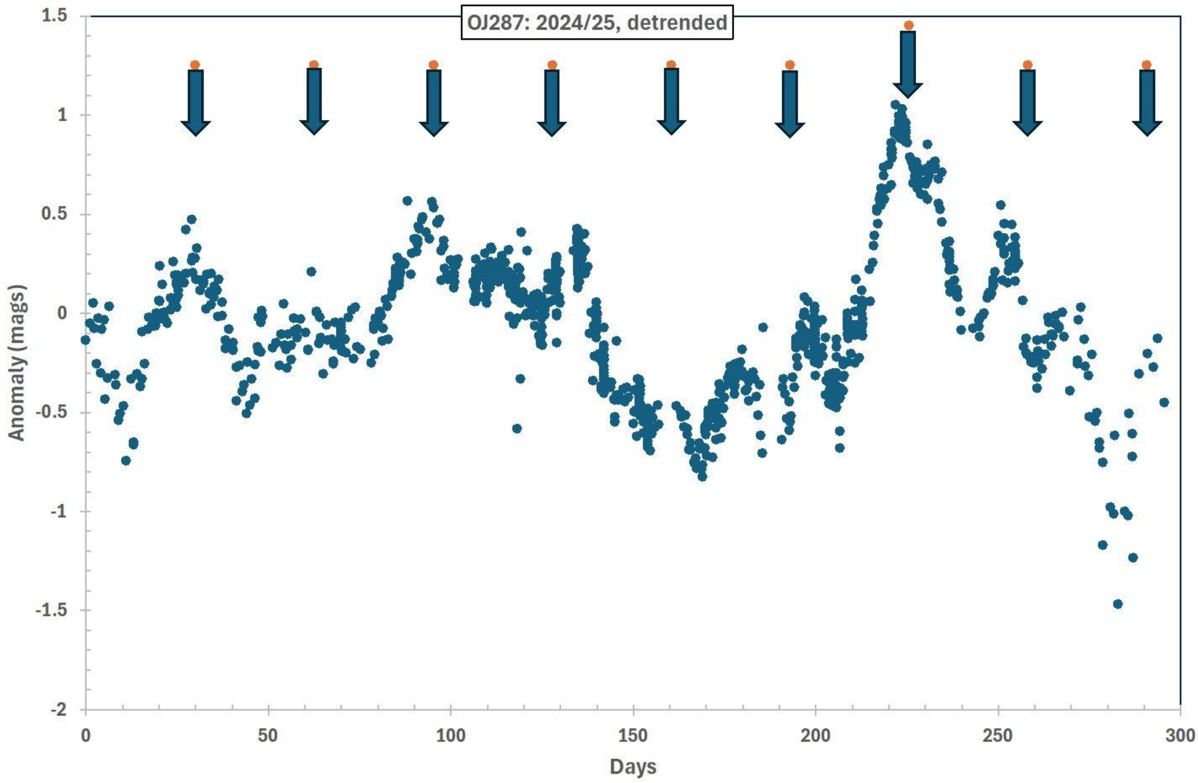


Figure 8: The detrended light curve of OJ287, for the 2024/25 observing season, from BAA-VSS/TA/Spanish data, with the expected timing for flares (arrows) assuming a 32.7 day period from the first observed flare. While there is some agreement initially, the last few events deviate increasingly from the expected epoch.

Acknowledgement

This research made use of Peranso (www.peranso.com), a light curve and period analysis software.

I would like to thank all the observers (see **Error! Reference source not found.** 4 for the names of all observers who have contributed data) for their continuing efforts.

Paunzen, E. & Vanmunster, T., 2016, Peranso - Light Curve and Period Analysis Software. Astronomische Nachrichten 337, 239

Fifty Southern Red Binocular Variables

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A short form analysis of the visual brightness of 50 southern red variables as seen in 2025 compared with Hipparcos V measurements from 1989-1992 together with a recommendation on the future monitoring of a selection of those stars. A proposal to adopt BQ Oct as the current South Pole Star is also provided.

Between 1968 & 1974 the Binocular Sky Society (BSS) targeted many relatively obscure binocular variables lying within the northern & equatorial regions of the sky. This project was inherited by the BAA VSS which established a binocular programme and the work is still in progress today within the Pulsating Stars Programme. Consequently, we now have good quality data on many northern & equatorial binocular variables over a continuous period of circa 55 years [1].

The southern hemisphere never had an equivalent of the BSS nor the BAA VSS binocular programme that followed it. In 1979 the VSS RASNZ released 10 binocular charts (known as the B series drawn by Mati Morel) partly based on BSS sequences covering equatorial variables, but they did not attract wide attention nor produce much data [2]. In 1998 Fraser Farrell in South Australia produced a booklet of charts for southern binocular variables but this initiative was discouraged by Frank Bateson who directed southern observers to concentrate on the wide-range variables on the existing programme of the VSS RASNZ [3]. More recently in 2014 Aline Homes promoted the observation and analysis of southern semi-regular variables [4] but this only covered bright and existing well-observed variables such as L2 Pup & T Mus. Therefore, it would appear that many of the southern red variables within binocular range have been neglected in the past, at least in comparison with their more northerly counterparts.

Many southern red stars were confirmed to be variable by the Hipparcos mission undertaken in 1989-1992 and I thought it might be worth investigating a number of the more obscure small-range red variables with binoculars whilst I was visiting South Africa in 2025. The intention was to see if any were discrepant with the Hipparcos data and therefore perhaps worth target monitoring by southern hemisphere observers in the future.

It is well-known that the Hipparcos V magnitudes for red stars are not compatible with their visual appearance mainly because the comparison stars utilised are normally less red and the colour difference creates an offset of a few tenths of a magnitude causing the red variables to appear fainter to the visual observer. The individual visual observers colour sensitivity can also attenuate or reduce the offset between V and visual (mv) photometry for red stars. To illustrate this more clearly Table 1 contains data on 50 northern & equatorial red variables comparing their long-term visual photometry with the Hipparcos V photometry. The primary outputs from this table are that visual is on average 0.7 magnitude fainter than Hipparcos V and the long-term visual variation range is on average three times greater than that recorded by Hipparcos. This then would form the basis for an analysis of the southern red binocular variables.

The observations of the southern red stars were made with 7x50 & 15x70 binoculars from Pringle Bay, South Africa (Figure 1) on 26 & 27 February and 1 & 2 March 2025.

Figure 1: Pringle Bay, South Africa photographed by the author on the 1 March 2025. This provides an indication of the favourable seeing conditions leading up to the third night that observations were made of the southern red stars.

One star I specifically targeted was BQ Oct because it lies very close to the South Celestial Pole (SCP). Colin Henshaw informs me that he has often used BQ Oct to align his camera drive on the South Pole because it is positioned much closer than the commonly recognised pole star sigma Oct (Figure 2 illustrates this point).

Figure 2: South Pole star trails photographed by the author from Siding Spring, Australia on 8 April 1986. The star trails clearly indicate the position of the SCP with BQ Oct being the brighter of the two orange stars displaying negligible trails in the lower centre of the photograph. Directly to the right of BQ Oct is the well-known sigma Oct (displaying a short white trail) and the brightest star on the photograph is beta Oct displaying an extended white trail near to the right-hand edge.

The data accumulated with respect to the southern red binocular variables is presented in Table 2 which in addition to the Hipparcos V measurements also includes a column summarising what photometry was previously available from the AAVSO database.

The most notable difference between Tables 1 and 2 is that the mean offset between Hipparcos V and visual is less (0.3 magnitude for Table 2 compared with 0.7 for Table 1) for the southern variables. This may be a selection effect as Table 1 included stars with a mean Hipparcos brightness of 6.77 over a greater part of the sky (29 constellations with a declination range of 86^0) whereas Table 2 was confined to southern stars (14 constellations with a declination range of 62^0) with a mean Hipparcos brightness of 7.79. The mean redness of the northern & equatorial stars (B-V +1.76) is greater than for the southern stars (B-V+1.60) so that could be an additional contributing factor. Also, it is worth highlighting that the visual datasets are not strictly equivalent as one set is a snapshot and the other is based on long-term systematic monitoring.

