AM CVn STARS

Star	$P_{orb}(s)$	$P_{sh}(s)$	Discovery	m_v
RXJ0806	321.25		2002	21.1

Israel et al (2002). Ramsay, Hakala & Cropper (2002)

V407 Vul (RX J1914+24)	569		1998	19.9

Cropper et al (1998).

ES Cet (KUV 01584-0939).		620.26	2001	16.9

Warner & Woudt (2002).
Stable light curve – no low states, but slight variations in mean brightness.

RxJ 0806

Israel et al.: 321 s – the shortest orbital period binary. 3

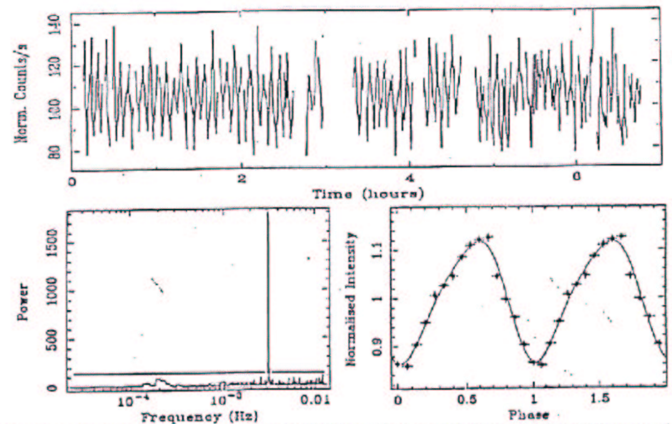


Fig. 2. TNG *DoLoReS* B (from start to 2.1hr), V (2.1–4.5hr) and R (4.5hr to the end) merged light curve for the optical counterpart of RX J0806.3+1527 (upper panel). Power spectrum density with superimposed the 99% confidence level threshold for signals (lower left panel). Merged B, V and R light curve folded to the best period of 321.5 s, with superimposed the best fit (lower right panel).

