ISSN 2631-4843

The British Astronomical Association

Variable Star Section Circular

No. 200 June 2024

BAA Office: PO Box 702, Tonbridge TN9 9TX

Contents

A message from the President 3

From the Director 4

An update on the Circulars index at the ADS – *Christopher Lloyd*............................ 7

More on the independent discoveries of the 1946 eruption of T CrB
by Knight and Woodman – *Jeremy Shears* 8

TA's 60th Anniversary – *Tracie Louise Heywood* 13

The Binocular Society – Fifty Years On – *John Toone* 16

CV & E News – *Gary Poyner* 20

The continuing story of super-cycle periods for V1159 Ori – *Stewart Bean* 24

Cataclysmic Variables – Do we really understand them? – *David Boyd* 28

Nine Years of Intensive Monitoring of OJ287 – *Mark Kidger* 32

My journey from 100,000 to 400,000 variable star observations.
Rod Stubbings 40

Recent observations of Mira Variables on the BAAVSS programme. 3
Shaun Albrighton 43

Eclipsing Binary News – *Des Loughney*... 49

Recent Minima of Various Eclipsing Binary Stars. 8 – *Tony Vale* 53

Investigations regarding the catalogue values of the periods of two long period
eclipsing variables V718 Persei and V1117 Cassiopeiae – *David Conner*................. 59

Section Publications & Contributing to the VSSC 64

Section Officers.. 65

Cover Picture

Corona Borealis – David Strange

A Message from The President

It groups itself in Sections, for Meteors, or for Mars,
While one has predilections for Variable Stars.

So, runs one of the verses of the song all about the activities of the BAA, penned by Savilian Professor of Astronomy Herbert Hall Turner in 1924, and revived by me at the Winchester Weekend this year. The BAA has catered for those with 'predilections for Variable Stars' since very soon after its foundation, and the Variable Star Section has correspondingly always been close to the core of the BAA, exemplifying all the activities for which the Association exists – systematic, careful observational work; long-term accurate record-keeping, analysis and reporting; tutelage of enthusiastic beginning observers by seasoned experts; production of data with minimal equipment, such as visual observation with binoculars, small telescopes, or even the naked eye; respectful and fruitful collaboration between amateurs and professionals working towards the shared goal of understanding stars in all their variety.

The dedication of successive Editors and Directors of the VSS, together with the work of the contributing authors and observers, has resulted in this *Circular* now reaching its 200th edition: a proud record on which I congratulate the members of the Section.

In April I was called to speak to MPs on the House of Commons Science, Innovation and Technology Committee, who have an ongoing investigation into the state of UK astronomy. They wanted to hear from me about what amateur astronomers do and get my views on what the government could do for us. I told them a lot about the BAA and about our ethos of encouraging scientific observation by amateurs and fostering pro-am collaboration in research. One of my main examples was the work of the VSS, and I used the method of visual magnitude estimation using a sequence of comparison stars as a prime example of how surprisingly accurate and useful simple visual observations can be, when collated over many contributors over time. I wished the politicians to understand how much value there is in amateur astronomy, not just in creating public support for professional science, but in its own right, and to wish to help us, by, for example, working to limit light pollution and satellite proliferation. (If you wish to hear all that I said, it is all recorded on the website of the Committee.)

Part of the importance of the work of this Section lies in the fact that all stars are variable. I have just returned from the meeting we held in Greenock, Scotland. Amongst talks from various distinguished speakers, we had one from Dame Jocelyn Bell Burnell, the discoverer of the first pulsar, on 'Bursts, bangs, and things that go bump in the night.' But almost to upstage our event, the particles emitted by the Sun in a massive coronal mass ejection from a huge sunspot (Active Region 3664) arrived at the Earth a few hours before our meeting was due to take place, giving the UK its most spectacular auroral storm for about 20 years – a dramatic burst of energy in the night sky, reminding us of the waywardness of our most local, but currently quite stable, variable star.

We study variable stars to understand stars in general, including our own, and we may find in future that such understanding is key to our survival as a species. The study of variable stars, like all real science, is more than just an academic exercise.

My best wishes to all members of the VSS.

Dr. David Arditti
President, British Astronomical Association

Back to contents

From the Director – *Jeremy Shears*

Welcome to the 200th Variable Star Section Circular

We have reached a truly remarkable milestone with the publication of this, the 200th Variable Star Section *Circular*. Although *circular*s had previously been issued by Colonel Markwick during his Directorship, VSSC number 1 was prepared on 1922 March 31 by VSS Director Félix de Roy at his home near Antwerp, Belgium. De Roy, who had become Director on January 1, introduced himself with the words: "The new Director begs to present his compliments to all the members of the Section". He went on to review the work of the Section, the list of variables under study, observing methods etc. He also announced a Section meeting to be held in London later in the year.

Eleven *Circular*s were issued during de Roy's Directorship, the final one on 1935 April 6. Then, somewhat reminiscent of the light curve of a RCB star in a prolonged fade, there was a long hiatus until 1972 when Acting Director John Isles famously opened VSSC 12 with the words: "We deeply regret the delay since the last *Circular*". Circulars have been issued regularly since then.

VSSC number 50 came out in 1982 June during Doug Saw's Directorship. The method of production was not without its practical difficulties, the Editor noting part the way through that "since we started preparation of this *Circular*….we apologise for the change in typewriter."

Moving forward to 1999 June, the 100th edition of the *Circular*, edited by Karen Holland, appeared under Gary Poyner's Directorship. It commenced with a foreword by the BAA President Martin Mobberley, who noted that the "BAA is, quite possibly, the premier body of amateur observers in the world." I am delighted that the current President, David Arditti, has kindly contributed to this 200th edition.

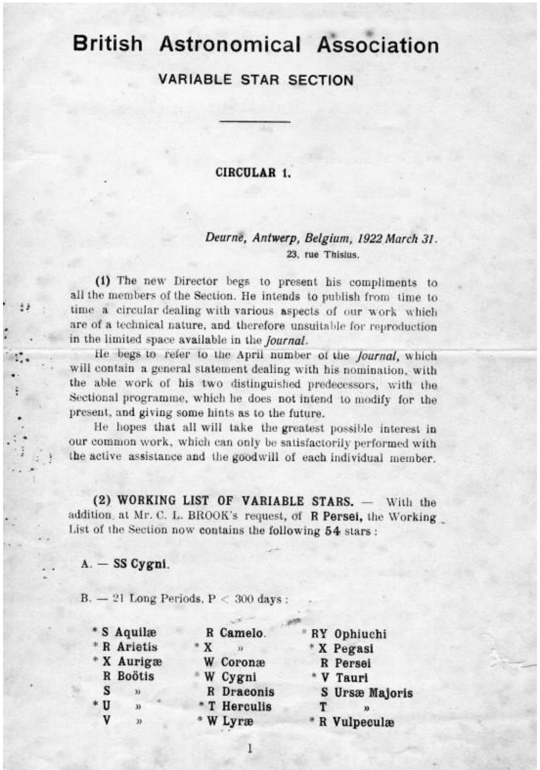
When the 150th *Circular* was printed, the Editor was Janet Simpson and the Director was Roger Pickard, both of whom are much missed.

Another milestone was achieved with VSSC 172 (2017 June) which was the last printed *Circular* to be distributed by mail, with its familiar yellow cover. From VSSC 173, *Circular*s were available in digital format only. This coincided with Gary Poyner taking on the role of Editor. Among other innovations which Gary introduced was a new, fresher, layout and an engaging cover image. Removing the costs of printing and postage, allowed the *Circular* to expand in length greatly, allowing much more material and illustrations to be included in full colour. I would like to thank Gary for his hard work and diligence over the last seven years during which the publication has gone from strength to strength. Although preparing each *Circular* is a labour of love, I know Gary spends many hours poring over submitted contributions, editing, raising questions with authors, and laying out each edition. Thank you, Gary, for all you do – it is greatly appreciated!

Each *Circular* is distributed far and wide to members and non-members. Over 220 are emailed around the world, including to observers, researchers, and other variable star organisations. Recipients include both amateurs and professionals. On top of this further copies are doubtless downloaded directly from the VSS website (https://britastro.org/vss/VSSC_archive.htm), where back numbers can also be read. Many VSSC articles are also available via the SAO/NASA Astrophysics Data System thanks to the diligence of Chris Lloyd who uploads them. Much of the information and analysis in the *Circular* is not available elsewhere. This is of great value as it allows researchers, now and in the future, to access the fruits of our labours. Chris provides an update on the ADS project later in this *Circular* in which he also describes how the content of the *Circular* has evolved over time.

There is another group that I must thank and that is our contributing authors without whom there would be nothing to read. It never ceases to amaze me both the high quality and the range of material covered. Whether you are a regular or an occasional contributor, thank you! Do consider writing something for a future *Circular*. In addition to the more formal articles, we are keen to encourage informal pieces. Why not write something about your interest in variables stars, your observatory, or perhaps your favourite star? I am certain your fellow variable star enthusiasts would be interested to read them. We can even include letters. In fact, VSSC 100 contained a letter from Maurice Gavin querying the use of spectrometry to derive stellar magnitudes.

Finally, my thanks go to you, our readers, for your support. It's especially gratifying to hear comments about what people have found interesting or particularly enjoyable after a *Circular* has been despatched. Whilst there are many other VSS communication vehicles available, such as the VSS website, the BAAVSS-Alert email list, the BAA Forum, VSS Facebook, it is true to say that the VSSC remains as relevant today for communicating the work and activities of the Variable Star Section as it was when VSSC 1 dropped through letterboxes 102 years ago. Here's to the next 200 editions!



British Astronomical Association

VARIABLE STAR SECTION

CIRCULAR 1.

Deurne, Antwerp, Belgium, 1922 March 31.
23, rue Thisius.

(1) The new Director begs to present his compliments to all the members of the Section. He intends to publish from time to time a circular dealing with various aspects of our work which are of a technical nature, and therefore unsuitable for reproduction in the limited space available in the *Journal*.

He begs to refer to the April number of the *Journal*, which will contain a general statement dealing with his nomination, with the able work of his two distinguished predecessors, with the Sectional programme, which he does not intend to modify for the present, and giving some hints as to the future.

He hopes that all will take the greatest possible interest in our common work, which can only be satisfactorily performed with the active assistance and the goodwill of each individual member.

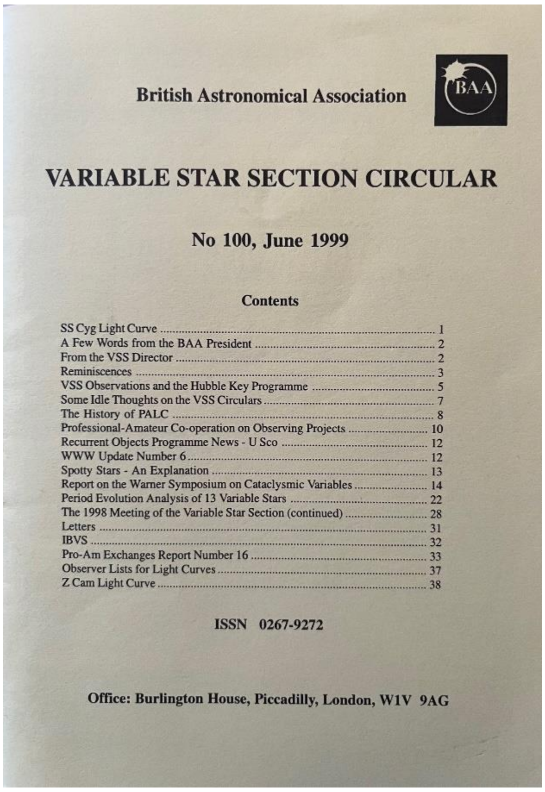
(2) WORKING LIST OF VARIABLE STARS. — With the addition, at Mr. C. L. BROOK's request, of **R Persei**, the Working List of the Section now contains the following **54** stars :

A. — **SS Cygni**.

B. — 21 Long Periods, P < 300 days :

* S Aquilæ	R Camelo.	* RY Ophiuchi
* R Arietis	* X »	* X Pegasi
* X Aurigæ	W Coronæ	R Persei
R Boötis	* W Cygni	* V Tauri
S »	R Draconis	S Ursæ Majoris
* U »	* T Herculis	T »
V »	* W Lyræ	* R Vulpeculæ

1



British Astronomical Association

VARIABLE STAR SECTION CIRCULAR

No 100, June 1999

Contents

SS Cyg Light Curve ... 1
A Few Words from the BAA President ... 2
From the VSS Director ... 2
Reminiscences ... 3
VSS Observations and the Hubble Key Programme ... 5
Some Idle Thoughts on the VSS Circulars ... 7
The History of PALC ... 8
Professional-Amateur Co-operation on Observing Projects ... 10
Recurrent Objects Programme News - U Sco ... 12
WWW Update Number 6 ... 12
Spotty Stars - An Explanation ... 13
Report on the Warner Symposium on Cataclysmic Variables ... 14
Period Evolution Analysis of 13 Variable Stars ... 22
The 1998 Meeting of the Variable Star Section (continued) ... 28
Letters ... 31
IBVS ... 32
Pro-Am Exchanges Report Number 16 ... 33
Observer Lists for Light Curves ... 37
Z Cam Light Curve ... 38

ISSN 0267-9272

Office: Burlington House, Piccadilly, London, W1V 9AG

VSSC 1 (1922 March) and VSSC 100 (1999 June)

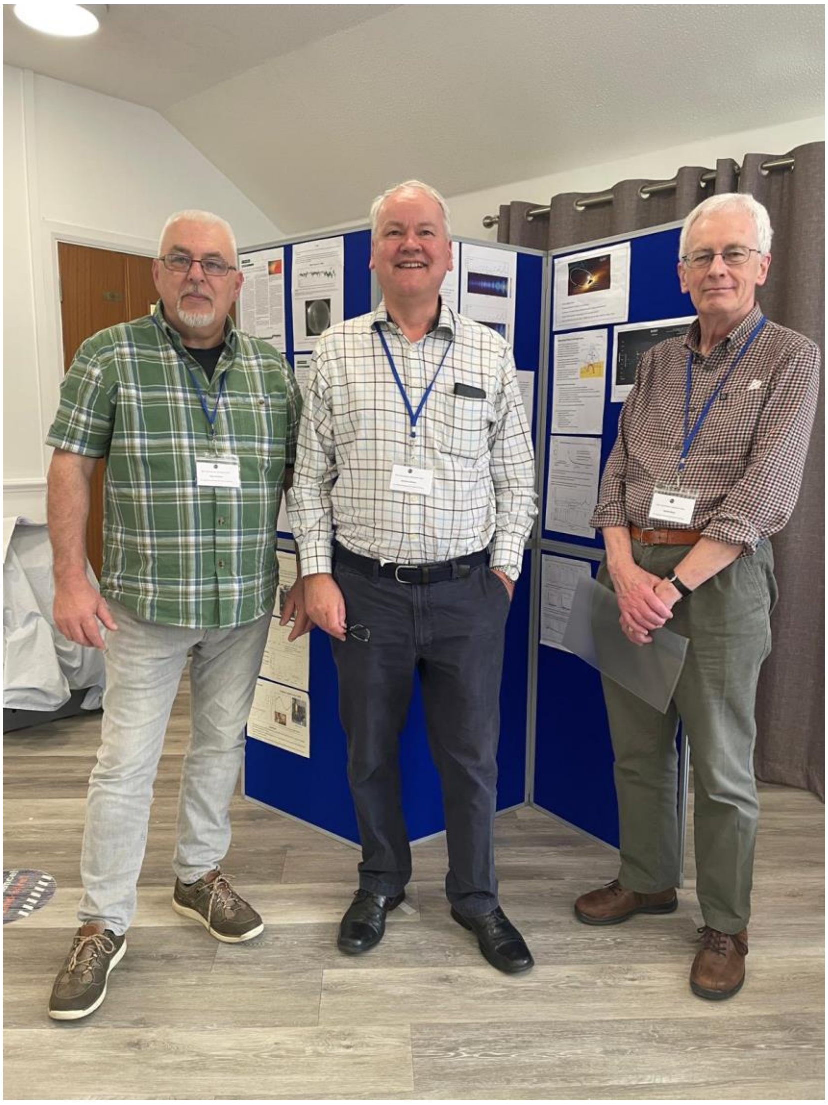
In memoriam: Roger Pickard

Several people contacted me after the brief obituary of Roger which appeared in the March VSSC, wanting to share their thoughts and memories. I have been in touch with Marian Pickard and she was touched to hear the messages of condolence.

A more detailed obituary appeared in the April BAA *Journal*.

Winchester Weekend

Another very enjoyable Winchester Weekend took place in April and it was good to see quite a few VSS observers present. As usual, the VSS had a display showing the results of recent work covering both visual, digital photometry and spectroscopy.



Gary Poyner, the Director and David Boyd at the BAA Winchester Weekend

Back to contents

An update on the Circulars index at the ADS

Christopher Lloyd

cl57@ymail.com

Indexing the BAA VSS Circulars at the NASA ADS is now complete so it will be possible to search these by author, title, keywords and star identifiers for items of interest.

As the *Circular* has reached this latest milestone it is an appropriate time to report on recent developments of the indexing programme at the NASA ADS. The process of creating the index is complete, but it will take some time to be assimilated into the ADS. Currently the issues available online are Nos.1-11 and 115-197, and a few isolated articles from the intervening years.

The *Circulars* as currently presented are a direct continuation of their reintroduction in 1972, under then Acting Director John Isles, following the wilderness years of 1935 to 1972, after the first 11 issues. Since its inception the *Circular* has been in constant change as it evolved to meet the needs of the day. Initially it was the primary means of disseminating information to the membership, and although that role has to some extent been assumed by the immediacy of the internet, and more recently social media, the *Circular* still provides a focal point for the section. As well as the functional aspect, the *Circular* now provides a forum for larger, self-contained articles of scientific, historical and even personal interest, and what has been indexed has also changed to reflect that evolution.

The early *Circulars* were not divided into articles, and certainly nothing akin to papers, but were largely headed paragraphs, without clear authorship, but probably written by the Director, and sometimes by others. The subject matter ranges from the obvious 'CI Cygni' to the less helpful 'Apologies,' but not all of these make it into the index. For the most useful, the title and the names of any stars that receive a significant mention are recorded through the keyword token. All the articles with named authors are also indexed, again with any relevant star names.

Considerable space was devoted to the lists of the main-programme and binocular-group variables, and discussion of which stars should be included. Where these various lists appear in the *Circulars* is indexed, but the individual stars are not. The trials and tribulations of creating and distributing charts and sequences also occupies considerable space, and demanded significant effort, so where new or amended charts are mentioned these have been indexed for the individual stars. In most cases the star names are not included in the title so they have been indexed through the keyword token. Although, this is probably only of historical interest as the charts and sequences are well documented elsewhere, these may still contain useful additional information. Occasionally individuals are mentioned by name and they may be indexed in the title or keyword.

A user guide to accessing the Circulars has already been published, and that article also contains some of the early history and references. In the ADS it is possible to search by many fields, but the 'Fulltext' field is the most useful when searching for stars. Despite the name, for the *Circular*, it only covers the title, abstract and keywords, which is why it is important to include an abstract when contributing to the *Circular*. It is possible to access the whole Circular Archive on the section website of individually by constructing the URL, https://britastro.org/vss/vsscads/VSSC<number>.pdf, where <number> is the issue number without any leading zeros. If necessary, a full text search can be performed on all the pdf files apart from Nos. 1-11, 13, 14 and 105. Now the index is up to date it is intended to maintain it in a timely way. Please report any omissions or errors found to the Editor.

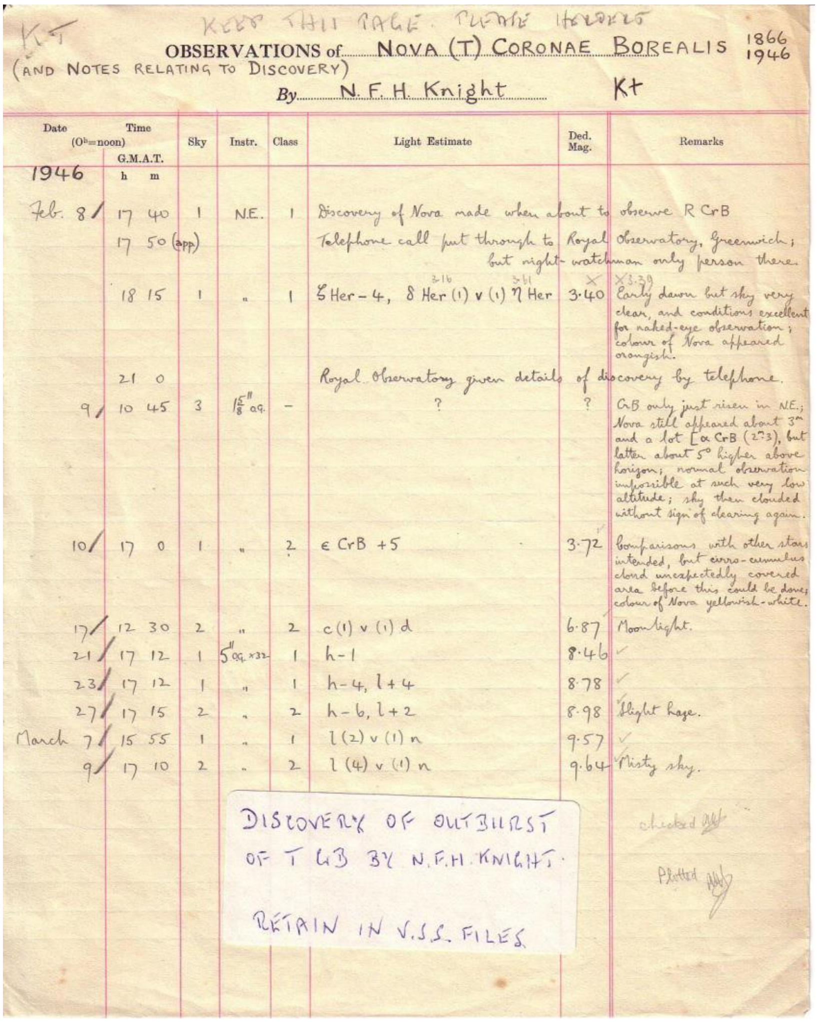
More on the independent discoveries of the 1946 eruption of T CrB by Knight and Woodman

Jeremy Shears

bunburyobservatory@hotmail.com

This article provides details about the discovery of the 1946 eruption by N.F.H. Knight, largely based on correspondence he sent to the VSS Director, W.M Lindley. It also considers Knight's reaction to the coverage in the popular press of an independent discovery by the teenager, Michael Woodman.

In VSSC 199 (2024 March) I wrote about the circumstances surrounding the independent discovery of the 1946 eruption of T CrB by a teenager from Newport called Michael Woodman [1]. In brief, N.F.H. Knight discovered the eruption on the morning of 1946 February 9 and he described background to the event at the BAA Ordinary Meeting held on Wednesday, 1946 February 27, at Burlington House, London. However, the meeting report in the *Journal* carried an addendum which stated that priority of discovery had been officially accorded to Michael Woodman, a schoolboy from Newport, South Wales. Woodman's discovery was recorded in the *Daily Mirror* newspaper of Tuesday February 12 under the headline "Boy found star the experts hunted for years".


KEEP THIS PAGE. PLEASE [illegible]

K.T

OBSERVATIONS of NOVA (T) CORONAE BOREALIS 1866 1946

(AND NOTES RELATING TO DISCOVERY)

By N.F.H. Knight Kt

Date 1946	Time (0h=noon) G.M.A.T. h m	Sky	Instr.	Class	Light Estimate	Ded. Mag.	Remarks
Feb. 8	17 40	1	N.E.	1	Discovery of Nova made when about to observe R CrB		
	17 50 (app)				Telephone call put through to Royal Observatory, Greenwich; but night-watchman only person there.		
	18 15	1	"	1	ζ Her − 4, δ Her (1) v (1) η Her	3·40	Early dawn but sky very clear, and conditions excellent for naked-eye observation; colour of Nova appeared orangish.
	21 0				Royal Observatory given details of discovery by telephone.		
9	10 45	3	1 5/8" og.	–	?	?	CrB only just risen in N.E.; Nova still appeared about 3m and a lot [α CrB (2·3), but latter about 5° higher above horizon; normal observation impossible at such very low altitude; sky then clouded without sign of clearing again.
10	17 0	1	"	2	ε CrB +5	3·72	Comparisons with other stars intended, but cirro-cumulus cloud unexpectedly covered area before this could be done; colour of Nova yellowish-white.
17	12 30	2	"	2	c (1) v (1) d	6·87	Moonlight.
21	17 12	1	5" og. ×32	1	h − 1	8·46	
23	17 12	1	"	1	h − 4, l + 4	8·78	
27	17 15	2	"	2	h − 6, l + 2	8·98	Slight haze.
March 7	15 55	1	"	1	l (2) v (1) n	9·57	
9	17 10	2	"	2	l (4) v (1) n	9·64	Misty sky.

DISCOVERY OF OUTBURST OF T CrB BY N.F.H. KNIGHT. RETAIN IN V.S.S. FILES

checked [illegible]

Plotted [illegible]

Figure 1 N.F.H. Knight's discovery and early observations of T CrB

John Toone has kindly provided me copies of letters from Knight to then VSS Director, W.M. Lindley, during the days following the eruption, which are present in the VSS sequences files. Unfortunately, we do not have Lindley's reciprocal correspondence.