Whilst there is a displacement in the mean difference, the spread is similar at 1.1 magnitude (0.1 to 1.2) for Table 1 and 1.2 magnitude (-0.3 to 0.9) for Table 2.

Star	B-V	Hp Range	Hp Mean	Hp Obs 1989-1992	mv Range	mv Mean	mv Obs	mv Years	mv Mean-Hp Mean	mv Range/Hp Range
AQ And	2.10	7.57-7.98	7.78	83	7.9-9.5	8.7	847	1979-2025	0.9	3.9
BZ And	1.40	7.87-8.20	8.04	145	7.8-9.0	8.4	866	1982-2025	0.4	3.6
V450 Aql	1.47	6.03-6.27	6.15	92	6.4-7.5	7.0	1182	1979-2025	0.6	4.6
UU Aur	2.77	5.16-5.64	5.40	89	5.4-6.9	6.2	1490	1977-2025	0.8	3.1
RV Boo	1.23	7.28-7.85	7.57	162	7.7-9.3	8.5	1314	1980-2025	0.9	2.8
RW Boo	1.18	7.32-8.05	7.69	108	7.5-9.2	8.4	1348	1980-2025	0.7	2.3
RX Boo	1.28	6.66-7.17	6.92	98	7.1-8.9	8.0	1359	1980-2025	1.1	3.5
ST Cam	2.10	6.37-6.86	6.62	229	6.8-8.2	7.5	1433	1980-2025	0.9	2.9
X Cnc	2.98	6.02-6.33	6.18	53	6.4-7.4	6.9	1149	1978-2025	0.7	3.2
RS Cnc	1.37	5.18-6.11	5.64	83	5.2-7.2	6.2	1241	1977-2025	0.6	2.2
RT Cnc	1.24	6.80-7.40	7.10	67	7.0-8.7	7.9	901	1981-2025	0.8	2.8
Y CVn	2.99	5.17-5.52	5.35	96	5.2-6.6	5.9	1508	1977-2025	0.5	4.0
TU CVn	1.45	5.55-5.80	5.68	195	5.5-6.5	6.0	1491	1977-2025	0.3	4.0
W CMa	2.55	6.39-6.97	6.68	86	6.9-7.7	7.3	691	1983-2025	0.6	1.4
V465 Cas	1.59	6.00-6.56	6.28	255	6.3-8.0	7.2	1795	1977-2025	0.9	3.0
W Cep	1.80	7.33-7.97	7.65	102	7.0-9.0	8.0	1500	1976-2025	0.3	3.1
RW Cep	2.22	6.46-6.62	6.54	139	6.7-7.8	7.3	1505	1979-2025	0.9	6.9
SS Cep	1.23	6.37-6.95	6.66	126	6.5-8.2	7.4	1239	1985-2025	0.7	2.9
RR CrB	1.31	7.14-7.70	7.42	139	7.4-8.5	8.0	1354	1980-2025	0.6	2.0
TT Cyg	2.92	7.35-7.74	7.54	146	8.0-9.0	8.5	1311	1979-2025	1.0	2.6
AF Cyg	1.39	6.26-7.16	6.71	104	6.2-8.3	7.3	1634	1980-2025	0.6	2.3
EU Del	1.16	5.40-5.85	5.63	71	5.7-7.1	6.4	1564	1978-2025	0.8	3.1
RY Dra	3.27	6.20-6.97	6.59	121	6.4-8.3	7.4	1680	1978-2025	0.8	2.5
TX Dra	1.50	6.87-7.46	7.17	92	6.6-8.6	7.6	1886	1977-2025	0.4	3.4
AH Dra	1.33	6.52-7.74	7.13	79	6.9-9.1	8.0	1467	1977-2025	0.9	1.8
TV Gem	2.14	6.26-6.87	6.57	67	6.5-8.1	7.3	1171	1978-2025	0.7	2.6
BU Gem	2.20	6.18-6.44	6.31	65	6.4-7.9	7.2	1186	1979-2025	0.9	5.8
ST Her	1.41	6.45-7.15	6.80	105	7.2-8.8	8.0	1291	1981-2025	1.2	2.3
SX Her	1.56	8.21-8.95	8.58	179	7.7-9.6	8.7	1141	1983-2025	0.1	2.6
UW Her	1.44	7.27-7.91	7.59	116	7.0-9.0	8.0	1525	1979-2025	0.4	3.1
OP Her	1.45	5.91-6.26	6.09	127	5.7-7.4	6.6	1511	1979-2025	0.5	4.9
SX Lac	1.54	8.19-8.60	8.40	161	8.1-9.0	8.6	1150	1980-2025	0.2	2.2
RX Lep	1.35	4.95-5.54	5.25	73	5.3-7.0	6.2	933	1977-2025	0.9	2.9
Y Lyn	1.46	6.34-7.09	6.72	97	6.3-8.9	7.6	1499	1979-2025	0.9	3.5
SV Lyn	1.43	6.52-7.05	6.79	71	6.7-8.2	7.5	1072	1981-2025	0.7	2.8
XY Lyr	1.44	5.55-6.02	5.79	103	5.8-6.9	6.4	1316	1981-2025	0.6	2.3
RV Mon	2.74	7.05-7.59	7.32	83	7.2-8.7	8.0	787	1982-2025	0.7	2.8
BL Ori	2.35	6.15-6.44	6.30	52	6.2-7.2	6.7	983	1980-2025	0.4	3.4
BQ Ori	1.48	7.06-7.96	7.51	99	7.2-9.8	8.5	1065	1979-2025	1.0	2.9
GO Peg	1.66	7.14-7.53	7.34	143	7.1-8.6	7.9	975	1981-2025	0.6	3.8
Z Psc	2.61	6.51-6.84	6.68	92	7.0-8.3	7.7	927	1979-2025	1.0	4.0
TX Psc	2.51	4.86-5.09	4.98	46	5.2-6.4	5.8	970	1977-2025	0.8	5.2
tau4 Ser	1.20	6.05-6.40	6.23	43	6.3-7.6	7.0	1193	1979-2025	0.8	3.7
W Tri	1.51	7.31-7.74	7.53	94	7.8-9.2	8.5	966	1979-2025	1.0	3.3
RY UMa	1.77	6.92-7.71	7.32	142	6.7-8.3	7.5	1490	1979-2025	0.2	2.0
ST UMa	1.53	6.32-6.92	6.62	90	6.5-8.0	7.3	1514	1979-2025	0.7	2.5
TV UMa	1.38	6.63-7.01	6.82	78	6.9-7.7	7.3	1292	1980-2025	0.5	2.1
V UMi	1.47	7.32-8.03	7.68	117	7.2-9.2	8.2	1546	1980-2025	0.5	2.8
RW Vir	1.42	6.57-6.98	6.78	76	7.2-7.8	7.5	632	1982-2025	0.7	1.5
SW Vir	1.29	5.88-6.53	6.21	78	6.2-8.5	7.4	878	1980-2025	1.2	3.5
Mean Values	1.76		6.77	107		7.5	1255		0.7	3.1

Table 1: A comparison of Hipparcos V photometry with long-term visual (mv) photometry by the author of 50 red binocular variables in 29 constellations between declination $+74^0$ (V UMi) and -12^0 (RX Lep).

