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PERIODICITIES OF A NOVA-LIKE CATACLYSMIC VARIABLE STAR RX J1951.7+3716

ZUBAREVA, A. M.[1]; ANTIPIN, S. V.[2,1]

[1] Institute of Astronomy, Russian Academy of Sciences, 48, Pyatnitskaya Str., 119017 Moscow, Russia
[2] Sternberg Astronomical Institute, 13, University Ave., 119992 Moscow, Russia
email: zubareva@inasan.ru, antipin@sai.msu.ru

Motch et al. (1998) classified RX J1951.7+3716 ($\alpha = 19^{\mathrm{h}}51^{\mathrm{m}}47\overset{\mathrm{s}}{.}50$, $\delta = +37^\circ16'47\overset{''}{.}8$; J2000.0) as a cataclysmic variable based on the X-ray and optical characteristics of the object. Peters and Thorstensen (2005) obtained optical spectra of the star and analyzed radial velocity changes using both absorption and emission lines. The authors found an orbital period of the system, $P_{orb} = 0\overset{\mathrm{d}}{.}492(1)$. There were no studies on brightness variations of RX J1951.7+3716 published to date.

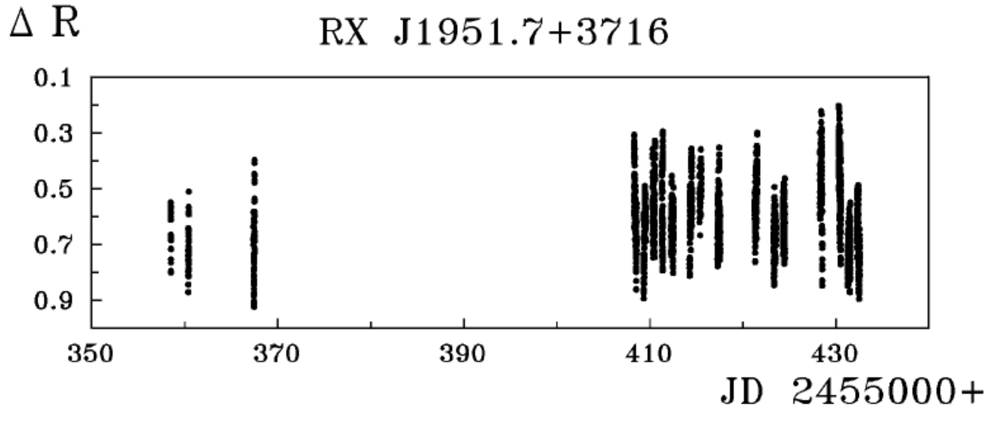

Figure 1. The summary light curve.

To confirm or disclaim present classification we have investigated RX J1951.7+3716 photometrically. Our observations were carried out at the 60-cm telescopes of the Terskol Branch of the Institute of Astronomy and the Crimean Laboratory of Sternberg Astronomical Institute equipped with a PixelVision SpectraVideoTM and an Apogee AP-47p CCD cameras respectively. We monitored RX J1951.7+3716 for eighteen nights on June 10–August 23, 2010 (JD 2455358–2455432). The frames were taken with 180 s (Terskol) and 120 s (Crimea) exposure times in the Johnson R filter. 2347 images were debiased, dark-subtracted, flat-fielded and then analyzed in MaxIm DL 4 package. USNO-A2.0 1200-13535122 ($\alpha = 19^{h}51^{m}50^{s}.37$, $\delta = +37^{\circ}15'56''.0$; J2000.0; photographic R magnitudes: $13^{m}.8$ in the USNO-A2.0 and $13^{m}.98$, $13^{m}.83$ in the USNO-B1.0 catalog) was used for comparison. Stability of the comparison star was verified by brightness measurements with respect of several check stars. The uncertainty of our photometry is about $0^{m}.03$. The summary light curve is shown in Fig. 1.

The amplitude of light variations of RX J1951.7+3716 during different nights of our set changes from $0^{m}.4$ to $0^{m}.8$. The shape of the light curves is composite. The most stable feature of brightness variations is a flickering on timescales of 15–25 minutes. Some of light curves contain steep brightness rises and declines (Fig. 2). This photometric behavior is typical of nova-like cataclysmic variables (Warner, 1995).