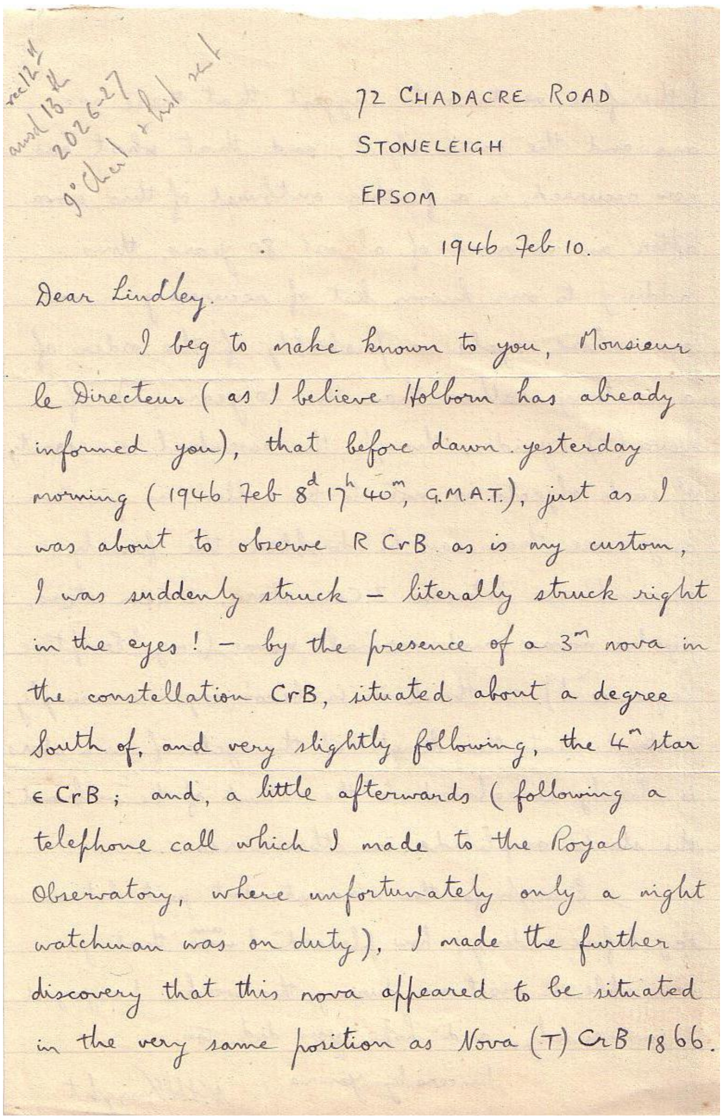
Figure 1 presents Knight's notes and observations of T CrB from the time he detected the eruption. Note that the times given are Greenwich Mean Astronomical Time, or GMAT, which begins at noon rather than midnight. It was used by astronomers before 1925 to avoid the need to change date during the night. Knight's first entry – the eruption discovery - is at 17.40 GMAT on February 8, or

05.40 UT on February 9. The notes mention that he telephoned the Royal Observatory Greenwich at approximately 05.50, but the night watchman was the only person available.

He gave further details of his discovery in a letter to Lindley written the following day, February 10 (Figure 2):

> *"before dawn yesterday morning…., just as I was about to observe R CrB as is my custom, I was suddenly struck – literally struck right in the eyes! – by the presence of a 3^m nova in the constellation CrB…."*

He goes on to say that he then realised that the "*nova appeared to be situated in the very same position as Nova (T) CrB 1866. I therefore venture to suggest that these are one and the same object, and that what has now occurred is a further outburst of this nova after an interval of almost 80 years.*"



rec'd 12th
ans'd 13th
2026-27

72 CHADACRE ROAD
STONELEIGH
EPSOM
1946 Feb 10.

Dear Lindley.

I beg to make known to you, Monsieur le Directeur (as I believe Holborn has already informed you), that before dawn yesterday morning (1946 Feb 8^d 17^h 40^m, G.M.A.T.), just as I was about to observe R CrB as is my custom, I was suddenly struck – literally struck right in the eyes! – by the presence of a 3^m nova in the constellation CrB, situated about a degree South of, and very slightly following, the 4^m star ϵ CrB; and, a little afterwards (following a telephone call which I made to the Royal Observatory, where unfortunately only a night watchman was on duty), I made the further discovery that this nova appeared to be situated in the very same position as Nova (T) CrB 1866.

Figure 2: Letter from Knight to VSS Director Lindley on February 10 (page 1 of 2)

One can see a pencil annotation in the top left corner of the letter, presumably by Lindley, saying "2026-27" which one might presume is his estimate of T CrB's next eruption considering the 80 elapsed between the 1866 and 1946 events. Lindley would have realised that he would not be around to see that event as he would be 135 years old in 2026. The annotation also states that Lindley received the letter on February 12 and answered it on the 13th.

Knight's next letter to Lindley was on February 13 by which time he had heard about the report of Michael Woodman's discovery in the *Daily Mirror* the previous day. Somewhat indignantly, Knight wrote (the underlining is his):

> *"*Daily Mirror *reports that nova was discovered by a 16-year old lad….who wrote to Astronomer Royal about it, and the latter made this known in a broadcast. Have you recently heard any radio speech by Astronomer Royal on subject of Nova CrB? I am sure I haven't…..Who is officially regarded as discoverer, I wonder. I can't find any report of Nova in the better-class newspapers."*

By contrast, on February 14 Knight told Lindley that he had seen a report in the previous day's edition of *The Times* newspaper which "correctly reported discovery, I now find". By *correctly*, he presumably means that it credits him alone with the discovery. The *Times* article, entitled "A Stellar Outburst," is well written and accurate, perhaps surprisingly so for a newspaper (Figure 3). This is because the "Astronomical Correspondent" of *The Times*, under whose soubriquet the column appears, was none other than the BAA's W.H. Steavenson during this epoch [2].

A STELLAR OUTBURST

FROM OUR ASTRONOMICAL CORRESPONDENT

The telescopic star T, in the constellation Corona Borealis, has suddenly increased in brightness several hundredfold and is now visible to the naked eye.

A previous and even more violent outburst took place 80 years ago, when T reached the brightness of the Pole Star and first attained the status of a " nova." It then faded rapidly and has remained of its original brightness until last Friday night, when it was first noted as a naked-eye object by Mr. N. F. H. Knight, an amateur astronomer living at Stoneleigh, near Epsom.

Corona Borealis, which rises to the left of Arcturus, is high enough to be observed from about 11 p.m. onwards, and the nova is on its south-eastern fringe, just outside the horse-shoe curve of stars that forms the constellation.

Figure 3: Excerpt from *The Times* 1946 February 13

In his letter to Lindley on February 17, Knight was even more buoyant about his discovery claim:

> *"I don't think we have to contend with a rival claim to discovery after all, for at the BAA last Wednesday the opinion appeared to be held unanimously that the Welsh boy's observation, whatever hour or night it was made, did not constitute a technical discovery. Furthermore, my communication to Greenwich on the morning of Feb. 9 was the first intimation they had had from anywhere of the present outburst of the nova; that was quite apparent to me as I spoke to Mr. Martin that morning."*

Knight wrote to Lindley the day after addressing the BAA Ordinary Meeting about his discovery. In this letter of February 28, he thanks Lindley for his "*letter of the 25th, informing me that priority of discovery of T CrB has been officially accorded to my 'rival' M. Woodman of Newport, Mon. As this appears perfectly factual I neither grudge it, contest it nor worry about it in any sort of way*."

Knight goes on to thank Lindley for the glowing tribute that had been read out at the BAA meeting about the discovery (Lindley not himself being present). Knight said that when he got up to speak at the meeting:

"I was given a reception which made me feel a trifle embarrassed and which left me in no doubt that everyone present fully concurred with your view that the boy's having beaten me by a matter of a few hours in no way detracted from the merit of my own independent discovery; the President also said a few words of the self-same tenor, adding that my information reached Greenwich on the Saturday morning [February 9] *and Woodman's not until the Monday* [February 11]*, so that the exact position was completely clarified, and I myself feel that full credit and justice has been given to both persons concerned in the discovery. And there, as far as I anxious, the matter can safely rest, except that I will take your good advice and write to Woodman, sending him a copy of my light curve."*

He asked whether Lindley might be able to supply Woodman's address, but we don't know if Knight ever wrote to Woodman. If we take this correspondence at face value, Knight had reconciled himself in the question of priority.

On the other hand, it irked Knight that he had not received a satisfactory response when he telephoned the ROG on the morning of discovery. As noted above, he was only able to speak to the night watchman when he called. In his February 17 letter to Lindley, he gives the time as 05.45 "*when I was informed that all the observers were 'in bed', and the night-watchman's efforts to arouse them were unsuccessful*". He also referred to a letter from W.H. Steavenson, informing him "*that none of the Greenwich instruments were in a fit condition to be turned towards the sky last Saturday, so he was baulked of his desired to secure daylight observation of Nova CrB. Pity*!" Whether the instruments, if they had been deployed, would have been able to pick up a third magnitude nova in daylight is another matter.

After failing to awake the ROG astronomers, and with dawn approaching, Knight made his final observation of discovery morning at 06.15 UT, placing it as magnitude 3.4. By this time, he noted (Figure 1) it was "*Early dawn but sky clear, and conditions excellent for naked-eye observations; colour of Nova appeared orangish*". Then, with daylight now upon him, he decided to call the ROG for a second time at 09.00 UT and gave them details of the discovery (Figure 1).

Knight glimpsed T CrB the following morning, February 10 UT, but it was very low in the sky and was soon covered by cloud. He didn't enter a definitive magnitude estimate, though he noted it was still about magnitude 3 (Figure 1). On the morning of February 11, he battled cloud to obtain an estimate of magnitude 3.72 whilst noting that the nova was yellowish-white.

The next few days were frustrating for Knight, being blighted by poor weather. He was hoping to validate the star chart and sequence that Lindley had prepared, saying "*I will try to do when the weather permits. Lord! Isn't it awful! Do you know, I haven't seen a star – any star - for exactly a week*." He didn't have too long to wait after posting the letter because later that night, at 00.30 on

February 18, he had T CrB at magnitude 6.87. He made further estimates over the next few days (Figure 1).

Knight (who, according to John Isles, went by the name Frank Knight, at least when he knew him in the 1970s) mentioned in the correspondence that he had only recently re-commenced VS observing at the time of his discovery. Although his first observation in the VSS photometry database was on 1936 December 5, through most of the first half of the 1940s he made few observations, presumably due to the war. He had started in earnest again in 1945 December and there are 1346 estimates of a range of variables in 1946 lodged in the VSS database. His final estimate of T CrB was just before dawn on 1946 December 26. However, his rekindled enthusiasm was not to last as he only made fifteen observations in 1947 and six in 1948. There then followed a roughly thirty-year gap until the next entry in the database: a handful of estimates in 1978. Between 1980 and 1987 he was more active generally making a few hundred observations a year, until his last on 1987 November 20. No obituary of Knight appeared in the *Journal*. If a reader has any further information about, or recollection of, N.F.H. Knight, I would be delighted to hear from them.

Similarly, it would be wonderful to learn what became of Michael Woodman of Newport and whether he maintained his interest in astronomy after such an auspicious start.

References

1. Shears J., *BAA Variable Star Section Circular*, **199**, 22-23 (2024). *A British independent discovery of the 1946 eruption of T CrB*. https://britastro.org/vss/VSSC199.pdf

2. Fry R.M., *J. Brit. Astron. Assoc*., **86**(5), 386-390 (1976). *Obituary: William Herbert Steavenson, 1894-1975*

TA's 60th Anniversary

Tracie Louise Heywood

traciheywood832@gmail.com

A look back at the presentation of variable star reports during the early years of 'The Astronomer' magazine.

This May, it was 60 years since the first issue was published of the magazine "The Casual Astronomer" (renamed a few years later as "The Astronomer" and often known as just "TA").

The first issue didn't actually contain any variable star observations. That had to wait until these observations of R Pegasi appeared in the June issue.

R P E G A S I

John Larard

Comparison stars for these observations, made in 1963, were as follows: A 7·4; B 8·4; C 8·7; D 9·3.

August 29, 21.05 UT: (misty conditions, low, Moon past First Quarter) A-2: C+1 = 8·3; B-1: D+2 = 8·7. Uncertain mean of 8½.

September 15, 21.29 UT: A-1: B+2 = 7·7; A-3: C+7 = 7·8.

October 18, 20.40 UT: =B = 8·4; A-1. D+1 = 8·3. Poor transparency.

November 12, 20.18 UT: (windy conditions and only one estimate could be made) C-2: D+1 = 9·0.

December 25, 17.15 UT: star not seen in bright moonlight.

The report drew a complaint in the July issue. It had not included the identities of the comparison stars A, B, C or D.

This is still the case. Indeed, the amount of detail published per observation would decrease in later issues. Given the sheer number of observations submitted to TA nowadays, it would simply not be feasible to include such detail.

There was no dedicated variable star sub-editor in the early issues. When reports did appear, they were usually listed observer by observer, rather than collecting together the observations of each star.

Here is an example from the May 1970 issue.

M J Gainsford: R Boo 7.4 rising (Apr 29); S Boo 12.35 falling (Apr 29); S Cep 10.2 rising slowly (Apr 29); T Cep 7.1 falling (May 2); U Cyg 11.1 rising (Apr 29); S Del 8.9 near maximum (May 2); T Dra 13.4 falling (Apr 23); R Gem 6.9 rising (Apr 27); SS Her (13.6 near minimum (May 2); U Ori 10.9 rising slowly (Apr 29); S Per 9.25 (Apr 23); R Tri 7.4 falling (Apr 23). - 2 Derwent Way, Nuneaton.

B A Carter: RX And (11.0 (Apr 23); Z Cam 12.9 rising (May 5); SS Cyg 10.4 fading (May 5); SS Aur (13.2 (May 5); SU UMa 13.2 (May 5). Observations were also made of UV Per, TZ Per, U Gem, AA Cnc, X Leo, AY Lyr, LL Lyr, UU Aql, and SW UMa, but poor conditions led to no observations of maxima. The following LPV's are bright: R Gem, R Leo, R Boo, R Cyg, V Cyg, S Del, T Her, S Her. - 35 Richmond Croft, Great Barr, Birmingham 22A.

Henk Feijth: SS Aur 10.7 (Apr 5), a maximum of which the rise was well observed; Z Cam 11.3 rising (Apr 20); SY Cnc 11.7 rising (Mar 11); SS Cyg 9.1 (Apr 8); AH Her 11.1 (Mar 27); X Leo 12.1 (Apr 5). - Chopinlaan 20, Kamer 411, Groningen, Netherlands.

A J Hollis: HT Cas 13.4 (Apr 23); Z Cam 12.7 fading (Apr 26); AF Cam 13.2 (Apr 26); SS Cyg 12.14 (Apr 26); AB Dra 12.9 rising (Apr 26); AY Lyr 12.9 (Apr 26); TZ Per (13.3 (Apr 26); X Aur 8.9 fading (Apr 23); S Boo 12.1 (Apr 13); X Cam 11.8 (Apr 23); S Cas 12.45 (Apr 26); S Cep 9.65 (Apr 26); S CrB 9.6 (Apr 26); W CrB 11.3 (Apr 4); R Cyg 9.07 (Apr 23); U Cyg 10.03 (Apr 23); V Cyg 10.56 (Apr 23); RY Dra fading from 7.0-7.5 during April; SS Her 10.4 (Apr 4); R Lyn 10.73 (Apr 23); RY Oph 9.45

As the number of variable star observations submitted grew, however, that practice became unsustainable and the May 1971 column included this note.

VARIABLE STAR NOTES

(In view of the increasing amount of space being taken up by these contributions, we are hoping to publish them in condensed form as from next month. - Ed)

John Isles took on this task and the June 1971 column was the first that started to resemble the column that we see nowadays.

D W Robinson (Ro): Here are a few "binocular" variable estimates, made with 12x40B, except 7x50B for Psi^1 Aur and X Cnc and 7.5cm OG x23 for RV Cyg, CH Cyg, TV Gem and BU Gem. - 41 St George's Road, Forest Gate, London E7.

P Yates (Ya): Here are some observations using 10x50B. - 78 Baldwin Road, Kidderminster, Worcs.

Other observers

J E Isles (Is), Flat 3, 116 Long Acre, London W.C.2.
D Pinnion (Pn), 41a First Avenue, Westcliff on Sea, Southend, Essex
A L Smith (Sm), 11 Lerryn Road, Gosport, Hants.
K Sturdy (St), 8 Pottergate, Helmsley, York.
J D Wise (Wi), 2 Gudgeheath Lane, Fareham, Hants.
D Young (Yo), 49 Glencairn Road, Dumbarton.

Mira-type variables (Dates are for May unless indicated)

R And: 16, 6.8 (Pc)
R Boo: 31, 11.4, brightening (Ga)
S Boo: 31, 9.2, brightening - and entering an awkward part of the sequence (Ga)
Z Boo: Now at max, 9.4 (Fe)
X Cam: Max mid-May, 7.9 (Fe)
R Cas: 13, 7.7, falling (Pc)
T Cas: 20, 9.6, fading (Hw)
S Cep: 31, 11.0 (Ga)
T Cep: 16, 7.5, falling (Pc); 27, 7.2, fading (Hw); 31, 7.8, fading (Ga)
W CrB: max in May, 8.5 (Fe)
X CrB: max about 10th, 9.0 (Fe)
R Cyg: 21, 12.3 (St); 27, 12.2, rising (Hw)
U Cyg: 31, 11.6, near min (Ga)
S Del: 31, 11.9, near min (Ga)
Z Del: bright max mid-May, 8.4 (Fe); 16, 8.7 (Pc)
R Dra: max at beginning of May, 7.3 (Is); max about 10th, 7.2 (Fe);

Subsequent sub-editors have been Ian Howarth, Peter Hornby, Melvyn Taylor, Tom Saville, Dave McAdam, Gary Poyner, with Chris Jones carrying out the task currently.

The Binocular Sky Society – Fifty Years On

John Toone

enootnhoj@btinternet.com

A look back at the work of the BSS some fifty years after it merged with the BAA VSS in 1974.

In the mid 1960's the BAA VSS continued to concentrate efforts on a relatively small number of programme stars such as Mira types and dwarf novae which had been the policy initially laid down by Col. Markwick during his Directorship in 1899-1909. Whilst it was important to maintain a long baseline of data (and still is) this approach catered mostly for observers equipped with medium to large telescopes and the Section reports often took a long time to get published.

Following George Alcock's first nova discovery with a pair of binoculars in 1967 and the ramp up of the Apollo moon missions there was a general boost to astronomy in the UK in the late 1960's. It is within this backdrop of events that the Binocular Sky Society was formed in December 1968. The BSS focused attention on two hundred variables brighter than magnitude nine that were not on the official programme of the BAA VSS.

THE BINOCULAR SKY SOCIETY

THE BINOCULAR SKY SOCIETY was founded in 1968 December as a result of growing interest in the field of binocular astronomy. Opera glasses and binoculars have often been advocated by educationalists as affording an initial stimulus to practical students of astronomy, but their potential as tools for serious research has not generally been appreciated. The overwhelming popular impression is that the more powerful the telescope, the more valuable is the work that can be done. This has led to a general denigration of hand-held instruments.

The uses to which a binocular of between 30 and 60mm aperture can be put include the following.

1) Estimation of variable stars brighter than the 9th magnitude.
2) Sweeping for, and observing, bright comets and novae.
3) Observations of sub-naked-eye meteors, the limiting magnitude depending on the angular velocity of the meteor.
4) Observations of artificial satellites brighter than the 8th magnitude.

Categories 3 and 4 are already covered by Observing Sections of the British Astronomical Association. Category 2 does not lend itself to participatory organisation. This leaves category 1, to which the work of the Binocular Sky Society is dedicated.

The Society co-ordinates work on the following projects within this category.

1) Observation of known semiregular and irregular variable stars.
2) Identification and confirmation of new or suspected variable stars.
3) The correction of erroneous magnitudes of stars in current charts and catalogues.

Work on these various projects is recorded in this Report.

J E ISLES, Director

London, 1969 June — JAMES MUIRDEN, Secretary

3

Figure 1. The introduction to the BSS given in the First Report of the BSS covering observations made in 1967/8. This report was published in June 1969.

Within the VSS sequence file archives I have located two documents published by the BSS a month either side of the Apollo 11 moon mission in July 1969.

The First Report of the BSS was dated June 1969 and included observations made in 1967 & 1968 (Fig 1). Clearly observations were being made well before the actual formation of the BSS but notably after Alcock's discovery of HR Del in July 1967.

The aims and methods of the BSS in its early days were described in Circular format in August 1969 (Fig 2). The stated primary intent was to give rapid feedback to observers and publish promptly the work of the Society.

The BSS was led initially by John Isles (Director) and James Muirden (Secretary), and several other officers gave valuable service during its existence. The majority of the stars observed by the BSS were red variables but there were also eclipsing binaries and a few blue variables.

The BSS produced a large number of charts drawn by Alan Pickup, John Isles & Melvyn Taylor. Most of the sequences were produced from scratch adopting HD & SAO catalogue values or even visual estimates in some cases (Fig 3). Many BSS charts & sequences were used by the BAA VSS until Hipparcos & Tycho photometry became available in the late 1990's and the original BSS sequences are now included within the VSS sequence files.

The BSS instructed observers to report full light estimates (same as the BAA VSS) to enable the reduced magnitude to be recalculated later whenever the sequences were updated. The observations generated by the BSS are now included in the BAA VSS database.

The BSS published a Second Report to cover observations of binocular variables made in 1969. Both the First & Second Reports provided lists of observations and also some light curves (Fig 4). The Reports also included work on the Orion Nebula variables, suspected variables and corrections to Atlas Coeli.

T H E   B I N O C U L A R   S K Y   S O C I E T Y

Director: J E Isles
Flat 3
116 Long Acre
London W.C.2

Secretary: James Muirden
44d The Mall
Ealing
London W.5

NATURE

An international body of amateur binocular observers, co-ordinated by a Director and Secretary, membership of which is open to all at the cost of ~~one guinea (£2.50)~~ 25/- per annum.

OBJECTS

1. The encouragement of observation of the less well-observed long-period and irregular variable stars brighter than the ninth magnitude. Visual observations of these stars are particularly valuable as they are difficult to estimate accurately on the patrol plates exposed at many observatories.

2. The amendment of stellar magnitudes in current star atlases.

3. The discovery of new variables, and the investigation of suspected variables.

4. A regular patrol of old novae.

METHODS

1. Charts and sequences for variable stars will be supplied to members on request at 9d each, plus postage. New members receive a set of five charts free. A catalogue of available charts will be supplied on request.

2. Members' estimates of variables, together with reports on other work, are published in the annual Report as soon as possible after the current year. Observations are also forwarded to the AAVSO for publication in their Quarterly Reports.

3. Circulars are issued at irregular intervals, containing matter of topical importance.

4. Papers and articles on the work of the Society are published from time to time in various astronomical journals.

GENERAL

Observation of variable stars is confined to stars not on the programme of the BAA Variable Star Section.

Rapid publication of results is the Society's chief aim. Copies of the Reports are circulated to a number of individuals and institutions outside the Society.

~~An alternative reduced subscription of 10/6~~ may be ~~paid. This does not include~~ the annual Report, ~~which~~ may be bought separately for 15/- ~~11/-~~, post free.

JAMES MUIRDEN
Secretary

1969 August

Figure 2. A summary of the purpose and activities of the BSS in a Circular format dated August 1969. This document was found in the sequence file folder for V1229 Aql (Nova Aql 1970).

The BSS was operational until 1974 when it was absorbed into the BAA VSS. Extensive information on the BSS and the merger was provided in VSS *Circular*s 18 & 19.

Although it was only active for less than six years the enduring legacy of the BSS is that we now have high quality photometric data on many bright variables over a continuous period of 55 years.

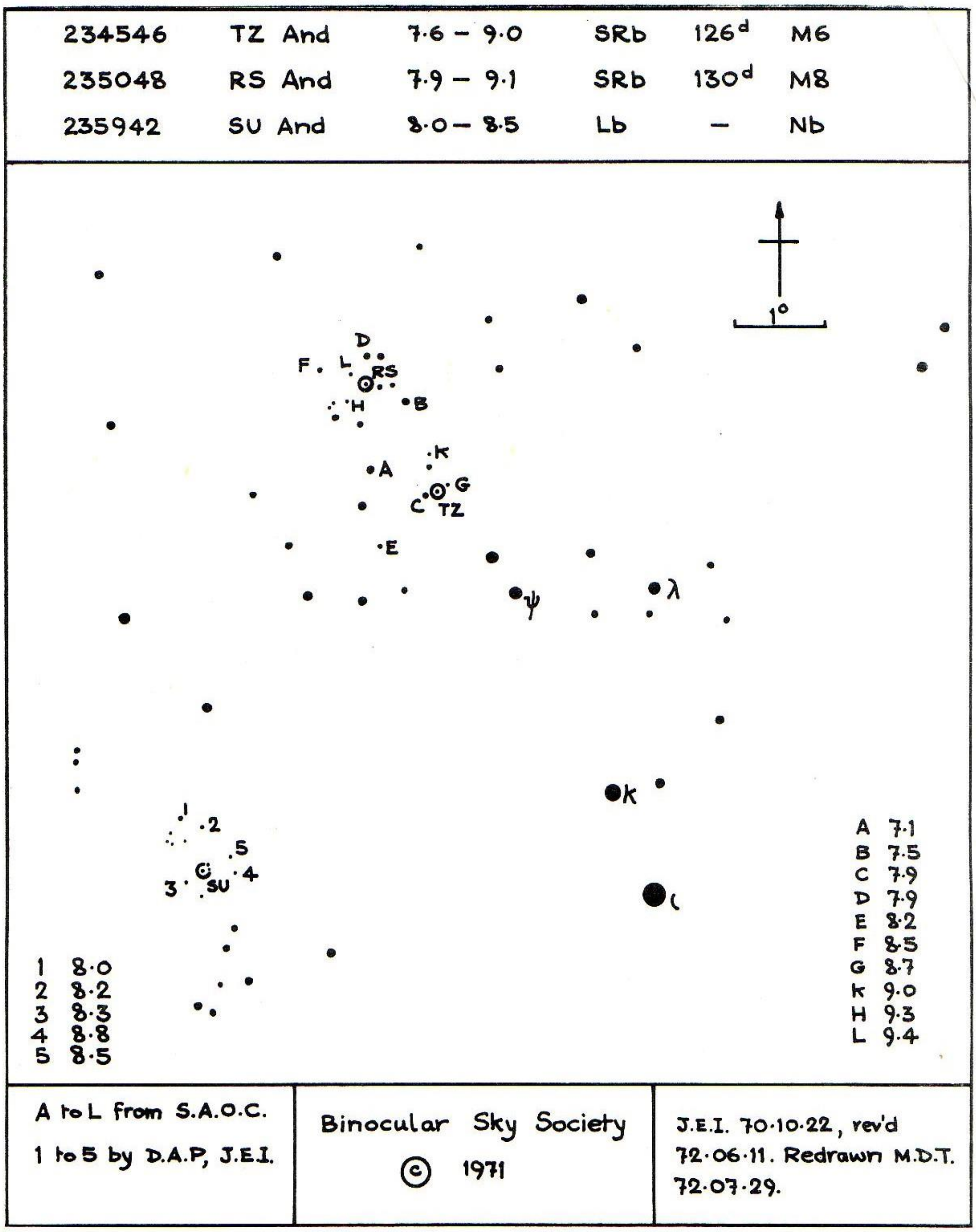


Figure 3: The BSS chart for three binocular variables within Andromeda drawn by Melvyn Taylor in 1972. Note that the sequence is a combination of SAO catalogue values and visual estimates.

