British Astronomical Association

VARIABLE STAR SECTION CIRCULAR

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Contents

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

NEW CHART FOR W UMA (see chart news)

JOHN TOONE

248·01

9° FIELD DIRECT

W URSAE MAJORIS 09h 43m 45·5s +55° 57′09″ (2000)

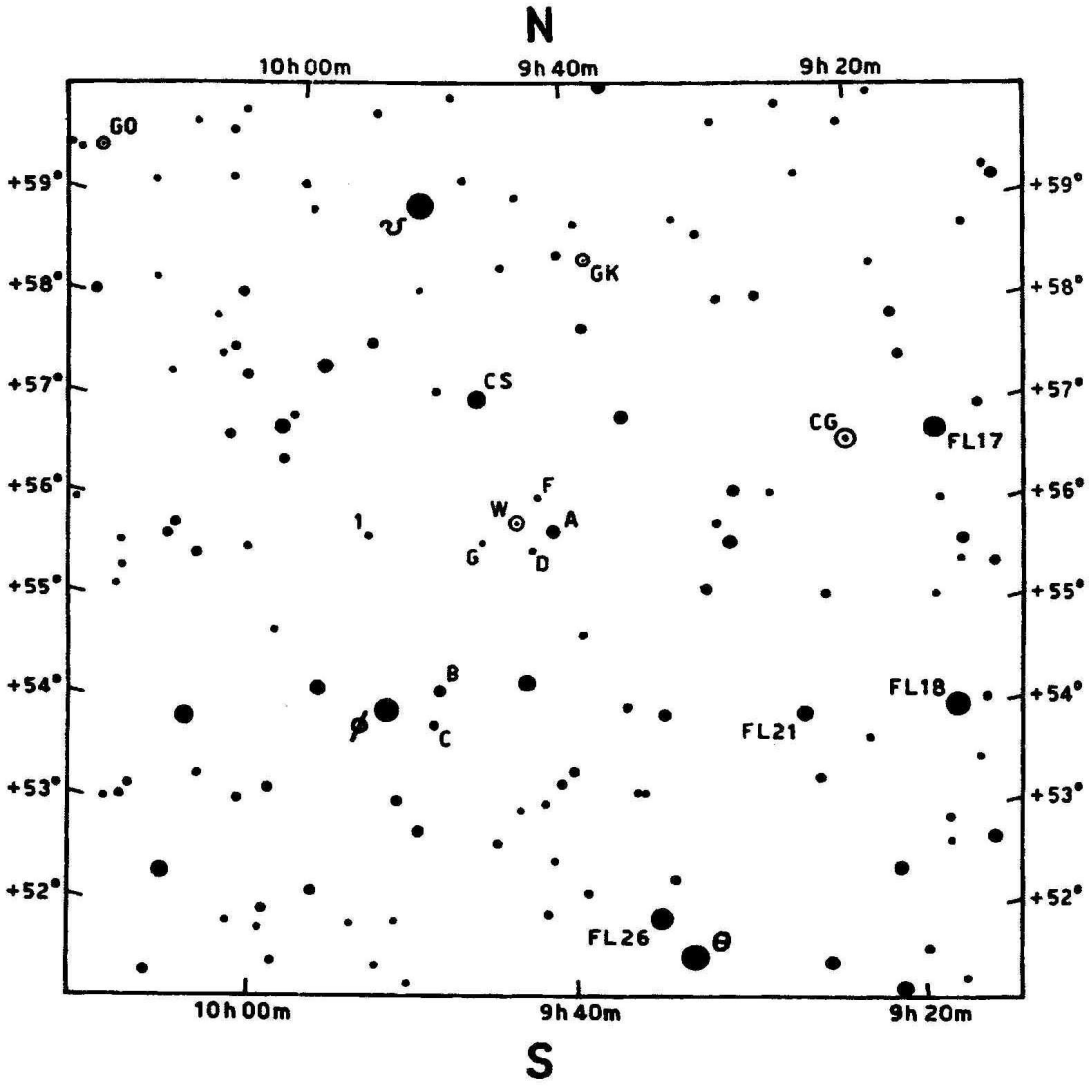


CHART:
ATLAS BOREALIS

SEQUENCE:
SAOC, AAVSO, WEP, & JEI

A	6·7	D	8·5
B	7·2	F	8·9
1	7·8	G	8·9
C	8·1		

BAA VSS
EPOCH: 2000
DRAWN: JT 25-05-00
APPROVED: RDP

FROM THE DIRECTOR

ROGER PICKARD

George Alcock

Most members will now be aware of the sad loss of George Alcock on December 15, last year, at the age of 88. I do not propose to go into any of George's remarkable achievements here; these have already been splendidly covered in many of the obituaries that appeared in the national press, and particularly in *The Astronomer* for January 2001. It suffices to say that George was the discoverer of 5 comets and 5 novae over a 32 year period. Will anybody ever come near to this remarkable achievement again?

Dave McAdam

Most observers will be aware that Dave McAdam has relinquished his post as Secretary of the Section. Possibly many will not be aware of the prodigious amount of work that Dave has undertaken on behalf of the Section over more than 10 years of dedication. Besides collating the observations that you send to him (no mean task with around 50,000 observations submitted annually), he took it upon himself to organise the entering into machine readable form, all of those observations which are still in paper form. These stretch back to before 1890; there are probably in excess of 1.5 million observations. The fact that there is probably only a few hundred thousand left to enter, is not only a tribute to Dave's own ability to tackle this task, but also his ability to persuade others to do so as well. As if this were not enough, he has also taken advantage of modern technology to build the Section's Web pages, from scratch, into something that is highly regarded by all who use it. Of course, he has also continued to supply data to those who request it, and to edit the monthly Astronomer magazine variable star column, which is no mean feat in itself. Thank you Dave, we owe you a great deal.

New Computer Secretary

So where does this leave the VSS? Whilst nobody has yet come forward to fill Dave's shoes entirely, John Saxton (after only a little persuasion!) has agreed to look after the database and oversee the entering of all new data into it. However, John does not wish to be unnecessarily involved in checking queries etc. Nor does he wish to maintain the Web Site. (Fortunately, Gary Poyner has kindly taken over the role of The Astronomer Variable Star Editor, a job that he is not new to, having done it before. I'm sure all BAAVSS members wish him well in this important job).

Therefore, we urgently need someone to come forward who would be prepared to check **MORE SERIOUS** queries that are thrown up by the checking software, when observations are entered into the database. I'm unsure at the moment just how much work this will entail. Just as urgently, we also need someone with the appropriate experience to administer the Section's World Wide Web site. So, from now on, please submit all electronic data, whether by disc or e-mail to John Saxton, our new Computer Secretary, whose details appear on the back cover. John is not new to the Variable Star Section of course, having submitted a number of articles over the last few years. He is principally a CCD observer, having graduated from

PEP, and is also very interested in photometry of asteroids. Thank you John, for agreeing to take on this responsible job.

Submitting Data To The VSS

So, given that we have a new person collating the data, but who has not yet developed the skills that Dave had in sorting out any mistakes we make in reporting our observations, it is even more vital that we submit our data in the required format. To this end, I repeat here some of the advice given by Dave in VSSC 77 (to which the reader is referred for a full discussion of this subject).

Submitting observations on computer disc or via e-mail

It would be very helpful if everyone kept as closely as possible to the standard format. The following example shows the preferred layout for a machine-readable observer report.

BAAVSS
**Year* 1990*
**Name* A N Other*
**Addr* 1 Place, Over There, London.*
**Loc* 0W 51N*
**Inst* 1 = B10X50, 2=R250*

**Star* AH Dra*
**Chart* DAP 25.1.72*
GMAT
Jan 04,1159 / 2(2)v(1)6 / 7.8 / 2/ 1/ M
Jan 16,0825 / 1(2)v(1)2 / 7.4 / 1/ / T,H
Feb 10,1000 / 2+2 , 1-1 / 7.4 / 1/ / O{5W 52N} x01
**X01* Obs from South Wales*

**Star* GK Per*
**Chart* IDH 1977 Aug*
UT
Feb 14,1912 / <D / <12.3 / 2 / 2/ M
Mar 19,2205 / D(1)v(1)E / 12.5 / 1 / /
Apr 23,2000 / =C / 11.8 / / / M

End

Further blocks of observations for other variables can be added before *End*, and files can contain up to about 700 observations. All files should be simple ASCII text, with the observation lines divided into fields by a separating character (‘/’ in the above example, but ‘:’ or ‘;’ can also be used). The last three fields are the class, instrument code, and comment fields, respectively. If the class or instrument fields are blank, the entry on the previous line is assumed. The important point to note, is that the lines should still have the same number of separators. It is quite important to get the format of the observation lines right, as it can be very fiddly to correct them (it is much easier to correct the keyword lines). If data is not submitted in the correct format then considerable delay may result in that observers data

being incorporated into the Section's database, and hence becoming available to analysts who require it.

If You Make A Discovery

Arne Henden, a professional astronomer from Flagstaff, Arizona, recently posted the following useful information on one of the various mailing lists the Director subscribes to, and I reproduce it here (with permission) but amended for UK/VSS subscribers and with the addition of a number of comments from Guy Hurst who has so much experience in this matter.

When you think you have discovered a new variable, do the following:

(a) Determine its co-ordinates. You can often do this from the USNO-A finding chart programme with a narrow field of view
http://www.nofs.navy.mil/data/FchPix/cfra2.html
Note: it is also vital to state whether 2000 or 1950 co-ordinates have been used (or any other).