RX 1914

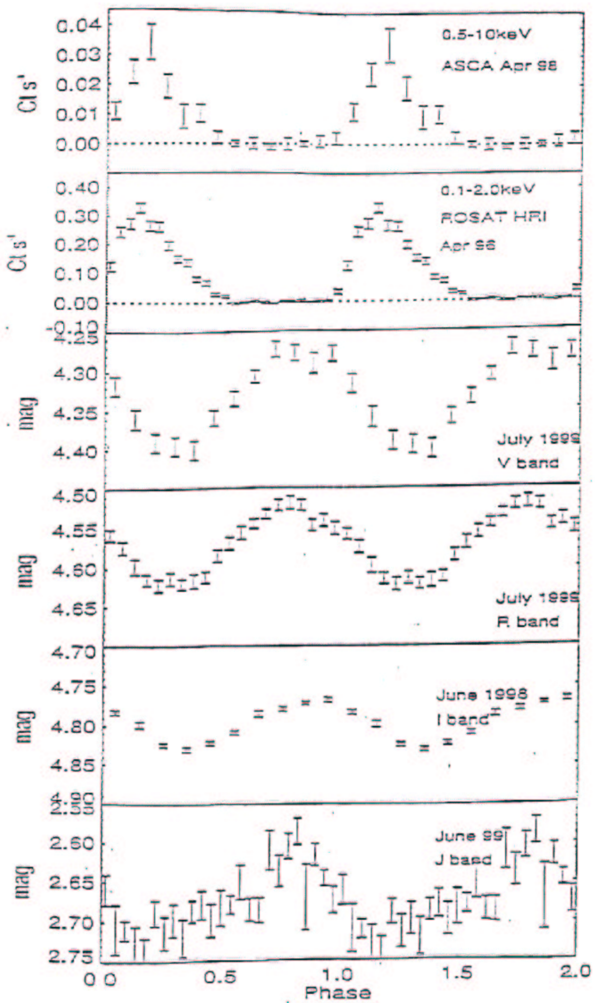
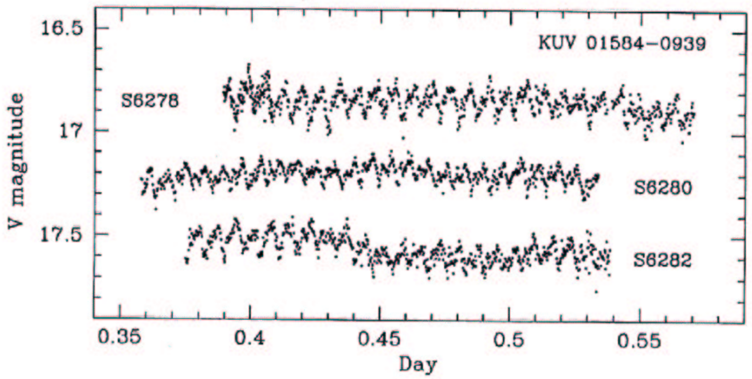
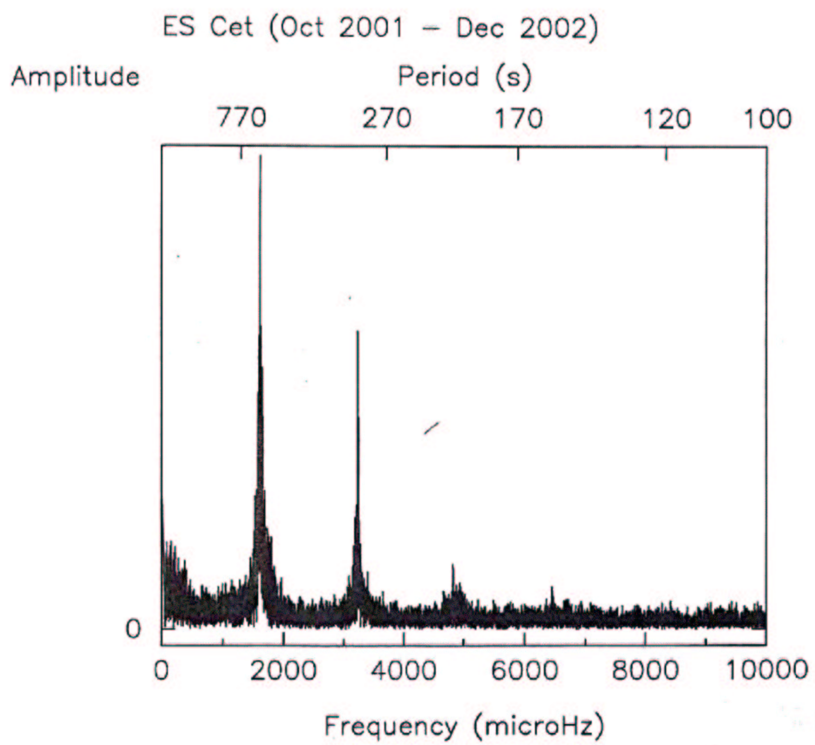
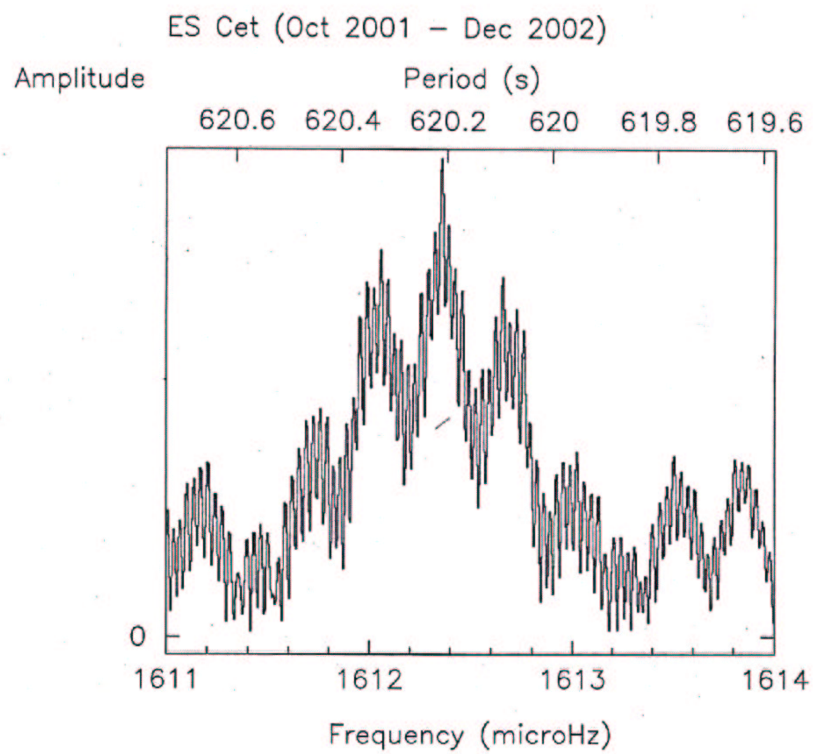


Figure 2. The light curve of RX J1914+24 as a functio energy folded on the 9.5 min period.




