British Astronomical Association

VARIABLE STAR SECTION CIRCULAR

No 98, December 1998

Contents

ISSN 0267-9272

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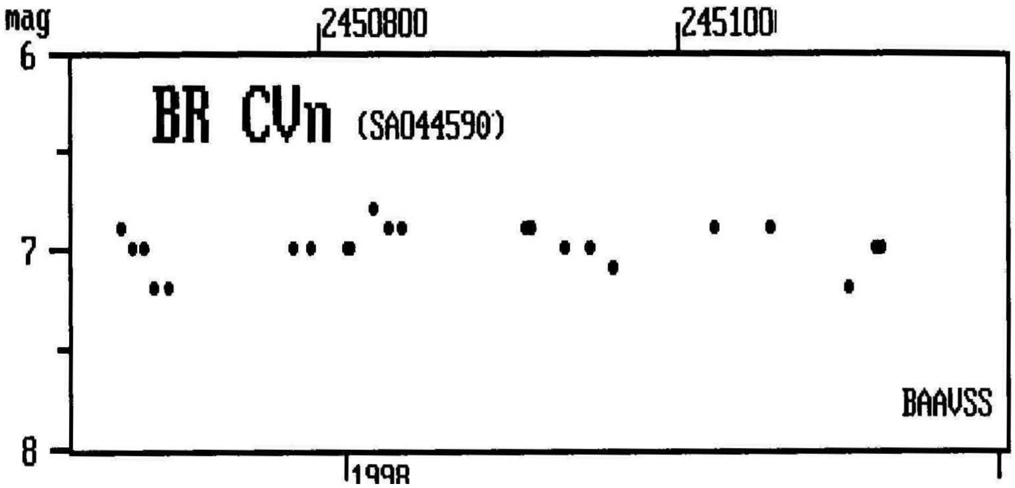
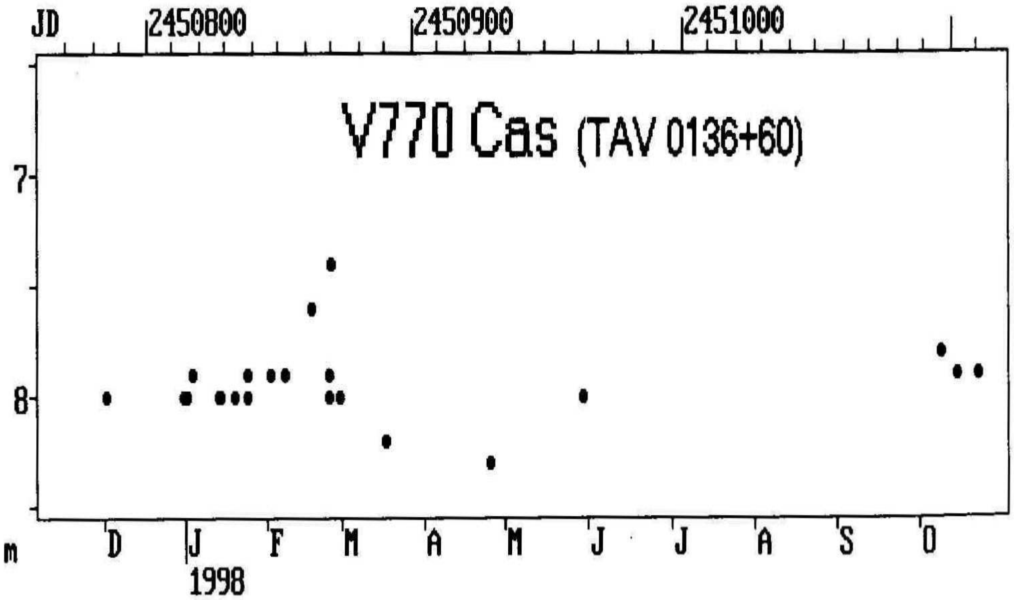
LIGHT CURVES

DAVE MCADAM



BR CVn 1997 to 1998. 22 observations by;- T Markham.



V77O Cas 1997 to 1998. 22 observations by;- K Holland, T Markham, I A Middlemist.

OUTBURST OF V592 HER

GARY POYNER

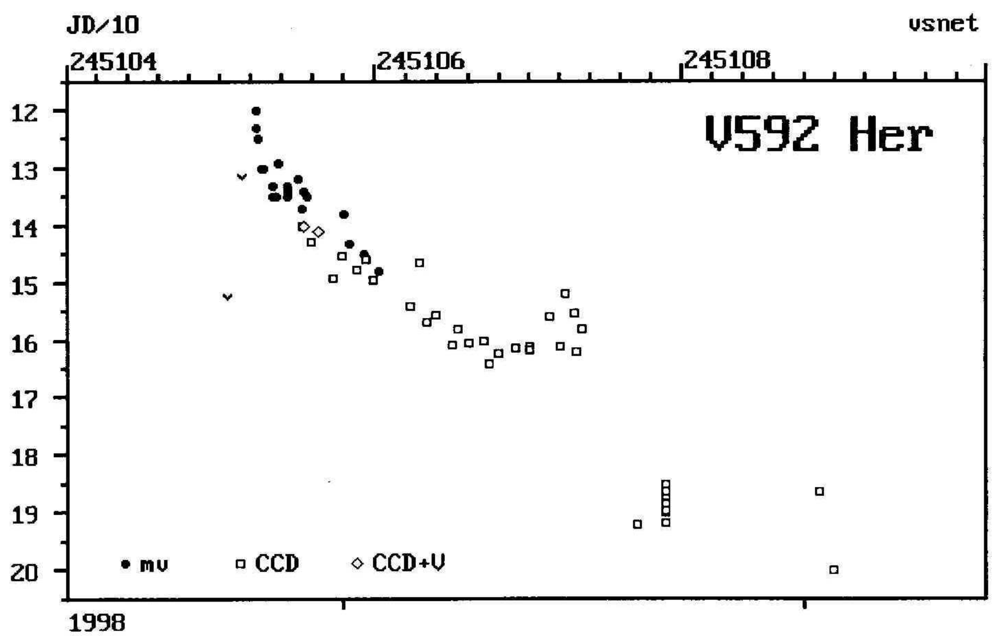
V592 Herculis was discovered in outburst on Sonneberg plates by Richter in June 1968. An examination of the light curve by H. Duerbeck, suggested that Nova Her 68 resembled that of the X-ray Nova V616 Mon. A preliminary t3 of 27days was associated with the decline[1].

A second outburst was picked up again on photographic plates on May 12, 1986. However, this was a poorly-covered event, and no details as to the type of outburst could be derived from the information available. Following this second outburst, the star became a target for amateur dwarf novae observers, and a more comprehensive monitoring programme was created. This included V592 Her being added to the UK Recurrent Objects Programme.

An unconfirmed brightening was reported by P. Ouimet on May 25.123 UT 1996 at 15.3, following an unfiltered CCD image[2]. However a follow up CCD image taken by M. Iida on May 26.512 UT recorded nothing brighter than 15.8.

The recent outburst was detected by the Finnish observer Timo Kinnunen on Aug 26.835 UT at visual magnitude 12.0. This was confirmed on Aug 27.181 UT by Lance Shaw in California. It appears from the observations reported to VSNET that the maximum brightness occurred on the day of the detection.

Superhumps were detected by Gordon Garrard on September 2nd, using time series CCD photometry. The amplitude of the superhumps being 0.3 magnitude, with a period of 83 minutes - the amplitude decaying to 0.1 magnitude by September 7th.



The large outburst amplitude (>9 mags) and recurrence period suggests that V592 Her is a member of the rare UGWZ class. Spectral analysis by R. Mennickent supports this classification.

Following maximum brightness, V592 Her faded to magnitude 15 within 10 days. The decline slowed down, to what appears to be a plateau stage around September 10th. A minor brightening was detected by unfiltered CCDs around September 15/16, followed by a further rapid decline to below magnitude 19 three days later.

The light curve accompanying this review was compiled from various VSNET reports. Contributing observers are as follows...

J. Bortle E. Broens G. Garrard (CCD) G. Hanson L. Jensen (CCD) T. Kinnunen J. Mackey (CCD+V) G. Masi (CCD) R. Modic	M. Moriyama Ouda Station (CCD) G. Poyner P. Schmeer Skartlien & Granslo CCD) L. Shaw T. Vanmunster (CCD) W. Worraker