(b) Check Simbad to see if it is a known variable
http://simbad.harvard.edu/cgi-bin/WSimbad.pl

(c) Check 2MASS or IRAS to see if it is a very red object (they are almost always variable).
http://www.ipac.caltech.edu/2mass/

(d) Check the asteroid location sites to see if it is just a known asteroid.
http://cfaps8.harvard.edu/~cgi/CheckSN.COM

(e) Check the scanned photographic plate archives to see its history, or at least its relative colour.
http://www.nofs.navy.mil/data/FchPix/cfra2.html
Note: It is better to check your own records (photographic CCD or whatever) as your observations may have a different colour response to other observers, other archives, etc. If you don't have any previous observations, then start compiling your own. This can often take a year or more! You should also enlist the help of another (Gary Poyner has offered his assistance in this respect regarding visual observations, and the Director is always willing to assist with CCD observations.

(f) Then, and only then should you contact either TA or the VSS.

Of course, if you don't have access to the Internet you may have to ask someone to do it for you.
It is probably even worth mentioning some sources or error that could make you believe you have something new.

1 Are you sure you haven't misidentified the object?
2 Are you sure you recorded the object correctly the first time? (NO discovery can be claimed with only ONE image or observation).
3 Are you sure that bias has not crept into your observation?
4 Are you trying to compare images obtained using different equipment?
5 Are you sure it is not an aberration or reflection within the instrument?

There are many more sources of error, and for an excellent treatment of the subject the reader is referred to the Webb Society Deep-Sky Observer's Handbook Volume 8 - Variable Stars, pages 38-42, although even this does not claim to be exhaustive, and is really only aimed at the visual observer.

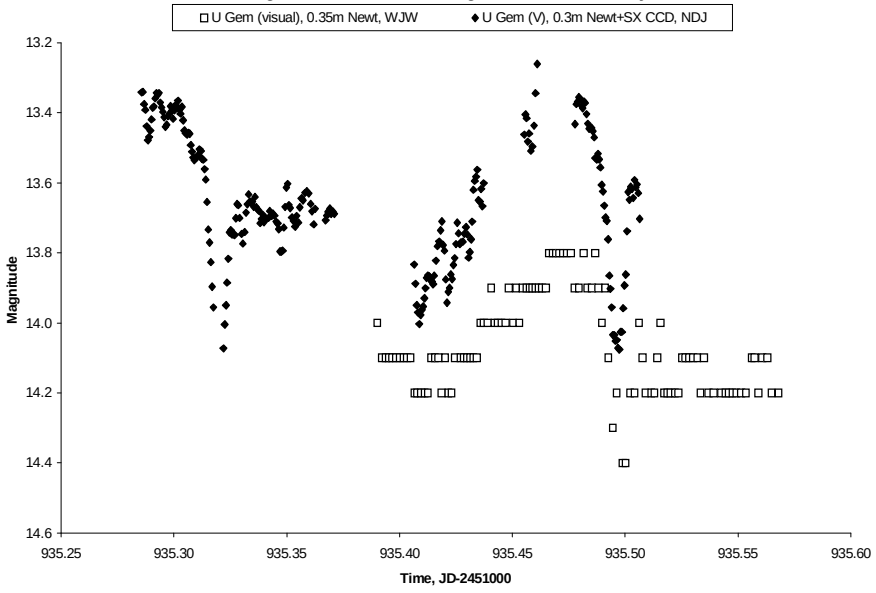
U GEMINORUM IN QUIESCENCE

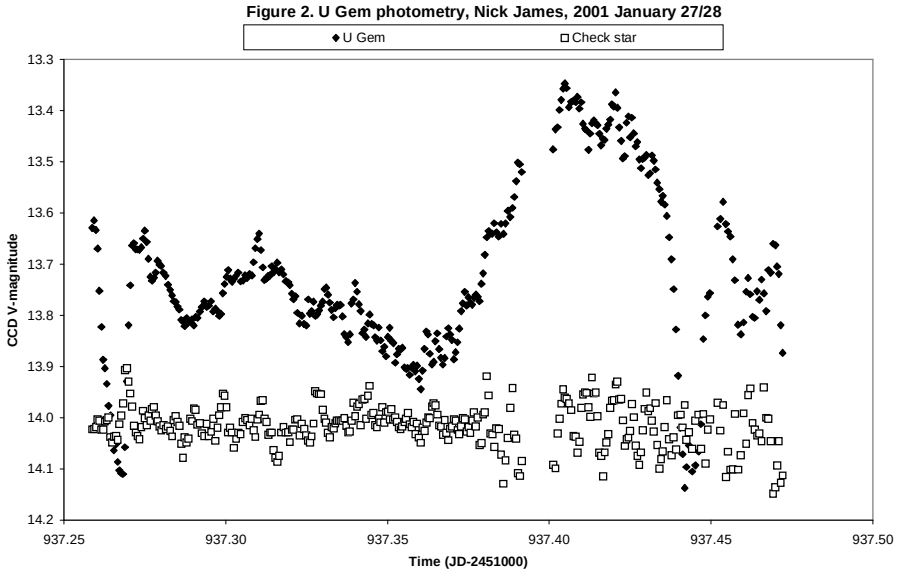
BILL WORRAKER

U Geminorum, discovered by J.R.Hind, whilst searching for new minor planets in December 1855, has been known longer than any other dwarf nova. It is also an eclipsing system, although the eclipses are very hard to detect when it is in outburst. When U Gem is in quiescence, observers may occasionally record it as being a little fainter than normal, not necessarily realising that they are witnessing eclipses. In order to demonstrate its eclipsing behaviour, Nick James and I agreed to observe U Gem for as long as possible on the night of January 25, 2001; Nick used a Starlight Express CCD camera with a V-filter on his 0.3m Newtonian reflector, whilst I observed visually with a 0.35m Newtonian. The light curves we obtained are shown in Fig 1. Two nights later Nick did a similar run, and obtained the light curve shown in Fig 2, in which a check star trace is included as a diagnostic of the observing conditions.

The break in Nick's light curve in Figure 1 was due to dewing of the optics. His dew removal system (a hair dryer) blew up, because of a spider which had set up home inside! However, he obtained a total of 4.45 hours data, while I managed to cover a complete orbital period of 4.25 hours. We were occasionally troubled by thin cloud; in my case this came at the start of the eclipse (about 0.992 UT), and a couple of times later. However, where the light curves overlap they are similar in shape, showing that visual observations can discriminate the orbital light variations quite well. The only obvious exception is the eclipse egress (about 00h on Jan 26), where the visual light curve lags the CCD light curve by 2/3 minutes - (observer bias)? The general offset between the two curves is largely explained by noting that Nick's comparison star, GSC 1375.01376 (V=12.82), is star R (mv=13.31) of the BAAVSS visual sequence (008.02). The light changes recorded by Nick are slightly larger than the corresponding visual light changes. One reason for Nick using a V-filter is that without it, the extended red response of the CCD chip might reduce the sharpness of the observed eclipses.

Figure 1. U Gem combined light curve, 2001 January 25/26





In Figure 2 the scatter in the check star trace after 0.88 UT shows the effect of dewing. However, the overall coverage (4.89 hours) is longer than in the previous run, and the eclipses are once again clearly defined.

What astrophysical information do these light curves reveal? In terms of the current standard model of non-magnetic cataclysmic variables, the high light level (or *orbital hump*) prior to each eclipse is attributable to the *bright spot* on the accretion disc (where the accretion stream hits the disc) turning towards the observer. The eclipses in U Gem are due largely to the secondary star blocking out light from the bright spot. The orbital inclination of this system is insufficient for the white dwarf primary star to be eclipsed. The two eclipses recorded by Nick in Figure 1 enable us to estimate the orbital period of U Gem. Measuring from mid-egress to mid-egress (the most sharply-defined point in the orbital light curve) gives a value of 4.230 hours, only about 1 minute less than the catalogued period of 4.2458 hours. A similar measurement on the Figure 2 data gives 4.266 hours, about 1 minute more than the catalogued period.

The eclipse durations measured from Nick's data plotted in Figure 1 at V=13.8 are 11.8 and 11.4 minutes respectively. Very similar results are obtained from the Figure 2 data. These durations are very short compared with the maximum of about 30 minutes which has been measured occasionally on the decline from outburst [Ref.1]. The implied small disc radius is consistent with considerable disc shrinkage since the last outburst, which began 113 days earlier (2000 October 4). Coupled with the somewhat brighter state of U Gem than in normal quiescence (V=13.4 rather than 14.0 in the orbital hump), these results suggest that it was likely to be on the brink of a new outburst. At the time of writing (Feb 06) no new outburst had begun.

We hope that our efforts will encourage other observers to attempt unusual and/or supposedly difficult observations of stars which vary on the time scale of a single observing session. The results may be not merely interesting, but perhaps publishable as part of a professional study.

References: 1. Krzeminski, W. 1965, "The Eclipsing Binary U Geminorum", Ap.J. 142, pp.1051-1067.

CHART NEWS

JOHN TOONE

The following new charts are now available from the Chart and Eclipsing Binary Secretaries:

038.02 X Cam (Formerly 038.01)
New 3 degree, 1 degree and 20' field charts have been drawn with no change to the sequence.

148.03 W Com (Formerly TA chart GMH 920227)
Comparison F was previously assigned to GZ Com, a magnitude 16 - 17 RR Lyr star.

242.01 BL Lac
No official VSS or TA chart previously existed for this prototype object, but a chart designated JT 23-9-84 has been generally used by observers. The new sequence is basically unchanged with the exception of comparison A, that was previously assigned to GSC 3206 1047, which has a high B-V value (1.78) and is a suspected variable.

243.01 Markarian 421 (Formerly JT 9-9-84)
Comparison A has been reassigned from a magnitude 8.4 star (SAO62379) to a more useful magnitude 10.25 star (GSC 3010 263). Comparison G (GSC 3010 2241) at magnitude 14.99 has been added.