ES Cet (Oct 2001 – Dec 2002)
Amplitude
Period (s)
770
270
170
120
100
0
0
2000
4000
6000
8000
10000
Frequency (microHz)


ES Cet (Oct 2001 – Dec 2002)
Amplitude
Period (s)
620.6
620.4
620.2
620
619.8
619.6
0
1611
1612
1613
1614
Frequency (microHz)

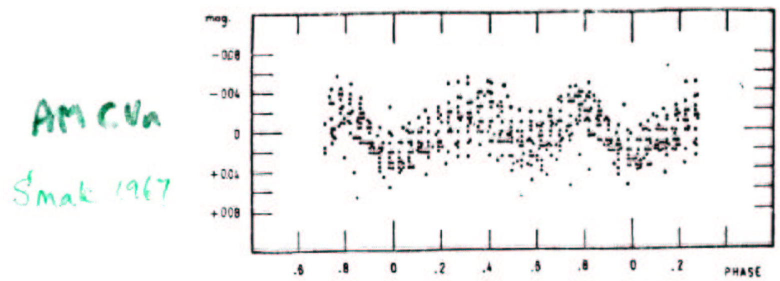
AM CVn 1028.77 1054 1972 14.1- 14.2

Skillman et al (1999). Solheim et al (1998).

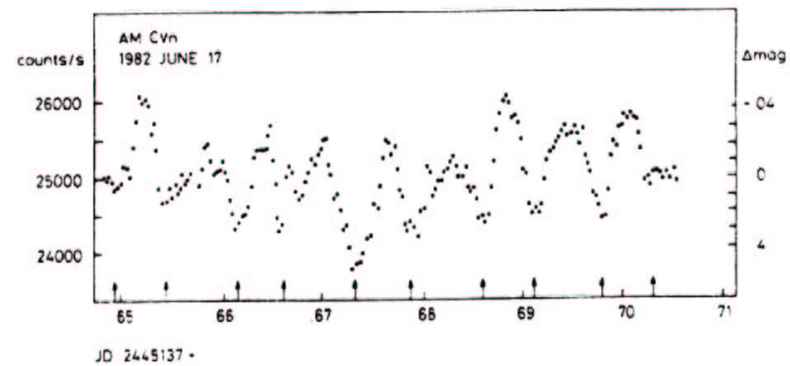
Some variations in mean brightness, but no low states. Could be the typical variations seen in nova-like variables.

HP Lib 1102.7 1119 1994 13.6
(EC 15330)

Permanent high state. Patterson et al (2002) give superhump and orbital periods. See also Solheim paper in Gottingen proceedings.

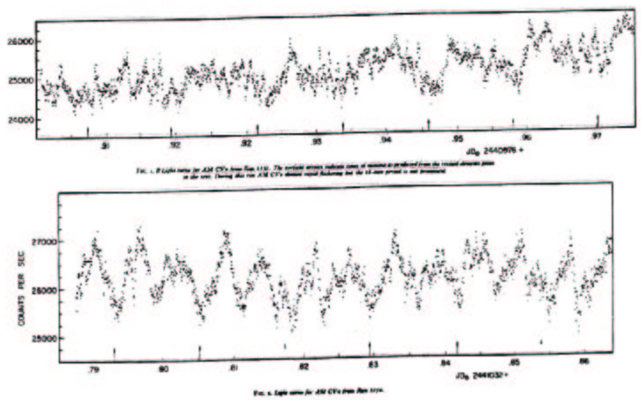


Composite light-curve of HZ 29 in ultraviolet light. Ordinate gives Δm as defined in the text; abscissa is phase in units of period.