References

1 A Reference Catalogue and Atlas of Galactic Novae. H. Duerbeck.

2 Private communication.

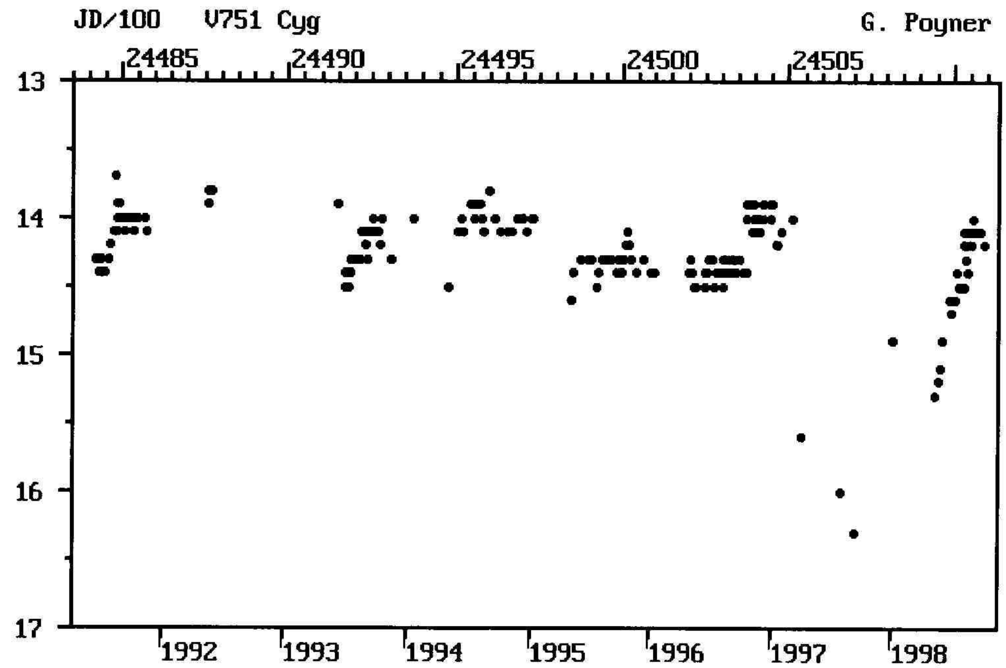
V751 CYG - A NEGLECTED VY SCL STAR

Gary Poyner

Of all the Nova like stars, the VY Scl type subgroup are perhaps one of the most interesting. Commonly (and misleadingly) known as 'Anti Dwarf Novae' they are usually found varying in the order of one magnitude at maximum brightness. At random intervals deep fades occur, which can last from days to weeks or even years. This led to the VY Scl stars being classified erroneously as type RCB until a few years ago. An examination of the spectra during low states however, reveals a remarkable similarity to Dwarf Novae in quiescence.

On rare occasions during low states, dwarf novae type outbursts occur. These are usually short duration events (a few days at most), and are by no means common in all VY Scl type objects. Probably the most famous star to exhibit this phenomenon is MV Lyr.

V751 Cygni is a VY Scl star with a range of 4.5 magnitudes (13.5-18.0V), and is associated with the Cygnus T1 association (IC 5070). I first became aware of V751 Cygni when it was included in a ROSAT CV target list in 1990, which I was contributing observations to. The light curve from my own visual observations included here shows that V751 Cygni varied around one magnitude from 1990 until March 1997, when the Hungarian observer, Laslo Szentasko, recorded a fade to magnitude 15.6. The fade continued quickly, until a deep V magnitude measurement of 17.8 was obtained by Ouda observatory, Kyoto, Japan during April 1997. This proved to be the first ever deep low state of V751 Cygni to be observed visually and with CCDs. Following this, V751 Cygni slowly began to recover until it had reached magnitude 16 by the end of that year. During 1998, the slow recovery was maintained, until the star is now approaching what might be termed its 'normal' high state.



A recent paper by Jochen Greiner[1], reveals that ROSAT observations during the recent low state, found V751 Cygni to be a highly luminous source of soft X-rays - possibly indicating that all VY Scl stars are SSBs (Supersoft Binaries).

Unfortunately V751 Cygni has not attracted too many visual observers in the past, and presently there are just two or three people around the world monitoring it on a regular basis. Considering just how little we know of its optical behaviour, and that we have just monitored the first optical low state to be seen, V751 Cygni surely deserves more attention from visual and CCD observers alike. To this end,V751 Cygni will be added to the telescopic programme in the hope that more observers will add it to their observing programmes - especially CCD users!

References

1 Relation between Supersoft X-ray sources and VY Scl stars - J. Greiner et al. www download from http://xxx.lanl.gov/abs/astro-ph/9810019

VSS MEETING VIDEO

ROGER PICKARD

The recent Section Meeting at Crayford was videoed and Glyn Marsh has volunteered to edit and duplicate them as necessary. Altogether the talks lasted over 5 hours and many people may either wish to hear them again, or if they were unable to attend, to listen to them for the first time! The question is, would members like to have their own copy, perhaps for a nominal charge of 10 pounds, or should a copy be available for hire, again for a very nominal sum? Perhaps interested members could e-mail me? (see details on back cover)

WEB PAGE UPDATES

DAVE MCADAM

The following items have been added since 14/10/98 - see back cover for URL.

Omicron Ceti: Mira's low-resolution spectrum by Maurice Gavin
Changing Emphasis: A Comparison of VSS records, 1925,1975,1997: Dave McAdam
IP Peg: Eclipse Observations during the October 1998 outburst: G Poyner

New current lightcurves-37; New or revised Long-term lightcurves - 13; Other detailed lightcurves - 18; Observing charts - 4

CHART NEWS

JOHN TOONE

The following revised charts are now available from the chart secretary

080.02 AG Dra
Formally 080.01 (JEI 7-4-90). The magnitudes of stars B, C and D have been adjusted to coincide with the latest AAVSO values while star E has been dropped. The new chart is reproduced here. Please replace your existing chart with this one.

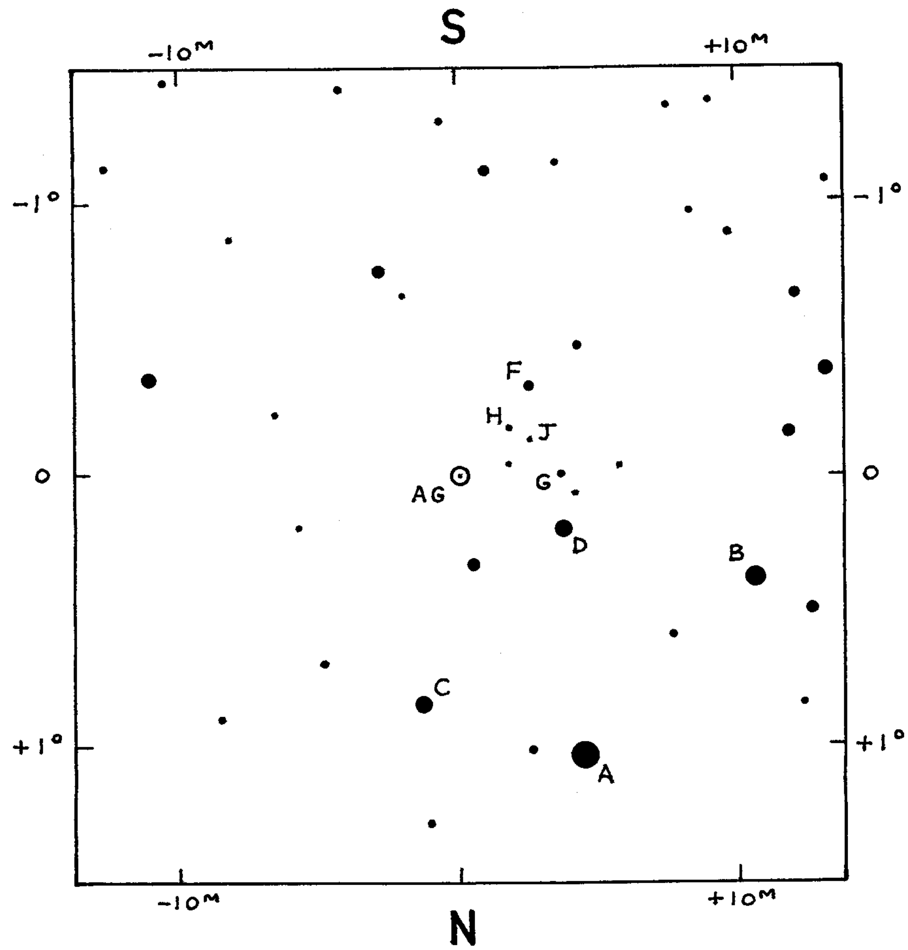
085.02 FG Ser
Formally 085.01 (JEI 7-4-90). An additional 20' field chart has been drawn to complement the existing 1 degree field chart. The sequence has been extensively revised to coincide with the latest AAVSO values. Stars M and N are added whilst star K is dropped.

The following additions to the Recurrent Objects Programme (refer to VSS Circular 97) have new 10' field charts available from the chart secretary:

237.01 V660 Her
238.01 Var 61 Her
239.01 Var 62 And
240.01 V358 Lyr
241.01 USNO 1425.09823278

080·02 3° FIELD INVERTED

AG DRACONIS 16H 01M 41S +66°48.2M (2000)



SEQUENCE: AAVSO
CHART: FROM GUIDE
VERSION 6·0

A	5·4	F	9·4
B	6·2	G	9·9
C	7·0	H	10·3
D	9·0	J	10·8

BAA VSS
EPOCH: 2000
DRAWN: JT 12-9-98
APPROVED: G. POYNER 15-9-98

THE EXPERIENCES OF A VARIABLE STAR OBSERVER

JULIE FARRER

There comes a time (usually just after Christmas) when the budding novice astronomer, whether 8 or 80, has scanned the skies for over a week with the new pair of binoculars, read 20 books on ‘Astronomy for Beginners’, and is looking around for something more 'in-depth' to persue. So it was with me.

I joined the local astronomical society and took great delight in searching for everything that my poor old 10 x 50s could reach. But the books and the lectures told of wondrous sights only to be beheld with a telescope and so within a year I was the proud owner of an 8" reflector. It was both my passport to the heavens (where I had only held a visa before) and yet, at the same time, the most frustrating setback I could imagine. I couldn’t point it accurately at anything unless it was a planet (it had no setting circles), but I was determined to get to “grips” with it.

It wasn’t long before I had star-hopped my way to the easily found objects and I needed a more planned approach to observing - one with a long term purpose - which is when I approached the Variable Star Section of the BAA.