245.01 EE Peg (Formerly JEI 72.02.16)
The magnitude of comparison E (SAO126959) has been revised from 8.6 to 7.8 to coincide with the Tycho Catalogue value.

246.01 IQ Per (Formerly JEI 72.11.07)
The magnitude of comparison H (SAO39245) has been revised from 9.0 to 8.7 to coincide with the Tycho Catalogue value. Comparison K (GSC 3331 1559) at magnitude 9.92 is effectively too faint to be usable and is dropped. A close companion (GSC 3331 1877, magnitude 9.27) to IQ Per is now shown on the chart.

247.01 HU Tau (Formerly JEI 71.08.27)
The chart has been redrawn with no change to the sequence.

248.01 W UMa (Formerly JEI 72.02.04)
Comparison E (SAO27385, spectral class K5) has been dropped because Hipparcos found it to be an unsolved variable. Comparison 1 (SAO27419) at magnitude 7.8 has been added.

249.01 V1316 Cyg
No previous VSS or TA chart existed for this star which until recently had been incorrectly identified with a close companion of magnitude 14.8. The sequence adopted is from A Henden.

250.01 Z UMi
No previous VSS or TA chart existed for this star, but the AAVSO preliminary chart referenced CES 11/94, and reprinted in VSS Circular No 85, has been generally used by observers. A new extended lettered sequence is introduced drawn from both AAVSO and VSNET sources.

RARE SUPEROUTBURST OF UV PER IN DECEMBER

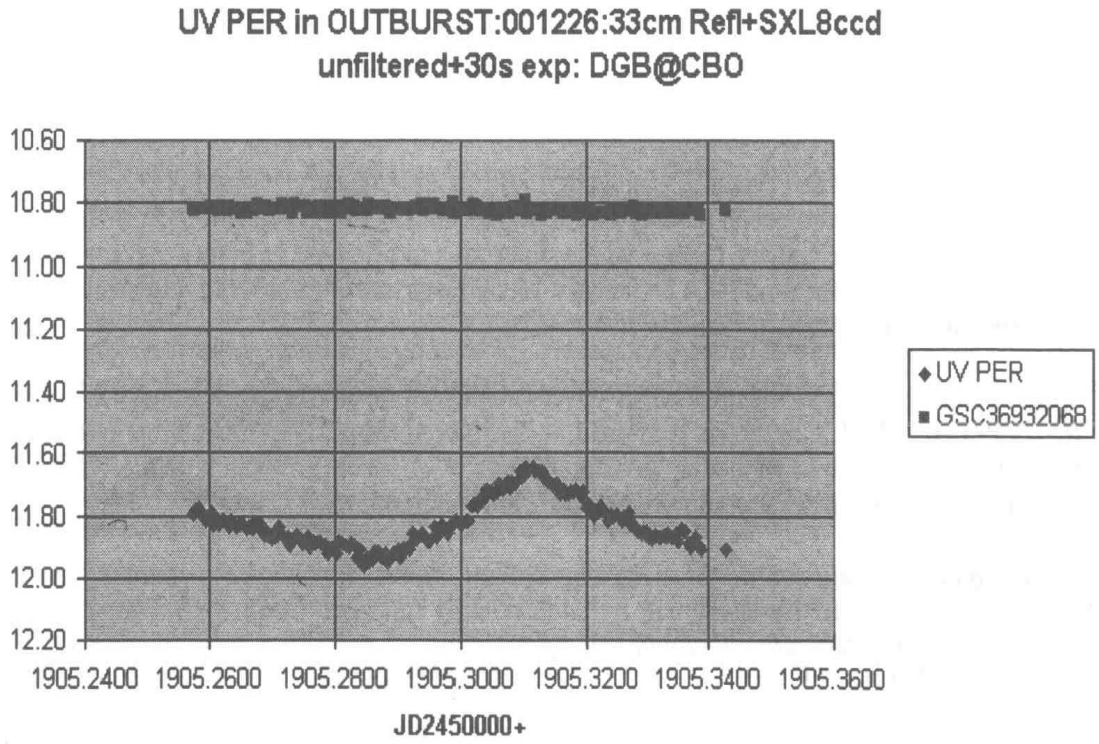
ROGER PICKARD

On 2000 December 25, Mike Simonsen in the US reported a relatively rare outburst of the SU UMa-type dwarf nova UV Per at magnitude 12.0. The most recent outbursts had been in 1999 June (normal outburst) and 1998 July (superoutburst). The outburst interval suggested that the current outburst would be a superoutburst.

Fully grown superhumps, with amplitudes of nearly 0.4 magnitude, were seen. An interesting feature was the superimposed relatively rapid fading of around 0.3 magnitude/day. See the light curve of UV Per in outburst obtained by Denis Buczynski, reproduced below.

It was interesting to note the early appearance of superhumps in such a short period system. The analysis of combined data gives the best superhump period as 0.06661 day, which is slightly longer than the previously published period. (This information has been extracted from various VSNET lists).

Amusingly, in private correspondence Mike Simonsen writes "My detection of UV Per was totally by coincidence. My real mission that night was to try and make a positive identification of Santa Claus".



SUPERNOVA SUCCESS

MARK ARMSTRONG

Since last September, I have been searching for supernovae with two telescopes. The new set-up is a Celestron 14 and an SBIG ST-9e CCD on a Paramount GT1100 robotic mount. The 0.3-m LX200 and Hale CCD camera are still racking up the patrols. Both telescopes are controlled remotely from my house, allowing for comfortable image checking and long observing sessions.

The ST-9 is a very sensitive camera with an array of 512x512 20-micron pixels, giving a field of view of nine arcminutes square. The Paramount's pointing, tracking and ease of use make it a joy to use. The software drives the scope and saves the images, which I check on the night, as far as possible. The 60-second images have a typical limiting magnitude of +19.5 and approximately 45 per hour are captured.

The Hale camera with the SITe chip is even more sensitive with a larger 512x512 24-micron array. Operating the LX200 at f10 gives a field of view of 14 arcminutes square, and 30 second images have a similar limiting magnitude to the C14, with as many as 90 an hour captured. WIDE software by Steve Foulkes drives the scope and saves images, which I check the next day.

The C14 set-up has discovered 5 supernovae since first light. Supernova 2000ez was discovered at magnitude 16.8 on 2000 November 23/4, in NGC 3995, a 13th magnitude spiral in UMa. Confirmation images had to wait until November 28, when Mike Schwartz in Arizona imaged the field. Peter Garnavich from Notre Dame University also secured an image using the 1.8-m Vatican Advanced Technology Telescope at Mount Hopkins, Arizona (See the colour image in the February 2001issue of JBAA). Spectra obtained on December 3 by the F.L. Whipple 1.5-m and 6.5-m MMT telescopes showed the supernova to be a type II several days after maximum light.

Supernova 2001G was discovered at magnitude 16.06 on 2001 January 7/8 in MCG +8-17-43 in UMa. I confirmed the object on January 12/13, brightening to 15.2. A spectrum from the F.L. Whipple telescope on January 15 showed the supernova to be a type 1a before maximum. It appeared to peak at magnitude14.4 on January 16, and was one of three relatively bright type 1a supernovae discovered in January.

Supernova 2001K was an independent discovery at magnitude 16.6 on 2001 January 15/16 in IC677 in Leo. The LX200/ Hale combination discovered this. My confirmation image on January 17/18 showed a brightening to magnitude 16.3. A spectrum taken with the Whipple on January 24 showed the supernova as a type II around maximum.

Mark is a contributing consultant to Astronomy Now, and is Assistant co-ordinator for the UK Nova/Supernova Patrol. He can be contacted at Butterfly Cottage, Hastings Road Rolvenden, Kent, TN17 4PN, England.
Tel (01580) 241388

FOSTER CARERS WANTED FOR CELESTIAL ORPHANS

CHRIS JONES

Not so very long ago (quite recently in fact), in a galaxy not very far away (well, OK, in this galaxy actually), there lived a star. Not a very bright or flashy kind of star, just an average, late, middle aged kind of star. For millions of years the star had toiled away diligently burning its hydrogen into helium. The star hoped that, if it was good, somehow, some day, somebody would notice it shining away and would pay it some attention. All the star really wanted was to be loved. As the years passed into aeons, and nobody noticed the star it became sad, and its light, with the feelings in its heart, started to shine sometimes brighter, and sometimes lower.

One day a shining prince, on a distant planet, noticed the wavering light of the star and was filled with wonder. And he said to the other princes and princesses on that distant planet "Lo see you all how yonder star shines sometimes brighter and sometimes fainter. Should we not investigate this and learn more about its waywardness?".

At this the star was elated. For, if only for a little time, on a planet far away, somebody would actually care about the star. The star readied itself for its 15 minutes of fame and with growing expectation, waited for the other princes and princesses to turn their gaze hither.

The star waited and waited and after many days went past the star's heart sank to the depths of despair. The other princes and princesses did not turn their gaze upon the star. They looked instead at the flamboyant displays and antics of the many twin cousins of the star burning their substance away by passing it from one onto the other. The star was all alone in the night and could not compete with the celestial showmen, and so it did the only thing it could, it went back to being ignored, and being very, very, sad.

Just a fairy story, and a piece of whimsy?

No, not really. The language is flowery and some of the details interpretational, but my little flight of fantasy tries to accurately describe the tragic situation that surrounds the more than 150 discoveries and recoveries made by Mike Collins.

Mike has been surveying parts of the Milky Way using twin 135mm telephoto lenses and hypered TP2415 in the course of the UK Nova/Supernova patrol for just over a decade. His images show stars as faint as magnitude 13, and in the course of hunting for novae, Mike has discovered a large number of previously entirely unknown variable stars. Mike has also recovered a good number of objects which had been previously discovered by some of the greats of observational astronomy (people like Ross and Hofmeister), but which, for a variety of reasons (inadequate positions, charting or lack of follow up) have not been unambiguously identified.

