British Astronomical Association

VARIABLE STAR SECTION CIRCULAR

No 89, September 1996

Contents

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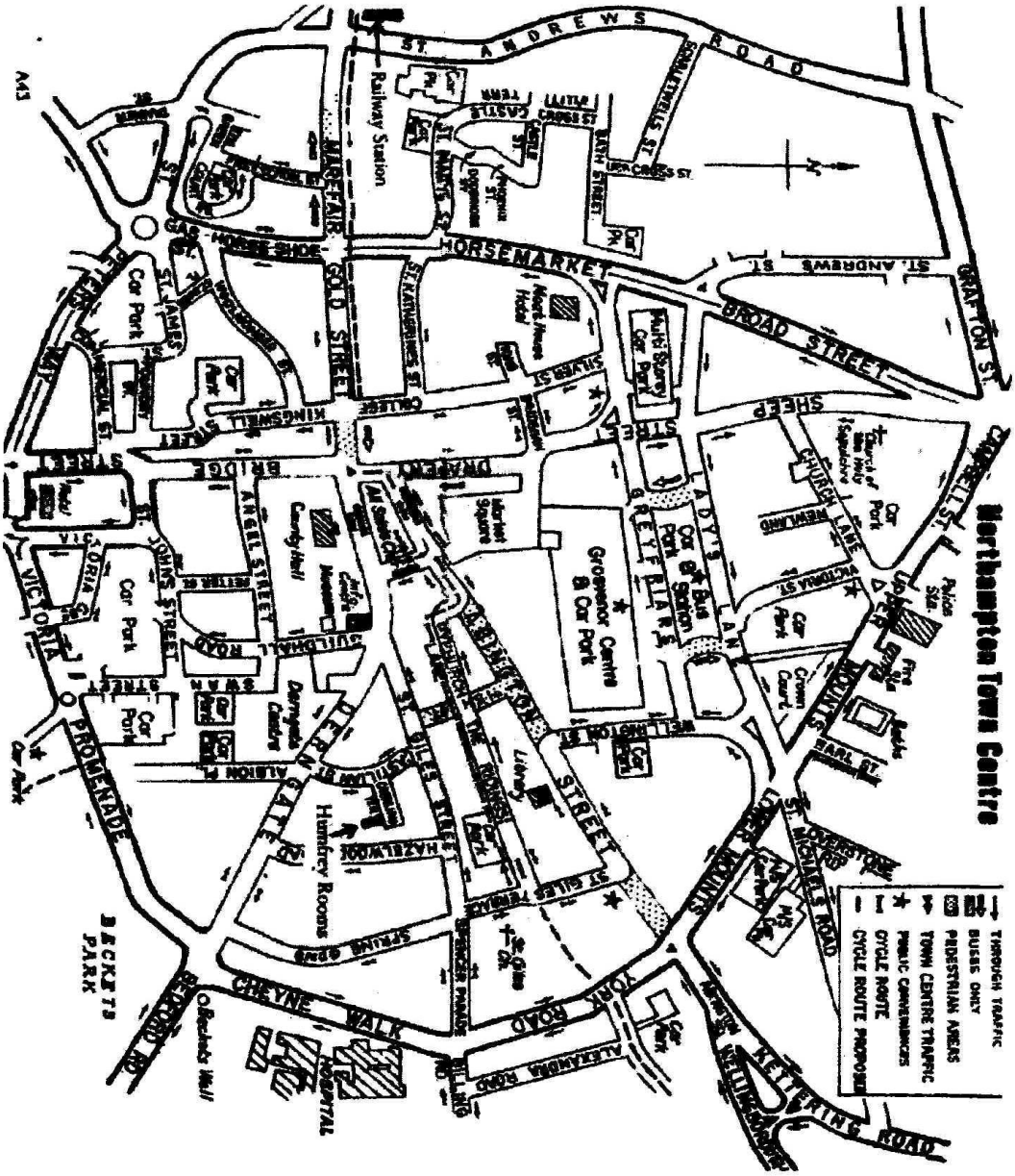


Please note:
The deadline for articles for inclusion in the December VSSC is 1st November.

SECTION MEETING

The section meeting will be held at the Humfrey Rooms, Castillian Terrace, Northampton (see map on facing page) on Saturday October 5th - starting at 11am. Invited speakers will be...

Dr. Mark Kidger..... The International OJ287 Project
Dr. Bill Worraker..... Eclipsing Dwarf Novae
Guy Hurst..... Novae/Supernovae
Kevin West..... Photoelectric Photometry
John Toone..... Binocular Variable Star Observing
John Mackey.....V-band CCD Photometry of Variable Stars
Tonny Vanmunster..... Centre for Back-Yard Astrophysics, Belgium

There will be a £1 charge at the door to cover refreshments during the day. A buffet lunch will also be available at £4.00, which must be booked in advance before the end of September. Luncheon orders should be sent to Bob Marriott, 24 Thirlestane Road, Far Cotton, Northampton, NN4 8HD. Please make cheques payable to NNHS. Exhibits are invited.

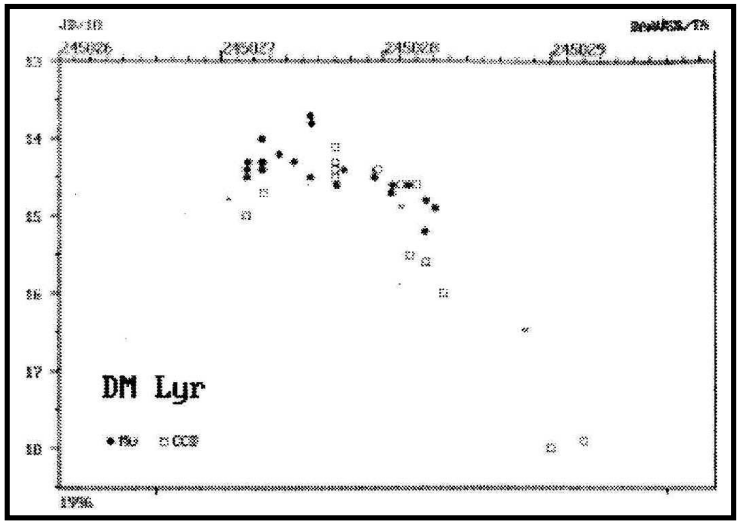
RECURRENT OBJECTS PROGRAMME News...

DM Lyr: A new UGSU Star

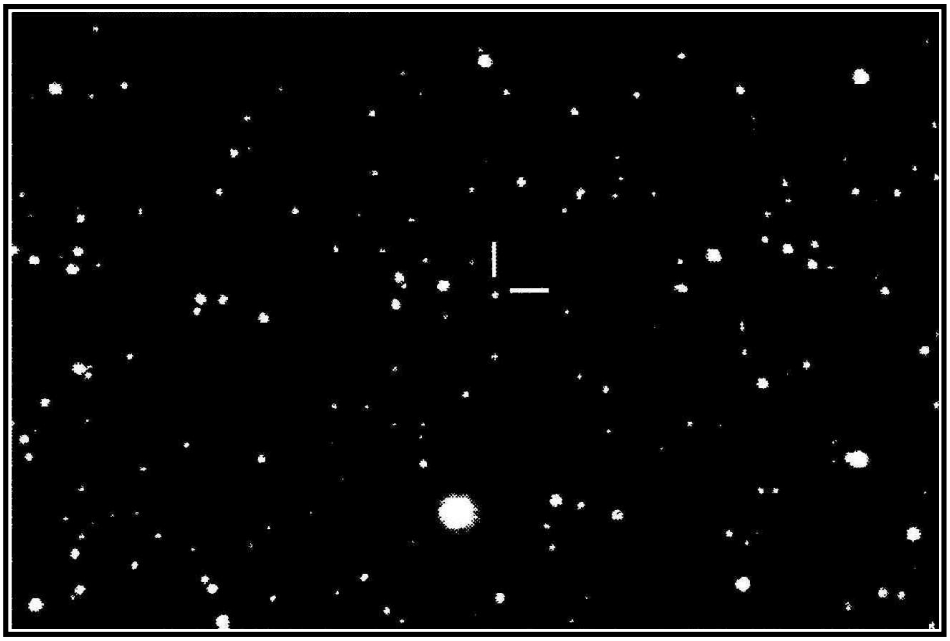
G POYNER

DM Lyr was detected in outburst by the Director visually on July 7.0431 UT at magnitude 14.5, and was confirmed by Tonny Vanmunster (CCD) and John Day (visually) shortly afterwards. This was the first outburst detected since November 1995 (Pietz), and the eighth since its first known outburst in 1992. Due to its position, coverage of the star is difficult during the winter months, and it is quite possible that several outbursts have been missed.

The July 1996 outburst - unlike the others - proved to be a long, bright one (see light curve overleaf), which caused several observers to wonder if it could possibly be a supermaximum which is indicative of a UGSU star (GCVS classification of DM Lyr is UG). Observers at Kyoto University, led by Daisaku Nogami, carried out V-band CCD photometry on July 16th with the 60cm reflector and detected superhumps of 0.1 mag amplitude, thus re-classifying DM Lyr as a UGSU star. Their preliminary period analysis gave 0.066 (+-0.002) day as the best estimated superhump period. At the same time Tonny Vanmunster (CBA, Belguim) also detected superhumps with his 25cm SCT, ST-7 unfiltered CCD. His preliminary analysis of the superhump period yielded a best value of 0.067d +/- 0.001d (PDM method) and a mean amplitude of 0.08 mag - all in good agreement with the Ouda team at Kyoto.
Although unfiltered CCD measures are photometrically inaccurate, employing them in this type of work (discovery of superhumps and determination of their period) can and does yield valuable and exciting results.



The CCD image shows DM Lyr in outburst. This image was taken by the Danish observer Lasse Teist Jensen, with a 25cm SCT & ST-6 unfiltered CCD on July 08.0194 UT.



DM Lyr continues to be monitored as part of the Recurrent Objects Programme, and observers are encouraged to monitor it for further outbursts. Filtered CCD observations would be especially welcomed.

