British Astronomical Association

VARIABLE STAR SECTION CIRCULAR

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Contents

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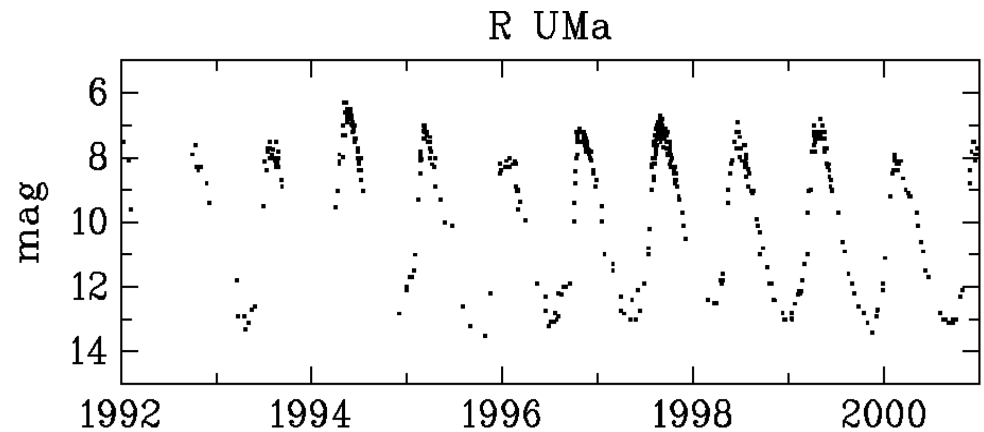
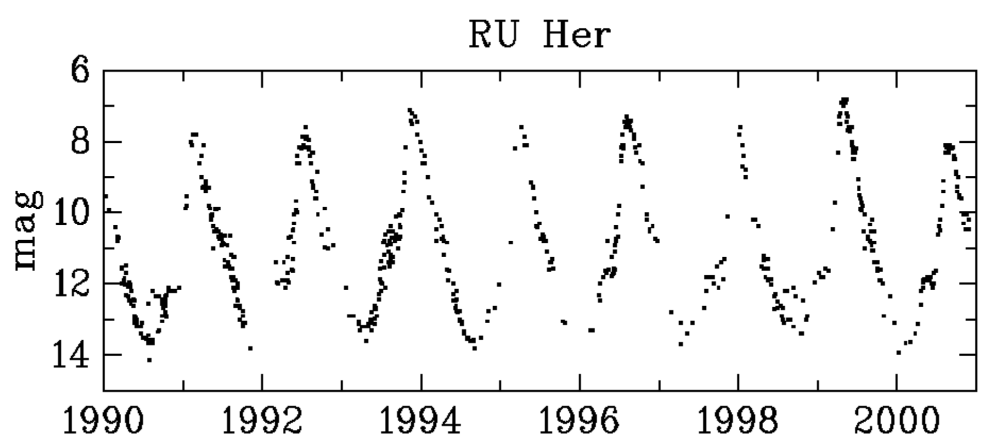
LIGHT CURVES

JOHN SAXTON



Observers: A R Baransky, M Barrett, B H Granslo, M Clarke, K Darbyshire, E H Horsley, F Hamilton, S Godwin, G O Mara, Stuart Inman, S Jenner, J Coates, L Green, N M Bone, P J Charleton, G Pointer, T Markham, R J Bouma, J Toone, Vince Tuboly, Petro Veleshchuk, E J W West



Observers: B H Granslo, C P Jones, M J Gainsford, J E Isles, M J Nicholls, R A H Paterson, T Markham, R J Bouma, J Toone, G Poyner

FROM THE DIRECTOR

ROGER PICKARD

It has been extremely disappointing that, following an almost unprecedented spell of fine weather in December, January should have been so cloudy. I had obtained a nice series of CCD photometry runs on a number of stars (some of which were only suspected of being variable), during those very cold nights in December, and I was looking forward to continuing the work into the New Year. Regrettably, I was only able to observe on three nights in January, but worse was still to come. Whilst endeavouring to upgrade the computer that I use to capture my images, the hard disc crashed so catastrophically, that I lost part of what precious little data I had obtained. This was my own fault for not backing it up beforehand! A lesson learned the hard way!

This reminded me of the occasion, not so many years ago, when I'd made some visual observations, but had inexplicably forgotten to record the date (the only time this has ever happened). When I came to reduce the observations some months later, I had no idea precisely when they had been made, and so had to discard them. What annoyed me most, was the fact that I'd spent a couple of hours or so making these observations, which was then totally wasted by poor recording. Another lesson learned the hard way!

But back to the weather! We are blessed with a (relatively) very bright supernova, two novae and the outburst of a rare WZ Sge type star, but am I able to make a single observation at the time of writing? Surely, the weather can only get better?

And then finally, we were blessed with a clear night, although not until later in the evening, and what happened? I obtained some preliminary images which were fine, and then, quite inexplicably, I discovered that all the images were corrupted! It was probably due to a bad connection somewhere, and indeed I did find one loose wire, but I didn't feel like getting the soldering iron and magnifying glass out at 23.30! Perhaps I'll go back to visual observing after all!

RAS/BAA PRO-AM Meeting on Variable Stars

This proved to be another highly successful meeting (despite the weather - again!), that was thoroughly enjoyed by all those attending. The programme left plenty of time for discussion, but even then it overran by an hour, due largely to a long discussion on the issue of charts and sequences. There will be a full report of the meeting in the Circulars (and elsewhere) in due course.

V838 Monocerotis (Peculiar Variable in Monoceros)

Nicholas Brown of Quinns Rocks, Australia, first noticed this peculiar variable star at about magnitude 10 in Monoceros, on a photograph taken on 2002 Jan 6.6UT using T-Max 400 film. An earlier photograph taken on 2001 Dec 22 did not show this object to a photographic limit of about magnitude 12. Its position is RA 07h 04m 04.85s Dec -03 50' 51.1" (2000). At first it seemed like a new Mira, but by the end of January/begining of February it was seen brightening at a rate of 0.1 mag per hour! As of early February, it was brighter than mag 7.0 and was still brightening. We are awaiting spectroscopic observations, which it is hoped will shed some light as to its precise category; Maurice Gavin has obtained some spectra which seem to indicate it is indeed nova-like.

V2540 Ophiuchi

This object was discovered by Katsumi Haseda, of Japan, with 0.10-m f4 twin patrol cameras using T=Max 400 film on 2002 Jan 24.838, at about magnitude 9.0, whereas on Jan 11.426, it was not recorded, and was therefore fainter than 13.1. Its precise location is RA 17h 37m 34.41s Dec -16 23' 17.9" (2000). Spectroscopy suggests that the object is probably a classical nova which has been caught at the early decline phase, so it may well have faded below the observation level of all but the larger amateur instruments by the time you read this.

Many thanks to the TA E-service and VSNET for information on these two objects.

RECURRENT OBJECTS NEWS

GARY POYNER

DO Dra

Independent outburst detections of this Intermediate Polar were detected on September 24.790 at 11.5mv by Eddy Muyllaert (Bel), on 24.792 at 11.4mv by Patrick Schmeer (Ger) and on Sep 24.857 at 10.9mv by Hazel McGee. The previous outburst occured on November 15th 2000. Do Dra was seen near minimum, at 15.1, on September 19th. The outburst was short lived, and by September 29th had faded to fainter than 14.3.

EF Peg

The first detected outburst of this UGSU star since November 1997 was detected by Eddy Muyllaert (Bel) on October 3.875 at 11.1mv. Confirmation came from Maciej Reszelski (Pol) on Oct 3.953 at 10.7mv. Superhumps were detected by D. Starkey and the Kyoto team, and by Jochen Pietz. See light curve on facing page.

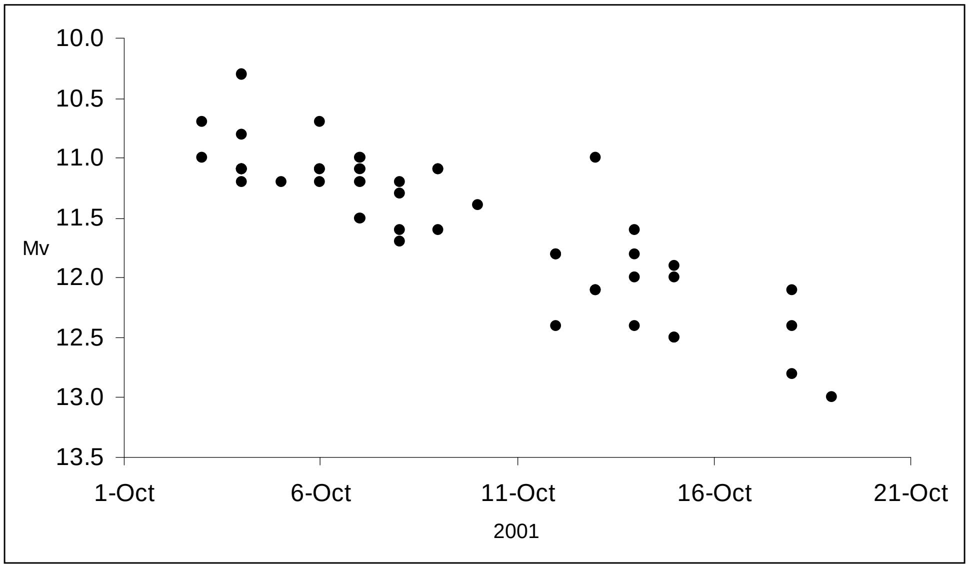
The outburst lasted 16 days, and peaked at magnitude 10.3 on Oct 4th.