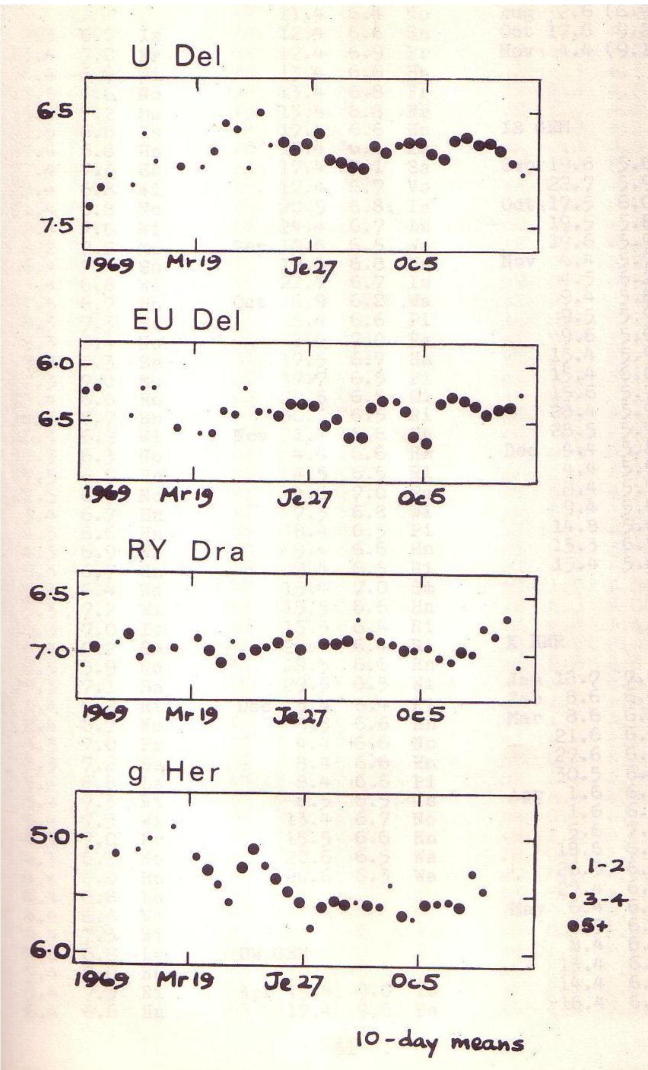


Figure 4: The BSS light curves for four popular binocular variables in 1969. The light curves were extracted from the Second Report published in November 1970.

Acknowledgement:

I am grateful to John Isles for reviewing this article and providing useful information on the BSS which was, of course, very much John's project.

Back to contents

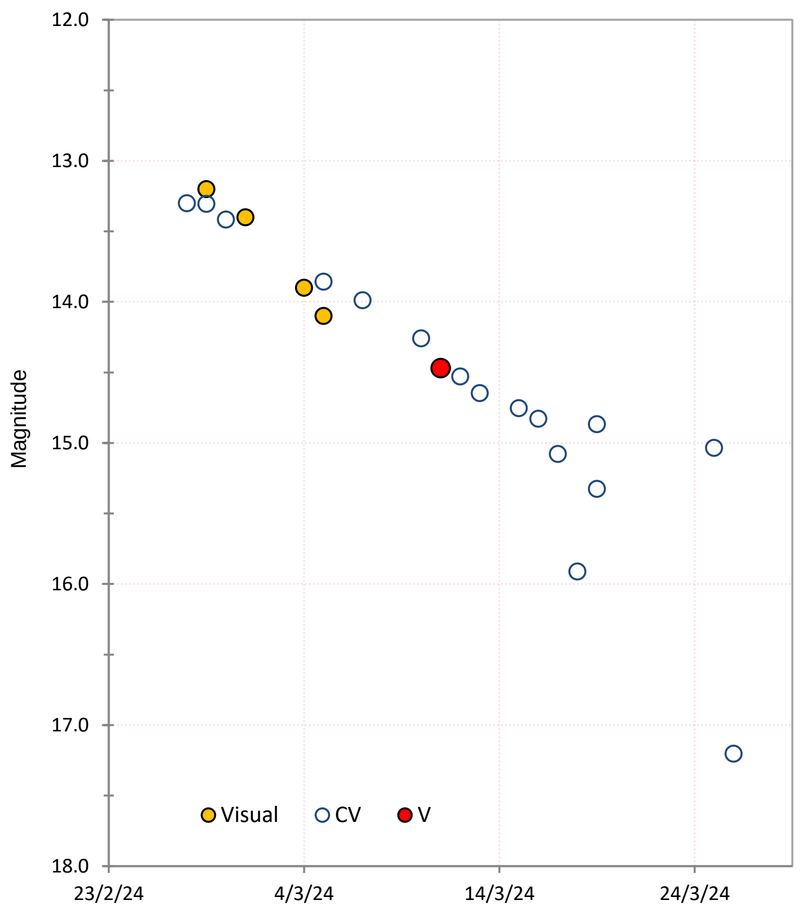
CV & E News

Gary Poyner
garypoyner@gmail.com

News of current activity in CV and eruptive stars on the BAAVSS programme, including the rare outburst of the UGWZ star IK Leo, and activity in AO Her, V742 Lyr, ES Aql and DY Per.

IK Leo

Discovered in 2006 by E. J. Christensen, Lunar and Planetary Laboratory, University of Arizona as a high amplitude variable star on unfiltered CCD images obtained by the Catalina Sky Survey, the large amplitude of the outburst and blue colour of the object indicated that a new CV of type UGSU or UGWZ had been discovered [1]. Amongst the initial designations were VAR LEO 06, SDSS J102146.44+234926.3 and CSS_J102146.6+234927. The 80th Name List of Variable Stars part II, announced the 'official' designation IK Leo in 2011 [2].

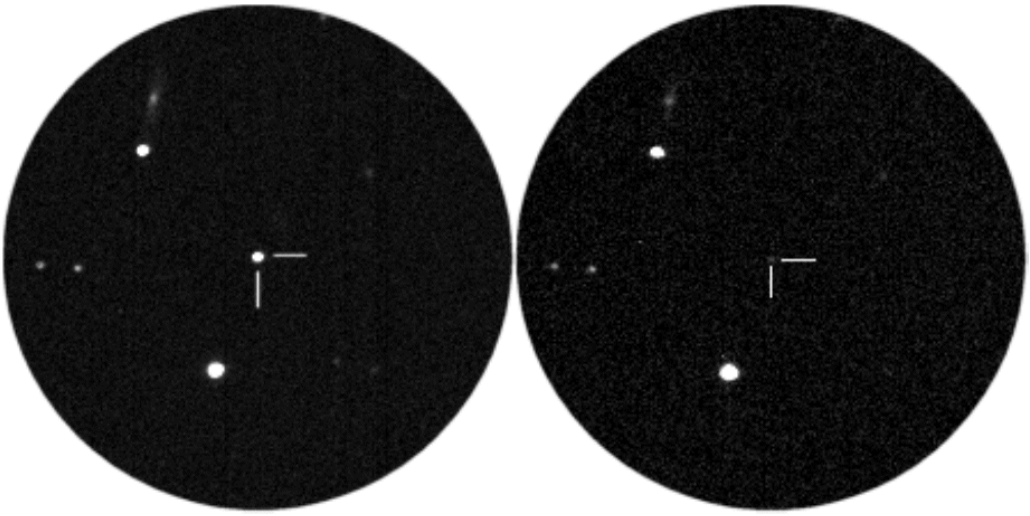


The 2024 outburst of IK Leo. BAAVSS Database

The 2006 outburst was covered by five AAVSO observers from November 21 to December 06. The outburst peaked in V at magnitude 14.7 on the 21st, and seven days later had faded to 15.59V. A rebrightening began on Nov 29 at magnitude 15.14V and continued (frustratingly) to the end of coverage on December 6 [3]. The UGWZ type was confirmed (Psh=0.056281 +/- 0.000015d) by Makoto Uemure et al and published in reference 4.

Monitoring of IK Leo continued after the outburst, with some detections at 18.0-19.0V, but no further outbursts were detected until February 27th 2024 when vsnet-alert 27990 announced an outburst discovery by Tomo-e on February 26th. Unfortunately, no further information was given on this outburst detection, but the report did announce that ASAS-SN survey had picked it up on February 21.957 at magnitude 13.024g

– just over 17.2 years after the initial discovery. The outburst was announced on BAAVSS-alert on February 27, and the first observation was made on Feb 27.9UT at magnitude 13.3CV.



IK Leo in outburst. *Left* Feb 29.006UT magnitude 13.42CV . *Right* Mar 26.094 UT magnitude 17.20CV
G. Poyner, truncated SLOOH Canary 2.

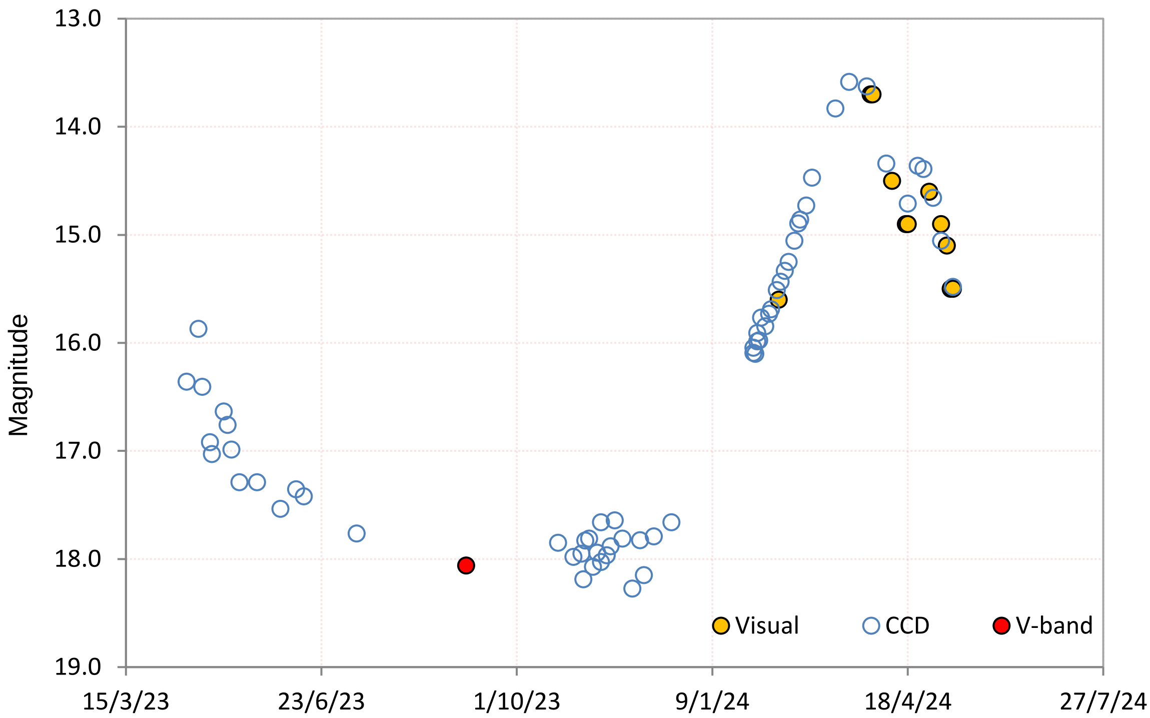
Unfortunately, only two VSS observers reported observations (G. Poyner & I. Walton), but the coverage was enough to determine that the outburst faded to magnitude 15.9CV by Mar 18.02 UT, rebrightened to magnitude 14.9CV by Mar 19.9 UT, then faded to magnitude 17.2C by March 26.1 UT.

Taking the ASAS-SN date as the beginning of the outburst, IK Leo was active for 34 days. The last positive magnitude we have is 18.73C on April 1.99 UT.

AO Her, V742 Lyr & ES Aql

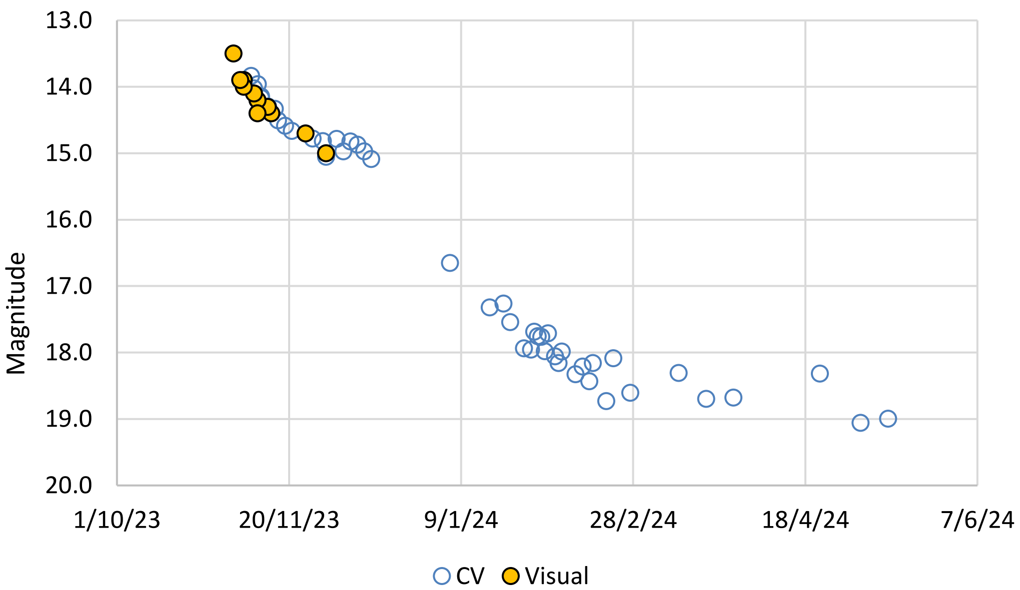
RCB stars are in the news again, with lots of interesting activity to monitor over the coming months.

AO Her had been in a deep minimum since the fade during the winter of 2022-23, which took the star below magnitude 18.0 in V and C bands. The two previous deep low states recorded in the BAAVSS database reached 18.5C in 2015 and 18.5V in 2017, although both faded from a slightly fainter magnitude of 11.0mv compared with the 2022-23 fade, which dropped 10 magnitudes from a visual brightness of 10.5. The recovery from the most recent deep minimum began sometime in late December 2023 and peaked at magnitude 13.6C in March 2024 before fading once again – this time by just 1.5 magnitudes to 14.9mv in just 21 days. A second brief recovery to magnitude14.4C followed, before AO Her faded again, reaching 15.5mv by May 11. Observers are asked to monitor carefully as often as possible during this active phase.



AO Her. April 2023 – May 2024. Observers PC Leyland, W Parkes, G Poyner, GJ Privett *BAAVSS Database*

V742 Lyr was seen to be fading in early November 2023 as reported in VSSC 198 in December 2023. Since then, a deep fade has set in with a minimum of 18.5-19.0CV reached during late February 2024. The decline of around 100 days is very similar to the previous deep fade of mid 2020 but twice as long as the first deep fade observed in this star during September 2017, which also reached magnitude 19.0V. It's possible V742 Lyr may show a recovery within the next month or so, as suggested by previous low states.



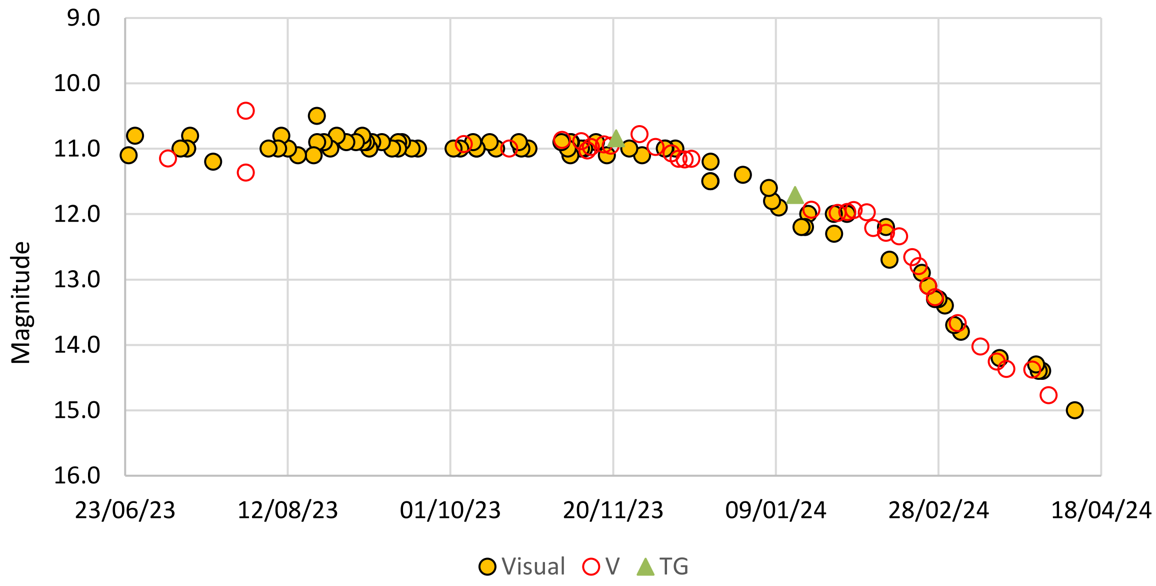
V742 Lyr. November 1, 2023 to May 14, 2024. Observers RC Dryden, W Parkes, G Poyner, PB Withers *BAAVSS Database*

ES Aql

According to the AAVSO IDB [5], ES Aql has been reported to be in a deep 17th magnitude fade by US observer Bill Pellerin. The previous observation was made on December 17, 2023 at magnitude 12.7mv. The fade has been confirmed with a 17.64C by Poyner on May 21.124UT. Observers might like to add this very active RCB star to their observing programmes. At maximum magnitude ES Aql can be seen varying between magnitude 11.5-12.0 and can drop below magnitude 19 at minimum.

DY Per

For the first time since October 2021, this prototype DYPer class variable has entered an active phase (apart from its normal SR activity at maximum brightness), with a fade beginning during late December 2023 and continuing until the field was lost in the north-west in mid-April at magnitude 15.0V. This, on average is as deep as fades go in this star, but on four previous occasions since DY Per has been monitored (1990), fades have reached magnitude 16.0. Hopefully observers can pick up the field again in early June in the north-eastern morning sky.



DY Per. June 2023 to May 2024. Observers JT Bryan, RC Dryden, W Parkes, R Pearce, G Poyner, T Vale, PB Withers. *BAAVSS Database*

References

1. AAVSO Special Notice #25, November 2006
2. The 80th Name-List of Variable Stars. Part II – RA 6h to 16h. Commissions 27 and 42 of the IAU Information Bulletin on Variable Stars, No. 6008
3. AAVSO Light Curve Generator for IK Leo
4. Discovery of a WZ Sge-Type Dwarf Nova, SDSS J102146.44+234926.3: Unprecedented Infrared Activity during a Rebrightening Phase. M. Uemura et al, PASJ
5. AAVSO International Database

The continuing story of super-cycle periods for V1159 Ori

Stewart Bean

sjbeanmail@aol.co.uk

The evolution of the super-cycle period is reviewed from 1997 to the present epoch. Between 1997 and 2010 the period was around 45 days. Since 2010 the interval between superoutbursts has been trending upwards. Periods of up to 69 days have been observed this observing season.

Introduction

Dwarf novae (DNe) are binary systems comprising a white dwarf with a companion star from which matter is being drawn into an accretion disc. This flow of matter leads to temperature oscillations in the accretion disc which in turn produce a series of brightening events known as normal outbursts. When the disc radius grows to a certain size, the disc becomes unstable and a long duration superoutburst, normally one magnitude brighter than normal outbursts, returns the disc to its initial state. The sequence of normal outbursts followed by a superoutburst then repeats. The time between superoutbursts is known as the super-cycle period P(sc). The Variable Star Index (VSX) [1] gives the following definition for the UGER stars:

ER Ursae Majoris-type subclass of UGSU dwarf novae. These stars typically spend a third of their time in super-outburst with a super-cycle of 20-90 days. Outside of super-outburst they typically pack in a rapid succession of normal outbursts.

UGER stars therefore offer the opportunity to observe several superoutbursts per year and derive P(sc) values. In an earlier note (VSSC 193) an analysis of data to the end of the 2021 season was presented. This note adds the 2022/3 and 2023/4 seasons to show an apparent trend towards increasing super cycle periods.

M. Otulakowska-Hypka and A. Olech [2] present a collection of P(sc) results for some UGER stars and suggest that an increasing super-cycle period may be a feature of most UGER stars. V1159 Ori has a brightness range of 12.4 to 15.2 and coordinates of RA 5 28 59.52 and Dec -3 33 52.9 according to VSX [1]. The observing season starts in August and runs until May based upon AAVSO database entries, but for UK based observers the season is a bit shorter.

V1159 Ori literature review

A shortened version of the review from VSSC 193 is presented here. As part of a larger study of ER UMa type stars, M. Otulakowska-Hypka and A. Olech [2] averaged individual V1159 Ori supercycle periods into five data points to produce the graph in Figure 1 below. This shows an apparent increase in P(sc) from 45 days in 1994 to 52 days in 2010.

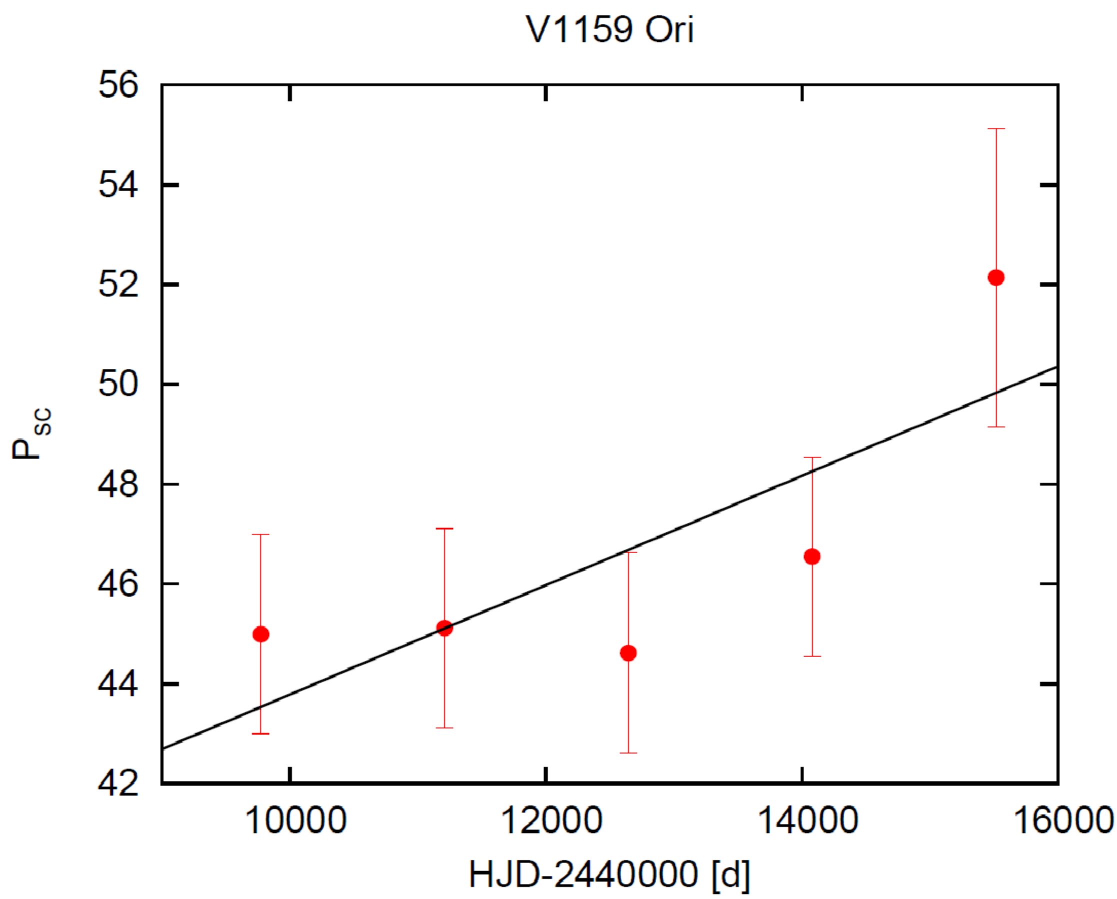


Figure 1. The averaged super-cycle period for V1159 Ori from M.Otulakowska-Hypka and A. Olech (2)

An updated analysis for V1159 Ori

An updated analysis has been made by extending the supercycle observations of Kato [2] using more recent observations from the AAVSO, VSOLJ, Lasair and ASAS-SN records to 2024 May. The updated supercycle period graph is shown in Figure 2 with individual observing seasons identified by colour and symbol. The coverage in each season does vary leading to sparse data for some years and the graphical presentation in Figure 2 reflects this.

The super-cycle period is centred on 45 days, with notable excursions up to 57 days, up to 2012. Since then, the super-cycle period has had a wide range of values including 52, 65, 69 and 70.5 days for the current observing season. A supercycle period of less than 45 days has not been observed for 10 years.