Star	AAVSO Database	B-V	Hp Range	Hp Mean	Hp Obs 1989-1992	mv 2025	mv-Hp Mean
NO Aps	306 V obs 2004-2012	1.62	5.77-5.93	5.85	136	6.0	0.1
NQ Aps	zero obs	1.69	7.22-7.35	7.29	140	7.9	0.6
NS Aps	14 obs 2009-2020	1.49	7.84-8.23	8.04	131	8.1	0.1
NU Aps	zero obs	1.58	8.56-8.71	8.64	133	9.2	0.6
NZ Aps	zero obs	1.66	7.94-8.08	8.01	150	8.4	0.3
OY Aps	zero obs	1.60	8.01-8.43	8.22	128	8.8	0.6
SU Cae	zero obs	1.45	8.51-8.71	8.61	146	8.7	0.1
V765 Cen	1 V ob 2013	1.60	6.20-6.42	6.31	99	6.5	0.2
V986 Cen	zero obs	1.55	6.69-6.79	6.74	83	6.9	0.2
V1005 Cen	zero obs	1.47	7.98-8.13	8.06	102	8.5	0.4
V1007 Cen	zero obs	1.60	8.06-8.31	8.19	119	8.5	0.3
DM Cha	2 obs in 2010	1.72	8.22-8.36	8.29	118	9.0	0.6
DN Cha	1 obs in 2010	1.78	7.62-7.72	7.67	112	8.5	0.8
DU Cha	zero obs	1.52	7.10-7.55	7.33	129	8.1	0.8
CY Cir	3 obs 2009-2011	1.62	6.98-7.15	7.07	81	7.0	-0.1
YY Col	zero obs	1.63	8.47-8.64	8.56	156	8.4	-0.2
AB Col	zero obs	1.58	7.71-7.87	7.79	159	8.1	0.2
WX Men	454 V obs 2000-2012	1.72	5.70-5.88	5.79	95	6.1	0.3
YZ Men	zero obs	1.10	7.84-7.99	7.92	120	8.0	0.1
KO Mus	2 obs 2010	1.43	8.53-8.84	8.69	115	8.9	0.2
LM Mus	1 obs 2011	1.62	6.99-7.19	7.09	130	7.7	0.6
BQ Oct	164 B&V obs 2010-2018	1.70	6.69-6.88	6.79	123	7.7	0.9
CF Oct	zero obs	1.08	7.93-8.15	8.04	130	8.2	0.1
CR Oct	zero obs	1.73	7.15-7.27	7.21	122	7.5	0.3
CZ Oct	zero obs	1.75	7.55-7.72	7.64	149	8.1	0.5
DG Oct	zero obs	1.77	8.80-8.97	8.89	155	9.1	0.2
DH Oct	zero obs	1.83	9.10-9.21	9.16	154	9.0	-0.2
DL Oct	1 obs 2011	1.55	7.64-8.18	7.91	139	7.9	0.0
DN Oct	261 obs 1998-2010 JA	1.65	7.26-7.37	7.32	128	7.0	-0.3
DP Oct	zero obs	1.52	7.81-7.95	7.88	134	8.1	0.2
DQ Oct	zero obs	1.63	8.35-8.59	8.47	144	8.7	0.2
NP Pup	150 obs 1978-2025	2.29	6.23-6.47	6.35	105	7.2	0.8
V359 Pup	zero obs	1.73	8.88-9.04	8.96	110	9.2	0.2
V367 Pup	1 obs 2009	1.67	8.36-8.46	8.41	124	8.6	0.2
LW TrA	zero obs	1.63	8.55-8.68	8.62	200	8.4	-0.2
LY TrA	3 obs 2002	1.65	7.32-7.45	7.39	216	7.4	0.0
MT TrA	2 obs 2009-2011	1.73	8.44-8.55	8.50	276	8.9	0.4
MW TrA	4 obs 2009-2011	1.60	8.60-8.71	8.66	180	8.7	0.0
BQ Tuc	306 V obs 2000-2012	1.57	5.57-5.76	5.67	156	6.0	0.3
CC Tuc	328 BV obs 2000-2012	1.63	6.26-6.38	6.32	126	6.4	0.1
CY Tuc	zero obs	1.48	8.70-8.85	8.78	130	9.2	0.4
CZ Tuc	zero obs	1.59	8.80-9.28	9.04	147	9.3	0.3
DE Tuc	zero obs	1.57	6.86-7.02	6.94	131	6.6	-0.3
DM Tuc	107 obs 2012-2021	1.22	6.62-7.26	6.94	216	7.7	0.8
GI Vel	zero obs	1.72	7.83-8.05	7.94	131	8.2	0.3
VV Vol	3 obs 2008-2011	1.55	8.42-8.62	8.52	114	9.2	0.7
VX Vol	3 obs 2008-2011	1.60	8.03-8.28	8.16	103	8.7	0.5
VY Vol	3 obs 2008-2011	1.80	8.81-8.92	8.87	102	9.2	0.3
VZ Vol	3 obs 2008-2011	1.50	8.21-8.34	8.28	109	8.9	0.6
WW Vol	3 obs 2008-2011	1.44	7.74-7.94	7.84	118	8.5	0.7
Mean Values		1.60		7.79	135	8.1	0.3

Table 2: A comparison of Hipparcos V photometry with snapshot visual (mv) photometry by the author of 50 red binocular variables in 14 constellations between declination -28^0 (SU Cae) and -90^0 (BQ Oct).

The selection criteria for identifying promising & active variables from Table 2 was two-fold; 1) the reported range by Hipparcos, and 2) the maximum deviation from the mean difference between the Hipparcos V and visual measurements.

The following stars had a Hipparcos V range greater than 0.35 magnitude:

NS Aps (range 0.39), OY Aps (range 0.42), DU Cha (range 0.45), DL Oct (range 0.54), CZ Tuc (range 0.48) & DM Tuc (range 0.64).

The 0.35 magnitude range was adopted because when the average range factor of 3 were applied from Table 1, it would result in long-term variation ranges greater than one magnitude.

The following stars had differences of 0.5 magnitude or more from the mean difference (0.3 magnitude) between the Hipparcos V and visual measurements:

DN Cha (+0.8), DU Cha (+0.8), YY Col (-0.2), BQ Oct (+0.9), DH Oct (-0.2), DN Oct (-0.3), NP Pup (0.8), LW TrA (-0.2), DE Tuc (-0.3) & DM Tuc (+0.8).

I would recommend that all of the above listed variables are worthy of future investigation but if one wanted to go after a short-list I would prioritise the following stars:

1. DU Cha and DM Tuc appear in both lists so they can be treated as top candidates for long-term, wide-range variation.
2. BQ Oct, DN Oct & DE Tuc displayed the greatest variance from the mean difference between the Hipparcos V and visual measurements.

Light curves are included in the Variability Annex of the Hipparcos & Tycho Catalogue (Vol 12) for CZ Tuc (HIP5038) and DM Tuc (HIP113330).

It is worth returning to and raising the profile of BQ Oct because since around 1900 this star has been closer to the SCP than sigma Oct and its closest approach (10 arc minutes) occurs very soon in about 2030. Polarissima Australis a 13th magnitude galaxy named by its discoverer John Herschel when based at the Cape of Good Hope, South Africa in 1837; is the closest NGC object (NGC2573) to the SCP but by 2000 the separation was 40 arc minutes and is increasing. Therefore, both of the commonly named South Pole objects are significantly further way from the SCP than BQ Oct and since there are no notable objects in the future path of the SCP for several hundred years, I would propose that BQ Oct deserves to be recognised as the current South Pole Star.

Whilst there are clearly limitations with a snapshot examination of the 50 southern stars, I trust that this article will serve to raise the profile of southern hemisphere red stars that are accessible to binoculars and in doing so will promote an overall levelling up of the monitoring efforts worldwide.

Acknowledgement:

Peter Williams brought to my attention most of the information relating to the VSS RASNZ and previous work undertaken on the lesser-known southern red variables.

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Eclipsing Binary News

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"Blue Straggler"

There has always been speculation about the evolution of contact Eclipsing Binaries. One hypothesis is that the two stars might merge. There are known to be at least 7000 systems in the W UMa class of EBs. It is now thought that globular clusters contain many examples of binaries that have merged. Such a star is known as a blue straggler - a star in a globular cluster that is more luminous and bluer than expected. Below is a Hubble image of NGC 6397, with a number of bright blue stragglers present.

