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OBSERVATIONS OF KV ANDROMEDAE DURING THE 1994 SUPEROUTBURST

KV And is a faint dwarf nova discovered by Kurochkin (1977). The object was photometrically studied by Kato et al. (1994), who discovered superhumps during its long outburst in November, 1993. Their observations established KV And as a new member of SU UMa-type dwarf novae, esp. as a good candidate for a TOAD (Tremendous Amplitude Dwarf Nova; Howell 1993, Howell et al. 1995). They gave two candidate values for the superhump period (P_{sh}) of this dwarf nova: 0.07520 ($\pm$0.00003) day or its alias 0.07427 ($\pm$0.00003) day. Due to a long gap in their observations, discrimination of these two periods should await further observations.

KV And was again caught in outburst on August 10, 1994 by Vanmunster (VSNET message). The authors started a series of time-resolved photometry to determine the true superhump period. The observations were done on six nights between August 11–18, 1994. The journal of observations is summarized in Table 1. Observations were carried out using a CCD camera (Thomson TH7882, 576 $\times$ 384 pixels) attached to the Cassegrain focus of the 60cm reflector (focal length=4.8m) at Ouda Station, Kyoto University (Ohtani et al. 1992). To reduce the readout dead time, an on-chip summation of 2$\times$2 pixels to one pixel was adopted. An interference filter was used which had been designed to reproduce the Johnson V band. The exposure time was between 90–100 sec depending on the brightness of the object.

These frames were first corrected for standard de-biasing and flat fielding, and were then processed by a microcomputer-based automatic-aperture photometry package developed by the author. The differential magnitudes of the variables were determined using a local standard star (C_1: $02^h17^m19\overset{s}{.}93$ $+40°39'50\overset{''}{.}9$ (J2000.0), V=12.6, C_1 in Figure 1). For details of the comparison and the check stars, see Kato et al. (1994).

Overall light curve constructed from all the data is shown in Figure 2. The light curve shows, as in 1993 superoutburst, a linear decline with an averaged rate of 0.12 mag day^{-1}, which is characteristic to a superoutburst of an SU UMa-type dwarf nova. Fig. 3 shows a representative light curve obtained on August 13. A clear superhump feature confirmed that the present outburst is unmistakably a superoutburst.

A period analysis of observations for the whole data set using the Phase Dispersion Minimization (PDM) method (Stellingwerf, 1978), after heliocentric correction and removal of a linear trend of decline, has yielded the best superhump period (P_{sh}) of 0.07434 ($\pm$0.0003) day. Owing to a good continuous coverage, we can now safely reject other aliasing periods in Kato et al. (1994). The new superhump period corresponds to the shorter value of the two most likely periods by Kato et al. (1994). The present period is very slightly (0.1 %) longer than the previously reported one, but the difference is within the errors of each estimate.

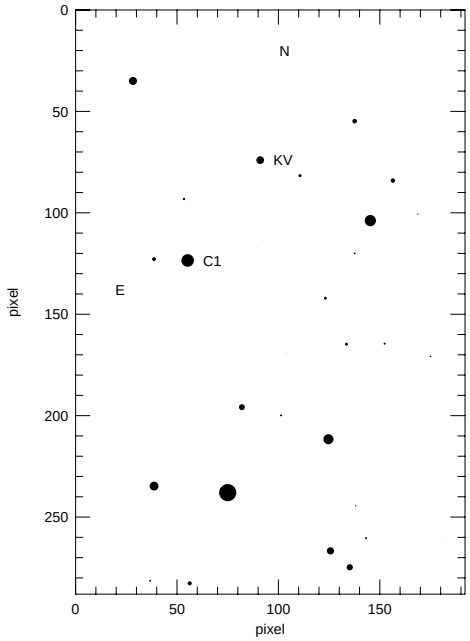

Figure 1. Finding chart of KV And drawn from a CCD image. North is up, and the field of view is about 10×7 arcmin. The primary comparison star (C_1), and KV And (KV) are marked.