Armed with star charts, star maps, advice, calculator, binoculars, telescope, notepad, red-light, enthusiasm and much much more, I stepped outside for a night of discovery. After 3/4 of an hour I stepped back in again, cold, frustrated and miserable. I hadn’t found one variable star on my list. Does all this sound achingly familiar? If not, I’m very pleased for you - really I am, but if it does (and this is my point), don’t worry. After the third night of slow, disappointing progress (although I had found a couple of stars - I think!) I called the section director - Gary Poyner who was full of encouragement and helpful advice. It still took several weeks to get into the swing of finding certain stars quickly and easily but it does happen. Don’t give up.

As far as finding variable stars goes, if you are experiencing problems, try looking for a star in an area of sky that you are already familiar with. Perhaps one near the ecliptic if you are familiar with observing the moon or planets, or in a favourite area of sky where you frequently observe another object.

Now that you’ve found the star there is another worry! Personally, the main fears I had, and still have, are that I would a) record the wrong star, b) use the wrong comparison stars, and c) misjudge the magnitude, but these can only come with experience so if the first few observations you make are worrying you, keep a record of them but make a note of your concerns alongside for future reference.

I suppose, the main point that I am making is - keep on trying! If it’s becoming a hard slog then leave it for a while and look at another object that interests you, come back to the variable in a few minutes when you are refreshed. Above all don’t loose faith in yourself; if you can only manage a couple of stars a night, once a week - that’s fine. Certainly by and by it will increase. So if you recognise any of the above perhaps it might be comforting to know that you are not the only one and it does get easier.

THE 1998 MEETING OF THE VARIABLE STAR SECTION

TRISTRAM BRELSTAFF

The 1998 meeting of the BAA VSS was held on Saturday 31st October at Crayford Manor House at Crayford in Kent. The meeting was opened by Roger Pickard who welcomed the participants and then introduced the first speaker, Dr Robert Smith of Sussex University.

Dr Smith explained that he had spoken on the subject of ‘Professional-Amateur Symbiosis’ at the BAA-VSS Centenary Meeting in 1991 and that he was going to continue on this theme by giving a brief history of two of the observatories at Sussex University. The first was built after a Mr Madge of Burgess Hill donated a 6 inch refractor to the university in 1964. However, in 1973 some students ‘swapped’ this telescope for a 10 inch reflector from a well-known telescope supplier (Dr Smith stressed that this was done without his knowledge!). During the 1980s light-pollution and vandalism at the site became increasingly worse, and in 1998 the dome was abandoned.

The second observatory was built after the university bought an 18 inch reflector from a Mr H. Robin of Tunbridge Wells in 1990. Difficulties with planning permission meant that the observatory was not opened until 1996. It is equipped with a CCD, but, because of lack of man-power, it is not being used for ‘real’ research, only used for undergraduate projects. However, it has been used to measure the orbit of T Tauri.

Next, the BAA VSS Director, Gary Poyner, reviewed what had been happening in the BAA VSS over the past 12 months. For 1997 more than 52000 observations of 541 stars had been submitted by about 700 observers (these figures include observations received from the SPA VSS and the RASNZ VSS, as well as observations submitted to The Astronomer magazine). Gary showed several slides to illustrate how the observations were distributed between the various programs. As usual, the bulk of the observations were of stars on the main ‘Telescopic’ and ‘Binocular’ programs. Most of the ‘Telescopic’ program observations were of cataclysmic variables - over 16000 were of dwarf novae alone. Three quarters of the ‘Binocular’ program observations were of semiregular variables. 6500 observations of stars on the ‘Recurrent Objects Program’ were received. Gary was a bit disappointed that more CCD observers weren’t monitoring these stars. Neither the Active Galaxy Program (run in conjunction with the Deep-Sky Section) nor the Mike Collins Stars Program were very popular during the year.

Gary went on to describe some special projects that BAA VSS members had been involved in during 1997. Six dwarf novae were monitored for Dr W. Skidmore of Keele University who was hoping to use the William Herschel Telescope to look for oscillations at minimum. Unfortunately, all six stars were in outburst during his observing run. EM Cygni was monitored for outbursts and standstills at the request of Les Thomas (Keele). Eclipses were observed in outburst. Observations of 3C66A and OJ287 were contributed to the ‘Blazar 2000 Project’ coordinated by Harry Lehto and Dr Mark Kidger. Observations were also contributed to the IP Pegasi campaign coordinated by Dr Tim Naylor (also Keele). Gary mentioned Bill Worraker as having done a lot of work on this.

In rounding off, Gary mentioned that John Greaves had been comparing some of our comparison star magnitudes against the Hipparcos and Tycho Catalogues. This sparked off a discussion. Norman Walker said that he had been comparing Kevin West’s photoelectric results against Tycho magnitudes and had found what he thought was a periodic error of about 0.2 magnitude in the Tycho magnitudes. However, he explained that it was fairly easy to get an internal accuracy of 0.01 mag within a particular comparison star sequence, and this was all that we needed for our purposes - we do not need to tie the magnitudes into a consistent all-sky system. Dr Richard Miles said that below mag 8 - 9 the Tycho data shows errors of 0.1 - 0.2 magnitudes. At this point Roger Pickard brought the discussion to an end by suggesting that we should consider organising a separate meeting just for this subject!

Then Eric Broens of the VVS (the Belgian variable star organisation) rose to speak on the period history of χ Cygni. It was a few years ago that he had first constructed an O-C diagram for this star using VVS and Dutch observations covering the years 1959 - 1994. He then started working with Chris Sterken and Chris Koen, and had observations from the BAA VSS, from Japan, and from other sources which extended the coverage back to 1838. They determined times of maximum by fitting 3rd-degree polynomials and then used linear regression to determine the best-fit period.

The resulting diagram showed large, possibly cyclic variations in O-C ranging from +40d to -40d. Eric explained that such apparently cyclic variations in O-C do not necessarily indicate the presence of true period variations. Back in the 1920's Eddington and Plakidis had pointed out that random variations in period length in Mira stars could easily accumulate to give the appearance of systematic variations in the period. In the 1930's, Sterne showed that it was necessary to use statistical techniques to assess the reality of such period changes. Analysis of the χ Cygni data by Koen (using a technique developed by Koen and Lombard) indicated that the observed variations were only marginally significant (at the 90% level).

However, Chris Sterken then managed to obtain copies of observations by G. Kirch (the discoverer of χ Cygni), C. Kirch, Cassini and Halley covering the years 1686 - 1736. These observations roughly doubled the timespan of the O-C diagram and revealed the presence of a systematic increase in period of 0.013d per year (equivalent to 4d since 1868). This period change is significant (at the 95% level). There are even suggestions in the earlier data of the cyclic variations suspected in the post-1838 data.

The increase in the period could be the result of the star having undergone a 'helium shell flash'. This is thought to occur in red giant stars with an inert carbon-oxygen core surrounder by an inert helium shell and, outside that, a burning hydrogen shell. As the core slowly contracts, the helium shell ignites, expands and then stops burning again at intervals of tens of thousands of years. Modelling by Wood and Zarro (1981) indicates that these flashes are accompanied by changes in luminosity and in pulsation period. Eric showed graphs of how these would be expected to vary from one flash to the next, and indicated the positions of R Aql, R Hya, W Dra and T UMi, some Mira stars known to have strongly varying periods. T UMi, in particular, is thought to have undergone its flash only very recently. χ Cygni, on the other hand, probably underwent its about 10000 years ago and is now in the recovery phase, with most of its energy coming from burning in the hydrogen shell.

Eric said that a paper giving these results had just been accepted for publication in Astronomy and Astrophysics (Sterken, Broens and Koen, 'On the Period History of χ Cygni') and that the data would appear in the Journal of Astronomical Data (a CD-ROM journal). In the discussion, Albert Zijlstra suggested that it might be possible to explain the observed period change by mass-loss alone, without a helium-flash.

The last speaker of the morning was Guy Hurst who described his experiences in CCD Nova

Patrolling. He bought a Starlight Xpress MX5 CCD from Terry Platt and fitted a standard camera lens to it (he was quoted 80 pounds for a spacer tube to do this but managed to find one for 10 pounds in a second-hand shop). He first practised by taking imges of a street-lamp before turning to the night sky. He showed an image of the Pleiades that he had obtained. Initially, he had had no finder so he had to point it in the direction of a bright star and hope for the best. He showed an image of the region of Gamma Cygni. He found that with a 5 second exposure the image trailing was not too bad and that by combining 4 such images he could reach mag 12.

In order to search for novae he first produces a set of master images of the area he is planning to search, and then uses these for comparison with later images. He decided not to use atlases for reference purposes as it is always better to use reference images taken with the same instrument that is to be used in the search. Guy feels that his search method must be effective because it is finding lots of previously-known variables in the magnitude 8 - 10 range.

In the discussion Guy said that the images were stored on the hard disc of a lap-top computer. Dr Richard Miles suggested that Guy should drive his CCD piggy-back on a Meade but Guy said that one of the ideas behind his project was that it should be low-cost!

To be continued...

χ CYGNI: SUPPLEMENTAL

J GREAVES

Further to Dave McAdam's (D McA) excellent analysis of χ Cygni in BAAVSSC 96 I present the following complementary results. The data used was a subset of the BAAVSS data utilised by him and is based on 85 complete maxima dating from 1902 to 1996 inclusive.

Firstly, derived elements. A totally independent analysis provided O-C derived elements of JD 2415991.6+408.68E: this gives a next predicted maximum on Nov 20th 1998, and therefore an O-C residual of -8 days in comparison to his elements. Comparison is made with elements given in the GCVS41 and the Hipparcos Periodic Variable Annex (jointly derived with AAVSO data)2 in table 1.

