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OBSERVATION OF SUPERHUMPS IN SS UMi

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The dwarf nova SS UMi was discovered as an optical counterpart of Einstein IPC source E1551+718 (Mason et al. 1982). Mason et al. (1982) reported the system to be varying between $V \sim 13$ and $V \sim 17$. The object was independently detected as an ultraviolet-excess object, PG 1551+719 (Green et al. 1982). Richter (1989) examined 4180 Sonneberg plates and suggested the SS Cyg-type classification based on his finding that faint maxima often last longer than bright maxima. The insufficient detection limit of Richter (1989), however, made the result inconclusive. The dwarf nova subtype was not certain – while Andronov (1986) suggested the 127 min periodicity from photographic observations taken during quiescence, CCD photometry by Udalski (1990) suggested a longer (6.8 or 9.5 h) period – until the discovery of superhumps by Chen et al. (1991). The superhump period (101 min) obtained by Chen et al. (1991) being only based on peak separations from sparsely distributed short runs, it needs to be refined, especially in view of the comparison with the orbital period (97.6 min) obtained by radial velocity study (Thorstensen et al. 1996).

The CCD observations were done using the 1.0-m telescope at the Wise Observatory during the 1998 April superoutburst detected and communicated on April 4 by Hanson (1998). The log of observations is summarized in Table 1. Our observation started four days after the onset of the superoutburst, and continued till its end. We used a V filter; the exposure time was 240 s. We used four local comparison stars (C1 to C4 in Figure 1), whose non-variability was checked down to 0.02–0.05 mag (1-sigma error) by inter-comparison. The magnitudes of SS UMi are given relative to C1, whose magnitude we determined as V=15.71. The typical estimated error of each observation is 0.03 mag. We applied heliocentric corrections to the observed times before analysis.

Figure 2 presents the whole light curve, showing a characteristic decline from superoutburst. Superimposed superhumps are already apparent.

Table 1: Journal of observations

Year	Month	Start (UT)	End (UT)	JD−2400000*	N**
1998	April	8.736	8.989	50912.236	87
		9.794	9.990	50913.294	52
		12.764	12.998	50916.264	60
		13.752	13.989	50917.252	67

*: start of observation, **: number of observations

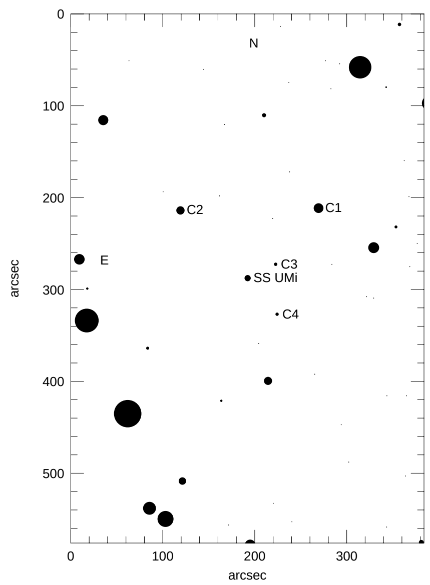

Figure 1. Comparison stars

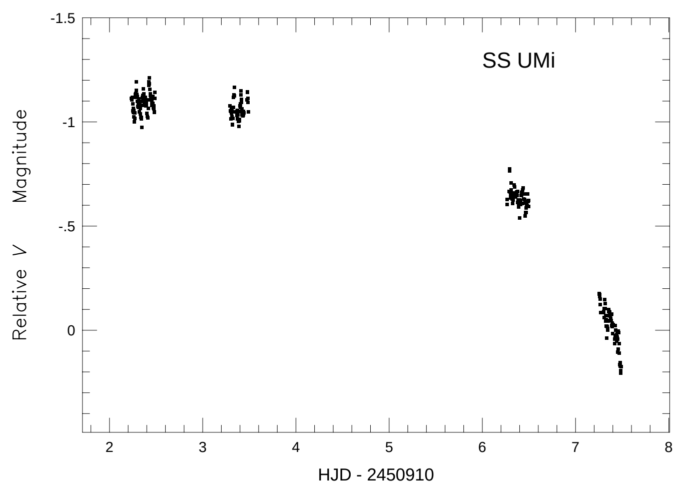

Figure 2. The entire light curve

For the the first two nights' data during the superoutburst plateau stage, we applied the Phase Dispersion Minimization (PDM) method (Stellingwerf 1978), after removing the linear trend of decline. The resultant theta diagram displayed in Figure 3. The best superhump period is 0.0699 ± 0.0003 day, which is 3.1 ± 0.4 % longer than the orbital period (Thorstensen et al. 1996).