NSV 7378
G POYNER

Due to the recent minor brightening of T CrB, it has been noted that some observers are using star 'K' from the BAAVSS sequence 025.01. Please note that this star is NSV 7378 - a suspected RV Tau star with a range of 9.1-9.9. Please do not use this comparison star for estimates of T CrB. Observations of star 'K' would be welcomed though, and should be reported to either of the secretaries in the usual way.

BINOCULAR COMPARISON STAR ANALYSIS
J TOONE

In VSSC No 88 (June 1996) page 3 it was stated that comparisons F and 69 shown on the charts for BL Ori and V CVn respectively should no longer be used.
This is correct but observers should note that these comparisons were shown on obsolete charts only. The current charts that should be used are 211.01 (BL Ori) and 214.01 (V CVn) as stated in VSSC No 87 (March 1996) page 11.
The rest of the comparison stars listed in the table in VSSC No 88 are valid and until their charts are also updated should not be used for making magnitude estimates

COMPUTERISATION
D MCADAM

Contributions to the project have greatly increased in 1996. By the end of July, more than 175,000 observations have been provided bringing the database total to over 903,000. Entries over 7 months are on a par with full annual totals for previous years! In part, the increase is due to work by Phil Barnard (Wolverhampton A.S.) on the published memoirs for 1905-1919, but other contributors have maintained or increased their quotas; Herbert Joy continues with his usual workload, Roger Pickard provided 1920-24 memoirs from Crayford A.S., John Moran, David Lloyd and Kevin West are e-mailing files keyed from written records -a little easier than sending disks. Full contributor names and totals will appear as usual in the first circular next year.

Electronic observer reports have also increased with Mike Gainsford and Tony Markham changing to this method. Tony has also provided files of SPA results (logged as 'SPA transfer') and I am sure SPA observers will join me in appreciation of this - it helps quicker updates of jointly observed variables and several bright variables have been added to the database.

A second 'new' source is 'TA transfer' which arose because I took on the monthly variable star summary for The Astronomer. Non-BAA members who primarily report to TA in electronic format allow their results to be logged into the BAAVSS database. This does not include joint BAA/TA subscribers, most of whom report in full BAA style which is then referenced for the TAsummary.

These collaborations, along with the RASNZ exchanges, are seen as beneficial to all participants.

OBSERVATIONS OF THE LB VARIABLE NO AUR

C. LLOYD AND D. MCADAM

NO Aur (HR 1939, HD 37536, BD+31 1049, SAO 58322) was discovered to be variable by Eggen (1967) on the basis of 5 photoelectric observations made over about 80 days in 1965-66. Only the last and brightest point is obviously different but there is clearly significant variation on this time scale. Isles (1967, 1972) also drew attention to the possible variability of this star by a few tenths of a mag and it was used by the VSS as comparison N for observations of "Andrews' Star". Despite the brightness of the star practically no further photoelectric photometry has been published. In the GCVS (Kholopov et al. 1985) NO Aur appears as an Lb variable with a magnitude range, V = 6.13 - 6.32, entirely on the basis of Eggen's photometry. The spectral type is given as M2 S Iab and in some recent papers on stellar populations it is also regarded as a supergiant (eg. Hickman et al. 1995). However, in similar studies it appears as a giant M3 III and this seems to be the prevailing view (Groenewegen 1993, Eggen 1992, Brown et al. 1990). There is no doubt that the star is chemically peculiar. It is an S-type star, which means that the atmosphere contains heavy elements from the *s*-process. This highly processed nuclear material is brought to the surface of the star by convection currents that periodically reach deep into the interior. In addition it also shows technetium (Tc) which is usually associated with the so-called 'third dredge up'. All this implies that the star is relatively massive and highly evolved. Of more immediate interest is the conclusion by Smith & Lambert (1987) that S-type stars with Tc are pulsating asymptotic giant branch (AGB) stars.

NO Aur was added to the VSS programme in 1973 and observed to 1988, and again in 1995 by a lone observer. There are only a relatively small number of observations, 1041, and the list of observers is given in Table 1.The raw observations are spread fairly evenly between m_v 6.2 and 7.0 but there is a definite suggestion of long term activity. The power spectrum of the raw data shows a strong period at ~ 2500 days, and even after the personal bias of the observers has been removed assuming that the star is constant, as in previous papers in the *Circulars*, this variation persists. The personal biases and the mean light curve were recalculated using 500 day bins and the power spectrum of the de-biased data is shown in Figure 1.The best fit period is 2520 ± 40 days and this is plotted through the data in Figure 2. The fit is not perfect but given that these are visual observations and the amplitude is only 0.30 mag, the scatter is not unreasonable.

Figure 1: The DFT power spectrum of the de-biased data using 500 day bins. The dominant feature occurs at a period of 2500 days.

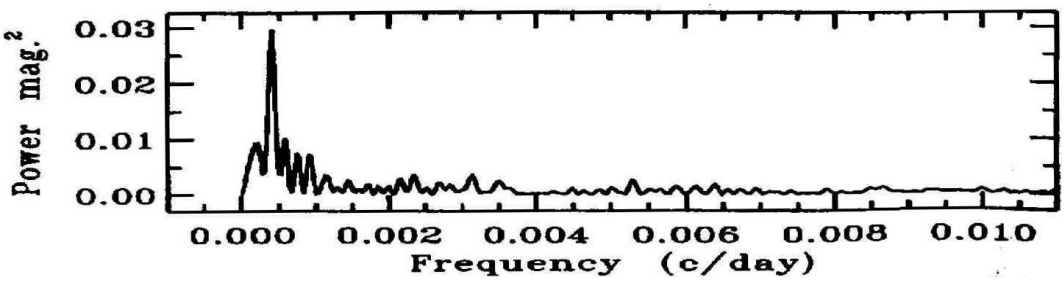
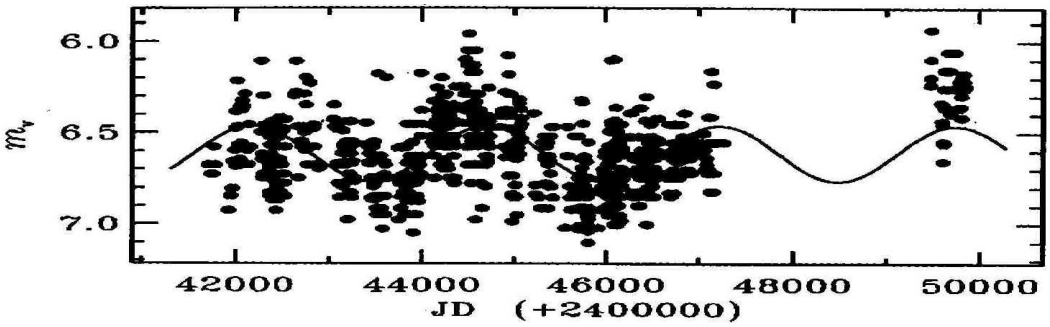


Table 1: List of observers

S W Albrighton, C M Allen, M R Bell, T Brelstaff, M J Currie, R B I Fraser, M Hather, A J Hollis, D Hufton, G M Hurst, G J Kirby, M Lunn, T Markham, R H McNaught, B R M Munden, I P Nartowicz, N Richardson, M D Taylor

Figure 2: The corrected light curve of NO Aur from the VSS data with a period of 2520 days plotted through the data.



Before a periodic variation can be claimed for this star a couple of points should be made. Firstly, this variation is on the limit of detection and at best only three cycles have been covered; only two have complete coverage. Secondly the recent observations are due to a single observer and as they are brighter than the average will exert a strong influence on the solution, although they are consistent with the solution derived from the early data alone. It should also be remembered that the photoelectric data show significant variation on a time scale of 80 days which cannot be accounted for by a long period variation.

Stars with *dominant* periods of a few thousand days are extremely rare so if this period is correct then NO Aur immediately assumes some significance. In the GCVS the only stars with similar periods are T Per, M2 Iab, SRc 2430 days, CQ Cas, M6.5, SRb 2300 days and Betelgeuse, M2 Iaev, SRc 2335 days (see Markham 1995). All these stars also have other periods in the few hundred day range. In the 3rd edition of the GCVS T Per is given a primary period of 326 days so even among these stars there is confusion over which period dominates. Many semi-regular variables have *secondary* periods in the few thousand day range, for example μ Cep (Brelstaff et al. 1996), these are typically 7-10 times the primary period. It therefore seems more likely that NO Aur is a semi-regular with a short period which is what is seen in the photoelectric data, and a long period which is apparent in the visual observations. Which of these periods dominates will require more observations to determine, but this is not one for the visual observer

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A NEW ECLIPSING BINARY IN DELPHINUS

T BRELSTAFF

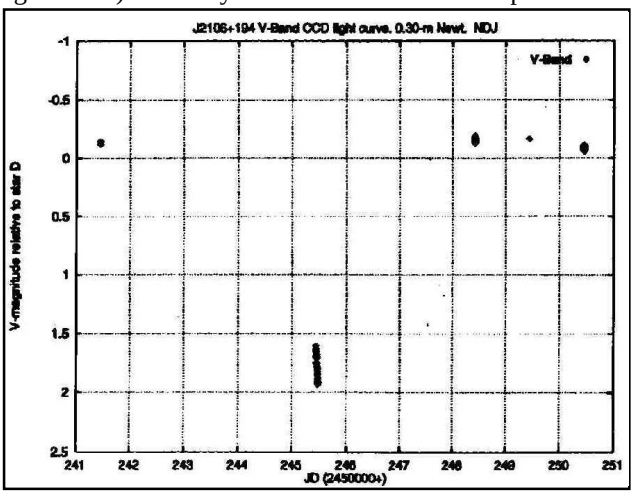
Mike Collins has found a probable new eclipsing binary on photos taken in the course of his nova patrol. The star is at 21h 4.2m +19° 12' (1950), 21h 6.5m +19° 25' (2000) and spends most of its time at mag 10.5-10.6 photovisual but occasionally fades to 12.2, and possibly further. Mike has produced the accompanying chart using the Guide Star Catalog (see facing page). From the times of fades recorded on his old patrol photos he has also derived the following approximate light elements:

