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SHORT PERIOD PHOTOMETRIC OSCILLATIONS IN V 795 HERCULIS

We present results of CCD photometry of the cataclysmic variable V 795 Herculis (=PG 1711 + 336) obtained on three nights in May 1992. At least on one night the photometric variability is time resolved and shows a pronounced preferred time-scale of 0.48 hours. This behaviour is similar to the one reported by Zhang et al. (1991).

The peculiar binary system V 795 Her presents a rare example of a cataclysmic variable inside the so called period gap (Shafter et al. 1990). Its spectroscopic period of 2.598 hour is 12 minutes shorter than the photometric one. This led Shafter et al. to classify the system as an intermediate polar. In this model the spectroscopic period represents the true orbital period of the system, while the photometric period results from a beat between the orbital period and the rotation period of the white dwarf. We note that V 795 Her may be peculiar with respect to this model, because it is not known as a (strong) X-ray source as many other polar emission stars are. On the other hand, it has been pointed out (Zhang et al. 1991) that the tight correlation between polar emission stars and X-ray sources may be a selection effect. It is also quite interesting to note, that a weak X-ray source has recently been detected in the direction of V 795 Her by ROSAT (Prinja & Rosen 1993).

In addition to photometric variability with the 2.7957 hour period, the object shows pronounced flickering on shorter time-scales. In 1989 Ashoka et al. claimed a detection of several quasi periods. Warner (1989) justly criticized this interpretation as not sufficiently supported by available data. Subsequently Shafter et al. (1990) confirmed the flickering, but found no significant enhancement of power at periods shorter than 1 hour. However Zhang et al. (1991) suggest that "the rapid variations (in light curves of V 795 Her) have a preferred time scale of 10-20 minutes and may be quasiperiodic." The coherence time of these variations was found to be of the order of 10 cycles. It is clear, that more observations are needed in order to elucidate the nature of these so far contradictory conclusions about the properties of photometric flickering.

In this paper we present the results of CCD photometry in the V photometric band obtained with the 0.36-m, f/11 Schmidt-Cassegrain telescope at the observing station Črni Vrh (Slovenia). On each of the three nights a sequence of 2 minute exposures was obtained. The CCD camera built by Wright Instruments contains a front-side illuminated EEV P86000 (574 × 385 pixel) chip which is cooled to -76 ^{o}C by a four stage Peltier cooler. The linearity and cosmetics of the chip are very good and the dark current is low (0.06 e^{-}/sec/pixel). The V filter made of Schott glass conforms to the Johnson standard (Bessell 1990). Data was collected by a PC and then transferred to a Vax mainframe, where it was reduced with the Daophot II package. This same hardware and software setup has been tested against the M67 sequence (Chevalier & Ilovaisky 1991) and no systematic errors were detected.

Relative photometry of V 795 Her vs. Star I.
Time at mid-exposure is given in units of JD−2,448,700.

56.4213	1.90	56.4840	1.91	56.5397	1.75	68.4755	1.77	71.3809	1.75
56.4228	1.87	56.4855	1.95	56.5412	1.76	68.4770	1.70	71.3827	1.84
56.4324	1.88	56.4870	1.94	56.5427	1.78	68.4785	1.73	71.3842	1.84
56.4342	1.89	56.4885	1.94	56.5444	1.77	68.4803	1.73	71.3858	1.84
56.4364	1.77	56.4901	1.88	56.5459	1.83	68.4819	1.68	71.3873	1.80
56.4379	1.82	56.4916	1.88	56.5475	1.82	68.4834	1.74	71.3889	1.78
56.4394	1.88	56.4931	1.89	56.5490	1.73	68.4849	1.77	71.3904	1.83
56.4410	1.85	56.4946	1.86	56.5505	1.76	68.4865	1.84	71.3919	1.82
56.4425	1.84	56.4962	1.82	56.5521	1.76	68.4880	1.80	71.3934	1.88
56.4440	1.82	56.4978	1.74	56.5536	1.83	68.4895	1.68	71.3950	1.84
56.4455	1.81	56.4994	1.74	56.5555	1.80	68.4911	1.80	71.3965	1.72
56.4471	1.86	56.5024	1.78	56.5571	1.70	68.4926	1.72	71.3980	1.87
56.4486	1.80	56.5039	1.82	56.5586	1.72	68.4941	1.68	71.3996	1.81
56.4501	1.87	56.5055	1.87	56.5601	1.74	68.4959	1.81	71.4011	1.74
56.4516	1.79	56.5070	1.87	56.5617	1.71	68.4974	1.79	71.4026	1.84
56.4532	1.78	56.5085	1.78	68.4384	1.60	68.4989	1.71	71.4041	1.90
56.4547	1.78	56.5101	1.74	68.4399	1.66	68.5005	1.69	71.4057	1.91
56.4562	1.82	56.5116	1.78	68.4415	1.71	68.5020	1.65	71.4072	1.86
56.4577	1.82	56.5132	1.78	68.4430	1.76	68.5040	1.65	71.4088	1.83
56.4593	1.81	56.5148	1.82	68.4445	1.71	68.5056	1.72	71.4103	1.86
56.4608	1.73	56.5163	1.76	68.4462	1.74	68.5072	1.75	71.4118	1.87
56.4623	1.76	56.5178	1.72	68.4477	1.81	68.5087	1.78	71.4133	1.84
56.4638	1.78	56.5194	1.70	68.4493	1.74	68.5105	1.82	71.4149	1.86
56.4654	1.83	56.5211	1.68	68.4557	1.78	68.5120	1.82	71.4164	1.72
56.4669	1.79	56.5226	1.73	68.4572	1.82	68.5136	1.76	71.4179	1.73
56.4684	1.84	56.5242	1.78	68.4588	1.81	68.5151	1.79	71.4195	1.74
56.4700	1.83	56.5257	1.84	68.4603	1.77	68.5166	1.91	71.4210	1.89
56.4715	1.88	56.5272	1.85	68.4618	1.83	68.5184	1.86	71.4225	1.88
56.4730	1.82	56.5289	1.83	68.4643	1.77	68.5200	1.81	71.4241	1.84
56.4745	1.82	56.5304	1.71	68.4659	1.79	71.3676	1.72	71.4256	1.84
56.4761	1.77	56.5319	1.75	68.4674	1.80	71.3695	1.74	71.4271	1.84
56.4776	1.78	56.5334	1.74	68.4689	1.75	71.3710	1.73		
56.4791	1.79	56.5350	1.75	68.4704	1.75	71.3726	1.84		
56.4806	1.84	56.5366	1.74	68.4724	1.73	71.3741	1.73		
56.4824	1.89	56.5382	1.79	68.4739	1.71	71.3756	1.73		