Very few of Mike's discoveries (or recoveries) have been characterised. In fact, for most of them there are just a handful of observations spread over anything up to 75 years. The website of *The Astronomer* maintains a list of Mike's discoveries and recoveries (I'll just call them discoveries from here on in and do my bit for the environment). The website currently shows 168 discoveries. Of those 168 objects, 29 have been named in the GCVS (but seven were named before the character was properly determined) and 40 have an NSV designation

(of which 15 have a reasonably well documented character). Which leaves 99 which have no internationally recognised designation and about the character of which very little, if anything, is known.

Mike's discoveries have been published and available for more than 10 years, and the group of objects that Mike has discovered covers just about every class of variable (no CV's yet though - sorry, Gary). This should be an absolute goldmine for the amateur, and yet there are currently only about half a dozen observers who regularly follow three or four times that number of objects.

I understand that it is not particularly glamorous to discover that an already known variable is actually 'just another mira'. Especially when compared to the discovery of say, supernovae, however, I would argue that it is every bit as much a contribution to science. There is also always the chance that far from being 'just another' mira the object turns out to be something extraordinary, a previously unknown RCrb star for example.

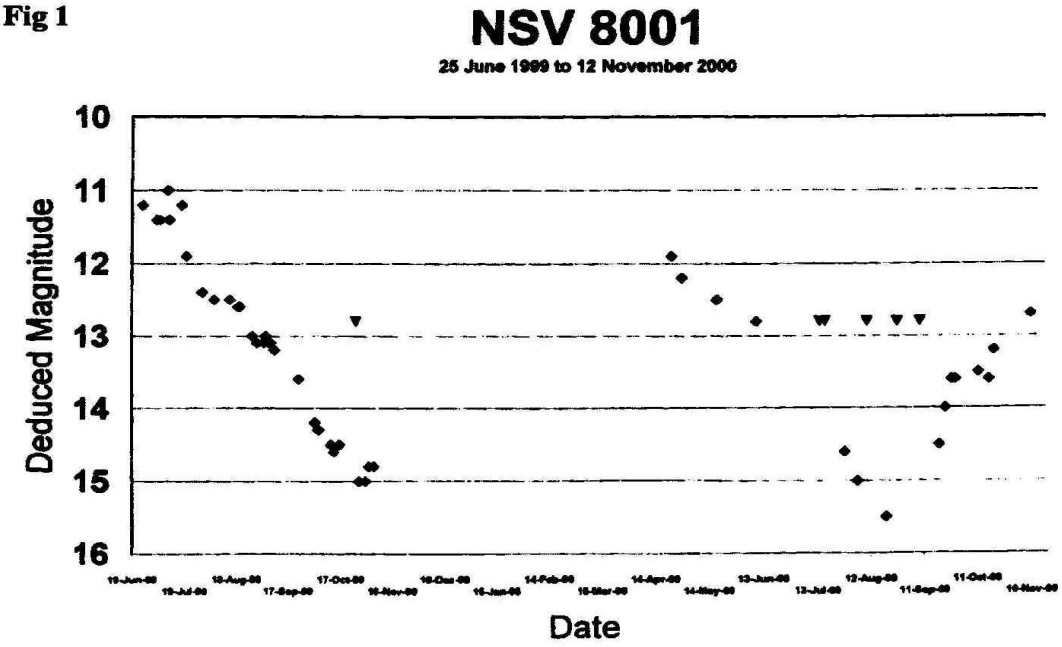
Documenting the light curves of known and suspected variables might not be particularly earth shattering or glamorous, but it can be done with very simple equipment and it can be done without the investment of huge quantities of time. Even a very small number of observations spread regularly over a period of a few weeks can yield very useful information.

Why aren't more of you observing any, or more, of Mike's discoveries?

"Because my few observations won't help..." - I don't think that this is ever true. Every observation has some value. The above statement is particularly untrue for Mike's stars.

The star NSV8001 was discovered by Ross on two plates from 20 May 1909 and 17 June 1926. An object on one plate, but not the other, could have been pretty much anything - plate flaw, minor planet, there are all sorts of possibilities. Nevertheless the object was given an NSV

Fig 1



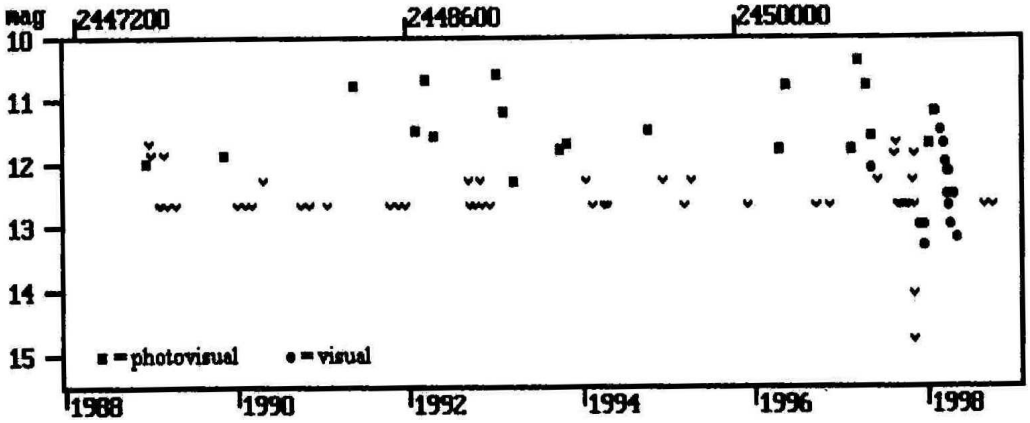
designation. Mike recovered the object on 7 May 1992. Archival film searches yielded some additional data, which resulted in there being 22 observations in the BAAVSS archives covering the period 1968 to 1999. This adds up to less than 1 a year, and even with a few years having two or three observations it is quite impossible to even guess at the period or the range of the object.

In June 1999, I started observing the object. In the last 18 months I have managed to make 48 observations - just under three a month. From the resulting light curve (see fig 1opposite) we can see that the range is approximately +11 to +15.5 (visual), that the period is of the order of 220 days and that the object is most likely to be a Mira. If the light curve is examined, it is possible to see that this information could probably have been gained with even fewer observations. One a fortnight would probably suffice to show the general trend.

"My telescope is too small for this kind of work."
There are very many of Mike's discoveries that are as bright as magnitude 9. This is inside the range of big binoculars and well within the range of small telescopes. The observations I've been making of Mike's objects, are of those objects that are very much fainter. I'm only doing that because I'm fortunate enough to own a large instrument, and I am deliberately leaving the brighter ones for those with smaller apertures.

The BAAVSS archive observations on V493 Aurigae show what can be done even without being able to follow an object to minimum. Figure 2 below, shows the observations of the star that were made up to the end of 1998. Note particularly that until 1997 this object had never been observed visually, and that the photographic observations alone give rather little clue about the period or range.

Fig 2



Now add in the visual observations up to the middle of 2000 (fig 3, see overleaf). Suddenly the period, and the range are really quite obvious. This object received its GCVS designation in the 75th name list released in April 2000.

"But there aren't any decent charts...."
There are good quality TA charts available for most of the brighter objects and for some of the fainter ones.

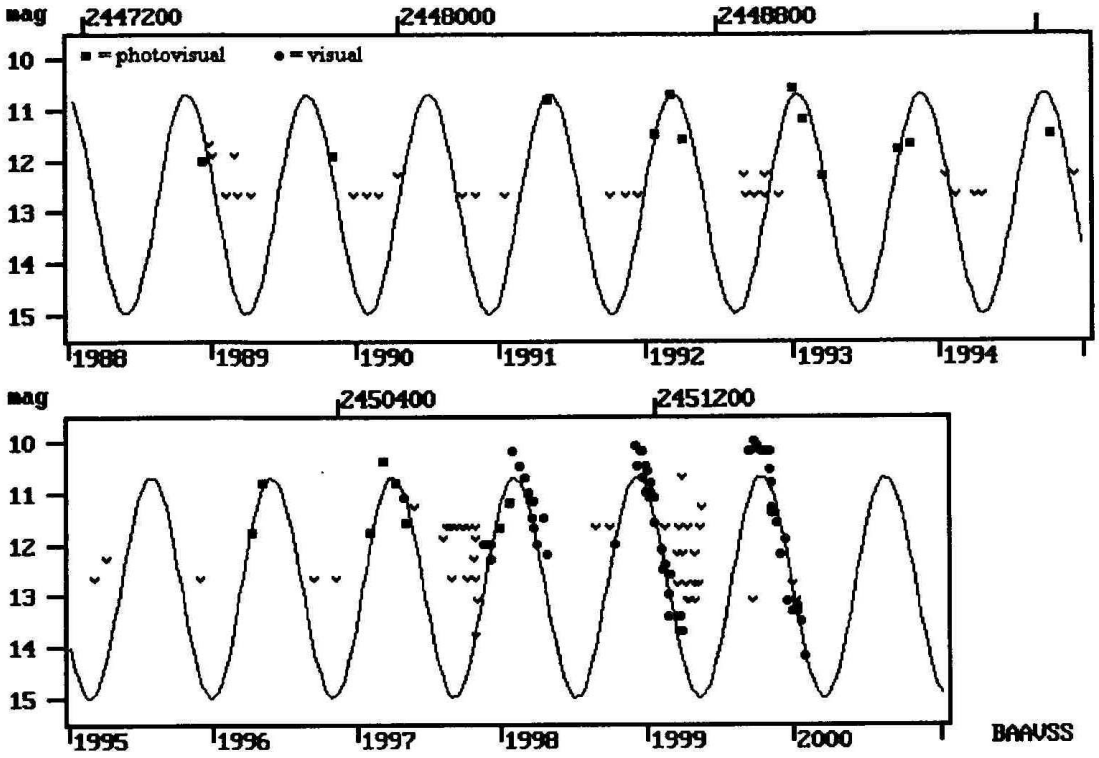


Fig 3

There is ongoing work to create more and better charts for Mike's discoveries. A finder chart for V493 Aur was included on p13 of VSSC99, which has since been updated and the sequence extended (see opposite and overleaf)

"I'm only interested in ... Mira's... EA's.... CV's..."
First I'd have to say you need therapy as you are obviously doing far too much variable star observing already! More seriously I've already indicated there are no CV's so far, but just about every other group is represented in those we already know something about. As for the unknowns - pick one, you never know it might turn out to be something really interesting.