Min = JD 2449593.483 + 10.3536xE

Geoff Kirby has made the following visual observations which confirm that the star does indeed fade at times predicted by the above elements:

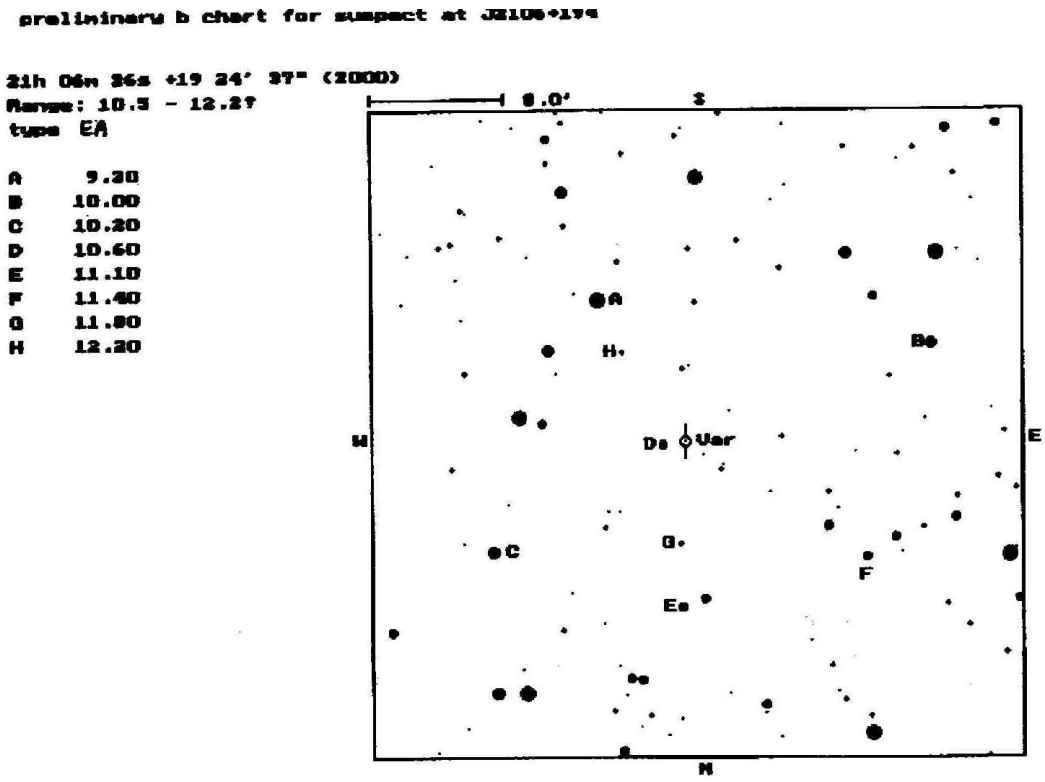
Date	Time (GMAT)	JD	Mag
1996 Jun 25	11:42	2450260.488	10.4
	12:11	2450260.508	10.3
	12:39	2450260.527	10.3
	13:00	2450260.542	10.2
	13:30	2450260.563	10.3
1996 Jul 1	10:58	2450266.457	<11.1

Nick James has obtained CCD photometry which shows the star fading from 12.1V to 12.6V over a 2 hour interval close to a predicted time of minimum (see the accompanying light-curve). Nick says he has also detected a dip of about 0.1 mag at phase 0.5. This is probably the secondary minimum.



Further observations are needed in order to define the depth and duration of the eclipses. The following predictions list the eclipses visible from Britain through to the end of 1997. The times are GMAT and the format is similar to that for the eclipsing binary predictions given elsewhere in this circular. The symbol '<<' indicates that mid-eclipse occurs before the start of the given day. Where the time of mid-eclipse is given as more than 24 hours then it means that it occurs after the end of the given day. The duration of eclipse has been assumed to be 24 hours for the purpose of these predictions. It may be longer so it would be prudent to start observing some time before the listed start times where possible. Please send any observations you get to me at the end of each month.

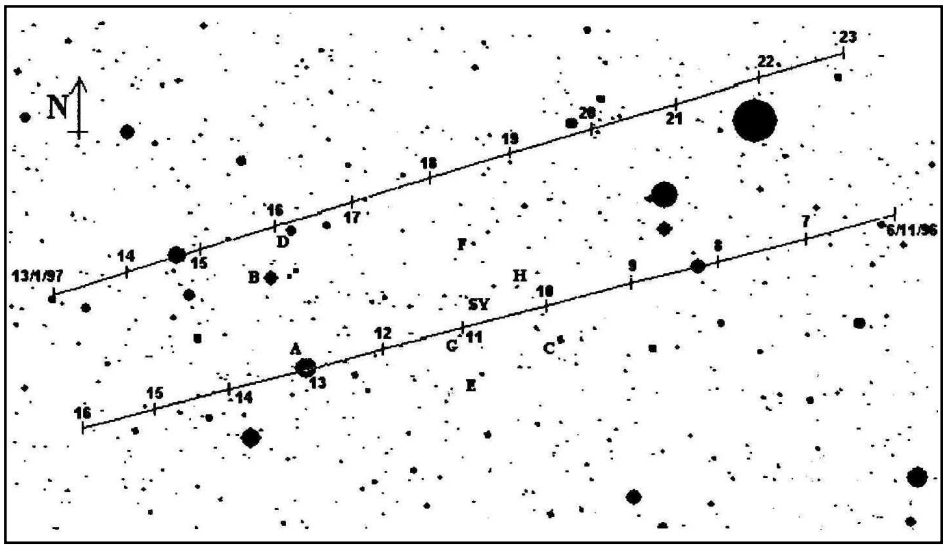
1996 Aug 1 Thu D09(13)15D
1996 Aug 11 Sun 09(21)15D
1996 Aug 12 Mon D09(<<)09
1996 Aug 22 Thu D08(06)16D
1996 Sep 1 Sun D08(14)16D
1996 Sep 11 Wed 11(23)16L
1996 Sep 12 Thu D07(<<)11
1996 Sep 22 Sun D07(07)15L
1996 Oct 2 Wed D06(16)15L
1996 Oct 12 Sat 12(24)14L
1996 Oct 13 Sun D06(00)12
1996 Oct 23 Wed D06(09)13L
1996 Nov 2 Sat D05(17)13L
1996 Nov 13 Wed D05(02)12L
1996 Nov 23 Sat D05(10)11L
1996 Dec 3 Tue 07(19)11L
1996 Dec 4 Wed D05(<<)07
1996 Dec 14 Sat D05(03)10L
1996 Dec 24 Tue D05(11)09L
1997 Jan 3 Fri 08(20)09L
1997 Jan 4 Sat D05(<<)08
1997 Jan 13 Mon L19(28)19D
1997 Jan 14 Tue D05(04)08L
1997 Jan 24 Fri D06(13)07L
1997 Jan 24 Fri L18(13)19D
1997 Feb 3 Mon L17(21)18D
1997 Feb 4 Tue D06(<<)07L
1997 Feb 13 Thu 18(30)18D
1997 Feb 14 Fri L17(06)18
1997 Feb 24 Mon L16(14)18D
1997 Mar 6 Thu L15(23)17D
1997 Mar 17 Mon L15(07)17D
1997 Mar 27 Thu L14(16)17D
1997 Apr 6 Sun L13(24)16D
1997 Apr 17 Thu L13(09)16D
1997 Apr 27 Sun L12(17)15D
1997 May 7 Wed 14(26)15D
1997 May 8 Thu L11(02)14
1997 May 18 Sun L11(10)14D
1997 May 28 Wed L10(19)14D
1997 Jun 8 Sun D10(03)14D
1997 Jun 18 Wed D10(12)14D
1997 Jun 28 Sat D10(20)14D
1997 Jul 9 Wed D10(05)14D
1997 Jul 19 Sat D10(13)14D
1997 Jul 29 Tue 10(22)15D
1997 Jul 30 Wed D09(<<)10
1997 Aug 9 Sat D09(06)15D
1997 Aug 19 Tue D08(15)16D
1997 Aug 29 Fri 11(23)16D
1997 Aug 30 Sat D08(<<)11
1997 Sep 9 Tue D07(08)16D
1997 Sep 19 Fri D07(16)16L
1997 Sep 29 Mon 13(25)15L
1997 Sep 30 Tue D07(01)13
1997 Oct 10 Fri D06(09)14L
1997 Oct 20 Mon D06(18)14L
1997 Oct 31 Fri D05(02)13L
1997 Nov 10 Mon D05(11)12L
1997 Nov 20 Thu 07(19)12L
1997 Nov 21 Fri D05(<<)07
1997 Dec 1 Mon D05(04)11L
1997 Dec 11 Thu D05(12)10L
1997 Dec 21 Sun 08(20)10L
1997 Dec 22 Mon D05(<<)08



APPULSES OF 24 THEMIS WITH SY CANCRI, COMMENCING 6TH NOVEMBER 1996 AND 13TH JANUARY 1997

J GREAVES

The field is roughly 1½° wide by 1° high with stars to a limiting magnitude of around 14. Tick marks are placed at 0h UT of date. The sequence is from chart TA901026, and the image is a modification of a basic field generated from Guide 4.0 by Project Pluto and was created by J Greaves.



SEQUENCE A 8.7 B 9.7 C 10.9 D 11.5 E 12.1 F 12.4 G 12.9 H 13.4

SY Cancri is a UGZ star of m_p 10.6 - 14.0 and can be found on BAAVSS chart 190.1 or TA chart TA901026

24 Themis has a maximum light amplitude of 0.15 of a magnitude and an orbital period of 8.4h. The B-V is 0.68.

On 11/11/96 24 Themis rises around 22.0h UT and lies only 4½' from SY Cancri at around magnitude 12.2. On 18/1/97 24 Themis rises around 17.5h UT and lies 17' from SY Cancri at around magnitude 10.9.

