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ON THE VARIABILITY AND NATURE OF V379 PEGASI

KATO, TAICHI[1]; YAMAOKA, HITOSHI[2]; TORII, KEN'ICHI[3]; ISHIOKA, RYOKO[1]; UEMURA, MAKOTO[1]

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

[2] Faculty of Science, Kyushu University, Fukuoka 810-8560, Japan; e-mail: yamaoka@rc.kyushu-u.ac.jp

[3] Cosmic Radiation Laboratory, Institute of Physical and Chemical Research (RIKEN), 2-1, Wako, Saitama, 351-0198, Japan; e-mail: torii@crab.riken.go.jp

V379 Peg = FBS 2351+228 = SVS 2550 = NSV 26158 was discovered as a UV-excess object during the first Byurakan Survey (FBS). Lipovetskii and Stepanyan (1981) detected the object on JD 2442329 (1974) showing a spectrum of a $B-A$ type blue star with a UV continuum. Lipovetskii and Stepanyan (1981) also commented that the object appears red on Palomar Sky Survey plates. The object was spectroscopically studied by Kopylov et al. (1988).

Kopylov et al. (1988) described that FBS 2351+228 shows a late M-type spectrum with prominent TiO bands, Ca I 4227Å and Na D absorption lines. The Balmer lines were in very narrow emission. Kopylov et al. (1988) reported that the spectrum of FBS 2351+228 resembles those of the quiescent states of the recurrent novae T CrB and RS Oph. According to this suggestion, the star has been regarded as a candidate recurrent nova or a symbiotic binary (cf. Downes et al. 1997, 2001). The star has been given a designation as a suspected variable star (NSV 26158) in the NSV Supplement (Kazarovets et al. 1998). The NSV Supplement gave a variability range of 15–16 $m_{\rm pg}$ following Lipovetskii and Stepanyan (1981).

We noticed, however, that this object has a significant proper motion, suggesting that the object is a nearby object rather than a distant, luminous symbiotic binary. Table 1 lists the available astrometry (errors are typically less than $0''.3$). From these values, we have determined a proper motion of $0''.065 \pm 0''.010$ yr^{-1}, PA = 236°. This value has been confirmed by a direct comparison of the DSS 1 and 2 scans, and a possible systematic error is confirmed to be small by a overplotting the cataloged positions of surrounding stars (see 5342-f2.gif, 5342-f3.gif in the electronic IBVS edition: the yellow, green, and red circles represent USNO A2.0, GSC 2.2.1 and 2MASS positions, respectively. The large proper motion of V379 Peg is apparent). The value is also in good agreement with the proper motion of $0''.063$ yr^{-1}, PA = 240° in USNO B1.0 (Monet et al. 2002).

This large proper motion makes the object likely a nearby object. Assuming an upper limit transverse velocity of 100 km s^{-1}, the upper limit of the distance becomes ∼300 pc (see also Kato and Yamaoka 2002). The upper limit of $M_{\rm V}$ of the secondary thus becomes +8, which safely excludes the possibility of a symbiotic binary with a giant secondary.

Table 1. Astrometry of V379 Peg.

Source	R. A.	Decl.	Epoch
	(J2000.0)		
USNO A2.0	23 53 51.069	+23 09 20.39	1953.608
GSC 2.2.1	23 53 50.922	+23 09 19.09	1990.661
2MASS	23 53 50.892	+23 09 18.75	1998.751

Table 2. Snapshot CCD photometry of V379 Peg.

JD	mag[a]	error	N
2451775.173	14.37	0.04	3
2451782.188	14.42	0.03	11
2451783.211	14.44	0.19	2
2451785.272	14.33	0.02	19

[a] Unfiltered CCD magnitude, zero point adjusted to R_c

The spectrum published in Kopylov et al. (1988) also lacks the evidence of a strong He II line, which is usually seen in symbiotic binaries. The likely presence of the CaH absorption at 6382 Å makes the low luminosity classification more likely. From these data, we conclude that V379 Peg is neither a symbiotic binary nor a recurrent nova candidate.

The variable star designation V379 Peg was given primarily based on the 1999 and 2000 reports of the possible outburst detections (Kazarovets et al. 2001). However, these detections were done with unfiltered CCD observations by L. T. Jensen (Kato 1999) and T. Vanmunster (Vanmunster 2000a). The maximum magnitude quoted in Kazarovets et al. (2001) apparently refers to the unfiltered CCD observation by T. Vanmunster, who reported a unfiltered CCD magnitude of 13.9 on 2002 August 9. The minimum magnitude in Kazarovets et al. (2001) apparently refers to T. Kinnunen's visual observations preceding these detections.