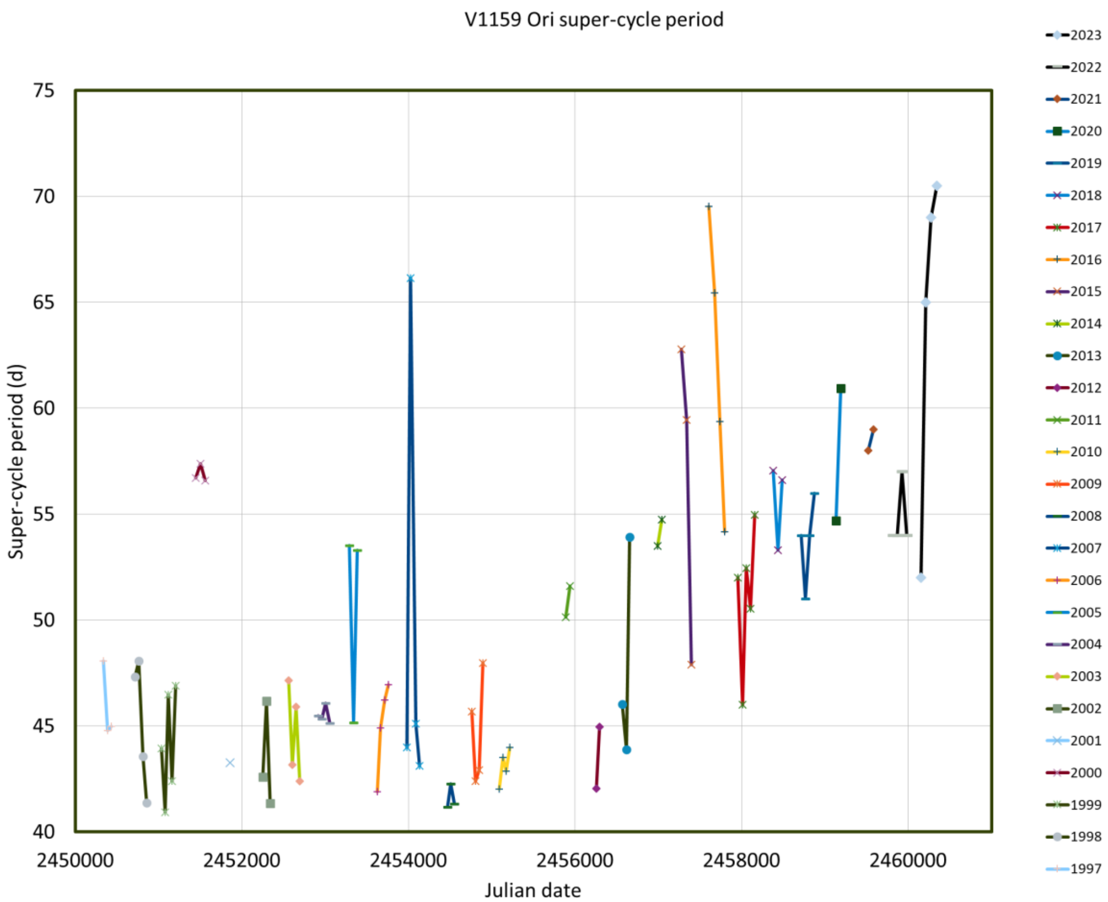


Figure 2. The super-cycle period for V1159 Ori since 1997. Each observing season is identified by colour and symbol.

Discussion

The new analysis extends the work of Kato and shows that the super-cycle period for V1159 Ori has reached large values recently. The most recent long period showed nine normal outbursts suggesting that the accretion of material continues. There have also been two years in which the period steadily decreased from a high value (2015 and 2016) whilst in the current season the period has steadily increased. Whether the period snaps back to short periods or enters a steady decline is not clear from the record.

The current observing season has now closed. The start of the next season opens in early August although observing is very difficult from UK latitudes. The state of V1159 Ori at that time will be revealing and I encourage early, if challenging, observations.

Summary

V1159 Ori has shown particularly long super-cycle periods in this observing season and a decadal trend towards longer periods. Further observations by the amateur community are most welcome. To this end, AAVSO are following V1159 Ori with their AAVSOnet telescopes in New Mexico, USA and Australia (both BSM Berry4 and BSM S4) to improve coverage of this star. Observations from Europe would help provide more evenly spaced data points.

Acknowledgements

I acknowledge, with thanks, all BAA-VSS and AAVSO members who contributed observations referred to in this note.

References

1. The International Variable Star Index (VSX) (aavso.org)
2. M. Otulakowska-Hypka and A. Olech, MNRAS 433, 1338–1343 (2013)
3. Kato, T. Publ. Astron. Soc. Japan 53, L17–L19, 2001 August 25
4. Lasair, K. W. Smith, R. D. Williams et. al., Research Notes AAS,**3**,26 (2019).
5. ASAS-SN Sky Patrol, Shappee B.J. Astrophysical Journal, 2014, (788), Iss 1, Article 48

Cataclysmic Variables – Do we really understand them?

David Boyd

davidboyd@orion.me.uk

There is growing observational evidence that the standard model of CV evolution is not the whole story.

The Standard Model

Cataclysmic variables (CVs) are interacting binary stars in which a white dwarf accretes mass from (typically) a main sequence star. There is broad consensus within the professional community that the evolution of CVs with orbital periods greater than about 3 hours is driven by angular momentum loss through a mechanism known as magnetic braking via a magnetised stellar wind (Knigge et al. 2011). This leads to transfer of mass from the secondary to the primary which in turn leads to reduction in the orbital period. This standard model therefore predicts that the orbital periods of CVs above 3 hours should steadily decrease.

Observations

Among CVs, those classified as novalikes are relatively bright and amenable to photometry, and where they are eclipsing it is possible to monitor their orbital periods. These stars are often referred to as SW Sex stars after the prototype of this informal group SW Sextantis. I have been observing 18 of these eclipsing SW Sex stars for 18 years (Boyd 2023 + more recent measurements) and this has provided ample evidence that many of them do not behave as predicted by the standard model. Their behaviour can be illustrated by finding the difference between observed (O) times of eclipses and calculated (C) times based on assuming a linear ephemeris (i.e. a constant orbital period) and plotting these as an O-C diagram. A star whose orbital period is steadily decreasing as the model predicts should show a concave downward curve in an O-C diagram. An increasing period would show a concave upward curve.

UU Aqr is a good example of a star which is doing what the standard model says it should (Figure 1).

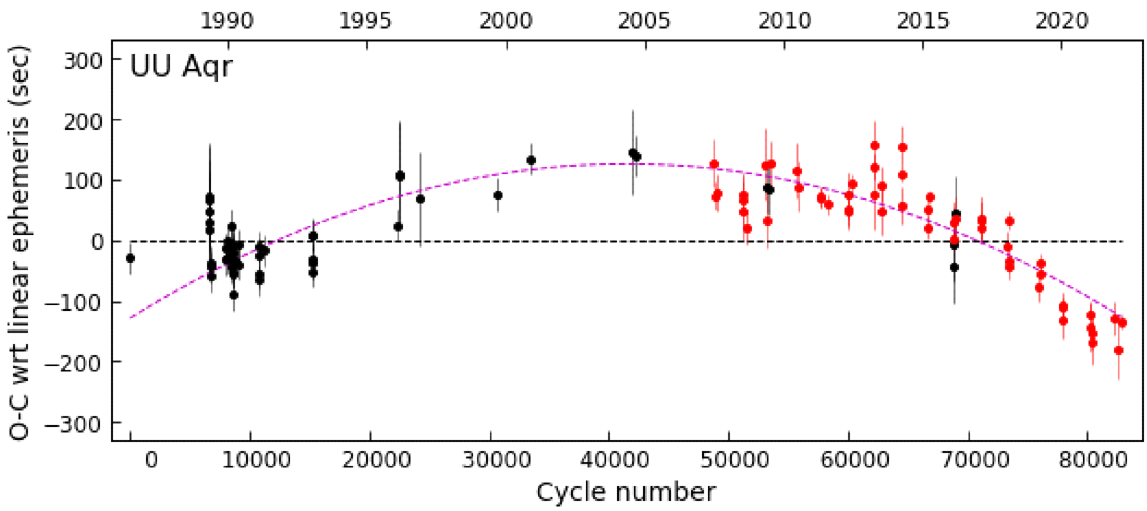


Figure 1. O-C diagram of UU Aqr using previously published (in black) and my (in red) eclipse timing measurements. The black dotted line represents a constant orbital period which best fits all the measurements while the purple dotted line is a fitted parabolic curve.

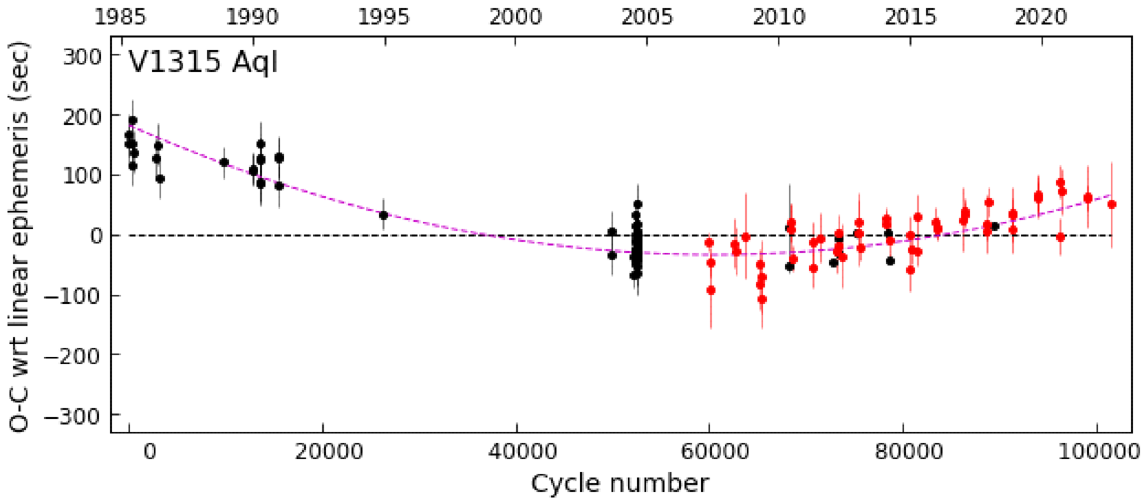


Figure 2. O-C diagram for V1315 Aql. Explanation and colour coding as for Figure 1.

In V1315 Aql, the O-C diagram (Figure 2) shows a concave upward curve indicating a steadily increasing orbital period. This is not explained by the standard model.

There are stars whose O-C diagrams do not follow a regular pattern but show apparently random, and in some cases relatively rapid, variations in their orbital periods. Examples are SW Sex (Figure 3) and RW Tri (Figure 4). The standard model offers no explanation for this behaviour.

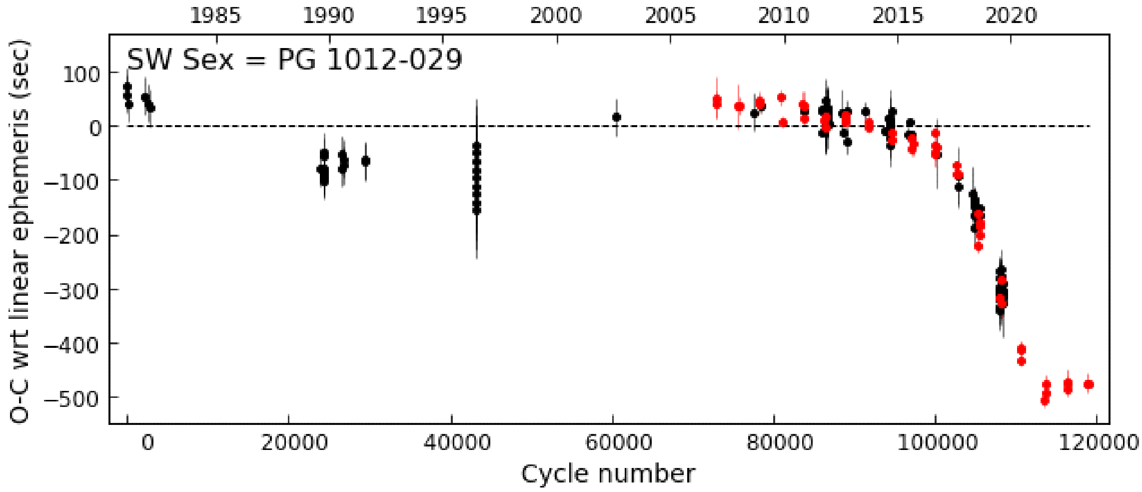


Figure 3. O-C diagram for SW Sex. Explanation and colour coding as for Figure 1.

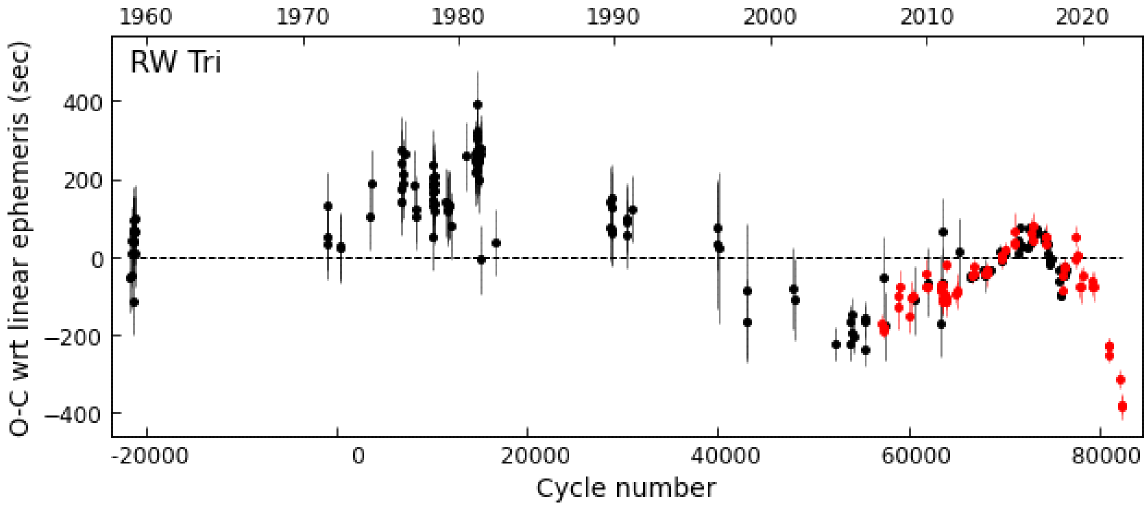


Figure 4. O-C diagram for RW Tri. Explanation and colour coding as for Figure 1.

In other cases, stars have experienced abrupt changes in orbital period between episodes of apparently constant periods (Boyd, 2024). An example of this is the UGSS CV HS 2325+8205 shown in Figure 5. This behaviour is not explained by the standard model, nor by any current understanding of how CVs behave.

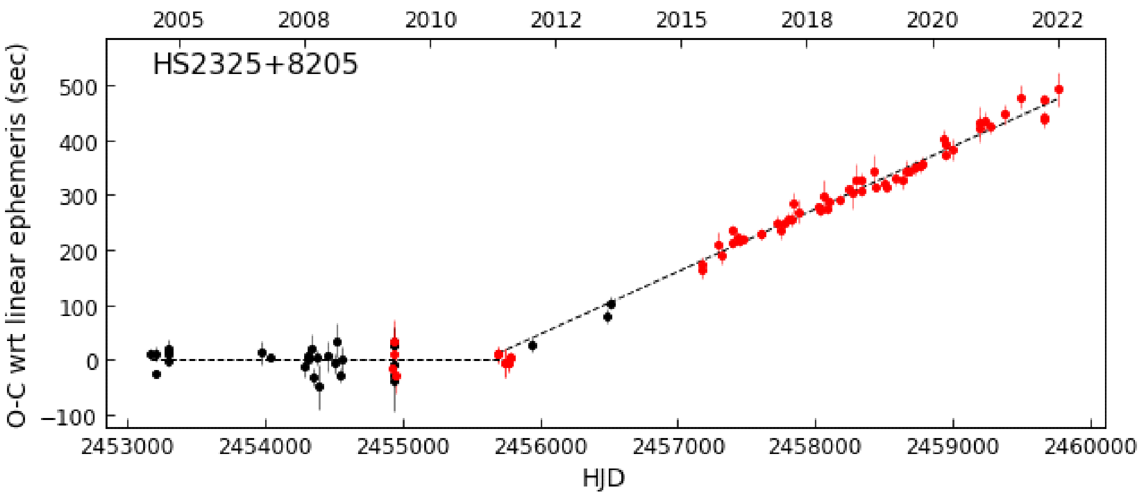


Figure 5. O-C diagram of HS 2325+8205 showing an apparently abrupt change in orbital period around the beginning of February 2011. The black dotted lines represent the two constant orbital periods which best fit measurements before and after the change.

Conclusion

These are some examples of variation in the orbital periods of CVs which is not explained by the standard model of CV evolution. There are many others. Schaefer (2024) gives a scathing critique of the magnetic braking mechanism, citing as evidence some of my own long-term observations.

References

Boyd D., J. Amer. Assoc. Var. Star Obs, 51, 74 (2023)
https://app.aavso.org/media/jaavso/3882_qKgpeOe.pdf

Boyd D., J. Br. Astron. Assoc. 134, 1, (2024)

Knigge C., Baraffe I. & Patterson J., Astrophys. J. Suppl. Ser., 194, 28 (2011)
https://iopscience.iop.org/article/10.1088/0067-0049/194/2/28/pdf

Schaefer B. E., Astrophys. J., in press (2024) https://arxiv.org/abs/2404.12525v1

Nine Years of Intensive Monitoring of OJ287

Mark Kidger

cricketingstargazer@gmail.com

I present a summary of results of monitoring of OJ287 from the maximum of the 2015 outburst to the present. There are no clear indications of Quasi-Periodic Oscillations (QPOs) in the light curve over this time, although there may be a weak signal at around 500 days. The behaviour of the colours is singular amongst quasars in that they show almost no variation with brightness.

Introduction

OJ287 is a singular object. A representative of the class of blazars – quasars in which the relativistic jet is approximately aligned with the observer's line of sight – that show extreme properties such as high luminosity, rapid and violent variability and (almost) featureless spectra. While there are blazars that have the jet even more closely aligned with the Earth than OJ287, the small redshift of OJ287 (z=0.306) allow us to see deeper into the throat of the relativistic jet than in any other blazar (Savolainen *et al*., 2010).

Intensive multicolour monitoring started in 2015 in a collaboration between the BAA-VSS, the Spanish Observadores-Supernovas Group and Mauri Valtonen at Tuorla Observatory (Finland). This monitoring captured the predicted peak of the 2015 outburst of OJ287 (Valtonen, 2011).

Data

We have a total of 15293 measures of OJ287 between December 2015 and May 2024, made in B,V,R,I, CV, Sloan g, r, i, Gaia G and visually. Data were normalised to BVRI using the procedure detailed in Kidger (2024). The telescopes used were typically in the range from 20-61cm diameter, equipped with cooled CCDs. The data obtained were from a mixture of backyard telescopes and remote observing at robotic observatories at a wide range of sites including Europe, the Canary Islands, Chile, western United States and Australia: particularly in 2022-2024 there is good longitudinal coverage.

The light curve

Figure 1 shows the full light curve 2015 – 2024. The light curve range is of 3.5 magnitudes, from a minimum of V=16.68 on 2023 April 4th to a maximum of V=13.15 on 2016 October 21st. The quasar was in a relatively high state in 2015-2017, but since it has been fairly stable just below magnitude 15 – the mean and median magnitude since solar conjunction in 2017 are both V=15.22, showing that there are effectively random variations about this mean level – although there was a prolonged faint level in 2023 (Komassa et al., 2023).

Back to contents

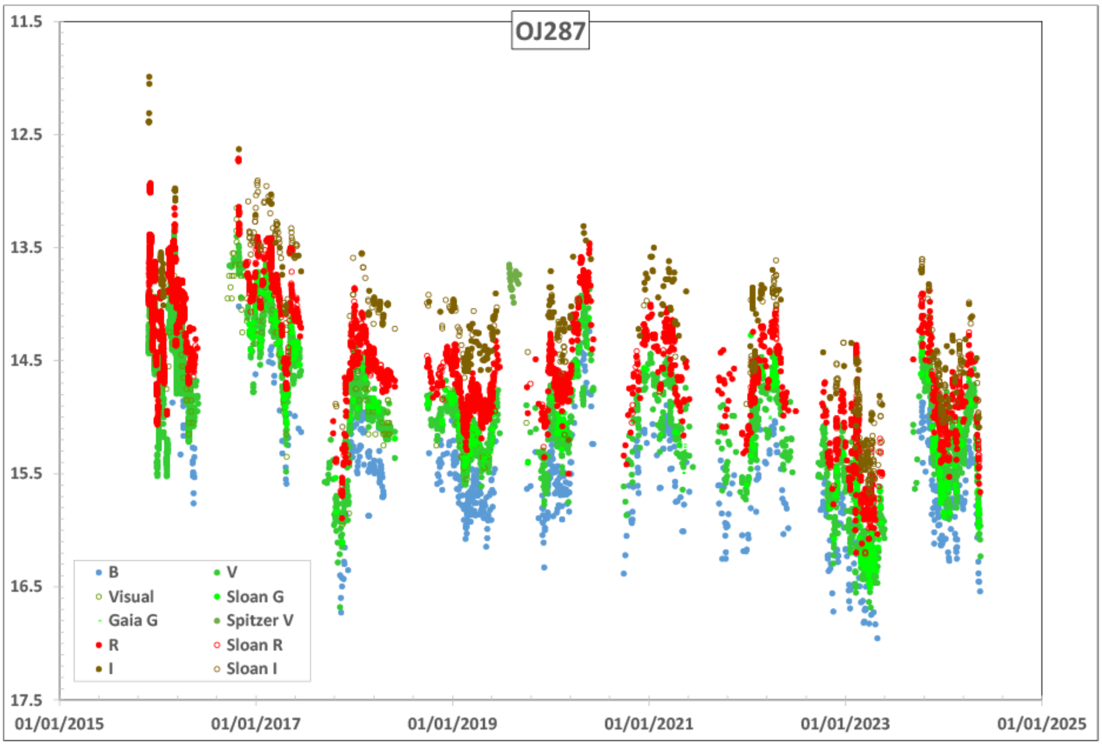


Figure 1. The light curve 2015 – 2024. The last data plotted were obtained on the morning of 2024 May 17th. The full range of the amplitude is from V=13.15 to V=16.68.

An interesting feature of monitoring in 2023 – 2024 has been the rather large amplitude of variation (Figure 2). There was a brightening from V=15.63 on 2023 September 16th to V=14.29 on 2023 October 13th and an on-going monotonic fade from V=14.57 on 2024 April 21st to V=16.23 on 2024 May 20th. During this fade, the dispersion of the data is small, suggesting that microvariability has been less prevalent than normal, although a microflare of amplitude 0.23 magnitudes is seen in the data from various telescopes between 2024 May 11th and 13th. A similar apparent suppression of microvariability is seen in the rapid decline in November 2023. In contrast, during the last week of March and early April 2024 constant, high-amplitude microvariability was seen when OJ287 was at a relatively high level.

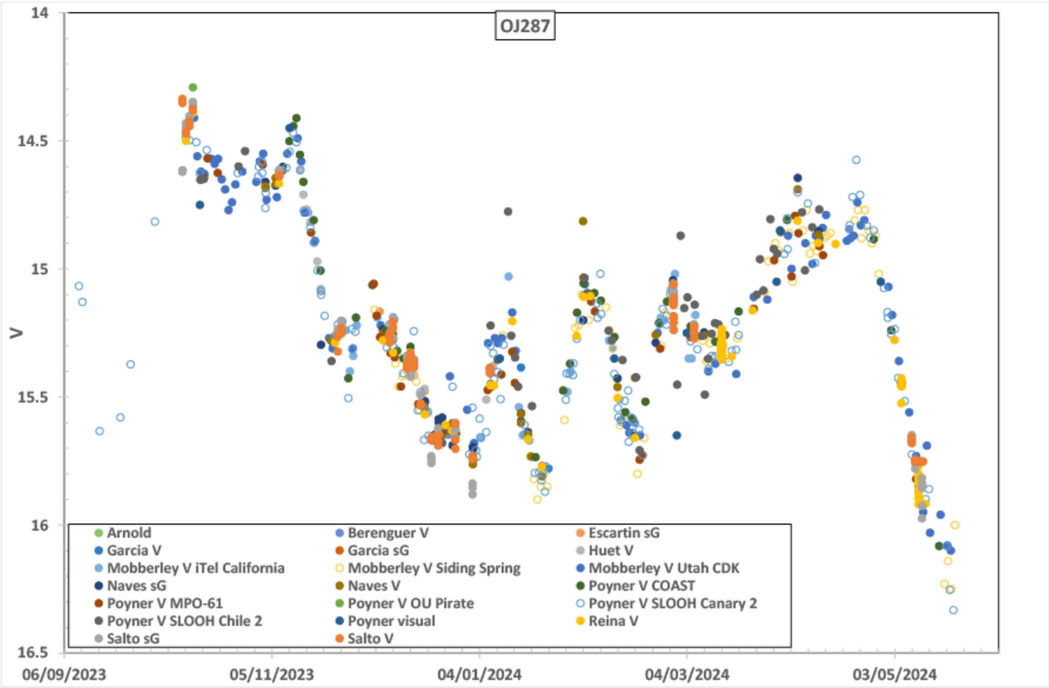


Figure 2. The light curve of OJ287 in V for the 2023-24 observing season. A feature is the rapid rise in September-October 2023 and the on-going rapid fade in April-May 2024.

Colour variations

An unusual feature of OJ287 relative to most quasars with very active light curves is the lack of obvious colour variability. Most objects show a flattening of the spectrum and are bluer when brighter. This is often interpreted as due to injections of energetic relativistic electrons (Brown et al., 1989). As the electrons decay radiatively and lose energy, the spectrum steepens and gets redder. However, OJ287 is an exception to this rule. In general, it shows little colour variability except at V>16. At faint magnitudes the underlying galaxy contributes significantly to the observed flux and, particularly at V>17, the colours tend to those of a giant elliptical galaxy (Valtonen et al., 2022).

Various observers have contributed pseudo-simultaneous BVR(I) photometry. Extraction of B-V, V-R and V-I colour indices is complicated because the observations in the different filters are always separated by some minutes in time and can be affected by microvariability. Similarly, the errors on the photometry sum in quadrature when we calculate the colour index and, thus, are dominated by the error in the photometry of the band with the largest uncertainty (usually B). This means that the dispersion in the calculated colour indices can be large.

