British Astronomical Association

VARIABLE STAR SECTION CIRCULAR

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Contents

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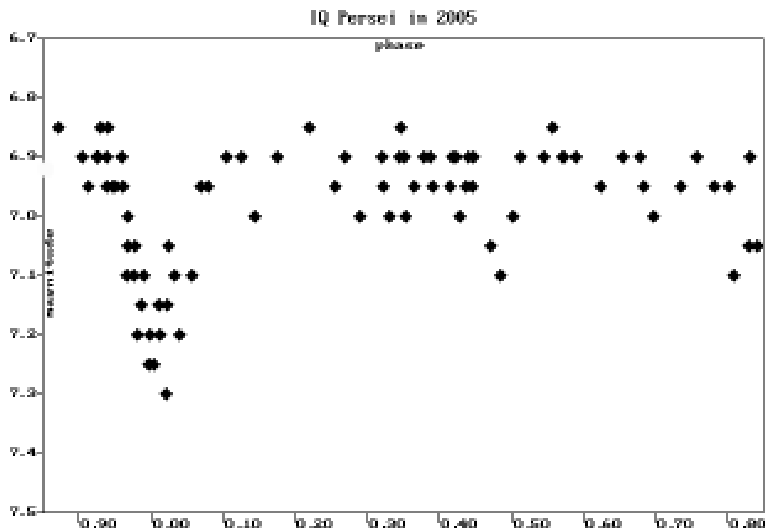
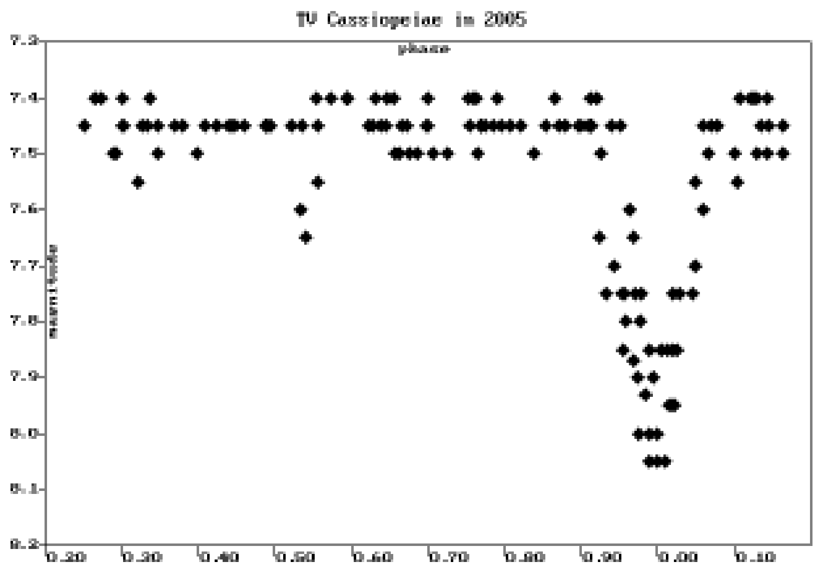
Office: Burlington House, Piccadilly, London, W1J 0DU

ECLIPSING BINARY LIGHT CURVES

TONY MARKHAM





The two light curves above are formed from observations made by Tony Markham. In each case, the variables were observed on a regular basis, rather than only at the times of predicted primary eclipses, and all observations were plotted in order to see how much scatter/tidy a light curve might result. In the case of IQ Per and TV Cas there are even indications of the secondary eclipse being visible near phase 0.5.

FROM THE DIRECTOR

ROGER PICKARD

Section Secretary

I'm delighted to advise that Clive Beech has agreed to take over the position of Section Secretary from John Saxton with immediate affect.

John Saxton has agreed to continue to support the software he has developed, but Clive will look after the day to day inputting of data. However, please bear with Clive whilst he gets to know precisely what is involved.

Clive lives in Plymouth, but has attended most of the more recent Section Meetings, and helped out by taking your money at the last one! He is more of a CCD man than a visual observer, but has some experience of visual recording as he has been inputting some old data recently.

Project Quixote

I'm also delighted to announce that Andy Wilson has taken over the maintenance and development of the Quixote database as well as the CCD database. This means that he will be uploading the visual data to the appropriate web page, and in time, he will also be uploading the CCD data. With this added responsibility I felt it was time to give Andy full *Officer* status, and to that end he has the title of *Database Secretary* (to fall in line with all the other Secretaries we have). We welcome both Clive and Andy to their new positions. Their contact details appear on the back of the Circular.

New Eclipsing Binary Secretary Wanted

After all the preceding good news, it was a blow to hear that Tony Markham has felt it necessary to stand down as Eclipsing Binary Secretary; you'll see the *Job Description* that Tony has written on the next page. Tony has been doing the job since the day I became Director on the first of September 1999, and I wish to express my thanks to him for his support during this time. Please let me know if you'd be interested in taking on this role.

Reversed Charts

With the advent of the now ubiquitous Schmitt-Cassegrain telescope and its ilk, observers will be well aware that the usual form of our charts are not suitable for use at the telescope as they need to be reversed. I'm pleased to advise that Gary Poyner has been working on this by reversing many of the newer style of charts. In addition, Janet Simpson has been reversing some of the fainter binocular charts, as she uses a small SCT to observe these stars. All these reversed charts will start to appear on the web pages soon, and my thanks go to Gary and Janet for making this possible.

Sequences

For those of you who run your observations through John Saxton's software prior to submitting it, you will be aware that it generates a warning whenever the sequence has not been identified. This is usually because the new sequence has not been updated in the database or perhaps has not been entered at all.

This is something our overworked Chart Secretary has offered to do at some stage, but in the meantime I wonder if there is someone out there who might like the small challenge of updating the sequences from the last six years?

Circulars to be Prepared for Scanning

We would like to have all the old Circulars scanned and converted into PDF format, as has already been done for Circulars numbered 88 onwards. However, before this can be done we need to cut them and place them in order such that an automated scanner will scan them in the correct order. Again, I appeal for anybody who may be prepared to undertake this task to contact me at their earliest convenience.

Job Description for the Eclipsing Binary Secretary
(prepared by Tony Markham)

The EB programme was for many years somewhat different from the binocular and telescopic programmes, with charts only being available on paper, and with all observations being submitted on paper forms and sent to the EB secretary (rather than to the main secretary). Changes in recent years have seen the EB programme being halved in size (to 75 stars); EB stars and sequences being added to the VSS database so that observations can be submitted electronically; and the updating of many charts to meet current standards, at the same time as making them downloadable from the VSS web pages. Currently most active observers are visual observers, although there are a few observers who occasionally observe photoelectrically. In addition the EBs observed most each year are usually the brighter binocular variables, with telescopic observations currently being rather limited.

The main activities of the EB secretary include:

- Providing advice to VSS members about the making of EB observations
- Providing information about specific EBs
- Supplying paper charts to members; although much progress has been made in recent years, the majority of EB charts are still paper-based
- Providing predictions of eclipses for VSS Circulars, the VSS Web Pages and the BAA Handbook
- Providing comparison star information to the Chart Secretary to allow more EB charts to be redrawn to meet the current standards and subsequently be downloadable from the web pages
- Carrying out analyses of observations
- Providing light curves for VSS Circulars and for display at meetings
- Producing the planned Eclipsing Binary handbook

SUMMER BINOCULAR VARIABLES

TONY MARKHAM

Many Mira type variables reach binocular visibility during the summer months. Exact dates of maxima cannot be predicted, and peak brightness varies from one maximum to the next; average peak magnitudes are given in brackets here. In addition, whereas some show quite sharp peaks, others remain near maximum for many weeks, so don't just look for them close to the maximum dates.

July sees **RS Her** (7.9) and **U Her** (7.5) peak around mid month. **R Boo** (7.2) will also be around maximum, although predicted dates from different sources range from late June to early August! **X Oph** and **Omicron Cet** will be fading from their spring maxima. Watch out for **R Cas** and **Chi Cyg**, amongst others, rising towards their August maxima. August is a bumper month for Mira maxima, **with R Cyg** (7.5) and **S Her** (7.6) reaching maximum early in the month, **R Cas** (6.5) and **Chi Cyg** (5.1) peaking mid-month followed by **V Cas** (7.9), **W CrB** (8.5) and **S De**l (8.8) late in the month. September sees **R Aql** (6.1) due at maximum around mid-month followed by **X Cam** (8.1), **R Cnc** (6.8) and **S CrB** (7.3) late in the month. Also watch out for **T Cep**, **U Per** and **R Tri** rising towards their autumn maxima.

R Sct went through a deep minimum in late February/early March, so the next one may well occur during July. **AC Her** shows similar behaviour but with a shorter period of around 75 days. **R CrB** and **CH Cyg** are always worth checking in case they start to show unusual behaviour.

The semi-regular variables **V CVn** and **Z UMa**, though well-placed initially, become less well-placed as summer progresses. Other reliable semi-regulars become more favourable. These include **V Aql**, **AF Cyg**, **U Del**, **TX Dra**, **AH Dra**, **UW Her**, **g Her** and **W Tri**. Remember, of course, that the brightness ranges of semi-regular variables in each cycle are often somewhat lower than the catalogue ranges listed, and their periodicities are not as obvious as those of Mira type variables. Having said that, it can be particularly rewarding to catch them when they show more unusual behaviour. Recent years have seen an unusually bright maximum of **AF Cyg** plus unusually deep minima of **TU Gem**, **TV Gem**, **XY Lyr** and **BQ Ori**.