And so.....
... if you've a telescope, and if you can manage at least two observations per month, adopt a celestial orphan today and make a sad and lonely star very, very happy.

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

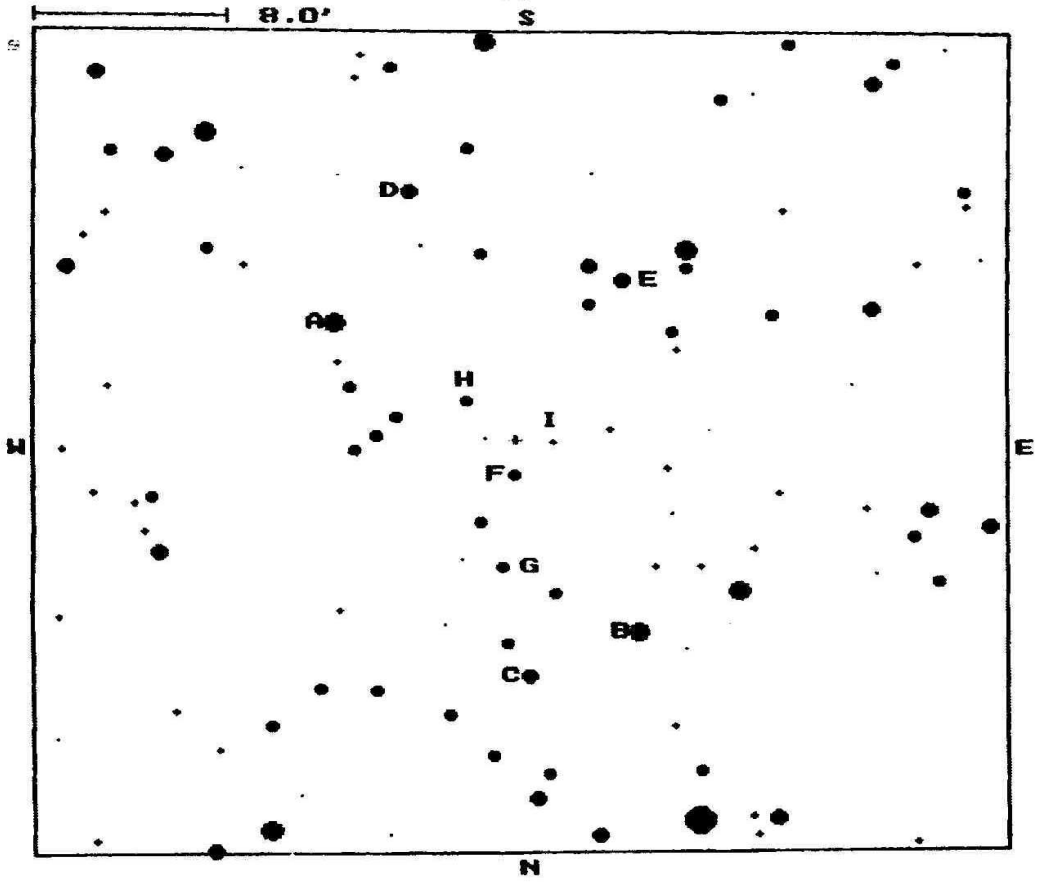
When he's not dreaming up fairy stories Chris can be reached at cpj@cix.co.uk or 29, Buller Road, Laindon, Essex SS15 6BA for advice on potential targets for observation and availability of finder charts.)

Charts are included on the next two pages for V493 Aurigae

(B)

V493 Aurigae

RA 05h 50 10s DEC +54 22.9' (2000)
RA 05h 46.0 DEC +54 22' (1950)
Magn: 10.4 – 15.0
Type: Mira



Sequence: Tycho Vj and est by C.Jones
A 9.52
B 10.19
C 10.7
D 10.85
E 11.3
F 11.7
G 11.9
H 12.3
I 12.7

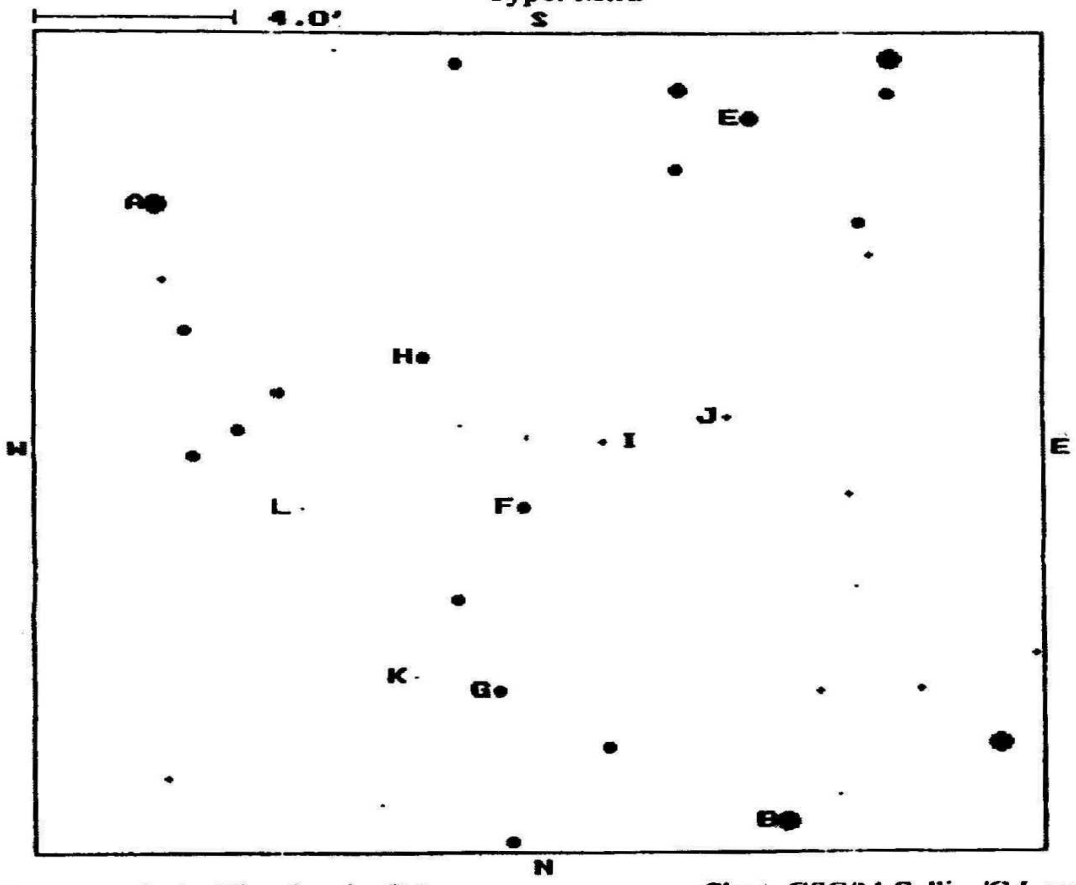
Chart: GSC/M.Collins/C Jones
G.M.Hurst 970427
Revision 000426
Revision 000830

TA library References: R280-282
Notes: Found by Mike Collins for UK Nova Patrol 1997 Mar 5.9 =Q1997/029. Star=GSC 3754.324. New designation 75th Name List

(C)

V493 Aurigae

RA 05h 50 10s DEC +54 22.9' (2000)
RA 05h 46.0 DEC +54 22' (1950)
Magn: 10.4 -- 15.0
Type: Mira



Sequence: Tycho Vj and est by C.Jones
A 9.52
B 10.19
E 11.3
F 11.7
G 11.9
H 12.3
I 12.7
J 13.2
K 13.8
L 14.1

Chart: GSC/M.Collins/C Jones
G.M.Hurst 000830

TA library References: R280-282
Notes: Found by Mike Collins for UK Nova Patrol 1997 Mar 5.9 =Q1997/029. Star=GSC 3754.324. New designation 75th Name List

THE 2000 MEETING OF THE VARIABLE STAR SECTION (CONTINUED)

TRISTRAM BRELSTAFF

The next speaker was **Bill Worraker** who spoke on ***Progress in Searching for Eclipsing Dwarf Novae***. He said that he was going to report the results obtained, so far, from a collaborative photometry project to detect eclipses in dwarf novae that were not previously known to show them. Eclipses are important for our understanding of dwarf novae, because they allow us to probe the structure of the accretion disc and other parts of the system. The photometry must cover at least one whole orbital cycle, in order to demonstrate the presence or absence of eclipses, but Bill said that he would prefer 3 orbital cycles coverage.

There are 5 observers participating in the project. Nine stars have been dropped from the programme, because they are now known not to show eclipses, and 3 new stars (**AR And, CY Lyr** and **LL Lyr**) have been added.