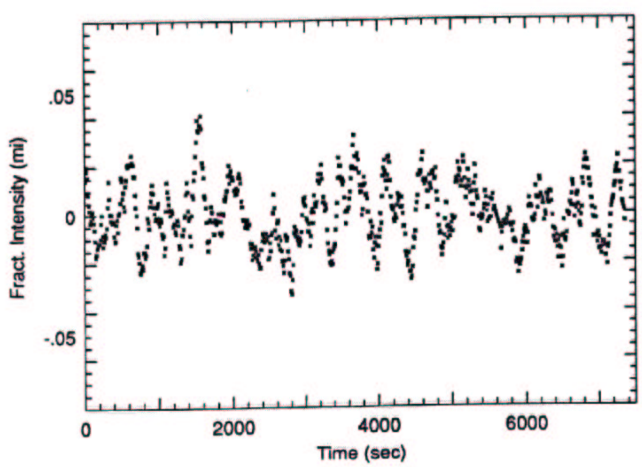


: curve of AM CVn at 25 s time resolution. Arrows point to light minima, emphasizing the irregular spacings. From S

AM CVn



1971
82-in telescope
McDonald observatory



1990
3.6m telescope
CFHT

CR Boo 1471 1490 1987 13.0 -18.0

VY Scl type behaviour (high and low states).

Kato et al (2000a) found 46 d supercycle. Kato et al (2001b) find from later observations another recurrence behaviour which gives a supercycle of 15 d.

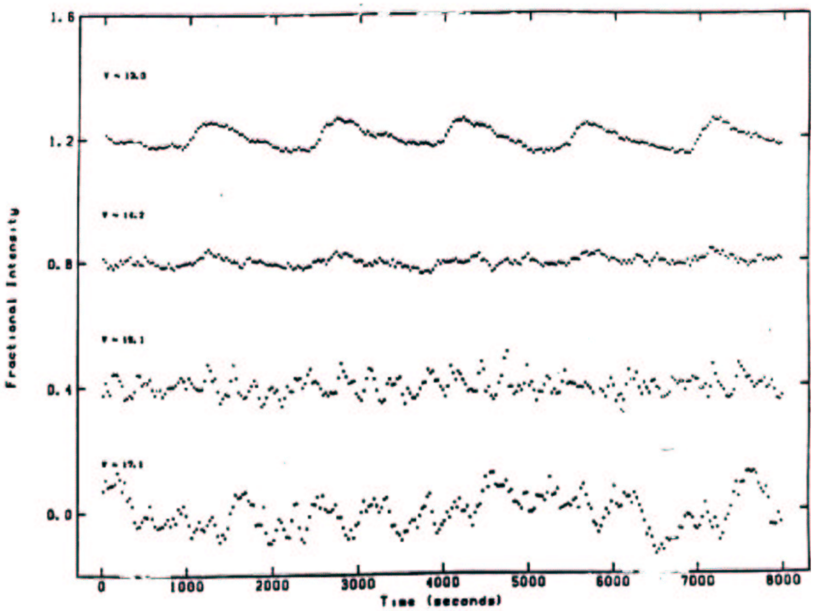
Patterson et al (1997) Dwarf nova with quasiperiod ~19 h. (More details to be taken from here).

Provencal et al (1997) WET campaign – details of harmonics (to be discussed by Patterson?)

KL Dra 1500 1530 1998 16.8 - 20

High and low states.

Wood, M. A., Casey, M. J., Garnavich, P. M. & Haag, B. 2002. MNRAS 334, 87. Superhumps in high state.



CR Boo

KL Dra

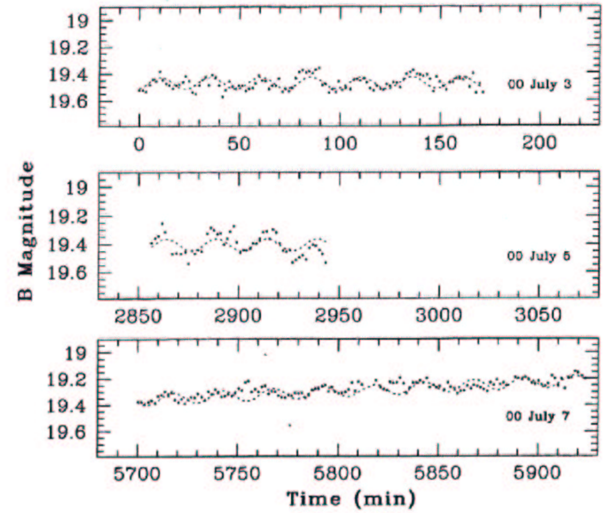


Figure 3. The VATT *B*-band light curves on the nights 2000 June 3, 5 and 7 (UT), from top to bottom. The Julian date of the first data point is 245 1698.84718. The best-fitting period to the data from the first two nights is shown as a dotted line (see text).