Image of NGC 6397 taken by the Hubble Space Telescope, with evidence of a number of blue stragglers. APOD 2002 February 20 (ESA/Hubble)

Blue stragglers were first discovered by Allan Sandage in 1953 while performing photometry of the stars in the globular cluster M3.

Based on their analysis of the blue straggler in 47 Tuc, astronomers favor the slower, gentler merger scenario between binary stars. In double-star systems where the stars are close enough to touch each other, the more massive star can cannibalize its partner, producing a single, even more massive star. This process, astronomers believe, is more likely to result in a rapidly spinning merger product where the fast orbital motions of the binary star produce the rapid spin of the consolidated pair.

According to Wikipedia **V1309 Scorpii** (also known as **V1309 Sco**) is a contact binary that merged into a single star in 2008 in a process known as a luminous red nova. It was the first star to provide conclusive evidence that contact binary systems end their evolution in a stellar merger. Its similarities to V838 Monocerotis and V4332 Sagittarii allowed scientists to identify these stars as merged contact binaries as well.

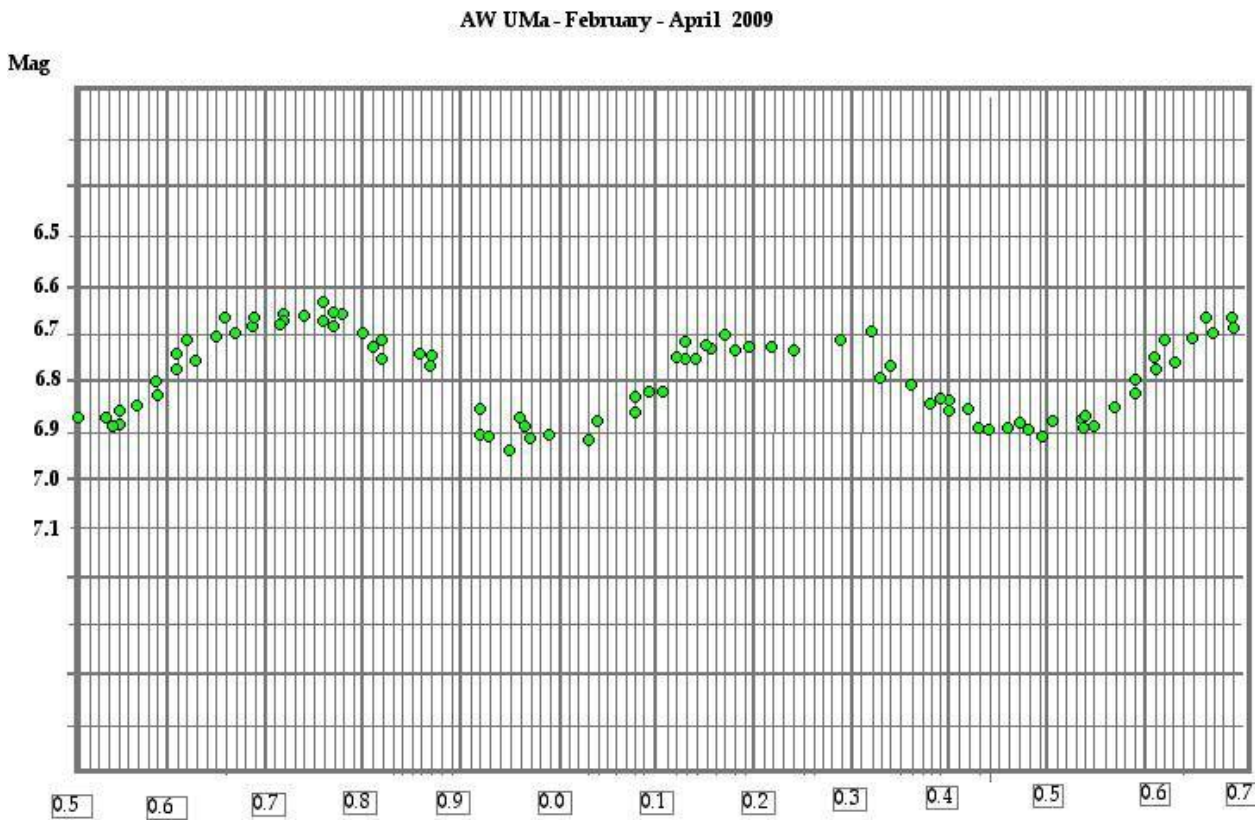
Citizen Scientists help discover 8,000 new Eclipsing Binaries

A recent article in Universe Today describes how Citizen Scientists helped discover 8,000 new eclipsing binaries [1]. Millions of light curves derived from TESS (Transiting Exoplanet Survey Satellite) data were examined by a special AI programme. The list was cut down so that the light curves could be examined by trained amateurs. The outcome of the process was that 10,001 eclipsing binary systems were identified. 7,936 were new to science and 2,065 were previously known. The identification of existing EBs proved useful because the TESS dataset provided updated and more accurate parameters for their periods.

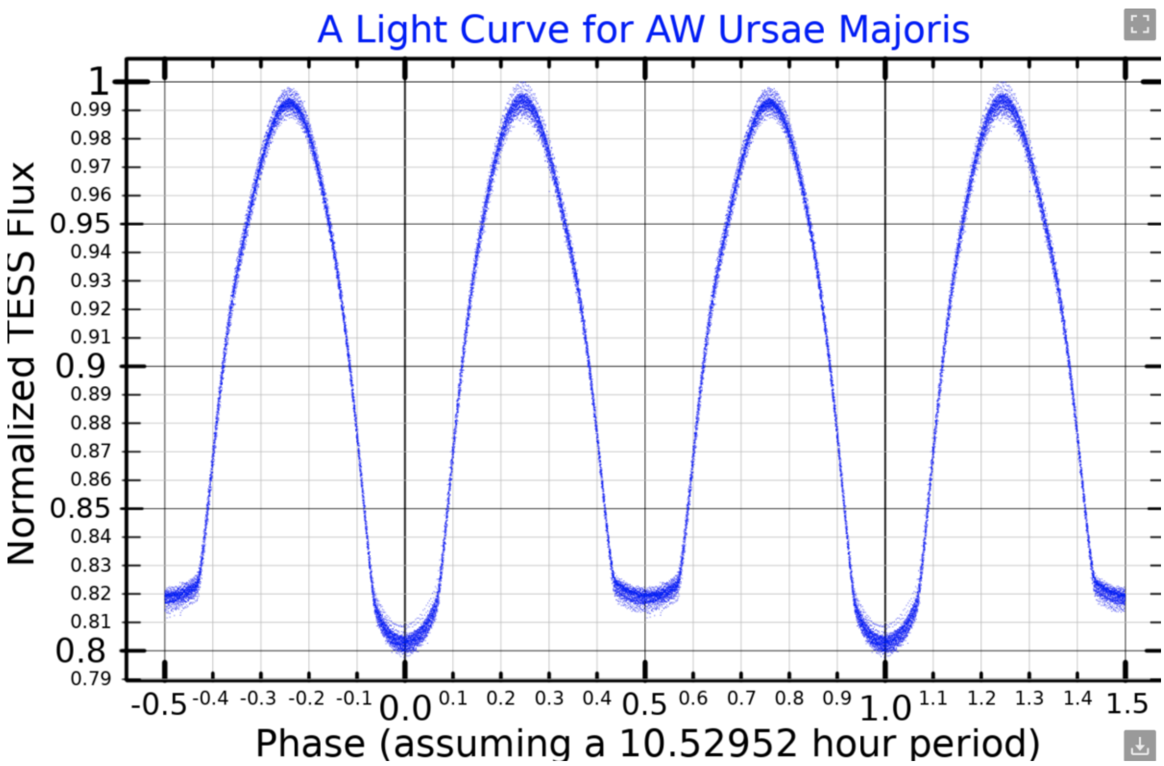
Embedded in the Universe Today article is a link to a YouTube Video (55 minutes) on the discoveries of TESS.