Bill then showed a CCD light-curve of **IY UMa**, obtained during its September 2000 outburst, in which it showed 1.3 magnitude deep asymmetric eclipses, along with 0.6 magnitude superhumps. Next he showed CCD light-curves by Nick James of **TZ Per** (during Jan 2000), **QY Per** (Jan 2000), **GX Cas** (Aug 2000), and by Salmon and Boyd of **V844 Her** (Jul 2000). **TZ Per** showed no significant variations, and the other three stars showed superhumps of 0.2-0.3 magnitudes, but none of them showed any evidence for eclipses.

So far, the project has produced results for 13 stars, all of which have turned out to be non-eclipsing, which suggests that eclipsing dwarf novae are rarer than expected. This conclusion is supported by data in the Downes and Shara Catalog which lists 386 dwarf novae of which fewer than 20 are known to show eclipses.

Bill then enumerated and examined the assumptions on which the expected number of eclipsing dwarf novae rested:

1. The standard model for dwarf novae holds.
2. Eclipses will occur if the orbital inclination is greater than 70 degrees.
3. The orbital planes are randomly distributed in space.
4. There are no significant selection effects in the discovery of dwarf novae that are related to the orbital inclination.
5. Any eclipses will still be visible during outburst.
6. Under-observation is the main reason for the small number of known eclipsing dwarf novae.

Regarding point 4, he explained that there appears to be no significant correlation between the orbital inclination and the outburst amplitude.

In summing up, he said that if further data confirms the shortfall in the number of eclipsing dwarf novae, then this would be important because it would would reveal a hole in our understanding of these stars. Alternatively, if further data contradicts the shortfall then this

would also be important because it would mean that more eclipsing dwarf novae will have been discovered. As well as getting further observations of more stars, Bill suggested that searches of literature for published photometry would also be useful.

The first talk after lunch was by **Paul van Cauteren** and was entitled ***V1162 Ori, a Mono or Multiperiodic Delta Scuti Star?*** Paul has an observatory located 10km south of Brussels and equipped with a 40cm f5 Newtonian and an ST7 CCD camera. He had originally intended to use the CCD camera to observe dwarf novae, but had tried a Delta Scuti star as a test object. When he showed his results to Patricia Lampens of the Royal Observatory Belgium, she was so impressed, that she suggested he continued observing these stars.

Delta Scuti stars are A - F main sequence and giant stars showing small-amplitude, short-period pulsations, some with two or more periods simultaneously. The variability of **V1162 Ori** was discovered by Lampens in 1985. She found it to be a Delta Scuti star with an amplitude of 0.18 magnitudes, and a single period of 0.08 days. This discovery was confirmed by Poretti et al., but in 1998, Hintz et al. published results that suggested that the star showed not one, but two periods. In 1999, Arencroft and Sterken organised an observing campaign in order to investigate this. Paul took part in this campaign, obtaining his first light-curve on 1999 Oct 17.

As well as the designated comparison star, Paul also observed several check stars whilst making his observations, and one of these check stars, star 3, he found to be varying with an amplitude of about 0.015 magnitudes. Other participants in the campaign soon confirmed this, and showed it to be another Delta Scuti star. The variations in star 3 then slowly damped down, until Paul started to have doubts but, to his relief, the variations eventually came back again.

Paul and Patricia announced the discovery that star 3 was a new multiperiodic Delta Scuti star in IBVS 4849 (Van Cauteren & Lampens, 2000). The amplitude was given as 0.014 magnitude, the period as 0.073 day, and the mean magnitude as 10.26. In IBVS 4857 (Lampens & Van Cauteren, 2000) they proposed that the multiperiodicity claimed for V1162 Ori by Hintz et al. was in fact, due to them having used star 3 as their comparison star. Further observations by other observers from around the world have since confirmed these conclusions. Paul finished his talk by warning CCD observers to be careful to check their comparison stars!

In the subsequent discussion Roger Pickard said that he also had come across a new Delta Scuti star. This one was in the field of an eclipsing binary which he had been observing with the Jack Ells APT.

Coel Hellier (Keele University) then got up to speak about ***Linking Amateur Cataclysmic Variable Observations to Professional Work***. He began by showing a light-curve of **SS Cyg** which, he said, had been under observation for over 100 years, but which was still well worth observing now. He illustrated this by describing how AAVSO visual observations had been used to aid the interpretation of satellite-based extreme ultraviolet and X-ray observations of an outburst of **SS Cyg**. The visual observations were used to fix the time of the start of the visual outburst. About 1 day later the X-rays started to rise but they then peaked and fell back again to the normal level by the second day, which was when the ultraviolet outburst

started.

The proposed interpretation of this behaviour, was that on day 0 the accretion disc started to expand inwards towards the surface of the white dwarf, emitting more and more visual light as it heated up. By day 1 the corona between the disc and the white dwarf had also heated up enough to start to emit X-rays, and the X-ray outburst began. By day 2 the inner edge of the disc reached the white dwarf's surface; it became hot enough to emit in the ultraviolet; the gap occupied by the X-ray emitting corona disappeared, and the X-ray outburst came to an end.

Amateur observers are also useful for alerting professionals to rare and unusual phenomena in cataclysmic variables. For instance, the star **EX Hya** shows infrequent short low-amplitude outbursts. But amateur alerts allowed X-ray observations and CTIO photometry which showed the evolution of the eclipse shape during outburst. Subsequent modelling reproduced the shapes of the eclipses rather well.

Amateur alerts will also be required if professionals are going to be able to study the very short duration outbursts reported in **TV Col** (a 2 magnitude outburst can last only 5-6 hours) and **EX Hya** (a 3 magnitude outburst lasts less than 24 hours according to RASNZ observers).

The echo outburst phenomenon was discovered by amateurs. In 1996-7 a superoutburst of **EG Cnc** was immediately followed by 6 short outbursts. Coel has a pet theory for them. During an SU UMa type superoutburst the disc becomes eccentric and precesses which causes the superhumps. In EG Cnc the disc may have remained eccentric after the superoutburst had finished and the mass flow inward was increased by the resultant tidal effects, triggering the repeated echo outbursts.

The transition from normal to late superhumps in **SU UMa** stars has been well covered by Joe Patterson's professional-amateur collaboration, the Center for Backyard Astrophysics (CBA). Coel showed some of their results for **DV UMa** (which also shows eclipses). He also mentioned **ER UMa stars**, that is, SU UMa stars with very short superoutburst periods of only about 20 days. These stars pose serious theoretical problems - it is hard to get the models to drop out of outburst fast enough.

VY Scl stars are cataclysmic variables that show extended low states during which they drop to several magnitudes fainter than normal. The standard cataclysmic variable model suggests that there should be repeated outbursts at the start of low state, but this is not what is observed. Coel suggested that the high mass transfer rate in these stars heats up the white dwarf so much that it prevents disc material from falling in and triggering outbursts. However, more data is needed on these stars, especially in their low states. **TT Ari** is one of the brightest VY Scl stars, being about magnitude 15 when in its low state.

Some novae, such as **Nova Aql 1999 No2**, show repeated dwarf-nova like outbursts on their decline and there is no really convincing model for this phenomenon. One speculative possibility is that dust starts forming in the nova and then disperses again. Professionals again need amateur alerts and good observational coverage of this behaviour.

In the discussion, Gary Poyner mentioned that **MV Lyr** is a very active TT Ari star. Bob Marriott said the audience should look out for Coel's book on Cataclysmic Variable Stars

published by Springer. Coel added that it was written as an introductory book and was not as hard a read as Brian Warner's book on the same subject.

Next, **John Howarth** of Crayford Manor House Astronomical Society got up to talk on ***Regularity in Semiregular Variables***. He started off by stating he was going to use BAA data to demonstrate that SRb stars may be more regular than is usually thought.

Then he then briefly described the *AMPSCAN* analysis techniques in which sine and cosine components of the variation are determined at various frequencies over a *moving window* through the data. These components are then used to produce plots that show how the phase and the amplitude of the oscillation have varied with time.

He compared the results obtained with this technique, with the O-C diagram for BAA observations of the Mira star **Chi Cyg** for 1891-2000. The O-C varies roughly sinusoidally with a period of 40 years. The *AMPSCAN* phase diagram shows a similar shape, but with less scatter. This is to be expected because the phase diagram uses information from the whole light-curve, whilst the O-C diagram only uses the times of maximum and minimum. The BAA observations of **R Leo** give similar results, that is, the *AMPSCAN* phase closely tracks the O-C diagram.

However, it is in the analysis of SRb stars, which often have two periods, that the *AMPSCAN* method comes into its own. Multiple periods can be rather difficult to sort out by O-C analysis alone.

W Cyg data for 1899-2000 shows two periods of 130 days and 234 days, which have different amplitudes at different times. *AMPSCAN* shows that there is no clear correlation between the amplitudes of these two periods.

U Boo data for 1918-2000 shows only a single period of 202 days. The *AMPSCAN* phase and amplitude plots are much more stable than those for **W Cyg**. This is rather unusual for an SRb star.

ST Cam data for 1981-2000 shows two periods of 205 days and 370 days. The *AMPSCAN* plots show both the phase and amplitude of these are relatively stable, except when the amplitude is small, that is, when the errors in the phase are large.

John went on to show results for **RY Dra** (main period of 1000 days), **AF Cyg** (periods of 96 days and 167 days) and **UU Aur** (periods of 233 days and 440 days with very steady phase).

In the discussion, Albert Zijlstra said that the results shown seem to suggest that double periods might tend to be in antiphase with each other.

To be continued...

REVIEW 2000

GRAHAM SALMON

It is just over 4 years since I acquired my SXL8 CCD during which time I have looked into various aspects of photometry to better my understanding of the subject, and improve my practical skills. I thought a review of progress at this stage might help a consideration of future projects, the purchase of a new CCD, and also prompt useful comparisons with the experience of others. My prime reasons for buying the SXL8 were

1 Price; it was substantially cheaper than others on offer from True Tech and SBIG.
2 Specification; the larger size enabled more comparison stars to be included. The frame transfer system employed in the SXL8 seemed an excellent way of ensuring an accurate exposure without a mechanical shutter. (I am still not sure how other systems deal with this.)
3 It is English made. As I hoped, direct contact with the manufacturers has been a great help in understanding the instrument and in practical details.