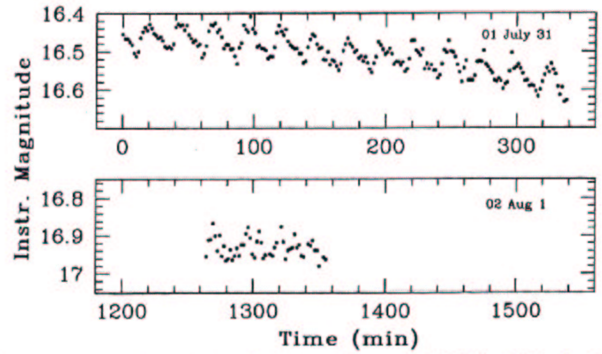


Figure 4. The SARA light curves on the nights 2001 July 31 (top panel) and August 1 (bottom panel). The Julian date of the first data point is 245 2121.75906. On July 31, the superhumps are well developed, and have the characteristic saw-tooth shape that gives rise to the first and second harmonics in the Fourier transform (see Fig. 5), but the star faded by more than a tenth of a magnitude over the course of 5 h, and by half a magnitude over 24 h. The August 1 light curve shows variations, but the 25.5-min periodicity is far less obvious.

gives rise to the first and second harmonics in the Fourier transform. This light curve is very similar to the high-state light curve of CR Boo (e.g. Wood et al. 1987, fig. 6 therein), and is the first-obtained light curve from KL Draconis to show unambiguous superhump oscillations. For the last ~3 h of the July 31 run, the star is fading at a rate of approximately 0.03 mag h^{-1}. The mean magnitude on the following night is approximately 16.93, and the 25-min signal is much less obvious.

V803 Cen 1618 1987 13.2 – 17.4

High and low states.

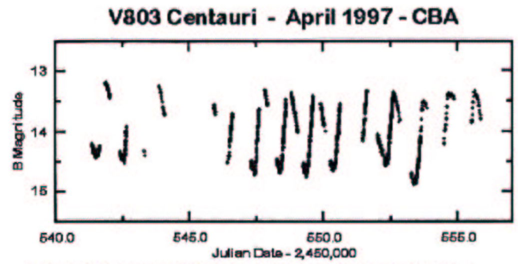
Kato et al (2000a,b) find ER UMa type light curve, with 77 d supercycle; but Kato et al (2001a) find "standstill" in the light curve, and the supercycle has disappeared.

Patterson et al (2000), from 1992 – 1999 photometry find superhump always present. Also occasionally is a dwarf nova with outburst period 22 +/- 1 hr. Recurrence time is 0.94 d when it is at V ~ 14.5 and ~ 5 d when at V = 17.2. (Agrees roughly with recurrence timescale being inversely proportional to Mdot).

CP Eri 1724 1991 16.5 – 19.7

High and low states.

No extensive photometry since Abbott et al 1992.



This is a light curve of V803 Cen, as synthesized from observations in South Africa (J. Patterson), Chile (J. Kemp), New Zealand (S. Walker), and Australia (P. McGee in Adelaide and G. Garradd in Loomberah). The period is 23.7±0.2 hr. The true speed demon among the dwarf novae! We earnestly ask southern observers everywhere to help us follow this amazing star through the rest of the observing season.

GP Com 2970 1981 15.7 - 16.0

'Permanent' low state (but could show decade outbursts)

Reviewed in Warner 1995. Additional photometry in Margaret (Kate) Harrop-Allan's MSc thesis. No other photometry published.

CE-315 3906 2001 17.6

'Permanent low state'.

Ruiz et al (2001) 65.1 min binary from spectroscopic measurement. Woudt & Warner (2002): no orbital modulation. Flares like GP Com.