TABLE 1: A comparison of χ Cygni 1998 maximum predictions from various elements

Source	Epoch JD	Period/d	1998 Max
D McAdam	2411911.6	408.53	Nov 12
J Greaves	2415991.6	408.68	Nov 20
GCVS4	2442140.0	408.05	Oct 13
HIP VA1	2448688.5	402.30	Dec 19

This table in many ways highlights the differences resulting from how much data is used to derive such elements, and how current the latest observations in the dataset are. The GCVS4 will have used a complete set of data, but this data will have ended prior to the publication date of 1984. The Hipparcos value, generated in tandem with contemporaneous amateur ground based observations that were coordinated by the AAVSO, will only cover the approximate period of that satellite's mission (about 1989 to early 1993) and therefore will reflect temporary trends.

Examination of D McA's Figure 4 on p13 of BAA VSSC 96 reveals a trend of declining O-C residuals since about 1989: for 1989 to 1992 we have residuals in roughly the +10 to +25 range, whereas since 1993 we have values at 0 or below (see the last ten or so points of his figure 4). This means that calculated epochs in 1989 to 1992 were generally earlier than observed ones on average, and thus inter-maxima lengths (or "periods") were on average shorter. Hence, any elements derived at that time are bound to suggest too short a period (see Table 1).

This, however, exemplifies an ironic consequence of using O-C charts for period determination in Mira variables. At present the trend in "period" length for χ Cygni is very near the long term average for the century , so one can have confidence in the accuracy of predictions for the next few years if they are based on a period of 408 to 409 days. This would also have been the case for the late Seventies to early eighties, but would not have been the case around the late Sixties to early Seventies, O-C residuals approaching -40 days at that time for such a period.

Mira stars invariably (and almost exclusively) have inter-maxima lengths ("periods") that wander randomly either side of zero on an O-C chart, often with maximal positive deviation similar in size to the minimal one (from personal experience). D McA's analysis of χ Cygni goes a long way in illustrating the scatter in period length that these stars exhibit, and why any particular maximum will not necessarily occur within a month of predicted dates! It will be noted that use of full and up to date datasets by D McA, the 1998 BAA handbook (presumably), and myself, all provide predictions within 12 days of each other for 1998.

As mentioned in D McA's article, long term variations in Mira periodicity are no longer thought to be necessarily meaningful: indeed although an O-C chart for the past century suggests such, it should be realised that one and a half cycles are nowhere near enough to confirm this. Statistical tests give no significant evidence (not even remotely) for period change through either the cumulative sums-based approach of Isles' "span length" test or Sterne's χ^2 test, although taking the correlation coefficient of a list of inter-maxima intervals compared with a copy of itself lagged by two intervals does give a better than 0.05 significance level of the period change being random, ie a low probability that such is the case (see C Lloyd, JBAA 101, 1, 46 [1991] for an overview of these procedures and further references).

Other numerical results derived from my analysis of nearly a century of BAA data for χ Cygni are given in Table 2, where they are compared with those given specifically for χ Cygni in a list of over 330 Mira and Semiregular stars with mean light curves derived from 75 years of AAVSO data[3]. Table 3 gives the ranges for these parameters from my analysis of the BAA data.

TABLE 2: Mean Parameters for χ Cygni lightcurves.

The numbers given for each entry are the mean value immediately followed by the standard deviation, followed by the total number of each phenomenon used to derive the figures, when appropriate. (f is rise time from minimum to maximum divided by the duration of the full period).

	Period (d)	**f**	**max mag**	**min mag**	**amplitude**
BAA	408.1 10.0 84	0.45 0.02	4.8 0.41 85	13.6 0.40 72	8.7 0.53 72
AAVSO	408.5 06.9 62	0.41 0.02	5.2 0.47 62	13.4 0.29 55	8.3 0.55 54

TABLE 3: Ranges for the Parameters in Table 2 for the BAA dataset.

	Period	**f**	**max mag**	**min mag**	**amplitude**
max	431	0.40	3.9	12.4	8.5
min	379	0.53	5.9	14.4	8.8

Figure 1 plots amplitude in magnitudes against frequency in cycles per day for a Fouriergram analysis of the data which gave a mean period of 408.7 days, essentially that derived via O-C methods (408.68). The median period length of 407.3 days for the full data set lies near the mean of 408.1 and suggests that there have been no overall trends in period change throughout the century, that is the scatter in period lengths has been quite evenly distributed about the mean. However, a modal period of 404 days suggests a bias towards longer periods at some point thus a larger mean value, or a preponderance of the number of longer periods over that of shorter ones, although the difference is negligible. The final series of figures illustrates many of these points graphically, so that readers can judge for themselves.

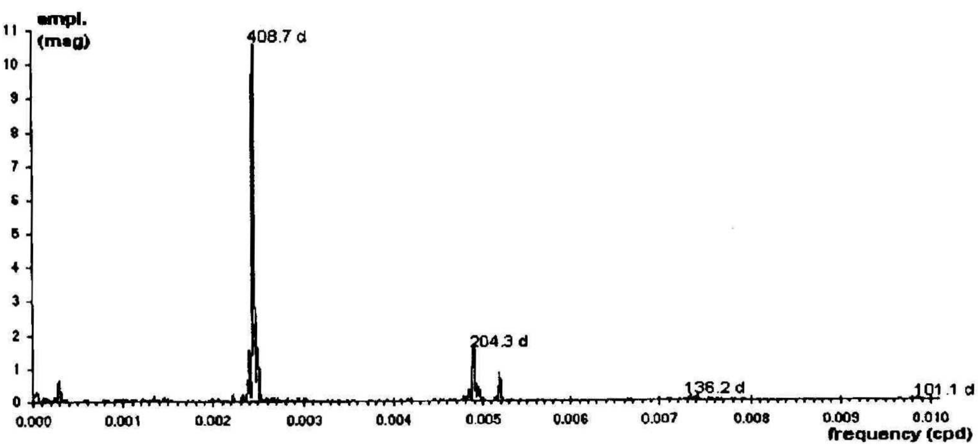


Figure 1:Fouriergram of BAAVSS chi Cygni data, 1902 to 1996.

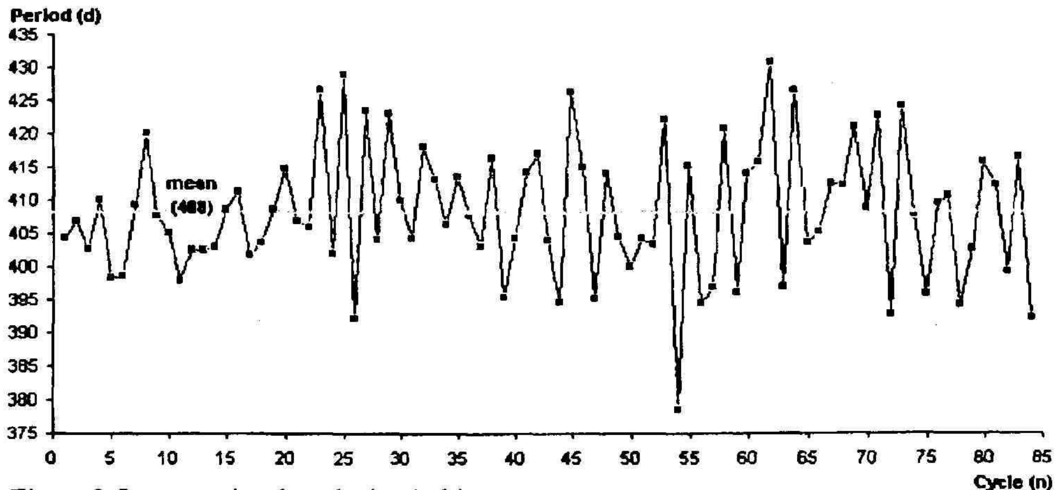


Figure 2: Inter-maxima lengths (periods)

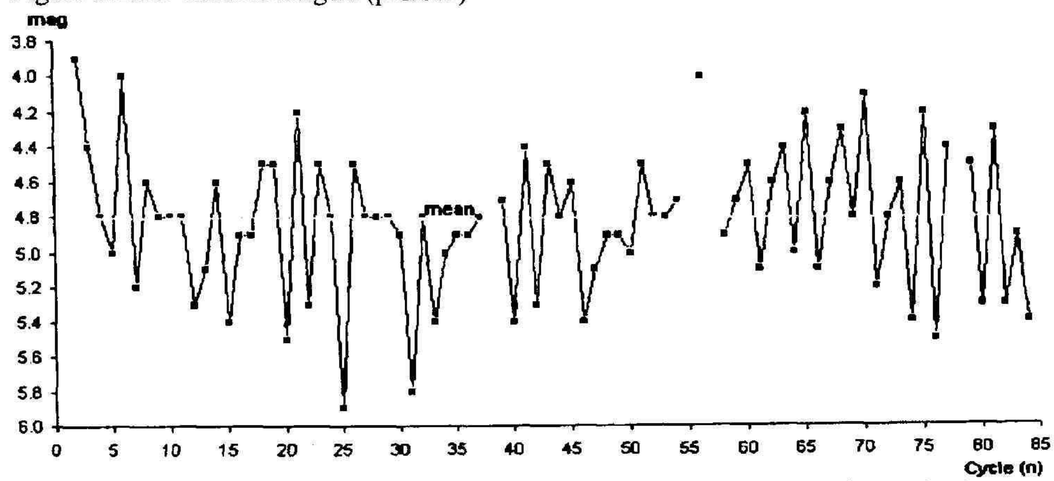


Figure 3: Maximum magnitudes (gapped lines denote non-consecutive data points)