Any and all estimates made of the brightness of this object should be forwarded to the BAA's **Asteroid Section** for proper evaluation, and **not** the Variable Section.

PHOTOELECTRIC OBSERVATIONS OF SUSPECTED VARIABLES

C LLOYD, K WEST, R PICKARD, M GOUGH AND J SAXTON

New photoelectric observations have been made of a number of suspected variables. The stars are taken from a number of sources including the lists of Lloyd (1992, Paper 1) Markham (1993, see also Lloyd 1994, Paper 2), from finding charts with suspicious comparison stars and directly from the Bright Star Catalogue (Hoffleit 1982).
A variety of instruments and equipment has been used. Most observations were made using an SSP3 photometer with a nominal V filter on a 20-cm Newtonian but the Jack Ells APT, which uses a prototype JEAP photometer with a V filter (Ells & Ells 1989, 1990, Walker 1986, 1991) and home built photometer using a Hamamatsu 1P28 with B and V filters on a 22-cm Newtonian have also been used. For most stars the observations cover two or more seasons while the less well observed stars have been taken up more recently. In some cases there are too few observations to be sure of the behaviour.

The results are summarised in Table 1. For each programme star the comparison and check stars used are given, together with the number of times the star has been observed, the mean magnitude and standard deviation. The mean magnitude is usually based on the comparison star but occasionally the check star magnitude is used.
The combined standard deviation of all the check stars is 0.014 mag so anything larger than about 0.025 begins to look suspicious. Where no photoelectric observations have been made a summary of any new information or visual observations is given in the comments.

Table 1: Summary of photometry of suspected variables

Star	Comparison	Check	N	Mean V	sigma
HR551	HD11428	HD11579	4	6.26	0.020
BD+49 2165	HD112570	HD110834	10	6.50	0.012
BD+49 2165	HD111421	HD110409	4	6.53	0.013
SAO19521	HD205235	HD204260	3	6.52	0.008
HD203265	HD203574	HD203551	26	6.47	0.056
HD202380	HD203574	HD203551	14	6.55	0.029
HD204599	HD203574	HD203551	15	6.09	0.036
33 Cet	HD6734	HD6288	5	5.95	0.019
zeta Cyg	HD197912	HD195295	7	3.25	0.023
69 Dra	HD178089	HD176795	5	6.11	0.016
HD52005	HD52556	HD54131	10	5.66	0.026
HD52609	HD52556	HD54131	9	5.84	0.017
theta Lyr	HD180163	HD176318	8	4.35	0.020
epsilon Peg	HD210418	HD218045	4	2.39	0.022
HD61294	HD63588	HD59826	5	(5.9)	0.024
HD62647	HD63588	HD59826	5	(5.3)	0.015
NSV1702	HD30122	HD29859	5	6.93	0.011
70 UMa	HD108135	HD108502	8	5.53	0.024

Comments

HR 551 (And), HD 11613, SAO 37607 (Paper 1) V=6.24 K2
Photoelectric results consistent with published value. No variability in visual observations over the past few years.

NSV 2537 (Aur), HR 1938, HD 37519 (Paper 1) V=6.04 B9.5III-IVp
Used a photoelectric comparison star and showed no sign of variability (Burki & Mayor 1981, Jerzykiewicz 1993).

SAO 19521 (Cep), HD 205938, BD+67 1329 (Paper 2) V=7.6, Ap
The catalogue magnitude of this star in the SAO and Sky Cat 2000, and other databases is wrong. The magnitude was queried long ago (Verdenet 1980) and caused confusion in the comparison sequences of T and GK Cep (Markham 1980). Visual observations made over the last couple of years and by Tony Markham during 1980 - 1992 place the star at mv = 6.5 - 6.8, which is consistent with the new photoelectric value (V=6.52). The suspicion of variability is probably based entirely on the catalogue error and there is no other evidence of variability.

HD 203265 (Cep), SAO 19298, NSV 13656 (Paper 2) V=6.7, M3
The largest scatter observed and range of 0.21 mag shows that this star is clearly variable, and this is consistent with the spectral type.The time scale is about 40 days.

HD 202380 (Cep), SAO 33232, NSV 13609, V=6.62, M3Ib
The scatter and range of 0.11 mag suggest that this star is probably variable. According to the NSV it is an Lb variable.

HD 204599 (Cep), HR 8224, NSV 13729, SAO 33443, V=6.10 M3II-III
The second largest scatter and range of 0.11 suggest that this star is variable. Also found to be variable by Percy et al. (1994).

BD+49 2165 (CVn), HD 111572, SAO 44343, NSV 5976 (Paper 2) 6.51 K1III
There is no indication of any variation.

33 Cet, HD 7014, HR 347, SAO 109715, NSV 422, V=5.95 K4III
No indication of any variation. Variability extensively discussed by Brelstaff (1993) and the reports were probably due to the different photographic systems used.

Zeta (64) Cyg, HR 8115, HD 202109, SAO 71070 (Paper 2) V=3.20 G8II Ba
The scatter is on the large side so there may be some low level activity. The published values have a range of 0.08 mag.

69 Dra, HD 190960, HR 7686, SAO 9606, V=6.20 M3III
Queried on the chart for UX Dra. There is no indication of any variation although the mean magnitude is not consistent with the published value.

SAO 78074 (Gem), HD 42379, NSV 2859 (Paper 1)
Used as comparison star H (labelled “Var?”) on the chart for TV Gem. It was observed as a suspected beta Cephei variable and although this was not confirmed it was found to be variable by a few hundredths of a magnitude (Hill 1967).

HD 52005, 41 Gem, HR 2615, SAO 96363, V=5.68 K3Ib
Observed magnitude is consistent with the catalogue value but the scatter is rather large; a possible variable. As the star is a supergiant there is a possibility of some variation, although normal K giants are usually constant.

HD 52609 (Gem), HR 2635, SAO 96409, V=5.82 M2III
Observed magnitude is consistent with the catalogue value and there is no indication of any variability, despite the favourable spectral type.

HD 61294 (Lyn), HR 2935, SAO 60257, V=5.73 M0III
Comparison magnitudes are poorly determined and inconsistent with the observations. The scatter is suggestive of more to come perhaps.

HD 62647 (Lyn), HR 2999, SAO 60328, NSV 3721, V=5.18 M3III
There is no indication of any variation. The same comparisons were used as for HD 61294.

Theta (21) Lyr, HR 7314, HD 180809, SAO 68065 (Paper 2) V=4.36 K0II
No real indication of any variation; and none really expected.

Epsilon (8) Peg, HD 206778, HR 8308, SAO 127029 (Paper 1) V=2.39 K2Ib
The scatter is on the high side but there are few observations and the mean magnitude agrees with the published value.

NSV1702 (Tau), HD 29935, SAO 76729, mv~6.9 B9
The visual and other photoelectric observations of NSV1702 have been discussed by Lloyd et al. (1995) and no variation was found.

70 UMa, HR 4701, HD 107465, SAO 28346 (Paper 1) V=5.55 K5III
The check-comparison star differences point to the comparison being responsible for the scatter. The comparison has a spectral type of M3 III and is almost certainly variable.

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A SELECTION OF ARTICLES AND NOTES FROM TA 1975-1995

T MARKHAM

Is there an article about variable stars that you remember reading, but you canno t remember which issue of TA it was in ? The list which follows picks out the main items for the years 1975-1995. The list is not intended to include all items about variable stars - there have also been many other (mostly shorter) notes during this period. The list also largely ignores supernovae and classical novae.

The numbers in brackets indicate approximate lengths in pages (quarto to 1982, A4 thereafter). In some cases there was also additional material on the cover of TA.

1975 Jan (1.0) Pre-discovery photographs of Nova Persei 1974 - Guy Hurst
1975 May (1.0) VZ Cassiopeiae - Henk Feijth
1975 Jly (0.5) Nova Scuti 1975 : Pre-discovery (0.5) Eruptive Object in Aquila
1975 Aug (1.3) RR Bootis - Henk Feijth
(1.7) Visual Sequence Photography for Amateurs - W E Pennell
1975 Oct (0.9) SY Herculis - Henk Feijth
1975 Nov (0.7) TW Lyrae - Henk Feijth
1976 Feb (0.4) A New Variable in Perseus - Guy Hurst
1976 Jly (0.5) SS Pegasi - Henk Feijth
1976 Dec (1.6) Visual Observations of X-Ray sources - Jeremy Bailey
(0.5) New Emission Object in Sagitta
1978 Jun (0.8) UBV and Sky Patrol - Jeremy Bailey
1979 Jan (0.7) The outburst of UZ Bootis - Aarre Kellomaki
1979 Aug (1.6) Meteor Observing and Flare Stars - Robert McNaught
1979 Sep (0.5) Struve 1927 = BV,BW Dra : A problem star - John Isles
1980 Aug (1.0) Recent observations of Eta Geminorum - Melvyn Taylor
1981 Feb (0.8) Discovery of new variable object in Scutum - Dave Branchett
1981 Aug (0.7) Extent of Variable Star Observing in Europe - Aarre Kellomaki
1981 Nov (1.0) Personal Computers and Variable Stars (BAAVSS) - Greg Coady
1982 Sep (1.0) Is WW Vulpeculae a R CrB star ? - D Bohme
1983 Jan (2.5) VY Aquarii : Long Period Eruptive - Robert McNaught
1983 Mar (0.8) VY Aquarii : Past and Future - Robert McNaught
1983 Apr (1.5) Nova Search Patrol at the Crni Vrh Vad Idrijo Observatory- Herman Mikuz
(1.0) 3A 1148 +719 and the enigma of YY Dra
(0.7) HR Del : pre-nova - Robert McNaught
1983 Dec (1.0) The 1983 outburst of VY Aquarii -Robert McNaught
1984 Feb (1.3) Computers and the Variable Star Observer [1] - Tristram Brelstaff
1984 May (1.3) Computers and the Variable Star Observer [2] - Tristram Brelstaff
1985 Feb (0.5) BV Tauri : A short period Beta Lyrae Variable - John Isles and Tristram Brelstaff
(0.8) Outburst of HT Cas
(0.8) Outburst of RS Oph
1985 Apr (1.3) Computers and the Variable Star Observer [3] - Tristram Brelstaff
1986 Jan (1.0) A new Dwarf Nova in Pegasus = IP Pegasi - B H Granslo