EY Cyg

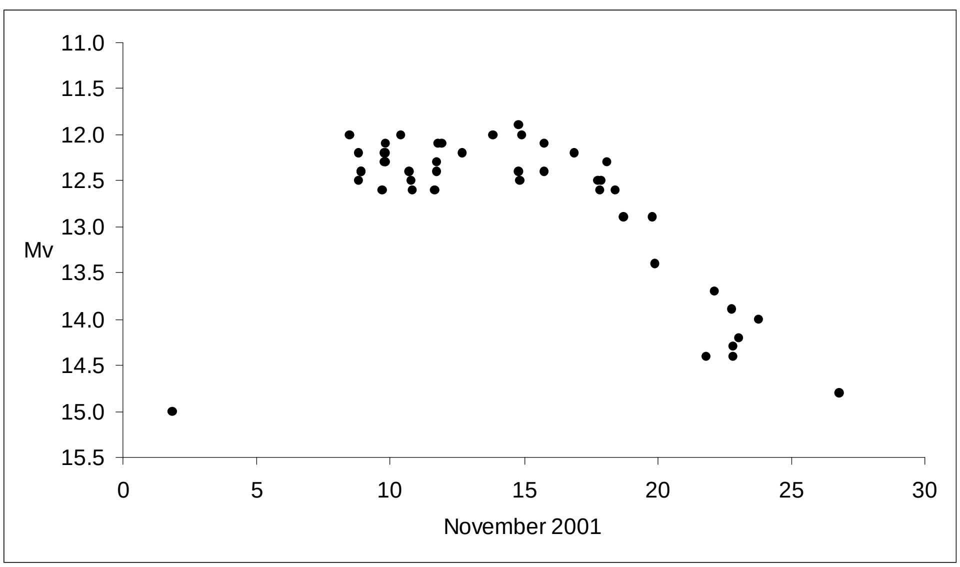
An outburst of this long period UG star was detected independently on November 8.794 at 11.3mv by H. McGee, and on Nov 8.825 at 12.8mv by Guy Hurst. This was the first recorded outburst since January 1997. The reasons for the discordant observations at the time of detection are unclear. See light curve on facing page.

The maximum brightness lasted for approximately 10 days, peaking at mean visual magnitude 12.3. The decline to minimum brightness (14.8-15.0) lasted a further 8 days.

Thanks are due to the VSNET on-line services for providing additional data to BAAVSS observations in compiling these light curves.



Light Curve for EF Peg



Light curve for EY Cyg

VSS DATABASE NEWS

JOHN SAXTON

I am making progress with the database but, as you will no doubt notice, the lightcurves on the covers of this circular only include data up to the end of 2000 (when Dave McAdam finished updating them). The 2001 data are sitting in a directory on my hard disc (and on various backup media too!) and are partly, but not wholly, processed. The main problem has been making my software 'typing error proof'. To put it another way, reading files which conform exactly to the desired format is one thing, but reading files which were entered manually and so contain typing errors of various sorts is something else! However, the software has now processed several months' data from a single observer in a single go, with little trouble, so I am nearing my goal of having the database fully operational at Lymm.

Old Reporting Format

This will continue to be acceptable, but I would like to clarify a few features:

Instrument field: you may have up to 10 instruments, each with a maximum of 20 characters.

Estimate field: if star is equal to A, say, then write =A, not just 'A'. My software flags these instances and requests confirmation. So far, this has only occurred when there have been two estimates together, and it has been obvious that the observer meant =A. Yet if you really meant >A and forgot the >, my software would not know. So please be careful.

Sequence field: I am concerned that 'AAVSO' is potentially ambiguous, especially if the AAVSO choose to change some of their sequences in the future. So please put in any other identifying information too. The sequence label may be up to 20 characters long.

Comment field: This usually consists of single code letters, which is fine.
Dave had a system of 'x01' for longer text which followed on the next line. I wish to discontinue the x01 feature as I can't cope with it! You may enter any text - up to a maximum of 30 characters in the comment field. Text entered under x01 is not actually lost forever, but does not end up in the database. It could still be traced by looking up the appropriate input file (the name of which is in the database).

New Reporting Format

A new reporting format now exists, which will, no doubt, please many of you who attended the Alston Hall meeting! This new format involves typing data into a Microsoft Excel spreadsheet produced by Gary Poyner, and which is available from me. It is not possible to use a text editor to generate files in this new format. If you wish to use a text editor then you will have to stick to the old format. The comments above about estimates, sequences and comments apply equally to this new format.

I am very grateful to Gary for having provided this spreadsheet, and I encourage you to use it. I hope that it makes it easier for you to enter data, and that it makes life easier at my end by ensuring the data arrive with fewer errors.

SUPERNOVA 2002AP IN MESSIER 74

Guy Hurst

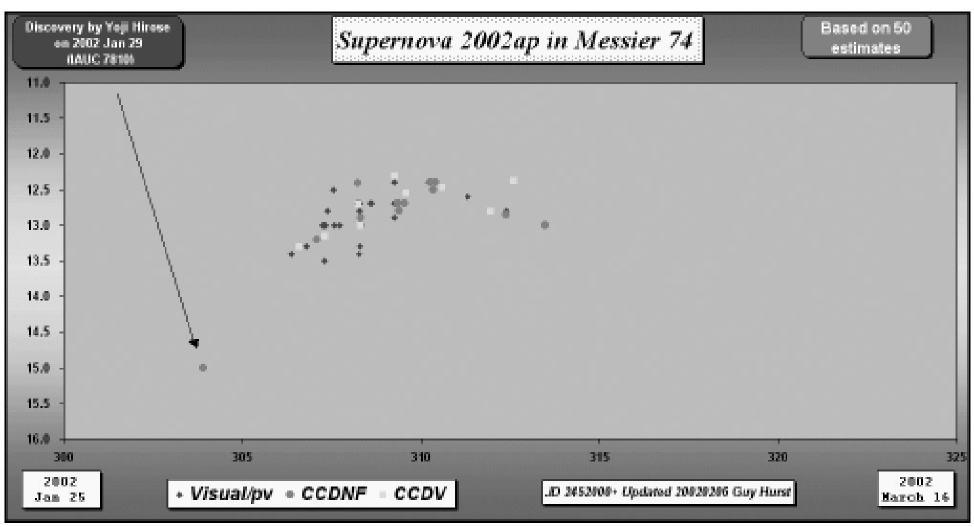
Yoji Hirose of Japan has been searching for supernovae for about 20 years, and recently enquired of Robin Scagell (to whom I am indebted for background information) as to how UK amateurs have found so many in recent years! Now he has one of his own, as he found a new object in Messier 74 on a CCD image of 2002 January 29, which he obtained from his home at Chigasaki-city, 50km west of Tokyo.

The discovery was made with a 0.25-m f/10 (with f/6.3 converter), Schmidt Cassegrain on a Takahashi EM200 mounting together with the SBIG ST-9 CCD. The standard exposure time of 30 seconds was used, and comparison was made with his own images obtained previously. Occasionally, reference is also made to a CCD Atlas or 'Real Sky', but on this occasion this was hardly necessary in view of the object being so bright.

The discovery details were announced on IAU Circular 7810, where the new object was stated to be 274" west and 93" south of the nucleus of M74. In the same circular, R. Kushida provided a precise position of RA 01h 36m 23.85s Dec +15 45' 13.2" (2000), which led to a revision of the offsets to 258" west and 108" south.

The object's discovery magnitude was quoted as 14.5, although examination of the discovery image by the author against the preliminary sequence shown in the attached chart (see opposite page) suggests it may have been as faint as magnitude 15.0.