ANALYTICAL MENTORS NEEDED

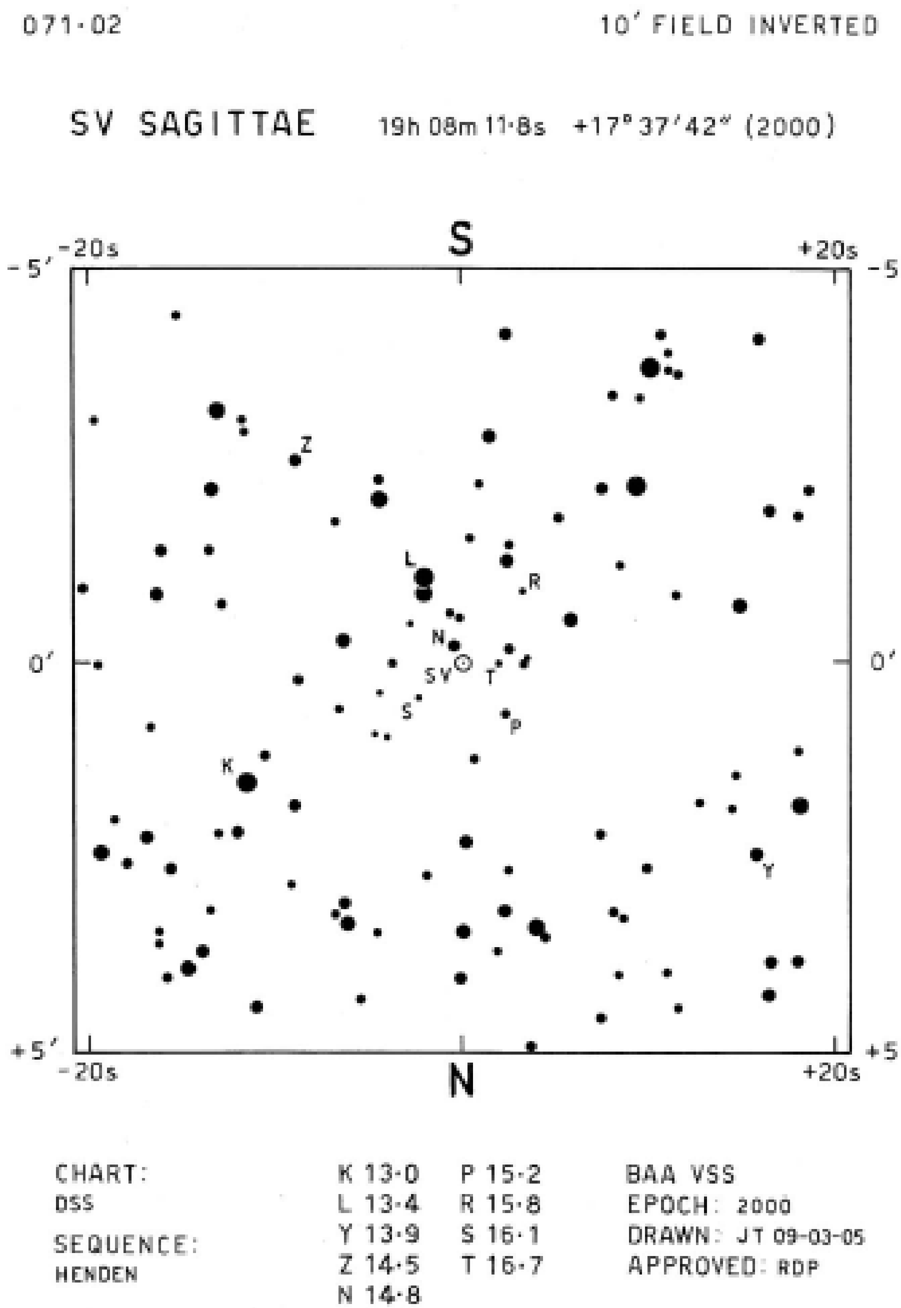
KAREN HOLLAND

Following the success of the Mentoring scheme that we set up some years ago, there are now a good number of visual and CCD mentors who offer advice and assistance to members who feel that they need help at any level.

We recently added a new category of mentor to the scheme, that of the *Analytical Mentors*. So far we have just one such mentor, but I would like to be able to offer a number of such mentors, and so would welcome volunteers who can demonstrate that they are sufficiently experienced to be able to advise others in the analysis of observations, and the subsequent preparation of the data for submission to the appropriate journal or body.

NEW CHARTS

John Toone



071·02 30′ FIELD INVERTED

SV SAGITTAE 19h 08m 11·8s +17° 37′ 42″ (2000)

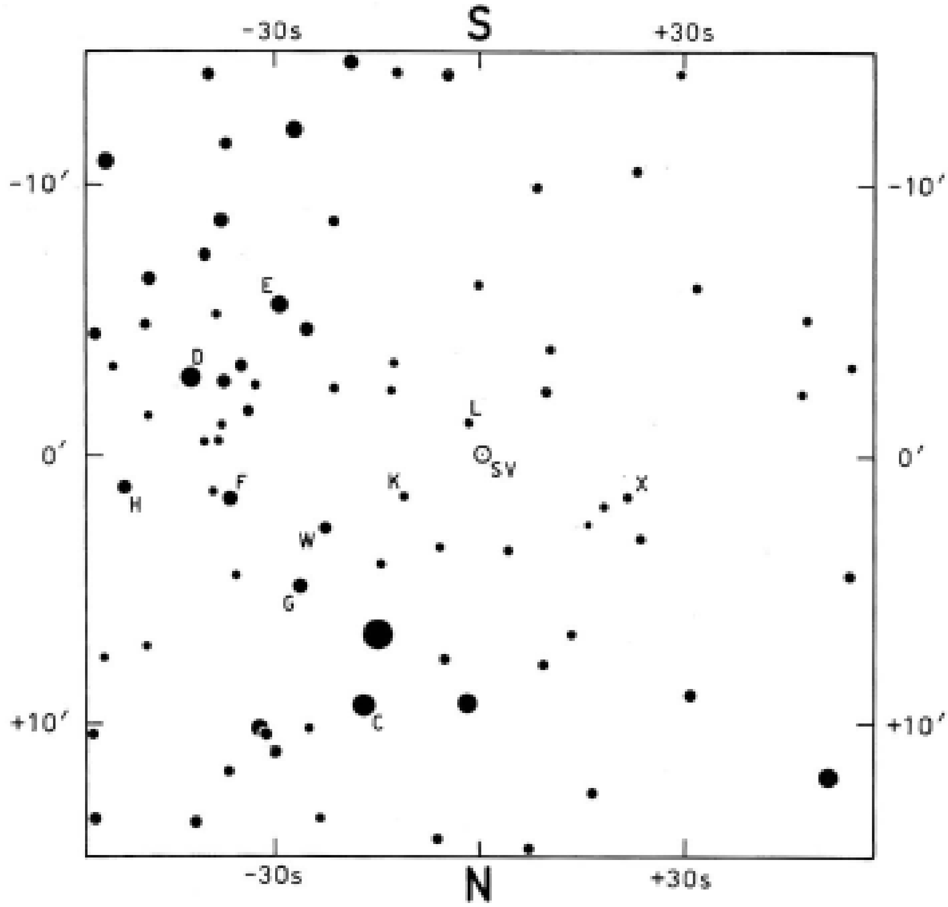


CHART: GUIDE 8	C 10·2	H 12·2	BAA VSS
	D 10·5	W 12·6	EPOCH: 2000
SEQUENCE: C–H ASAS-3, W–L HENDEN	E 10·9	X 12·9	DRAWN: JT 09-03-05
	F 11·4	K 13·0	APPROVED: RDP
	G 11·7	L 13·4	

V2576 OPHIUCHI – AN UNEXPECTED NOVA

Peter Williams

The visual discovery of a nova is a somewhat rare achievement these days. Most recent discoveries have been shared by the All Sky Automated Survey (ASAS3); the Japanese photographic and CCD searchers; and by Bill Liller who has maintained a very successful photographic survey of the southern skies over many years from Chile.

The visual discovery of Nova Ophiuchi 2006 No.2 at Heathcote, NSW, Australia, on the evening of April 6 (UT) therefore came as a surprise to most of us.

As part of my normal variable star observing routine, I have conducted a visual search for novae. This is usually carried out at the beginning of an observing session, during the final stages of dark adaption. A naked-eye search along the band of our Milky Way is followed by a search of selected areas with the 10 x 50 mm binoculars.

The naked-eye search netted V382 Vel, Nova Velorum 1999, in May of that year (VSSC 101). The binoculars have yet to catch a nova, but clouds have thwarted several close encounters.

Clearly, there are novae within reach of the visual observer who takes the opportunities presented, and, with some degree of luck, looks in the right place at the right time.

The discovery of Nova Oph 2006 No.2 resulted from a series of fortunate coincidences, commencing with pruning the gardens adjacent to my backyard observatory several weeks earlier. This regained some of my eastern and southern horizons lost during the summer months.

After several weeks of cloud and hazy conditions, the evening of April 6 was clear with the first quarter moon in Cancer. Setting up the 30 cm telescope followed the usual run of binocular variables. After checking several fields in the western sky it was apparent that the seeing conditions that night were rather poor, with only brief periods of fair seeing.