My LX200 10" f10 telescope needed accurately setting up to achieve several aims.

It needed to be polar aligned. Norman Walker supplied me with one of his welded steel wedges, which is robustly made and can be adjusted finely. Having aligned it as carefully as I could initially, I later needed to improve it. I took a series of CCD shots over about 20 minutes each of 2 stars near the celestial equator, one near the meridian and one as close as possible to the horizon, I then worked out the angle of N-S drift of each. This gave the error in polar alignment in azimuth and altitude respectively.

I needed a good level of pointing accuracy. Using the LX200 Smartdrive provision, in which an equatorial star is tracked for the 8 minutes it takes for the worm wheel to make 1 revolution, most of the tracking errors were eliminated. However, the telescope still displays one odd fault; finding a star from coordinates is good near the meridian, but one towards the eastern horizon requires a further 6-9 arcmins move east, and one towards the western horizon requires a further 6-9 arcmins move west. This effect is roughly proportional to the distance from the meridian and does not appear to be caused by the weight of the CCD and filter box (which are counterbalanced.)

As the CCD is attached to the filter box, and the filter box to the telescope, both by screw threads, the orientation of each is variable which is a nuisance when it comes to determining the positions of comparison stars. I have therefore added some lines and a pointer to maintain correct alignment, but a built in arrangement would be preferable. This problem also affects the flatfielding.

Variable star projects in general seem to demand two types of routines. Objects which are too faint for visual estimates need to be monitored. This needs good finding and instant, but not top accurate, answers. Computer control provides the former - I use Megastar's User List which is quite good although for some reason it refuses to recognize southern declinations! To get it perfectly positioned, how I long for an illuminated reticle which would still give me my 30' diameter field of view, but also give me my 10.3' square CCD outline, The CCD is not coaxial to the eyepiece and has no adjustment for it. I use *PixL8*, the SXL8 software, which

provides instant photometry although it does have a few problems.

Continuous observation of one object is also required. Finding problems are less important here, but automatic exposure can be used, followed by more accurate photometry. PixL8 provides for automatic exposures, saving the frames as numbered FITS files. A method of automatically changing the filter is also needed. Norman has provided a design for attaching a stepper motor to the filter box with a circuit to drive it, but it would require a trigger from the CCD software which I think is not available at the moment.

In order to acquire the images I find it best to generate two finder charts for each star, one normal and one mirror image, using the GSC, so that they are all to the same scale and marked with both the CCD square and the eyepiece field of view. I then mark them with the comparison stars. (I suppose if I used an erect image diagonal I would only need one chart / star.) I have an exposure chart to determine the exposure for each star depending on the range to be covered - to keep it out of non-linearity at the top end but a useful signal at the other. PixL8 has an 'Auto-contrast' facility which, unless the whole image is faint, will change the contrast to make it visible without altering the image values. I also have a little scale to estimate how far to move the telescope if the position is not quite right.

The computer adds a time to the image file description. If accurate timing is required, eg. heliocentric , this delay after exposure needs to be taken into account, as does the accuracy of the computer clock itself, which I find seems to be not as good as my watch! Why not?? When doing linearity tests, I suspected that the timing of short exposures, of two seconds or less, was not very accurate although I am assured by my local computer chap that there is no reason that it should not be.

I take 16 Dark Frames (DF) and 8 offset (bias) frames each session using the using the 'Continuous' and 'Autosave as Fits' facilities. The dark frame exposure time is the longest used for any stellar image in that session. Taking offsets as well enables me to produce darks for any shorter exposures. I only take one set as my stamina does not permit all night sessions!

I take 8 Flat Fields (FF) for each filter used that session. As catching twilight seemed almost impossible, I now have a white painted board 1 metre in front of the telescope dew cap, which is illuminated by a blue tinged daylight bulb from one side. I performed a simple test to see how 'flat' this was, by illuminating it from each side in turn, and taking the difference between the two results. The result was not zero, but I have yet to go back and look at it more thoroughly. I may need a bigger board; my present one is not much bigger than the telescope diameter. MIPS usually 'normalises' FFs so that the mean level is, say, 5000.

Because MIPS has a good collection of image processing commands and a simple programming facility in BASIC attached, I have used it to automate this and other processes. I have the telescope on the roof, with its computer connected by ethernet to my main computer downstairs. I set up a table giving the name, filter and exposure for each of the numbered image frames. The 'download' programme takes each image in turn, and converts it into MIPS format. The exposure for the DFs is the longest used for stellar images in any session, so a set of offset frames are taken as well so that merged DFs for each exposure value can be generated. FFs are then generated for each filter used. Appropriate DFs and FFs are then applied as each image frame is downloaded and it is then saved in its appropriate subdirectory.

My present method uses the *Comparison* program, in which each star is clicked in term, its centroid determined and the relative position to the brightest star close to the variable is determined. As there is an error in determining the instrumental magnitude of each star, it seems to me to be sensible to take the average of several comparison stars rather than just one, particularly if this can be done automatically. This is why, if the orientation of the CCD is firmly fixed N-S, then the relative positions of the variable and comparison stars can be derived from the catalogue and scaled to a number of pixels.

In this *First* program each frame is presented in turn, and the cursor is placed on the reference star, the mouse is clicked, and the programme determines its centroid.

Using the list of first stars, and the list of comparison stars, the *Photometry* program will automatically generate the magnitudes of the variable and all the comparison stars. Provision had to be made in case any of the stars has moved out of the frame, otherwise the program will crash. I have tried various photometry methods but there are basically two options. In the first option, three concentric circles are centered on the nearest pixel to the centroid. The background is determined from the annulus between the outer two circles, and this is deducted from the stellar value given by the inner circle. This ensures that the background (BG) figure is not affected by the fringe of the stellar image, but can pose problems by getting tangled up with neighbouring stars. Alternatively a square aperture can be used. Basing the photometry on the centroid of the stellar image (say to a tenth of a pixel) was too difficult for me with a circular aperture but was possible with a square one. The values of the edge pixels could be proportioned according to the position of the centroid within the centre pixel. This method is also open to adaptation if poor tracking results in trailed images (the square aperture can be made rectangular). Using the centroid is a more consistent method than estimating the centre from the appearance of the star on the screen. The BG could be determined from a square border around this aperture, but I thought it better to provide this option with the BG determined with a click on a point around each star which is definitely free of other stars. The results are logged automatically for transfer to a spreadsheet.

MIPS is a DOS program, and so is relatively slow, and can crash over an 'illegal move' such as having too many variables in the program. Programs, or a group of programs run in succession, are limited to about 60 variables. The photometry program, in particular, required this sort of number, and care had to be taken to keep within it.

When I started this exercise, I was aware that I was faced with a steep learning curve. It has been thoroughly enjoyable, if highly frustrating at times. There are so many things to get right at the same time. The DNe project is helping me to get my whole system running more smoothly, which will give me more confidence in my results and enable me to sort out the various problems. One of the problems with the V844 Her results I obtained, was condensation creeping up unnoticed, so I have invested in a heated dew belt!

The MIPS programme has been very useful, and within my capabilities, but has obvious drawbacks. I am now taking lessons in Visual Basic from my Whitby daughter as I believe it may be possible to write specific photometry programmes within the Starlight Express software which would incorporate some of the methods I have found useful. All comments on this will be most welcome. I have promised Richard a copy of my MIPS programmes and will deliver SOON! I tried to tidy them up for public viewing, got in a muddle so they will have to come more or less as they are with a few notes about their eccentricities. Anybody else interested, please let me know. Likewise for the full spreadsheet for V844 Her.

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 Mar 1 Thu
HU Tau D07(04)07
TW Dra D07(06)11
TX UMa D07(06)11
X Tri D07(07)10
Z Per D07(09)13L
ST Per 12(16)13L
S Equ L17(12)17

2001 Mar 2 Fri
X Tri D07(06)09
Z Dra 09(12)14
Z Vul 14(20)18D

2001 Mar 3 Sat
HU Tau D07(05)09
X Tri D07(06)08
RW Gem D07(06)11
RZ Cas D07(06)09

2001 Mar 4 Sun
X Tri D07(05)08
ST Per D07(08)12
TX UMa D07(08)13
Z Per D07(11)13L
U Cep 07(11)16
RZ Cas 09(11)13
S Equ 17(22)18D

2001 Mar 5 Mon
X Tri D07(04)07
Z Dra D07(05)07
SW Cyg D07(06)08L
HU Tau D07(06)10
SW Cyg L10(06)12
RZ Cas 13(16)17D
U Sge L14(10)16

2001 Mar 6 Tue
RW Gem D07(03)08
Z Dra 11(13)16
TW Dra 15(20)17D

2001 Mar 7 Wed
HU Tau D07(08)11
TX UMa D07(09)14
Z Per 07(12)13L
Z Vul L13(17)17D

2001 Mar 8 Thu
RW Tau 10(15)12L
U Sge 14(20)17D

2001 Mar 9 Fri
RZ Cas D07(06)08
Z Dra D07(07)09
HU Tau D07(09)12L
U Cep D07(11)16
ST Per 11(15)13L
TW Dra 11(16)17D
SW Cyg 14(20)17D