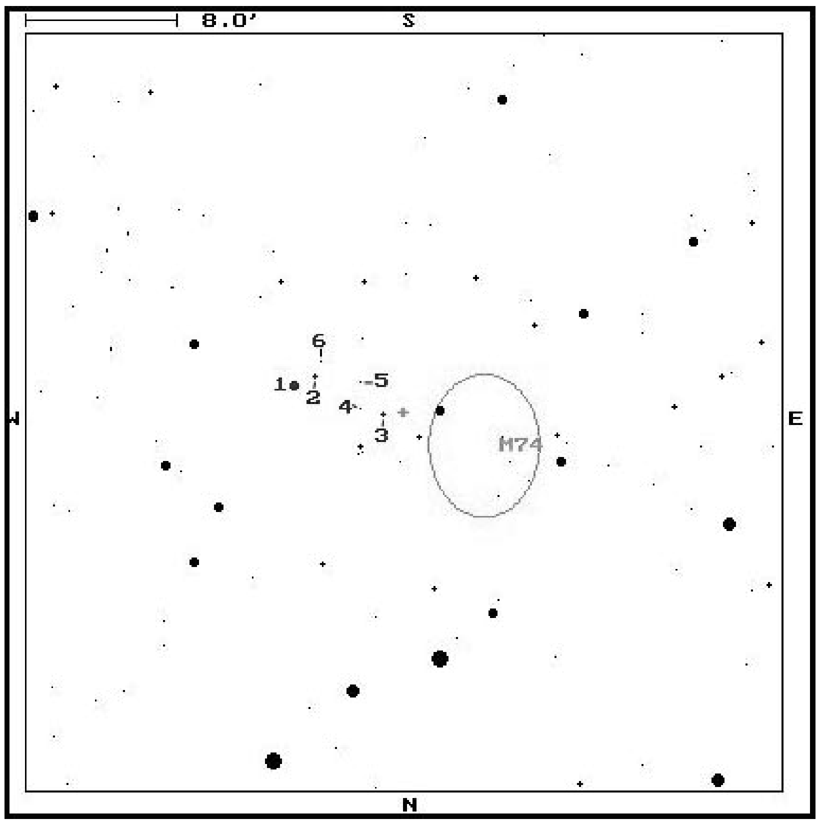
Various professional observatories provided an analysis of spectra which were reported in IAU Circular 7811. Amongst these reports was a summary from Peter Meikle and Stephen Smartt, both of who, by coincidence, had provided lectures on supernovae at the RAS/BAA Pro-Am conference held in Cambridge on January 26! The spectrum was obtained by R.



(B) 0131+15

SN 2002ap in Messier 74

RA 01h 36m 24s DEC +15 14'.6 (2000)
RA 01h 33m 43s DEC +15 29'.9 (1950)
Magn:12.7?-?
Type: SN Offsets 274"W;93"S



Sequence: Preliminary V by Henden

Chart: GSC download
G.M.Hurst 020203

1 12.1
2 13.1
3 13.3
4 13.9
5 14.1
6 14.6

BAA Sequnece reference: SN/044.01
TA Library References:
Notes: Discovered by Yoji Hirose on image of 2002 Jan 29

Ostensen with the William Herschel Telescope on Jan 30.9 UT, and the analysis showed the features resembled SN 1998bw. Meikle and Smartt added that SN 2002ap might be a younger and more energetic version of SN 1998bw. This comparison of two supernovae, both with peculiar spectral properties, attracted much attention, especially as SN 1998bw might have had a possible link with a gamma-ray burster, designated GRB 980425.

Efforts were being made, at the time of writing, to trace a progenitor for the supernova. Although a mag V=21 object was initially proposed, more refined positional measurements now discount this.

Meanwhile alerts were sent to the amateur astronomical community via BAA and TA circulars, but bad weather severely restricted observations in the UK. Overseas contacts had contributed about 50 estimates by Feb 7, and a very preliminary light curve (shown on page 5) clearly shows that the object was caught on the rise. By Feb 4, the object may have peaked at V=12.4 although this may need revision depending on any changes to the initial sequence.

Observers are strongly urged to monitor this important object, visually or by imaging; a chart is provided on the facing page. Observations should be reported to me (contact details on the back of this circular).

THE USE OF A CCD AND TELEPHOTO LENS IN VARIABLE STAR STUDY

ANDY HOLLIS

An unasked-for change in personal circumstances has meant that I have had to give up my observatory and 350 mm Cassegrain telescope, and move to a house on my own. However, this has prompted me to assess how I should continue effective observing with no telescope or observatory, and no prospect, at least in the immediate future, of obtaining one. This article will describe the experimentation that has been ongoing, using a 135mm focal length telephoto lens and a Starlight Express MX-516.

Back in the early 80s, I realised that I was uncomfortable with the errors and uncertainty of visual observing; I had made many thousands of estimates since I began in the early 60s, ranging from naked eye objects, to those requiring my 350mm telescope. Because of my concern with the errors, I designed a photoelectric system which was based on a photomultiplier tube with glass colour filters. This was first used during the eclipse of Epsilon Aurigae. I secured photoelectric measurements of the rise from totality, and these, when taken with Richard Miles' measurements of the falling branch, meant that there were results for the whole eclipse (which lasted from 1981 to 1983) entirely from UK observers. This setup was used to follow eclipsing binaries, asteroid rotations, and eclipse events for the satellites of Saturn and Jupiter.

I have been cautious about the use of unfiltered CCDs in photometry, and raised a furore when I dared to voice my opinion in a letter to the BAA Journal some years ago. After the initial condemnation, it seems that this view has been accepted, and, for example, Norman Walker's filter boxes are now regularly used to allow the use of CCDs to produce photometry that can be transformed to a standard system.

So now the gamekeeper is turning poacher! Eighteen months ago (I think) Guy Hurst spoke at the VSS Northampton Meeting, about his work to develop techniques for nova-searching, which involved using a 50mm focal length camera lens together with a Starlight Express MX-516 CCD. He mentioned that on many images a significant number of stars varied in brightness, and he wondered if this could be caused by light falling on the dark patch between wells, and thus be of instrumental origin. I started thinking about how I could use this technique in my work and experiment to eliminate potential instrumental shortcomings. The Sony chip used by the Starlight Express has a pseudo V-band window to the front. As these chips were designed for use in video cameras, this pseudo V-filter is used to mimic what your eye would see. The first thought that I had, was that although the spectral tail of this filter extends to the red more than is required by the standard Johnson waveband, at the blue end it is a reasonable match. Could it then be useful in stellar use, with a suitable transformation? Could the results match or even improve on the estimations of a visual observer? I floated this idea at the 2001 Instruments and Imaging Section meeting, and I think the general consensus of the meeting was that I had a point; I should try it out and see!

So I have progressed in this direction, and the setup that is now in use consists of this combination sitting on an undriven camera tripod. I currently have a 30mm finderscope mounted on the camera. At present I have largely confined my use to asteroids, though I have also taken an evening of images (a total of 65!) at the meridian and declination of + 20°, to determine the colour consistency and the transformation coefficients. I have to acknowledge the assistance of Richard Miles who has given me support, encouragement and assistance in the image processing in this data.

The combination that I used, gives a field size of 2.1° by 1.6° which is manageable (although the bigger chip that the MX-916 camera has, would give about twice the field area). The procedure I used was to acquire the field in the finder (an essential accessory), and take four images with exposures of 10 seconds each. Each image gets to something like magnitude 11 at an elevation of 25°. If comparison stars are chosen from Hipparcos that are constant and brighter than about magnitude 8.5, then errors are likely only to arise due to faintness of the variable.

The colour correction seems to be minimal for B-V indices between 0.0 and 1.2. I well remember John Isles commenting to me, many years ago, that in his opinion, all red stars should be considered variable whether variability has been observed or not. To minimise the errors, the comparison and the object should be as closely matched in B-V as possible, and this would lead to using red comparisons for red variables - so in many cases a compromise is required. In my case, with the apparent flat colour correction, I am less worried by this, as I have not looked at very early or late spectra stars that would give problems.

Most variable star sequences that are in use by amateur organisations have been around for many years, and inconsistent comparisons have been weeded out in many cases. I am uneasy, however, about the wide spread of colours that are used for comparison stars, as each individual visual observer's colour response is unique to him. At the very least, the set-up that I have described should take out the individual's bias. Doug Saw used to say that a light curve that was a straight line at constant magnitude, could represent many years of results of W Cygni, as the scatter was so great and random that it masked any true variation.
So what have I learnt in this exercise so far?

Well the first thing, is that the idea of using a CCD camera in this way, seems to be both sound and capable of good accuracy. Images that are taken of one object over several nights, seem to be internally consistent, I have reduced and plotted seven nights of data for **11 Parthenope**, and I have derived values for the phase function which is in line with that of the professionals; I think a correction to the value of G may be indicated (I think the professionals use an assumed value rather than the measured value). If I try to image objects that are too faint, then the scatter on the results tends to increase; this is due to the charge generated by photons becoming of similar magnitude to the electronic noise in the system, and due to the fact that the inherent noise on the signal (photon noise=poisson noise) becomes a greater percentage at lower signal levels. It seems that the colour response of the system can be transformed to a standard system, but the corrections required are not major (at least between B-V values of 0 to 1.2). Alhough most CCDs are particularly red and infra-red sensitive, and thus require separate filtration, the pseudo V window to the Sony chips allows the possibility for this simple mode of use, and requires minimal colour correction without a separate filter glass; but it should be noted that this technique must be used with caution, and the user must avoid attempting measurements on stars which are extremely red or blue.

