COMMISSIONS 27 AND 42 OF THE IAU
INFORMATION BULLETIN ON VARIABLE STARS

Number 5023

Konkoly Observatory
Budapest
26 January 2001

HU ISSN 0374 – 0676

UNUSUAL SHORT-PERIOD DWARF NOVA RX J2315.5–3049

ISHIOKA, R.[1]; KATO, T.[1]; MATSUMOTO, K.[1]; UEMURA, M.[1]; IWAMATSU, H.[1]; STUBBINGS, R.[2]

[1] Dept. of Astronomy, Kyoto University, Kyoto 606-8502, Japan
e-mail: ishioka@kusastro.kyoto-u.ac.jp, tkato@kusastro.kyoto-u.ac.jp, katsura@kusastro.kyoto-u.ac.jp, uemura@kusastro.kyoto-u.ac.jp, iwamatsu@kusastro.kyotro-u.ac.jp

[2] 19 Greenland Drive, Drouin 3818, Victoria, Australia, e-mail: stubbo@sympac.com.au

The ROSAT X-ray source RX J2315.5–3049 was identified with a 17.3-mag cataclysmic variable (Schwope et al. 2000). Schwope et al. (2000) classified the object as a dwarf nova. One of the authors (RS) visually detected first-ever outburst on 2000 July 8 ($m_v = 13.4$, Stubbings 2000a) and next outburst on 2000 October 26 ($m_v = 14.0$, Stubbings 2000b). We performed CCD observations on this later outburst. In this paper, we report our CCD observations and some peculiarities of this object.

The CCD observations were done using R_c-filtered PixelVision camera (SITe SI004AB chip, CryoTiger-cooled) attached to a 60-cm reflector at Ouda Station (Ohtani et al. 1992) and an R_c-filtered ST-7E camera attached to Meade 25-cm Schmidt–Cassegrain telescope at Kyoto University. Exposure time was 30 sec. The images were dark-subtracted, flat-fielded and analyzed with IRAF APPHOT package (IRAF is distributed by National Optical Astronomy Observatories in U.S.A.), and with Java^{TM}-based aperture photometry package developed by one of the authors (TK), respectively. The differential magnitudes of the variable were measured against the comparison star GSC 7507.14 (USNO r-magnitude 12.1), whose constancy was confirmed by the check star GSC 7507.708 (USNO r-magnitude 12.2). We performed observations on five nights, but only upper limits were obtained on two nights. Table 1 is a summary of the observations. All the data are given in Tables 2 and 3, which appear electronically in the IBVS website as files 5023-t2.txt and 5023-t3.txt, respectively.

The visual observations were done by one of the authors (RS) with a 32-cm reflector. Magnitudes and upper limits were estimated using V-magnitude comparison stars.

Figure 1 (see Table 2) gives the long-term light curve of RX J2315.5–3049 covering 6 months. The abscissa is time in Julian Date and the ordinate is m_v or R_c-magnitude (the '$\vee$' mark represent upper limits). Some observations by Pearce and Monard were supplied from their reports to VSNET. Two outbursts are clearly seen.

These observations revealed that RX J2315.5–3049 is a dwarf nova with a recurrent period of about 110 d, and a range of 13.4–17.3 m_v. The minimum magnitude corresponds to the V-magnitude by Schwope et al. (2000).

Figure 2 (see Table 3) gives the light curve of RX J2315.5–3049 on Oct. 27. The abscissa is time in Julian Date and the ordinate is the differential magnitude of Ouda data (filled circles), Kyoto data (open circles), or comparison (lines). Two humps with an amplitude

