British Astronomical Association

VARIABLE STAR SECTION CIRCULAR

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Contents

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

NEW CHARTS

John Toone

249·01 10′ FIELD INVERTED

V1316 CYGNI 20h12m13·7s +42°45′51″(2000)

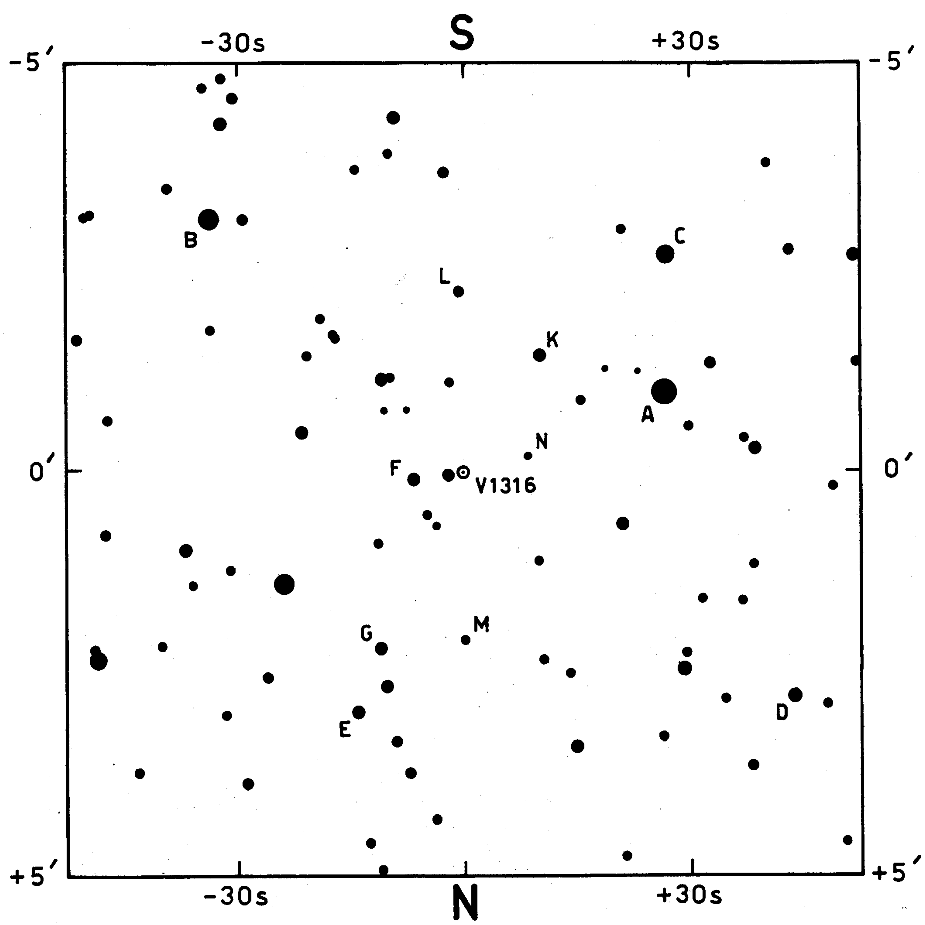


CHART:
FROM POSS PLATE

SEQUENCE:
A.HENDEN

A 11·5	G 14·3
B 12·4	K 15·1
C 13·1	L 15·7
D 13·3	M 16·1
E 13·8	N 16·6
F 14·1	

BAA VSS
EPOCH: 2000
DRAWN: JT 12-11-00
APPROVED: RDP

FROM THE DIRECTOR

ROGER PICKARD

John Hosty

It is with considerable sadness that Guy Hurst has reported that John Hosty passed away in Huddersfield Royal Infirmary on May 13th. He was just 51. Many of you will know that John was best known as the only member of the UK Nova/Supernova Patrol who discovered a nova visually; this was **Nova Sagitta** in 1977.

Guy also adds the following note: "however, less well known, is the remarkable support he gave to so many people who were starting out, especially in nova hunting. It was his enthusiasm that passed to so many astronomers, and persuaded them also to search the heavens. He was a great admirer of George Alcock, and it is indeed sad that we have lost two great observers in so short a period".

Dave McAdam

Firstly, I know all members will be delighted to know that at the February BAA Council meeting, Dave McAdam was awarded the Merlin Medal and gift, for his services to astronomy. This will be presented to Dave at the BAA Exhibition Meeting on July 7th, and I hope that many of you will be able to attend this meeting to see him receive the medal. The award is made in recognition of a notable contribution to the advancement of astronomy; I gave a few details of Dave's outstanding contribution in the last Circular.

Database

Dave has not quite handed over the database to John Saxton at the time of writing, as he has been tying up some loose ends, and completing the database to the end of 2000. However, it is probable that as you read this, John Saxton will already have started to get to grips with it, so please keep those observations coming in.

Campaign to Monitor SU UMa (also see Darren Baskill's article on page 8)

In March 2001, the Director received a request from Darren Baskill of Leicester University X-ray Astronomy Group, for the VSS to monitor the dwarf nova **SU UMa.** This is part of a campaign, in which Darren is the Principal Investigator using the NASA X-Ray satellite RXTE. He requested that observations be made as often as possible throughout the period under investigation, which runs from March to late June 2001. The satellite looks at SU UMa twice a day, and the idea behind the proposal is to monitor, on long time scales, how the x-ray flux varies with the optical. The Director contacted those observers who had previously had observations entered into the database, and a number of them have been submitting observations on a regular basis. If any other observers managed to make observations of this star (either visually or with a CCD and V filter), which they have not yet reported to the Director, I shall be pleased to receive them. Similarly, it is still worth attempting to observe SU UMa until the end of June.

Further details of this project can be obtained from Darren Baskill's home page at **http://www.star.le.ac.uk/~dbl** and a graph of visual and X-ray plots can be viewed at **http://www.star.le.ac.uk/~dbl/suuma.gif.**

U Gem

Many of you will probably be aware that **U Gem** went into outburst at the end of April, some 202 days since the start of its previous outburst, which is about twice the recognised outburst cycle length. Intensive coverage of this star is now underway worldwide, not just as part of Bill Worraker's campaign to monitor these stars, but by professionals at many other wavelengths. It will be interesting to report back in the next Circular just what may have been discovered from such intensive observation. But please note, it was amateur visual observations which sparked this monitoring in the first place.

BAA VARIABLE STAR SECTION MEETING 2001

ROGER PICKARD AND DENIS BUCZYNSKI

The BAA is to hold a weekend meeting at Alston Residential Hall, near Preston in Lancashire, under the theme *'Variable Star Astronomy - an Observational Perspective'*. Alston Hall is a large Victorian country residence situated in the Ribble valley in rural Lancashire, and is operated by Lancashire County Council for Adult education courses. Adjacent to the Hall are the University of Central Lancashire's Observatories and Lecture/Labs. On this site, and available for use, are the Grubb 15 inch double refractor and two 30cm Meade Schmidt Cassegrains. The meeting will run from Friday 5th October 19.00UT, and will end at 16.00 UT on Sunday 7th October. The Hall has residential accommodation for up to 40 persons and for a further 30 day visitors. The cost for the whole residential weekend, including all meals (breakfasts, lunches, evening meals, plus teas and coffees throughout the day) is approximately 100 pounds, with day visitors paying a pro rata amount. Further details should be obtained from, and bookings made directly through the Hall using the form enclosed with this circular.

The meeting is to have three main components:

- A series of lectures by professionals working in the field of variable stars, including one lecture by Professor Gordon Bromage, Director of the Centre for Astrophysics at UCL (Flare Stars); one lecture by Dr Maurizio Salaris, Liverpool John Moores University (RR Lyrae and Cepheid stars), one lecture by Dr Keith Robinson, UCL (Symbiotic stars) and two lectures by Dr Allan Chapman, University of Oxford (The History of Variable Star Astronomy) 2 lectures.
- A BAA VSS workshop session covering data analysis, chart and sequences and CCD observing techniques.
- A weekend-long display of poster papers related to current observations, programmes and results, plus equipment, such as portable telescopes, computer and software etc. bought along by participants.