Knowing these poor conditions would severely reduce the limiting magnitude attainable, I changed from my normal observing routine. Rather than first check the usual CVs, I proceeded with a run of brighter Mira variables.

After some time I commenced checking the CVs and other unusual and peculiar stars, commencing in the western sky and slowly working towards the east.

As the evening progressed there was only a marginal improvement in the seeing conditions. It was getting late, and work the following day suggested calling an end to the night's observing. A considerable number of the available fields remained to be checked, and a decision had to be made on which stars to observe before retiring. In what turned out to be a wise choice, I decided to check a number of the RCB stars, including V517 Oph that had been active in recent years, but which I had not yet observed since end of the 2005 season.

V517 Oph is found by offsetting a little northward of a triangle of magnitude 7 stars. Although well above the horizon, this field was partially obscured through the finder scope by the nearby gardens, and totally obscured when viewed through the telescope. Pass on that one.

I noticed two other RCB stars, RT Nor and RZ Nor, were accessible through a gap between the trees. RT Nor had not experienced a deep decline since 1990 and was still at maximum near 10.5 magnitude. RZ Nor had declined in March 2005 and remained near minimum throughout the 2005 observing season. This event has continued through conjunction and it remains near minimum, at magnitude 13.5, into the current season.

Nearby, the little studied Mira star V630 Ara was also noted near maximum brightness.

These precious minutes allowed V517 Oph to rise above the tree line. Slewing the telescope from the bright triangle to a small semi circle of magnitude 10 stars adjacent to V517 Oph, the field immediately looked confused. An additional star of magnitude 10 changed this asterism to a ringlet of stars.

As this field lies relatively close to the ecliptic, my immediate thoughts were this must be an asteroid. None the less, I plotted the object on my chart and moving indoors donned a pair of sunglasses to retain some dark adaption while I checked the asteroid tables in the 2006 Year Book. Nothing was listed at this position.

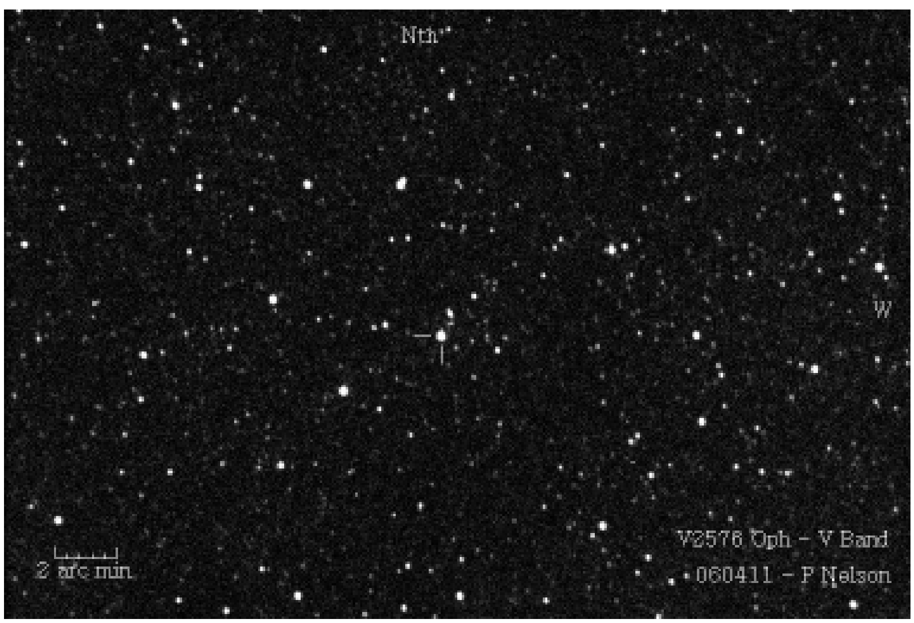


Figure 1: V-band image of V2576 Ophiuchi taken by P Nelson

Peter Williams with 30cm reflector at Heathcote NSW.

I started up the PC and checked for email reports of any newly discovered objects. Again, I found nothing. Back at the telescope, the object had shown no obvious motion, and by this stage I began wondering if this was indeed a nova.

Returning again to the PC, I made an additional check for asteroids on the Minor Planet Checker (http://scully.harvard.edu/~cgi/CheckSN) to avoid any gross embarrassment. This revealed only (9069) Hovland at magnitude 18 nearby, much too faint to be the suspect star.

With an hour now passed since first sighting the star and still no movement, an email was sent to the recently established AVSON, the Austral Variable Star Observer Network (http://groups.yahoo.com/group/AVSON/), and to the CVNET and VSNET variable star networks seeking independent confirmation of this object.

It was well after midnight as my head finally hit the pillow.

Checking emails first thing next morning showed my initially reported position was slightly in error and other observers were unable to confirm the object's existence. This could be a long day!

Rechecking my charts, I provided revised coordinates that, within minutes, brought confirmation from Bill Liller who had photographed that field the night before my observation. He noted the object was visible on his films but most likely too faint to have been noticed had the films been checked immediately.

A spectrum obtained at the Nishi-Harima Astronomical Observatory on April 7.8UT confirmed the object as a nova with prominent Balmer lines and P-Cyg profiles evident, plus other lines in absorption, features which are typical of a classical nova near maximum brightness.

The official designation V2576 Oph was assigned by the GCVS team of the Sternberg Astronomical Institute, Moscow University, and announced in IAUC8700.

At discovery on April 6.5UT, V2576 Oph was still rising towards maximum, reaching a peak visual brightness of magnitude 9.2 the following day. It remained near maximum for 6 days, then fell to magnitude 10.5 where it remained for some 10 days. The nova then dropped a full magnitude to 11.5, where it remained a further 5 days through to the time of writing. The step nature of the light curve is somewhat unusual for a nova and this object may prove an interesting target for long term monitoring.

There is no doubt that I have been lucky, but as an astronomer once said, *if you are not outside looking, you will only read about it!*

THE 2006 MARCH SUPEROUTBURST OF SDSS J080434+510349 LYN

JEREMY SHEARS

An outburst of the Dwarf Nova SDSS J080434+510349 was detected by Elena Pavlenko on 2006 March 4 at approximately 19h UT, using the 2.6 m Shain telescope at the Crimean Astrophysical Observatory. I learnt of the discovery via the VSnet-alert (message 8874) and the CBA-news groups. The latter relayed Pavlenko's original announcement:

Last night ……I found CV SDSS 080434.20+510349.2 at 4.5 mag brighter than before. Accordingly to P. Szkody [1] this object was 17.9 - 18.3, its spectroscopical period [of] 1.42 h is twice the photometrical one (42.5 min). During ~0.2-d time interval this object could display fast 0.5-mag brightening, the 42.5-min oscillations increase their amplitude from 0.05 mag to 0.2 mag! At another time this star could show no brightness oscillations. No brightenings/outbursts were known so far for this object. During this bright state over ~4 h duration the star displayed both oscillations and quiet state, and mean brightness remained stable.

Hence this appears to be the first ever recorded outburst of this star. Daisaku Nogami, from the VSnet team, pointed out that the period and sudden appearance suggested this could be a dwarf nova of the UGSU family, or even UGWZ: always an exciting prospect!

Within a few hours of the VSnet posting, I produced my own finder chart using SkyMap Pro 10, in combination with a small (5' x 5') image of the field, which I downloaded from the Downes CV Atlas [2]. I then proceeded to open up the dome at the Bunbury Observatory and set up the Takahashi FS 102 along with the Starlight Xpress SXV-M7 CCD camera. The first 60s image clearly confirmed that the star was in outburst (Figure 1 opposite):

2006 March 5.833 13.13C

My aim was to continue with time-resolved photometry; however after 1 h 55 min I was completely clouded-out, and had to close up for the night as it began to rain. This was the beginning of a prolonged spell of bad weather, so I was unable to carry out further observations of the outburst. However, analysis of the photometric data showed a single hump reminiscent of a superhump (Figure 2 opposite). The amplitude was about 0.13 magnitude.

Other observers were more successful in their observations on the same night. Pierre de Ponthiere, observing from southern Belgium [3], detected three complete superhump cycles with Psh = 0.05955 d (85.8 min) +/- 0.00015. Geir Klingenberg (Norway) [4], detected 6 consecutive superhumps with Psh = 0.0591 d. In both cases the amplitude was about 0.1 magnitude.