A total of 597 pairs of B and V photometry and 406 sets of pseudo-simultaneous BVR photometry were extracted from the database. If an outburst leads to an injection of relativistic electrons, we would expect to see two, potential types of colour variation:

1. A time variation, with the colours tending to redder values as the outburst fades.
2. A correlation of colour with magnitude, with redder colours at fainter magnitudes.

The resultant correlations are shown in Figures 3 and 4. Figure 3 shows the correlation of colour index with V magnitude. To give a wider range of colour the B-V and B-R colour indexes are plotted against the V magnitude. We see that the two colour indexes show slightly different behaviour. B-V shows no trend with magnitude over the observed range: it is consistent with a constant B-V index of +0.48 magnitudes. In contrast, B-R shows a slight tendency to redder colour at fainter magnitudes, although with an insignificant correlation coefficient (R^2=0.03), consistent with a constant B-R colour of +0.88. Currently, there are insufficient observations at V>16.5 to show the trend to red colours at faint magnitudes.

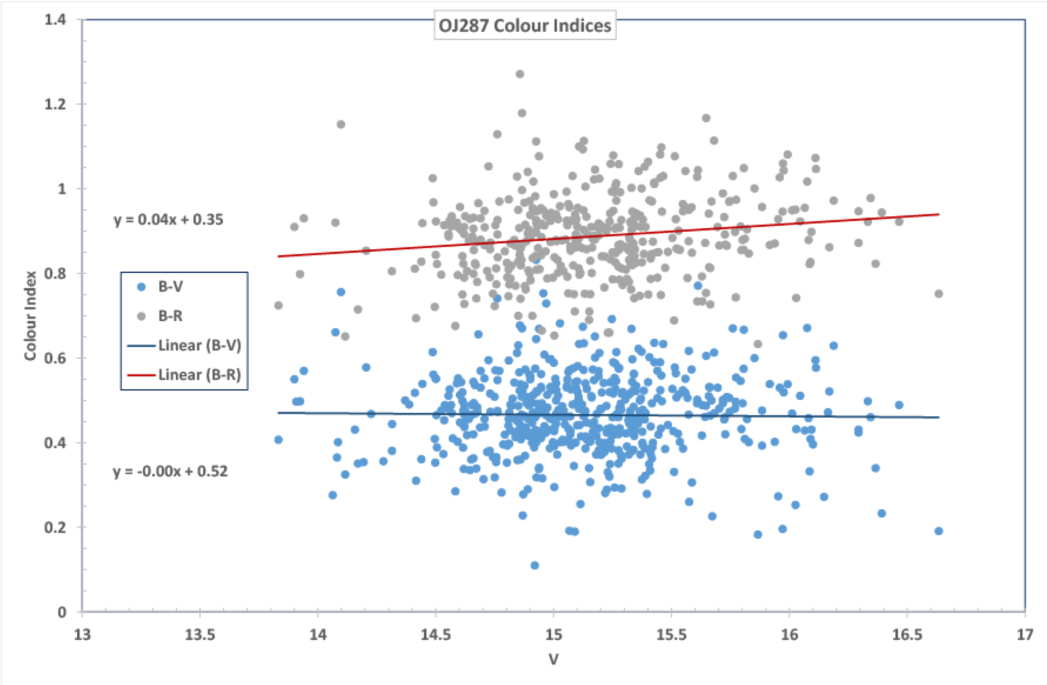


Figure 3: The correlation between the B-V colour index of OJ287 and V magnitude (lower) and between the B-R colour index and V (upper). The median values of B-V and B-R are +0.48 and +0.88 respectively.

There is little evidence of time variability in the colour indices (Figure 4). There is a suggestion that the colours became slightly blue after the 2015 outburst, but the small amount of data in these years makes inferences of time variability unreliable. What we can say is that there is no clear evidence that the decline from the 2015 outburst produced a change in the colours of the quasar, thus there is no clear evidence of the radiative decay of an injection of relativistic electrons during the outburst.

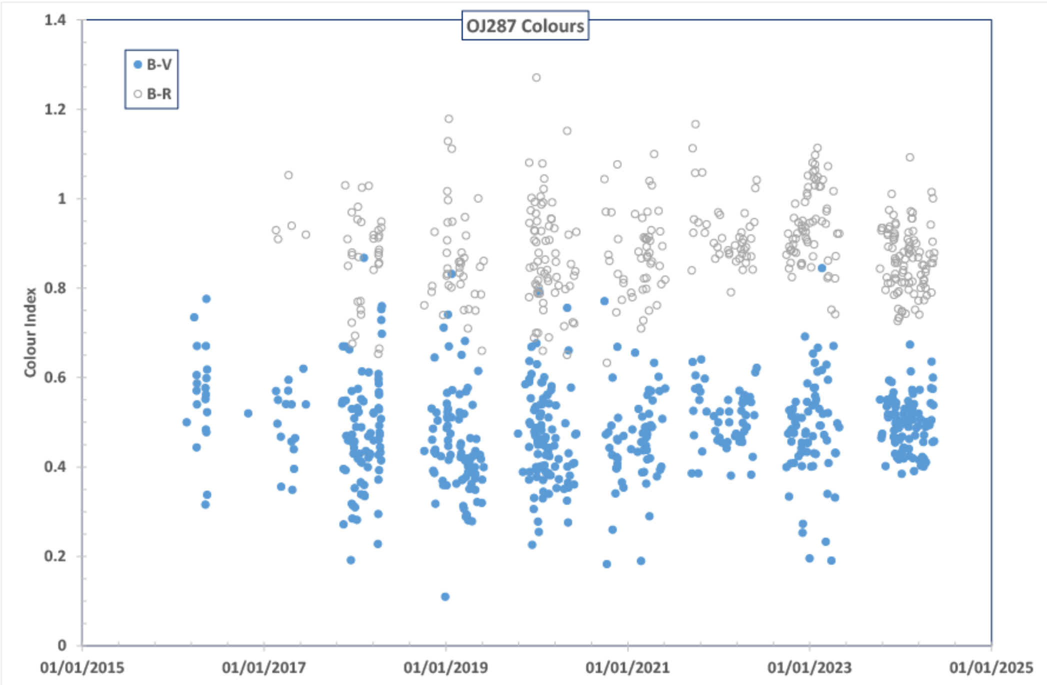


Figure 4: Time variability of the B-V and B-R colour indexes during the campaign. There is no evidence for significant trends that might indicate the radiative decay of injections of electrons.

Quasi-Periodic Oscillations (QPOs)

Any periodicity in an astronomical object carries potential information on the mechanism(s) at work, which may be rotational, precessional, orbital, or pulsational, or due to the intervention of an obscuring medium between the observer and the light source. While it has been accepted for many years that quasar light curves are essentially random in nature, there are many reports of apparent short-term periods in quasars (see the short summary in Kidger, 2024). These are often known as QPOs because they are quasi-periodic rather than being strictly periodic. The best known QPO is the characteristic 11.65 year interval between major outbursts of OJ287 (Sillanpää, 1988), however even this is only an approximate periodicity.

The V light curve of OJ287, consisting of 7977 magnitudes was analysed for indications of QPOs. To investigate the characteristics of the light curve, Peranso v.3.0.4.4 was used for the analysis (Paunzen & Vanmunster, 2016). Peranso is an extremely powerful tool that offers many different methods of periodicity analysis. The spectral window – i.e., the periodicity in sampling the light curve – is, unsurprisingly, totally dominated by the characteristic sampling intervals of 1 day and 1 year (Figure 5).

Initially, the Power Spectrum was calculated in 100 000 steps at periods from 5 to 2500 days. Standard methods (Deeming, CLEANEST, Lomb-Scargle) were tested and all gave almost identical results. The power spectrum is dominated by a broad peak at 1600-1700 days: given that this is only a half of the total length of the light curve it is not a plausible QPO (it is probably due the approximate separation of the two largest peaks and the two deepest minima). So, the range for the search was reduced from 10 to 1000 days (Figure 6). This shows a series of broad peaks in the range from 250 to

460 days, with the largest at 463 days, although all are of similar amplitude. Here, the result of Deeming analysis (Deeming, 1975) is shown but all the methods gave almost identical results.

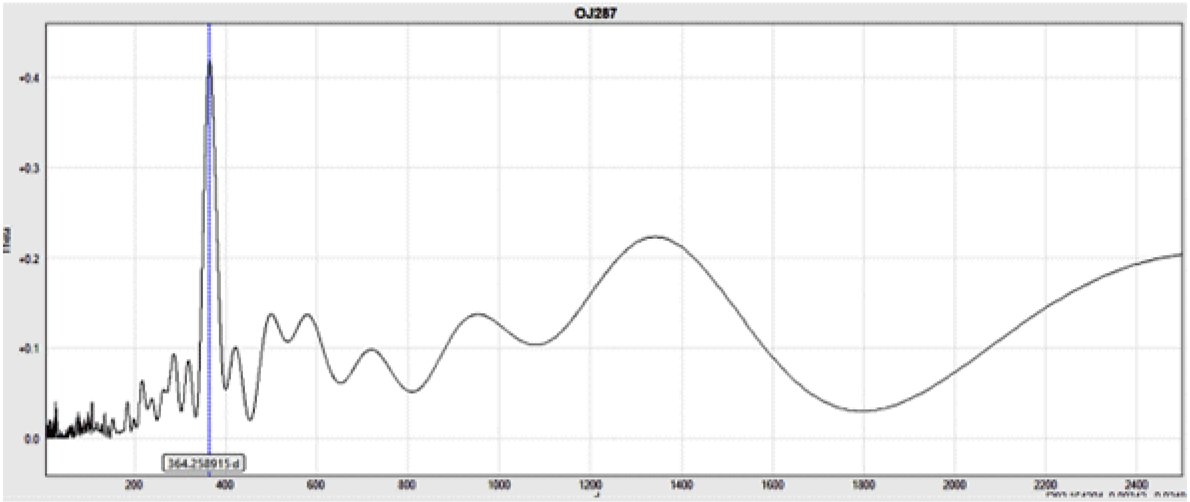


Figure 5: Spectral window of the light curve presented in the text, calculated from 5 to 2500 days. The yearly sampling completely dominates the plot. However, we also see a considerable increase in power to lower frequencies (i.e., longer periods).

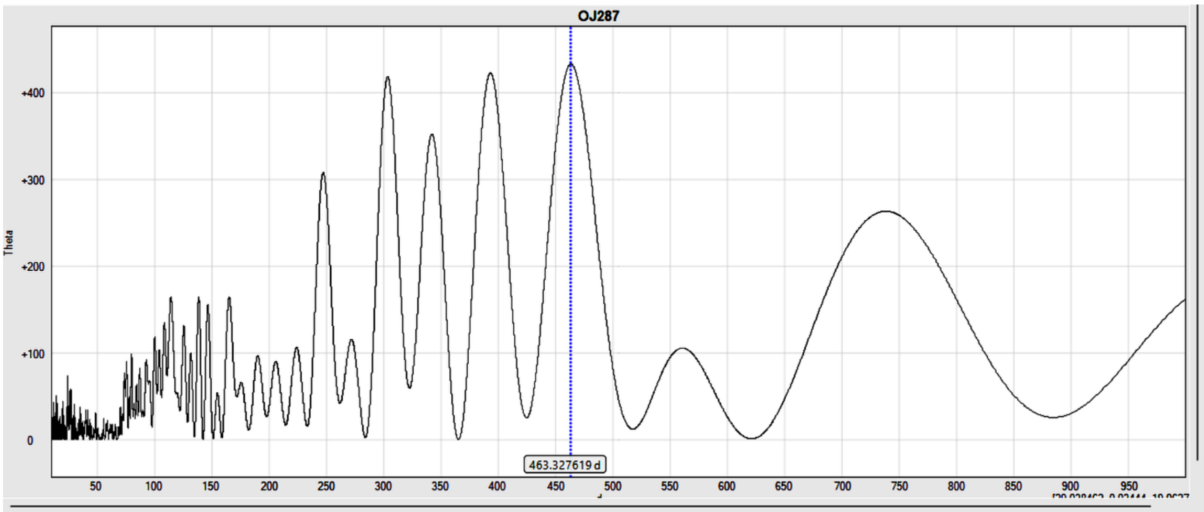


Figure 6: Power spectrum from Deeming analysis for the data presented in the text. It is calculated for 100 000 periods from 10 – 1000 days.

The calculated False Alarm Probability, which examines multiple randomised light curves to see what fraction give a period with equal or larger amplitude in the power spectrum, suggests that this period is of high significance (>99%). The Phase Curve gives an average light curve that is a saw tooth with fast rise and slow decline.

The presence of multiple peaks in the power spectrum suggests that, if there is a genuine QPO present in the light curve, harmonics could be a major contaminating factor. This can happen particularly when the principal period is not a sinusoid but, instead, can be decomposed into a combination of sinusoids. An alternative approach is to use periodogram analysis, folding the light curve around many trial periods (Jurkevich analysis). Figure 7 shows that the periodogram is rather cleaner, but the principal periods shown are quite different: 494 and 250 days, the latter being almost exactly half the former. The folded light curve (Figure 8) also shows a fast rise, slow decline sawtooth.

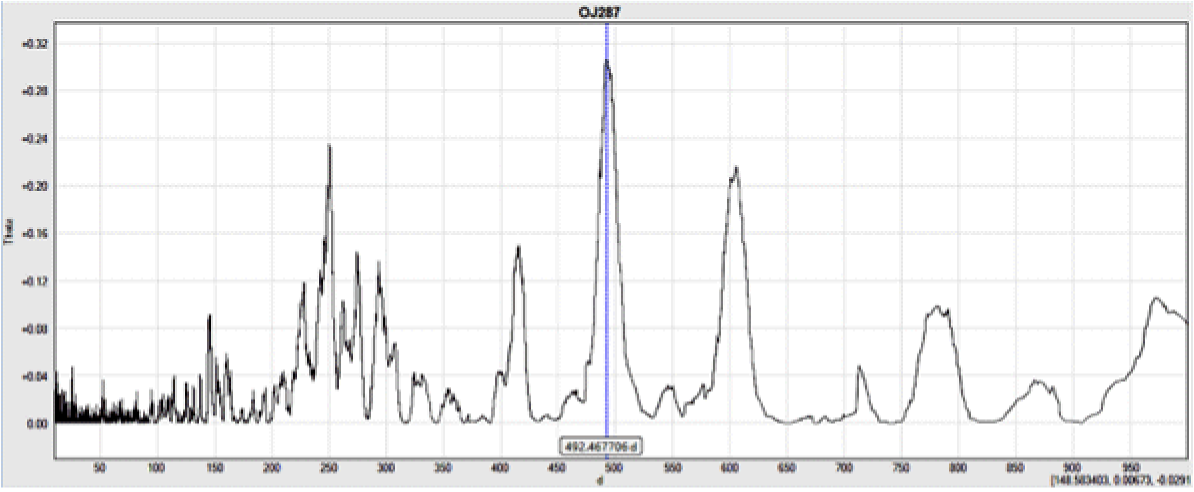


Figure 7: Jurkevich periodogram analysis of the data presented in the text. The results are significantly different to those of classical Fourier Transform analysis with principal periods at 492 days and almost exactly half of this value.

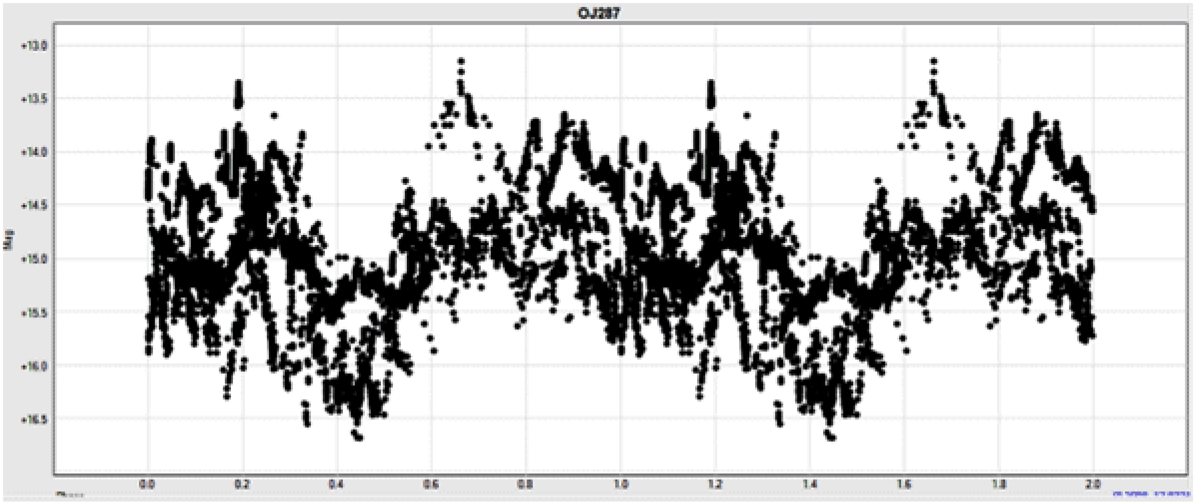


Figure 8: The light curve folded around a best period of 492 days.

It is axiomatic that when different methods of light curve analysis give different results the periodicity is unlikely to be genuine. However, the difference between 463 and 492 days is not great, and the peak found by the Jurkevich method falls within the broad peak shown in the Deeming analysis, so this cannot be completely discounted as a genuine QPO signal, although neither can it be regarded as a confirmed QPO candidate.

Conclusions

Light curve data show that OJ287 has varied around V=15.2 since the decline of the 2015 outburst, spending approximately equal amounts of time above and below this level. No significant colour variations can be detected in the data, with mean colours of B-V=+0.48 and V-R=+0.40. The 2023/24 observing season has been characterised by two episodes of rapid, monotonic fade of similar rate (≈0.07 magnitudes/day), which have both shown suppressed microvariability while they are taking place. There is some evidence of a QPO with a period ≈492 days, but its existence should be treated with great caution.

Acknowledgements

This research made use of *Peranso* (www.peranso.com), a light curve and period analysis software. I would like to thank the observers who have participated in this campaign.

References

Brown L. M. J., Robson E. I., Gear W. K. & Smith M. G., 'Multifrequency Observations of Blazars. IV. The Variability of the Radio to Ultraviolet Continuum', *Astrophysical Journal*, 340, 150 (1989).

Deeming T. J., 'Fourier analysis with unequally-spaced data,' Astrophys. Space Sci., 36, 137 (1975)

Kidger M.R., 'A 6.65-day pseudo-periodicity in OJ 287's flaring in 2023', BAAJ, 134, 33 (2024).

Komossa S. *et al.*, 'The blazar OJ 287 in a long-lasting low-state with small-amplitude rapid flares superposed', Astronomer's Telegram, 16071 (2023b).

Paunzen E. & Vanmunster T., 'Peranso – light curve and period analysis soft- ware,' Astron. Nachr., **337**, 239 (2016)

Savolainen T. *et al*., 'Relativistic beaming and gamma-ray brightness of blazars,' *Astron. Astrophys*., **512**, A24 (2010).

Sillanpää A. et al., 'Binary pair of supermassive black holes,' Astrophys. J., **325**, 628 (1988)

Valtonen M. J. *et al*., 'Testing the black hole no-hair theorem with OJ 287', *Astrophys. J.*, **742**, 22 (2011).

Valtonen, Mauri J. et al., 'Host galaxy magnitude of OJ 287 from its colours at minimum light', Monthly Notices of the Royal Astronomical Society, **514**, 3017 (2022).

My journey from 100,000 to 400,000 variable star observations

Rod Stubbings

stubbo@dcsi.net.au

My journey from 100,000 to 400,000 variable star observations was a challenging but fulfilling experience. Through this journey, I have developed a deep appreciation of the role that visual observation plays in advancing our knowledge of the cosmos.

In 1993, I made my first observation of a variable star, and since then, I have developed a strong passion for observing at every opportunity. This passion, although sometimes bordering on obsession, led me to achieve a great year in 1999, when I recorded 17,500 observations. Then, on June 8th, 2002, in my ninth year of observing, I reached a personal milestone of 100,000 visual observations, which was unimaginable in 1993. It's worth mentioning that I was the first observer from Australia to reach this milestone of 100,000 visual observations.

On January 24th, 2012, after 18 years and 8 months of diligent work, I successfully completed my 200,000th visual variable star observation. On October 6, 2018, I reached another significant milestone by completing my 300,000th observation of a variable star. This feat was accomplished after 25 years and 5 months. Finally, on February 10, 2024, after 30 years and 9 months of enjoyable work, I achieved my 400,000th visual variable star observation.

So, there have been intervals of 9 years, 9.8 years, 7.5 years, and 5.9 years between certain events. It appears that I am becoming more productive with age, but as we all know, it largely depends on how many clear nights are available.

In 2015, I upgraded to my current telescope, Infinity, which is a 22” f/3.8 Dobsonian. The main purpose of this upgrade was to study and detect fainter dwarf novae stars at their minimum. My first light was in November 2015 under a near-full Moon, and I recorded a 15.4-pinpoint star. On my first dark night observing, I was able to observe magnitude 17.3 stars visually. The faintest I've seen is 17.6. In terms of magnitude with this telescope over the past eight years, I haven't really lost anything, as I can still get to 17.2-17.3. However, I don't go for the faintest star I can see on every star field, only when needed. Additionally, some star fields just won't allow you to. It's worth noting that this telescope has made over 150,000 observations up to March 2024.

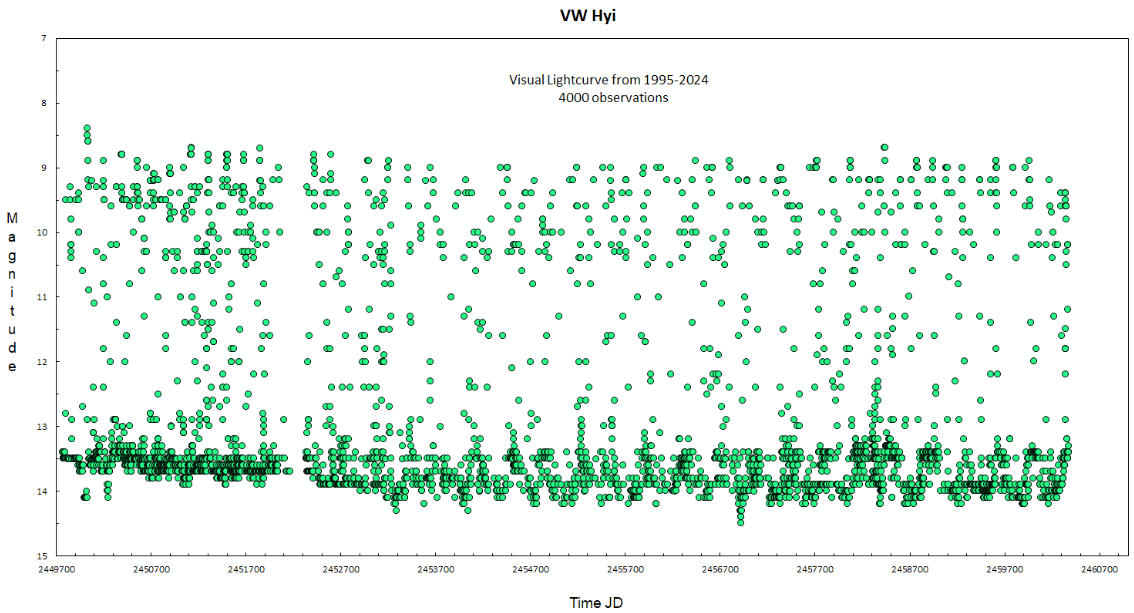
Upon upgrading my telescope, I began reviewing my observations and detections of dwarf novae outbursts on an annual basis. Here are the statistics from 2016 to 2023.

In the year 2016 review, a total of 15,300 observations were made, resulting in the detection of 765 dwarf novae. Similarly, in the year 2017 review, 15,785 observations were made, and 816 dwarf novae were detected. The number of observations increased to 19,867 in the 2018 review, and 938 dwarf novae were detected. In 2019, 18,284 observations were made, and 872 dwarf novae were detected. The year 2020 resulted in 17,069 observations and 738 dwarf novae detections. In the 2021 review, 19,293 observations were made, and 867 dwarf novae were detected. Similarly, in the year 2022 review, 18,050 observations were made, and 731 dwarf novae were detected. Finally, in the year 2023 review, 18,191 observations were made, and 826 dwarf novae were detected.

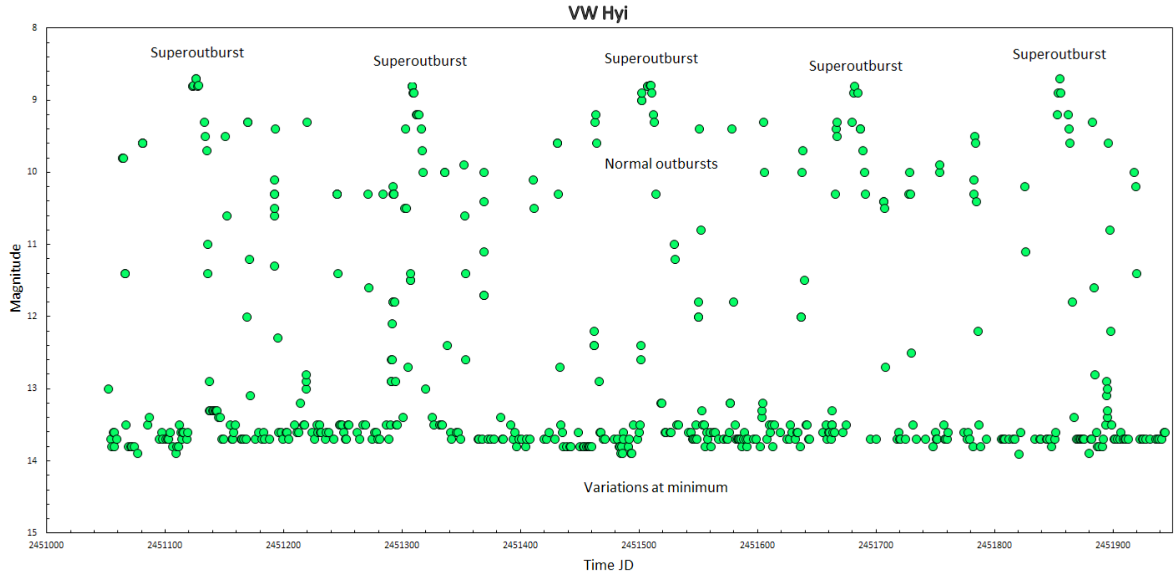
Through Infinity, I have discovered that my ability to navigate the night sky with a larger telescope remains undiminished. In fact, I am now able to observe faster and at a fainter level with ease, which has opened up new possibilities for discovering unusual behaviour in dwarf novae.