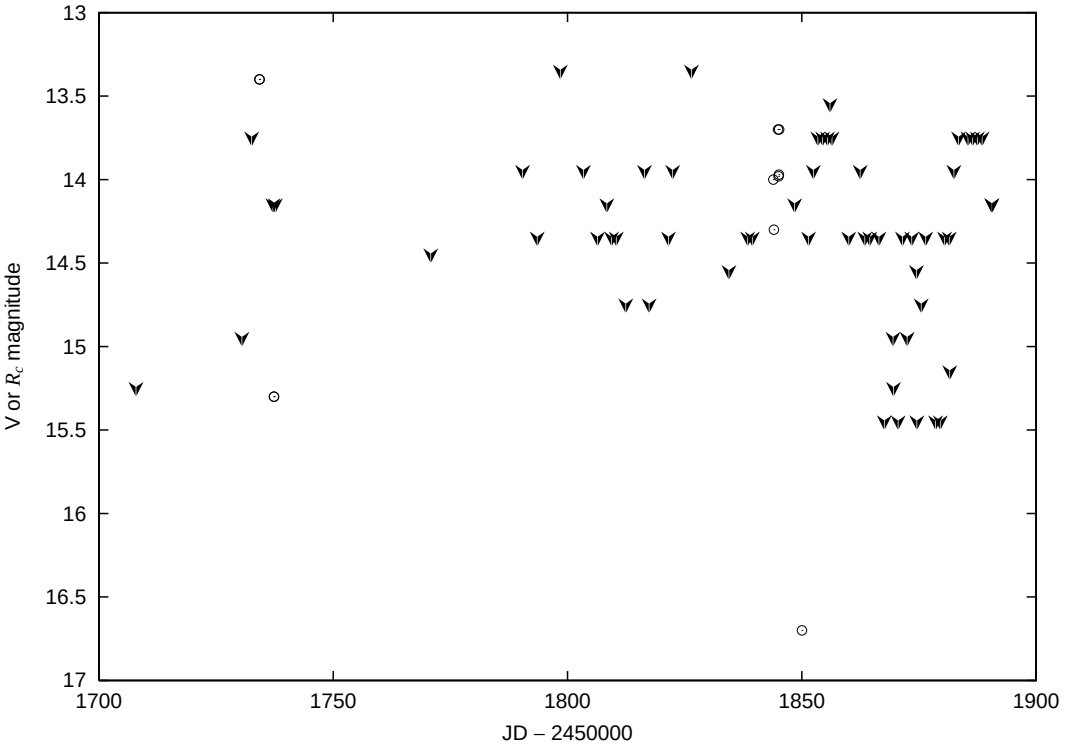

Figure 1. Long-term light curve of RX J2315.5–3049

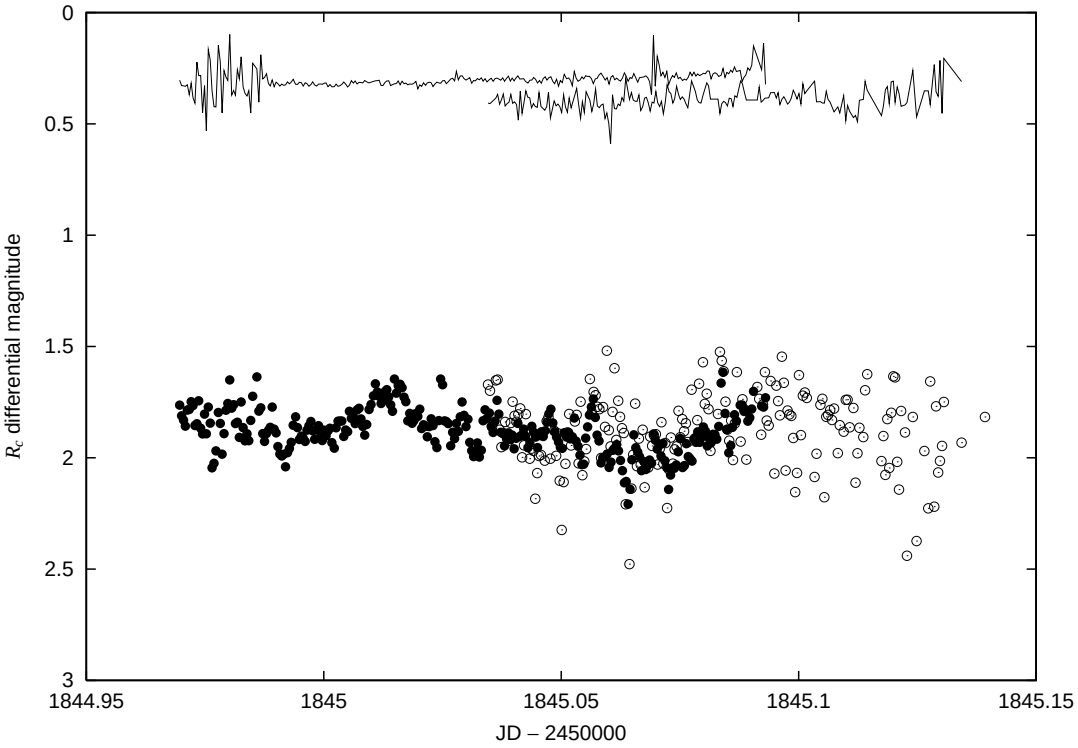

Figure 2. Short-term light curve on 2000 October 27

Table 1: Summary of the observations

start / end (JD − 2450000)	N^a	Exp (sec)	Filter	σ^b (mag)	Δmag^c (mag)	Site^d
1844.061 / 1844.063	4	30.0	R_c	-	2.2	O
1844.970 / 1845.093	299	30.0	R_c	0.05	1.88	O
1845.035 / 1845.139	201	30.0	R_c	0.3	1.87	K
1850.013 / 1850.048	17	30.0	R_c	0.02	4.6	O
1856.019 / 1850.022	10	30.0	R_c	-	>1.5	K
1860.017 / 1860.020	10	30.0	R_c	-	>2.3	K

[a] number of frames
[b] standard deviation of differential magnitudes of the comparison star: comparison − check
[c] nightly averaged differential magnitude relative to GSC 7507.14
[d] O: at Ouda, K: at Kyoto

of $\simeq 0\overset{\mathrm{m}}{.}3$ and a period of $0\overset{\mathrm{d}}{.}078$ were detected. The humps showed a smooth, rapid rise and a slower decline, which are very characteristic to superhumps in SU UMa-type dwarf novae. We therefore identify this hump feature as superhumps and consider this outburst as a superoutburst of an SU UMa-type dwarf nova (for a review of SU UMa-type dwarf novae and superhumps, see Warner 1995).

However, there are some atypical features. As indicated in Fig. 1, this outburst faded rapidly (within 9 d) as if it was a normal outburst, rather than a long-lasting superoutburst (cf. Warner 1995).

Furthermore, Augusteijn et al. (2000) reported that they have found an orbital period of $0\overset{\mathrm{d}}{.}058$ based on their photometry and spectroscopy. Augusteijn et al. (2000) also noted that they detected $\sim 0\overset{\mathrm{m}}{.}3$ eclipse-like feature in their quiescent light curve similar to that of WZ Sge. Our period is $\sim 30\%$ longer than the reported period. If the observed features in our outburst photometry are genuine superhumps, this fractional superhump excess is exceptionally large among all SU UMa-type dwarf novae (the fractional largest superhump excess in SU UMa-type dwarf novae was 7.7% observed in TU Men, cf. Stolz et al. 1984, Nogami et al. 1998). If this large superhump excess is confirmed, this may require a new mechanism for exciting superhumps.