A bigger finder would help me to identify the field, but changing from my current finder would mess up the balance of the equipment; so far, I have not done this, as I am following a cautious approach but I may well try this shortly. I am also considering whether a driven barn door type mount might allow penetration to greater magnitudes, but then I have had driven mounts since the early seventies. Using an alt-az mount is not easy when you have had 40 years of equatorials, and learning about the orientations is also not easy (even binoculars give you more freedom)!

As with all ventures, the main worries tend to be resolvable when the scheme is implemented and new ones come into play. Yes, this method works at a high accuracy for bright objects (well maybe not the Moon or Jupiter, though I will try stopping the aperture down for them just to gauge the effect!).

So I would encourage anyone interested to have a go. It is a surprisingly cheap way of doing accurate scientific work. As we build up a body of similar experience from observers, things should progress. Guy is nova searching, I am carrying out evaluation of the system and using it at present for asteroids (variables that move!) though I have imaged **R Sct**. Colin Henshaw is looking into going this way as well so the field is widening. The requirements are only a telephoto lens, tripod, CCD and computer so who needs the £50,000 observatory?

POSSIBLE ECLIPSING BINARY STAR

ALEX VINCENT

The star **HD221670** in Cassiopeia is a spectroscopic binary some five degrees north of Beta Cas and it is possible that it is an eclipsing binary. Its magnitude at maximum is 7.34. The star's position is at RA 23h 33.6m and Dec is 60 28 (2000). It is very close to HD221639 which is magnitude 7.18, and can be used as a reference star.

The last dates of possible eclipses were on May 10 1994, Dec7 1995, Jul 3 1997, Jan 31 1999 and Aug 27 2000. It seems to have a period of about 576 days and so the next possible minimum is due between March 21 and 24 2002. The eclipse will last some seven or so days and observations should be made between March 16 and April 2. The amplitude may be very small (less than 0.5mags) and so photometry may be required to show any fade.

RECENT PAPERS ON VARIABLE STARS

DICK CHAMBERS

*Superhumps in Cataclysmic Binaries XX. **V751 Cygni**; Patterson, J, Thorstensen, J R., Fried, R., Skillman, D R., Cook, L M, and Jensen, L,PASP, Vol. 113, No.779 (Jan. 2001), p72*

V751 Cyg is classified as a cataclysmic variable in the VY Sculptoris class (anti-dwarf novae). Photometry was undertaken by members of the Centre of Backyard Astrophysics, using telescopes of aperture from 0.25m to 0.66m during 1993, 1999 and 2000. Spectroscopic observations were also undertaken. Periods of 7.169(3) and 0.254(6) cycles per day are reported: identified respectively as negative superhumps, and the wobble period of the tilted accretion disc. A modulation of radial velocities of 6.92(1) cycles per day was identified as the orbital frequency. The spectrum shows occasional P Cygni absorption of the Balmer and HeI lines. The explanation for the detection elsewhere of soft X-ray emission remains unresolved.

*Distance of the RR Lyrae Star **V716 Monocerotis**;Hoard, D W, Layden, A C, Buss, J, Demarco, R., Greene, J, Kim-Quijano, J, Soderberg, A.M, PASP, Vol. 113, No.779 (Jan. 2001), p82*

First identified as a cataclysmic variable, V716 Monocerotis (= **NSV 0375)** is now confirmed as a RR Lyrae variable, of class ab. Multi-filter photometry has confirmed a period of 0.565 days. Using empirical relations between light-curve Fourier components and physical properties, it is estimated that the star's metallicity is [Fe/H] = -1.33 ± 0.2 dex ; absolute magnitude M_v = 0.80 ±0.06; and reddening in the range E(B-V) = 0.05 ± 0.17 mag, placing the star at a distance of 4.1 ± 0.3 kpc, near the plane of the Galaxy and well outside the solar circle.

Dissertation Summary; RR Lyrae variables and Type Ia Supernovae: Discovery and Calibration of Astronomical Standard Candles, PASP, Vol. 113, No.779 (Jan. 2001), p121:

By using data from the Sloan Digital Sky Survey, it is found that V-H and V-K are excellent indices for determining extinction in V of type-Ia supernovae (hereafter SN). Analysis of observations of 9 Type Ia supernovae leads to a Hubble constant of 59 ± 4.0 $kms^{-1}Mpc^{-1}$.

Spectroscopically Peculiar Type Ia Supernovae and Implications for progenitors; D.Branch, PASP, Vol. 113, No. 780 (February 2001), p169

The implications of the presence of spectroscopically peculiar type Ia SN are discussed. It is concluded that multi-progenitor systems are less likely to occur than has been suggested.

The Subluminous Type Ia Supernova 1998de in NGC 252; M.Modiaz, W Li, A.V Filippenko, J Y King, D C.Leonard, T Matheson, R.R.Treffers and A.G Riess, PASP, Vol. 113, Vol. 781, (March 2001), p308

Spectroscopic and photometric observations of **SN 1998de** over a period of 8 days before, and 76 days, after B-band maximum, established this star as a peculiar and subluminous type Ia supernova. Differences from normal SN Ia are noted. Comparison with another subluminous SN type Ia - SN1991bg are made. The implications of these observations for progenitor models and explosion mechanisms of peculiar subluminous SN Ia are discussed.

On Echo Outbursts and ER UMa Supercycles in SU UMa-Type Cataclysmic Variables; C. Hellier, PASP, Vol. 113, No. 782 (April 2001), p469:

Consideration is given to Osaki's tidal thermal instability model for SU UMa-type cataclysmic

PASP = Publications of the Astronomical Society of the Pacific variables and difficulties associated with 'echo' outbursts of WZ Sge-type systems and short supercycles associated with ER UMa-type systems. It is suggested that the decoupling of the tidal and thermal instabilities in systems where the mass ratio is not greater than 0.07 allows an explanation for these problems. The idea may also apply to soft X-ray transients.

Similarities between Stunted Outbursts in Nova-like Cataclysmic Variables and Outbursts in Ordinary Dwarf Novae; R. .Honeycutt,PASP, Vol. 113, No. 782 (April 2001), p473
Stunted outbursts in the range 0.4-1 mag are to be seen in nova-like cataclysmic variables. This paper is based on long-term photometry over the period 1991-2000 of 20 stars. Analysis of the data leads to a dwarf nova mechanism for the outbursts being favoured. An unexpected discovery is the presence of stable repetitive intervals of 26.50 days for the dwarf nova **SY Cnc** and of 32.45 days for the nova-like cataclysmic variable **FY Per**.

Optical Photometry of the Double-lined Cataclysmic variable ***Phoenix 1****; D W Hoard and S Wachter, PASP, Vol. 113, No. 782 (April 2001),Page 482*
Observations over 7 nights of Phoenix 1, leads to the detection of two candidate periods of 0.1334 and 0.2683 day. The longer period is favoured with the observed double modulation caused by ellipsoidal variations of the secondary.

R. Centauri*: An Unusual Mira Variable in a He-shell Flash; G Hawkins, J A Mattei and G Foster, PASP, Vol. 113, No. 782 (April 2001), p501*
AAVSO visual observations from 1918 to 2000 are analysed. The period of the dominant mode has been slowly decreasing, and the pulsation amplitude has decreased by 3 mag. It is suggested these result from a He-shell flash. The light curve showed alternate deep and shallow minima, but as the secondary mode has remained almost constant, the double maxima have nearly vanished from the light curve in recent years.

The Accretion Disc and White Dwarf in the Short-Period Dwarf Novae ***TY Piscium*** *and* ***V436 Centauri*** *during Quiescence, I Nadalin and E M Sion, PASP, Vol. 113, No. 785 (July 2001), p 829*
IUE observations of these two similar SU UMa-type dwarf novae have been studied with the object of obtaining stellar and disc luminosities and accretion rates. Predicted fluxes are found to be significantly different from observed luminosities. It is concluded that the systems were not at their deepest level of quiescence when observed.

The Blazhko Effect of the RR Lyrae Star ***FM Persei****; K M Lee and E G Schmidt, PASP, Vol. 113, No. 785 (July 2001), p835*
615 new V and R observations have identified a primary period of 0.489256 days together with a Blazhko period of approximately 122 days.

Post-Eruptive Detection of ***Variable 12 in NGC 2403 (SN 1954j)****:Another Eta Carinae Variable, N Smith, R M Humphreys and R. D Gehrz, PASP, Vol.113, No.784(June 2001) p692*
Observations of this star some 50 years after its detection as a supernova proves it to be a member of the very rare class of Eta Carinae-type variables.