The field of view of the CCD is $9' \times 12'$ and contains several suitable comparison stars. Our prime standard, the 10^m star I, lies 7' N and 1' W of V 795 Her at the GSC coordinates $\alpha_{2000} = 17^h12^m\ 52\overset{s}{.}5$, $\delta_{2000} = 33^o34'45''$. Checking star I against the secondary standard star located 5' E of V 795 Her, we found the flux from Star I to be constant to within 0.017 mag. The standard deviation for relative photometry of V 795 Her versus star I was found to be 0.02 mag. It was derived on the basis of the relative photometry of a star fainter than V 795 Her located 2' SE of it (i.e. the bright star seen at the lower edge of the finding chart published by Downes & Shara 1993). Throughout this paper the absolute photometric V magnitude of V 795 Her is calculated from relative photometric data assuming the V magnitude 10.52 for Star I, as given in the HST GSC catalogue.

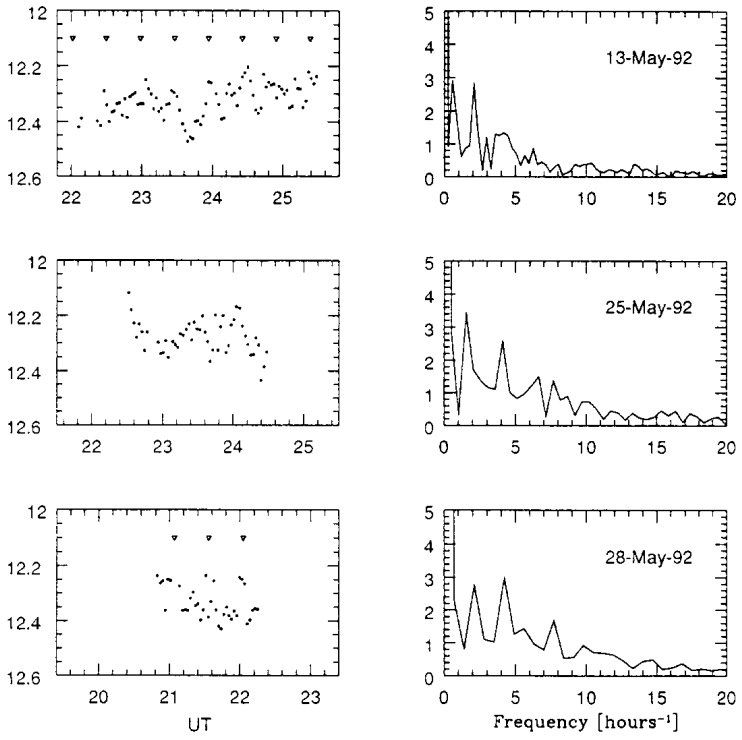

Figure 1. V band light curves of V 795 Herculis and their power spectra. See text

The results are presented in Figure 1. Graphs on the left show V magnitudes of V 795 Her for each of the three nights. The graphs on the right show the corresponding power spectra where the intensity unit is one per cents of the continuum intensity (0.01^m). Each night is labelled by its evening date. All spectra show significant power peaks. The lowest frequency peaks in the spectra of the first two nights have poorly defined frequencies and are most likely harmonics of the 2.8 hour photometric period. However the peaks at the frequency of 2.1 ± 0.1 h^{-1} in the spectra of May 13 and May 28 are not harmonics of either the photometric 2.8-hour or the spectroscopic 2.6-hour period. We cannot exclude the presence of variability with this frequency on the night of May 25 though the power is clearly much lower. Power peaks at the frequency of ~ 4 h^{-1} can be interpreted as the first harmonic of the 2.1 h^{-1} frequency.

The properties of the window function have been studied with an artificial data set assuming that a constant intensity was measured at the actual observing times. The corresponding power spectra show no power enhancement at or near the 2.1 h^{-1} frequency. Moreover the reality of the 0.48 hour timescale can be checked by visual inspection of positions of triangles in the first and the last graph on the left which mark the times of maxima of the 0.48 hour sinusoid.

Powers around the 0.48 hour time-scale and its first harmonic are comparable. Time span of observations obtained on each of the nights is rather short so we cannot exclude the possibility that the preferred timescale is actually the first harmonic with the period of $\sim 0.48/2$ hour. If so, the observed flickering is similar to the one reported by Zhang et al. (1991) who claimed a detection of QPO oscillations with periods between 970 and 1240 seconds.

To conclude, our results agree with the claim by Zhang et al. (1991) that short timescale photometric variability can have a coherence time of a few hours so that the corresponding power spectrum shows significant power enhancements. However absence of such behaviour in other published power spectra and differences between the spectra we obtained on different nights exclude the possibility of a pronounced and stable photometric period between a few minutes and one hour.

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