The year 2024 started off well, with plenty of clear nights, and my total observations in January were 2,700. However, February turned out to be a record-breaking month.

On February 10, the night of my 400,000th observation, I had to observe 148 stars to reach this total. I started at 9:00 p.m. and completed the task by 11:11 p.m. The star I observed was VW Hyi, one of the most frequently observed stars in the southern skies. It was in a super-outburst, and I have more than 4000 observations of this star, along with a detailed light curve from 1995 to 2024, as shown.



This detailed analysis of a small section of the light curve depicts superoutbursts, normal outbursts and variations at minima. The mean superoutburst cycle from this section is 182d.



The clear nights kept coming, giving me ample opportunities to make observations. By the end of the month, I had achieved a new personal record of 3,307 observations. This was a major accomplishment for me, as I had never before recorded over 3,000 observations in a month.

The clear nights persisted into March, and I was able to make more than 300 observations on some nights. By the end of the month, and to my surprise, I had surpassed my previous month's record and made 3,800 observations. I can hardly believe that things could get any better than this!

Well, it certainly did, and I'm thrilled to share that I've been awarded the 2024 Berenice and Arthur Page Medal for excellence in amateur astronomy in Australia and its Territories from the Astronomical Society of Australia (ASA). The announcement was made on March 29, during the National Australian Convention of Amateur Astronomers held in Parkes, New South Wales, home of the Dish. It's an incredible honour and privilege to receive this recognition.

The year 2024 has been remarkable thus far. In January, 2,700 observations were recorded, followed by 3,307 observations in February and a record-breaking 3,800 observations in March. As of now, I have over 1,600 observations approaching the end of April. In total, more than 11,400 observations have been made in the first four months, which is an extraordinary personal accomplishment. After 30 years of visual variable star observation, I still maintain the same passion and drive to continue the observation of variable stars through visual astronomy.

Recent observations of Mira Variables on the BAAVSS programme. 3

Shaun Albrighton

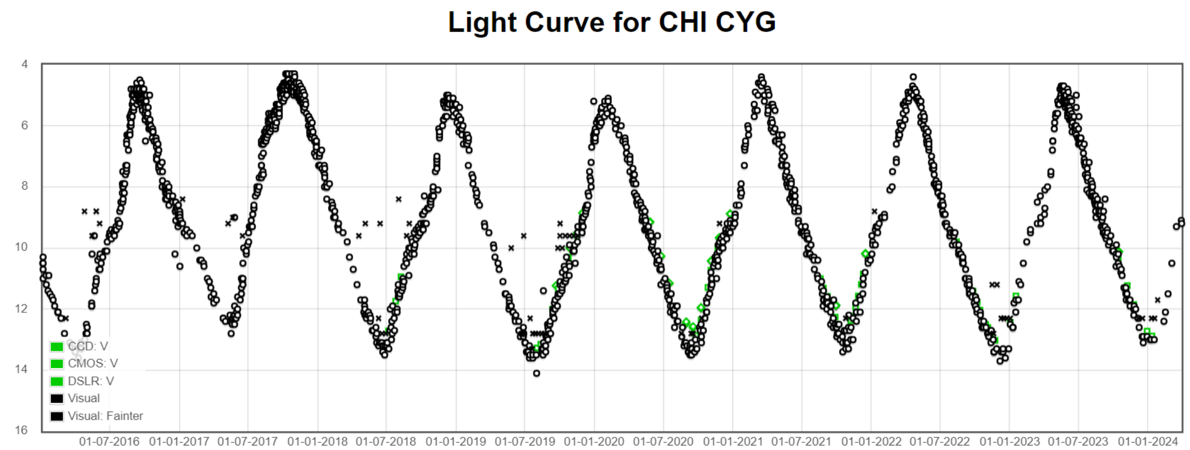
shaunalbrighton93@gmail.com

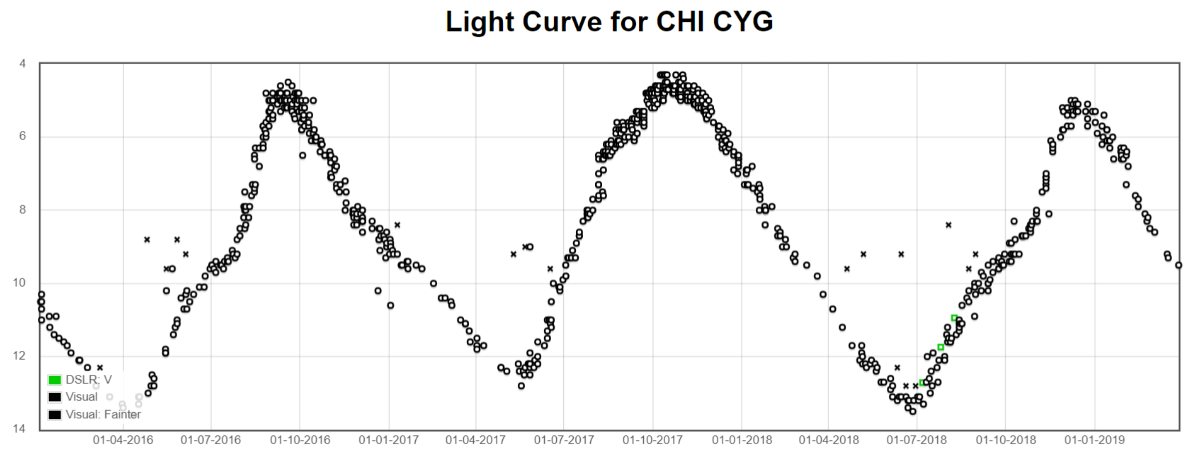
In this article, we examine a further seven Mira variables on the BAAVSS programme between 2016 and March 2024. Of note are the obvious humps on the ascending branches of Chi Cyg and RU Her, and apparent oscillation in the period of V Cyg.

chi Cyg

chi Cyg, is one of the most famous of all Mira variables. Not only was it one of the first, having been discovered by Gottfried Kirch in 1686, but also due to its huge extreme range of nearly 11 magnitudes (3.3-14.2). VSX lists the stars period as 408.05d, rise time 41% (167d), spectrum S6, 2e-S10, 4e(MSe) [1]. Analysis of Period v Time by T. Karlsson [2], shows a relatively small and random range of approximately 403-414d.

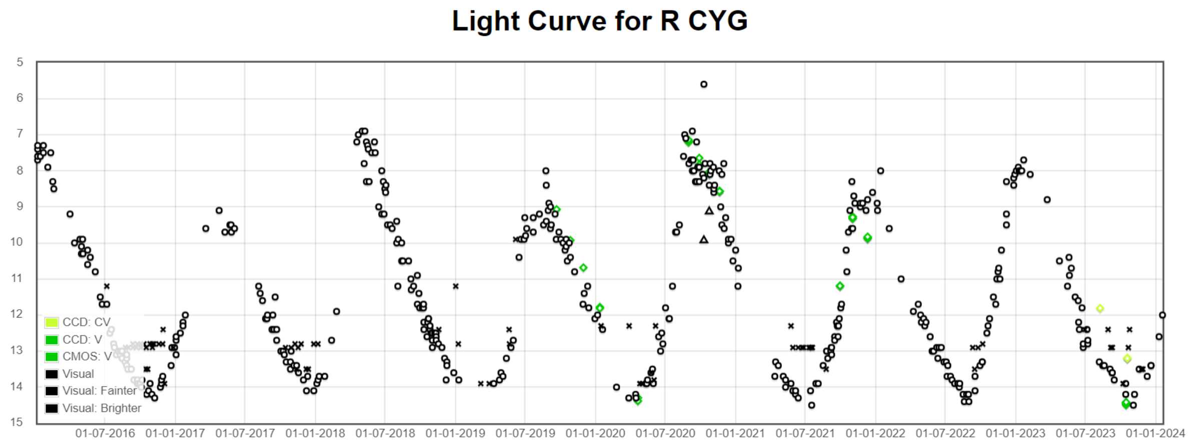
The plot for observations since 2016, clearly show both the large range and humps on the ascending branch. A second plot for the max occurring in 2017, shows that the hump occurred as the star neared max, resulting in a broader maxima.





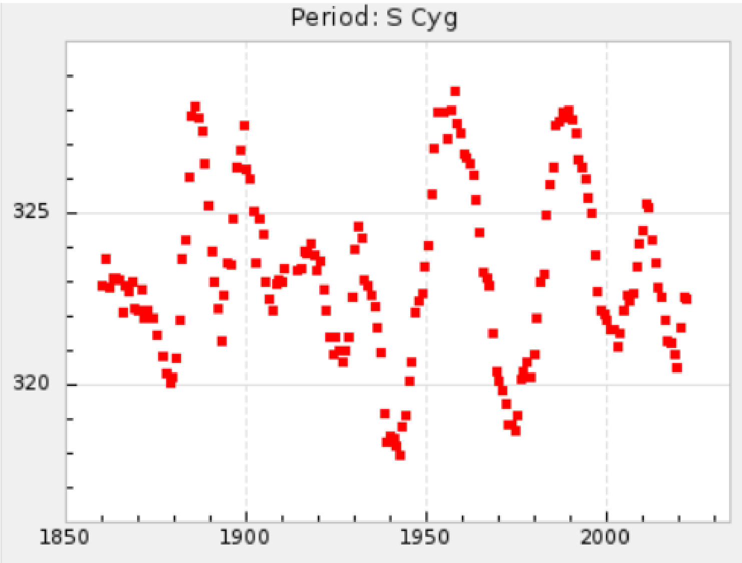
R Cyg

VSX lists R Cyg as having a large range of 6.1-15.0V, period 427.1d, rise 35% (149d). Spectrum S2.5, 9e – S6, 9e(Tc). The period has shown to vary in a random fashion in the range 419-433d. Observations since 2016 give an extreme range of 6.9-14.5, and clearly show the unpredictability of the star's maximum magnitude. Note the maximum of 2017, where it didn't reach mag 9.0.

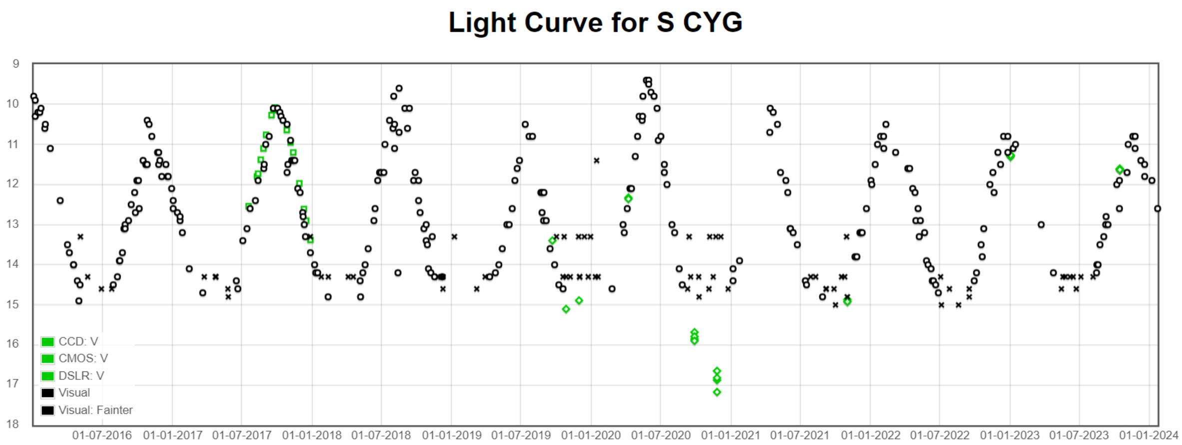


S Cyg

VSX lists the star as range 9.3-17.0V, period 322.93d, rise 50% (161d), spectrum S2.5, 1e(M3.5-M7e). Period analysis shows that the period oscillates between 318-328d

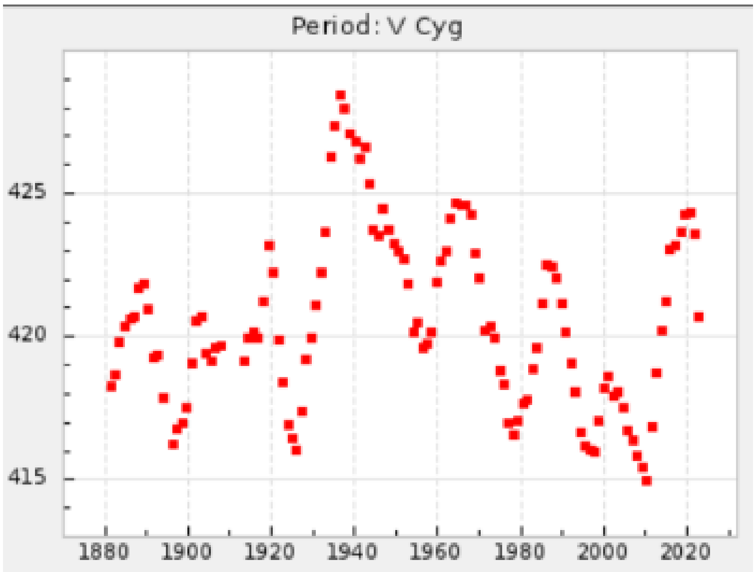


BAA observations since 2016, confirm the symmetry of the light curve and shows maximum occurring in the range 9.5-10.7. Due to the faint minima, visual observations do not cover this part of the light curve. CCD observations in 2020 do record the star near to 17th mag. CCD observers are encouraged to add this star to their programme.

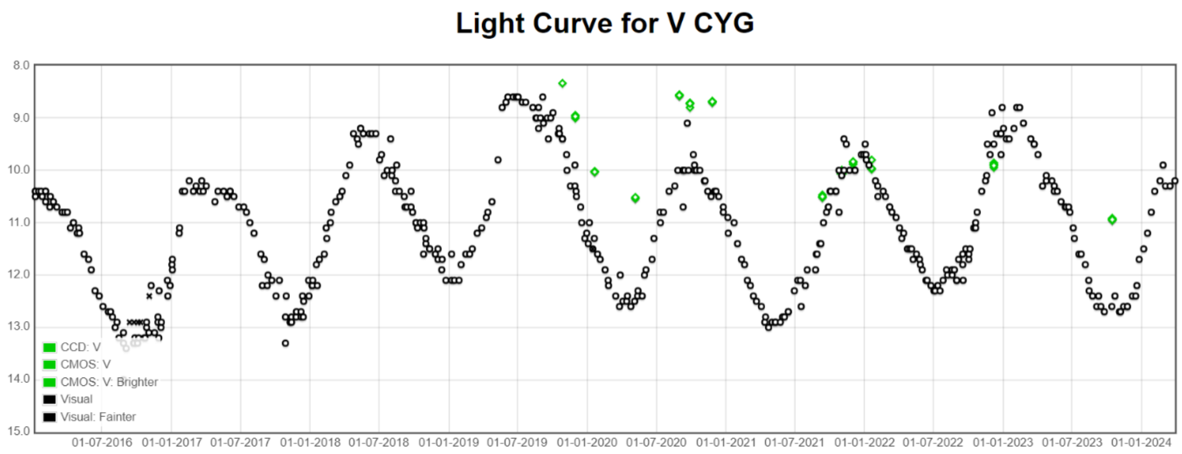


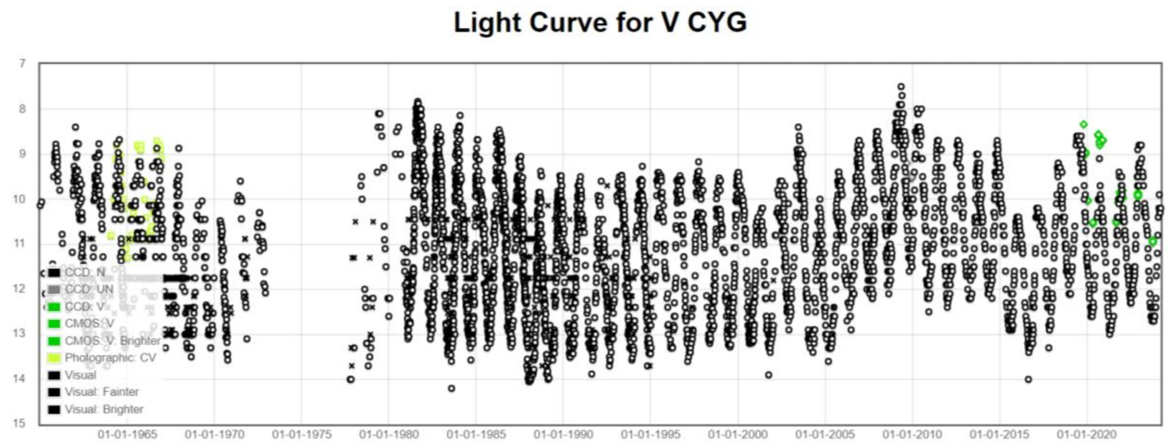
V Cyg

VSX lists V Cyg, range 7.7-13.9V, period 421.27d, rise 46% (193.78d), spectrum C5,3e-C7,4e(Npe). Period analysis reveals the period oscillates in the range 415-428d.



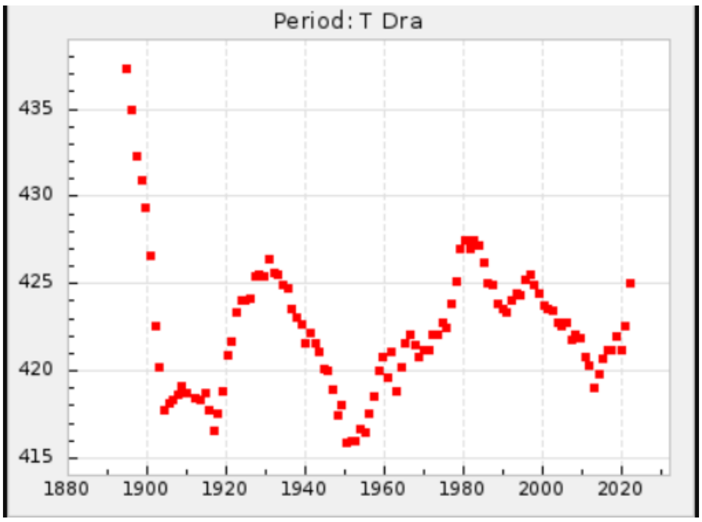
BAA observations since 2016 show V Cyg has displayed an extreme range of approx. 8.7-13.2, however what is clear is that the actual range for each individual period is lower at approximately 3.5 magnitudes. In addition, there appears to be variation in the mean magnitude of the star, which is further demonstrated in the second plot of observations since 1960. Not only are there hints that the mean magnitude appears to oscillate, but the range itself varies. In the 1980's the range was around 5 magnitudes, 1.5 magnitudes greater than the current range.



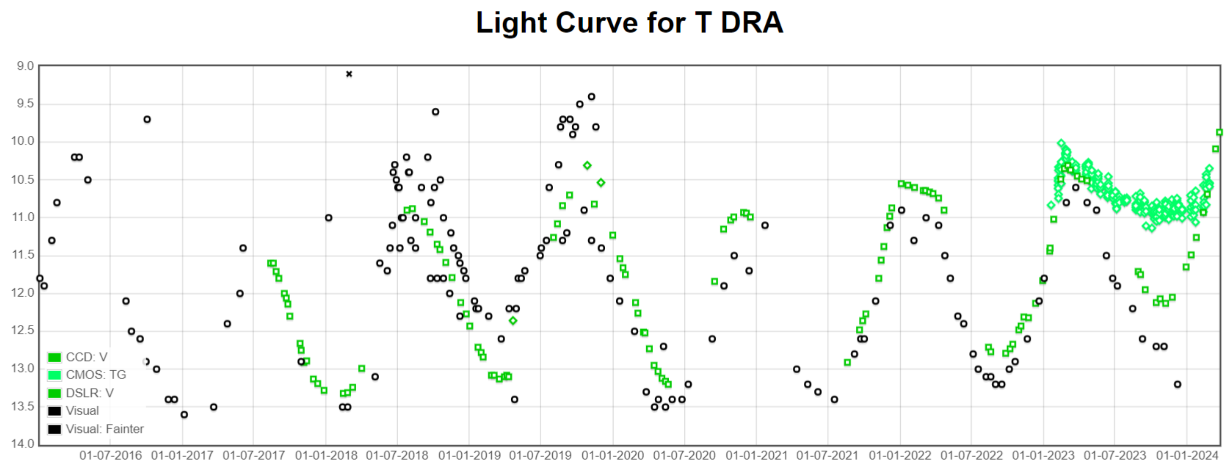


T Dra

VSX lists the range as 7.5-13.5, period 422.2d, rise 44% (193.78), spectrum C6,2e-C8,3e(N0e). Analysis of period v time reveals that the period rapidly reduced from approximately 437d in the 1890s to 416d around 1918, since when it has fluctuated randomly between 416-427d.



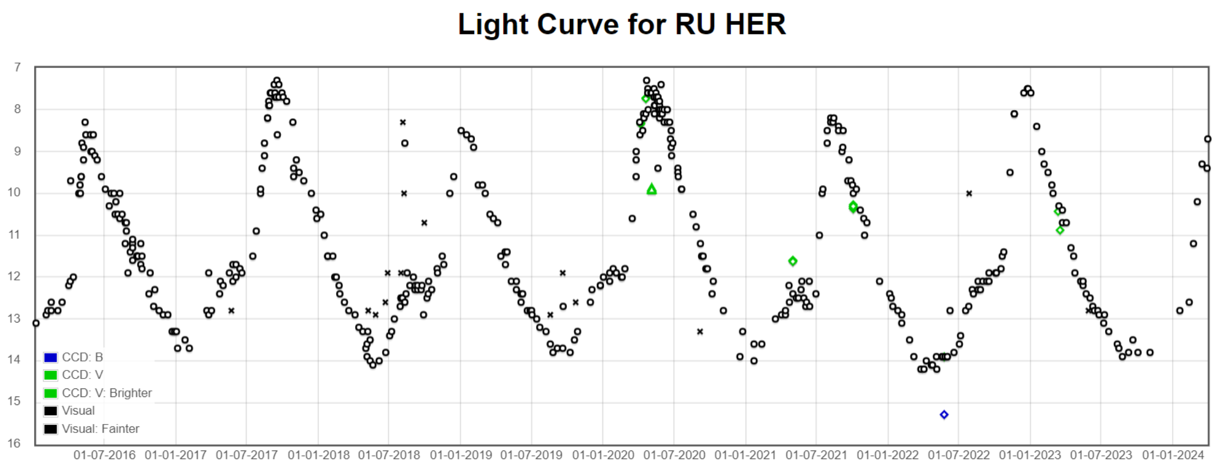
BAAVSS observations since 2016 (both Visual and CCD) show that at no point has the star been brighter than 9th magnitude, whereas minima seem to have been consistent at around 13.5. Being a carbon star means that the star is very red, which causes much broader variations in observer magnitudes - observers have different red sensitivities. It is therefore beneficial that we have long runs of observations by individual observers, so that allowances can be made. Despite being circumpolar from the UK, it is in need of additional observers to add this star to their programme.



RU Her

VSX lists RU Her as having a range of 6.7-14.3V, period 485.9d, rise 43% (209d), spectrum M6e-M9. Period analysis reveals that the star's period varies only slightly between 473-479d.

BAAVSS observations clearly show the prominent hump on the rising branch. This constantly has occurred when the star nears 12th magnitude.

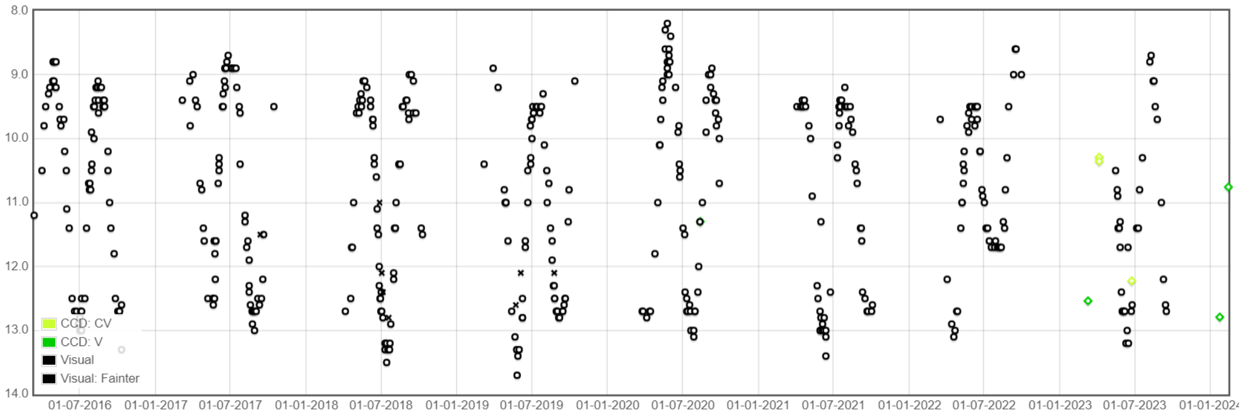


SS Her

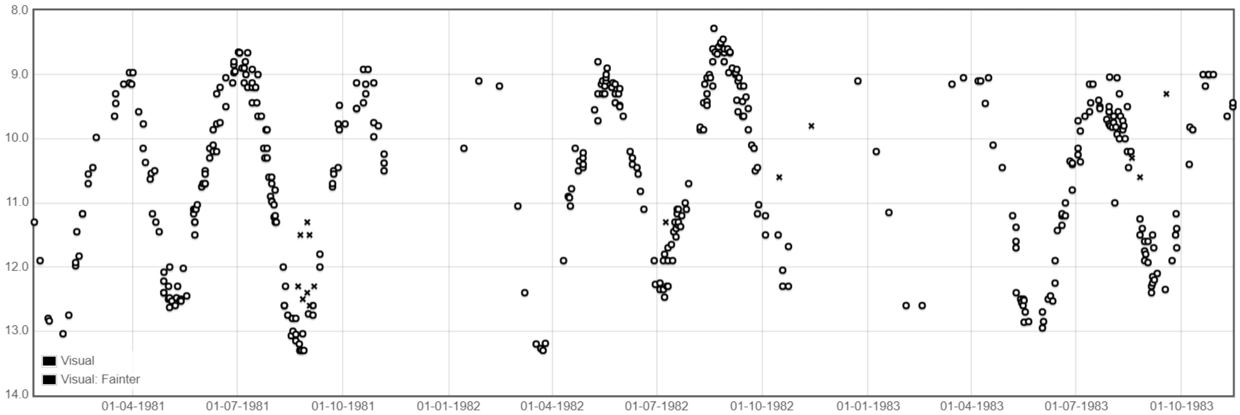
VSX lists SS Her as having a range of 8.5-13.5, and a very short period of 114.2d. In line with other short period Mira variables, the stars light curve is highly symmetrical, with the rise occupying 48% (55d). Spectrum is given as M0e-M5e. Period analysis yields only small random variations between 104.5-110d.