The Pulsation Mode of the Cluster Cepheid ***V1726 Cygni,*** *D. G. Turner, G. W. Billings and L.N.Berdnikov, PASP, Vol. 113, No. 784 (June 2001), p715*
CCD V-band observations and archival O-C estimates yield an ephemeris which indicates an increase in period at a rate of $+0.304 \pm 0.026$s yr^{-1}, consistent with a star in its third crossing of the instability strip and pulsating in its first overtone.

Accretion-Disc Precession and Substellar Secondaries in Cataclysmic Variables, J. Patterson, PASP, Vol. 113, No. 784 (June 2001), p736:
Although the faintness of the mass-losing secondaries in cataclysmic binaries prevents direct observation it is possible to determine the mass-ratio by simple photometric observations of 'superhumps' using equipment often possessed by amateurs. The technique involves measuring the apsidal precession rate of the accretion disc. Results of such studies reaffirm that most secondaries are near the main sequence but that stars near to 0.08 solar masses are bloated which sets the minimum of the orbital period for H-rich binaries at 76 to 80 minutes. Seven stars are found with secondaries in the mass range 0.014 ± 0.06M

*Period Studies of Some Neglected Close Binaries:**EP And**, **V724 Aql**, **SS Com**, **AM Eri**, **FZ Ori**, **BY Peg**, **EQ Tau** and **NO Vul**, S. Qian and Y. Ma, PASP, Vol.113, No.784 June 2001), p754*
Observations are presented and discussed. Further eclipse timings will be needed to ascertain the predictions of period changes.

A Catalog and Atlas of Cataclysmic Variables: The Living Edition, R.A.Downes, R.F.Webbink, M.M.Shara, H.Ritter, U.Kolb and H.W.Duebeck, PASP, Vol. 113, No. 784 (June 2001), p764
A web site to contain a 'living' edition of this work is described.

Photometric monitoring of Bright Be Stars. IV. 1996 - 1999; J. R. Percy and A. G. Bakos, PASP, Vol. 113, No. 784 (June 2001) p748
UVB photometry of 15 bright active Be stars have been added to a data base extending back 20 years. Variations on timescales ranging from a day to many years are found. The stars are: **X Per, EW Cma, θ CrB, 4 (V839) Her, 88 (V744) Her, 66 (V2048) Oph, NW Ser, CX Dra, 12 (V395) Vul, 28 (V1624) Cyg, QR Vul, 59 (V832) Cyg, EW Lac, ο And** and **KX And.**

*Evidence of a Third Star Orbiting the Eclipsing Binary **Delta Librae**, Thaddeus F. Worek, PASP Vol. 113, No. 786 (August 2001) p964*
Delta Librae is the third brightest Algol-type eclipsing binary in the skies. Analysis of radial velocity data indicates the presence of a third companion some five magnitudes fainter with an orbital period of 2.762 years. The light-time effect for the eclipsing system amounts to a semiamplitude of 3.9 minutes over this period. There is a surprising lack of photometric data for so bright a star, the last light curve being published nearly 40 years ago.

*The Accretion Disc and White Dwarf during the Quiescence of the Dwarf Novae **VW Vulpeculae** and **X Leonis**, C.K.Henry and E.M.Sion, PASP Vol. 113, No. 786 (August 2001) p970*
The I.U.E. archives have been used to study these two U Gem- type dwarf novae during quiescence. An attempt is made to characterise the properties of the white dwarf accreters and the discs.

Long-term VRI Photometry of Small-Amplitude Red Variables, 1: Light Curves and Periods, J.R.Percy, J.B.Wilson and G.W.Henry, PASP Vol. 113, No. 786 (August 2001) p983
Up to 5000 days of VRI photometry of 34 pulsating red giants is reported. The stars are: **TV Psc, EG And, Z Psc, RZ And, 4 Ori, RX Lep, UW Lyn, Eta Gem, Mu Gem, Psi-1 Aur, V523 Mon, V614 Mon, HD 52690, Y Lyn, BC CMi, X Cnc, UX Lyn, RS Cnc, VY Uma, ST Uma, TU CVn, FS Com, SW Vir, 30 Her, Alpha-1 Her, V642 Her, R Lyr, V450 Aql, V1293 Aql, Delta Sge, EU Del, V1070 Cyg, W Cyg, Mu Cep** plus some comparison stars.

REPORT ON THE VARIABLE STAR SECTION MEETING AT ALSTON HALL, PRESTON, (continued)

Karen Holland

There follows a continuation of the summary of the above meeting. It is stressed that this summary is extremely condensed, **and a full version of this report**, together with figures, appears on the VSS web pages at **http://www.britastro.org/vss**. The whole meeting was recorded on video; the six videos are available for loan, for the price of the return postage - please contact the Variable Star Section director for further information.

The Saturday evening lecture was given by **Dr Allan Chapman**, who talked about the time **When Amateurs Ruled Astronomy.** Alan began by asking the question 'Why did we have the golden age of astronomy in the nineteenth century?' At that time, people might have *occupations* in astronomy but they did not have *jobs.* They could be defined as 'the grand amateurs'. Part of the answer, to this question, was that money and pensions meant far less at that time. Science was not centrally-funded in the way that it is today. In those days, you only paid for the things that were entirely necessary; work that was intellectually valuable, but not essential, would never be financed. The only jobs that were paid jobs, were those jobs that were paid for by the state. In other countries abroad, however, this was not the case. There were places, such as the St Petersburg or Berlin Observatory, in which, if you were reasonably well educated, you could aim for a job as a director, with a pension to follow later. In these countries the money was raised to fund these observatories by taxing the poor. So why was it that this did not happen in England?

Charles II was wise enough when he founded the Royal Society, in 1600, not to tax the poor, but to ensure that the Royal Society understood that they must raise their own money to pay for any research. Later on through the eighteenth century, there was the energy and the cash to develop the industrial revolution, but the money stayed in people's pockets; so if you had an idea you could develop it. In this way, a deeply capitalist economy emerged. The English people had the freedom to do as they wished, and foreign visitors noticed and commented on this. This environment created a pool of people with a good education, and this was the beginning of the age of 'grand astronomers', some of whom Dr Chapman went on to describe.

Greenwich was a rare institution, in that it received funding for the task of working out how to find the longitude whilst at sea. Flamsteed, Halley and others had all failed in their attempts to solve this problem. John Harrison finally succeeded because he had the instruments necessary to do the job, and in 1749 he received the Copley medal of the Royal Society, which was the Nobel Prize of that time. In 1764, William, his son, was also elected as a Fellow of the Royal Society. These men moved in this open elite without barriers.

People at this time used the word 'amateur' proudly (in the Latin sense to be an amateur astronomer means that you love astronomy. At this time, paid astronomers didn't have status; they were considered equivalent in status to a groom or a lawyer's clerk. The people who had the esteem, the likes of the Fellows of the Royal Society, were the amateurs. It was assumed that by the time you were able to join the society (requiring that you were able to pay a 40 guinea subscription, and have sufficient friends who were already members to be able to nominate you for membership), you had the education to know what was worth researching.

There was a body of men who knew what needed to be done. They published in the major journals, and they travelled to collaborate with other astronomers abroad. Many astronomers knew each other very well; so well that when Struve had been staying with Lassell and left a shirt behind, Lassell sent it by ‘Airy’ post some days later, when Airy was travelling from Lassell’s house up to London. Cooperation between astronomers had to be voluntary, but where it existed, a good railway system and cheap post meant that you could correspond almost as quickly as you can today.

The grand amateur league also hosted some battles. What these gentlemen regarded as important were gold medals and honarary degrees; they loved letters after their names. This meant more to them than their jobs did. They often fought and disagreed with each other. South famously fell out with Airy and Troughton (who manufactured astronomical instruments). South paid £1800 to Troughton to make him an equatorial mount for a large telescope. Troughton didn’t want to build it to South’s design, because of a number of design faults that he could see. However, South convinced him to go ahead, and build the mount according to his specifications. When it was built it had all the defects that Troughton had said that it would have, and South then refused to pay; Troughton sued. The whole of the RAS took sides in this argument. Eventually after about six years going through the courts, it was decided that South must pay. In a fit of rage South smashed the mount up, and then issued a handbill to the scrap merchants that they could take the scrap metal. It seemed, at this time that South was almost going mad; had he not been a knight, and had many friends, he would most probably have been certified mad. During this time he started to write letters to The Times newspaper, airing many bad feelings.

The professional astronomers were only awarded money to do work once the amateurs had already blazed the trail. Astronomy was a passion to many victorian astronomers such as John Jones who worked at a slate counter at Bangor Docks; he made a 8.25 inch reflector and a spectroscope although he earned very little.

Dr Chapman finally showed some slides including several of Dr Lee, and Hartwell house. One of the slides showed Dr Lee at the telescope wearing his observing hat with tassels and signs of the zodiac decorating the hat.

