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Time-resolved photometry of cataclysmic variables

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Abstract. We present time-resolved photometry of two cataclysmic variables whose CCD photometric observations were obtained with the 1m telescope at the South African Astronomical Observatory in October 2002 and August 2003 and with the 1m telescope at Hoher List in Germany. Concerning MCT 2347-3144 we detect for the first time a period of 6.65h. For V1193 Ori the 3.96 h periodicity has for the first time been confirmed through time-resolved photometry.

1. MCT 2347-3144

MCT 2347-3144 is a cataclysmic variable detected by the Montreal-Cambridge-Tololo survey of subluminous blue stars (Lamontagne et al. 2000). No subsequent analysis and work had been done for this object so far.

The CCD photometric unfiltered observations were taken with the 1m telescope at SAAO during 4 consecutive nights in 2002 and 3 nights in 2003. Their duration varied from 3 to 4.2h and from 4.5 to 8h hours in 2002 and 2003 respectively. The CCD frames were processed in a standard way for bias removal and flat field corrections using the IRAF analysis packages. Aperture photometry was conducted using the DAOPHOT procedures. The same comparison stars were used for the data reduction in both runs. The light curves of all the observing runs can be seen in Figures 1a and 1b for 2002 and 2003, respectively. The periodogram analysis on the data taken in 2002, revealed a period of 0.277d or 6.65h with a semi-amplitude of 0.144 mag. The corresponding phase diagram is given in Figure 1c, while the folded residuals, computed after subtraction of the corresponding periodicity from the folded data can be seen in Figure 1d. The high amplitude derived and the smooth phase diagram, led us to believe its reality. However, the maximum duration of one night's observing run being less than the periodicity we had detected, still allowed some doubt. Therefore and in order to confirm the 6.65h period, we needed another observing run of greater duration, which we achieved in August 2003.

The 2003 light curve is given in Figure 1b, where it is evident that the mean magnitude of the cataclysmic variable differs between the two years: the object appears to be one magnitude brighter in 2003 compared to 2002. This could mean that in last August's observing run it was in a high state or in a small outburst. Moreover MCT 2347-3144 shows a greater scatter in 2003 compared

to 2002 and no evidence of the previous periodicity. The signal's absence in 2003 is also evident from Figure 1b where the sinusoidal fit of the folded 2002 data is superimposed on the 2003 light curves.

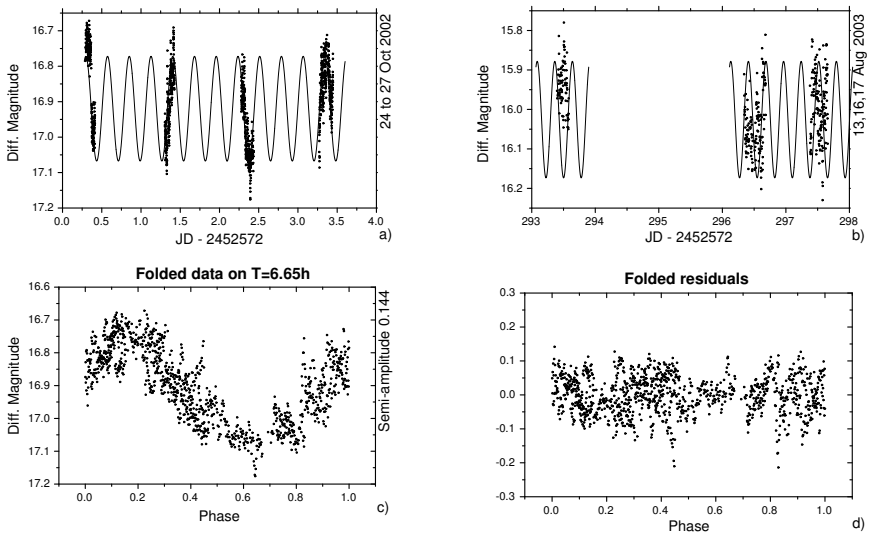

Figure 1. 1a & 1b: Light curves of MCT 2347-3144 with the fitted sine curve to the folded data of 2002, superimposed on them. 1c: Folded data on the periodicity of 6.65h, the first one ever detected for the star. 1d: Folded residuals, determined from the subtraction of the detected periodicity from the folded data in Fig. 1c.