BAA VSS members are cordially invited, and further details will be announced in due course. Anyone wishing to attend should contact Alston Hall directly on 01772 784661 and send a deposit of 20 pounds to secure a place. Could you also let me (Denis) know as well, either by e-mailing me at denis@cb978iau.demon.co.uk, or by phone in the evening on 01524 68530.

OBSERVING U GEM TO THE LIMIT

John Toone

The 2000/2001 apparition of **U Gem** began and ended with consecutive *Long* outbursts and no intervening *Short* outburst. The interval between these outbursts was exceptionally long at 202 days (nearly twice the average period of 105 days), and readers might be wondering if this is a record for this star. The answer is that it falls well short of the record, by more than 50 days in fact.

Although uncommon, consecutive *Long* outbursts have been observed by the VSS on 8 previous occasions since records began back in 1904. All of these consecutive *Long* outbursts have had lengthy intervening periods in excess of 135 days. A close check of the records reveals that the 1928/1929 apparition produced two *Long* outbursts in succession on the 18th September 1928 and 1st June 1929, with a record intervening period of 255 days. This is how the event was reported in the BAA Journal, Volume 45, No 1 (November 1934) by the future VSS Director W. M. Lindley:

"The outstanding event documented by these observations has been the occurrence of a Long maximum on 1929 June 1, 255 days after the Long of 1928 September 18, and without the least chance of an intervening rise having remained undetected. This is interesting for two reasons. Firstly, although two consecutive Long maxima may have been observed before, this appears to be the first quite definite case. Secondly, the longest interval between successive rises actually observed previous to this, and without resorting to any hypothesis, is 137 days, so that the 255 days here recorded show an interval almost twice as long as any before. The above facts, the evidence for which was examined particularly carefully in view of their exceptional character, are fully established by our observations alone, except for a fortnight's gap at the end of, and immediately following the 1928 September Long, which however, is closed by AAVSO and AFOEV observations; in addition these confirm in every way that no rise can have escaped unnoticed during the remainder of the period".

The 1929 outburst began on the 28th May and was followed by R. G. Chandra and P. M. Ryves in trying conditions (twilight) until 6th June, just long enough to establish beyond doubt, that it was a *Long*. This demonstrates the merit of observing non red stars into twilight and extending their apparitions for as long as possible. For U Gem this means observers should try to pick up the field as early as possible in August and follow it into June. Chandra and Ryves did not have to contend with the levels of light pollution that we have today, but on the other hand the larger apertures now available can potentially compensate to a degree. Unobstructed north eastern and north western horizons are the most important factors though. With U Gem having risen at the end of April 2001, and if the next outburst is close to the average period of 105 days, then it could rise again during August. What an incentive this is to see how early observers can pick up the field in the 2001/2002 apparition.

Without the determined efforts of Chandra and Ryves observing U Gem to the limit in 1929, our knowledge of this important star's behaviour would be much less complete, and we could now be heralding the 2000/2001 apparition as one of record breaking proportions.

RECURRENT OBJECTS NEWS

GARY POYNER

RZ Leo

An extremely rare outburst of this Recurrent Objects Programme star was detected by Australian observer Rod Stubbings on December 20.662 UT at mv=12.1, and confirmed by P.A. Dubovsky on Dec 21.062 UT at mv=12.2. One has to go back to March 10th 1989 for the last confirmed outburst (Namuri, mv=13.8). The ROP database records two other confirmed outbursts and one unconfirmed:

1984	December 29	mv=12.9	(Ducoty)
1987	November 27	mv=12.3	(Lubbock)
1990	October 27	mv=12.8	(Dyck - unconfirmed)

Vsnet-Alert 5447 includes further possible sightings:

1935	March 25th	12:p	uncertain, see IBVS 2714
1952	April 17	13?p	uncertain, see IBVS 2714
1976	March 3	13:p	uncertain, see IBVS 2714
1988	April 20	13.8v	Miroyama (single sighting)

Unlike previous outbursts, the December 2000 event was intensely monitored by both amateur and professional CCD photometry, which resulted in new information being revealed on this exciting system.

RZ Leo has, for some time, been a suspected member of the rare WZ Sge class of Dwarf Novae, and observers eagerly awaited the results of early photometric runs, which predictions indicated would show early superhumps as seen in other WZ Sge stars during the initial stages of an outburst, developing into fully grown superhumps as the outburst evolved.

T. Vanmunster (CBA Belgium) reported the detection of 0.20 magnitude amplitude superhumps on December 21st (1). Tonny’s findings were confirmed very soon afterwards by the Kyoto team, who reported small amplitude (0.18) superhumps on December 22nd, and a preliminary superhump period of 0.079 days (2), which was later refined to 0.0786 days (3) using combined data from several sources. Fully grown “true” superhumps were observed by the Kyoto team on December 23rd, revealing an amplitude of 0.3 magnitude, and a 6% longer period (0.0808 days) than the early superhumps (4). These true superhumps eventually reached 0.4 magnitude amplitude.

The outburst lasted 17 days, and was detected at maximum brightness. By December 26th the magnitude had fallen to visual magnitude 13.3, just six days after detection. The fade then slowed down somewhat, so that by January 4th, RZ Leo had faded to visual magnitude 14.4. A rapid fading then set in, in which a 1.4 magnitude fade was observed in just under two days (see Fig. 1).

Fig. 1 Light curve of 2000/2001 outburst (Source VSNET/TA/BAAVSS)

For the complete story of the outburst, including superhump profiles and photometric tables, visit the VSNET pages dedicated to the outburst at
www.kusastro.kyoto-u.ac.jp/vsnet/DNe/rzleo.html

1: VSNET-Alert 5446
2: VSNET-Campaign 598
3: VSNET-Campaign 640
4: VSNET-Alert 5455

V1413 Aql: An Eclipsing Symbiotic Star

V1413 Aql (AS 338 & Hen 1737) is an eclipsing symbiotic system located at 19h 03m 46.8s +16° 26' 19" (2000.0). The maximum and minimum magnitudes are listed as 10.6-15.1V, and the eclipse period is 434.1 days. Several outbursts have been recorded, most notably by Munari and Yudin (IAUC 5884 1993, Oct 28), in that the magnitude of V1413 Aql had risen from 13.0V in 1990 to 11.2 in 1993, and the most recent by John Bortle who reported an increase in brightness from magnitude 13.0v in Dec 1994, to 11.2v in February 1995.

The eclipsing and outbursting nature of this object was first noted by M. Wakuda, and reported in VSOLJ bulletin 5, 17, 1988 (1). He gave the following eclipse ephemeris:

$$\text{Min} = \text{JD } 2445784 + 434\ E$$

Further analysis by U.Munari (2) gave the following revised eclipse ephemeris:

$$\text{Min} = \text{JD } \underset{\pm 15}{2446650} + \underset{\pm 0.2}{434.1}\ E$$

Munari concluded from optical and UV spectroscopy and photometry that V1413 Aql was composed of an M5 star and a very hot compact star, resulting in a symbiotic nova-type thermonuclear runaway, without a detectable mass ejection (2).

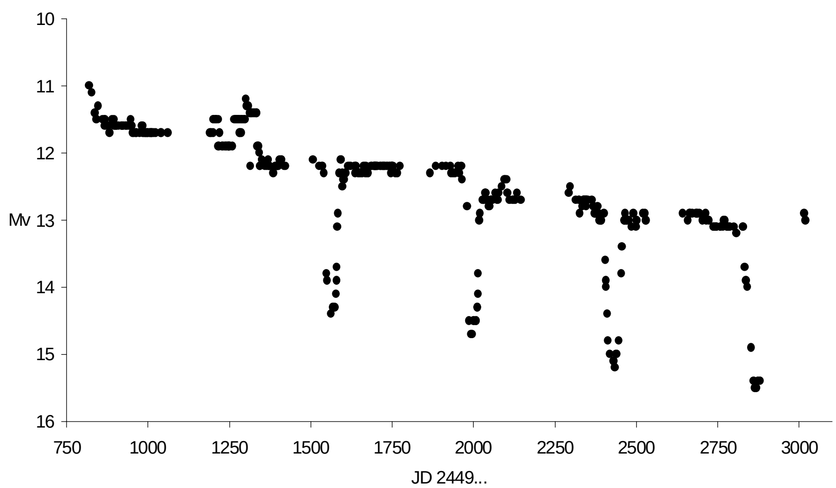


Figure 1: Light curve of V1413 Aql 1995-2001

I began to monitor V1413 Aql following Bortle's outburst announcement in 1995. Unfortunately for me, the next eclipse occurred during February 1996, when the field is extremely difficult for me to observe because of local obstructions. Eclipses were observed however in 1997, 1998, 1999 and 2000 (Fig. 1). What is also apparent from the light curve is that V1413 Aql has been showing a very slow intrinsic fade since the 1995 outburst - some two magnitudes over the five year period, with a very brief outburst to magnitude 11.2 in the Summer of 1996.