There was also a slide of Lassell's giant telescope which was the world’s first big equatorial reflector. Lassell shipped this to Malta together with his family and grand piano for five years. He felt that people in Malta considered him to be an eccentric amateur, going over there, as he had, purely to observe the skies.

Gary Poyner, then continued, speaking about his experience of observing **at the telescope**, in particular discussing his method of data entry following the collection of observations. He explained that as he sent data to multiple organisations, it was simplest to enter his data into one line of an Excel spreadsheet, and then to export it in different formats for each organisation. Data only needed to be entered into one or two fields in the main sheet, which drew data from a look-up table to complete the remaining entries automatically. Gary felt that it was important not to have to enter data in several different formats after a long observing session, and that this system therefore worked well for him. Gary felt that the BAA format did not work well now, and the BAAVSS should consider accepting single line entries. In this case, it would be possible to give people Excel templates to use.

Hazel McGee suggested that instead of fiddling around with paper and pen and torch to note observations, she found that a small digital recorder was more useful, and particularly for meteor observations. Gary thought that the digital recorders were also very useful for eclipse observations.

Melvyn Taylor then spoke about **Binocular Variables**; he began by suggesting that the binocular programme probably needed a bit of revision. The programme had originated in the late 1960s, was modified in the early 1970s, and it had been hoped at that time, that the binocular programme would help to increase the popularity of variable star observing.

Melvyn went on to discuss some important aspects of binocular observing: bias was an important area, as this could not be taken out of the individual equation; he suggested that we all needed to look at our own observing, and do what we could to minimise bias; binoculars could be difficult to hold, and Melvyn showed a picture of a practical binocular holder which helped to minimise movement of the image, which he had found offered a significant magnitude advantage over non-mounted binoculars.

It was noted that there were a number of very under-observed stars on the programme. The Z And-type star **NQ Gem** was an important star, that only had a few observations in the database. Being very close to three 7th and 8th magnitude stars in Gemini, its observability was difficult and coverage was minimal. It was felt that these very under-observed stars should be noted in a future circular. Melvyn said that some of the LPVs/Miras were also under-observed. Chris wondered if the 'under-observed' list that used to be published some time ago should be reproduced again.

Melvyn suggested that there should be a re-examination of the binocular programme; the interests and views of professionals should be sought. Chris Lloyd felt that many of the low-amplitude and irregular stars might be dropped from the list. Roger felt that some analysis of existing data was important before any stars were removed from the programme.

John Toone asked if it would not be worthwhile putting a note in the circulars when an SRb entered an active phase, so that people might be encouraged to observe these stars; he felt that these were especially good targets for new observers. Hazel said that the BAA were going to start issuing e-circulars and this sort of thing could be reported through them. Norman added that he thought that it was still important to monitor stars, even when they appeared not to be doing anything, as the quieter phases could often contain information.
John asked if there was any news on the binocular observing book coming out, that the VSS had planned for some time. Roger noted that all the leaflets had been combined and edited, and that it had come back from the printers. The book included an introduction to the section, a chart catalogue, about two dozen charts and some light curves.

John Saxton gave a quick update on the status of the **computer database**. He said that he could now read the standard VSS reporting format. In the following discussion there seemed to be consensus that John should specify the standard format that he required, and that observers should provide data in that format. It was agreed that the CCD reporting format would be decided upon at a later date. John thought that he would be able to generate the light curves, and e-mail the data to the web pages once a month.

Tom Lloyd Evans was struck by the **AF Cyg** light curve that Melvyn showed; he wanted to stress that professionals were only recently starting to become interested in these stars. He mentioned that five period luminosity relations had been found when looking at the LMC, but that it was very important to get good observations of stars in our own galaxy ,as these were the ones that could be studied in detail.

Nick James wanted to show some of the techniques that he used for producing magnitudes from CCD images in his talk on **electronic observing**, but he first addressed the question of why filters should be used, by showing several graphs of QE (Quantum Efficiency) vs wavelength for different CCD chips, which illustrated the vast variation present in response, between different types of chip.   He explained that, if unfiltered photometry was perfomed, different results would be obtained from different cameras for different coloured stars. Filters either needed to be carefully matched to the CCD response, or careful calibration should be conducted.

Nick explained how processing of a CCD frame should proceed prior to photometry being perfomed on the images, covering the removal of dark current, and the elimination of optical effects, and individual pixel sensitivities using flat fields - well illustrated by the *flat field from hell!* Once initial processing had been performed, then aperture or PSF (point spread function) photometry proceeded. Nick also described an evaluation of his camera's unfiltered performance that he had undertaken, finding a magnitude difference of about -0.1 magnitude in the V band, and about +0.2 magnitudes in the R band. Nick also described the software that he had written which enabled batch-processing of the data to be performed.

Nick said that he felt that he needed to do something about defining the errors on the measurements that he was making, and Chris Lloyd said there were fairly standard expressions that you could find, that took into account flat-fielding, readout noise, and noise on the signal.

Richard Miles then discussed the use of f**ilters for CCDs**, starting by itemising the three levels of CCD work that he felt were possible for amateurs:

(a) non-filtered, e.g. suitable for some asteroid work and where the colour index of a variable changed little, or where the variable is very faint;
(b) single filter, say V-passband, and never change it, and
(c) the full-filtered set up, e.g using a filter wheel or similar.

He outlined the different types of filters that might be considered suitable for use with CCDs and listed their advantages and disadvantages, and discussed the Kron-Cousins system that evolved from the filter system that was originally developed for use with photomultiplier tubes. The Kron-Cousins standard passbands were shown, and suitable Schott glass combinations were outlined which might reproduce the passbands if used with suitable CCD chips; in practice a couple of the glasses were gradually attacked by moisture (BG 39 and KG 3), so that these ‘sensitive’ elements needed to be sandwiched between other, more stable ones for protection. John Saxton had done some observing runs on M67 using Norman’s BVRI filters to see how they compared to the standard system. He had found that for the V-band the difference between their measured magnitude and the standard system was only 1.6%, and for the I-band the difference was only 4.0% (Figure 2). Out of the BVRI filters, only the V-band and the I-band were considered close enough to be used for precision photometry, the others need to be fine-tuned further.

Filter glasses could be mounted in a number of ways that were considered, but it was important for filter wheels to be properly constructed if they were to be used for precision photometry, to ensure that the filter returned to precisely the same position each time the wheel was moved.

Richard said that he thought that a CCD programme would be a good idea to get people up to speed in using CCD cameras to do useful work. Nick James added that he thought that we needed to be careful about putting people off from doing CCD work by talking about filters, as there was a lot that could be done without them. Richard thought that if we had a programme, perhaps we could have three sections as outlined above: one for unfiltered work (useful for new starters to photometry), one for V-band only and one for multicolour (UBVR or I) projects.

Norman Walker then spoke about his designs for a **spectrograph** that would allow amateurs to do useful scientific work. He outlined the requirements for a basic spectrograph: a slit, collimator, prism and lens, in which the focal ratios of the components were appropriately matched.

Norman discussed the advantages and disadvantages of prisms and gratings, and briefly outlined the benefits that could be obtained by using a fibre-optic feed from the telescope to the spectroscope. He also described the kind of equipment that could be included in the spectroscope adapter that would attach the spectrograph to the telescope. It would be possible to include an incandescent lamp for flat-fielding, and a cathode lamp for wavelength calibration purposes - both with the appropriate lenses to ensure the f-ratios from these light sources would be the same as that coming out of the back of the telescope.

Norman showed Christian Buil's spectrograph design, in which the light came from the telescope through a slit, a right-angled mirror, a camera lens, on to an Edmund Scientific grating, and back through the same camera lens to the CCD camera. The disadvantages of this system, he felt, were that the spectrograph was mounted directly on the telescope, so it would be movement-sensitive; a slit was used, so much light was lost; and the same camera lens was used for both the collimator and the exit optics, so that the f-ratio of either could not be independently altered. However, the results that Buil obtained (which could be viewed on his web site) were remarkable. The spectroscope achieved a dispersion of 0.515 Apixel^{-1} in a spectrum portion of **Zeta Cepheus**.

Norman said that in order to optimise a spectrograph design for use with a typical CCD chip, which is square or rectangular, ideally an echelle grating should be used. Echelle gratings produced very high overlapping orders, which have to be separated from each other with either another grating, or a prism used at right angles to the echelle dispersion. Norman said that there was lots of astrophysically important information in the spectral range between the Balmer limit and H-alpha; this was a 1000+ angstrom region that would be interesting to cover. Unfortunately, echelle gratings were very expensive. Norman felt that software might also be a problem, but Chris Lloyd didn't agree. He said that there was plenty of software already written, albeit running under Linux.

Tom Boles then spoke about his experience of **Discovering Supernovae**, beginning by jokingly pointing out that in this weekend of Variable Star talks, this was actually the first talk that had been given on REAL variables - rather than puny 2.5 magnitude miras!