1986 Nov (0.4) Outburst of CH Ursae Majoris
1987 Apr (1.0) New Variable in Mon = Q1987/8 = TAV 0723-03
1987 Jly (1.0) Outburst of VY Aquarii
1987 Dec (0.4) Outburst of RZ Leonis - S Lubbock
1988 Jan (2.0) FSV 113211 : A new Dwarf Nova in Crater - Richard Fleet
1988 May (1.0) The variability of ADS 7539 B (21 Leonis B) - S Korth
1988 Aug (1.0) CH Ursae Majoris : An Enigmatic Dwarf Nova - Stephen Lubbock
1989 Jan (1.0) FSV 113211 - Guy Hurst
1989 Apr (3.0) The 5% International Time Project 1988/89 : Cataclysmic Variables - Mark Kidger
1989 May (2.0) SAO 139174 is an Eclipsing Binary - R Casas & J M Gomez-Forrelad
1989 Jun (2.0) Nova Cygni 1938 reappears
1990 Feb (2.0) TASV 1809+23 : A new Eclipsing Binary - Tristram Brelstaff
1990 Jun (1.0) V635 Cas - Dr Diane Roussel-Dupre
1990 Nov (0.5) TY Sagittae
1990 Dec (1.4) Debehogne as possible Dwarf Nova in Libra
1991 Jan (3.0) TAV 0033+59
1991 Feb (0.6) UV Persei - Patrick Schmeer
1992 May (1.0) HV Virginis (outburst)
1992 Jun (1.0) PG 0943+521 (outburst)
1992 Aug (2.0) The Soft Gamma Repeater in Aquila - David Palmer
1992 Oct (2.7) Searching for new variables - Lennart Dahlmark
1993 Jan (0.8) T Leonis (outburst) - Patrick Schmeer, Taichi Kato
1993 Feb (1.0) NGC 4151 (bright) - Guy Hurst
(0.9) The deep minimum of DY Persei in 1991 - Andrejs Alksnis
1993 Apr (2.0) Fade of NSV 1671 - L L Chinarova and I L Andronov
1993 Jun (1.9) V344 Lyrae super-outburst
1993 Jly (2.0) Multi-periodic changes in Cataclysmic Variable TT Arietis - Dr Ivan Andronov
1993 Aug (1.4) BD +22o743 : Bright suspected variable with unknown period
1993 Oct (1.8) OJ287 : request for observations
(1.0) TAV 1836+11
1993 Dec (1.0) OJ287 The TA Recurrent Objects programme -W J Worraker
1994 Apr (3.0) Outburst observations of LL Andromedae - Steve Howell, Guy Hurst & James DeYoung
1994 May (0.8) DQ Vulpeculae : a very red object near M27
1994 Nov (2.0) OJ287 on the rise to outburst ? - Mark Kidger
1994 Dec (2.0) FG Cep and IN Cep - Mike Collins and Nick James
1995 Jan (2.5) Rare Outburst of V1251 Cygni
1995 Apr (0.8) UW Persei
(2.0) Variable in Cepheus on LD Photograph (=Q1995/033)
- Lennart Dahlmark, Karl Gustav Andersson & Margareta Westlund
1995 May (2.0) NSV 1020 is a Mira Type variable - Mike Collins & Margareta Westlund
(4.8) All known, suspected or possible TOADs - Steve Howell
1995 Jun (3.6) Report on the 1994 TA/BAA VSS Observing Project on IP Pegasi - W J Worraker
1995 Oct (2.0) Observation of the suspected variable NSV 1702 = BD +22o743 - Chris Lloyd, John Watson & Dave McAdam
1995 Dec (0.6) 69 (Delta) UMa : a Long Period Eclipsing variable ?

IBVS's 4294-4348

G POYNER

4294 Photometry of the active star UZ Lib. (Paunzen & Strassmeier, 1996)
4295 UBV Photometry of Nova Cas 1995 at Premaximum phase. (Oshima et al,1996)
4296 New Possible Variables in the Globular Cluster NGC 6229. (Spassova & Borissova, 1996)
4297 Photometric Variations of the marginal Am star HD 143232. (Paunzen & Duffee, 1996)
4298 Photometry of the Mira Variable c Cyg at Maximum. (Sterken et al, 1996)
4299 Observations of the Superoutburst of VW Hydri, November 1995. (Liller, 1996)
4300 Times of Minima of Five Eclipsing Binaries. (Jordi et al, 1996)
4301 Pulsation of HD 83014 and HD 221756. (Paunzen & Handler, 1996)
4302 Non-Variability among l Boo Stars I.: ESO 1993 & 1994 Data. (Paunzen et al, 1996)
4303 1995 Photometry of SV Camelopardalis. (Heckert, 1996)
4304 Period Changes in V839 Ophiuchi. (Wolf et al, 1996)
4305 Optical observations of the active star FF Cancri. (Robb & Gladders, 1996)
4306 Confirmation of the classification of a new Tycho Variable: HD32456 IS a 3.3-Day Cepheid. (Bastian et al, 1996)
4307 New times of Minima of the Eclipsing Binaries 44i Bootis and VW Cephei. (Oprescu et al, 1996)
4308 New elements for the Eclipsing Binary ZZ Cnc. (Berthold, 1996)
4309 Minimum times and period behaviour of the neglected eclipsing binary WZ Cygni. (Rovithis et al, 1996)
4310 Non-Variability among l Bootis stars II.: SAAO (1994, 1995), CTIO (1994) and IAA (1996) data. (Kuschnig et al, 1996)
4311 On the Peculiar flickering activity of HR 2492. (Sterken et al, 1996)
4312 Optical observations of SN 1996C in MCG+08-25-47. (Balam, 1996)
4313 The pulsation frequencies of Beta CMa. (Balona et al, 1996)
4314 Multiperiodicity in pulsating Lambda Boo star 29 Cyg (HD 192640, V1644 Cyg). (Kusakin & Mkrtichian, 1996)
4315 New deep minimum of the CV binary KR Aur in 1994-95. (Antov et al, 1996)
4316 Rotation periods for four low mass stars in the Taurus-Auriga region with CaII emission. (Grankin, 1996)
4317 Photometric observations of the new bright classical Cepheid SAO 25009 = HD 32456. (Campos-Cucarella et al, 1996)
4318 New photometric data for HD 142703 & HD 192640. (Paunzen & Handler, 1996)
4319 NSV 12597 and RX J1957.0+2005. (Richter & Greiner, 1996)
4320 New information on V558 Cas: Type & Period. (Vandenbroere, 1996)
4321 Accurate positions of Variable Stars near the South Galactic Pole. (Demartino et al 1996)
4322 Accurate positions of suspected Variable Stars near the South Galactic Pole. (Demartino et al, 1996)
4323 NSV 05256,a low amplitude RRab Star in Camelopardalis. (Campos-Cucarella et 1996)
4324 The new overcontact system GSC 3273.0761 in Andromeda and a star showing an optical transient. (Vidal-Sainz et al, 1996)
4325 Has the Delta Scuti star AD CMi a companion? (Fu Jian-Ning & Jiang Shi-Yang, 1996)
4326 A Ha flare on UV Piscium. (Quingyao et al, 1996)
4327 UBV photometry of V511 Per. (Ozdemir & Tanriver, 1996)
4328 Observations of the flare star V1929 Cygni. (Tsvetkov et al, 1996)
4329 New Variable Stars in Cygnus, Lacerta and Andromeda. (Dahlmark, 1996)
4330 UBV observations of AB Dor, late 1995. (Bos et al, 1996)
4331 HD 194378-A new Eclipsing Binary in the Open Cluster M29. (Kim & Lee,1996)
4332 V470 Cassiopeia is an RR Lyrae Type Variable. (Agerer et al, 1996)

4333 GSC 4767.894 - A new W UMa type Eclipsing Binary in the field of GG Ori. (Wolf & Sarounova, 1996)
4334 Light curves and periods of the RR Lyrae stars SU Cha & SW Cha. (Winterberg & Bruch, 1996)
4335 Observations of low amplitude late type variables. (Lloyd & West, 1996)
4336 Photometry of the 1994-95 active phase of AG Dra. (Montagni et al, 1996)
4337 GT Aquarii: New Elements. (Diethelm, 1996)
4338 CI Aquilae. (Greiner & Alcala, 1996)
4339 Photographic and CCD photometry of V350 Cephei. (Semkov, 1996)
4340 Photoelectic minima of 30 eclipsing binary systems. (Hegedus et al, 1996)
4341 Photoelectric UBV observations of EG Andromedae. (Tomov & Tomova, 1996)
4342 New variable stars in the Eta Herculis field. (Antipin, 1996)
4343 New variable stars in the Xi Coronae Borealis field. (Antipin, 1996)
4344 New variable stars in the 66 Ophiuchi field. (Antipin, 1996)
4345 Nine new variables in the 66 Ophiuchi field. (Antipin, 1996)
4346 The spectra of FG Sagittae in 1995. (Kipper & Klochkova, 1996)
4347 Improved positions of variable stars in Ara, I. (Lopez & Lepez, 1996)
4348 Discovery of 30-min. oscillations in the Ap Sr (EuCr) star HD 75425. (Martinez, 1996)
Un-numbered...Changes in the SAC

PRO-AM EXCHANGES REPORT - AN ADDITION TO THE ENTRY IN VSSC 88

The Pro-Am exchanges report in VSSC 88 was unfortunately incomplete. The remainder of this report follows below. Apologies for any inconvenience this may have caused.

940608 V404 Cygni Phil Charles, Oxford We supply outburst photo by M.Mobberley at his request which appeared in The Astronomer 1989 September issue.
940608 Pos SN in NGC 4495 Brian Skiff, USA Message received that Larry Mitchell,Texas has a suspect SN seen visually June 4 at mag 14. Various observers confirm the new object.
940615 LL And Steve Howell, USA Requests we also submit shorter paper to IBVS to which I agree
940621 NR Vul Chris Lloyd, UK We supply old TA issues and Observer Bulletins relating to this object previously found by John Hosty.