The eclipses themselves are interesting to follow. Figure 2 shows the 1999 eclipse in some detail. According to my visual observations, the eclipse lasted a total of 71 days. Eclipse ingress took 22 days, and the egress 28 days; 21 days were spent in eclipse. The depth of the eclipse is just over 2 magnitudes deep. However, the intrinsic brightness of V1413 Aql dictates how easy the eclipses are to follow. The 1997 eclipse, for example, dropped from magnitude 12.3-14.4, and was fairly easy to observe even with a 22cm telescope. The 1999 eclipse, however, faded from 13.0-15.2, and needed a larger telescope to confidently follow the whole eclipse event. Future eclipses will become increasingly difficult to observe, if the system continues to follow the slow fading trend it has displayed over the past five years. To make matters worse, there is a close field star near to V1413 Aql at magnitude 13.2. The closeness of this star can cause problems when estimating the brightness of V1413 Aql with small telescopes around the 12.5-13.5 magnitude range.

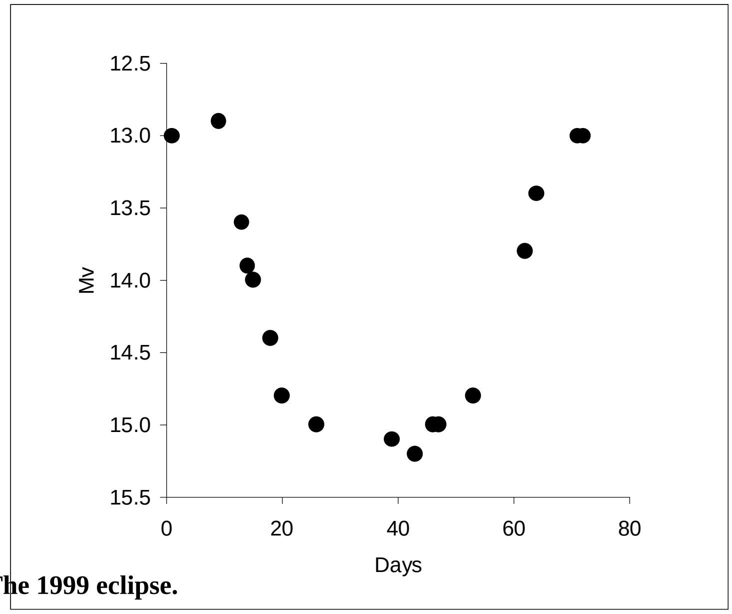


Fig. 2 The 1999 eclipse.

The eclipse of Autumn/Winter 2000 turned out to be somewhat of a disappointment for me personally. V1413 Aql duly began its eclipse ingress during mid October, fading from 13.1 on the 11th to 15.4 by November 12th (see Fig.2). By December the system was ready to egress. I was hopeful of observing the rise to maximum brightness, despite its poor location in the SW during evening. However disaster struck on December 12th, when an electrical fault in my telescope heater caused a small fire, and damaged the 40cm reflector beyond repair (this has now been replaced with a 46cm). Poor weather following this prevented me from observing the rise with my 22cm reflector, so the whole event was missed. The next eclipse is due towards the end of December 2001, with mid eclipse occurring in January 2002, which means observations will be very sparse.

Unfortunately, V1413 Aql is not on the BAAVSS telescopic programme, so a VSS chart does not exist. There is a TA 'C' chart (dated 941126), but this is only a preliminary sequence with a limit of 14.3, which is fine for most of the time, but not for monitoring eclipses. I have been using a VSNET chart with V magnitude values since 1995, and find this to be most suitable. I have placed a copy of the VSNET chart and sequence, along with a finder chart for downloading on my web pages: **http://members.aol.com/GaryPoyner/ V1413Aql_charts.html)**

V1413 Aql offers a rare chance to observe an eclipse in a symbiotic system, and over a fairly long period in time. The fading of the system over recent years also offers the observer the opportunity to monitor the long-term intrinsic magnitude variations. All in all, this is a most interesting star to add to one's observing programme.

1: Kato. T. vsnet-alert Apr 11, 1997
2: Astronomy & Astrophysics. 257, 163, 1992)

CAMPAIGN ON SU UMA

DARREN BASKILL

It is over 150 years since the first dwarf nova was discovered, so you might expect us to know all there is to know about these fascinating objects, but history has taught us that the universe does not give up its secrets quite so easily. It took another 40 years to discover the second dwarf nova, and the fact that dwarf novae are actually binary star systems was only proven in 1974 (although it was hypothesised 20 years previously).

We now know that dwarf novae consist of a white dwarf star tearing material away from a red dwarf secondary star. Once the material falls into the realm of the white dwarf, it forms a disc one hundred times larger than the white dwarf itself, and the stolen stellar material falls through this disc and onto the white dwarf surface. The luminosity of the disc, which dominates our optical view of dwarf novae, is dependent upon the rate at which mass falls though the disc. As the stellar material eventually plummets into the white dwarf, at a rate of the order of a million, million tonnes every second, X-rays are produced.

One complication is caused by sudden avalanches of material falling through the disc, caused by some unknown instability. Usually the disc is in a faint quiescent state, but an avalanche can cause the disc to increase in brightness by over 100 fold - an optical outburst. Once this wave has passed through the disc and onto the white dwarf, the X-ray output also varies.

This is where the problems begin! X-ray telescopes are expensive, having to be space-borne to avoid the 10 centimetres of air that is enough to extinguish 90% of typical X-rays. Such telescopes are only built if there is a large demand for them from astronomers, which there is. In an ideal world, we would constantly watch how the X-rays vary from a dwarf nova. Instead we have brief snap-shots to allow as many astronomers to use the telescopes as possible.

The problem this causes is best described by example. Take the dwarf novae SS Cygni and Z Camelopardalis, both of which are fortunate to have been observed twice with the Japanese X-ray satellite ASCA. When Z Cam was optically faint it was X-ray bright, and when Z Cam entered an optical outburst, the X-rays were suppressed. SS Cyg, however, displayed completely the opposite behaviour! This also demonstrates how vitally important amateur observations are; we would not know about this strange behaviour if it was not for the correlation of the X-ray data with the amateur optical data.

One solution to this problem is to observe as many dwarf novae as possible in both optical outburst and quiescence. To do this you have to catch an outburst! This is where, yet again, the contributions from amateurs are vital. A lucky few astronomers are permitted *Target-Of-Opportunity* requests, allowing astronomers to interrupt the current observation and to quickly reposition the orbiting telescope to acquire a new target. Such requests are almost always prompted by amateur observations, and are a race against time! Astronomers prefer to catch the X-ray behaviour before the outburst wave reaches the inner disc, which occurs within a day of the initial optical outburst!

But are all outbursts the same? If one optical outburst suppresses the X-rays, can we really expect the following outburst to do exactly the same? Do the X-ray intensities vary in tune with the optical? The only way we can answer these questions is through an X-ray telescope that is dedicated to long-term observations; that satellite is NASA's Rossi X-ray Timing

Explorer (RXTE).

I, along with colleagues at the X-ray Astronomy Group at the University of Leicester, have been granted a three-month monitoring campaign with RXTE from March through to June 2001, to observe one of the brightest (in X-rays), and most frequently outbursting dwarf nova - **SU Ursae Majoris.** Optical data is crucial for this monitoring campaign, and we are working alongside the American Association of Variable Star Observers, the Centre for Backyard Astrophysics and, of course, the BAA Variable Star Section.