He said that supernova-hunting was actually very simple; you just had to sit down and take many images for as long as possible, as faint as possible, and then you were left with the job of analysing the data. The real challenges began after a potential discovery had been made, when there was a great deal to be done; Tom explained the process of checking and confirmation that was necessary after a suspected supernova had been imaged.

Tom explained that if you took 1200 images, then roughly one in 50 would have something on it that was worthy of further investigation. If the weather was bad, then there would be lots of suspects created by noise generated from the weather, but if the weather was good, then stars that had never been seen before would be detected. It seemed that the probability of success was related not only to the number of images that were taken, but also to the speed at which they were taken. Tom's success rate had increased from one supernova, on average every 7000 patrols whilst surveying at a rate of around 25 patrols per hour, to one success every 4000 patrols, since his rate had increased to 140 images per hour, with considerable equipment development. Tom suspected that this increase in the success rate could be due simply to the fact that he got to targets before others did, if he patrolled faster.

Supernova-hunting required the most up-to-date equipment, and even the equipment that Tom and Mark had was now out-of-date. There was a constant push to keep the cameras running for longer, and to update equipment. Tom showed some slides of his new observatory, and described how his equipment had been developed to maximize the number of galaxies that could be patrolled; he had two telescopes which doubled the effective number of clear nights that were available. Tom and Mark were considering strategies that might maximise their efficiency, such as splitting up the sky between them. It was clear that supernovae hunting is an activity that, in order to be at the top, requires complete dedication.

Chris Lloyd and **John Howarth** then briefly spoke about **data analysis** - using some freely available packages to demonstrate real-time analysis.

Chris first used Kevin West's **UX Dra** data to demonstrate the PDMwin3 package (which calculated Stellingwerf's PDM periodogram), and it clearly identified the two main periods. It also folded the data to show the light curve, and removed the main period, then re-calculated the periodogram. Chris then used the AVE package (downloaded from the VSNET website) and demonstrated the Stellingwerf, Jurkerwicz and Scargle methods. All three methods found the same periods but the appearance of the periodograms seemed very different. This was partly in the way they were presented, but also the relative strengths of the periods found were not the same. The variations of UX Dra could be interpreted as being due to the presence of two periods, where one was nearly a harmonic of the other, but he concluded that there was lots of other activity as well. It was very important to use enough frequency steps to resolve the periods properly; the number of frequency steps was determined by the length of data that you had. The Scargle method apparently produced a probability, using the Horne and Baliunas algorithm, and gave very similar results to the first analysis; it also found other lower frequencies as well. Kevin's data for **V465Cas** was also examined as it showed lots of activity; there was clearly a long term variation with something shorter imposed on it. Chris used Scargle's periodogram, and this found five frequencies in the data altogether. Chris and Norman then proceeded to import the data into Excel to plot graphs of the sets of frequencies that had been found in these stars.

These sorts of stars with multiple and or changing periods were the most difficult to analyse, and stars with single periods should be much simpler to study. All the period-finding methods found the main periods but the relative strengths of the less significant periods were quite often different. To properly do a period analysis, you needed to be able to remove periods from the data individually and then re-calculate the periodogram.

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 parantheses, with the start and end times of visibility on either side. The times are hours GMAT (UT-12h). D indicates that the eclipse starts/ends in daylight, and L indicates low altitude at the start/end of the visibility period. Thus, for example, on Apr 4, *TV Cas D08(10)14* indicates that an eclipse of TV Cas starts in daylight, but can be observed between 08h and 14h GMAT (20h and 02h BST), with mid eclipse at about 10h GMAT (22h UT). Please contact the EB secretary if you require any further explanation of the format. Note that predictions for RZ Cas, Beta Per, Lambda Tau and HU Tau can be found in the BAA Handbook.

2002 Apr 1 Mon
Z Dra 10(12)14
U Sge L12(14)16D
2002 Apr 2 Tue
U Cep D08(10)14
SW Cyg L08(13)16D
TV Cas 11(15)16D
RW Gem 11(16)12L
Z Per L16(17)16D
2002 Apr 3 Wed
TX UMa D08(12)16D
TW Dra 14(19)16D
2002 Apr 4 Thu
Z Dra D08(05)08
TV Cas D08(10)14
Z Vul L11(12)16D
2002 Apr 5 Fri
RW Gem 08(13)12L
ST Per 10(14)11L
Z Dra 11(14)16
Z Per L16(18)16D
2002 Apr 6 Sat
TV Cas D08(06)10
TX UMa 09(13)16D
TW Dra 10(15)16D
2002 Apr 7 Sun
U Cep D08(09)14
SW Cyg L08(02)08
S Equ L14(12)16D
2002 Apr 8 Mon
ST Per D08(05)09
Z Dra D08(07)09
RW Gem D08(10)12L
RW Tau 08(13)10L
U Sge L11(08)14
Z Per L16(19)16D
2002 Apr 9 Tue
TW Dra D08(10)15
TX UMa 10(15)16D
Z Vul L11(10)15
Z Dra 13(16)16D
2002 Apr 10 Wed
X Tri D08(10)08L
2002 Apr 11 Thu
V640 Ori D08(06)08
RW Gem D08(07)12L
RW Tau D08(08)10L
X Tri D08(09)08L
SW Cyg 10(16)16D
U Sge 12(17)16D
TV Cas 12(16)16D
Z Vul 16(21)16D
Z Per 16(21)16D
2002 Apr 12 Fri
TW Dra D08(05)10
Z Dra D08(09)11
X Tri D08(09)08L
U Cep D08(09)14
TX UMa 12(16)16D
2002 Apr 13 Sat
V640 Ori D08(06)08L
TV Cas D08(12)16
ST Per 08(12)10L
Z Dra 15(17)16D
2002 Apr 14 Sun
RW Gem D08(04)09
Z Vul L10(08)13
S Equ L14(09)15
2002 Apr 15 Mon
V640 Ori D08(07)08L
TV Cas D08(07)11
TX UMa 13(18)16D
2002 Apr 16 Tue
ST Per D08(04)08
SW Cyg D08(06)12
Z Dra 08(10)13
Z Vul 13(19)16D
2002 Apr 17 Wed
U Cep D08(09)13
S Equ 14(20)16D
TW Dra 15(20)16D
2002 Apr 18 Thu
U Sge L11(12)16D
TX UMa 15(19)16D
2002 Apr 19 Fri
Z Vul L10(06)11
2002 Apr 20 Sat
Z Dra 10(12)15
TW Dra 10(16)16D
SW Cyg 14(20)16D
TV Cas 14(18)16D
2002 Apr 21 Sun
ST Per D08(11)10L
Z Vul 11(17)16D
U Sge 15(21)16D
2002 Apr 22 Mon
U Cep D08(08)13
RW Tau D08(09)09L
TV Cas 09(13)15D
2002 Apr 23 Tue
TW Dra D08(11)15D
2002 Apr 24 Wed
TV Cas D08(09)13
Z Dra 11(14)15D
S Equ L13(17)15D
U Cep 15(20)15D
2002 Apr 25 Thu
RW Tau D08(04)09
SW Cyg D08(09)15D
RW Gem 09(15)11L
U Sge L10(06)12
2002 Apr 26 Fri
TW Dra D08(06)11
Z Vul L10(14)15D
2002 Apr 27 Sat
Z Dra D08(07)09
U Cep D08(08)13
2002 Apr 28 Sun
RW Gem D08(11)10L
U Sge L10(15)15D
Z Dra 13(16)15D
2002 Apr 29 Mon
ST Per D08(10)09L
U Cep 15(20)15D
TV Cas 15(19)15D
2002 Apr 30 Tue
Z Per D09(05)10L
2002 May 1 Wed
RW Gem D09(08)10L
Z Dra D09(09)11
Z Vul L09(12)15D
TV Cas 11(15)15D
S Equ L13(14)15D
2002 May 2 Thu
U Cep D09(08)12
Z Dra 15(17)15D
2002 May 3 Fri
Z Per D09(06)09L
TV Cas D09(10)14
RW Tau D09(11)09L
2002 May 4 Sat
RW Gem D09(05)10L
SW Cyg D09(13)15D
TW Dra 11(16)15D
U Cep 15(19)15D
2002 May 5 Sun
TV Cas D09(06)10
Z Dra D09(10)13

U Sge L10(09)15D

2002 May 6 Mon

Z Per D09(08)09L
Z Vul L09(10)15D

2002 May 7 Tue

TX UMa D09(04)09
U Cep D09(07)12
ST Per D09(09)09L
TW Dra D09(12)15D

2002 May 8 Wed

S Equ L12(11)15D
U Sge 13(19)15D

2002 May 9 Thu

Z Per D09(09)09L
Z Dra 10(12)15
U Cep 14(19)15D

2002 May 10 Fri

TX UMa D09(06)11
TW Dra D09(07)12
TV Cas 12(16)15D

2002 May 11 Sat

Z Vul D09(08)13

2002 May 12 Sun

U Cep D09(07)12
TV Cas D09(12)15D
U Sge L09(04)09
Z Per L14(10)15D
ST Per L14(16)15D