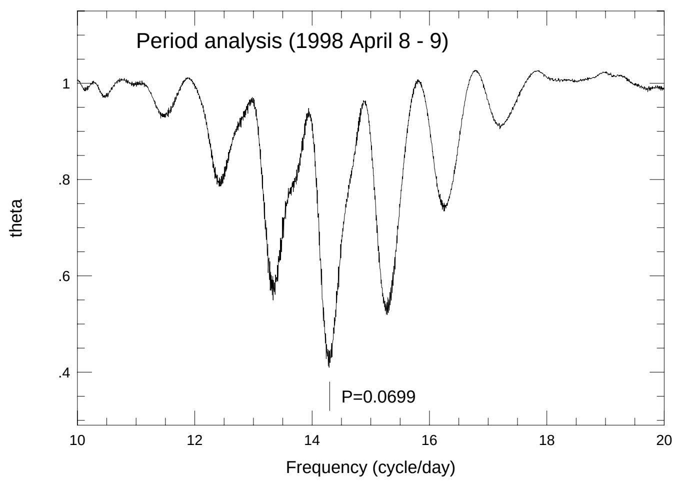

Figure 3. Period analysis for 1998 April 8 and 9

Similar analysis was applied for the latter two nights. The best obtained period from the theta diagram (Figure 4) is 0.0677 ± 0.0003 day, which exactly agrees with the orbital period within the estimated error. The result implies that orbital signals predominate rather than late superhumps at the very terminal stage of a superoutburst of this star.

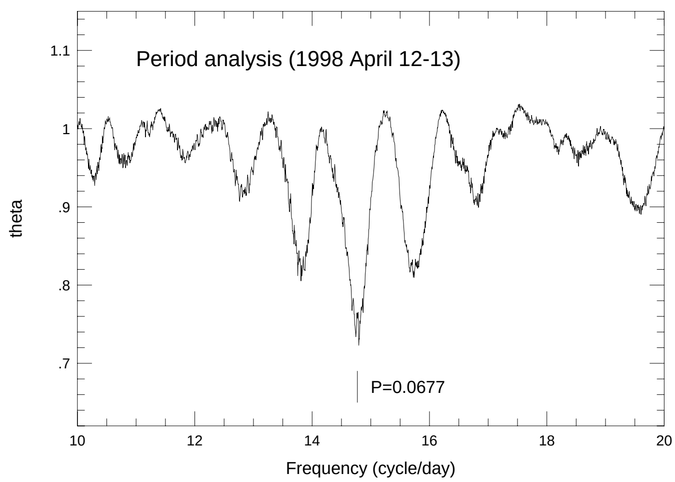

Figure 4. Period analysis for 1998 April 12 and 13

Figure 5 represents phase-averaged light curves of the first two nights (upper panel) and of the last two nights (lower panel). While the former shows a typical profile of a superhump, the latter, folded by the orbital period, shows a broader hump-like feature.

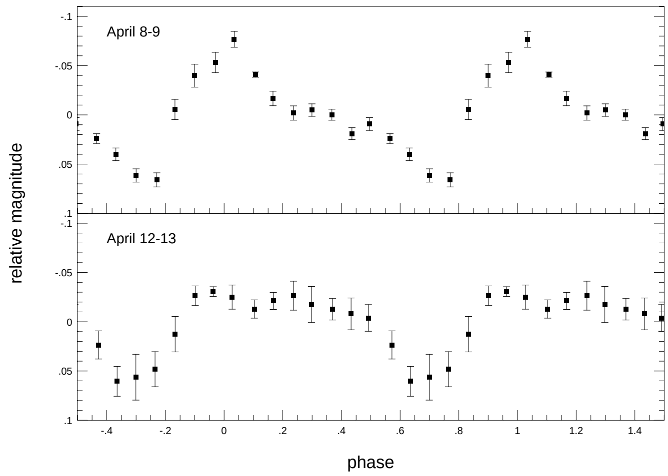

Figure 5. Averaged light curves

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