Extracting the large amount of new science from this data is an exciting project. For example, one part of the analysis will involve timing the delay between the optical outburst and the X-ray reaction. This delay is the time taken for the material to travel from the originating site of the outburst in the disc to the white dwarf at the centre. And this delay tells us from what point in the disc the avalanche originated. Thus, the RXTE monitoring campaign will help us answer the questions "Are all outbursts the same?" and "Do the outbursts originate in the same place?" This goes to show that every single optical observation made by an amateur is vital; one observation could help to constrain this delay, leading to a more confident conclusion.

So, thanks to the assistance of amateur astronomers world-wide, the future of dwarf novae research promises to be exciting. No doubt, that for every question answered, new unknowns will arise.

For more details about the ongoing RXTE SU UMa campaign, visit:
http://www.star.le.ac.uk/~dbl

LETTER TO THE EDITOR

This letter (e-mail) was received from **Peter Williams in Heathcote, New South Wales, Australia,** on 26 March, 2001, and was directed to both the chart secretary and the circulars editor.

I continue to receive the BAA VSS Circulars for which I again would like to thank you both. These are most enjoyable and interesting for me, although most of the stars mentioned are a little too far north from my southerly location. I can, however, certainly feel the positive 'vibes' coming from the Section. It's great!

Within VSSC107 (page 9) is the article 'Foster Carers Wanted for Celestial Orphans' by Chris Jones. This, I found of particular interest, as I have for a number of years been caring for several southern orphans in much the way suggested by Chris. John, I think I mentioned this during your visit down under when we met at Ilford several years ago. This Foster Care is now starting to show some rewards.

HDE331015 Ara. (V871 Ara)
This star was noted as variable by Paul Camilleri during his nova searches, but was never officially mentioned by him. A visual study over several years showed it to be an EA type eclipsing binary, whose elements have been determined as 2450311.9775+9.4169895 days. This was summarised on VSNET, and the star has now received the designation V871 Ara in the 75th Name List. Results are expected to appear shortly in the VSS RASNZ Publications.

Theta Apodis.
This bright, but neglected, semi regular was investigated recently and it was shown that the GCVS period is slightly in error. The results were published in the VSS RASNZ Publications No.24 (2000) showing a revised epoch for maxima of 2449588+115.93 days.

NSV4189 Hydrae.
Results show that this is a large amplitude Mira type star, whose elements are 2450190 +448.0 days. This also appeared in Publ.24 of the VSS RASNZ.

NSV1710 Eridani (EO Eri).
Observations have shown that this is a typical single wave Mira star. The earlier suggestion of a double wave maximum, as seen in R Cen, was not confirmed. Epoch for maximum light is 2448597+447.5 days. These results were summarised on VSNET and submitted in October 2000 but are yet to appear in the VSS RASNZ Publ.

NSV4721 Velorum.
This appears to be an interesting multi-wave, multi period, large amplitude red variable, wherein a relation seems to exist between the observed amplitude and the period. Further long term observations may provide some interesting results. A summary appeared on VSNET, and a paper was submitted to the VSS RASNZ December 2000.

The following stars are still under investigation to determine a preliminary period and epoch for maximum brightness. Some are known variables, but they apparently have had no period yet determined. Preliminary periods are indicated here:

***X Muscae**: this appears to be a red variable of period near 250 days.*
***NSV5087** Carinae: a period near 275 days seems likely for this large amplitude red variable.*
***NSV4223** Pyxidis: this appears to be a large amplitude Mira star of period near 325 days.*
***YY Centauri**:a Mira star of period near 366.53 days.*
***SW Horologii:** a Mira star of period near 276.5 days.*
***ST Reticuli**: a Mira star of period near 274.4 days.*
***IY Carinae**: a Mira star of period near 285.0 days.*
***WY Pyxidis (NSV4154):** a Mira star of period near 285 days.*

I have about another dozen or so similar stars also under regular observation, or recently added to my working list about which data is rather scant. Brief papers on the above stars will be prepared progressively (in no set order) as I feel comfortable with the data.

This is, of course, in addition to my regular programme stars with the VSS RASNZ and the several observations per month is not a large additional work load at the telescope.

I guess this merely confirms the message given by Chris Jones, and while certainly not as exciting as CVs and related stars, it is useful data obtained with minimal effort - and a lot of fun!

V854 CASSIOPEIAE

Chris Jones

On New Years Eve 1995 Mike Collins reported his discovery of an apparent variable in the course of his work for the UK Nova/Supernova Patrol. The object had appeared bright during mid November 1995, and at three other epochs, which initially suggested a period of around 334 days.

The object was assigned the TA query number 1996/002, and was subsequently designated as **TASV J2352+665**. Further research identified the object with the IRAS source **IRAS 23496+6618**. An analysis of the star appeared in The Astronomer (1) during 1996, and further refined the light ephemeris to JDmax=2447697.03+332.05 E, as well as giving a preliminary finder chart.

Lennart Dahlmark subsequently reported (2) that an inspection of nineteen plate pairs, exposed between 1967 and 1982, plus forty-four exposed between 1985 and 1996, yielded 64 magnitude estimates. Analysis of these indicated that the period was increasing, such that images taken between 1970-79 are consistent with a period of 328 days; images from 1979-88 give a period of 330 days and those from 1988-1996 a period of 332 days. Dahlmark also reported that the range of the star was 11.3 - 14.6 (photographic) with a colour index of 2.1, and identified the star as a Mira type variable.

In April 2000 the object appeared in the 75th name list of the GCVS3 as V854 Cassiopeiae, identified as a Mira with a range 11.3 to 14.6 (no period was given). This object is well placed for observers from the UK, being circumpolar located 8° North of Beta Cassiopeiae, and the same distance West of Iota Cephei. At maximum V854 Cas is bright enough to be seen with relatively small instruments.

The author has observed this object since late 1998; this has been sufficient to obtain visual observations through two complete cycles. Figure 1 shows the resulting light curve.

Fourier analysis of the 26 positive estimates made by Collins over 12 cycles (since 1988) yields a highest power period of 331.6 days, consistent with the overall period found by Dahlmark and Collins previously. A similar analysis of the 44 visual estimates made over just two cycles yields, not surprisingly, two periods of almost equal power - 328.4 days and 340.91 days. Little credence should be placed on this however, due to the brevity of the coverage (just two cycles) and the fact that the data derives from a single observer. Combining the visual data with the photographic yields a highest power period of 330.69 days.

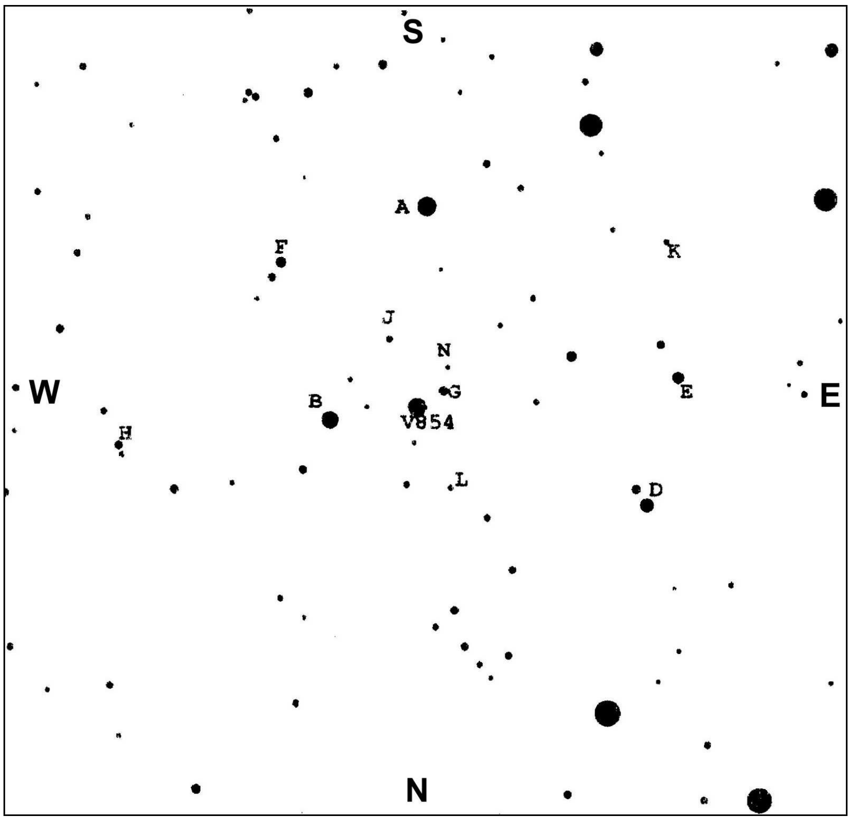
The observed visual magnitude range is 11.9 to 15.8, in keeping with the range found by Collins and Dahlmark, once the colour index is taken into consideration. A revised and extended sequence based on the GSC was produced by TA and is reproduced in the chart printed overleaf.