148 *CHAPTER 5. GP COMAE*

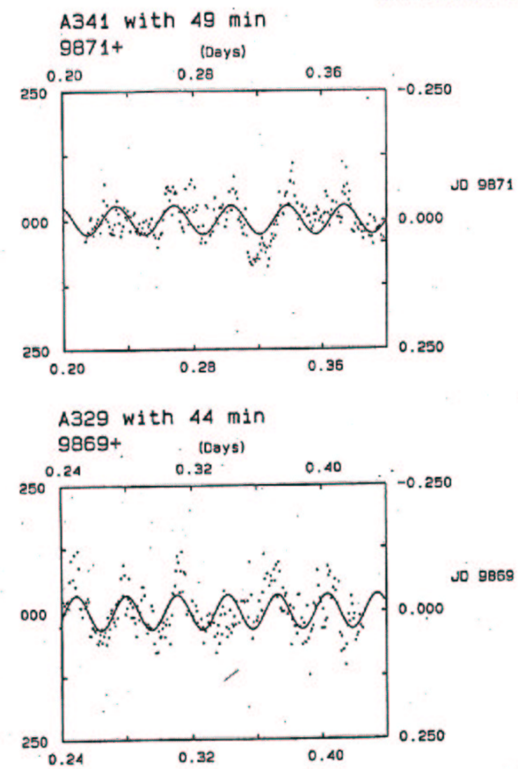


Figure 5.6: Runs A329 and A341, showing the intermittent ~ 46 min modulations. The dominant low-frequency variations (~ 312 min in A329 and ~ 249 min in A341) have been removed from the light curve in each case.

CE-315

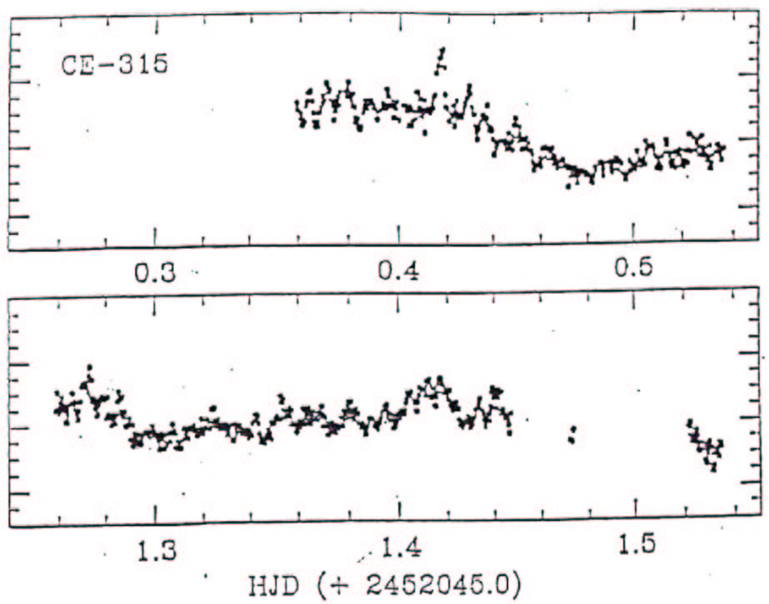


Figure 12. The light curves of CE-315 obtained on 2001 May 15 and 16. The data in the top panel have been binned along the horizontal axis by a factor of four, the data in the bottom panel by a factor of two.

DNOs in V803 Cen

(O'Donoghue, Menzies & Hill 1987)

Date	B	
2 July 1986	13.4	175.77 s
3 July 1986	13.4	
4 July 1986	13.5	
5 July 1986	13.5	
7 July 1986	15.4	178.8 s

Seen also in high state in 1987 (O'D & Kilkenny 1989)

Not seen in low state (B ~ 17.0)
(O'Donoghue et al 1990)

DNOs in CR Boo

(Patterson : description of 1996 CBA Campaign on CR Boo

"On 3 nights at the peak of the bright state the star showed a low amplitude (0.003 mag) signal in the range 19–22 s (but defined to within 0.02 s on each night)."