PRO-AM Exchanges Summary Updated

Half year ending	Number of exchanges	My Report Nos
1988 Dec 31	42	1
1989 Jun 30	51	2,3
1989 Dec 31	45	3
1990 Jun 30	69	4
1990 Dec 31	23	5
1991 Jun 30	40	6
1991 Dec 31	43	7
1992 Jun 30	52	8
1992 Dec 31	42	9
1993 Jun 30	63	10
1993 Dec 31	59	11
1994 Jun 30	58	12
To Date	**587**	

Updated 1996 April 21

RECENT PAPERS ON VARIABLE STARS

T BRELSTAFF

The Visibility of Galactic Supernovae (Dawson & Johnson, J. Roy. Astron. Soc. Canada, 88, 369-382, 1994)
Integrate interstellar absorption along the lines of sight to a large number of randomly-chosen stars in our galaxy. Use the result to estimate the distribution of the apparent visual magnitudes of galactic supernovae. Find that 70% are fainter than mV=6, and 50% fainter than mV=13! On this basis, the observed rate of historical supernovae implies an overall galactic supernova rate of 3 per century.

Peak Brightnesses of Historical Supernovae and the Hubble Constant
(Schaeffer, Astrophys. J., 459, 483-454, 1996)
Estimates the peak, apparent and absolute mags for the SNs of 185, 1006, 1572 and 1604 AD using techniques not previously used on these stars. SN 185 was probably not a supernova. SN 1006 was of uncertain type (but definitely subluminous), and was at 1.6kpc and with mV=-5 and MV=-17 at max. SN 1572 was a type Ia or Ib SN at 2.4kpc with mV=-4.5 and MV=-18.6 at max. SN 1604 was probably not a type Ia SN, was at 3.4kpc with mV=-3.0 and MV=-19.0 at max. The errors and uncertainities involved make these SNs useless for solving the Hubble Constant problem.

The Peak Brightness of SN 1960F in NGC 4496 and the Hubble Constant
(Schaeffer, Astrophys. J. Lett., 460, L19-L23, 1996)
SN 1960F is important because cepheids have recently been detected in the parent galaxy by the HST. This paper re-reduces the original observations and finds a max of mV=11.51 and mB=11.77. The rate of decline is then used to determine a value of 62±5 km/s/Mpc for the Hubble Constant. Averaging this with the results for 9 other type Ia SNs gives 55±3.

"New" B and V Photometry of the "old" Type Ia Supernova SN 1937C: Implications for H_0 (Pierce & Jacoby, Astron. J., 110, 2885-2909, 1995)
Re-reduce photos by Baade and Zwicky and find at mV=9.00 and mB=8.94 at max. At the distance of the host galaxy IC 1482 (as determined by cepheids) this corresponds to MV=-19.36 and MB=-19.42, making it one of the most luminous SNs yet studied. Yields a Hubble Constant of between 68±5 and 74±6 km/s/Mpc.

An Upper Limit to the Mass of the Black Hole in V404 Cygni (Sanwal et al, Astrophys. J., 460, 437-442, 1996)
Infra-red (H-band) light-curve shows the 0.25 mag amplitude, 6.4714 day ellipsoidal variations of the K0IV component. Derive upper limit of 12.5 solar masses for the mass of the 'unseen' (black hole) component.

Possible Change of the Orbital Period of the Nova-like Binary V Sagittae
(Simon, Astron. Astrophys., 309, 775-776, 1996)
Analyses photoelectric, CCD and visual timings (the latter published in the VSSCs) of this cataclysmic binary. Shows that the orbital period has only changed slightly over the past 31 years. This change is much less than predicted from the mass-transfer rates required by existing models for this system.

Large-amplitude Superhumps in ER Ursae Majoris during the earliest Stages of a Superoutburst (Kato et al, Publ. Astron. Soc. Japan, 48, L5-L7, 1996)
CCD Photometry shows that 0.35 mag amplitude superhumps appear at max or even on the rise. These quickly decay over the next few days. This early appearance of superhumps appears to contradict the current models for superhump formation.

Discovery of a new SU UMa-type Dwarf Nova, V1113 Cygni (Kato et al, Publ. Astron. Soc. Japan, 48, 45-49, 1996)
CCD photometry of the superoutburst in September 1994 shows superhumps with a period of 0.0792 days confirming the SU UMa classification. This star is unusual in having both a large amplitude (6 mags) and a short outburst period (10 days).

Superhumps in Cataclysmic Binaries VIII: V1159 Orionis (Patterson et al, Publ. Astron. Soc. Pacific, 107, 1183-1200, 1995)
Report 400 hours of photometry on 168 nights in 1992-94. The star is found to be a SU UMa star with a normal outburst period of 4.0 days and a superoutburst period of 47.6 days. At minimum the orbital period of 89.83 mins is detectable in the light-curve. During superoutbursts superhumps with a period of 92.4 mins are seen. These appear very suddenly on the rise and die down to 0.1 mags in a few days, but are still detectable down to minimum and even on the following normal outburst! On two occasions a superhump period of 82.7 mins was observed. The superhumps are interpreted as arising in an accretion disk with an advancing line of apsides.

The Discovery of Magnetic Cataclysmic Variable Stars (Warner, 'Cape Workshop on Magnetic Cataclysmic Variables', Astron. Soc. Pacific Conf. Series, 85, 3-9, 1995)
Gives an account of the discovery and modelling of the first polars, intermediate polars and DQ Her stars.

Rapid Light Variations in Symbiotic Binary Stars (Dobrzycka et al, Astron. J., 111, 414-423, 1996)
Present results of a search for rapid light variations in 8 symbiotic stars. Z And, T CrB, AG Dra, BX Mon and AX Per showed no variations on the minute-scale. CH Cyg, RS Oph and MWC 560 showed 0.2-0.3B variations over minutes to 10s of minutes. The semi-coherent period of 22 mins in MWC 560 was confirmed. A period of 82 mins was found in RS Oph. There was not enough data to look for periods in CH Cyg. MWC 560 and RS Oph seem to follow the same spin-period relation as DQ Her stars which suggest that they might also contain magnetic white dwarfs.

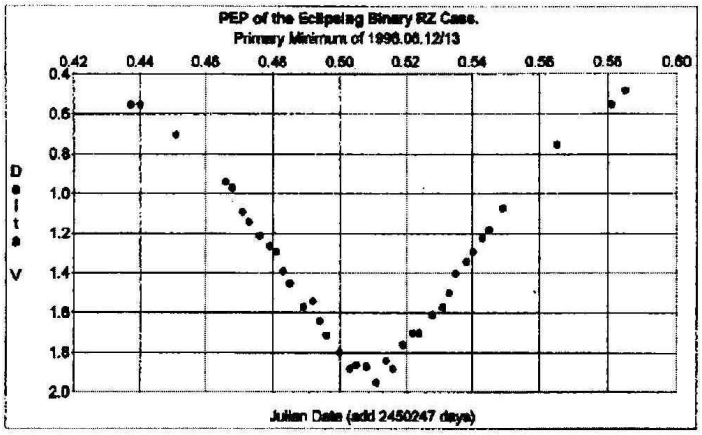
The 5.52-year Cycle of Eta Carinae (Damineli, Astrophys. J. Lett., 460, L49-L52, 1996)
Finds a 5.52 year periodicity in near infrared light curves which correlates well with spectral changes. This period is highly stable and fits all shell episodes in the past 50 years as well the three 19th Century outbursts.

Variable Stars in the Herzsprung-Russell Diagram (Hall, 'Conference on Robotic Telescopes', Astron. Soc. Pacific Conf. Series, 79, 65-80, 1995)
Proposes the folowing classification scheme based on physical mechanisms: I Eclipsing or extrinsic, II Pulsating, III Rotating, IV Long-term Magnetic Cycles, V Supergranulation, VI Transient Phenomena. Shows how most of the GCVS types can be fitted into this scheme and discusses those that cannot.

NEIGHBOURS IN SPACE

K WEST

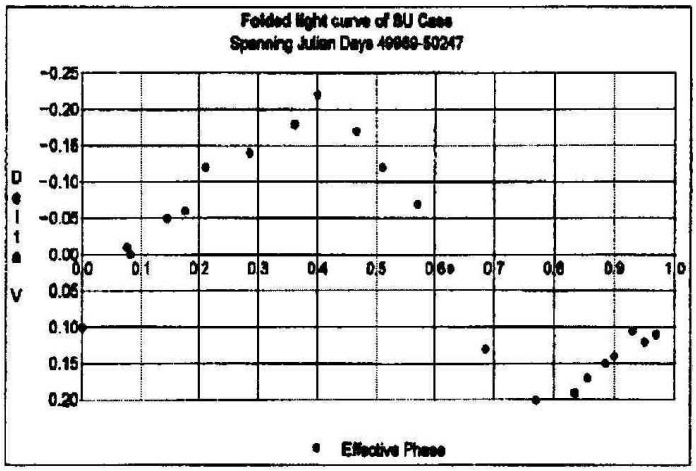
Over the last year I have managed to squeeze in a few extras to my very full programme of photometry. Two near, apparent neighbours in space, RZ Cas and SU Cas, both on BSS chart J.E.I 71.07.17, and only about a degree apart have yielded interesting dividends from the time invested in them.



A Late Eclipse of A Sun?

A very satisfying primary minimum that took literally all night to obtain, from dusk to dawn twilight. Particularly pleasing is the fact that at the start, observations were made at an altitude of 60 degrees and this does not seem to have adversely affected the data. In addition, the eclipse appears (according to the 1993 Rocznik Observatory {Krakow} Ephemeris) to be around 45 mins late. This has yet to be verified by the Eclipsing Binary Secretary.

Observations of Cepheids (despite UK weather).