Why V854 Cassiopeiae deserves more observation.
The lengthening of the period reported by Dahlmark deserves further investigation. It is a phenomenon that has been reported in other Mira stars, but which remains only poorly understood. The key to the determination of the period is, obviously, the accurate

(C)

V854 Cassiopeiae

RA 23h 52 12s DEC +66 35.0' (2000)
RA 23h 49 41s DEC +66 18.3' (1950)
Magn: 11.3 - 14.3V
Type: Mira



Sequence: Guide Star Catalog with visual checks by Chris Jones.

A 9.5
B 9.8
D 10.6
E 11.1 K 13.4
F 11.6 L 13.8
G 12.1 N 14.3

Chart Supplied by Guy Hurst, TA

Chart: Chris Jones
30'x30'
(b) 960114
(c) by CJ adopted 010315

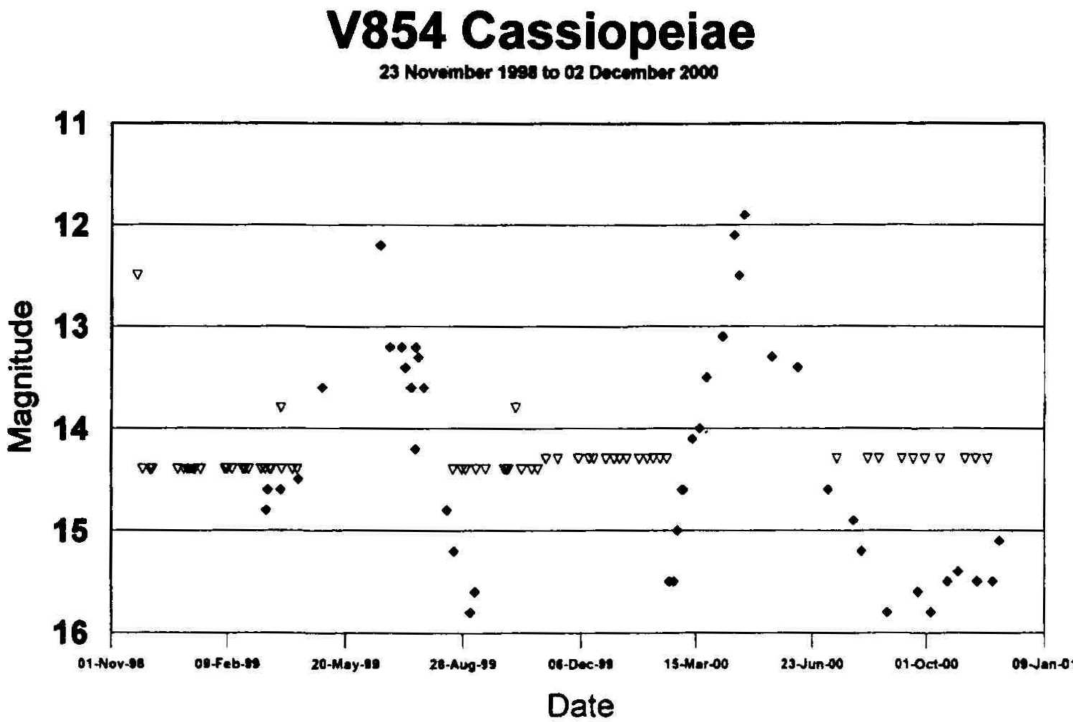


Figure 1 - Light curve for V854 Cas

determination of the time of maximum. Observers are encouraged to observe this object throughout the spring and into the early summer in order to provide a good coverage of the time of maximum.

This year maximum fell during mid/late April with the variable then in the North-western sky at sunset. V854 Cas is still available for observation, although it is now quite low in the Northwest. It can be found relatively easily between the bright constellations of Cassiopeia and Cepheus.
At maximum V854 Cas exceeded magnitude 13 (although as with any Mira there is always a degree of uncertainty), and it should still be within the reach of the, oft mentioned, 6" reflector.

Anybody wanting further information on Mike Collins' discoveries can find more on the TA Website at
http://www.demon.co.uk/astronomer/mikes_variables.html.

When he's not worrying about faint Mira's, Chris can be reached at cpj@cix.co.uk or 29, Buller Road, Laindon, Essex SS15 6BA and would welcome any observations, thoughts or comments on this and other Mike Collins stars.

1 The Astronomer, Vol 33, No387, p67 (1996 July)2

THE 2000 MEETING OF THE VARIABLE STAR SECTION (CONTINUED)

TRISTRAM BRELSTAFF

The last talk before the tea break was by **Albert Zijlstra** of UMIST (University of Manchester Institute of Science and Technology) who spoke on ***The Mira and Semiregular Period-Luminosity Relations***. However, he started off by talking first about planetary nebulae. Planetary nebulae have masses of about 0.2 solar masses, and are expanding at a velocity of about 25 kms^{-1}. Their central stars are hot white dwarfs of around 1 solar mass. If you run their evolution back in time, the nebula falls back on to the central star, and you get something that looks very like a Mira star.

Mira stars are pulsating red giants with periods of 200-500 days, and amplitudes of greater than 2.5 magnitudes. Closely related to them are the OH/IR stars which have periods of 700-3000 days, and are only visible in the infra-red. There are also the semiregular (SR) variables, which can be split into two groups: the SRA stars which are really just Mira stars with amplitudes of less than 2.5 magnitudes, and the SRB stars, which also have small amplitudes but are more irregular. The following evolutionary sequence has been proposed:

SR -> Mira -> OH/IR -> Planetary Nebula

Miras are very strange objects; they can vary by up to 10 magnitudes within one year. Their spectra show bands of vanadium oxide and titanium oxide. Titanium oxide is actually used in sun-creams to block sunlight, and the large amplitudes of Miras are mainly due to them periodically ‘putting sun-cream on’ to prevent visible light from getting out. However, infra-red radiation is not blocked by titanium oxide, and so the infra-red amplitudes of Miras are much smaller. “Miras are pretenders - they are not as variable as they seem in visible light.”

The pulsations of Miras are sound waves which move out through the star, reach the surface and then move back in again. The bigger and more luminous the star is, the longer the sound wave takes to do this. The Mira period-luminosity (PL) relation was discovered in 1982 for Miras in the Large Magellanic Cloud (LMC), and is valid for periods of less than 400 days. The relationship is narrow and well-defined, which is odd because modelling suggests that Miras should be evolving across the line of the relation, and so the relation should be broad and ill-defined. However, we do see stars evolving towards the relation; these are SR stars evolving along a separate brighter PL relation known as the Whitelock track.

The local Mira stars within our own Galaxy were shown, from HIPPARCOS data a few years ago, to also fit the LMC PL relation. The local Mira star, R Doradus has been seen to switch back and forth between two periods, one of which fits the LMC Mira PL relation, and another which fits the Whitelock SR PL relation. This is rather hard to reconcile with the idea that SR stars evolve into Mira stars. Possibly there are two distinct types of SR star: the pre-Miras which are less luminous and less evolved, and the Miras with overtone pulsations, and these two types just happen to be at the same place in the period-luminosity diagram.

There is also a suggestion of an intermediate sequence between the Whitelock SR and LMC Mira PL relationships. However, the evidence for this is uncertain, and it may just be due to stars being assigned incorrect periods or to a systematic bias in distances derived from uncertain parallaxes.

