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UW Tri: ANOTHER LIKELY WZ Sge-TYPE STAR

KATO, TAICHI[1]; NOGAMI, DAISAKU[1,2]; LOCKLEY, J. J.[3,4]; SOMERS, M.[4]

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

[2] Hida Observatory, Kyoto University, Gifu 506-1314, Japan, e-mail: nogami@kwasan.kyoto-u.ac.jp

[3] Department of Physics and Astronomy, the University of Southampton, Highfield, Southampton SO17 1BJ, UK, e-mail: jjl@astro.soton.ac.uk

[4] Physics Department, Keele University, Keele, Staffordshire ST5 5BG, UK

UW Tri was discovered as a possible nova in 1983 by Kurochkin (1984). The discovery was communicated by Aksenov (1983). Argyle (1983) reported accurate astrometry of this possible nova, but the lack of spectroscopic observation made the nova identification inconclusive. Kurochkin (1984) reported that the object reached a maximum of 14.7 pg, and the outburst lasted at least 32 days. The light curve resembled a fast nova, but the extreme faintness and the high galactic latitude makes a normal nova unlikely. Another possibility is a WZ Sge-type dwarf nova, a small subgroup of SU UMa-type dwarf novae (see Osaki 1996 for a review), which also show a fast nova-like light curve and very long (typically $\sim$ 10 years) outburst recurrence time. The latter possibility suggested that the phenomenon can be recurrent, and a search for additional outburst was conducted by several amateur astronomers.

Meanwhile, the second historical outburst was detected by Vanmunster (1995). The detection was made on 1995 March 3.819 UT, at visual magnitude of 14.7. The outburst was confirmed by E. Broens and G. Poyner (Vanmunster 1995). James (1995) reported accurate astrometry of $02^{\rm h}45^{\rm m}17\overset{\rm s}{.}30$, $+33^\circ31'26\overset{''}{.}5$ (J2000.0), which confirmed the absence of a counterpart of POSS-I plates. Since the presence of superhumps is the diagnostic feature of SU UMa-type dwarf novae, we started time-resolved CCD photometry.

The observations at Ouda Station, Kyoto University (Ouda) were done on eight nights between 1995 March 5 and 20, using a CCD camera (Thomson TH 7882, 576×384 pixels, on-chip 2×2 binning adopted) attached to the Cassegrain focus of the 60-cm reflector (Ohtani et al. 1992). An interference filter was used which had been designed to reproduce the Johnson V band. The exposure time was 60–180 s depending on the brightness of the object. The frames were first corrected for standard de-biasing and flat fielding, and were then analyzed using the Java$^{\rm TM}$-based PSF photometry package developed by one of the authors (TK). The observations at Keele University (Keele) on two nights 1995 March 7 and 12, using an ST-6 CCD camera and a Johnson V filter, attached to a 60-cm telescope. The exposure times were 30 s. Total numbers of useful frames were 216 (Ouda) and 421 (Keele). Both observatories used GSC 2329.320 (GSC magnitude 12.8) as the comparison star, whose constancy during the run was confirmed using GSC 2329.1501 and GSC 2329.534. By interpolating Ouda light curves and comparing Keele observations, the

observations at Keele were found to be systematically fainter than Ouda observations by $0^{m}.21$. This systematic difference is probably caused by a small difference of the natural systems between these observatories, combined with the blue color of an outbursting dwarf nova. The difference will not significantly affect the following analysis. We first corrected this systematic difference. Heliocentric corrections to the observed times were made before the following analysis.