2002 May 13 Mon

TX UMa D09(07)12
SW Cyg 10(16)15D
Z Dra 12(14)15D
Z Vul 14(19)15D

2002 May 14 Tue

TV Cas D09(07)11
U Cep 14(19)15D

2002 May 15 Wed

U Sge D09(13)15D
S Equ L12(07)13
Z Per L13(12)15D

2002 May 16 Thu

Z Vul D09(06)11
Z Dra D09(07)10
TX UMa D09(09)14

2002 May 17 Fri

U Cep D09(07)11
Z Dra 13(16)14D

2002 May 18 Sat

SW Cyg D09(06)12
Z Vul 11(17)14D
TW Dra 12(17)14D
S Equ 13(18)14D
Z Per L13(13)14D
Y Psc L14(14)14D

2002 May 19 Sun

TX UMa D09(11)14D
U Cep 14(18)14D
TV Cas 14(18)14D

2002 May 20 Mon

Z Dra D09(09)11
ST Per L14(14)14D

2002 May 21 Tue

TW Dra D09(13)14D
TV Cas D09(13)14D
Z Per L13(14)14D

2002 May 22 Wed

U Cep D09(06)11
U Sge D09(07)13
TX UMa D09(12)14D
SW Cyg 14(20)14D

2002 May 23 Thu

TV Cas D09(09)13
Z Vul D09(14)14D

2002 May 24 Fri

TW Dra D09(08)13
Z Dra D09(11)13
Z Per L13(16)14D
U Cep 13(18)14D

2002 May 25 Sat

TX UMa D09(14)14D
U Sge 10(16)14D
S Equ L11(15)14D

2002 May 27 Mon

U Cep D10(06)11
SW Cyg D10(10)14D
Z Per L13(17)14D

2002 May 28 Tue

Z Vul D10(12)14D
Z Dra 10(12)14D
TX UMa 10(15)14D
ST Per L13(13)14D

2002 May 29 Wed

U Cep 13(18)14D

2002 May 30 Thu

TV Cas 11(15)14D
Z Per 14(18)14D

2002 May 31 Fri

TX UMa 12(17)14D

2002 Jun 1 Sat

U Cep D10(06)10
TV Cas D10(10)14D
U Sge D10(10)14D
S Equ L11(12)14D
Z Dra 12(14)14D
TW Dra 13(18)14D

2002 Jun 2 Sun

Z Vul D10(10)14D
Y Psc L13(16)14D

2002 Jun 3 Mon

TV Cas D10(06)10
U Cep 13(17)14D
TX UMa 13(18)14D

2002 Jun 4 Tue

TW Dra D10(13)14D

2002 Jun 5 Wed

SW Cyg D10(13)14D
ST Per L13(12)14D
Z Dra 13(16)14D

2002 Jun 6 Thu

U Cep D10(05)10
Y Psc L13(10)14D

2002 Jun 7 Fri

Z Vul D10(08)13
TW Dra D10(09)14

2002 Jun 8 Sat

U Sge D10(05)10
Z Dra D10(09)11
S Equ L10(09)14D
TV Cas 12(16)14D
U Cep 12(17)14D

2002 Jun 9 Sun

X Tri 13(16)14D
Z Vul 14(19)14D

2002 Jun 10 Mon

TV Cas D10(12)14D
X Tri L13(15)14D

2002 Jun 11 Tue

U Sge D10(14)14D
X Tri L13(14)14D

2002 Jun 12 Wed

Z Vul D10(06)11
TV Cas D10(07)11
Z Dra D10(11)13
X Tri L13(14)14D

2002 Jun 13 Thu

U Cep 12(17)14D
ST Per L12(10)14D
X Tri L13(13)14D

2002 Jun 14 Fri

SW Cyg 11(17)14D
Z Vul 11(17)14D
X Tri L13(12)14D

2002 Jun 15 Sat

S Equ D10(06)11
X Tri L13(12)14D

2002 Jun 16 Sun

Z Dra D10(12)14D
X Tri L13(11)13

2002 Jun 17 Mon

X Tri L13(10)13
Y Psc 13(17)14D
TV Cas 14(18)14D

2002 Jun 18 Tue

U Sge D10(08)14D
TW Dra D10(14)14D
S Equ 11(16)14D
U Cep 12(16)14D
ST Per 13(17)14D

2002 Jun 19 Wed

SW Cyg D10(06)13
TV Cas D10(13)14D
Z Vul D10(15)14D

2002 Jun 20 Thu

Z Dra 12(14)14D

2002 Jun 21 Fri

TV Cas D10(09)13
TW Dra D10(10)14D
U Sge 12(17)14D
ST Per L12(09)13
Y Psc L12(12)14D

2002 Jun 23 Sun

U Cep 11(16)14D

2002 Jun 24 Mon

Z Vul D10(12)14D
Z Dra 13(16)14D

2002 Jun 25 Tue

S Equ D10(13)14D

2002 Jun 26 Wed

ST Per 12(16)14D

2002 Jun 27 Thu

Z Dra D10(09)11
Z Per L11(07)11

2002 Jun 28 Fri

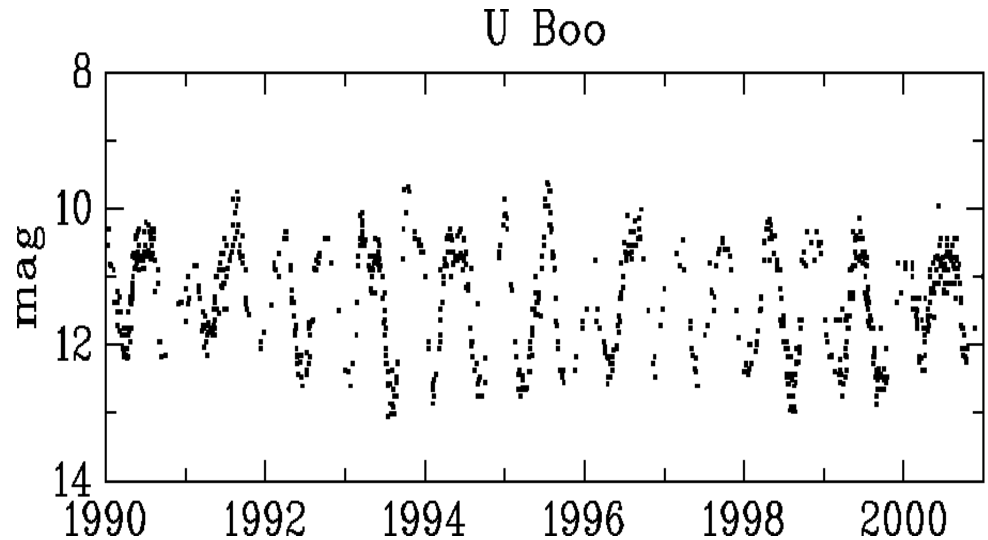
TX UMa D10(06)11
SW Cyg D10(10)14D
U Sge D10(12)14D
TV Cas 11(15)14D
U Cep 11(16)14D

2002 Jun 29 Sat

Z Vul D10(10)14D
ST Per L11(08)12

2002 Jun 30 Sun

TV Cas D10(10)14D
Z Per L10(08)13



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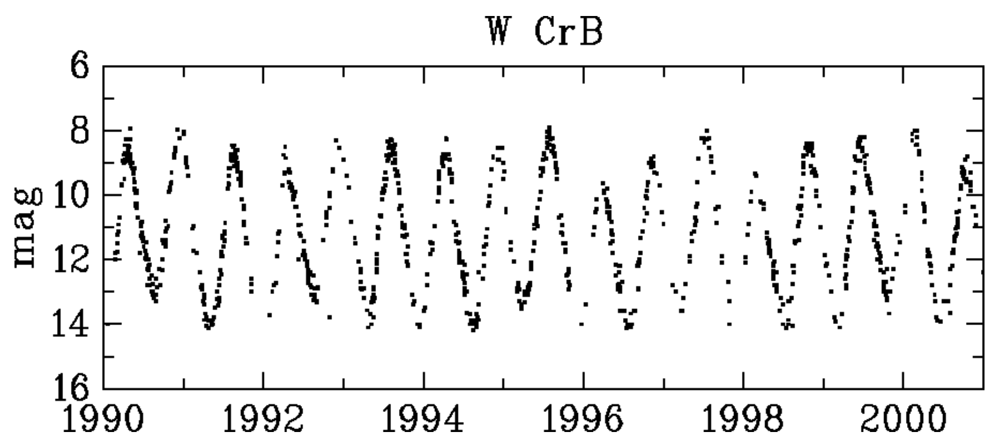

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The deadline for contributions to the issue of VSSC 112 will be 7th May. All articles should be sent to the editor (details are given on the back of this issue).

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