We must note, however, V379 Peg is a red object (GSC 2.2.1 magnitudes: $r = 14.04$, $b = 15.96$, 2MASS magnitudes: $J = 11.35$, $H = 10.76$, $K_s = 10.51$), which is consistent with the above spectroscopic classification. Since the reported "outburst" red-sensitive CCD observations had magnitude close to the r magnitude in GSC 2.2.1, it is most likely these CCD detections were not true outbursts, but were simply bright detections of a red object on red-sensitive CCDs. The lack of short-term variation during the claimed outburst (Vanmunster 2000b) is also suggestive of this interpretation. The lack of significant variability was also confirmed by our follow-up snapshot CCD observations (Table 2, taken at RIKEN, 20-cm telescope and an unfiltered AP-7 camera), following the claimed 1999 outburst detection. Although there was a historical hint of variability of 15–16 m_{pg} (Lipovetskii and Stepanyan 1981), we conclude that the claimed large-amplitude variability of V379 Peg has not yet been confirmed.

We further obtained time-resolved unfiltered CCD photometry on 2002 November 5, with two telescopes (RIKEN: 25-cm reflector, AP-6E CCD, 40 s exposure, 130 frames; Kyoto: 25-cm Schmidt–Cassegrain telescope, ST-7E CCD, 30 s exposure, 84 frames). The magnitudes were determined relative to GSC 2252.2143, whose constancy during the

observation was confirmed by a comparison with GSC 2252.1995. A 0.061 mag was added to the Kyoto magnitudes to correct the systematic difference between the instruments. The resultant light curve (Figure 1) did not reveal significant variation larger than the observational errors.

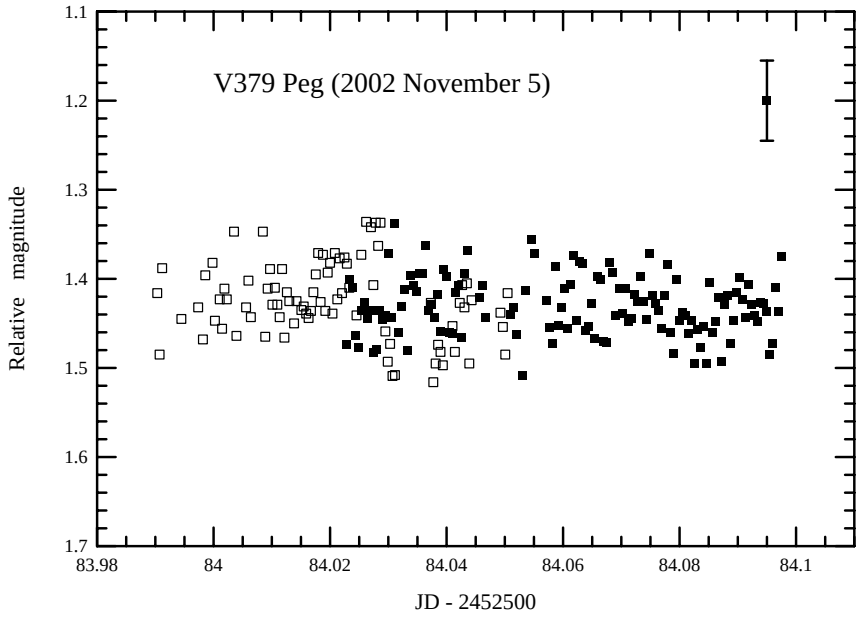

Figure 1. Light curve of V379 Peg on 2002 November 5. The filled and open squares represent RIKEN and Kyoto observations, respectively. No significant variation was detected larger than the observational errors.

From the presence of a UV excess (in 1974) and Balmer emission lines, V379 Peg seems to be a binary of a white dwarf and a red dwarf. If this object is indeed a cataclysmic (CV) type binary, the lack of a blue continuum in the spectrum (in Kopylov et al. 1988) suggests that the object has a very low accretion rate. This object, together with RX J2309.8+2135 (Kato and Yamaoka 2002), may comprise a previously overlooked nearby population of CV-type binaries with low mass-transfer rates. However, if the very blue object detected in 1974 was indeed the presently identified V379 Peg, the reported magnitude (15 $m_{\rm pg}$) corresponds to $M_V \leq +7$, which is unusually faint for a CV-type outburst (cf. Warner 1987). V379 Peg can alternatively be a detached binary of a white dwarf and a red dwarf. The narrowness of the emission lines and the lack of short-term photometric variability may prefer the detached binary interpretation. In either cases, the claimed very blue appearance of the spectrum in 1974 (Lipovetskii and Stepanyan 1981) still remains a mystery.

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