Miras are not as regular as we tend to think they are. In the short-term, their light-curves do not repeat perfectly from one cycle to the next. There is even some evidence for changes of a magnitude or more within a few hours or days (possibly the result of the rapid formation of titanium oxide). In the long-term, the amplitude of **V Boo** has declined since 1925; the period of **R Hya** decreased to 1949 but has been steady since then; the period of **W Hya** fluctuates, and the period of **Chi Cyg** has been slowly increasing (in line with expected evolutionary changes) over the past couple of centuries.

The outer layers of a Mira move out at about 20kms^{-1} and then move back in again, but not quite as much material moves back as moved out, and some is lost as a stellar wind. The expected velocity of this wind, 20kms^{-1}, is about the same as the expansion velocity of planetary nebulae, suggesting that nebulae may be generated by winds from their central stars when they are in their Mira phase. Stronger pulsations would be expected to produce stronger stellar winds, and so more mass would go into the into the nebula. Long-term variations in the pulsations of Miras should therefore produce variations in the density of the nebula. Are there any signs of this in the planetary nebulae that we can observe? Yes there are, for example, in the spherical halo of **NGC 7027** there are rings which could be the result of episodic mass loss. The Egg Nebula also shows such rings. There is even a suggestion of rings in the IRAS images of the nebula around **R Doradus.**

There is still further work to be done on analysing the long-term light-curves of Miras for period variations, and on looking into historical records for SR stars that used to be Miras. Also, the reality of the intermediate PL sequence needs confirming.

In the question session, John Howarth asked if there was any explanation for why, in multiply periodic stars, the longer period was often about 10 times the short one. Albert said that where the ratio P1/P2 was 1.7-1.9 this was understood as being due to overtone pulsation. Maybe these could interact to produce the longer periods. However, we really need more evidence to establish the existence of the very long periods.

After the tea break, **Tonny Vanmunster** spoke on ***An Amateur Robotic Telescope for Variable Star Observing***. Since 1996, Tonny has been operating his own robotic observatory and has accumulated more than 82000 CCD images, and more than 77 days of operation in total (far longer than the CCDs expected lifetime!). He submits his results to the CBA (Center for Backyard Astrophysics), which is a network of amateur and professional CCD observers coordinated by Joe Patterson of Columbia University, New York.

Tonny's observatory, known as 'CBA Belgium', has a roll-off roof and holds a Celestron-14 telescope equipped with an ST7 CCD camera. In the observatory he has a PC which he uses to control the telescope and the CCD. This PC is connected to his home PC which he uses to reduce the data (in almost real-time), analyse the results, monitor the scope, monitor sky conditions, and connect to the internet. Tonny has also installed software which allows him to operate either PC from the other one.

A typical observing session starts with an e-mail request from Joe Patterson for observations of a particular star. Tonny goes to the observatory, boots up the PC, starts Guide 7.0 and connects to the telescope. He then starts MIPS, an image processing program, and compares the CCD image with the chart. He checks the photometric suitability of the sky, selects a guide star for the telescope, and then starts his exposure program, which then takes images at regular intervals through the night.

Tonny then goes back into his house where he starts a program on his home PC to monitor the sky conditions. This program will raise an alarm if a certain number of consecutive blank images are recorded. He uses another program to postion the telescope at the end of the run so that it doesn't end up pointing at the Sun.

Tonny also uses his image processing software to inspect the recorded images, and to produce preliminary light-curves before the end of the night. However, he always sends his images in to the CBA for further analysis and eventual publication. He showed some of his results for the X-ray binary **RX J0909.8+1849**. These images revealed, for the first time, that this system undergoes deep eclipses.

In answer to a question from John Wall, Tonny said that mechanical problems prevented him from automating the closing down at the end of an observing session. To another questioner he said that he had not had any problems with the German mount near the meridian; the autoguider compensates for this. He also said that he kept a library of dark frames which he re-did every few months and, in response to Norman Walker's query, he said that his CCD was temperature controlled.

The next talk was ***X-ray Transients and Microquasars*** by **Dr Sylvain Chaty** of the Open University. Microquasars are black hole X-ray binaries with relativistic jets. They are small-scale analogues of quasars. The first one was dicovered near the centre of our own galaxy in 1992.

In quasars, such as the one at the centre of M87, the black hole has the mass of several billion suns, and is surrounded by an accretion disc fed by material from the host galaxy. Quasar accretion discs are heated to several thousand degrees, and emit strongly at visual and ultra-violet wavelengths. The relativistic jets in quasars can be millions of parsecs long. In microquasars the black hole is only several solar masses, and the accretion disc is fed by material from a companion star in a binary system. Microquasar discs are heated to several million degrees and emit strongly in X-rays. The jets of microquasars are only a few parsecs long. Because of the difference in scale, variations that would take place on a timescale of thousands of years in quasars, take place in minutes in microquasars. This makes them a lot more convenient to observe.

GRS 1915+10.5 is a microquasar at a distance of about 12.5 kpc near the centre of our galaxy. It is a strong, highly variable X-ray source. In radio wavelengths it shows jets exhibiting superluminal ejection (1.25c). The connection between accretion and ejection in this object has been studied by Mirabel, Dhawan, Chaty et al. (Astronomy & Astrophysics, vol 330, pp L9-L12, 1998). The ejection events seem to occur semiperiodically. Each event starts with a drop in the X-rays which is followed, a few tens of minutes later, by a rise in the infra-red. The X-rays return, the infra-red starts to fade and the radio emission increases, peaking a few tens of minutes later. The initial drop in X-rays is interpreted as being due to the inner, X-ray emitting, part of the disc falling into the black hole. Soon afterwards a dense cloud is ejected in the jet. Initially this cloud is so dense that it emits only infra-red synchrotron radiation, but, as it moves further out, it disperses and starts to emit at longer (radio) wavelengths instead. The return of the X-rays is thought to be due to the disc material moving in and reforming the X-ray emitting inner part.

Studies have also been carried out on how the outer ends of microquasar jets interact with the interstellar environment. A VLA radio image of the **1E1740.7-2942** shows two elongated radio lobes, each several parsecs long, where the jets interact with the interstellar medium. In addition, a VLA radio image of **W50**, the nebula around **SS 433** appears to contain helical trails left by precessing jets (it is still undecided whether the central object in SS 433 is a neutron star or a black hole). In **GRS 1915+10.5** there are two IRAS sources symmetrically placed on opposite sides, apparently aligned with the jets; but it is not yet clear, whether these are really due to the jets or not.

Dr Chaty then went on to describe some work he had done with Carol Haswell (also of the Open University) on the soft X-ray transient source **XTE J1859+226**. In 70% of X-ray transients the central source is thought to be a black hole. XTE J1859+226 is normally at magnitude 23, but in October 1999 it rose to magnitude 15. CCD observations were made at Keele and by various amateurs. A search for periodicities with the Nordic Optical Telescope revealed a period of 24 minutes, and work is in progress on a possible cause. Observations obtained with the Hubble Space Telescope and the UK Infra-red Telescope have allowed modelling of the disc during outburst.

The day was rounded off with a series of short talks each lasting only 5 minutes.

First, Melvyn Taylor showed some visual observations he had made of **W UMa** during February and March 2000. Combining them into a phase diagram gave a minimum at about phase 0.04 relative to the elements in the Krakow Yearbook.

Gary Poyner then talked about the Z And star **V1413 Aql** that was due to eclipse in November 2000. He reported that it was currently near maximum at magnitude 13.3, but would soon fade by about 2 magnitudes. The eclipses last about 71days, with a totally eclipsed duration of about 21days.

Next, Joel Minois of the AFOEV and SAF (Society Astronomique de France) publicised a meeting that the SAF were planning to hold at Fleurance in south-west France on 16th-18th August 2001.

Peter Moreton then described a CCD camera he was building that he hoped to be offering at about 600 GBP within a month. The CCD camera was a clone of the “Audine” camera that is available in France. More details can be found at **www.rockinghaminstruments.com.**

The VSS director, Roger Pickard, then announced that the next VSS meeting would be held at Alston Hall, Preston on 5th - 7th October 2001. It was being organised by Denis Buczynski. The cost for the weekend, including accommodation and all meals, would be about 100 GBP per person. Finally, Roger closed the meeting by thanking Cyril Sampson for supplying the refreshments, Bob Marriott for helping organising the meeting, and all the speakers.