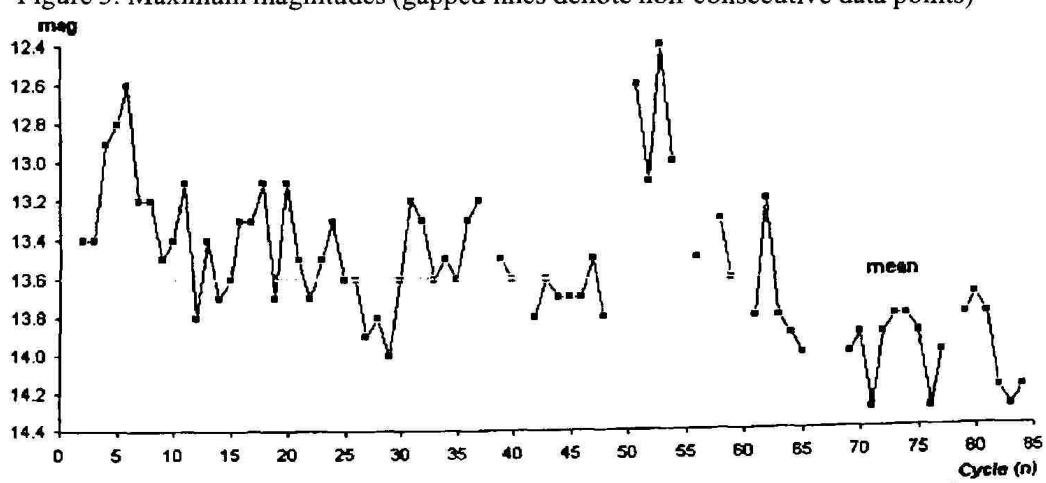


Figure 4: Minimum magnitudes (gapped lines denote non-consecutive data points).

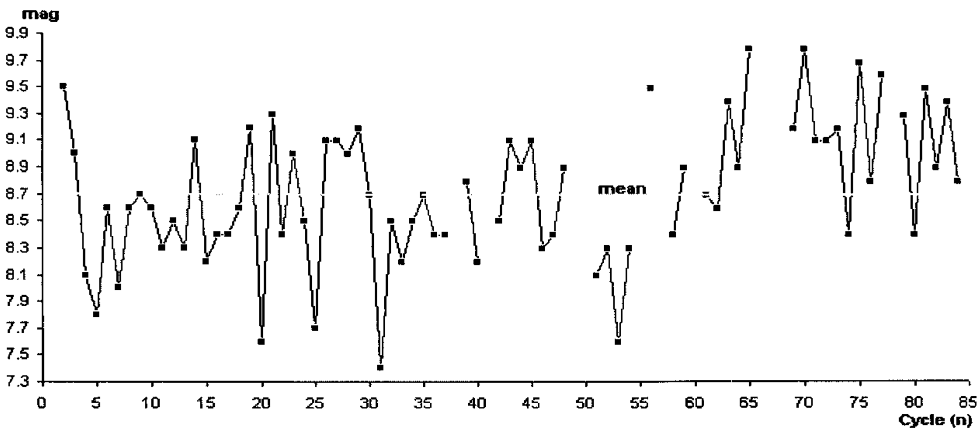


Figure 5: Amplitude variation, in magnitudes (gapped lines denote non-consecutive data points)

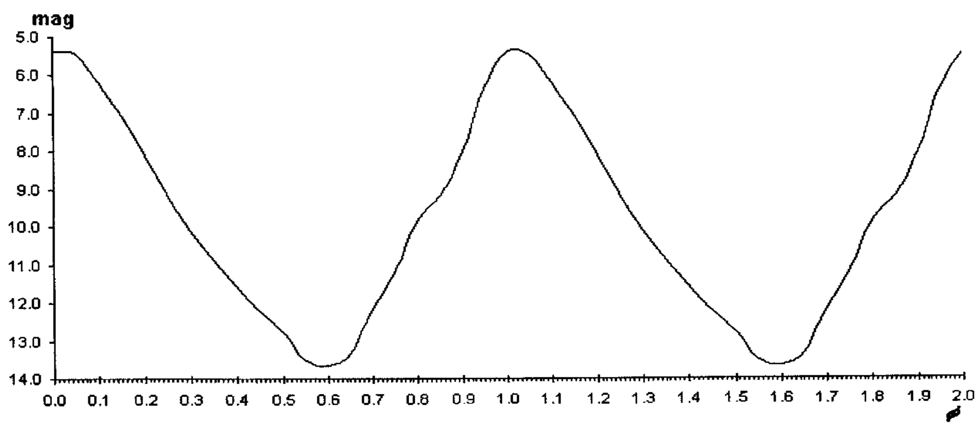


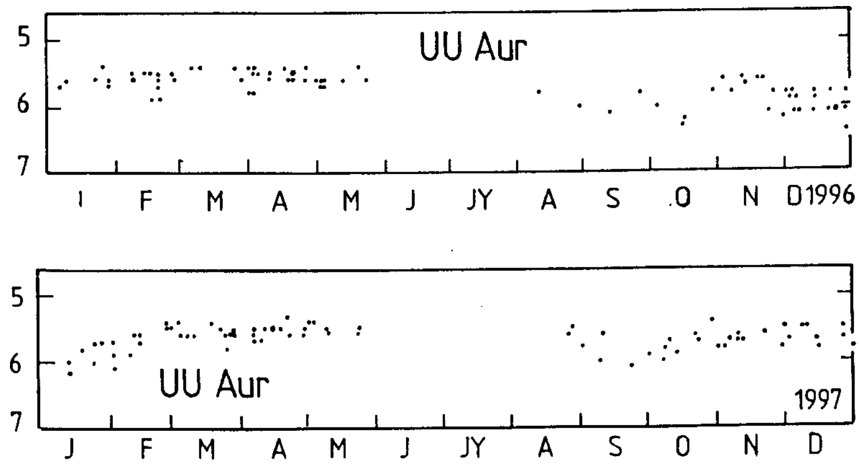
Figure 6: Phase diagram showing representative chi cygni light curve generated by folding approximately 4000 observations from JD244551 to 2450720 on the mean period (with no binning). Mapped as two complete cycles for illustrative purposes.

References

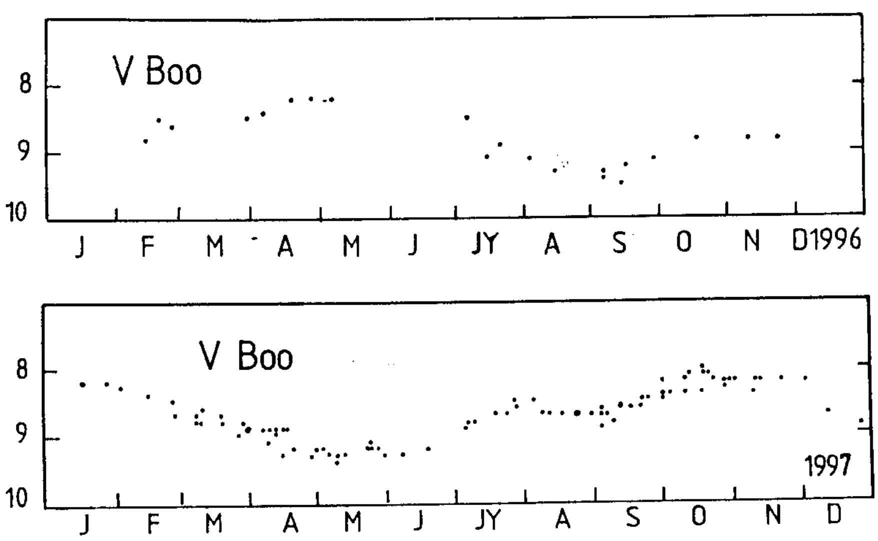
1 Kholopov et al. 1985-88. General Catalogue of Variable Stars 4th edition (sourced via Selected Astronomical Catalogs Vol. 1 No. 1, ADC, GSFC, NASA, Greenbelt, Maryland, USA).
2 Hipparcos and Tycho Catalogue. ESA SP-1200 1997 (CD-ROM volume 1)
3 Mennessier M.O., Boughaleb H., Mattei. J.A. Astron. Astrophys. Suppl. Ser. 124, 143 (1997)