BAA observations confirm both the VSX range and symmetrical light curve. A second plot from 1981-1983 show this variability more clearly. Having a shorter period, observations can be made more regularly (5d).

Light Curve for SS HER



Light Curve for SS HER



References

1. All data VSX
2. Period plots are by Thomas Karlsson (SAF) https://var.saaf.se/mirainfoper.php

Eclipsing Binary News

Des Loughney

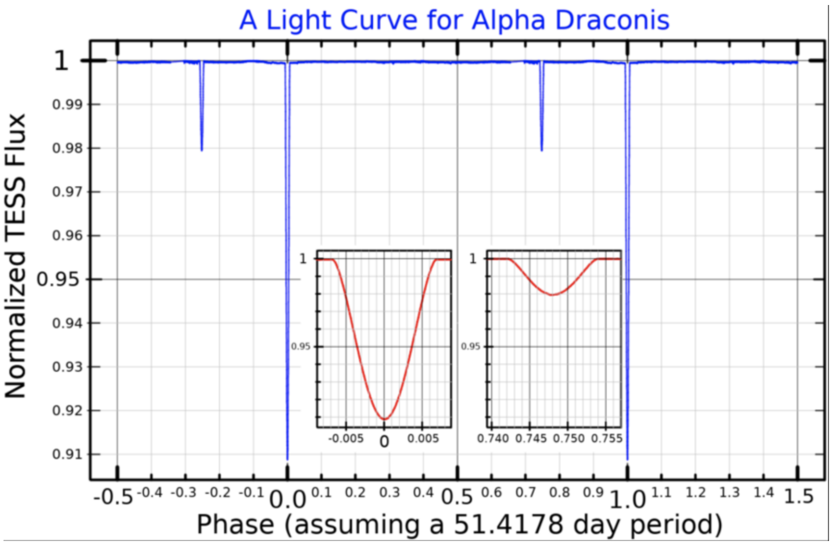
desloughney@blueyonder.co.uk

Transiting Exoplanet Survey Satellite (TESS)

TESS was launched in 2018 with a two-year primary mission of detecting exoplants around 1,250 target stars. Another 13,000 stars were observed. For an example of what TESS has done see: https://en.wikipedia.org/wiki/TOI-700_d. TESS's mission has been extended, currently to 2025. TESS has, in addition to its primary mission, discovered many eclipsing binaries. Here are some examples of its discoveries.

Alpha Draconis - Thuban

This star is not listed as an eclipsing binary by either the Krakow website or the GCVS Catalogue. However, the TESS data found it to be an EA class eclipsing binary. Below is the light curve displayed in the Wikipedia entry on Alpha Draconis (which is 309 light years from our Sun). TESS found that the period is 51.42 days.



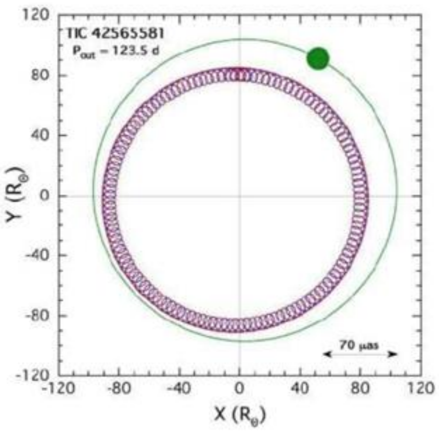
This well-known bright system (of magnitude 3.67) had long been known as a binary but TESS discovered that it was an eclipsing binary. It has a period of 51.4 days and the primary eclipse lasts 6 hours. The diagram above illustrates the TESS light curve showing that the system is a classic EA system. It will be noted that the orbit of the system is eccentric with the secondary eclipses occurring not at 0.5 on the phase diagram but at 0.75.

It is estimated that TESS data has allowed the analysis of 80 million stars. Of these there are 450,000 candidates for eclipsing binary systems. At least 100 of these systems are not binaries but contain 3 or more stars, including a six-star system.

JULY 1, 2022

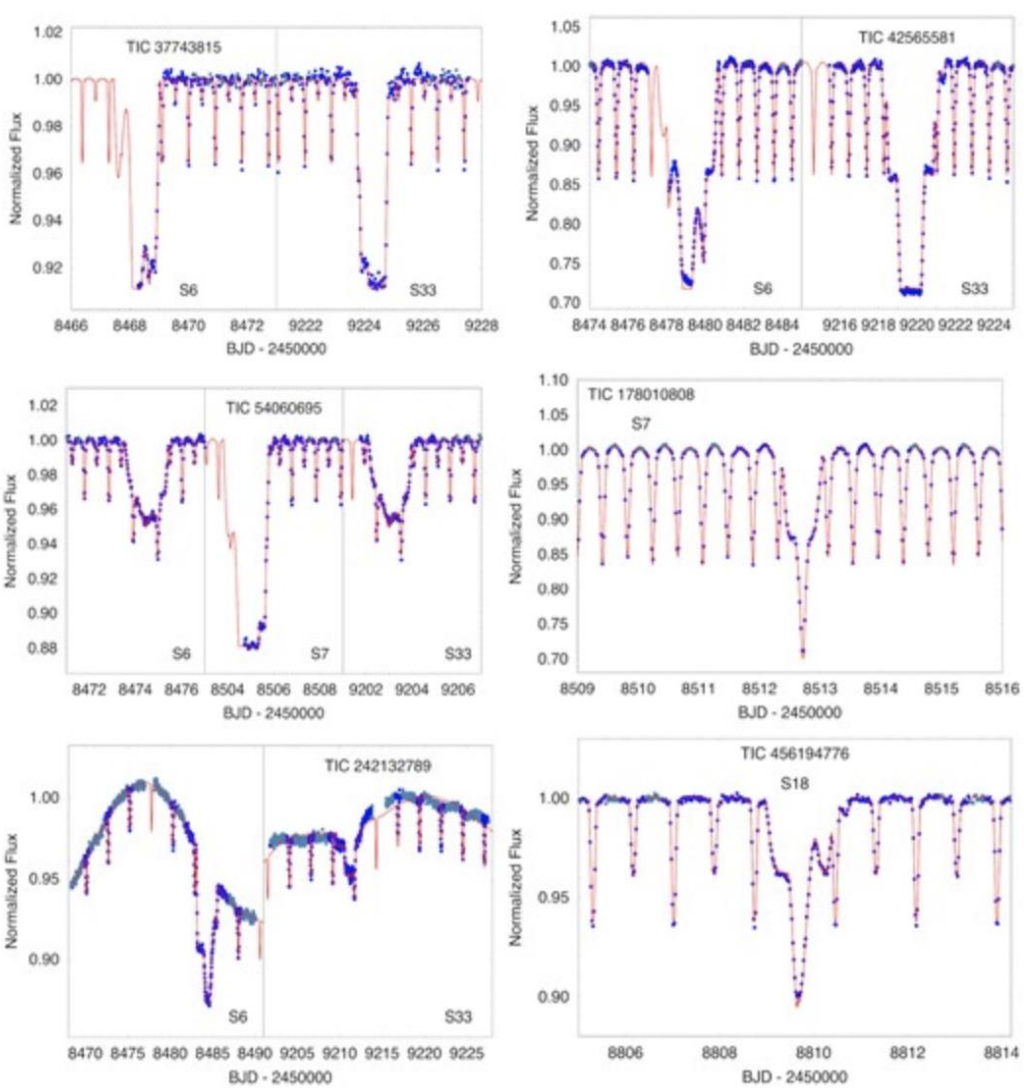
Triply eclipsing stellar systems

by Harvard-Smithsonian Center for Astrophysics



The schematic (*left*) of a triple eclipsing stellar system is seen from above the orbital plane. The green circle and green track mark the tertiary star, while the inner red/blue tracks are for the inner eclipsing binary pair. Only about twenty triply eclipsing stellar systems are known; astronomers have used TESS observations, combined with other datasets, to study six new ones.

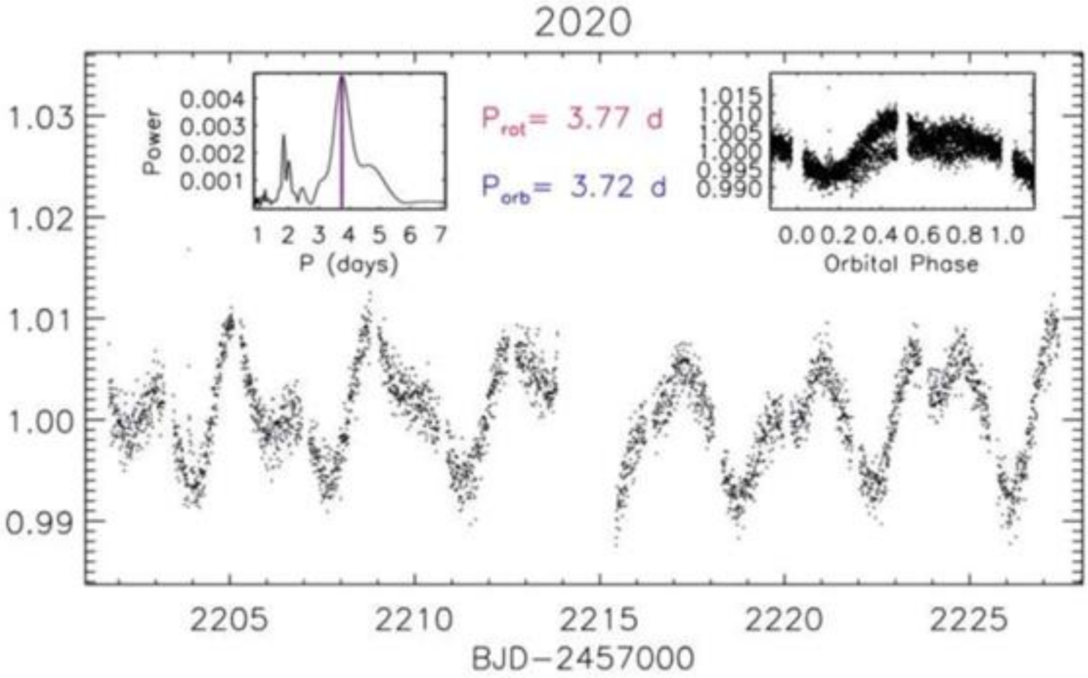
Triplet stellar systems can also be eclipsing, but because the third star in a typical triplet, orbits further out (it is further in order for the system to remain relatively stable and not eject one of the stars), its period is closer to a year and longer monitoring is needed to spot and study them. To date over a million eclipsing binary systems are known, but only twenty triple eclipsing systems have been published (2). Below are six of the triplet light curves detected by TESS.



Back to contents

Eclipsing Binary Detected in the open cluster NGC 2232

Using TESS, European astronomers have discovered an eclipsing binary in the open cluster NGC 2232. The binary, designated TIC 43152097, is the first such system detected in this cluster. The finding is reported in a paper published by A Frasca et al July 26 entitled TIC 43152097. The first eclipsing binary in NGC 2232.



TESS light curve of TIC 43152097 in 2020. Credit: Frasca et al, 2023

The TESS observations found that TIC 43152097 is composed of a late F-type dwarf primary star and a late K-type pre-main sequence (PMS) secondary star. The orbital period of the system was measured to be approximately 3.72 days.

The results suggest that the primary star of TIC 43152097 is about 12% larger and 16 more massive than the sun. The secondary component has a radius of 0.88 solar radii and its mass is estimated to be 0.76 solar masses (1)

DSLR Photometry Tip

I decided to use DSLR photometry to study the Mira star T Cassiopeiae, which is one of the BAAVSS target Miras. It is a star which GCVS states varies from 6.9 to 13.0 magnitude. Current authorities state that the variation is now between 7.5 and 11.5 magnitude. The complication that arose in trying to use DSLR photometry is that T Cas is very close to another star HIP 1852 of magnitude 8.09. It seemed impossible to achieve enough separation to analyse alone the photons from T Cas. Too much of the light analysed was coming from HIP 1852 which made T Cas seem brighter than it really was. After some experimentation a way was found to better isolate the light from T Cas (using AIP4WIN). The first step was to double the size of the image being analysed, which helped separate the two stars. The next step was to reduce the sizes of the circles that are used by AIP4WIN to analyse the light of a variable. The standard settings are 6, 12 and 15. These are reduced to 3,9 and 12.

References

1. **A. Frasca et al, TIC 43152097. The first eclipsing binary in NGC 2232**, arXiv (2023). DOI: 10.48550/arxiv.2307.14081

2. Six New Compact Triply Eclipsing Triples Found With TESS," S. A. Rappaport, T. Borkovits, R. Gagliano, T. L. Jacobs, V. B. Kostov, B. P. Powell, I. Terentev, M. Omohundro, G. Torres, A. Vanderburg , T. Mitnyan, M. H. Kristiansen, D. LaCourse, H. M. Schwengeler, T. G. Kaye, A. Pal, T. Pribulla, I. B. Bıro, Cs anyi, Z. Garai, P. Zasche, P. F. L. Maxted, J. E. Rodriguez, and D. J. Stevens, MNRAS 513, 4341 2022.

Recent minima of various Eclipsing Binary stars. 8

Tony Vale

tony.vale@hotmail.co.uk

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 photometric database.

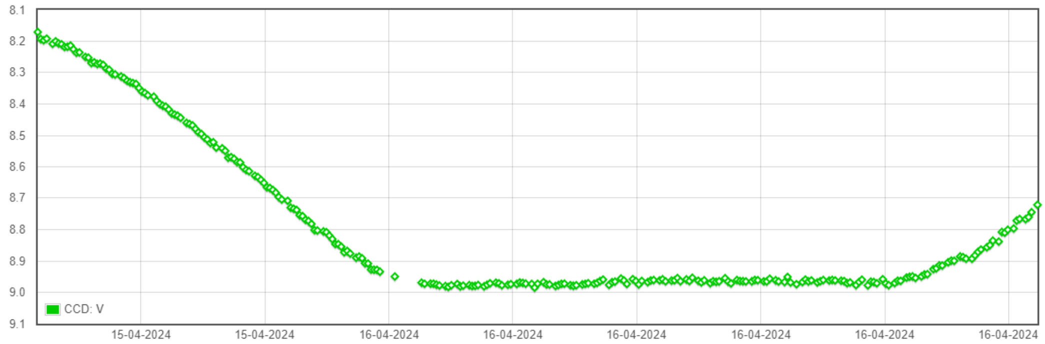
Times of Minimum of some eclipsing binaries

Star	HJD of Min	Filter	Error	Type of Minimum
TT Aur	2460273.38750	V	0.0005	Secondary
IR Cas	2460298.43425	V	0.0002	Secondary
WZ Cep	2460319.39613	V	0.0005	Secondary
V765 Cas	2460327.41735	V	0.001	Secondary
CD Cam	2460328.47885	V	0.002	Secondary
UX Uma	2460364.49318	V	0.01059	Primary
TZ Boo	2460376.43459	V	0.00219	Primary
UV Leo	2460403.58145	V	0.0002	Secondary
Y Leo	2460405.56661	V	0.0013	Primary
RS CVn	2460416.59581	V	0.0015	Primary
TU Boo	2460412.68421	V	0.00015	Primary
AZ Vir	2460414.63149	V	0.00015	Primary
AW Vir	2460410.57513	V	0.0003	Primary
AW Uma	2460422.48728	V	0.0006	Primary
AH Vir	2460423.52224	V	0.0004	Primary

The observations from which these timings were obtained were made from November 2023 to April 2024 using a 102mm refractor and an ASI 183MM-Pro cooled mono CMOS camera. The timings were extracted using Bob Nelson's Minima software. Poor weather in the UK restricted the number of observations which could be made during this period and of the 15 timings reported here, 7 were obtained between 3rd and 23rd of April from Andalucia in Spain. The total eclipse of RS CVn shown below was one of these. The observation took place over about 8 hours during the night of the 15th to 16th April. The O-C shows the period continuing to reduce as it has been for the last 50 years or so.

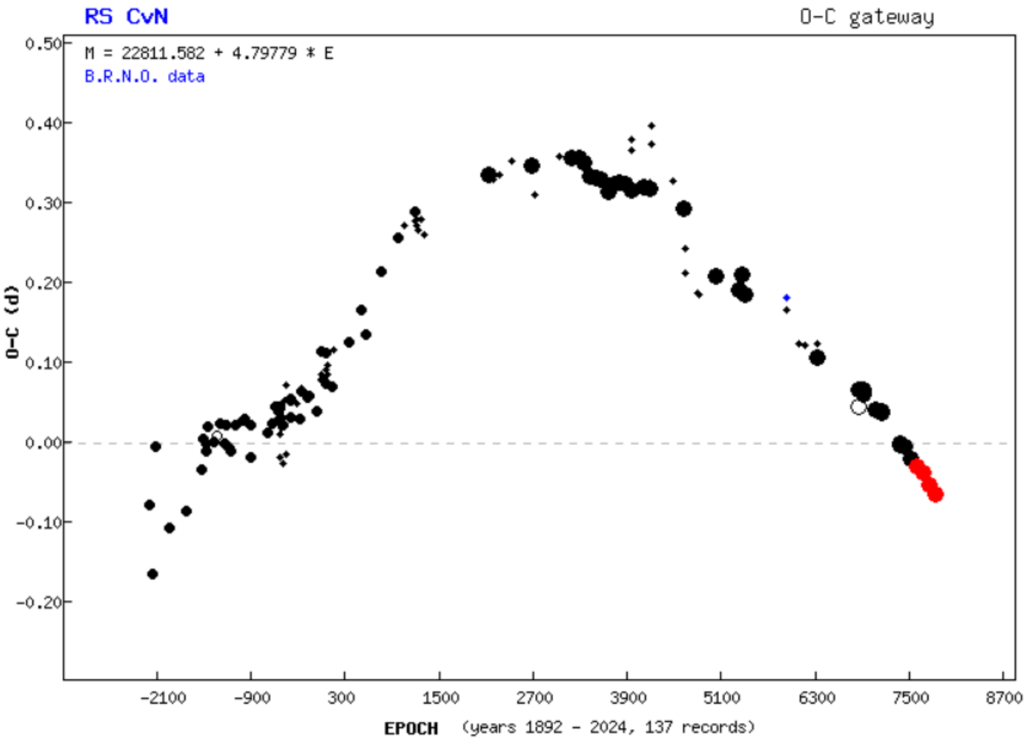
Original Observer Magnitudes

Light Curve for RS CVN



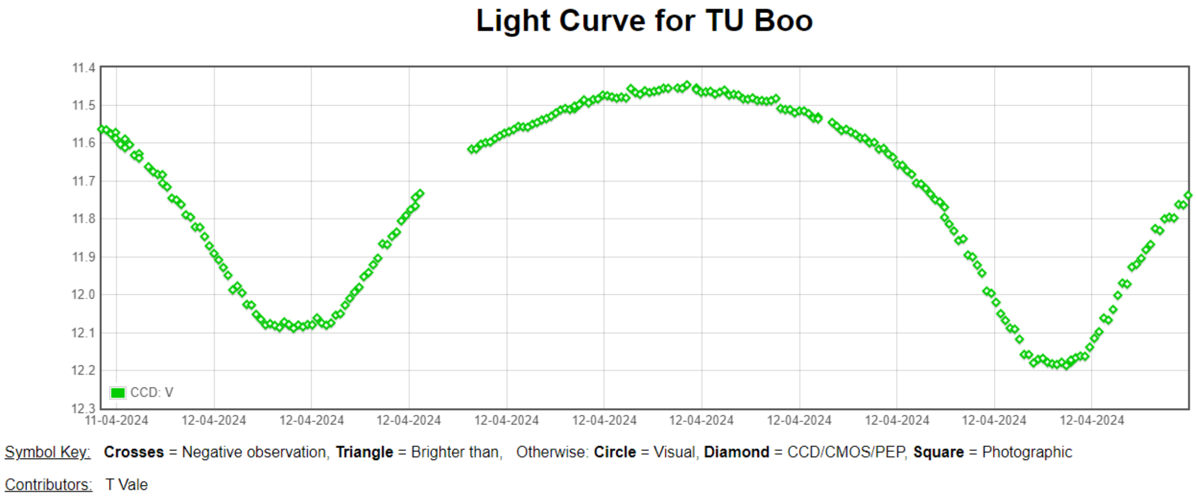
Symbol Key: **Crosses** = Negative observation, **Triangle** = Brighter than, Otherwise: **Circle** = Visual, **Diamond** = CCD/CMOS/PEP, **Square** = Photographic

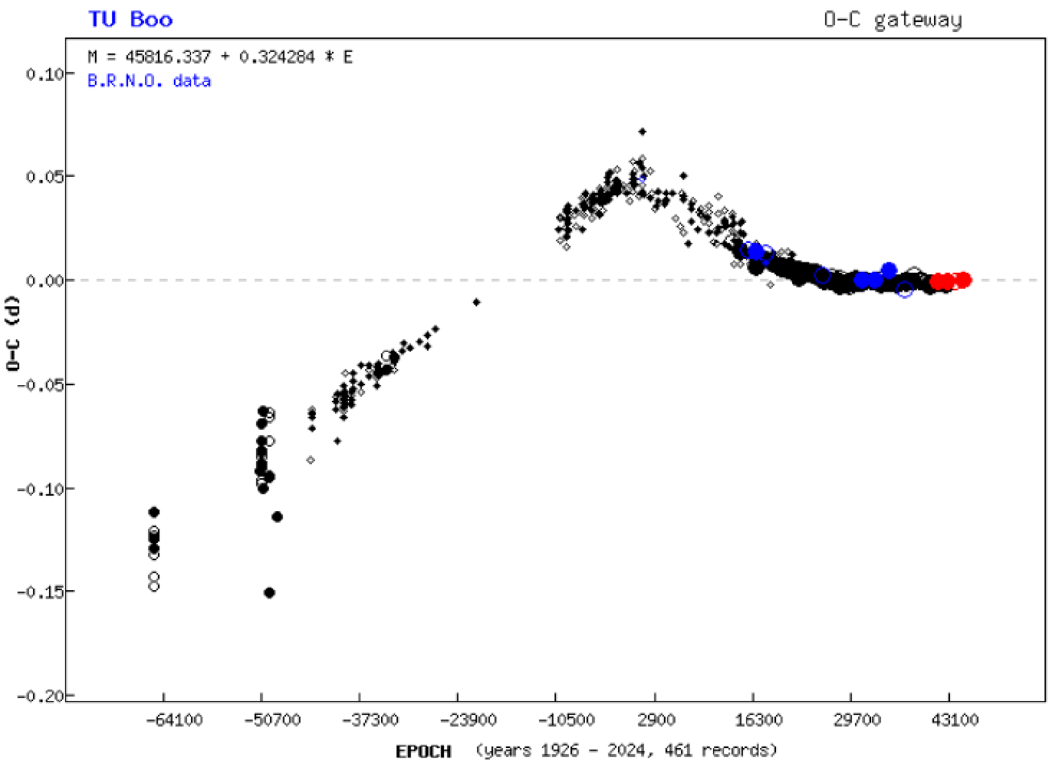
Contributors: T Vale



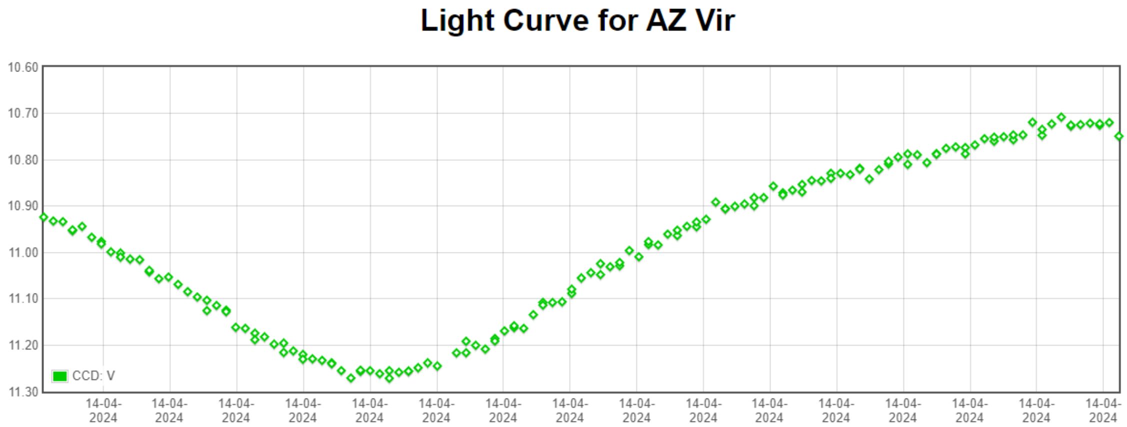
Back to contents

TU Boo is a W UMa type contact binary with a period of 7.7 hours. The observation shown here covers about 72% of the full period which has remained largely unchanged over approximately the last 12 years.