AW UMa

This eclipsing binary is on our recommended list of low amplitude systems that could make good DSLR targets. It is a W UMa class contact binary with the classification EW/KW which implies it is prone to major star spots. It has a maximum magnitude of 6.83 with a primary minimum of 7.13 and a secondary minimum of 7.08. The period we have quoted in the EB Handbook is 0.4387299 days, but the period currently specified in the Krakow database is 0.4337218 days. The period is decreasing. I studied the system in early 2009 using DSLR photometry. Below is a phase diagram of my measurements assuming, at that time, a period of 0.4337250d. There is a suggestion that the secondary eclipse was total. Another sequence of measurements was completed between March and May 2012. A similar light curve was obtained.



In the Wikipedia entry on AW UMa is a light curve derived from TESS data which was uploaded in September 2022. This light curve is reproduced below. There is again a suggestion that the secondary eclipse is total. There seems to be no evidence of star spots so the KW classification may be wrong.



I think that in early 2026 there is an opportunity to look at AW UMa which I intend to take up to find out if there have been period changes or changes in the light curve since the TESS data. Some of the papers quoted in the Wikipedia entry are saying that W UMa may not be a contact binary but may be a semi-detached EB with the stars linked by an accretion disk,

Reference

1:https://www.universetoday.com/articles/citizen-scientists-help-discover-8000-new-eclipsing-binaries

Recent minima of various Eclipsing Binary stars - 10

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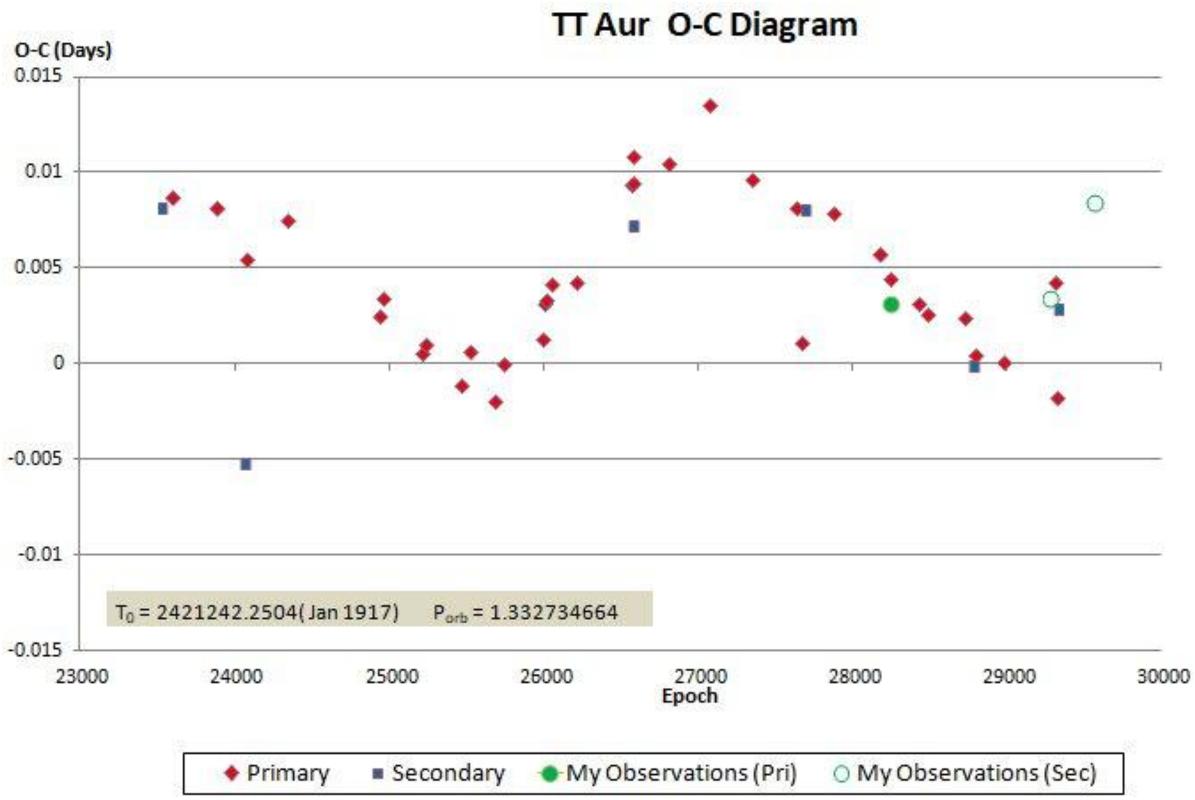
This report lists recent timings of minima of various eclipsing binaries. The observations from which the timings were obtained have all been posted to the BAAVSS and the AAVSO photometric databases.

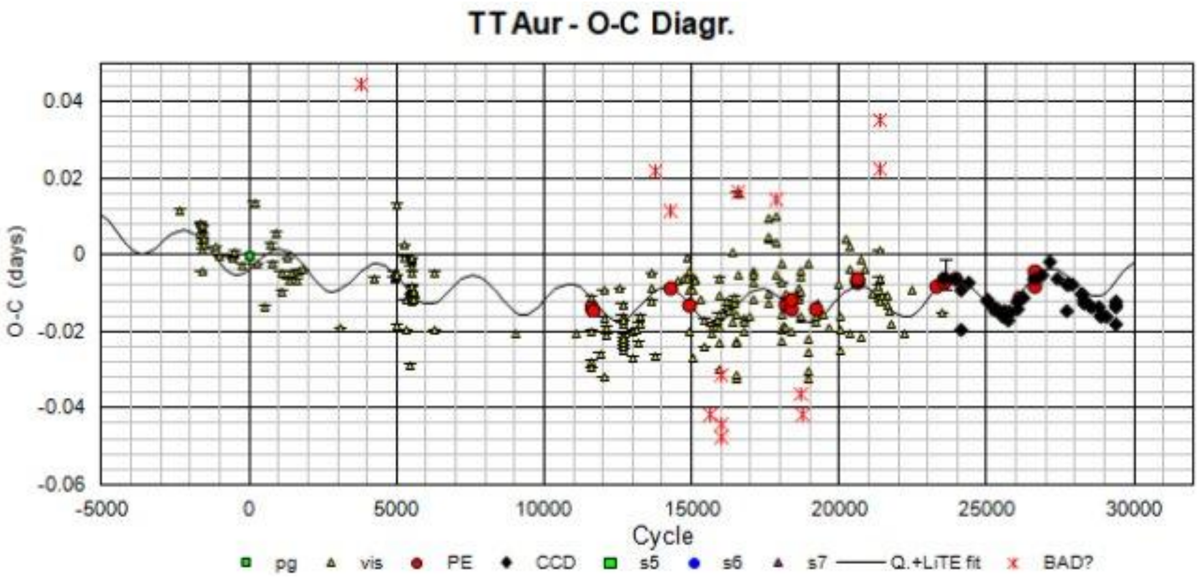
Star	HJD of Min	Filter	Error	Type of Minimum
TT Aur	2460650.55655	V	0.0004	Secondary
CW Cep	2460664.39246	V	0.0005	Primary
EG Cep	2460678.55329	V	0.0006	Primary
WZ Cep	2460683.39823	V	0.0005	Secondary
CD Cam	2460712.47632	V	0.0010	Primary
UV Leo	2460729.42847	V	0.0003	Secondary
AB Cas	2460735.48921	V	0.0002	Primary
NU Uma	2460753.39669	V	0.0005	Primary
AW Vir	2460767.40398	V	0.0002	Primary
AL Cam	2460775.48586	V	0.0002	Primary
TY Boo	2460789.61720	V	0.0002	Secondary
AZ Vir	2460807.65616	V	0.0005	Secondary
TZ Boo	2460810.57799	V	0.0010	Primary
TU Boo	2460856.46943	V	0.0005	Secondary
TZ Boo	2460860.49793	V	0.0008	Primary
SW Lac	2460892.57855	V	0.0002	Secondary

The observations were obtained from December 2024 to August this year using a 102mm refractor and an ASI 183MM-Pro cooled mono CMOS camera. The timings were extracted using Bob Nelson's Minima software. O-C diagrams are based on Nelson's Database of Eclipsing Binary O-C Files (https://www.aavso.org/bob-nelsons-o-c-files). The database is maintained by the AAVSO and is updated a couple of times a year.