These results suggest that SDSS J080434+510349 Lyn is a member of the UGSU family of dwarf novae. Sadly, after the brief excitement of discovery, very few observers worldwide appear to have made follow-up observations of this star. Steve Brady (USA) reported photometry to the AAVSO on March 6, 7, 8 and 12; it was still at 13.88C on March 12.004. However, it was later reported on VSnet-alert (#8891) that Nakajima (Ja-

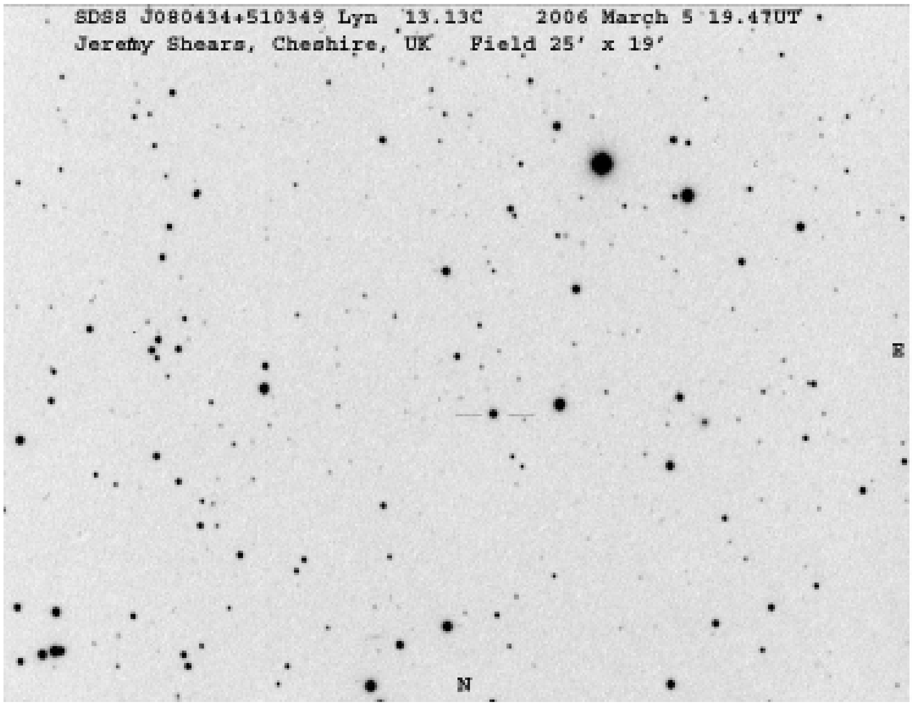


Figure 1: SDSS J080434+510349 Lyn in outburst on 2006 March 5.833
Field 25' x 19'. N at bottom, E to right.

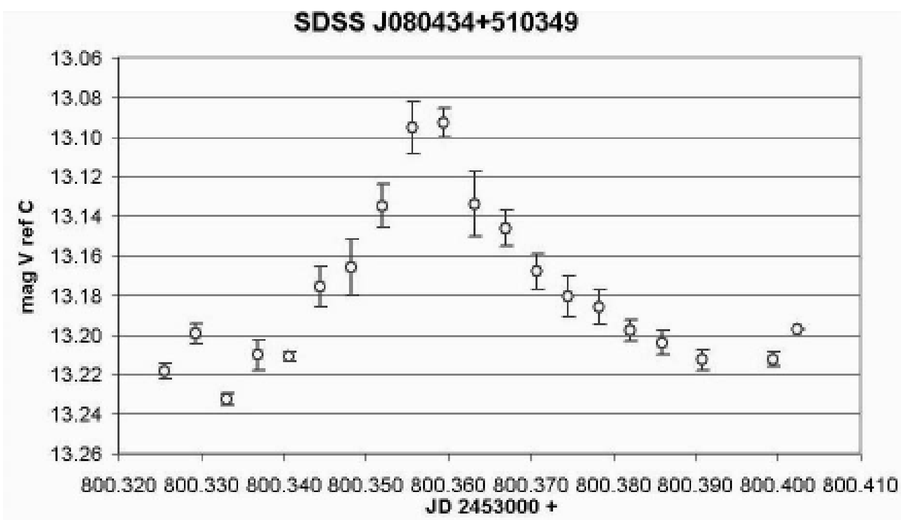


Figure 2: Light curve on 2005 March 5
Each point represents the average of 5 separate measurements made between 19.45 and 21.40UT

pan) detected several small rebrightenings (13.5-15.0) over a few days, although few details were provided. This leaves the possibility that SDSS J080434+510349 Lyn could indeed be a member of the rarer UGWZ class of dwarf novae.

References

[1] Szkody et al., AJ, 131, 973 (2006)
[2] Downes et al, http://archive.stsci.edu/prepds/cvcat/index.html
[3] http://users.skynet.be/dppobservatory/
[4] http://asp.jm-data.no/geke15obs/

JS, “Pemberton”, School Lane, Bunbury, Tarporley, Cheshire, CW6 9NR
bunburyobservatory@hotmail.com

SUMMARY OF THE CCD DATABASE MEETING 08/04/06

KAREN HOLLAND

A quick CCD Database meeting was held at Winchester, at which David Boyd, Karen Holland, Roger Pickard, Jeremy Shears, and Andrew Wilson attended.

Andy led a brief outline of ***current and future development Work***. The old CCD data had now been transferred to the new database layout, although submissions in the old format could still be accepted. The new import software was able to import a single file, or all the files within a folder, and it checked various aspects of the data during a pre-import check. It didn’t check for inconsistencies such as an observer using a different magnitude for a comparison star to that on the latest chart.

Andy commented that whilst the current database was adequate, it would fail to be sufficient once we reached a data volume of about 100 times the current volume. At this point, it would be necessary to move to alternative software such as Microsoft SQL Server. He would start to consider this.

Andy showed how his software would allow ***extraction of data from the CCD database***. Data could be selected by star, and then observer, filter, and date-type (Julian or UT). It recalculated the magnitudes where possible, allowing for a comparison star to be excluded should it be found to be a variable. It also had the ability to generate a light-curve when required. Whether a star had been used as a *check* or a *comparison* star was to be recorded, as opposed to simply that it was a *comparison* star (may be used as either a check or a comparison star). Where the observer was able to supply the error on a reference magnitude, this was to be recorded in the database. Future versions of the photometry template would incorporate this additional data in the output files for the VSS database.

It was decided that sufficient data should be recorded on ***Multi-Colour Photometry*** to allow any observations to be reconstructed at a later date if one of the comparisons was found to be a variable at a later stage. There was no decision on the data to be recorded in order to achieve this, but it was agreed that there would be future discussions to tie down precisely what data would be required. It was intended that ***PEP data*** would also eventually be added to the database.

Figure 1: Members of the CCD Database Working Party at their 'quick' meeting at Winchester (Karen not present as she is taking the image!)

Andrew said that it might be possible to make ***CCD database data available through the internet***, using the Project Quixote interface in the future. This would require additional development of the Quixote database.

A brief discussion followed on ***data security*** as observers might not wish their locations and equipment details to be available on line. It was agreed that although we would continue to store instrument information, this, together with observer location details, would not be made available through internet data access.

The ***short term priorities agreed for future development*** on the database and photometry software were agreed to be:

- Finish the data extract application
- Minor modifications to the database and associated applications
- Separately identify check and comparison stars
- Add alias tables for charts and stars
- New version of photometry spreadsheet to process AIP4WIN version 2 format files (ensemble photometry)

In ***post-meeting discussions*** subsequent to the meeting it was decided to investigate the possibility of creating a unified Visual, CCD and PEP database, and if possible amalgamate this with Quixote. Andrew Wilson thought this would be a good idea, though he advised that it would probably take one to two years to do properly.

THE TELEVUE RADIAN EYEPIECE

DES LOUGHNEY

At the May 2005 meeting of the *Astronomical Society of Edinburgh* Gary Poyner recommended that anyone wishing to look at faint objects, whether they are galaxies or stars, should consider purchasing a Radian eyepiece. With this eyepiece, he said, it is possible to see objects of magnitude 14 (with a 200 mm/ 8 inch telescope) even in an urban environment.

I wondered if this would be the case. I obtained an 8 mm Radian which gives a magnification of 125 with my 200 mm reflector. Using my old eyepieces, under the best conditions I could perhaps see stars of 12.6 magnitude. Under ordinary conditions 12.2 often seemed to be the limit. I was often straining to pick out SS Cygni at minimum.

As Gary recommended, I cleaned the primary and secondary mirrors of my reflector, and I recollimated the telescope. As he also recommended, I made a black tube to attach to the end of the telescope to keep out some stray light, and I made a black hood so that eye adaptation would not be disturbed.

I had repeated looks at three star fields to see what the Radian, under the new set of conditions, might reveal. The three fields were those around W Lyrae, RR Geminorum and 12 Comae Berenices. Although it may be obvious, I should say that it is pointless attempting to pick out faint stars unless your eyes are fully dark-adapted, and your telescope lenses/mirrors have temperature-adapted. I do not have an observatory, and my reflector has to be set up afresh for each night's series of observations. In that respect, observers with observatories have an advantage.

I quickly became aware that however good the night sky seemed from the shelter of suburban Edinburgh, with the observer enjoying a gentle breeze, strong winds aloft ruined observing faint stars. Stars of 11 or 12 magnitude became fuzzy balls, and nothing dimmer could be perceived.

On a reasonable night, I could easily see the the two 12.9 neighbours of W Lyr. I could not see a 13.45 neighbour, which I think was due to the glare from W Lyr, which at that time was around 8.8. In the RR Gem field I could pick out a 13.45 star. In the 12 Coma Ber field I could consistently see stars of 13.2, 13.45, 13.55, 13.6 (magnitudes according to StarryNight Pro), and intermittently a star of 13.7. In this last field, I think that I could have done a reasonable estimation down to 13.55 if the variable was in the same field of view as the comparison stars.

The Radian has other advantages: I can use it with spectacles. Previously, for viewing faint stars, I used my 10 mm and 5 mm eyepieces, which could not be used with spectacles, and this caused some problems because I have astigmatism. Also the Radian improves all viewing of stars under magnitude 10, because of the quality of the optics and the wide field of view. It is very comfortable to use, because even with the drive off it takes a little time for objects to move across the field of view. I think that with the Radian I will fulfill a long held ambition to follow R CrB down to a minimum, and I may be able to see Pluto.

