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CCD PHOTOMETRY OF THE 1999 SUPEROUTBURST OF V844 Her

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V844 Her was discovered as a dwarf nova (Var43) by Antipin (1996). He reported that the duration of the best-observed outburst is between 12 and 18 days, whose light curve closely resembled that of a superoutburst of an SU UMa-type dwarf nova. A systematic search for further outbursts was carried out by members of various variable star organizations, yielding the first ever detection by Scovil (1996) on 1996 Oct. 12. Time-resolved CCD photometry by Vanmunster (1996) during this outburst unambiguously detected superhumps, leading to a secure classification of an SU UMa-type dwarf nova. The determination of the superhump period was first achieved during the next superoutburst in 1997 (Vanmunster 1997; Jensen 1997), yielding a period of 0.056 ± 0.001 d, which resulted in one of the shortest superhump periods among SU UMa-type dwarf novae. A more precise superhump period of 0.05597 ± 0.00002 d is listed by Patterson (1998).

Upon the detection by McGee (1999) of a bright outburst at visual magnitude of 12.3 on 1999 September 29.824 UT, we started time-resolved CCD photometry. The observations were done using an unfiltered ST-7 camera attached to the Meade 25-cm Schmidt-Cassegrain telescope. The exposure time was 30 s. The images were dark-subtracted, flat-fielded, and analyzed using the Java^{TM}-based aperture and PSF photometry package developed by one of the authors (TK). The flux of the variable was measured relative to GSC 3062.32 (Tycho-2 magnitudes: $V = 10.57$, $B - V = 1.25$), whose constancy was confirmed by comparing with GSC 3062.281 ($V = 12.79$, $B - V = 1.03$, Henden and Sumner(1999)). A total of 1566 observations were obtained. Heliocentric corrections were applied to all observations before the following analysis.

Figure 1 illustrates the overall light curve of the present observation. Each point represents a nightly averaged magnitude with an error bar indicating the standard error. The light curve is characteristic of an SU UMa-type superoutburst, showing the slowly fading "plateau" stage, followed by an abrupt decline, and the final fading. The superhump signal was first detected on October 1 observation (~ 1.7 d after the outburst detection), when the amplitude of the signal was 0.09 mag. Further observation on October 3 clearly showed fully grown superhumps with an amplitude of 0.3 mag (see Figure 2).

The object entered a rapid decline stage on October 13 according to observations reported to VSNET. The data during the superoutburst plateau (October 3–12) were analyzed, after subtracting the linear decline, using the Phase Dispersion Minimization (PDM) method (Stellingwerf 1978).