Inspired by John Isles' article in Astronomy Now (Sept. '95) I have started to observe a few of the bright Northern cepheids with a view to obtaining folded PEP light curves. Although more observations are needed, SU Cas is the first to bear fruit. It's amplitude of around 0.4V, unlike a few rarer cepheids (Polaris e.g.) has remained constant. Professional and amateur (including myself) observers of these maverick, variable amplitude cepheids, are collaborating in a world-wide project to monitor the enigmatic V473 Lyr. The amplitude of it's normal, regular, 1.5 day cepheid oscillations, varies itself over timescales of 1258 days. My recent observations indicate that the amplitude, like that of Polaris has almost faded to zero

ECLIPSING BINARY PREDICTIONS

T 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 British Isles. The times of mid-eclipse appear in parentheses with the start and endtimes 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 85 for a list) are available from the Eclipsing Binary Secretary at 10p each (please enclose a large SAE).

1996 Oct 1 Tue
U Sge D06(12)13L
X Tri 10(13)15
RZ Cas 13(16)17D
1996 Oct 2 Wed
TW Dra D06(02)07
X Tri 10(12)15
V640 Ori L13(14)17
Z Per 14(19)17D
1996 Oct 3 Thu
Z Dra D06(05)08
ST Per D06(10)14
U Cep D06(10)15
X Tri 09(11)14
RW Tau 12(16)17D
1996 Oct 4 Fri
Y Psc D06(05)10
Z Vul D06(09)14L
X Tri 08(11)13
Z Dra 11(14)16
V640 Ori L13(15)17D
RW Gem 15(20)17D
TW Dra 16(21)17D
1996 Oct 5 Sat
RZ Cas D06(06)08
S Equ D06(09)13L
X Tri 08(10)13
Z Per 16(21)17D
1996 Oct 6 Sun
X Tri 07(09)12
RW Tau L07(11)16
RZ Cas 08(10)13
V640 Ori L13(15)17D
1996 Oct 7 Mon
Z Dra D06(07)09
X Tri D06(09)11
SW Cyg 07(13)17D
TW Dra 12(17)17D
RW Gem 12(17)17D
RZ Cas 13(15)17D
1996 Oct 8 Tue
U Sge D06(06)12
X Tri D06(08)11
U Cep D06(10)15
ST Per 13(17)17D
V640 Ori 13(16)17D
Z Dra 13(16)17D
Z Per 17(22)17D
1996 Oct 9 Wed
Z Vul D06(06)12
X Tri D06(07)10
RW Tau L07(05)10
1996 Oct 10 Thu
X Tri D06(07)09
TW Dra 07(12)17
RW Gem L10(14)17D
V640 Ori 13(16)17D
U Cep 17(22)17D
1996 Oct 11 Fri
TX UMa D06(03)08
RZ Cas D06(05)08
X Tri D06(06)08
ST Per D06(08)12
Z Dra 06(09)11
U Sge 10(15)12L
Z Vul 12(17)13L
Y Psc 13(18)16L
1996 Oct 12 Sat
SW Cyg D06(03)09
X Tri D06(05)08
S Equ D06(06)11
RZ Cas 08(10)12
V640 Ori 14(17)17D
Z Dra 15(17)17D
1996 Oct 13 Sun
X Tri D06(05)07
TW Dra D06(07)12
U Cep D06(10)15
RW Gem L09(10)16
RZ Cas 12(15)17
1996 Oct 14 Mon
X Tri D06(04)06
Z Vul D06(04)10
TX UMa D06(04)08L
RW Tau 13(18)17D
V640 Ori 14(17)17D
RZ Cas 17(19)17D
1996 Oct 15 Tue
U Sge D06(01)06
Y Psc 08(12)15L
Z Dra 08(10)13
S Equ 11(16)13L
U Cep 17(22)17D
1996 Oct 16 Wed
TW Dra D06(03)08
RW Gem L09(07)12
Z Vul 10(15)13L
SW Cyg 11(17)17L
ST Per 11(15)17D
V640 Ori 15(18)17D
Z Dra 17(19)17D
1996 Oct 17 Thu
RZ Cas D06(05)07
TX UMa D06(06)08L
RW Tau 08(13)17
TX UMa L10(06)11
1996 Oct 18 Fri
Z Per D06(02)07
Z Dra D06(04)06
U Cep D06(09)14
U Sge D06(10)12L
RZ Cas 07(09)12
V640 Ori 15(18)17D
TW Dra 17(22)17D
1996 Oct 19 Sat
Z Vul D06(02)07
S Equ D06(03)08
Y Psc D06(07)11
ST Per D06(07)11
RW Gem L09(04)09
Z Dra 10(12)15
RZ Cas 12(14)16
1996 Oct 20 Sun
TX UMa D06(07)07L
RW Tau L07(07)12
TX UMa L10(07)12
V640 Ori 16(19)17D
RZ Cas 16(19)17D
U Cep 16(21)17D
1996 Oct 21 Mon
Z Per D06(03)08
SW Cyg D06(06)12
Z Vul 08(13)12L
TW Dra 12(18)18D
1996 Oct 22 Tue
Z Dra D06(05)08
S Equ 08(13)12L
V640 Ori 16(19)18D
1996 Oct 23 Wed
RZ Cas D06(04)06
TX UMa D06(09)07L
U Cep D06(09)14
TX UMa L10(09)14
Z Dra 11(14)16
1996 Oct 24 Thu
Z Per D06(05)09
RZ Cas 06(09)11
TW Dra 08(13)18D
ST Per 10(14)18D
RW Gem 16(22)18D
V640 Ori 17(20)18D
1996 Oct 25 Fri
U Sge D06(04)10
RZ Cas 11(13)16
SW Cyg 14(20)17L
RW Tau 15(20)18D
U Cep 16(21)18D
X Tri 17(20)18D
1996 Oct 26 Sat
Z Dra D06(07)09
Z Vul D06(11)12L
TX UMa 06(10)07L
TX UMa L10(10)15
RZ Cas 16(18)18D
X Tri 17(19)18D
V640 Ori 17(20)18D
1996 Oct 27 Sun
ST Per D06(06)10

Z Per D06(06)11
TW Dra D06(08)13
RW Gem 13(18)18D
Z Dra 13(16)18D
X Tri 16(18)18D

1996 Oct 28 Mon

U Cep D06(09)14
U Sge 07(13)11L
RW Tau 10(14)18D
X Tri 15(18)18D
SS Cet 17(22)17L

1996 Oct 29 Tue

RZ Cas D05(04)06
S Equ D05(10)12L
TX UMa L09(12)17
X Tri 15(17)18D
ST Per 17(21)18D

1996 Oct 30 Wed

TW Dra D05(04)09
Z Per D05(07)12
SW Cyg D05(10)16
RZ Cas 06(08)11
Z Dra 06(09)11
Y Psc 09(14)14L
RW Gem 10(15)18D
X Tri 14(16)18D
U Cep 16(21)18D

1996 Oct 31 Thu

Z Vul D05(09)12L
RW Tau L06(09)14
RZ Cas 10(13)15
X Tri 13(16)18D
Z Dra 15(17)18D
SS Cet 16(21)17L

1996 Nov 1 Fri

ST Per 09(13)17
TX UMa L09(13)18D
X Tri 12(15)17
RZ Cas 15(18)18D

1996 Nov 2 Sat

U Cep D05(08)13
Z Per D05(09)14
RW Gem L08(12)17
X Tri 12(14)17

1996 Nov 3 Sun

Y Psc D05(08)13
RW Tau L06(03)08
Z Dra 08(11)13
X Tri 11(14)16
SS Cet 16(20)17L

1996 Nov 4 Mon

SW Cyg D05(00)06
RZ Cas D05(03)05
ST Per D05(04)08
U Sge D05(07)11L
TX UMa 10(15)18D
X Tri 10(13)15
TW Dra 13(18)18D
U Cep 15(20)18D
Z Dra 17(19)18D

1996 Nov 5 Tue

Z Vul D05(06)11L
S Equ D05(07)11L
RZ Cas D05(08)10
Z Per D05(10)15
RW Gem L08(09)14
X Tri 10(12)15
RW Tau 17(22)18D

1996 Nov 6 Wed

Z Dra D05(04)06
X Tri 09(12)14
RZ Cas 10(12)15
SS Cet 15(20)17L
ST Per 16(20)18D

1996 Nov 7 Thu

Y Psc D05(03)07
U Cep D05(08)13
X Tri 08(11)13
TW Dra 09(14)18D
Z Dra 10(12)15
TX UMa 12(16)18D
RZ Cas 15(17)18D

1996 Nov 8 Fri

Z Per 07(11)16
SW Cyg 07(13)16L
X Tri 08(10)13
RW Gem L08(05)11
RW Tau 11(16)18D
SW Cyg L18(13)18D

1996 Nov 9 Sat

X Tri 07(10)12
ST Per 07(11)16
SS Cet 14(19)16L
U Cep 15(20)18D

1996 Nov 10 Sun

Z Vul D05(04)10
Z Dra D05(05)08
TW Dra D05(09)14
X Tri 06(09)11
TX UMa 13(18)18D

1996 Nov 11 Mon

U Sge D05(02)07
RZ Cas D05(07)09
X Tri 06(08)11
RW Tau 06(11)15
Z Per 08(13)18
Z Dra 12(14)16

1996 Nov 12 Tue

ST Per D05(03)07
S Equ D05(04)10
X Tri D05(07)10
U Cep D05(08)13
RZ Cas 09(12)14
Z Vul 10(15)11L
SS Cet 14(18)16L

1996 Nov 13 Wed

SW Cyg D05(03)09
TW Dra D05(04)09
X Tri D05(07)09
RZ Cas 14(16)18D
TX UMa 15(20)18D
RW Gem 18(23)18D

1996 Nov 14 Thu

RW Tau D05(05)10
X Tri D05(06)09
Z Dra D05(07)10
U Sge D05(11)10L
Z Per 09(14)18D
Y Psc 11(15)13L
ST Per 14(19)18D
U Cep 15(20)18D