Figure 1: The Televue Radian Eyepiece

I would say that the Radian is definitely worth buying. For me it has opened a new clutch of variables down to magnitude 13. It has made observing and estimating under magnitude 11 much easier and more reliable, and I have therefore found Gary's recommendation to be very valuable. Although I would find it hard to follow a star that varied solely between 13 and 14, I can follow down a Mira star whose minimum lies between 13 and 14.

I am now sure that I could see down to magnitude 14, if I was able to implement Gary's recommendations in full. I do not think, though, that I will be able to erect the required number of boards to block all light from street lamps and neighbouring bedroom and bathroom windows.

For the full specifications of the Radian see the Televue web site at **www.televue.com** and look at their section on eyepieces. The cost? Ordering an eyepiece from the UK, at the present time, costs just under £200 including VAT and carriage. It is possible to order one from the USA, but the carriage cost and the exchange rate would need to be checked out to establish whether a significant saving could be made.

PHOTOMETRIC STUDY OF THE V2 CEPHEID IN M13

FRANCISCO A. VIOLAT BORDONAU1,2,3, FLORENTINO SÁNCHEZ BAJO4,5 AND TONI BENNASAR ANDREU1,2

Abstract

Small amateur telescopes equipped with photometric filters and CCD cameras constitute a valuable tool for variable star research. In this regard, we have carried out a photometric campaign over three years (May 2001-November 2003), centred on the globular cluster M13 (NGC 6205). In this work, we present the results obtained from the photometric analysis of the BL Her Cepheid V2 data, that can be used to estimate the distance to M13 (8.0 kpc), as well as some physical features of the star (mean radius about 13 solar radii, effective temperature about 6630 K, and mean luminosity of 316 times the solar luminosity).

Introduction

V2 in M13 is a BL Her Cepheid discovered photographically as variable by Bailey in 1898 from Arequipa, Peru (Bailey, 1902). Barnard (1900) determined visually a period of about 5.10 days, with an amplitude of a magnitude. Designated L306 (Ludendorff, 1905), Sawyer (1942) later measured a period of 5.11003 days from analysing photographic plates. From the study of these cepheids, and others in M13, a distance of 9.2 kpc, or 30000 light-years was estimated, corresponding to a distance modulus of 14.8 (uncorrected for absorption). The period of V2 was refined by Arp (1955), which provides a value of 5.11128 days, with a photographic median absolute magnitude of -1.54. An analysis of all observations carried out by Osborn (1969) since 1900 leads to a period of 5.110939 days, showing an increase of 5.5x10-8 days/day (or 20 days per million years). Although other observers (Demers, 1971; Pike and Meston, 1977) have provided light and colour curves of V2, no attempts to refine the period were made until the work of Wehlau and Bohlender (1982), who derived a period of 5.11070 days with an increase of 18.0 ± 2.0 days per million of years, in agreement with the results of Osborn. The study of its proper motion (Cudworth and Monet, 1979), confirms that V2 indeed belongs to the globular cluster M13. A new determination of the period (Russeva and Russev, 1983), leads to a value of 5.110818 days. Although the variable has been studied in recent years (Osborn, 2000; Kopacki et al., 2003), no new period values have been calculated; in spite of that, very complete light curves in the V and Ic bands (Kopacki et al., 2003) have been obtained (displaying an amplitude of 0.870 magnitudes and a mean

[1] Asociación de Variabilistas de Espana, Apdo nº 22, E-35017 Tafira Alta, Las Palmas de Gran Canaria (Spain)
[2] Asesores Astronómicos Cacerenos, Apdo nº 409, E-10080 Cáceres (Spain), E-mail: violat@olanet.net
[3 G.R.A.V., Gruppo di Ricerca Astrofotometrica Variabilisti, www.grav.it/ (Italy)
[4] Departamento de Electrónica e Ingeniería Electromecánica, Escuela de Ingenierías Industriales, Universidad de Extremadura, Avda. de Elvas s/n, E-06071 Badajoz (Spain), E-mail: fsanbajo@unex.es
[5] Agrupación Astronómica de Cáceres, Apdo nº 153, E-10080 Cáceres (Spain)

V magnitude of 13.054). In this work, we have carried out observations of V2 with small amateur telescopes, in order to obtain its light curve and to determine the period and amplitude of the variable. The measured period has been used to calculate the distance of the cepheid (and, hence, the distance of M13), and also some physical characteristics of V2, such as its luminosity, temperature and radius, by using empirical relations.

Observations and data reduction

In this work, two Schmidt-Cassegrain MEADE telescopes with diameters of 305 and 203 mm, located in Palma de Mallorca (Islas Baleares, Spain) and Cáceres (Spain), respectively, have been used. The CCD images were obtained using a Starlight MX916 and a MX516 CCD cameras (16 bits). Although some unfiltered frames were obtained, most of the images were collected using a Johnson V filter. Subsequently, all the frames were dark and flat-field corrected. Figure 1 shows two images with the star near to its minimum and maximum brigthness. The photometric measurements were carried out on the calibrated frames using the program IRIS (Christian Buil, http://www.astrosurf.com/buil/us/iris/iris.htm), for the 2001-2002 images, and AstroArt 2.0 (MSB Software, http://www.msb_astroart.com) for the 2003 ones. The reference stars used in the measurements are labelled in figure 2. A set of 211 useful magnitude estimates were obtained along the whole campaign (133 in the period 2001-2002 and 78 in the year 2003). The analysis of the photometric data was performed by means of the programs AVE 2.5 (Rafael Barberá, Grupo de Estudios Astronómicos, G.E.A.) and ISDA (Jaan Pelt, http://www.aai.ee/~pelt/soft.htm).

Results

The analysis of our photometric data yields a period of 5.11168 ± 0.00021 days, which is in very good agreement with the results previously indicated. Figure 3 displays the light curve of V2, folded with the obtained period. In the same figure, a solid line, which represents a four harmonic model fitted to the data, is superimposed. From the best fitting model, a mean V magnitude of 13.089 ± 0.005 is obtained, also in good agreement with the literature data of Kopacki et al. (2003), 13.054, and Pike and Meston (1977), 13.10. From the model, the magnitude range is 12.683-13.545, with an amplitude of 0.862 magnitudes. This result is in excellent agreement with the value of the amplitude quoted by Kopacki et al. (2003). From the single colour-period relation (B-V)o = 0.275 + 0.206 log P (Harris, 1985), a colour index (B-V)o = 0.42 was obtained, in rough agreement with the value of 0.53 quoted by Wallerstein and Cox (1984). This colour index corresponds to an effective temperature of about 6630 K, according to the empirical relations of Flower (1996). Moreover, the period-luminosity-metallicity relation for the globular cluster cepheids with first-overtone pulsation (Nemec et al., 1994), as it is suggested for V2, leads to a mean V absolute magnitude of -1.51. Using a reddening of 0.03 for M13, and the mean V magnitude of 13.089 indicated above, we have calculated a distance of 8.0 kpc, in good agreement with the value of 7.7 kpc of Harris (1996) for the distance to M13. In this regard, from the bolometric correction of 0.015 for a colour index of 0.42 (Flower, 1996), the mean absolute bolometric magnitude of V2 is -1.49. From this value, we obtain a mean luminosity of 316 times the solar luminosity (assuming that the absolute bolometric magnitude of the sun is 4.76) for V2. This result, according to the luminosity-radius-temperature relation derived from the Stefan-Boltzmann law, leads to a mean radius for V2 of about 13 solar radii (15 ± 1 from Böhm-Vitense et al., 1974). Although these results