ECLIPSING BINARY PREDICTIONS

TONY MARKHAM

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 GMAT (UT-12h). D and L are used to indicate where daylight and low altitude respectively prevent part of the eclipse from being visible. The variables (charts available on BAAVSS web page) covered by these predictions are :

Star	Mag Range	Star	Mag Range	Star	Mag Range
RZ Cas	6.18 - 7.72 V	S Equ	8.0 - 10.08 V	U Sge	6.45 - 9.28 V
U Cep	6.75 - 9.24 V	RW Gem	9.53 - 11.76 V	HU Tau	5.9 - 6.7 V
SS Cet	9.4 - 13.0 v	V640 Ori	11.2 - 13.5 p	RW Tau	7.98 - 11.59 V
SW Cyg	9.24 - 11.83 V	Z Per	9.7 - 12.4 p	X Tri	8.88 - 11.27 V
Z Dra	10.8 - 14.1 p	ST Per	9.52 - 11.40 V	TX UMa	7.06 - 8.80 V
TW Dra	8.0 - 10.5 v	Y Psc	9.44 - 12.23 V	Z Vul	7.25 - 8.90 V

2001 Jul 1 Sun
Z Per 10(15)14D
ST Per L11(12)14D
U Sge 12(18)14D

2001 Jul 2 Mon
Y Psc L11(12)14D
TW Dra 13(18)14D
Z Dra 13(16)14D
X Tri 14(16)14D

2001 Jul 3 Tue
Z Vul D10(13)14D
X Tri 13(16)14D

2001 Jul 4 Wed
RZ Cas D10(09)11
U Cep 11(15)14D
Z Per 12(17)14D
X Tri 12(15)14D

2001 Jul 5 Thu
Z Dra D10(09)11
TW Dra D10(13)14D
RZ Cas 11(14)14D
X Tri 12(14)14D
RW Tau L13(16)14D

2001 Jul 6 Fri
S Equ D10(15)14D
Y Psc L11(07)11
SW Cyg 11(17)14D
X Tri L11(14)14D

2001 Jul 7 Sat
X Tri L11(13)14D
Z Per 13(18)14D

2001 Jul 8 Sun
TW Dra D10(08)13
Z Vul D10(11)14D
U Sge D10(12)14D
X Tri L11(12)14D
RW Tau L13(11)14D

2001 Jul 9 Mon
Z Dra D10(11)13
U Cep 10(15)14D
ST Per L11(11)14D
X Tri L11(12)14

2001 Jul 10 Tue
RZ Cas D10(08)11
X Tri L11(11)13

2001 Jul 11 Wed
SW Cyg D10(07)13
RZ Cas 11(13)14D
X Tri L11(10)13

2001 Jul 12 Thu
X Tri L11(09)12

2001 Jul 13 Fri
Z Vul D10(09)14D
S Equ D10(12)14D
Z Dra 10(12)14D
X Tri L11(09)11
SS Cet L14(18)14D

2001 Jul 14 Sat
U Cep 10(15)14D
ST Per 14(18)14D

2001 Jul 15 Sun
U Sge D10(07)12

2001 Jul 16 Mon
RZ Cas D10(08)10
RW Tau 13(18)14D
TW Dra 13(18)14D
SS Cet L14(17)14D

2001 Jul 17 Tue
RZ Cas 10(12)14D
ST Per L10(09)13
Y Psc L10(14)14D
Z Dra 12(14)14D

2001 Jul 18 Wed
Z Vul D10(07)12
U Sge 10(16)14D

2001 Jul 19 Thu
TW Dra D10(14)14D
U Cep D10(14)14D
RW Tau L13(12)14D
SS Cet L14(17)14D

2001 Jul 20 Fri
Z Dra D10(07)10
S Equ D10(09)14
SW Cyg D10(11)14D
Z Vul 13(18)14D

2001 Jul 21 Sat
Y Psc L10(08)13
Z Dra 13(16)14D

2001 Jul 22 Sun
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TW Dra D09(09)14
ST Per 12(16)14D
SS Cet L14(16)14D

2001 Jul 23 Mon
Z Vul D09(05)10
TX UMa D09(06)11
RZ Cas 10(12)14
S Equ 14(19)15D

2001 Jul 24 Tue
Z Dra D09(09)11
U Cep D09(14)15D
RZ Cas 14(17)15D

2001 Jul 25 Wed
TW Dra D09(05)10

U Sge D09(10)15D
ST Per L10(08)12
Z Vul 10(16)15D
SS Cet L13(16)15D

2001 Jul 26 Thu

TX UMa D09(07)12

2001 Jul 27 Fri

S Equ D09(06)11

2001 Jul 28 Sat

Z Dra D09(11)13
SS Cet L13(15)15D
U Sge 14(19)15D

2001 Jul 29 Sun

TX UMa D09(09)13L
RZ Cas D09(11)14
U Cep D09(14)15D
SW Cyg D09(14)15D

2001 Jul 30 Mon

Z Vul D09(14)15D
S Equ 11(16)15D
ST Per 11(15)15D
RW Tau L12(14)15D
RZ Cas 14(16)15D
TW Dra 14(19)15D

2001 Jul 31 Tue

SS Cet L13(14)15D

2001 Aug 1 Wed

U Sge D09(04)10
Z Per D09(05)10
TX UMa D09(10)13L
Z Dra 10(13)15D
Y Psc 11(15)15D

2001 Aug 2 Thu

ST Per L09(07)11
TW Dra 10(15)15D
RW Tau L12(09)13

2001 Aug 3 Fri

SW Cyg D09(04)10
U Cep D09(13)15D
SS Cet L13(14)15D

2001 Aug 4 Sat

Z Per D09(06)11
RZ Cas D09(11)13
Z Vul D09(11)15D
TX UMa D09(12)12L
U Sge D09(13)15D
HU Tau L13(10)14
X Tri 15(17)15D

2001 Aug 5 Sun

Y Psc D09(10)14
TW Dra D09(10)15D
Z Dra 12(14)15D
RZ Cas 13(15)15D
X Tri 14(16)15D

2001 Aug 6 Mon

S Equ D09(13)15D
SS Cet L13(13)15D
HU Tau L13(12)15D
X Tri 13(16)15D

2001 Aug 7 Tue

Z Per D09(07)12
TX UMa D09(13)12L
ST Per 10(14)15D
SW Cyg 11(18)15D
X Tri 13(15)15D
TX UMa L15(13)15D

2001 Aug 8 Wed

TW Dra D09(05)10
Z Dra D09(07)10
U Cep D09(13)15D
X Tri 12(14)15D
HU Tau L13(13)15D

2001 Aug 9 Thu

Z Vul D09(09)15
X Tri 11(14)15D
SS Cet L12(12)15D
Z Dra 14(16)15D

2001 Aug 10 Fri

ST Per D09(05)09
Z Per D09(09)14
RZ Cas D09(10)13
TX UMa 10(15)12L
X Tri 10(13)15D
RW Tau 11(16)15D
HU Tau L12(14)15D
RW Gem L14(17)15D
TX UMa L15(15)15D

2001 Aug 11 Sat

U Sge D09(08)13
X Tri 10(12)15
RZ Cas 12(15)15D
Z Vul 15(20)15D

2001 Aug 12 Sun

SW Cyg D09(07)13
Z Dra D09(09)12
X Tri 09(12)14
SS Cet L12(12)15D
HU Tau L12(16)15D

2001 Aug 13 Mon

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U Cep D09(13)15D
X Tri L09(11)13
RW Tau L11(10)15
TX UMa 12(17)12L
RW Gem L13(14)15D
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TW Dra 15(20)15D

2001 Aug 14 Tue

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U Sge 11(17)15D
HU Tau 13(17)15D

2001 Aug 15 Wed

ST Per D08(12)15D
X Tri L09(10)12
SS Cet L12(11)15D

2001 Aug 16 Thu

RZ Cas D08(10)12
Z Per D08(11)15D
Z Dra 08(11)13
X Tri L09(09)11
TW Dra 10(15)15D
Y Psc 12(17)15D
Z Vul 13(18)15D
RW Gem L13(11)15D
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HU Tau 14(18)15D