2. V1193 Ori

V1193 Ori is a cataclysmic variable discovered accidentally by M. Hamuy while making a photometric sequence in 1986 (Maza, Hamuy, & Ruiz 1986). The confirmation of this CV belonging to the sub-class of nova-like variables came one year later by Bond et al. (1987) who obtained both high-speed photometry and spectroscopic observations. A short time scale variability with a peak-to-peak amplitude of 0.2 mag was present in their light curves but their power spectra showed no evidence of any periodicities. They reported the existence of an irregular flickering with a peak-to-peak amplitude of more than 0.15 mag. They considered their observations insufficient for establishing the orbital period. Warner & Nather (1988) obtained a 3.6h photometric run and reported rapid flickering activity of 0.25 mag but again no orbital modulation was evident in their light curve. Later on, time-resolved spectroscopy conducted by Ringwald, Thorstensen, & Hamwey (1994) revealed the existence of a 0.165d or 3.96h orbital period with an error of 43s.

Time-resolved photometry of this object was conducted for four consecutive nights during October 2002 at SAAO and for four more nights at Hoher List Observatory. Their duration varied from 1.7 to 4.7 hours and from 4 to 5 hours respectively. After the same standard procedures and period analysis of the 2002 light curves we were able for the first time, to photometrically confirm the orbital period. We derive a period of 0.165d$\pm$0.00137d or 3.96h$\pm$0.0329h

and a semi amplitude of 0.052 mag. The folding of the data on this period and the corresponding residuals can be seen in Figures 2a and 2b respectively. However, we were not able to detect the periodicity in 2003 when the system's mean magnitude appeared to have increased by 0.4 mag.

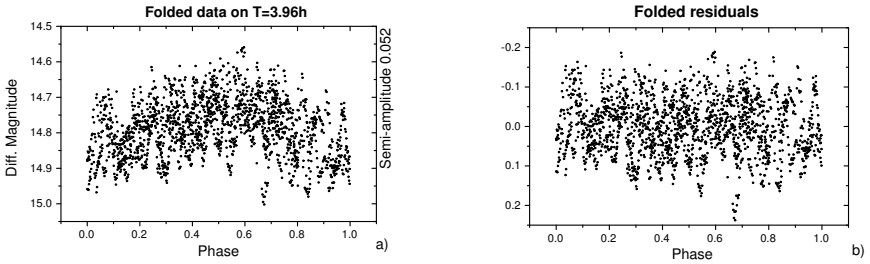

Figure 2. 2a: Folded 2002 data on the periodicity of 3.96h. 2b: Folded residuals, determined from the subtraction of the detected periodicity from the folded data in Fig. 2a.

Moreover we confirm the rapid flickering also dominating the light curves of all photometric observations of V1193 Ori. It has a large amplitude of 0.15 mag. From the folded residuals (Fig. 2b) it is evident that the detection of any periodicity becomes very difficult.

3. Discussion

The origin of the periodicity in V1193 Ori is not clear, but by looking at the phase diagram and taking into consideration the low amplitude, one thought is that it could be the extra light of the side of the secondary that is face on with the primary i.e. the irradiation of the companion star. This speculation is strengthened by the fact that H-α spectroscopy (Ringwald et al. 1994) revealed irradiation of the secondary.

Concerning MCT 2347-3144, we have checked that the absence of the periodic signal in 2003 cannot be attributed to poorer observing conditions. It must thus be related to the fact that the disc brightened. In order to develop a solid interpretation more work and observations are definitely called for.

References

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