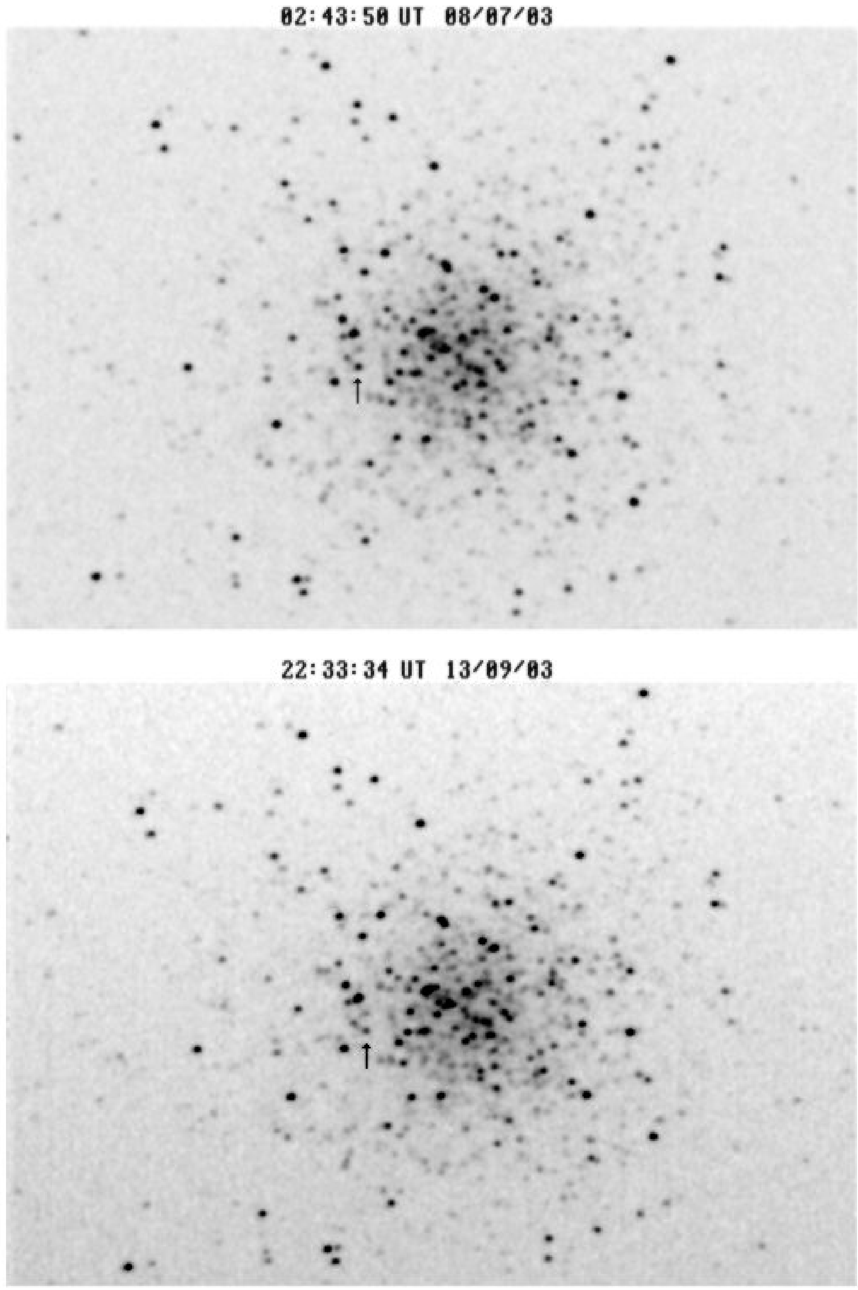


Figure 1. CCD frames of the globular cluster M13 taken with the 203 mm telescope and the Johnson V filter. The cepheid V2 is arrowed near its minimum and maximum brightness. The time exposure was 45 s. North is to the bottom and East is to the right.

must be considered with caution, owing to the uncertainties associated with the empirical relations used, they provide estimates of physical parameters of the star that are in rough agreement with the features expected for a W Virginis variable. In regard to this, the luminosity and color index of the star agrees with the results of the literature, and the estimated distance is very close to the value accepted today for M13.

Conclusions

Digital technology has opened a wide range of possibilities for the amateur astronomer. In particular, amateurs with small telescopes (20-40 cm), low-cost commercial CCD cameras, and appropriate software tools, can contribute with accurate data to the photometric study of many interesting stars, even from the polluted skies of our cities. As we have shown in this work, an amateur with modest equipment can provide results that are comparable with those obtained in professional astronomy. In our case, in spite of the relatively low apparent luminosity of the star (mV = 13), a careful analysis of the photometric data of the cepheid V2 in M13 can be used to estimate the distance to the variable, its absolute luminosity, temperature and radius. This star has been extensively studied by many authors, but there are a considerable number of variables that are relatively bright, but with poor light curves, that can be used as targets in photometry. In this way, amateur astronomers can make a valuable contribution to

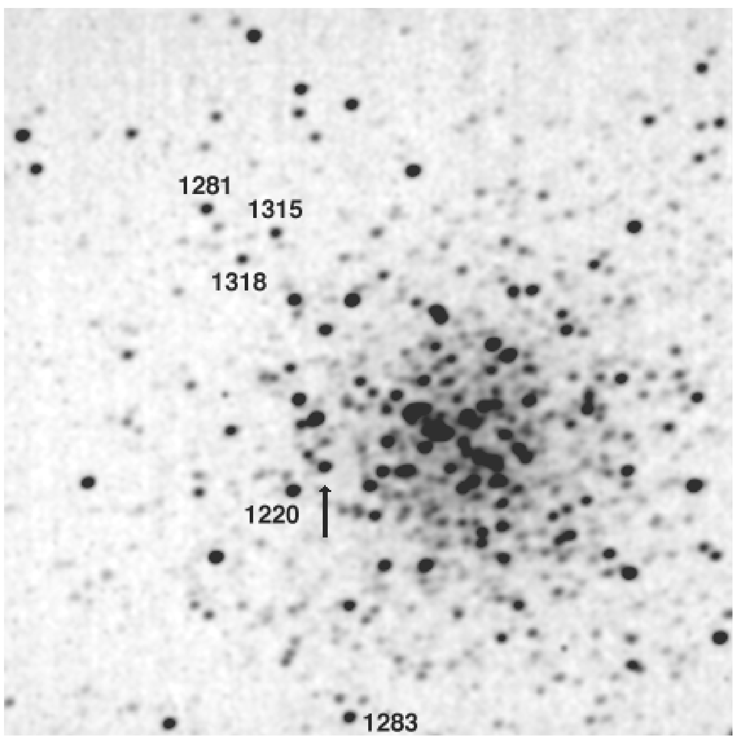


Figure 2. Reference stars used in the photometric measurements of V2, labelled along with their V standard magnitudes. The decimal points have been omitted. As in figure 1, North is to the bottom and East is to the right.

research in photometric astronomy (as, in fact, they are doing currently for many variable star types, from eclipsing binaries to long period variables).

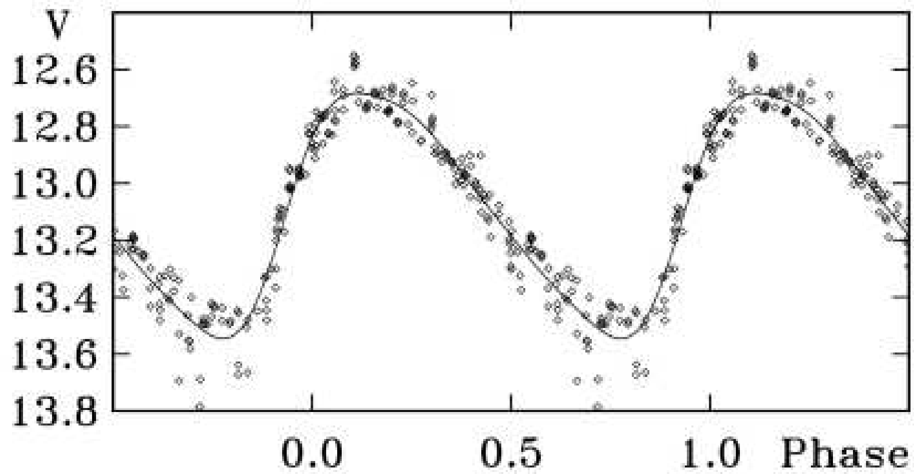


Figure 3. Light curve of V2, from the 211 observations collected in this study. Solid line is a four harmonic model fitted to the data.

Acknowledgements

We would like to thank Dr. Wayne Osborn for his assistance and guidance, and Josep M. Gómez (Grupo de Estudios Astronómicos, G.E.A) for his helpful comments which improved this study. The NASA ADS Abstract Service was used to access data and references. The observational data used in this work are available upon request to Francisco A. Violat Bordonau (violat@olanet.net).

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BINOCULAR PRIORITY LIST

MELVYN TAYLOR

Variable	Range	Type	Period	Chart
AQ And	8.0-8.9	SRC	346d	82/08/16
EG And	7.1-7.8	ZA		072.01
V Aql	6.6-8.4	SRB	353d	026.03
UU Aur	5.1-6.8	SRB	234d	230.01.
AB Aur	7.2-8.4	INA		83/10/01
V Boo	7-12	SRA	258d	037.01
RW Boo	6.4-7.9	SRB	209d	104.01
RX Boo	6.9-9.1	SRB	160d	219.01
ST Cam	6.0-8.0	SRB	300d?	111.01
XX Cam	7.3-9.7?	RCB?		068.01
X Cnc	5.6-7.5	SRB	195d	231.01
RS Cnc	5.1-7.0	SRC	120d?	84/04/12
V CVn	6.5-8.6	SRA	192d	214.01
WZ Cas	6.9-8.5	SRB	186d	82/08/16
V465 Cas	6.2-7.2	SRB	60d	233.01
γ Cas	1.6-3.0	GC		064.01
rho Cas	4.1-6.2	SRD	320d	064.01
W Cep	7.0-9.2	SRC		83/10/01
AR Cep	7.0-7.9	SRB		85/05/06
mu Cep	3.4-5.1	SRC	730d	112.01
O Cet	2.0-10.1	M	332d	039.02
R CrB	5.7-14.8	RCB		041.02
W Cyg	5.0-7.6	SRB	131d	062.1
AF Cyg	6.4-8.4	SRB	92d	232.01
CH Cyg	5.6-10.0	ZA+SR		089.02
U Del	5.6-7.5	SRB	110d?	228.01
EU Del	5.8-6.9	SRB	60d?	228.01
TX Dra	6.8-8.3	SRB	78d?	106.01
AH Dra	7.1-7.9	SRB	158d?	106.01
NQ Gem	7.4-8.0	SR+ZA	70d?	077.01
X Her	6.3-7.4	SRB	95d?	223.01
SX Her	8.0-9.2	SRD	103d	113.01
UW Her	7.8-8.7	SRB	104d	107.01
AC Her	6.8-9.0	RVA	75d	048.03
IQ Her	7.0-7.5	SRB	75d	048.03
OP Her	5.9-6.7	SRB	120d	84/04/12
R Hya	3.5-10.9	M	389d	049.01
RX Lep	5.0-7.4	SRB	60d?	110.01
SS Lep	4.8-5.1	ZA		075.01
Y Lyn	6.9-8.0	SRC	110d	229.01
SV Lyn	6.6-7.5	SRB	70d?	108.01
U Mon	5.9-7.8	RVB	91d	029.03
X Oph	5.9-9.2	M	328d	099.01
BQ Ori	6.9-8.9	SR	110d	84/04/12
AG Peg	6.0-9.4	NC		094.01.
X Per	6.0-7.0	GC+XP		84/04/08
R Sct	4.2-8.6	RVA	146d	026.03
Y Tau	6.5-9.2	SRB	242d	84/04/12
W Tri	7.5-8.8	SRC	108d	114.01
Z UMa	6.2-9.4	SRB	196d	217.01
ST UMa	6.0-7.6	SRB	110d?	102.01
VY UMa	5.9-7.0	LB		226.01
V UMi	7.2-9.1	SRB	72d	101.01
SS Vir	6.9-9.6	SRA	364d	097.01
SW Vir	6.4-7.9	SRB	150d?	098.01

ECLIPSING BINARY PREDICTIONS

TONY MARKHAM

Eclipsing Binary observing changes significantly during the summer months. Initially the nights are so short that only part of any eclipse is visible, but by the late summer whole eclipses can be observed once more. In addition the northern Milky Way constellations become better-placed bringing many popular variables back on show.