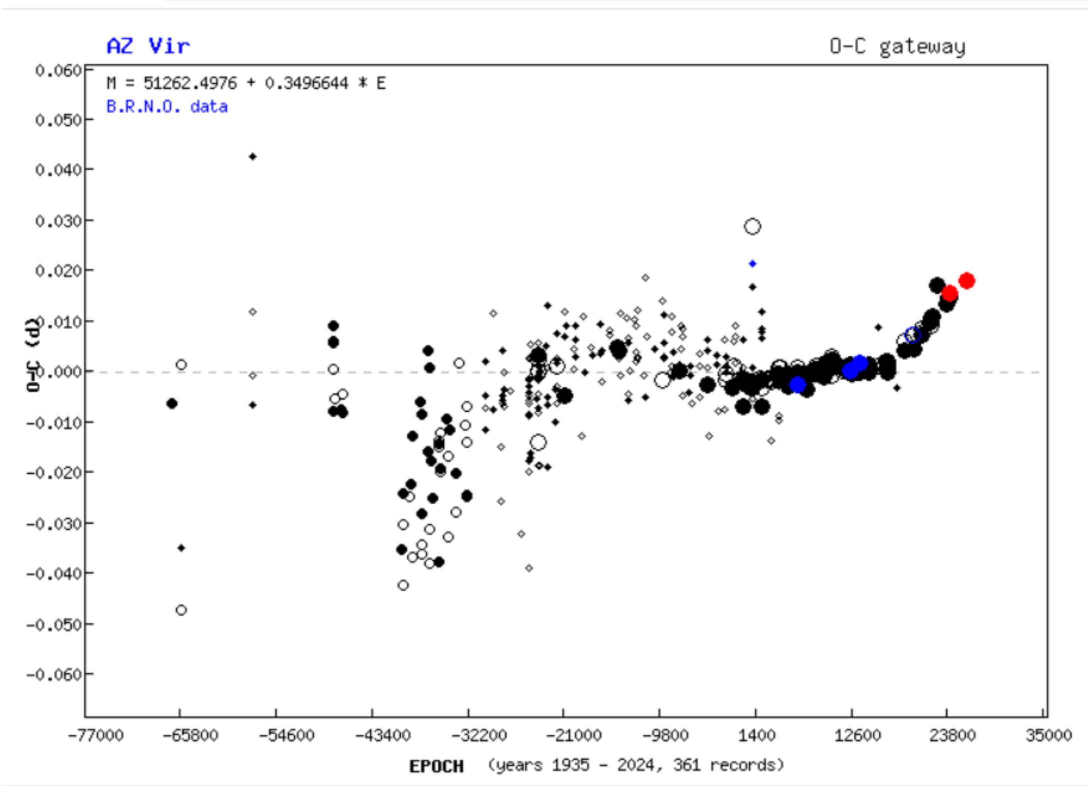


AZ Vir is also a W UMa contact system with a period of 8.4 hours. The O-C diagram shows that for several years before 2015, the period remained constant and in line with the light elements used in the diagram below but then in 2015 it increased abruptly by about 0.2s and has changed little since.



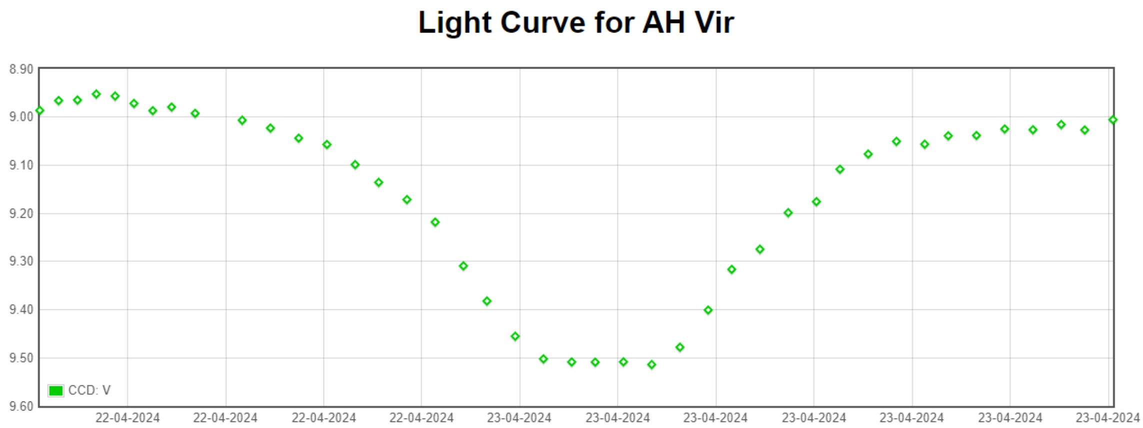
Symbol Key: **Crosses** = Negative observation, **Triangle** = Brighter than, Otherwise: **Circle** = Visual, **Diamond** = CCD/CMOS/PEP, **Square** = Photographic

Contributors: T Vale



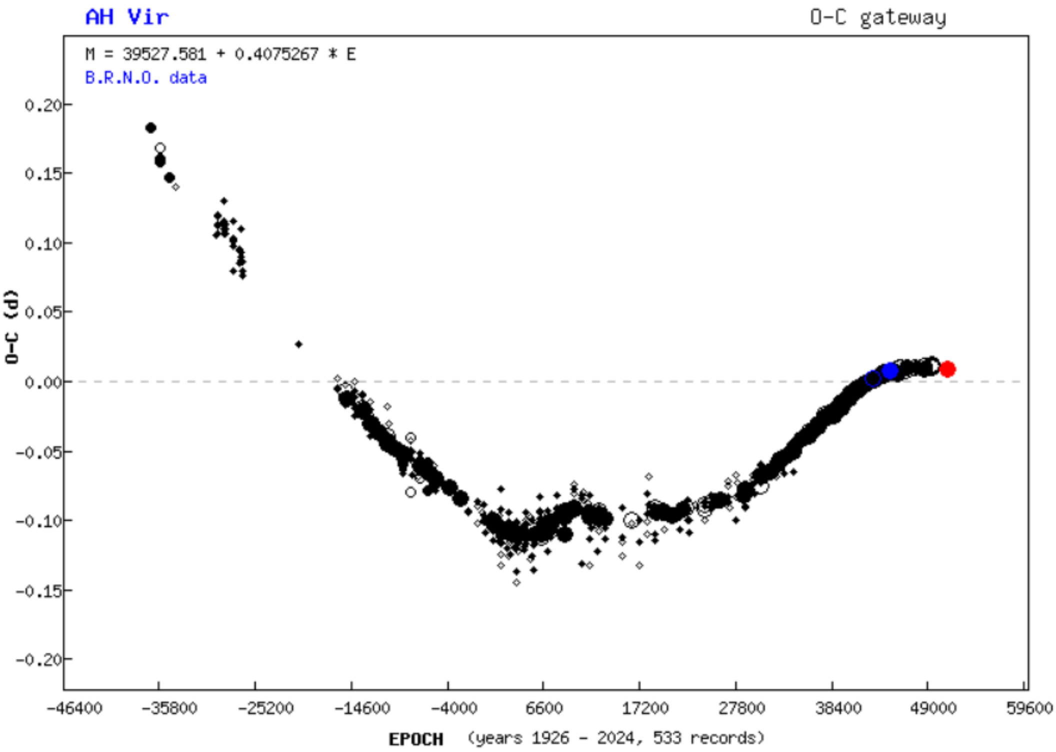
Back to contents

AH Vir is another W UMa contact system. The period is 9.8 hours. The light curve below shows a total eclipse of the secondary and some irregularities which may be caused by star spots appearing and disappearing as the system rotates.



Symbol Key: **Crosses** = Negative observation, **Triangle** = Brighter than, Otherwise: **Circle** = Visual, **Diamond** = CCD/CMOS/PEP, **Square** = Photographic

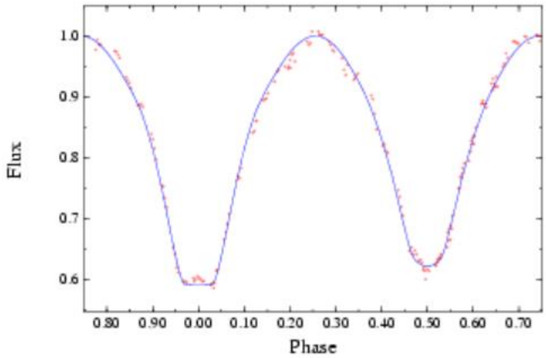
Contributors: T Vale

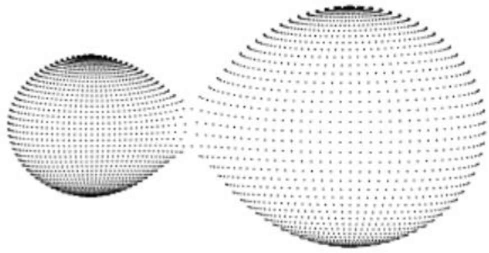


The Catalogue and Atlas of Eclipsing Binaries (CALEB) includes the following phase diagram and a representation of the AH Vir system showing the components in contact and the primary much larger than the secondary. From this it can easily be seen why there is a total eclipse of the secondary at the primary minimum.

AH Vir

Lu1993 - Lu1993V (Johnson V)





Back to contents

Investigations regarding the catalogue values of the periods of two long period eclipsing variables – V718 Persei and V1177 Cassiopeia.

David Conner

david@somerbyconners.plus.com

Long term observations of under observed long period variables can show discrepancies between their apparent periods and their catalogued periods, as these two examples illustrate.

My observing program includes several long period variable stars which are suited to the observing regime of online telescopes. These variables tend to be under-observed, and my results sometimes appear at variance with the catalogued periods of the objects. Two of these, V718 Persei and V1177 Cassiopeiae, are discussed here.

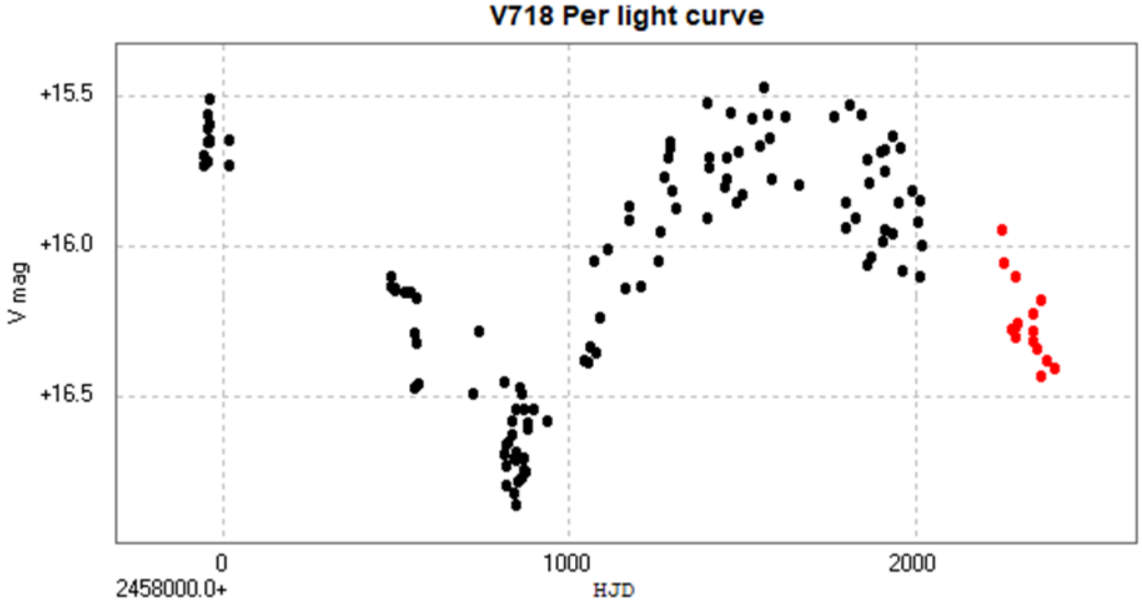
V718 Persei

Light curve and phase diagram of the long period variable star V718 Persei.

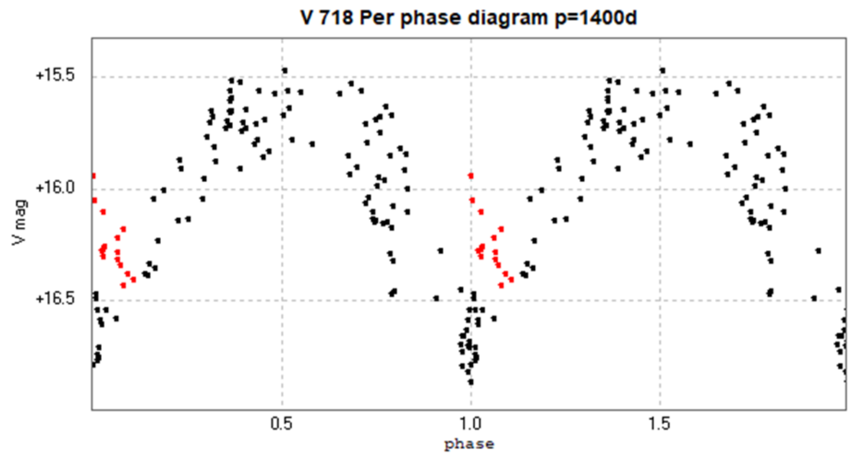
Note, this star is catalogued as an eclipsing binary of indeterminate type (type 'E', GCVS, AAVSO VSX), although an analysis of the system suggests otherwise (Grinin *op cit*), as discussed in my previous article in VSSC 187 (March 2021). This star is within the star forming region IC 348 and might be pre-main sequence.

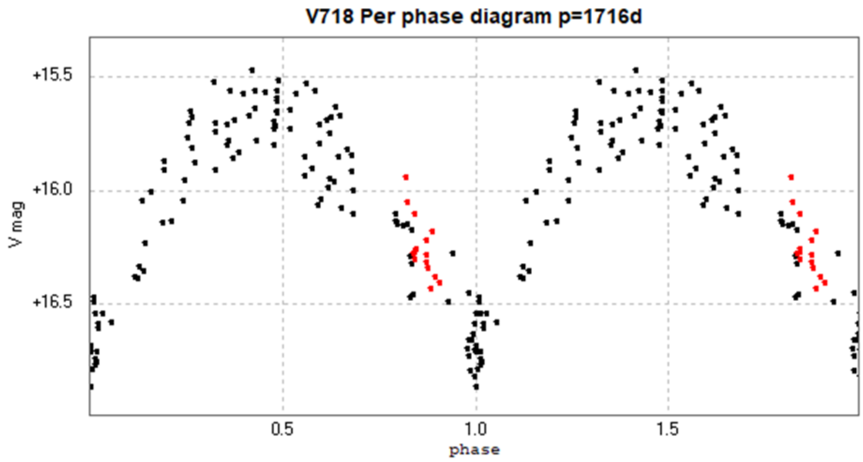
There are a number of catalogued periods for this star, 1716 days ref AAVSO VSX and Grinin *et al* 2008, and 1400 days ref GCVS and Cohen *et al* 2003 [accessed 2024 May 11].

15 observations were made with the COAST telescope between 2023 November 4 and 2024 April 1, and were added, in red, to my previous observations (in black) in the following light curve. All observations were made using a V filter. Note that the maximum exposure allowed on the COAST system is 180 seconds, which is too short for a star of this magnitude. This, coupled with it being in a nebula, leads to the large scatter of the observations.

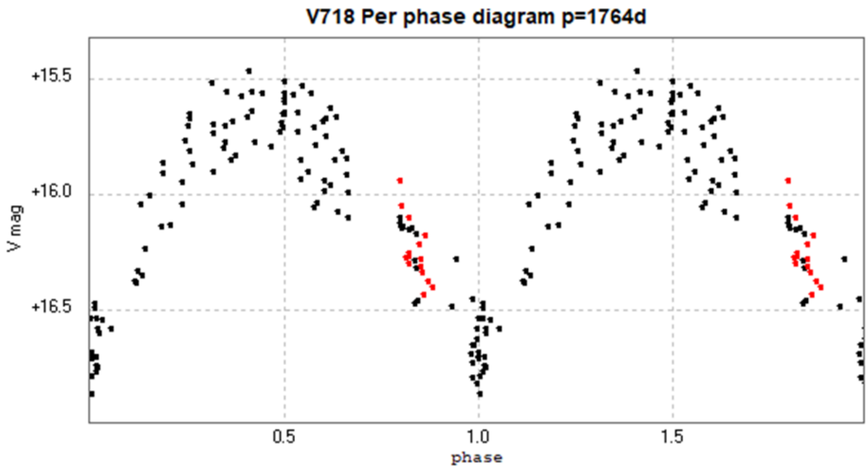


The following phase diagrams were plotted using both of the above catalogue values for the period.





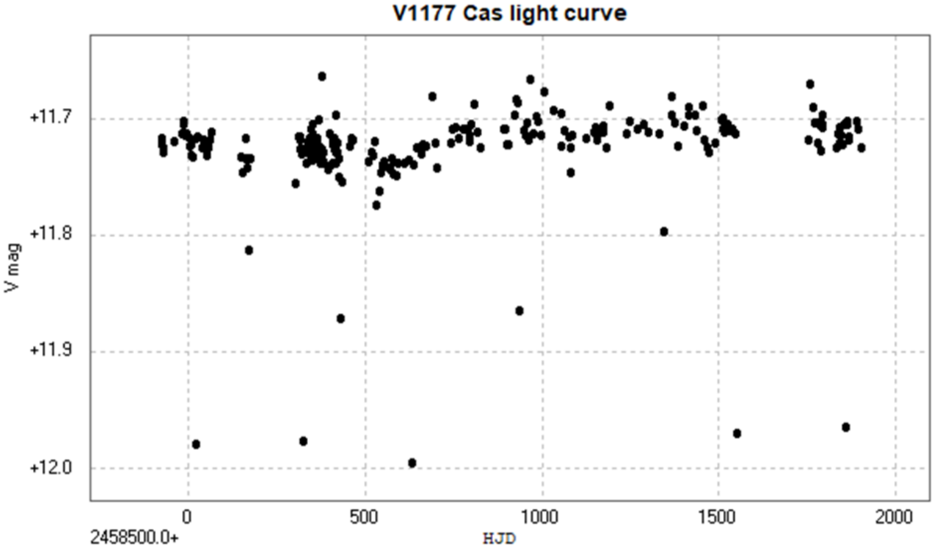
The 'best fit' period to my observations is below.



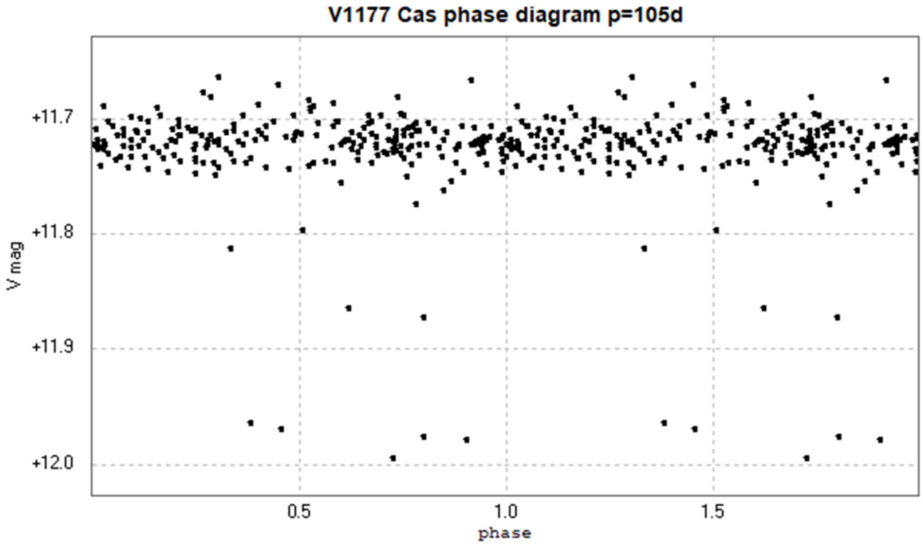
While these observations might suggest that the actual period is significantly different from the 1400-day value there is still some potential ambiguity since only 3 data points do not fit both phase diagrams. That said, the recent (red) observations taken together fit the decline to minimum better than they fit the rise from it. More observations are needed in order to remove this ambiguity.

V1177 Cassiopeiae

The following light curve and phase diagrams were constructed from photometry of 229 images taken with the Open University COAST telescopes between 2018 November 4 and 2024 April 3 using a V filter.



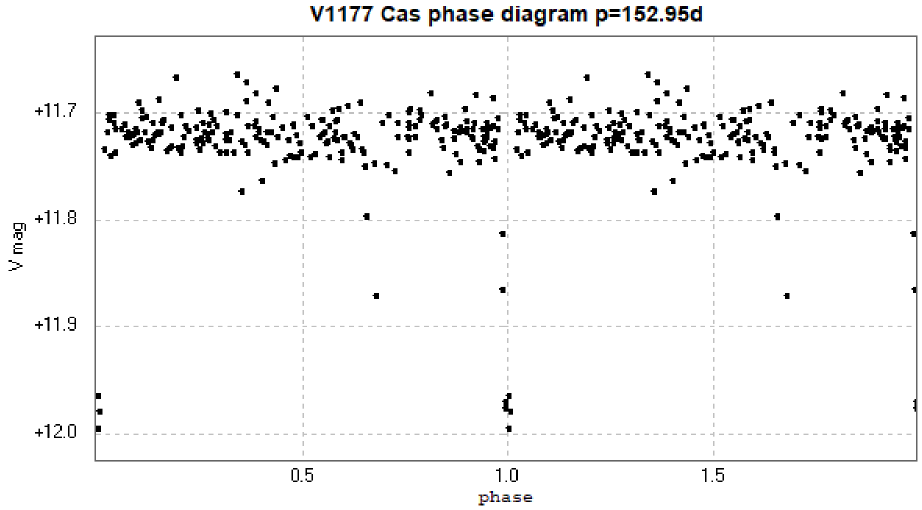
This under observed star is catalogued as an EA type eclipsing binary with a period of 105 days (GCVS and AAVSO VSX accessed 2024 May 11). The following phase diagram is plotted with this period



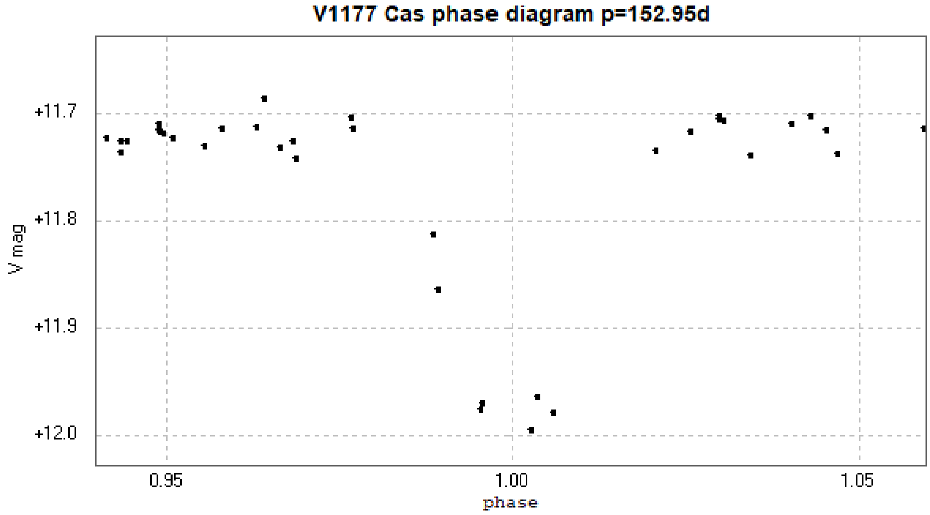
This would suggest that 105 days is not the correct period.

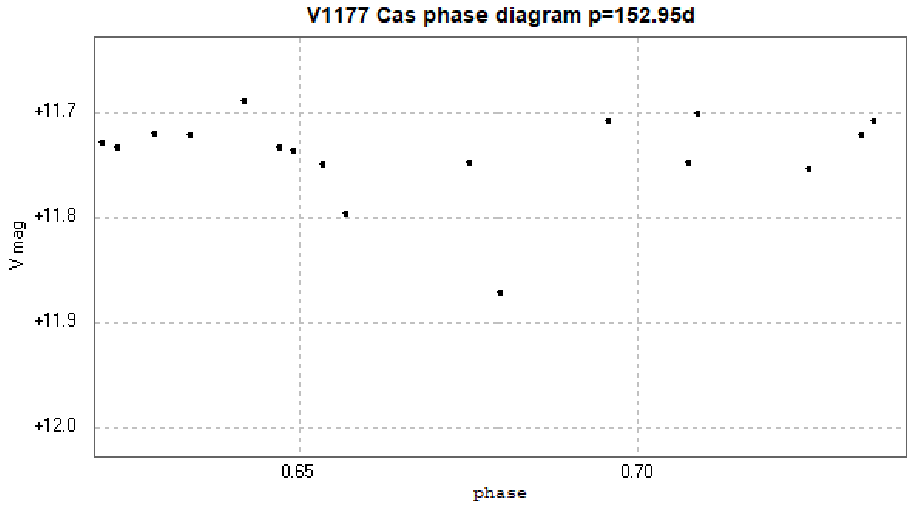
A period of 152.95d has been suggested by Otero et al in 2006 [1], where the star is listed as GSC 4330 1963. With many thanks to Christopher Lloyd for pointing this out.

When plotted with this period, the following phase diagram is generated.



Expanded views of the primary and the possible secondary minima follow.





The sparse data points around phase ~0.68 might be related to a secondary minimum, which the GCVS mentions and the VSX suggests is at phase 0.53, but more observations are required to confirm or refute this.

Both of these systems remain in my current observing program. More information can be found on my website.

Reference

1: New eccentric eclipsing binaries found in the ASAS, Hipparcos and NSVS databases. Otero et al, Commissions 27 and 42 of the IAU information bulletin on variable stars number 5681 (2006).

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 VSS Circular

Written articles on any aspect of variable star research, observing or letters 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 BAAVSS web pages on the 1st day of March, June, September and December.

Deadline for the next VSSC is August 15th 2024.

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, *Circular*s 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**.

Back to contents