1996 Nov 15 Fri

Z Vul D05(02)07
X Tri D05(05)08
S Equ 09(15)10L
SS Cet 13(18)16L
Z Dra 13(16)18

1996 Nov 16 Sat

X Tri D05(05)07
RW Gem 15(20)18D
TX UMa 16(21)18D

1996 Nov 17 Sun

X Tri D05(04)07
RZ Cas D05(06)09
U Cep D05(07)12
ST Per 06(10)14
Z Vul 08(13)11L
Z Per 11(15)18D
SW Cyg 11(17)15L
SW Cyg L17(17)18D

1996 Nov 18 Mon

X Tri D05(03)06
Y Psc 05(10)13L
Z Dra 06(09)11
RZ Cas 09(11)14
SS Cet 13(17)16L
TW Dra 14(19)18D

1996 Nov 19 Tue

S Equ D05(01)06
X Tri D05(03)05
RW Gem 11(16)18D
RW Tau 13(18)18D
RZ Cas 13(16)18
U Cep 14(19)18D
Z Dra 15(17)18D
TX UMa 18(23)18D

1996 Nov 20 Wed

Z Vul D05(00)05
ST Per D05(02)06
Z Per 12(17)18D
RZ Cas 18(21)18D

1996 Nov 21 Thu

U Sge D05(05)10L
TW Dra 09(15)18D
SS Cet 12(17)16L

1996 Nov 22 Fri

Y Psc D05(04)09
SW Cyg D05(07)13
U Cep D05(07)12
Z Vul 06(11)10L
S Equ 06(12)10L
RW Tau 08(12)17
RW Gem 08(13)18
Z Dra 08(11)13
ST Per 13(17)18D

1996 Nov 23 Sat

RZ Cas D05(06)08
Z Per 13(18)18D
Z Dra 17(19)18D

1996 Nov 24 Sun

TW Dra D05(10)15
RZ Cas 08(11)13
U Sge 08(14)10L
SS Cet 11(16)15L
U Cep 14(19)18D

1996 Nov 25 Mon

Z Dra D05(04)06
RW Tau D05(07)12
ST Per D05(09)13
RW Gem L07(10)15
RZ Cas 13(15)18

1996 Nov 26 Tue

TX UMa D05(02)05L
Z Dra 10(12)15
SW Cyg 14(20)15L
Z Per 15(20)18D
SW Cyg L17(20)18D
RZ Cas 18(20)18D

1996 Nov 27 Wed

TW Dra D05(05)10
U Cep D05(07)12
Z Vul D05(09)10L
SS Cet 11(15)15L

1996 Nov 28 Thu

U Sge D05(<<)05
RW Tau D05(01)06
RW Gem L06(07)12

1996 Nov 29 Fri

RZ Cas D05(05)08
Z Dra D05(05)08
S Equ D05(09)10L
TX UMa L07(03)08
Y Psc 12(17)12L
U Cep 14(19)19D
Z Per 16(21)19D
X Tri 17(19)17L

1996 Nov 30 Sat

TW Dra D05(01)06

RZ Cas 08(10)12
SS Cet 10(15)15L
Z Dra 12(14)16
ST Per 12(16)19D
RW Tau 15(20)19D
X Tri 16(18)17L

1996 Dec 1 Sun

U Sge D05(08)09L
SW Cyg D05(10)14L
RW Gem L06(04)09
RZ Cas 12(15)17
X Tri 15(18)17L
SW Cyg L16(10)16

1996 Dec 2 Mon

U Cep D05(06)11
Z Vul D05(07)10L
TX UMa L07(05)09
X Tri 15(17)17L
TW Dra 15(20)19D
RZ Cas 17(19)19D
Z Per 17(22)19D

1996 Dec 3 Tue

Z Dra D05(07)10
ST Per D05(07)12
Y Psc 07(11)12L
SS Cet 09(14)15L
RW Tau 10(14)19L
X Tri 14(16)16L

1996 Dec 4 Wed

X Tri 13(16)16L
Z Dra 13(16)18
U Cep 13(18)19D

1996 Dec 5 Thu

RZ Cas D05(05)07
TX UMa L07(06)11
TW Dra 10(15)19D
X Tri 13(15)16L
SW Cyg 18(24)19D

1996 Dec 6 Fri

SW Cyg D05(00)06
S Equ D05(05)09L
RW Tau D05(09)13
RZ Cas 07(09)12
SS Cet 09(13)15L
X Tri 12(14)16L
RW Gem 16(21)19D

1996 Dec 7 Sat

Z Vul D05(04)09L
Y Psc D05(06)10
U Cep D05(06)11
Z Dra 07(09)11
X Tri 11(14)16
RZ Cas 12(14)17

1996 Dec 8 Sun

U Sge D05(03)08
TW Dra 06(11)16
TX UMa L07(08)12
V640 Ori L09(06)09
ST Per 10(15)19L
X Tri 11(13)16
Z Dra 15(18)19D
RZ Cas 16(19)19D

1996 Dec 9 Mon

Z Per D05(01)06
RW Tau D05(03)08
SS Cet 08(13)14L
X Tri 10(12)15
RW Gem 13(18)19D
U Cep 13(18)19D

1996 Dec 10 Tue

SW Cyg 08(14)14L
V640 Ori L09(07)10
X Tri 09(12)14
SW Cyg L16(14)19D

1996 Dec 11 Wed

RZ Cas D05(04)07
TW Dra D05(06)11
ST Per D05(06)10
U Sge 06(12)08L
TX UMa L07(09)14
Z Dra 08(11)13
X Tri 08(11)13
RW Tau 17(22)18L

1996 Dec 12 Thu

Z Vul D05(02)08
Z Per D05(02)07
U Cep D05(06)11
RZ Cas 06(09)11
SS Cet 08(12)14L
X Tri 08(10)13
V640 Ori L08(07)10
RW Gem 09(15)19D
Z Dra 17(19)19D

1996 Dec 13 Fri

S Equ D05(02)08
X Tri 07(10)12
RZ Cas 11(14)16
ST Per 18(22)18L

1996 Dec 14 Sat

TW Dra D05(01)06
Z Dra D05(04)06
TX UMa L06(11)15
X Tri 06(09)11
Z Vul 08(13)09L
V640 Ori L08(08)11
RW Tau 11(16)18L
U Cep 13(18)19D
RZ Cas 16(18)19D
Z Vul L18(13)18

1996 Dec 15 Sun

SW Cyg D05(03)10
Z Per D05(04)08
X Tri 06(08)11
RW Gem 06(11)17
SS Cet 07(12)14L
Z Dra 10(12)15

1996 Dec 16 Mon

X Tri 05(08)10
S Equ 08(13)08L
V640 Ori L08(08)11
ST Per 09(13)17
TW Dra 16(21)19D
Z Dra 19(21)19D
Z Vul 19(24)19D

1996 Dec 17 Tue

Z Vul D05(00)05
RZ Cas D05(04)06
U Cep D05(05)10
X Tri D05(07)09
RW Tau 06(11)15
TX UMa 08(12)17

1996 Dec 18 Wed

Z Per D05(05)10
Z Dra D05(06)08
U Sge D05(06)08L
X Tri D05(06)09
RW Gem L05(08)13
RZ Cas 06(08)11
SS Cet 06(11)14L
V640 Ori L08(09)12
Y Psc 08(13)11L

1996 Dec 19 Thu

ST Per D05(05)09
X Tri D05(05)08
Z Vul 06(11)09L
RZ Cas 11(13)15
TW Dra 11(16)19D
SW Cyg 11(17)13L
Z Dra 12(14)17
U Cep 12(17)19D
SW Cyg L15(17)19D

1996 Dec 20 Fri

X Tri D05(05)07
RW Tau D05(05)10
V640 Ori L08(09)12
TX UMa 09(14)18
RZ Cas 15(18)19D

1996 Dec 21 Sat

X Tri D05(04)07
Z Per D05(06)11
RW Gem L05(05)10
SS Cet 06(10)14L
ST Per 16(20)18L
Z Vul L18(22)19D
U Sge L19(15)19D

1996 Dec 22 Sun

X Tri D05(03)06
U Cep D05(05)10
Y Psc D05(07)11L
Z Dra 05(07)10
TW Dra 06(12)17
V640 Ori L08(10)13

1996 Dec 23 Mon

X Tri D05(03)05
RZ Cas D05(03)05
S Equ D05(10)08L
TX UMa 11(15)19D
Z Dra 14(16)18

1996 Dec 24 Tue

RW Gem D05(02)07
SW Cyg D05(07)13L
Z Per D05(08)12
Z Vul D05(09)08L
SS Cet 05(10)13L
RZ Cas 05(08)10
V640 Ori 08(10)13
ST Per 08(12)16
U Cep 12(17)19D
U Sge 19(24)19D

1996 Dec 25 Wed

U Sge D05(00)06
TW Dra D05(07)12
RZ Cas 10(12)15
RW Tau 13(18)17L

1996 Dec 26 Thu

Y Psc D05(01)06
Z Dra 07(09)11
V640 Ori 08(11)14
TX UMa 12(17)19D
RZ Cas 15(17)19D
RW Gem 17(22)18L
Z Vul L18(20)19D

1996 Dec 27 Fri

ST Per D05(04)08
U Cep D05(05)10
SS Cet D05(09)13L
Z Per D05(09)14
Z Dra 15(18)19D

1996 Dec 28 Sat

TW Dra D05(02)07
U Sge D05(10)07L
RW Tau 08(12)17L
V640 Ori 09(11)14
SW Cyg 15(21)19D

1996 Dec 29 Sun

Z Vul D05(07)08L
U Cep 12(17)19D
TX UMa 14(18)19D
RW Gem 14(19)18L
ST Per 15(19)17L

1996 Dec 30 Mon

S Equ D05(07)08L
RZ Cas D05(07)10
SS Cet D05(08)13
Z Per 06(10)15
Z Dra 08(11)13
V640 Ori 09(12)15
TW Dra 17(22)19D

1996 Dec 31 Tue

RW Tau D05(07)11
RZ Cas 09(12)14
Z Dra 17(19)19D
Z Vul L17(18)19D
U Sge L18(19)19D

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