BINOCULAR PRIORITY STARS - SELECTED LIGHT CURVES

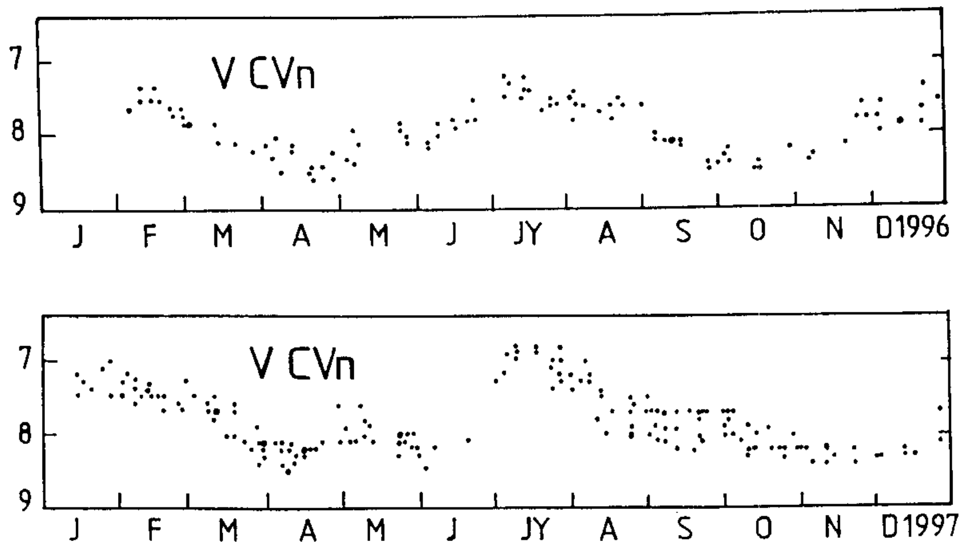
MELVYN TAYLOR



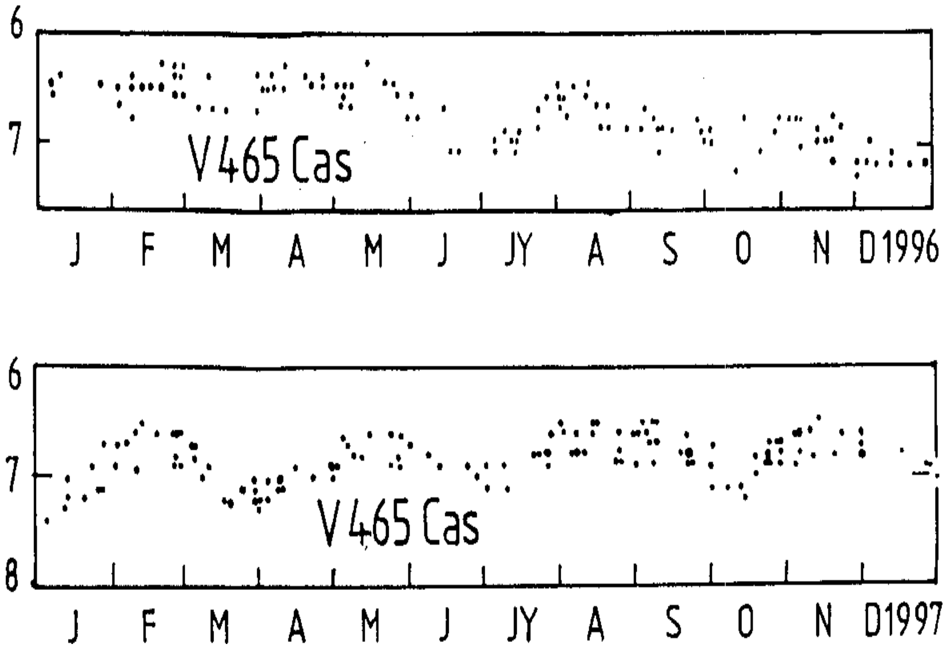
UUAurigae SRB, 5.1 - 6.8, 234d



V Bootis SRA, 7 - 12V, 258d, M6



V Canum Venaticorum SRA, 6.2 60d, M5



V 465 Cassiopeiae SRB, 6.2 - 7.2, 60d, M5

PRACTICAL ASPECTS OF FILTER PHOTOMETRY - II

GRAHAM SALMON

Perhaps I should explain straight away that I am contributing these articles not because I am any sort of expert but because I have found the subject absorbing and I am looking for others to co-operate with. If, like me, observing time needs to end by 1am, but you have time for computer work during the day and you enjoy measuring things, this could be the subject for you! I am particularly conscious that having only taken up astronomy seriously on retirement four years ago, I am very short on practical experience. So any feedback will be very welcome.

As indicated in my last article, in order to extract the maximum information from light, photometry needs to be done with more than one filter, thus deriving the change in colour index of the star and hence the change in temperature.

I have been using Norman Walker's filter box which is provided with a six position switch - four for the B, V, R and I filters, one for no filter and one for a small diagonal viewing mirror. It is designed to ensure that the filter always returns to exactly the same position so that small dust particles on the filter will always affect the same pixels on the CCD. The flat field will then compensate for them.

The insertion of the filter box between the telescope and the CCD has three effects. On my 10" F10 LX200, the CCD will no longer swing through the bottom of the fork, which prevents it going higher than a declination of 70°N. It also pushes the focal point further out. As it takes some fiddling to ensure that the CCD is in focus when the eyepiece is in focus, I keep my eyepiece locked on the filter box. The additional weight also puts a strain on the RA drive which increases the problems with tracking, particularly for fainter stars requiring exposures of 2 minutes or more. The LX200 has a 'Smartdrive' system for ironing out errors in the worm wheel drive, but I have only had partial success with it. It has a 'learning' mode in which you track a star for the 8 minute cycle of the worm wheel, and it remembers the corrections you have made. I improved the situation by providing a counterweight to the filter box and CCD. This consisted of two strips of lead, sewn in to a cotton sleeve and attached round the top end of the telescope tube with velcro.

I use my lowest power eyepiece which has a 30' field of view. The CCD covers about a quarter of this. One could do with an adjustable graticle which would outline the CCD's position on the field of view, but I don't think it has been invented! It is therefore a case of judgement, followed by trial shots to see if all the desired comparison stars are in the frame.

Exposures need to be carefully judged, particularly if a wide range of magnitudes are to be accommodated in one frame. The brightest stars must not be saturated, nor the faintest lost in the noise of the background. I have been using QMips32 for the photometry, which also provides a method which eliminates the need for taking dark frames during observing sessions[1]. It is as well to record the ambient temperature, the CCD temperature and the sky conditions. If the CCD has been turned on for about an hour before observing begins, it should have stabilised and hold its temperature to +/-0.1°C, but I find this varies for the SXL8 according to ambient temperature from -21.5°C at 12°C to -18.5°C at 22°C.

One immediate problem soon becomes apparent. With visual photometry we are accustomed to having a list of the V magnitudes of all the comparison stars provided. However, data on the B, R and I magnitudes for comparison stars do not seem to be at all readily available. Even for stars on the VSS programme, the comparison stars may not be close enough to be included in the same image as the variable and others may have to be used whose V magnitude is not certain. The data on magnitudes given by Sky GSC and other sources should not be relied upon too much. In an attempt to bridge this gap, I have tried to determine the absolute difference in sensitivity when using the different filters from my observations of the standard star group in M67. However, my results are still not very consistent, presumably because even on good nights, sky conditions are still changing between, say, the exposures for B and V frames. I am still working on this.

Several of us have recently been exploring the linearity of CCDs, the effect of the anti-blooming gates and their consequent effect on linearity. This is an important matter and we hope to come to some conclusions soon. In the next article I hope to discuss the pre-processing of the images and their subsequent photometry.

References

1. Buil C. - CCD Astronomy, Chap.5, Willman-Bell Inc 1991

A GAMMA-RAY BURST FROM A SUPERNOVA

TRISTRAM BRELSTAFF

The issue of 'Nature' dated 15th October 1998 contains three papers on an unusual supernova that was apparently associated with the gamma-ray burst GRB980425. The latter was detected on 25th April 1998 by instruments on the BeppoSAX and Compton Gamma-Ray Observatory satellites and lasted about 30s. Images of the field taken a few days later showed a 16th magnitude supernova very close to the location of the x-ray afterglow of the gamma-ray burst.

This supernova, which has been named SN1998bw, is situated in the barred spiral galaxy ESO 184-G82. Over the next few weeks it brightened to 13.6V before starting to fade again. Galama et al (Nature, 395, 670-672, 1998) report photometry and spectroscopy. They consider the possibility that the supernova and gamma-ray burst might just have occurred together as a coincidence, and are not related, but they conclude that this is very unlikely. They find it to be an unusually luminous (MV = -19.35) type Ic supernova.

Kulkarni et al (Nature, 395, 663-669, 1998) report observations of radio emissions from the supernova. These emissions started within only a few days of the outburst - apparently this is another indicator of the extreme violence of the explosion. Iwamoto et al (Nature, 395, 672-674, 1998) try to interpret all the observations by modelling the light-curve and spectra. They find good fits with an explosion of $3x10^{52}$ ergs occurring in a star consisting mainly of 13.8 solar masses of carbon and oxygen, and producing 0.7 solar masses of nickel 56. The latter generates most of the light of the supernova. They also calculate that a compact remnant of 2.9 solar masses should have been left and, as this is above the upper limit for neutron stars, this would be in the form of a black hole.