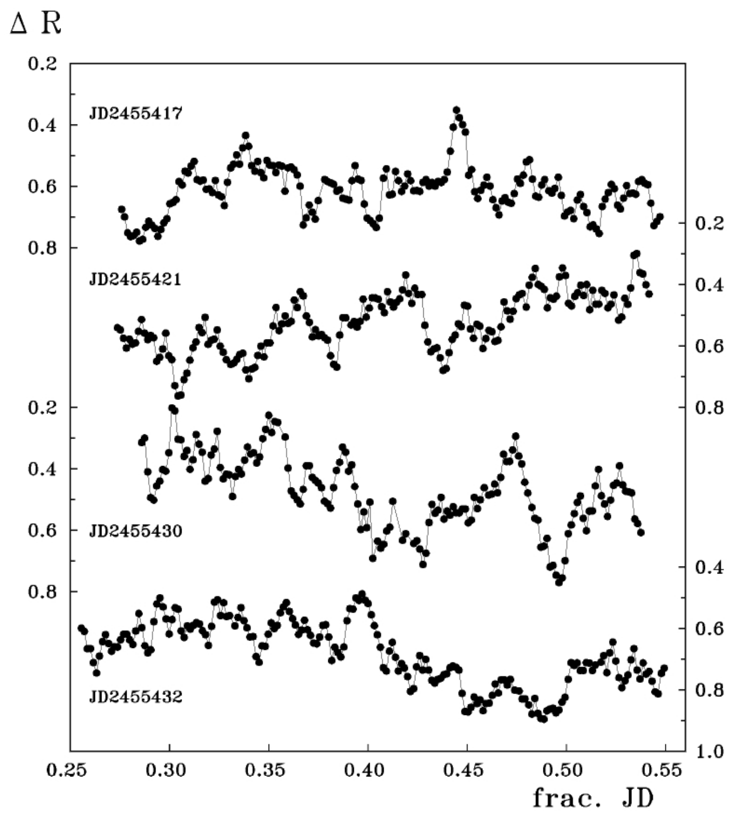

Figure 2. Individual light curves for several nights of observations.

We have analyzed our data (available through the IBVS website as `5968-t1.txt`) for periodicity using the Lafler and Kinman method (Lafler and Kinman, 1965) implemented in Pelt's (Pelt, 1980) and V.P. Goranskij's packages. The spectral orbital period (Peters and Thorstensen, 2005) is not present in our observations explicitly. Looking for periodicity in a very narrow interval in the vicinity of this period, we find only a low peak at 0.4928 days. We hope that the corresponding phased light curve (Fig. 3) can be considered as photometric reflection of the orbital motion. Two features are present in the figure. First, the wide minimum close to the phase 0.0 is better seen in the averaged light curve. Second, the flickering at the phases 0.2–0.35 is less prominent than at other intervals. We suppose that the latter finding can be explained by an eclipse of the interaction region of the disk with the accretion stream. Notice that, statistically, cataclysmic variables with orbital periods longer than ten hours are quite rare (e.g. Warner, 1995).

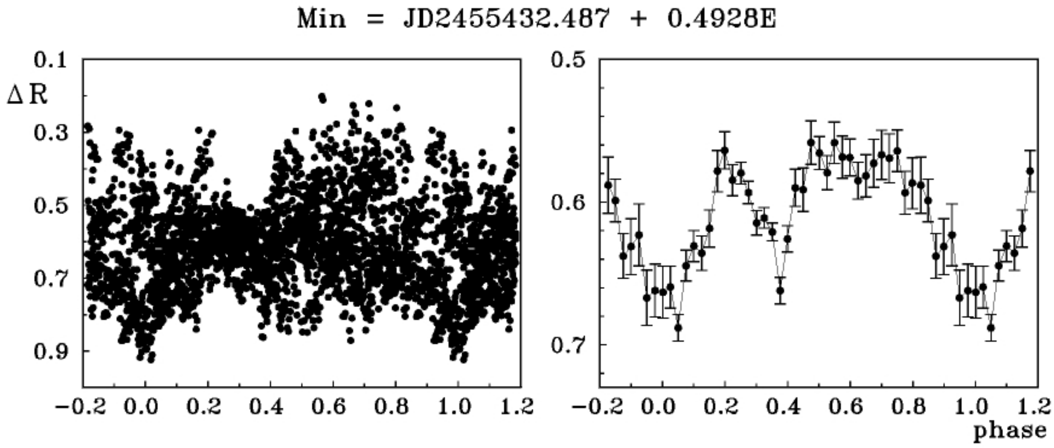

Figure 3. The phased light curve for the orbital period.