2001 Aug 17 Fri

X Tri L09(08)11
RZ Cas 12(14)15D

2001 Aug 18 Sat

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SS Cet L12(11)15

2001 Aug 19 Sun

Z Vul D08(05)10
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X Tri L09(07)09
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2001 Aug 20 Mon

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ST Per 15(20)16D

2001 Aug 21 Tue

SW Cyg D08(11)16D
U Sge D08(11)16D
Z Vul 11(16)16D
SS Cet L12(10)15
RW Tau 13(18)16D

2001 Aug 22 Wed

TW Dra D08(06)11
RZ Cas D08(09)11
Z Per 09(14)16D

2001 Aug 23 Thu

Z Dra D08(06)08
ST Per D08(11)15
U Cep D08(12)16D
RZ Cas 11(14)16D
S Equ 12(17)16D

2001 Aug 24 Fri

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SS Cet L11(09)14
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2001 Aug 25 Sat

Z Per 11(16)16D

2001 Aug 26 Sun

Z Vul 08(14)16D

2001 Aug 27 Mon

S Equ D08(04)09
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SS Cet L11(09)13

2001 Aug 28 Tue

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ST Per 14(18)16D

2001 Aug 29 Wed

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2001 Aug 30 Thu

SW Cyg 08(14)16D
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2001 Aug 31 Fri

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ST Per D08(10)14
Z Vul D08(12)16L
U Sge 09(15)15L
Z Per 13(18)16D
Y Psc 14(18)16D

2001 Sep 1 Sat

RW Tau 15(20)16D
Z Dra 15(18)16D

2001 Sep 2 Sun

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TW Dra D08(12)16D
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RW Gem L12(15)16D

2001 Sep 3 Mon

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2001 Sep 4 Tue

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RZ Cas 10(13)15

2001 Sep 5 Wed

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2001 Sep 6 Thu

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2001 Sep 7 Fri

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2001 Sep 8 Sat

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2001 Sep 9 Sun

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2001 Sep 10 Mon

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2001 Sep 11 Tue

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2001 Sep 12 Wed

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2001 Sep 13 Thu

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2001 Sep 14 Fri

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HU Tau L10(13)16D

2001 Sep 15 Sat

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Z Dra D07(08)10
X Tri 09(12)14
RW Tau 11(16)16D
Y Psc 15(20)16D

2001 Sep 16 Sun

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TW Dra 07(12)16D
X Tri 09(11)14
RZ Cas 09(11)14
HU Tau 11(15)16D
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S Equ 13(19)14L
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2001 Sep 17 Mon

U Cep D07(10)15
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X Tri 08(10)13
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SW Cyg 15(21)16D

2001 Sep 18 Tue

X Tri 07(10)12
RW Tau L09(10)15
HU Tau 12(16)17D

2001 Sep 19 Wed

Z Per D07(02)07
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X Tri D07(09)11
Z Dra D07(09)12
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TX UMa L12(11)15
RW Gem 15(20)17D

2001 Sep 20 Thu

Z Vul D07(03)08
S Equ D07(05)11
X Tri D07(08)11
HU Tau 13(17)17D
Z Dra 16(18)17D

2001 Sep 21 Fri

RZ Cas D07(06)09
X Tri D07(08)10
RW Tau L08(05)09
ST Per 10(14)17D

2001 Sep 22 Sat

TW Dra D07(03)08
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X Tri D07(07)09
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SW Cyg D07(11)17D
TX UMa 08(12)09L
RZ Cas 08(11)13
Z Vul 08(14)14L
RW Gem 12(17)17D
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HU Tau 15(19)17D

2001 Sep 23 Sun

X Tri D07(06)09
Y Psc D07(08)13
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RZ Cas 13(16)17D

2001 Sep 24 Mon

X Tri D07(06)08
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U Sge D07(07)12
HU Tau 16(20)17D

2001 Sep 25 Tue

X Tri D07(05)07
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RW Gem L11(14)17D
TX UMa L12(14)17D

2001 Sep 26 Wed

X Tri D07(04)07
RW Tau 13(18)17D

2001 Sep 27 Thu

S Equ D07(02)08
Y Psc D07(03)07
RZ Cas D07(06)08
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Z Vul D07(12)14L
U Sge 10(16)13L
Z Dra 10(13)15
TW Dra 13(18)17D

2001 Sep 28 Fri

Z Per D07(06)11
RZ Cas 08(10)13
RW Gem L10(10)15
TX UMa L11(15)17D

2001 Sep 29 Sat

RW Tau L08(12)17
ST Per 09(13)17D
RZ Cas 13(15)17D

2001 Sep 30 Sun

Z Dra D07(06)08
S Equ 07(13)13L
TW Dra 08(13)17D

245·01 9° FIELD DIRECT

EE PEGASI 21h 40m 01·9s +09°11′05″(2000)

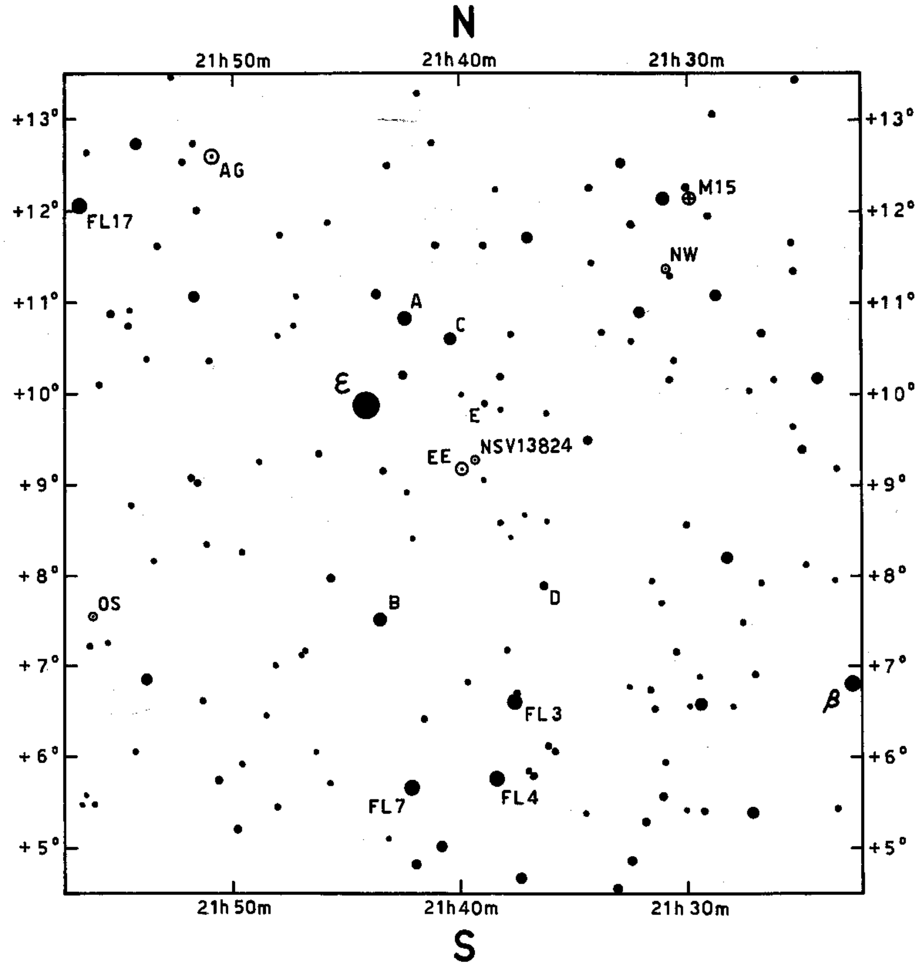

CHART: ATLAS ECLIPTICALIS	A 6·0 D 7·8	BAA VSS
SEQUENCE: SAOC,WEP,TYCHO	B 6·8 E 7·8	EPOCH: 2000
	C 7·0	DRAWN: JT 21-05-00
		APPROVED: RDP

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

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