IBVS

GARY POYNER

4601 CCD Photometry of the eclipsing binary AR Bootis. (Wolf et al, 1998)
4602 Observations of superhumps in SS UMi. (Kato et al, 1998)
4603 Photometry of stars in the field of HP Andromedae (and a new red variable). (Skiff, 1998)
4604 Photometric and polarimetric observations of visual binary WDS 00550+2338 (ADS 755= HD 5286). (Tamazian et al, 1998)
4605 CCD Photometry of the eclipsing binary AU Draconis. (Sarounova et al, 1998)
4606 Photoelectric minima of selected eclipsing binaries and maxima of pulsating stars. (Agerer & Huebscher, 1998)
4607 Radial velocity variablility of three supergiants. (Paredes et al, 1998)
4608 New observations and ephemeris of RT CMa. (Kiyota, 1998)
4609 Accurate position estimates for known variables. (Gombert, 1998)
4610 Photometry of the W UMa system GSC 3869_484. (Robb & Cardinal, 1998)
4611 UBV light curves of the very short period W UMa binary, GSC 03305_00677.(Samec & Faulkner, 1998)
4612 Spectral types for named or suspected variable stars in the IRAS Point Source Catalogue. (Bidelman & Macconnell, 1998)
4613 On the orbital period of EG Cancrii. (Matsumoto et al, 1998)
4614 AAVSO Photoelectric Photometry of RU Cam. (Percy & Tang, 1998)
4615 New outbursts of V1118 Ori. (Hayakawa et al, 1998)
4616 UBV observations of the Solar type near contact binary, CN Andromedae. (Samec et al, 1998)
4617 HD 6628: A new active, single lined spectroscopic binary. Watson et al, 1998)
4618 Photoelectric BVIc observations and new elements for the Cepheid CU Orionis. (Berdnikov & Turner, 1998)
4619 BV Photometry of the eclipsing binary Blue Stragglers in the Globular Cluster NGC 5466. (Mckinley & Corwin, 1998)
4620 Period determinations for the RRc Variable CI Coma Berenices. (Diethelm, 1998)
4621 Photoelectric minima of selected eclipsing binaries. Nelson, 1998)
4622 S 10943 Vulpeculae: A new ROSAT selected Dwarf Nova, probably of SU Ursa Majoris subclass. (Richter et al, 1998)
4623 GSC 223:1761 - A new Delta Scuti variable in Cancer. (Wetterer et al, 1998)
4624 Period change in UV Leonis. (Snyder, 1998)
4625 First photometric observations at the Turkish National Observatory. (Kesin & Aslan, 1998)
4626 Observations of the II Carinae, a 65 day classical Cepheid in the Southern Milky Way. (Berdnikov & Turner, 1998)
4627 1997 Photometry of CG Cygni. (Heckert, 1998)

ECLIPSING BINARY PREDICTIONS (Jan-Mar 1999)

TRISTRAM BRELSTAFF

The following predictions are calculated for an observer at 53 degrees north, 1.5 degrees west but should be usable for observers throughout the BritishnIsles. The times of mid-eclipse appear in parentheses with the start and end times of visibility on either side. The times are hours GMAT, that is UT-12h. 'D' and 'L' are used to indicate where daylight and low altitude, respectively, prevent part of the eclipse from being visible. Charts for all of the stars included in these predictions (17 in all - see VSSC 96 for a list) are available from the Eclipsing Binary Secretary at 10p each (please enclose a large SAE).

1999 Jan 1 Fri
U Sge D05(00)05
Z Dra D05(03)05
S Equ D05(04)07L
RW Tau D05(05)10
X Tri 08(11)13
U Cep 11(16)19D

1999 Jan 2 Sat
Z Vul D05(08)08L
RW Gem D05(09)14
ST Per 07(11)15
TW Dra 07(12)17
X Tri 07(10)12
Z Dra 09(11)14
Z Per 16(21)17L

1999 Jan 3 Sun
RZ Cas D05(04)07
Y Psc D05(05)09
X Tri 07(09)12
Z Dra 18(20)19D

1999 Jan 4 Mon
SW Cyg D05(03)09
U Cep D05(04)09
U Sge D05(09)07L
X Tri 06(09)11
RZ Cas 07(09)11
Z Vul L17(19)19D

1999 Jan 5 Tue
ST Per D05(02)06
Z Dra D05(05)07
RW Gem D05(06)11
TW Dra D05(07)13
X Tri 05(08)10
RZ Cas 11(14)16

1999 Jan 6 Wed
X Tri D05(07)10
Z Dra 11(13)16
U Cep 11(16)19D
RW Tau 13(18)16L
RZ Cas 16(18)19D

1999 Jan 7 Thu
TX UMa D05(01)06
Z Vul D05(06)07L
X Tri D05(07)09
ST Per 14(18)17L
U Sge L17(18)19D

1999 Jan 8 Fri
S Equ D05(01)07
RW Gem D05(02)08
TW Dra D05(03)08
X Tri D05(06)08
SW Cyg 11(17)12L
SW Cyg L14(17)19D

1999 Jan 9 Sat
U Cep D05(04)08
RZ Cas D05(04)06
X Tri D05(05)08
Z Dra D05(06)09
RW Tau 08(12)16L
Z Vul L17(17)19D

1999 Jan 10 Sun
TX UMa D05(03)08
X Tri D05(04)07
ST Per 05(09)14
RZ Cas 06(08)11
Z Dra 12(15)17
TW Dra 17(22)19D

1999 Jan 11 Mon
U Sge D05(03)06L
X Tri D05(04)06
S Equ 06(12)07L
U Cep 11(15)19D
RZ Cas 11(13)16

1999 Jan 12 Tue
Z Per D05(01)05
X Tri D05(03)06
Z Vul D05(04)07L
RW Tau D05(07)12
RZ Cas 15(18)19D

1999 Jan 13 Wed
TX UMa D05(04)09
SW Cyg D05(06)12L
Z Dra 06(08)10
TW Dra 13(18)19D
RW Gem 15(20)17L

1999 Jan 14 Thu
U Cep D05(03)08
Y Psc 07(12)09L
Z Dra 14(17)19D
Z Vul L16(14)19D
U Sge L17(12)18

1999 Jan 15 Fri
RW Tau D05(01)06
Z Per D05(02)07
RZ Cas D05(03)06
ST Per 12(17)16L

1999 Jan 16 Sat
TX UMa D05(06)11
RZ Cas 06(08)10
TW Dra 08(13)18
U Cep 10(15)19D
RW Gem 12(17)17L

1999 Jan 17 Sun
Z Vul D05(01)07
V640 Ori L06(03)06
Z Dra 07(10)12
RZ Cas 10(13)15
SW Cyg 14(20)19D
RW Tau 15(20)16L
U Sge L17(21)19D

1999 Jan 18 Mon
Z Per D05(03)08
Y Psc D05(06)09L
ST Per D05(08)12
S Equ D05(09)06L
RZ Cas 15(17)19D
Z Dra 16(18)19D

1999 Jan 19 Tue
U Cep D05(03)08
TX UMa D05(07)12
TW Dra D05(08)13
V640 Ori L06(04)07
RW Gem 08(14)17L
Z Vul L16(12)18

1999 Jan 20 Wed
RW Tau 10(14)15L

1999 Jan 21 Thu
Z Per D05(05)10
U Sge D05(07)06L
V640 Ori L06(04)07
Z Dra 09(11)14
U Cep 10(15)19D
Z Vul 18(23)19D

1999 Jan 22 Fri
TW Dra D05(04)09
RZ Cas D05(07)10
TX UMa D05(09)14
SW Cyg D05(10)11L
RW Gem D05(10)15
SW Cyg L13(10)16
Z Dra 18(20)19D

1999 Jan 23 Sat
RW Tau D05(09)13
V640 Ori L06(05)08
RZ Cas 10(12)14
ST Per 11(15)16L

1999 Jan 24 Sun
U Cep D05(03)07
Z Dra D05(05)07
Z Per D05(06)11
Z Vul D05(10)06L
SS Cet 11(16)11L
RZ Cas 14(17)19D
U Sge L16(16)19D
TW Dra 18(23)19D