In absence of an evident orbital period, the strongest peaks on the periodogram correspond to $0^{\mathrm{d}}.628$ and its daily alias $0^{\mathrm{d}}.3879$ (Fig. 4, Fig. 5). We emphasize that these periods are not coupled with the orbital one. Nature of these periodicities remains unknown. The flickering being the most prominent feature of the variable's light curve, a whitening of the mentioned phased curves for the orbital variability and, vice versa, a whitening of the orbital curve for 0.628 or 0.3879 day periodicities does not improve the phased curves.

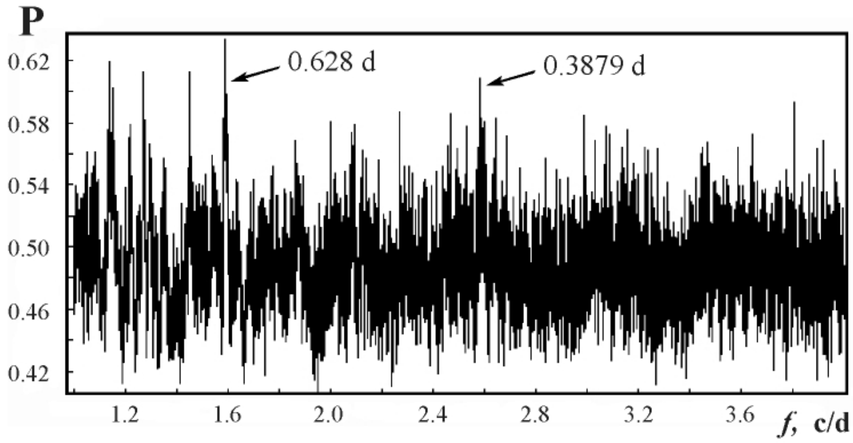

Figure 4. The power spectrum constructed using the Crimean set of observations (2232 images, July 30–August 23, 2010).

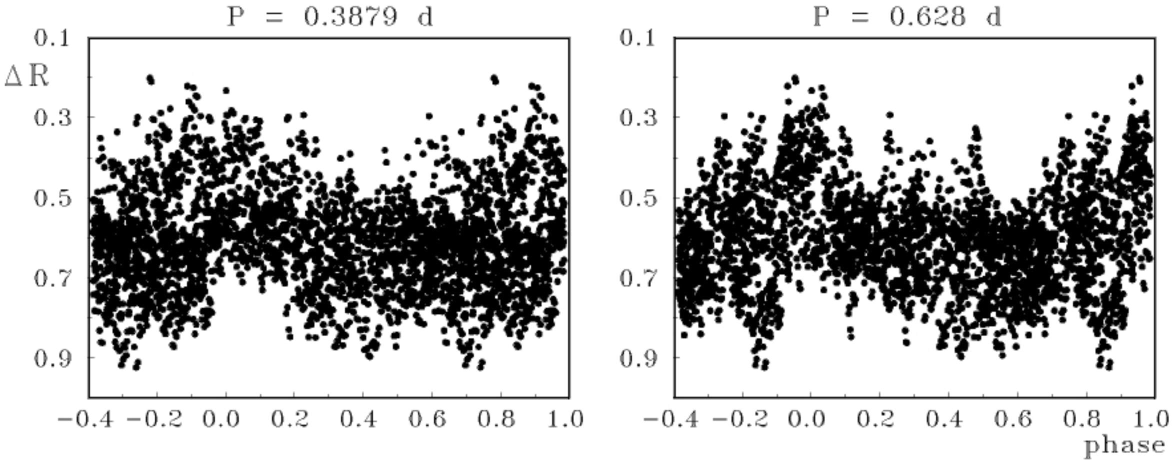

Figure 5. The phased light curve for possible periodicities.

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