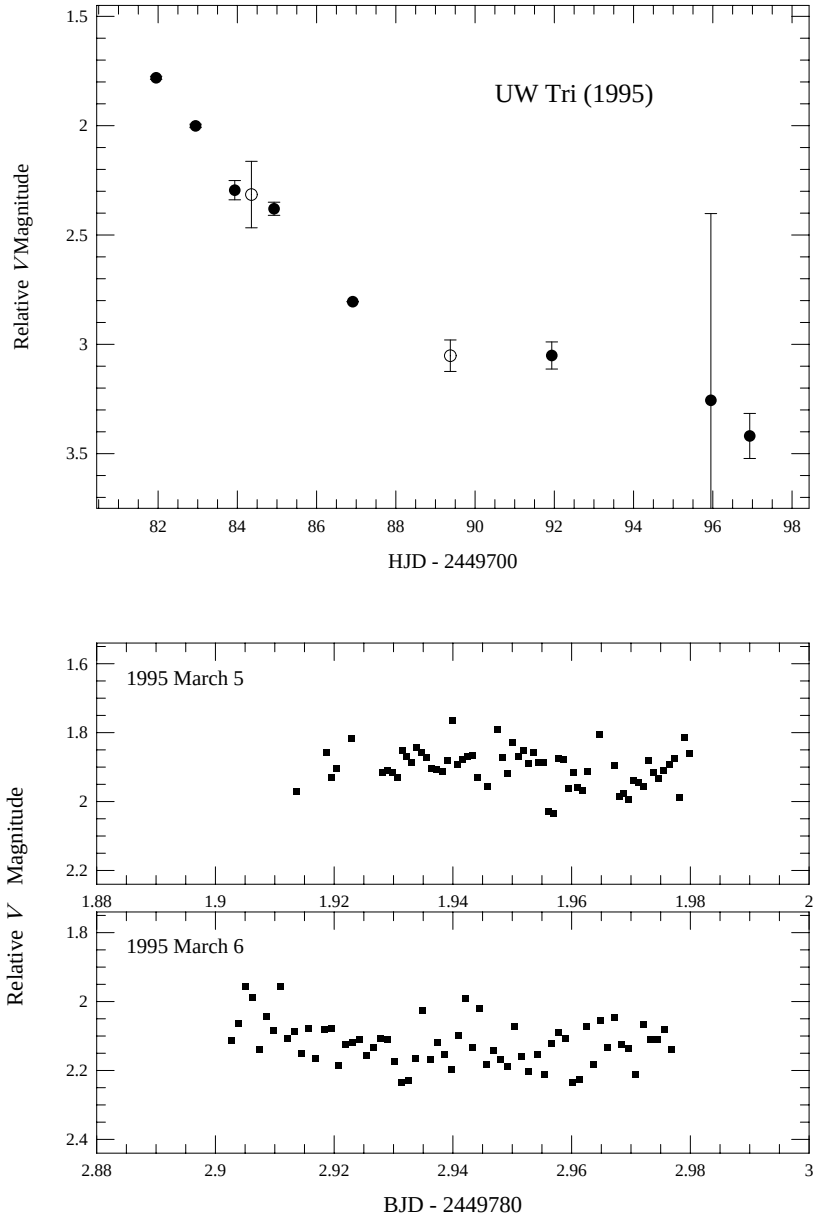

Figure 1. (Top) Overall light curve of UW Tri. Filled and open circles represent Ouda and Keele observations, respectively. (Bottom) Enlarged light curves of the first two nights.

The overall light curve is shown in Figure 1 (top). Each point represent averages and standard errors of nightly runs. The object initially rapidly faded at a rate of 0.2 mag d^{-1}, and the fading later became slower, reproducing the 1983 outburst recorded by Kurochkin (1984). The outburst lasted at least for 17 days. Owing to the short visibility in the evening, it is very difficult to make a firm conclusion on its intranight variation.