The first O-C diagram of TT Aur includes mostly recent observations made with modern sensors. The observation included above is the most recent. There is a strong suggestion of a sinusoidal pattern which would be consistent with the presence of third body. However, the curve seems to have a "saw tooth" appearance to it.



The second TT Aur O-C diagram was taken unaltered from the AAVSO file and includes all the observations contained in the file, extending back around 35,000 cycles or 128 years. A curve has been fitted which looks to have a sinusoidal and long term parabolic components, although it doesn't seem to fit that well with the most accurate observations at the end of the sequence. The parabolic component, if actually present, could be consistent with a steadily increasing period. This might indicate continuing mass transfer taking place between the components.



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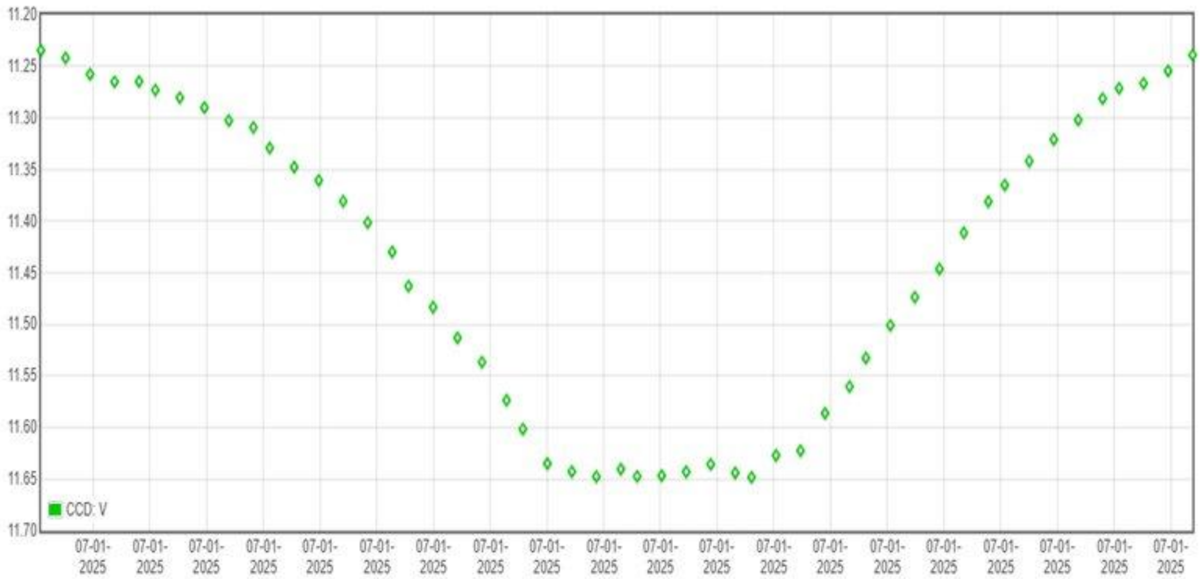
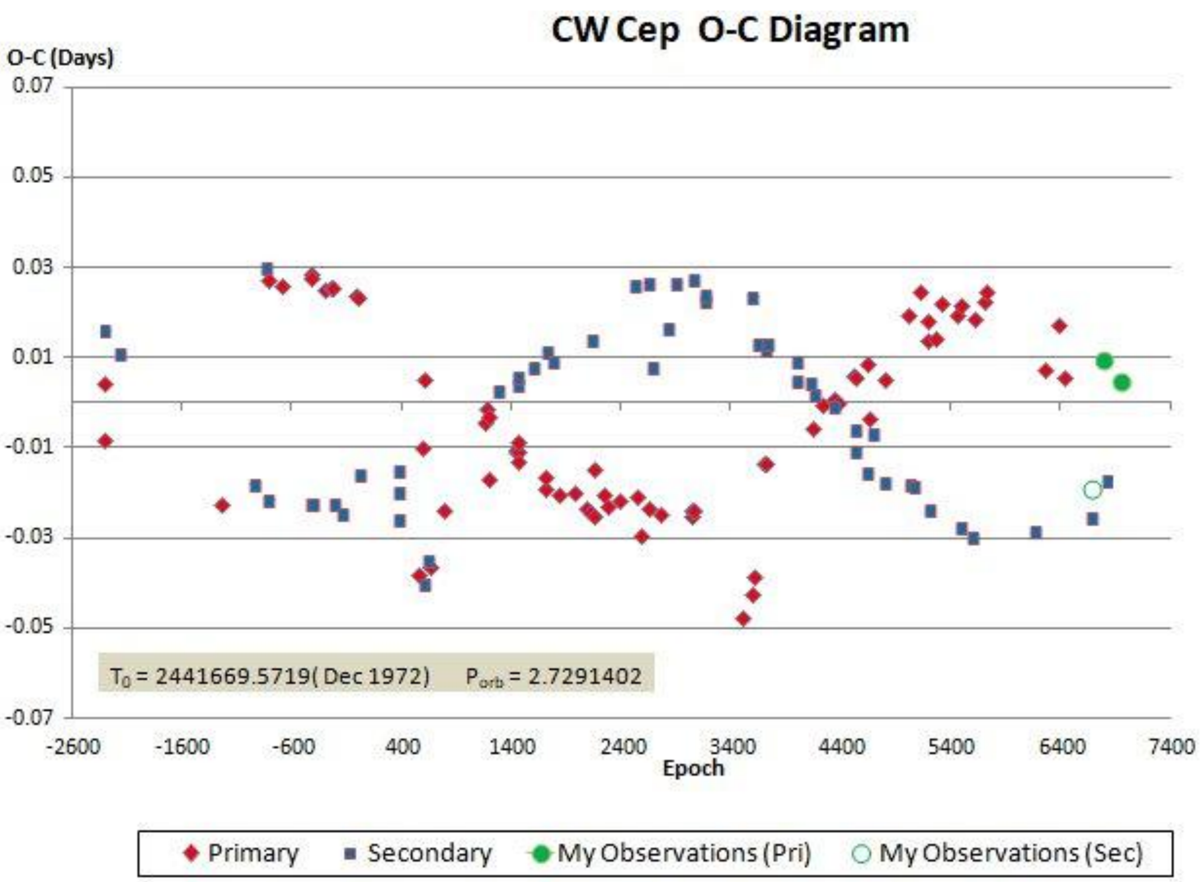
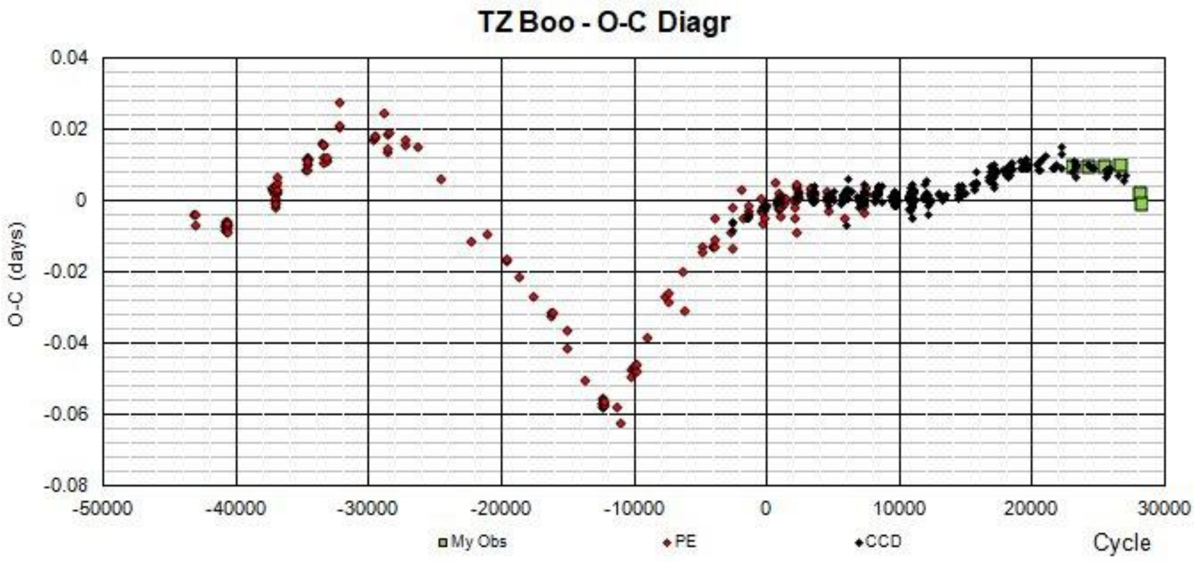
The light curve for the secondary minimum of WZ Cep shows a flat bottom indicating a likely transit of the secondary across the disc of the primary or a total eclipse of the secondary.