DNOs in AM CVn

26.2 s signal of typical DNO coherence

Magnetic Cataclysmic Variables
*ASP Conference Series, Vol. ***, 2003*
Eds. M. Cropper and S. Vrielmann

Dwarf Nova Oscillations and Quasi-Periodic Oscillations: Extension of the Two-QPO Diagram of X-Ray Binaries, and a new kind of DNO

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Department of Astronomy, University of Cape Town, Rondebosch 7700, South Africa

Abstract. Seventeen examples are given of Cataclysmic Variable (CV) stars possessing both Dwarf Nova Oscillations (DNOs) and Quasi-Periodic Oscillations (QPOs). These form an extension of the X-Ray Two-QPO correlation to frequencies three orders of magnitude lower. We draw attention to the existence of a second type of DNO in CVs, which is probably caused by magnetically channelled accretion onto the white dwarf.

1. Introduction

We reported at the August 2001 Göttingen meeting on CVs that VW Hyi in outburst has Dwarf Nova Oscillations (DNOs) and Quasi-Periodic Oscillations (QPOs) that keep an approximately constant period ratio of ~ 16 as they vary in period by a factor of two during the late stages of outburst (Warner & Woudt 2002a; see also Woudt & Warner 2002). Interpreting the DNOs and QPOs in VW Hyi as analogues of the high and low frequency QPOs observed in X-Ray binaries, we showed that VW Hyi lies on an extension to low frequencies of the two-QPO correlation in X-Ray binaries found by Psaltis, Belloni & van der Klis (1999). An important addition to this correlation was made by Mauche (2002), who found that the X-Ray DNOs and QPOs in SS Cyg also fall on this relationship, which helps to close the gap between the CVs and the X-Ray binaries.

One aspect of QPOs in CVs is that double DNOs are sometimes observed, and their frequency difference is equal to the QPO frequency (Woudt & Warner 2002) - which we interpret as the DNO rotating beam reprocessed off a progradely travelling wave in the inner disc (Warner & Woudt 2002b). Therefore, even if a QPO is not directly observed in a light curve, a proxy for it can be found when double DNOs are observed.

1

A NEW TYPE OF DNO

VW Hyi	14 – 40	~ 88	Haefner, Schoembs & Vogt, 1977, 1979 Warner & Woudt 2002
EC 2117-54	23	~ 92	Warner & Woudt 2002
SS Cyg	6 – 12	~ 33	Patterson 1981
HT Cas	20	~ 100	Patterson 1981
AH Her	24 –33	~ 100	Patterson 1981
OY Car	19 n- 28	~ 50	Woudt & Warner 2002

VW Hyi
(Schoembs)

Table 1. Observational data and results

Date: 1975 Dec	Run	Start (UT)	Duration (s)	Mean B-magnitude	Period (s)
21./22.	1	$1^h35^m34^s$	8190	10.5	-
	2	4 10 49	8805	10.6	89.6 *)
22./23.	1	1 05 30	10110	12.3	87.6 *)
	2	4 13 16	8805	12.5	-
23./24.	1	1 05 34	11400	13.3	88.2
	2	4 32 34	13440	13.3	88.4, 86.8, 86.0
24./25.	1	1 12 49	8775	13.5	88.5
25./26.	1	1 11 31	5340	13.7	-
	2	2 41 11	7845	13.7	88.0, 86.9
26./27.	1	1 31 26	5940	13.6	87.6, 86.2
	2	3 11 19	5100	13.6	87.8
29./30.	1	1 18 30	7425	13.7	88.0
31./1.	1	1 42 11	10590	13.7	-

*) low signal to noise ratio

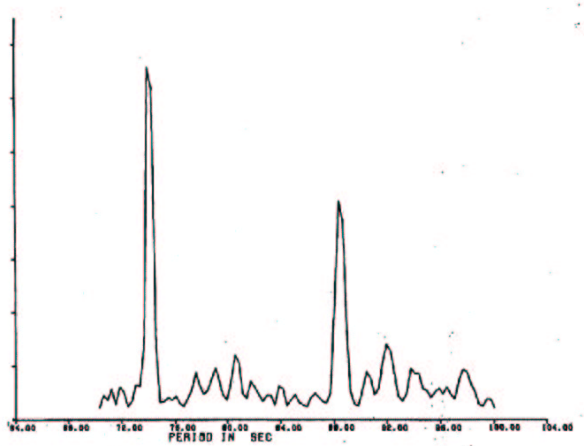

Fig. 2. Periodogram showing the oscillation of VW Hyi near 88 s and a calibration peak at 74 s