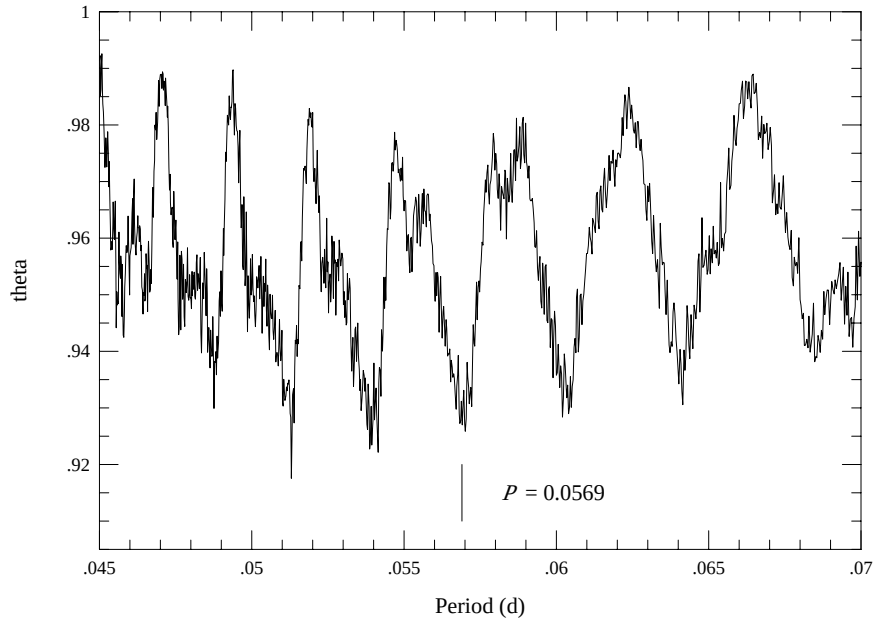

Figure 2. Periodogram of UW Tri

We applied Phase Dispersion Minimization (PDM) method (Stellingwerf 1978) to the data on the first two nights which gave the best signal-to-noise ratio. The trend of linear decline was subtracted before the analysis. The resultant theta diagram is shown in Figure 2. There are indications of the presence of short-period modulations, attributable to superhumps. Together with the long recurrence time, this finding strengthen the possibility of UW Tri being a WZ Sge-type dwarf nova. It is virtually impossible to select the unique period among strong aliases close to 0.051, 0.054 and 0.057 d. Since almost all hydrogen-rich cataclysmic variables have orbital periods longer than the period minimum of $\sim 0^{\rm d}.055$ (cf. Ritter and Kolb 1998), we adopted a period of $0^{\rm d}.0569$ as the most likely period. However, one must bear in mind that this period should be treated as the likely one among several possibilities. By adding data points made on later nights, the results remained basically unchanged.

The phase-averaged light curve by the period of $0^{\rm d}.0569$ is shown in Figure 3. The profile is characteristic to superhumps of SU UMa-type dwarf novae, but the amplitude of $0^{\rm m}.07$ is smaller than those (0.1–0.3 mag) in usual SU UMa-type dwarf novae. Given that observations were made during the rapidly fading, early epoch of a superoutburst, this modulation may be better interpreted as low-amplitude "early superhumps", characteristic to WZ Sge-type dwarf novae (Kato et al. 1996; Matsumoto et al. 1998; Kato et al. 1998). Phase-averaging of the late-phase observations had a severe difficulty with their low signal-to-noise ratio and short individual runs. By assuming the 0.0569-d period, the Keele data give $\sim 0^{\rm m}.1$ amplitudes both on March 7 and 12, suggesting that the variation may have evolved as in other WZ Sge-type stars, but the result should be treated with caution because the detection was marginal. The quiescence counterpart of UW Tri was discovered by Robertson et al. (2000) at a magnitude of $B = 22.6$–22.9, and astrometry end figures of $17^{\rm s}.29$, $26''.31$, which are in excellent agreement with James's astrometry in outburst (1995). This makes the outburst amplitude of $\sim 8^{\rm m}.0$, which is very similar to that ($\sim 8^{\rm m}.5$) of WZ Sge. All the available observations support that UW Tri is similar to WZ Sge, in large outburst amplitude, long recurrence time, and short superhump period.

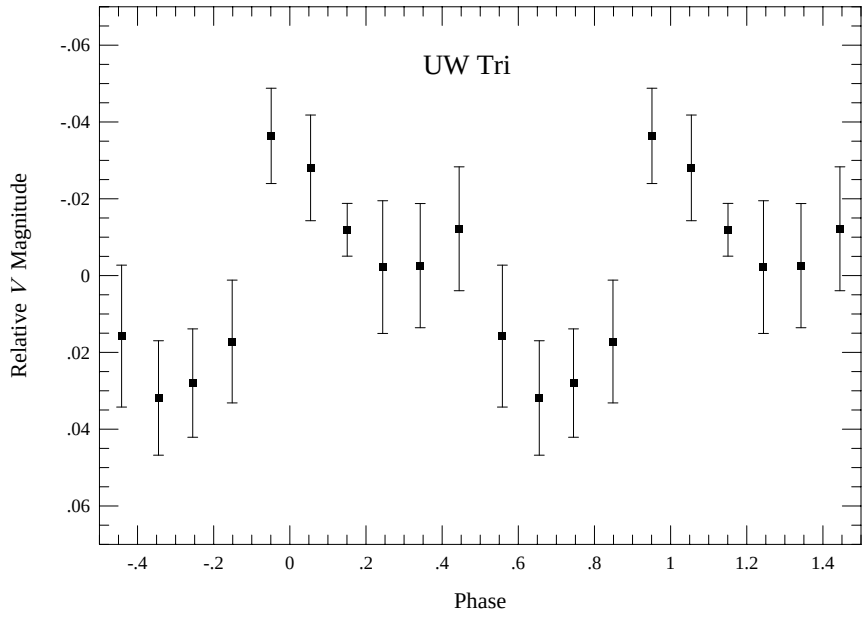

Figure 3. Phase-averaged light curve of UW Tri

Confirmation of these properties, as well as spectroscopic confirmation of its classification, is strongly encouraged in future outbursts.

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