The following predictions, based on the latest Krakow elements, should be usable for observers throughout the British Isles. The times of mid-eclipse appear in parentheses, with the start and end times of visibility on either side. The times are hours UT, with a value greater than 24 indicating a time after midnight. D indicates that the eclipse starts/ends in daylight; L indicates low altitude at the start/end of the visibility; and << indicates that mid-eclipse occurred on an earlier date.

Thus, for example, on Aug 27, TV Cas D20(21)25 indicates that TV Cas will be in mid-eclipse at approx 21h UT. The start of the eclipse occurs during Daylight, but the eclipse will be observable from approx 20h UT through to the end of the eclipse at "25h" (i.e. 01h UT on Aug 28). Please contact the Eclipsing Binary secretary if you require any further explanation of the format.

The variables covered by these predictions are :

RS CVn	7.9-9.1V	Z Dra	10.8-14.1p	RW Tau	7.98-11.59V
TV Cas	7.2-8.2V	TW Dra	8.0-10.5v	HU Tau	5.92-6.70V
U CrB	7.7-8.8V	S Equ	8.0-10.08V	X Tri	8.88-11.27V
SW Cyg	9.24-11.83V	Z Per	9.7-12.4p	TX UMa	7.06-8.80V
V367 Cyg	6.7-7.6V	U Sge	6.45-9.28V	Z Vul	7.25-8.90V

Note that predictions for RZ Cas, U Cep, Beta Per and Lambda Tau can be found in the BAA Handbook.

Five long-period eclipsing variables have eclipses due during this interval. These are KL Cep (mid -clipse Jly 15), Zeta Aur (Jly 24), mu Sgr (Aug 5), BM Cas (Sep 4) and RZ Oph (Sep 12). For further details, see VSSC 114.

In addition, a primary eclipse of the recently discovered NN Del (SAO 126201) is predicted to be centred on approx 01h UT on Jun 14, followed by a secondary eclipse centered on approx 17h on Jly 2. These will be followed by a primary eclipse at approx 07h UT on Sep 21 and a secondary eclipse at approx 0h on Oct 10. Outside of eclipses, NN Del is of magnitude 8.4. Both eclipses are approx 0.5 magnitudes deep, with the primary eclipse lasting approx 17 hours, compared with approx 21 hours for the secondary eclipse.

2006 Jul 1 Sat
U Sge D22(19)25
TX UMa D22(24)26D
Z Vul D22(26)26D
2006 Jul 2 Sun
Z Dra D22(21)24
2006 Jul 3 Mon
RS CVn D22(27)26D
Z Per L22(18)23
2006 Jul 4 Tue
U CrB D22(21)26D
TX UMa D22(25)26D
U Sge 23(28)26D
2006 Jul 5 Wed
SW Cyg D22(20)26D
V367 Cyg D22(57)26D
2006 Jul 6 Thu
Z Per D22(20)25
Z Dra D22(23)26
Z Vul D22(23)26D
V367 Cyg D22(33)26D
2006 Jul 7 Fri
V367 Cyg D22(09)26D
TX UMa D22(27)26D
TV Cas 23(27)26D
2006 Jul 8 Sat
V367 Cyg D22(<<)26D
RS CVn D22(22)26D
S Equ 22(27)26D
2006 Jul 9 Sun
Z Per D22(21)26
TV Cas D22(23)26D
TW Dra D22(27)26D
2006 Jul 10 Mon
Z Dra 23(25)26D
TX UMa 23(28)26L
2006 Jul 11 Tue
U CrB D22(18)24
Z Vul D22(21)26D
U Sge D22(23)26D
2006 Jul 12 Wed
TW Dra D22(22)26D
Z Per D22(23)26D
2006 Jul 13 Thu
RW Tau L01(02)02D
2006 Jul 14 Fri
SW Cyg D22(24)26D
U CrB 23(29)26D
2006 Jul 15 Sat
Z Dra 00(03)02D
Z Per D22(24)26D
S Equ D22(24)26D
2006 Jul 18 Tue
TV Cas D22(24)26D
Z Per D22(25)26D
2006 Jul 21 Fri
X Tri 01(03)02D
Z Dra D22(22)24
U Sge D22(26)26D
U CrB D22(27)26D
Z Per 22(27)26D
2006 Jul 22 Sat
X Tri 00(03)02D
S Equ D21(21)26D
X Tri 23(26)26D
2006 Jul 23 Sun
SW Cyg D21(27)27D
TW Dra 22(27)27D
Z Vul 23(28)27D
X Tri 23(25)27D
2006 Jul 24 Mon
RW Tau L00(04)03D
V367 Cyg D21(47)27D
X Tri L22(25)27D
Z Per 23(28)27D
2006 Jul 25 Tue
V367 Cyg D21(23)27D
Z Dra D21(23)26
X Tri L22(24)26
2006 Jul 26 Wed
V367 Cyg D21(<<)27D
TW Dra D21(23)27D
X Tri L22(23)26
2006 Jul 27 Thu
RW Tau L00(<<)03D
RS CVn D21(26)25L
TV Cas 21(26)27D
X Tri L22(23)25
2006 Jul 28 Fri
Z Per 00(05)03D
SW Cyg D21(17)23
U Sge D21(20)26
U CrB D21(25)27L
Z Vul D21(26)27D
X Tri L22(22)24
2006 Jul 29 Sat
TW Dra D21(18)23
S Equ D21(18)24
TV Cas D21(21)25
X Tri L22(21)24
Z Dra 23(25)27D
2006 Jul 31 Mon
U Sge 24(29)27D
2006 Aug 1 Tue
RS CVn D21(22)25L
S Equ 23(29)27D
2006 Aug 2 Wed
SW Cyg 01(07)03D
Z Vul D21(24)27D
2006 Aug 3 Thu
Z Dra 00(03)03D
2006 Aug 4 Fri
RW Tau 01(06)03D
U CrB D21(22)26L
2006 Aug 5 Sat
Z Dra D21(20)22
TV Cas 23(27)27D
2006 Aug 6 Sun
RS CVn D21(17)23
SW Cyg D21(21)27
TW Dra 23(28)27D
RW Tau L23(24)27D
2006 Aug 7 Mon
Z Dra 02(04)03D
Z Vul D21(21)27
TV Cas D21(23)27
U Sge D21(24)27D
2006 Aug 8 Tue
S Equ D21(26)27D
2006 Aug 9 Wed
HU Tau L01(01)03D
Z Dra D21(22)24
TW Dra D21(24)27D
2006 Aug 10 Thu
TX UMa D21(19)24
2006 Aug 11 Fri
HU Tau L00(02)03D
U CrB D21(20)26L
V367 Cyg D21(62)27D
2006 Aug 12 Sat
TW Dra D21(19)24
Z Vul D21(19)25
V367 Cyg D21(38)27D
2006 Aug 13 Sun
HU Tau L00(04)03D
V367 Cyg D21(14)27D
TX UMa D21(21)24L
Z Dra 21(23)26
2006 Aug 14 Mon
V367 Cyg D21(<<)27D
U Sge D21(18)24
2006 Aug 15 Tue
TV Cas 00(05)03D
Z Vul 01(06)03D
HU Tau 01(05)03D
S Equ D20(23)27D
SW Cyg D20(24)27D
2006 Aug 16 Wed
TX UMa D20(22)24L
TV Cas D20(24)27D
2006 Aug 17 Thu
Z Vul D20(17)22
U Sge 21(27)27D
RW Tau L23(26)27D
Z Dra 23(25)27D
2006 Aug 18 Fri
U CrB D20(18)24
TV Cas D20(20)24
2006 Aug 19 Sat
TX UMa D20(24)23L
Z Vul 23(28)28D
2006 Aug 20 Sun
TX UMa L02(00)04D
Z Dra D20(18)21
RS CVn D20(26)24L
RW Tau L22(20)25
2006 Aug 21 Mon
TW Dra 00(05)04D
X Tri 03(05)04D
U CrB 23(29)25L
2006 Aug 22 Tue
Z Dra 00(03)04D
X Tri 02(05)04D
S Equ D20(20)25
TX UMa 21(25)23L
2006 Aug 23 Wed
X Tri 02(04)04D
TX UMa L02(01)04D
TW Dra D20(24)28D
2006 Aug 24 Thu
X Tri 01(03)04D
TV Cas 02(06)04D
Z Per D20(17)22
Z Dra D20(20)22
U Sge D20(21)27
Z Vul 21(26)28D
SW Cyg 22(28)28D
2006 Aug 25 Fri
X Tri 00(03)04D
RS CVn D20(21)23L