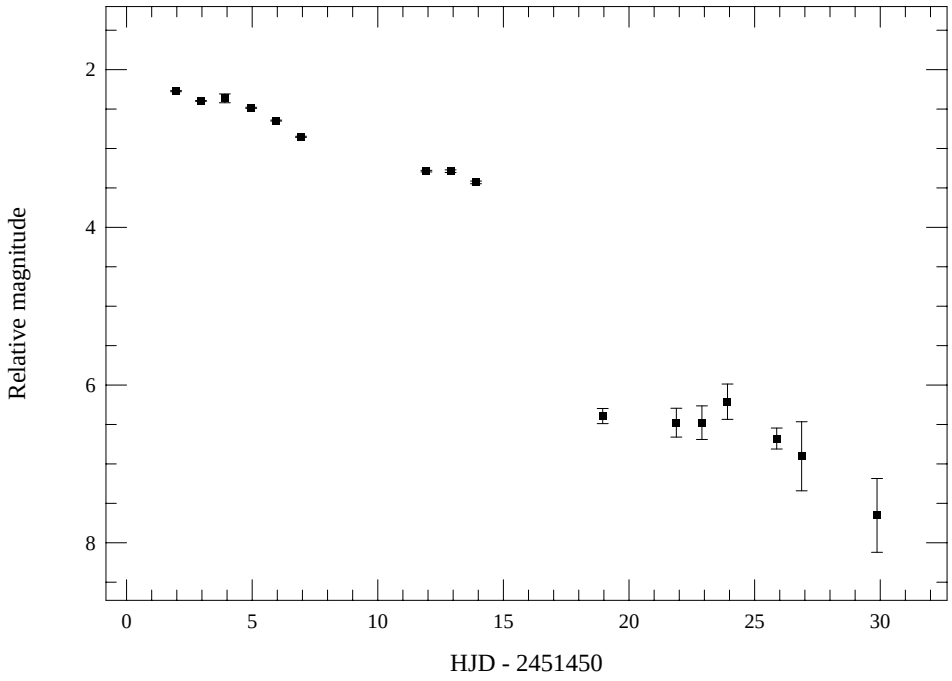

Figure 1. Overall light curve of V844 Her

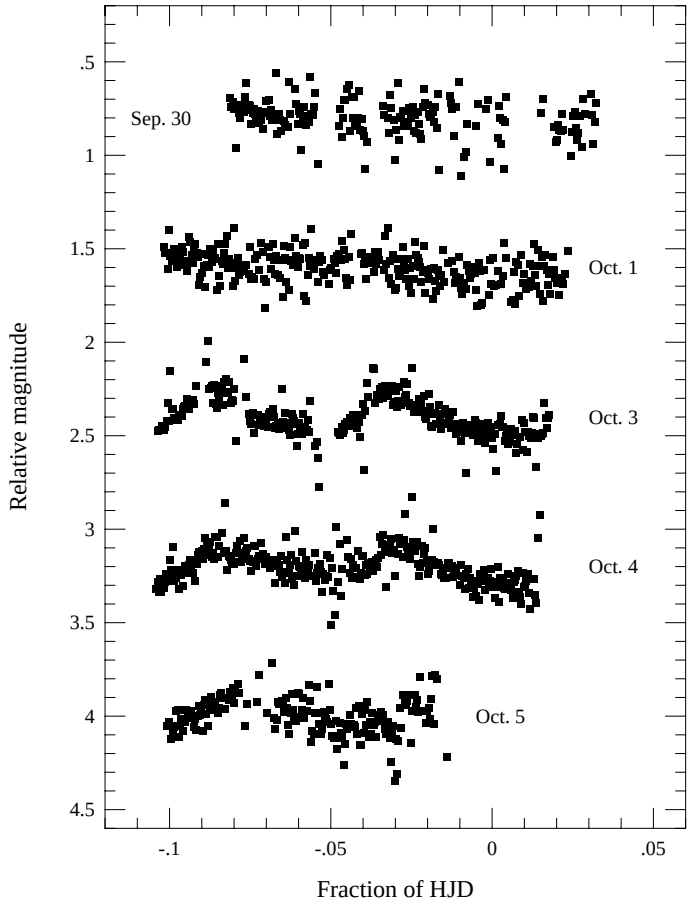

Figure 2. Period analysis of V844 Her

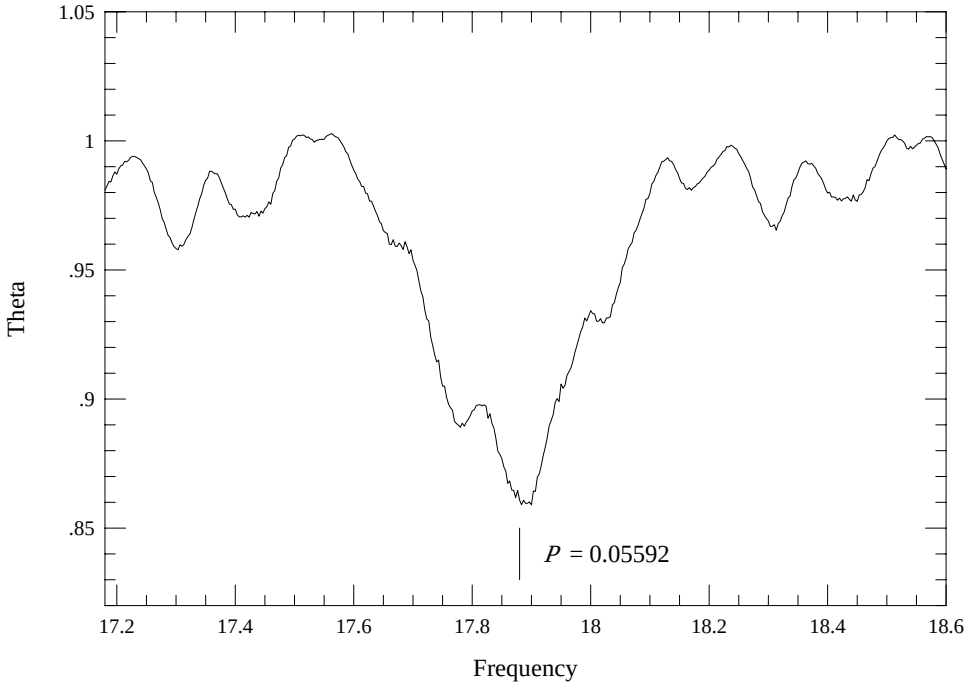

Figure 3. Development of superhumps in V844 Her

The result of period analysis is given in Figure 3. Although unavoidable one-day aliases exist, we can safely choose, with the help of previous period determinations, the correct period of 0.05592 ± 0.00002 d, corresponding to the frequency of 17.88 d^{-1}. The present best period agrees with the previously determined period (Vanmunster 1997; Patterson 1998). The analysis for the period October 1–3 yielded practically the same period (0.0559 ± 0.0001 d), which indicates the absence of a remarkable period change during the superhump growth.

Besides superhumps, we examined the post-superoutburst behavior, during which some SU UMa-type dwarf novae, especially systems with short orbital systems (Kato et al. 1998), are known to show rebrightenings. No evidence of rebrightening was observed, both in our CCD monitoring until 15 d past the steep decline, and visual monitoring reported to VSNET.

Aside from V485 Cen, almost all of SU UMa-type dwarf novae with the shortest superhump (orbital) periods belong either to what is called WZ Sge-type dwarf novae (Bailey 1979; Downes, Margon 1981; O'Donoghue et al. 1991) and ER UMa-type dwarf novae (for a review, see Kato et al. 1999). The former category contains WZ Sge, AL Com, HV Vir, EG Cnc, and related members LL And, SW UMa, WX Cet and T Leo. The latter group contains DI UMa and RZ LMi. From available photometric materials (Antipin (1996) and observations to VSNET), long and bright outbursts (presumably superoutbursts) are separated by 220–290 d, without detectable normal outbursts. Such a low frequency of normal outbursts resembles that of SW UMa, another SU UMa-type dwarf nova with a short orbital period, but the relatively regular occurrence of superoutbursts in V844 Her makes a slight difference. It may be that V844 Her occupies a previously unknown extension of WZ Sge-type dwarf novae toward the short recurrence period.

The authors are grateful to all observers who reported observations to VSNET, and especially to Hazel McGee who timely notified the outburst detection.

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