2001 Mar 10 Sat
TX UMa D07(11)16
RZ Cas 08(10)13
Z Per 08(13)13L
Z Dra 13(15)17D

2001 Mar 11 Sun
RW Tau D07(09)12L
HU Tau D07(10)12L
RZ Cas 13(15)17D
S Equ L16(19)17D

2001 Mar 12 Mon
ST Per D07(06)10
TW Dra D07(11)16
Z Vul L13(15)17D

2001 Mar 13 Tue
V640 Ori D07(05)07
Z Dra D07(08)11
HU Tau 08(12)12L
TX UMa 08(13)17D
Z Per 10(15)13L

2001 Mar 14 Wed
RW Tau D07(04)08
SW Cyg D07(09)08L
U Cep D07(11)16
SW Cyg L09(09)16
RW Gem 12(17)13L
Z Dra 15(17)17D

2001 Mar 15 Thu
V640 Ori D07(05)08
RZ Cas D07(05)08
TW Dra D07(06)11
HU Tau 09(13)12L
U Sge L13(14)17D

2001 Mar 16 Fri
RZ Cas 07(10)12
TX UMa 09(14)17D
Z Per 11(16)13L

2001 Mar 17 Sat
V640 Ori D07(06)08
Z Dra 08(10)13
RW Gem 09(14)13L
ST Per 09(13)12L
HU Tau 11(14)12L
RZ Cas 12(14)17
Z Vul L12(13)17D

2001 Mar 18 Sun
S Equ L16(16)17D
Z Dra 16(19)17D
RZ Cas 17(19)17D

2001 Mar 19 Mon
V640 Ori D07(06)09
U Cep D07(10)15
TX UMa 11(16)17D

2001 Mar 20 Tue
ST Per D07(05)09
RW Gem D07(11)13L
TW Dra 16(21)17D

2001 Mar 21 Wed
V640 Ori D07(07)09
Z Dra 09(12)14

2001 Mar 22 Thu
RZ Cas D07(09)12
RW Tau D07(11)11L
Z Vul L12(11)16
TX UMa 12(17)17D
U Sge L13(08)14

2001 Mar 23 Fri
V640 Ori D07(07)10L
RW Gem D07(07)12
SW Cyg L09(13)17D
TW Dra 11(16)17D
RZ Cas 12(14)16

2001 Mar 24 Sat
Z Dra D07(05)07
U Cep D07(10)15

RZ Cas 16(19)17D
Z Vul 17(22)17D
2001 Mar 25 Sun
RW Tau D07(05)10
V640 Ori D07(08)10L
ST Per 08(12)12L
Z Dra 11(14)16
U Sge L12(17)17D
TX UMa 14(19)17D
S Equ L15(13)17D
Z Per L17(20)17D
2001 Mar 26 Mon
RW Gem D07(04)09
TW Dra D07(12)17D
2001 Mar 27 Tue
V640 Ori D07(08)09L
Z Vul L12(09)14
2001 Mar 28 Wed
ST Per D07(04)08
Z Dra D07(07)09
RZ Cas D07(09)11
SW Cyg L08(03)09
TX UMa 15(20)17D
2001 Mar 29 Thu
TW Dra D07(07)12
V640 Ori D07(09)09L
U Cep D07(10)15
X Tri 09(11)09L
RZ Cas 11(13)16
Z Dra 13(15)17D
Z Vul 14(20)17D
2001 Mar 30 Fri
X Tri 08(11)09L
RZ Cas 16(18)16D
2001 Mar 31 Sat
V640 Ori D07(09)09L
X Tri D07(10)09L
2001 Apr 1 Sun
TW Dra D07(03)08
Z Dra D07(08)11
X Tri D07(09)09L
SW Cyg 10(16)16D
Z Vul L11(07)12
U Sge L12(11)16D
S Equ L15(10)15
2001 Apr 2 Mon
X Tri D08(09)09L
V640 Ori D08(10)09L
ST Per D08(11)11L
RW Tau 08(13)11L
Z Dra 15(17)16D
2001 Apr 3 Tue
X Tri D08(08)09L
RZ Cas D08(08)10
U Cep D08(10)14
Z Vul 12(17)16D
2001 Apr 4 Wed
X Tri D08(07)08L
V640 Ori D08(10)09L
RZ Cas 10(13)15
U Sge 15(21)16D
S Equ 15(20)16D
2001 Apr 5 Thu
X Tri D08(07)08L
RW Tau D08(07)10L
Z Dra 08(10)13
RZ Cas 15(17)16D
2001 Apr 6 Fri
X Tri D08(06)08
V640 Ori 08(11)09L
SW Cyg L08(06)12
RW Gem 10(15)12L
TW Dra 12(17)16D
2001 Apr 7 Sat
HU Tau D08(04)08
2001 Apr 8 Sun
U Cep D08(09)14
V640 Ori 08(11)09L
Z Vul L11(15)16D
U Sge L11(06)11
2001 Apr 9 Mon
HU Tau D08(05)09
RZ Cas D08(08)10
RW Gem D08(12)12L
TW Dra D08(13)16D
Z Dra 10(12)14
2001 Apr 10 Tue
ST Per D08(09)11L
RZ Cas 10(12)15
SW Cyg 14(20)16D
2001 Apr 11 Wed
HU Tau D08(07)10L
U Sge L11(15)16D
S Equ L14(17)16D
RZ Cas 14(17)16D
2001 Apr 12 Thu
TW Dra D08(08)13
RW Gem D08(09)11L
2001 Apr 13 Fri
TX UMa D08(04)08
Z Per D08(04)09
HU Tau D08(08)10L
U Cep D08(09)14
RW Tau 10(15)10L
Z Vul L11(13)16D
Z Dra 11(14)16D
2001 Apr 15 Sun
TW Dra D08(03)08
RW Gem D08(06)11
RZ Cas D08(07)09
HU Tau D08(09)10L
SW Cyg D08(10)16D
2001 Apr 16 Mon
TX UMa D08(05)10
Z Per D08(05)10
Z Dra D08(07)09
RW Tau D08(09)10L
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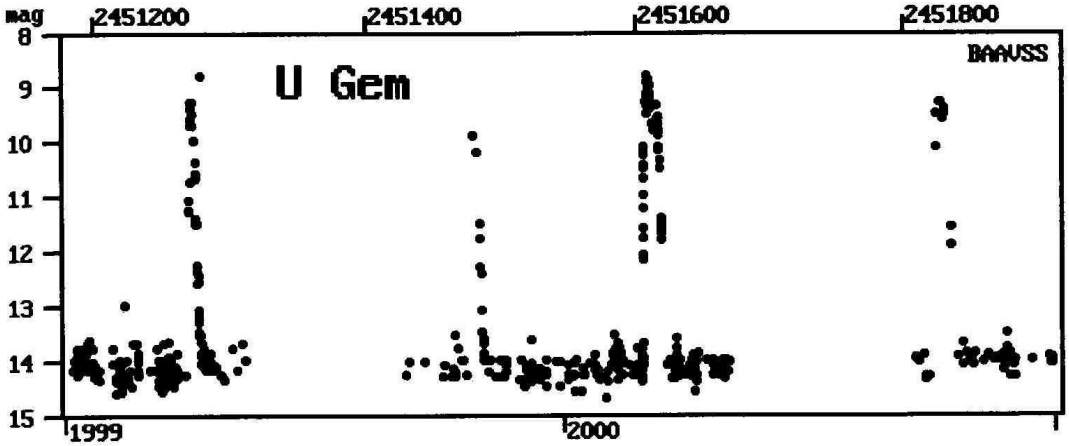
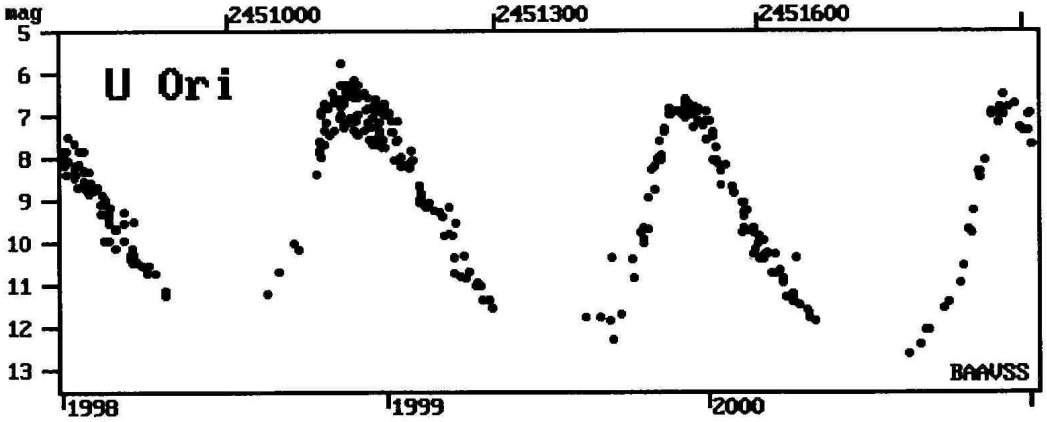
DAVE MCADAM



U Gem 1999 to 2000. 927 observations by;-
R J Bouma, Tom Cragg, R C Dryden, M J Gainsford, B H Granslo, G M Hurst, C P Jones, Miroslav Komorous, H W McGee, J Meacham, E Muyllaert, R A H Paterson, A Pearce, G Poyner, J D Shanklin, J Stubbings, Luca Talamoni, M D Taylor, J Toone, W J Worraker.



U Ori 1998 to 2000. 351 observations by;-
S W Albrighton, M Barrett, R J Bouma, M Clarke, R C Dryden, Julie Farrer, M J Gainsford, A D Godden, S Godwin, B H Granslo, E H Horsley, T Markham, J Meacham, I A Middlemist, Volodymir G Mormyl, M J Nicholls, G W Salmon, J D Shanklin, M D Taylor, J Toone, Vince Tuboly.

The deadline for contributions to the June issue of VSSC will be 7th May, 2001. All articles should be sent to the editor (details are given on the back of this issue)

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