The O-C diagram of CW Cep is typical of apsidal motion, in which the components orbit eccentrically and the primary axis of the orbit is precessing. From the diagram, a full rotation of the major axis looks to take about 6,000 cycles or around 45 years. The components in these systems tend to be relatively well separated and so are usually EA (Algol) type systems.



The first of the two observations of TZ Boo reported above seemed rather too far off the O-C curve below, so I decided to repeat it. The second observation seems consistent with the first as did a couple of AAVSO observations which were not available when the O-C was originally prepared. The diagram below therefore seems to show that there has recently been a fairly abrupt spinning up of the system.



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Updated light curve and phase diagram of the Eclipsing Binary CQ Aurigae

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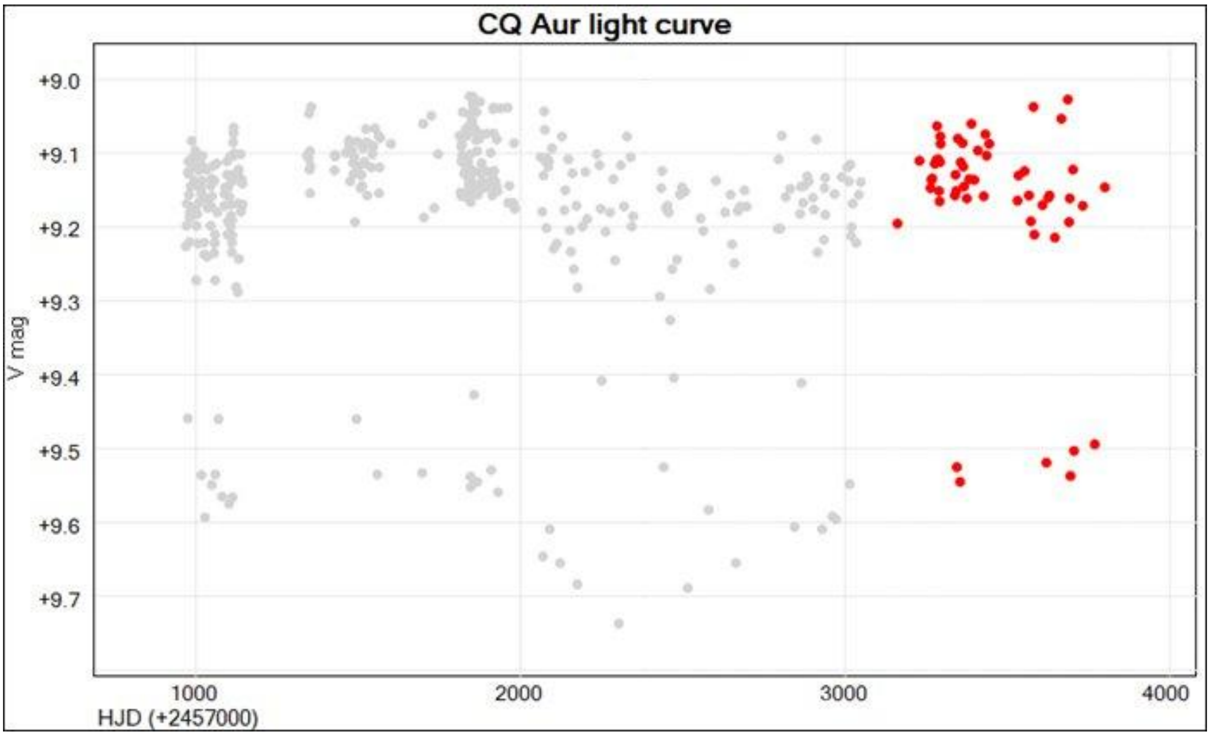
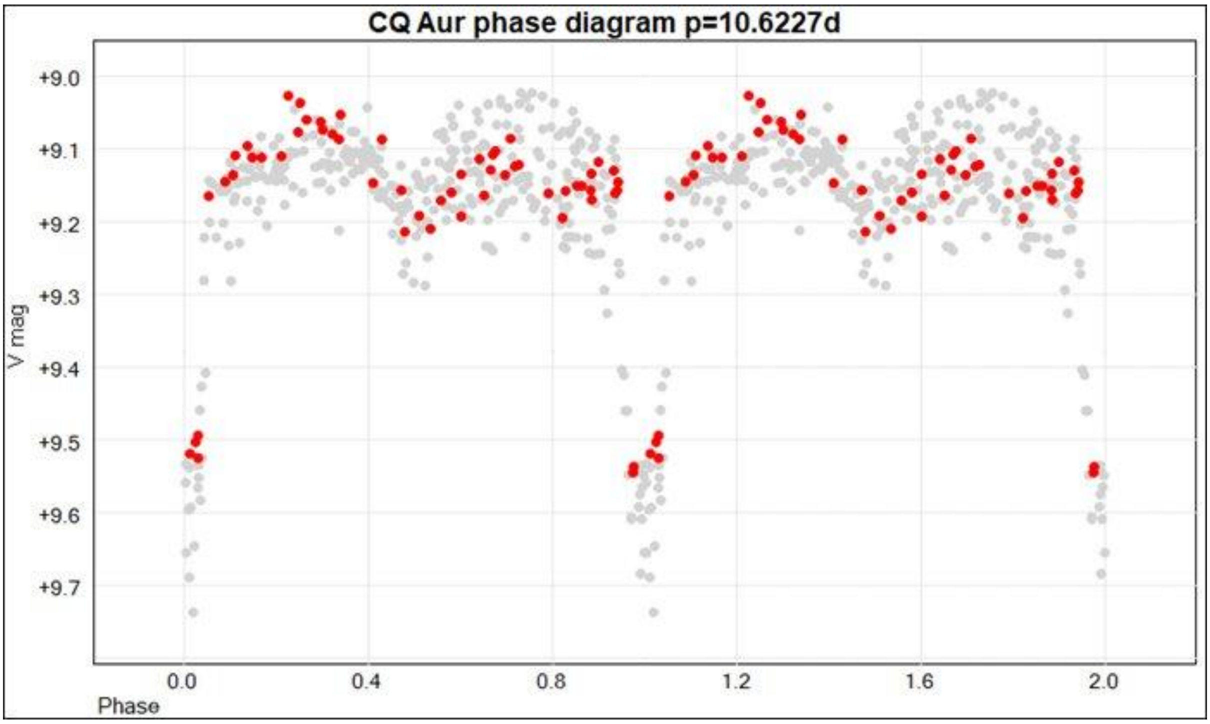
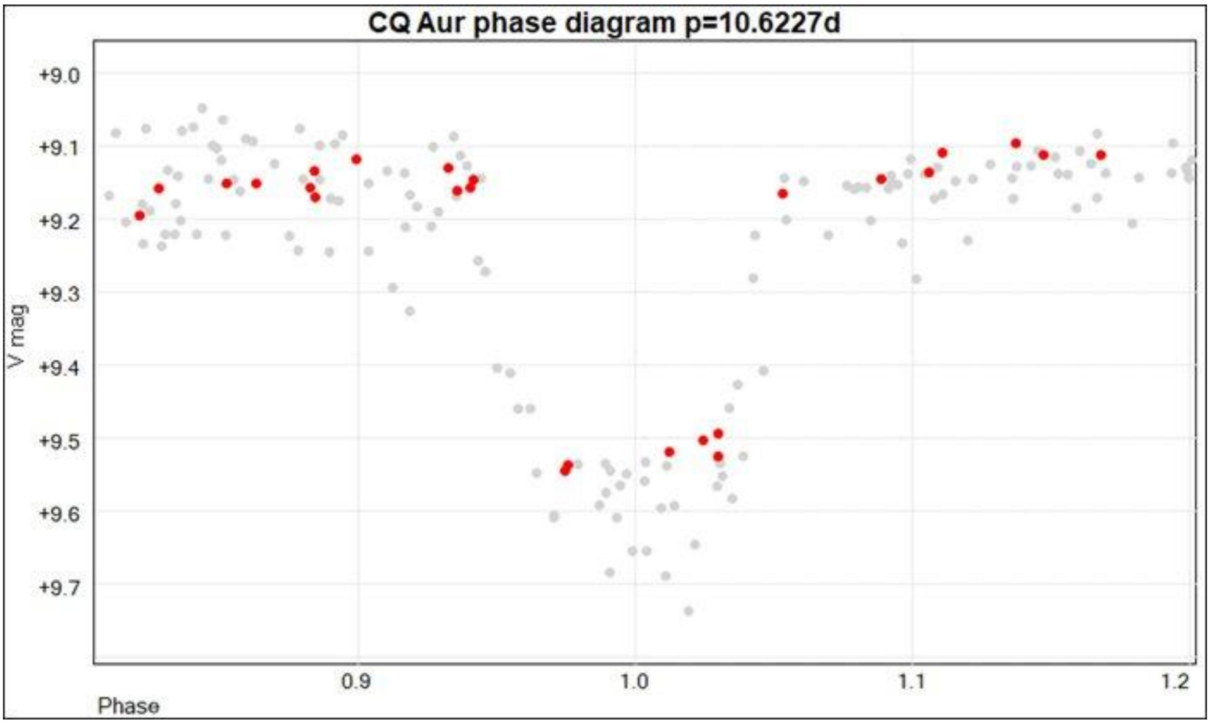
This article follows on from my previous article about this system in Variable Star Section Circular 198 (December 2023) which discusses the changing light curve of the eclipsing binary CQ Aurigae