1999 Jan 25 Mon
S Equ D06(05)06L
RW Gem D06(07)12
V640 Ori L06(05)08
TX UMa 06(10)15

Z Dra 11(13)16
1999 Jan 26 Tue
RW Tau D06(03)08
ST Per D06(07)11
U Cep 10(14)19D
Z Vul 16(21)19D
SW Cyg 18(24)19D
1999 Jan 27 Wed
SW Cyg D06(00)06
V640 Ori D06(06)09
Z Per D06(07)12
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TW Dra 13(18)19D
1999 Jan 28 Thu
RW Gem D06(04)09
Z Dra D06(06)09
RZ Cas D06(07)09
TX UMa 07(12)17
1999 Jan 29 Fri
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V640 Ori D06(06)09
Z Vul D06(08)06L
RZ Cas 09(11)14
X Tri 12(15)13L
Z Dra 13(15)17
1999 Jan 30 Sat
Z Per D06(09)14
TW Dra 09(14)19D
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1999 Jan 31 Sun
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U Cep 09(14)19D
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RW Tau 11(16)15L
SW Cyg L12(13)19D
Z Vul L15(19)19D
RZ Cas 18(21)19D
1999 Feb 1 Mon
Z Dra 06(08)11
X Tri 10(13)13L
1999 Feb 2 Tue
V640 Ori D06(07)10
Y Psc D06(08)08L
TW Dra D06(09)14
Z Per D06(10)15
SS Cet 09(14)11L
X Tri 10(12)13L
Z Dra 14(17)19D
1999 Feb 3 Wed
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ST Per D06(05)10
RZ Cas D06(06)09
RW Tau 06(10)15L
X Tri 09(11)12L
TX UMa 10(15)18D
U Sge L16(19)18D
1999 Feb 4 Thu
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X Tri 08(11)12L
RZ Cas 08(11)13
1999 Feb 5 Fri
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TW Dra D06(05)10
Z Per 07(11)15L
Z Dra 07(10)12
X Tri 08(10)12L
SS Cet 09(13)11L
U Cep 09(14)18D
RW Gem 13(18)16L
RZ Cas 13(16)18
Z Vul L15(17)18D
1999 Feb 6 Sat
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RW Tau D06(05)10
V640 Ori D06(08)11
X Tri 07(09)12
TX UMa 12(17)18D
Z Dra 16(18)18D
RZ Cas 18(20)18D
1999 Feb 7 Sun
X Tri 06(09)11
S Equ L18(23)18D
1999 Feb 8 Mon
U Cep D06(02)06
X Tri D06(08)10
V640 Ori 06(09)12
Z Per 08(13)15L
SS Cet 08(13)11L
ST Per 08(13)15L
RW Gem 10(15)16L
1999 Feb 9 Tue
RZ Cas D06(06)08
X Tri D06(07)10
Z Dra 09(12)14
SW Cyg L12(17)18D
TX UMa 13(18)18D
1999 Feb 10 Wed
X Tri D06(07)09
V640 Ori 07(09)12
RZ Cas 08(10)13
U Cep 09(13)18
TW Dra 14(19)18D
Z Vul L15(15)18D
U Sge L15(13)18D
Z Dra 18(20)18D
1999 Feb 11 Thu
ST Per D06(04)08
X Tri D06(06)08
RW Gem 07(12)15L
SS Cet 07(12)10L
Z Per 09(14)15L
RZ Cas 13(15)17
RW Tau 13(18)14L
1999 Feb 12 Fri
Z Dra D06(05)07
X Tri D06(05)08
V640 Ori 07(10)12L
TX UMa 15(20)18D
RZ Cas 17(20)18D
1999 Feb 13 Sat
U Cep D06(01)06
X Tri D06(05)07
TW Dra 10(15)18D
Z Dra 11(13)16
U Sge 17(23)18D
1999 Feb 14 Sun
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SW Cyg D06(07)09L
RW Gem D06(08)14
SS Cet 07(11)10L
RW Tau 08(12)14L
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Z Per 11(16)15L
SW Cyg L11(07)13
S Equ L18(20)18D
1999 Feb 15 Mon
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U Cep 08(13)18
Z Vul L14(12)18
TX UMa 16(21)18D
1999 Feb 16 Tue
Z Dra D06(07)09
TW Dra D06(10)15
ST Per 07(11)14L
RZ Cas 07(10)12
V640 Ori 08(11)12L
1999 Feb 17 Wed
RW Gem D06(05)10
RW Tau D06(07)11
Y Psc D06(09)07L
SS Cet D06(11)10L
RZ Cas 12(14)17
Z Per 12(17)14L
Z Dra 13(15)17
Z Vul 18(23)18D
1999 Feb 18 Thu
V640 Ori 09(11)12L
SW Cyg 14(20)18D
RZ Cas 17(19)18D
TX UMa 18(23)18D
1999 Feb 19 Fri
ST Per D06(03)07
TW Dra D06(05)10
1999 Feb 20 Sat
RW Gem D06(02)07
Z Dra D06(08)11
SS Cet D06(10)10L
U Cep 08(13)18
V640 Ori 09(12)12L
Z Per 13(18)14L
Z Vul L14(10)16
U Sge L15(17)18D
1999 Feb 21 Sun
Y Psc D06(03)07L
RZ Cas D06(04)07
Z Dra 14(17)18D
S Equ L17(17)18D
1999 Feb 22 Mon
RZ Cas 07(09)12
V640 Ori 10(12)12L
Z Vul 16(21)18D
1999 Feb 23 Tue
SS Cet D06(10)10L
SW Cyg D06(10)09L
SW Cyg L11(10)16
RZ Cas 11(14)16
1999 Feb 24 Wed
ST Per D06(10)14L
Z Dra 08(10)12
V640 Ori 10(13)11L
TW Dra 15(20)18D
RZ Cas 16(19)18D
1999 Feb 25 Thu
U Cep 08(12)17
RW Tau 09(14)13L
RW Gem 14(20)15L
Z Dra 16(19)18D
1999 Feb 26 Fri
SS Cet D06(09)09L
V640 Ori 11(13)11L
1999 Feb 27 Sat
TW Dra 10(15)18D

Z Vul 14(19)18D
U Sge L14(11)17

1999 Feb 28 Sun

TX UMa D07(03)08
RW Tau D07(09)13L
RZ Cas D07(09)11
Z Dra 09(12)14
RW Gem 11(16)14L
S Equ L17(14)18D

1999 Mar 1 Mon

SS Cet D07(08)09L
RZ Cas 11(13)16
ST Per 13(17)13L

1999 Mar 2 Tue

TW Dra D07(11)16
U Cep 07(12)17
U Sge 14(20)18D
RZ Cas 16(18)18D

1999 Mar 3 Wed

RW Tau D07(03)08
TX UMa D07(05)09
Z Dra D07(05)07
RW Gem 08(13)14L

1999 Mar 4 Thu

SS Cet D07(08)09L
ST Per D07(09)13
SW Cyg 08(14)08L
SW Cyg L10(14)18D
Z Dra 11(13)16
Z Vul L13(17)18D

1999 Mar 5 Fri

TW Dra D07(06)11

1999 Mar 6 Sat

TX UMa D07(06)11
RZ Cas D07(08)10
RW Gem
D07(10)14L

1999 Mar 7 Sun

Z Dra D07(07)09
SS Cet D07(07)09L
U Cep 07(12)17
RZ Cas 10(13)15
X Tri 10(13)10L

1999 Mar 8 Mon

X Tri 10(12)10L
RW Tau 11(16)12L
Z Dra 13(15)17D
RZ Cas 15(17)17D

1999 Mar 9 Tue

SW Cyg D07(03)08L
RW Gem D07(07)12
TX UMa D07(08)12
X Tri 09(11)10L
ST Per 12(16)13L
Z Vul L13(15)17D
U Sge L13(14)17D

1999 Mar 10 Wed

SS Cet D07(06)09L
X Tri 08(11)10L
TW Dra 16(21)17D
S Equ L16(22)17D

1999 Mar 11 Thu

Z Per D07(02)07
Z Dra D07(08)11
RW Tau D07(10)12L
X Tri 08(10)10L

1999 Mar 12 Fri

RW Gem D07(03)09
ST Per D07(07)11
RZ Cas D07(07)10
TX UMa D07(09)14
U Cep D07(11)16
X Tri 07(09)10L
Z Dra 14(17)17D

1999 Mar 13 Sat

SS Cet D07(06)08L
X Tri D07(09)10L
RZ Cas 10(12)15
SW Cyg 11(17)17D
TW Dra 11(16)17D

1999 Mar 14 Sun

Z Per D07(04)08
RW Tau D07(05)10
X Tri D07(08)10L
Z Vul L13(12)17D
RZ Cas 14(17)17D

1999 Mar 15 Mon

X Tri D07(07)10L
TX UMa D07(11)15
Z Dra 08(10)12

1999 Mar 16 Tue

SS Cet D07(05)08L
X Tri D07(07)09
TW Dra D07(12)17
U Sge L13(09)14
Z Dra 16(19)17D

1999 Mar 17 Wed

Z Per D07(05)10
X Tri D07(06)08
U Cep D07(11)16
ST Per 10(14)12L
S Equ L16(19)17D

1999 Mar 18 Thu

X Tri D07(05)08
SW Cyg D07(07)07L
RZ Cas D07(07)09
TX UMa 08(12)17
SW Cyg L09(07)13

1999 Mar 19 Fri

SS Cet D07(05)08L
X Tri D07(05)07
TW Dra D07(07)12
RZ Cas 09(12)14
Z Dra 09(12)14
Z Vul L12(10)16
U Sge L13(18)17D

1999 Mar 20 Sat

ST Per D07(06)10
Z Per D07(06)11
RW Gem 13(18)13L
RZ Cas 14(16)17D

1999 Mar 21 Sun

TX UMa 09(14)17D
Z Vul 16(21)17D

1999 Mar 22 Mon

TW Dra D07(02)07
SS Cet D07(04)08L
Z Dra D07(05)07
U Cep D07(11)16
RW Tau 07(12)11L
SW Cyg 15(21)17D

1999 Mar 23 Tue

Z Per D07(08)12L
RW Gem 09(14)13L
Z Dra 11(14)16

1999 Mar 24 Wed

RZ Cas D07(06)09
TX UMa 11(15)17D
Z Vul L12(08)13
S Equ L15(15)17D
TW Dra 17(22)17D

1999 Mar 25 Thu

SS Cet D07(03)08L
RW Tau D07(07)11L
RZ Cas 09(11)13
ST Per 09(13)12L

1999 Mar 26 Fri

Z Dra D07(07)09
Z Per D07(09)12L
RW Gem D07(11)13L
U Sge L12(12)17D
RZ Cas 13(16)17D
Z Vul 14(19)17D

1999 Mar 27 Sat

U Cep D07(10)15
SW Cyg L09(10)16
TW Dra 12(17)17D
TX UMa 12(17)17D
Z Dra 13(15)17D

1999 Mar 28 Sun

ST Per D07(05)09

1999 Mar 29 Mon

RW Gem D07(08)12L
Z Per D07(10)12L
U Sge 16(21)17D

1999 Mar 30 Tue

RZ Cas D07(06)08
Z Dra D07(08)11
TW Dra D07(12)17D
TX UMa 14(18)17D

1999 Mar 31 Wed

RZ Cas 08(10)13
Z Vul 12(17)16D
Z Dra 15(17)16D
S Equ L15(12)16D

The deadline for contributions to the March issue of VSSC will be 7th February, 1999. All articles should be sent to the editor (details are given on the back of this issue)

Whilst every effort is made to ensure that information in this circular is correct, the Editor and Officers of the BAA cannot be held responsible for errors that may occur.

Printed by RAMPrint 01604 233677

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TELEPHONE ALERT NUMBERS

Nova and Supernova discoveries

First telephone the Nova/Supernova Secretary. If only answering machine response, leave a message and then try the following: Denis Buczynski 01524 68530, Glyn Marsh 01772 690502, or Martin Mobberley 01245 475297 (weekdays) 01284 828431 (weekends).

Variable Star Alerts

Telephone Gary Poyner (see above for number)

BAAVSS web pages: http://www.telf-ast.demon.co.uk/

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