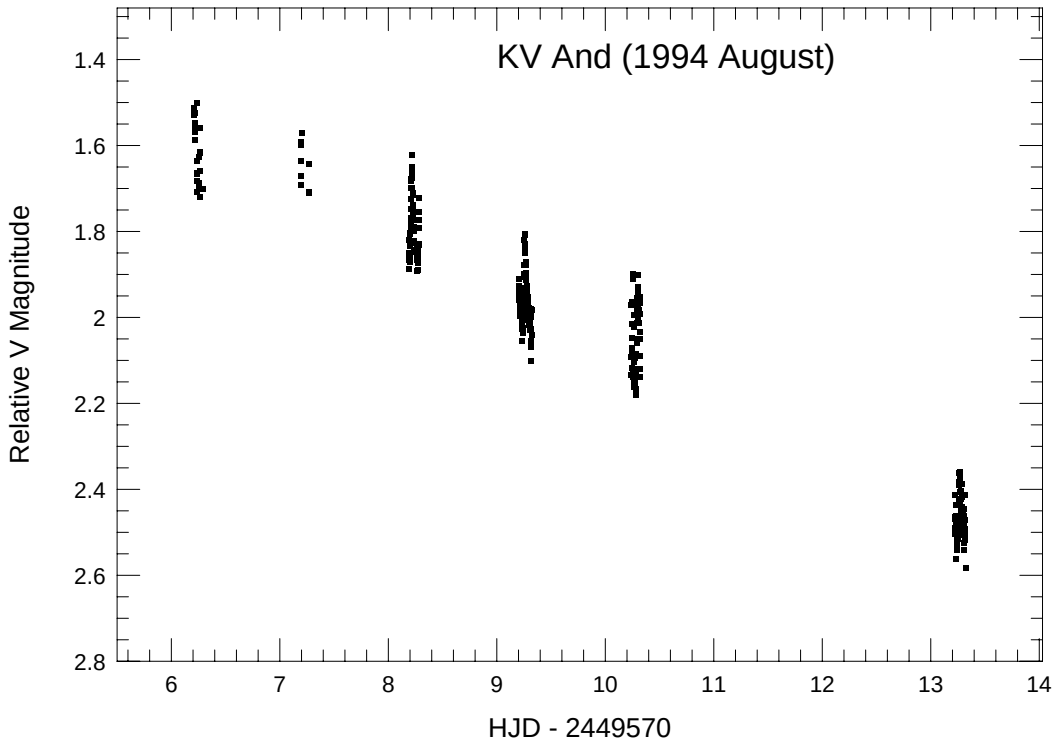

Figure 2. V-band light curve of KV And during a superoutburst in Aug. 1994. The zero point of the relative magnitudes corresponds to V=12.6.

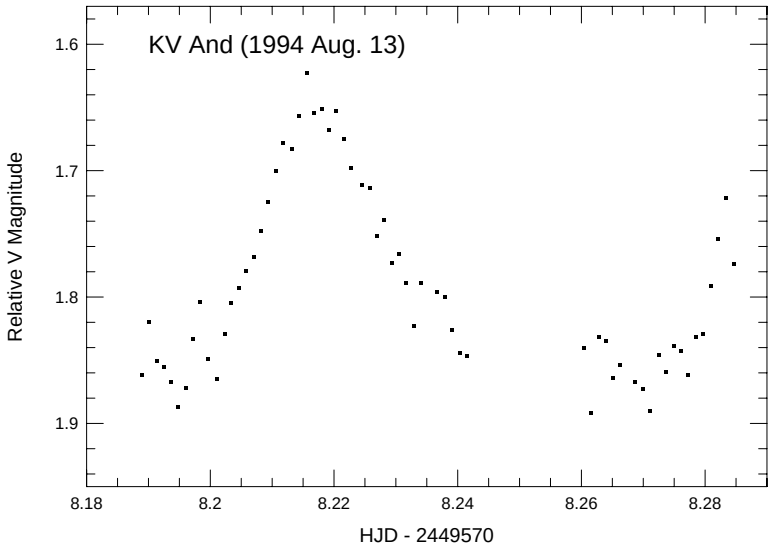

Figure 3. Enlarged light curve on August 13, 1994. A superhump is clearly seen.

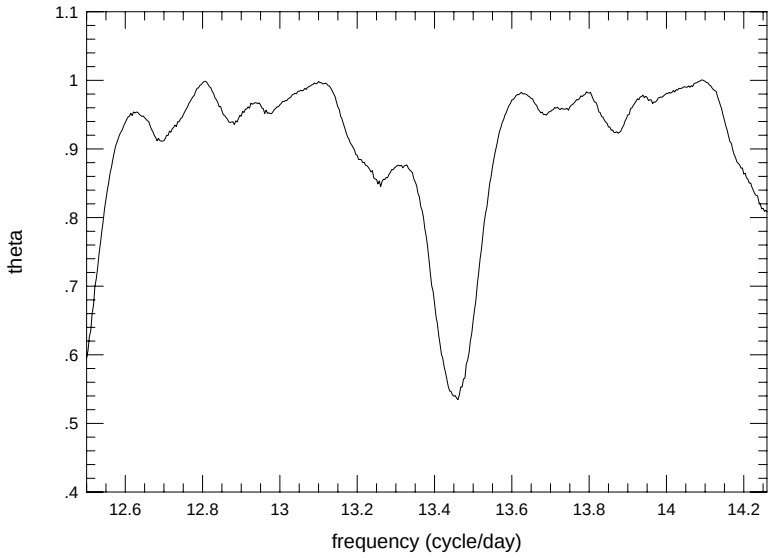

Figure 4. Theta-diagram for all the data obtained by the phase dispersion minimization (PDM) method (Stellingwerf 1978). The minima represent likely periods. The lowest minimum at frequency 13.451 day^{-1} corresponding to 0.07434 day clearly represents the best superhump period of KV And.

Table 1. Journal of observations of KV And

Date	Start (UT)	End (UT)	T*	N†
1994 August 11	17^h00^m	18^h59^m	90^s	25
12	16 37	18 29	90	9
13	16 29	18 47	90	63
14	16 46	19 40	90	100
15	17 41	19 42	90	71
18	17 16	19 40	100	71

* Exposure time.
† Number of useful object frames.

The present observations thus firmly established the superhump period of a suspected TOAD, KV And. From the interval of two recent superoutbursts, we can determine the cycle length of superoutburst (supercycle) as $\sim$ 270 days. The cycle length of normal outbursts can be guessed from recent visual observations, which gave the two shortest observed intervals as 18 days and 55 days (Vanmunster, Howell 1995). We cannot yet firmly say the typical cycle length of normal outbursts in this dwarf nova system, but the recent data seem to give shorter values than can be derived from discovery observations (Kurochkin 1977). Concerning the TOAD classification, the cycle lengths of 18 – 55 days (normal outburst) and $\sim$ 270 days (superoutbursts) seem to be too short for a dwarf nova with an outburst amplitude of 7.9: mag (cf. Table 2 in Howell et al. 1995). Clearly more precise determination of the quiescent magnitude would be a next step in understanding KV And.

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