Here is an updated light curve and phase diagram of the EA/RS eclipsing binary CQ Aurigae. This system has a catalogued period of 10.62251 days (GCVS AAVSO VSX), placing this system in the long period group. [Accessed 2025 August 10]. The period used in my phase diagram below relates to my observations alone.

The following light curve and phase diagram were constructed from images taken with the Open University COAST and PIRATE telescopes using a V filter. The 351 grey data points are observations made between 2017 August 8 and 2023 April 12, while the more recent 55 observations are in red and were made between 2023 August 4 and 2025 May 3.

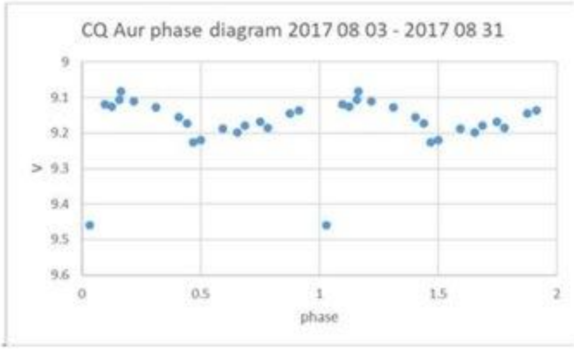


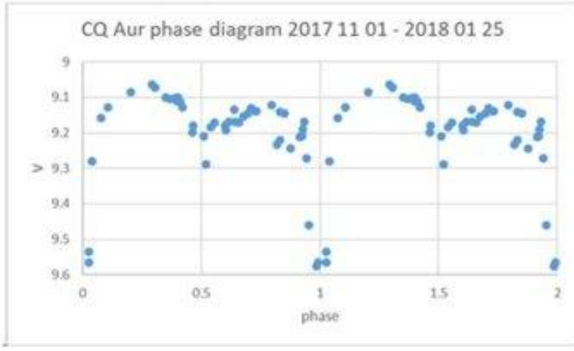


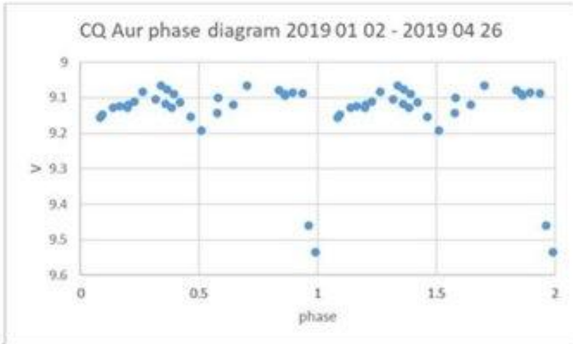


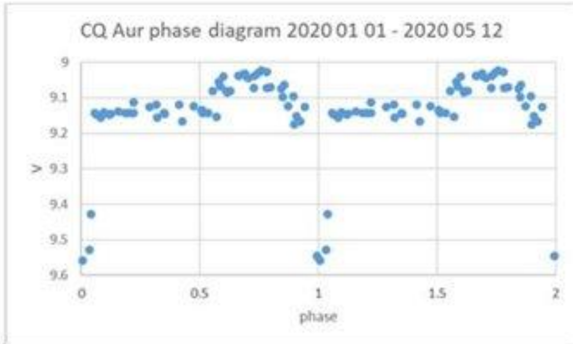
Discussion

The system is catalogued as an EA/RS type, which have light curves which can have unequal maxima which can change over many cycles. The following examples can be seen on my website.









In my previous article I suggested that these changes were due to the O'Connell effect (O'Connell (1952)). It has been suggested that changes in the CQ Aurigae light curve are possibly due to variable star spots on one or both components, Kang (1993), but this paper does not refer to it as the O'Connell Effect.

Additionally, other research papers appear to effectively *define* the O'Connell Effect as applying only to close binaries which can interact with each other (e.g. Knote *et al* (2022) , Cabrera *et al* (2025)). This would exclude detached systems like CQ Aur, although star spots as a possible cause of the O'Connell Effect *per se* in such systems are not ruled out in both these papers. On the other hand, Pan and Zhang (2023) include star spots as a possible cause of quasi-periodic variation in the (named) O'Connell Effect, specifically in RS CVn type variables.

More work obviously needs to be done on these complex variables; the possible causes of the O'Connell Effect, including observations in a wider range of wavelengths, modelling different types of binaries (contact, semi-contact and detached), stellar rotations and periods. But in addition, there appears to be some ambiguity over the actual definition and usage of the term *O'Connell Effect*. Does it just refer to differences in the relative *maximum* magnitudes of primary and secondary maxima, whatever their shapes, or is their overall shape also relevant? For example, can it be caused by star spots which only occur at fixed longitudes of 90 degrees and/or 270 degrees but not drifting in longitude? What if the minima also change shape or depth?

In the meantime, my V band observations of CQ Aurigae will continue! Observations of this and other systems can be found on my website.

References

O'Connell, D. 1952, The So-Called Periastron Effect in Close Eclipsing Binaries.
Kang, Y. 1993, Photoelectric observations of long-period RS CVn binary CQ Aurigae.
Knote, M. *et al*. 2022, Characteristics of Kepler Eclipsing Binaries Displaying a Significant O'Connell Effect.
Cabrera, D. *et al*. 2025, Multiband analysis of the O'Connell effect in 14 eclipsing binaries.
Pan, Y, and Zhang, X. 2023, KIC 7284688: A Solar-type Eclipsing Binary with Rapidly Varying O'Connell Effect.

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