TV Cas 21(26)28D
TX UMa 22(27)23L
X Tri 24(26)28D

2006 Aug 26 Sat

S Equ 01(06)04D
TX UMa L02(03)04D
Z Dra 02(05)04D
TW Dra D20(20)25
X Tri 23(25)28D

2006 Aug 27 Sun

Z Per D20(19)24
TV Cas D20(21)25
X Tri 22(25)27

2006 Aug 28 Mon

U Sge 01(06)03L
Z Dra D20(22)24
U CrB 21(26)25L
X Tri 22(24)26
RW Tau 23(28)28D

2006 Aug 29 Tue

TX UMa L01(04)04D
S Equ D20(16)22
SW Cyg D20(17)23
Z Vul D20(24)28D
X Tri 21(23)26

2006 Aug 30 Wed

RS CVn D20(16)23
Z Per D20(20)25
V367 Cyg D20(52)28D
X Tri 20(23)25

2006 Aug 31 Thu

X Tri D20(22)24
V367 Cyg D20(28)28D
RW Tau L22(22)27

2006 Sep 1 Fri

TX UMa L01(06)04D
V367 Cyg D20(04)28D
X Tri D20(21)24
Z Dra 21(23)26
S Equ 22(27)27L

2006 Sep 2 Sat

V367 Cyg D20(<<)25
X Tri D20(21)23
Z Per D20(21)26

2006 Sep 3 Sun

SW Cyg 01(07)04D
X Tri D20(20)22
Z Vul D20(22)27
U Sge D20(25)27L
TV Cas 23(27)28D

2006 Sep 4 Mon

TW Dra 01(06)04D
X Tri D20(19)22
U CrB D20(24)24L

2006 Sep 5 Tue

X Tri D20(19)21
TV Cas D20(23)27
Z Per D20(23)28
Z Dra 23(25)28

2006 Sep 6 Wed

TW Dra 20(25)28D
HU Tau L23(20)24

2006 Sep 7 Thu

X Tri D19(17)20
TV Cas D19(18)22
SW Cyg D19(21)27

2006 Sep 8 Fri

Z Dra D19(18)21
Z Vul D19(19)25
S Equ D19(24)27L
Z Per D19(24)28D
HU Tau L23(21)25

2006 Sep 9 Sat

RW Tau 01(05)04D
TW Dra D19(21)26

2006 Sep 10 Sun

Z Dra 01(03)04D
U Sge D19(19)25
HU Tau L22(22)26

2006 Sep 11 Mon

Z Vul 01(06)03L
U CrB D19(22)24L
Z Per 21(26)28D
RW Tau L21(24)28D

2006 Sep 12 Tue

TW Dra D19(16)21
Z Dra D19(20)23
HU Tau L22(24)28

2006 Sep 13 Wed

TV Cas 00(05)04D
Z Vul D19(17)22
RS CVn 20(26)22L
U Sge 22(28)26L

2006 Sep 14 Thu

Z Dra 02(05)04D
TV Cas 20(24)28
RW Tau L21(18)23
Z Per 22(27)28D
HU Tau L22(25)28D

2006 Sep 15 Fri

S Equ D19(21)26
Z Vul 23(28)27L

2006 Sep 16 Sat

TV Cas D19(20)24
SW Cyg D19(24)28D
Z Dra 19(22)24
HU Tau 23(27)28D

2006 Sep 17 Sun

V367 Cyg 22(66)28D
Z Per 23(28)28D

2006 Sep 18 Mon

TW Dra 02(07)04D
Z Dra 04(06)04D
U CrB D19(19)23L
RS CVn D19(21)22L
V367 Cyg D19(42)29D

2006 Sep 19 Tue

HU Tau 00(04)05D
V367 Cyg D19(18)29D

2006 Sep 20 Wed

RW Tau 02(07)05D
V367 Cyg D19(<<)29D
U Sge D19(22)26L
Z Vul 21(26)26L
TW Dra 21(26)29D
Z Dra 21(24)26

2006 Sep 21 Thu

Z Per 01(06)05D
HU Tau 01(05)05D

2006 Sep 22 Fri

TV Cas 02(06)05D
X Tri 04(07)05D
TX UMa D19(17)21L
S Equ D19(18)23
RW Tau 21(26)29D

2006 Sep 23 Sat

HU Tau 03(07)05D
X Tri 04(06)05D
RS CVn D19(16)21L
TW Dra D19(22)27
TV Cas 22(26)29D

2006 Sep 24 Sun

Z Per 02(07)05D
X Tri 03(06)05D
Z Dra 23(25)28

2006 Sep 25 Mon

X Tri 02(05)05D
U CrB D19(17)23L
TX UMa D19(18)21L
TV Cas D19(21)25
Z Vul D19(24)26L
RW Tau L20(20)25
SW Cyg 22(28)29D
S Equ 23(28)26L

2006 Sep 26 Tue

X Tri 02(04)05D
TW Dra D19(17)22

2006 Sep 27 Wed

X Tri 01(03)05D
Z Per 03(08)05D
TV Cas D19(17)21
U Sge D19(17)22
Z Dra D19(18)21

2006 Sep 28 Thu

X Tri 00(03)05D
TX UMa D19(20)21L
U CrB 22(28)23L
TX UMa L23(20)24
X Tri 24(26)29

2006 Sep 29 Fri

Z Dra 01(03)05D
X Tri 23(25)28

2006 Sep 30 Sat

SW Cyg D19(18)24
Z Vul D19(22)26L
U Sge 20(26)25L
X Tri 22(25)27

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Binocular Booklet	Director or BAA Office	£2.00
CD-ROM of the last 3 items	BAA Office	£7.50

Charts are downloadable from the VSS web pages at
http://www.britastro.org/vss/chartcat/wfb.php

For more information, please visit our web pages at
http://www.britastro.org/vss

CONTRIBUTING TO THE CIRCULAR

If you would like to prepare an article for consideration for publication in a Variable Star Section Circular, please read the *Notes for Authors*, published on the web pages at **http://www.britastro.org/vss/circs.htm**, or reproduced in full in VSSC127 p 24.

If you are unsure if the material is of a suitable level or content, then please contact the editor for advice.

The **deadline for contributions** to the next issue of VSSC (number 129) will be 7th August, 2006. All articles should be sent to the editor (details are given on the back of this issue)

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SECTION OFFICERS

Director
Roger D Pickard
3 The Birches, Shobdon, Leominster,
Herefordshire HR6 9NG
Tel: 01568 708136
Email: rdp@star.ukc.ac.uk

Secretary
Clive Beech
14 Warren Park, Woolwell, Plymouth,
Devon PL6 7QR
Tel: 01752 211799
Email: clive.beech@blueyonder.co.uk

Chart Secretary
John Toone
Hillside View, 17 Ashdale Road,
Cressage, Shrewsbury, SY5 6DT.
Tel: 01952 510794
Email: EnootnhoJ@aol.com

Binocular Secretary
Melvyn Taylor
17 Cross Lane, Wakefield,
West Yorks WF2 8DA
Tel: 01924374651
Email: melvyn.taylor@breathemail.net

Nova/Supernova Secretary
Guy M Hurst
16 Westminster Close, Basingstoke,
Hants, RG22 4PP
Tel& Fax: 01256 471074
Email: Guy@tahq.demon.co.uk

Eclipsing Binary Secretary
Tony Markham
20 Hillside Drive, Leek,
Staffs ST13 8JQ
Tel: 01538 381174
Email: tonymarkham@compuserve.com

Database Secretary
Andy Wilson
67 Ringden Avenue, Paddock Wood, Tonbride
Kent TN12 6EF
Tel: 01892 832 693
Email: andyjwilson_uk@hotmail.com

Recurrent Objects Co-ordinator
Gary Poyner
67 Ellerton Road, Kingstanding,
Birmingham, B44 0QE.
Tel: 0121 6053716
Email: garypoyner@blueyonder.co.uk

CCD Advisor
Richard Miles
Grange Cottage,Golden Hill, Stourton Caundle,
Dorset, DT10 2JP
Tel: 01963 364651
Email: rmiles.btee@btinternet.com

Circulars Editor
Karen Holland
136 Northampton Lane North, Moulton,
Northampton, NN3 7QW
Tel: 01604 671373 Fax: 01604 671570
Email: karen.holland@xcam.co.uk

Webmaster
Callum Potter
The Cottage, Bredon’s Hardwick, Tewkesbury,
Glos., GL20 7EE, UK.
Tel: 01684 773256
Email: callum.potter@gmail.com

TELEPHONE ALERT NUMBERS

Nova and Supernova discoveries

First telephone the Nova/Supernova Secretary. If only answering machine response, leave a message and then try the following: Denis Buczynski 01524 68530, Glyn Marsh 01772 690502, or Martin Mobberley 01284 828431.

Variable Star Alerts Telephone Gary Poyner (see above for number)