The other possible explanation may be that the period detected by Augusteijn et al. (2000) represents the spin period of an intermediate polar (IP), and that the period we detected represents the orbital or superhump period. In this interpretation, the ratio of orbital period versus spin period, 1.34 for RX J2315.5-3049, is close to 1.46 for EX Hya (Hellier et al. 1987), the well-known IP below the period gap. The relatively strong X-ray emission may also be explained by its suggested IP nature. If the latter possibility is confirmed, the object makes the second established member of the EX Hya-like IPs.

To understand the nature of RX J2315.5-3049, confirmation of the orbital period with spectroscopic or photometric observation is needed.

References:

Augusteijn, T., *vsnet-campaign*, 544
(http://www.kusastro.kyoto-u.ac.jp/vsnet/Mail/vsnet-campaign/msg00544.html)
Hellier, C., Mason, K. O., and Rosen, S. R., 1987, *MNRAS*, **228**, 463

Nogami, D., Kato, T., Masuda, S., 1998, *PASJ*, **50**, 411
Ohtani, H., Uesugi, A., Tomita, Y., Yoshida,M., Kosugi, G., Noumaru, J., Araya, S., Ohta, K., 1992, *Memoirs of the Faculty of Science, Kyoto University, Series A of Physics, Astrophysics, Geophysics and Chemistry*, **38**, 167
Schwope, A. D., Hasinger, G., Lehmann, I., Schwarz, R., Brunner, H., Neizvestny, S., Ugryumov, A., Balega, Yu., Trämper, J., Voges, W., *AN*, **321**, 1
Stolz, B., and Schoembs, R., 1984, *A&A*, **132**, 187
Stubbings, R., 2000a, *vsnet-outburst*, 245
(http://www.kusastro.kyoto-u.ac.jp/vsnet/Mail/vsnet-outburst/msg00245.html)
Stubbings, R., 2000b, *vsnet-outburst*, 810
(http://www.kusastro.kyoto-u.ac.jp/vsnet/Mail/vsnet-outburst/msg00810.html)
Warner, B., 1995, *Cataclysmic Variable Stars*, Cambridge University Press, Cambridge