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DETECTION OF SUPERCYCLE IN SS UMi: NORMAL SU UMa-TYPE DWARF NOVA WITH THE SHORTEST SUPERCYCLE

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ER UMa stars are a small subgroup of SU UMa-type dwarf novae, which have extremely short supercycles (the interval between successive superoutbursts) of 19–50 d (for a review, see Kato et al. 1999). Only four definite members have been recognized (ER UMa, V1159 Ori, RZ LMi and DI UMa). Since the shortest known supercycles of "usual" SU UMa-type dwarf novae are in the range of 90–130 d (e.g. Table 1 in Nogami et al. 1997), several objects have been proposed as candidates for the missing link between ER UMa stars and the usual SU UMa-type dwarf novae: SX LMi (Nogami et al. 1997), HS Vir (Kato et al. 1998b), NY Ser (Nogami et al. 1998) and CI UMa (Nogami and Kato 1997). V503 Cyg (Harvey et al. 1995) also has a supercycle as short as 89 d. However, none of these objects show perfectly intermediate outburst statistics between ER UMa stars and usual SU UMa-type dwarf novae. Both HS Vir and NY Ser have short ($\sim$ 8 d) outburst recurrence times, while superoutbursts occur less frequently. In SX LMi and CI UMa, superoutbursts occur more irregularly and the frequency of normal outbursts is small. V503 Cyg shows a more regular supercycle, while the number of normal outbursts (usually two) is anomalously low compared to ER UMa stars and other SU UMa-type dwarf novae. The deviation in statistics and regularity of these systems from extremely regular ER UMa stars should require an anomalous disk viscosity or other unknown mechanisms (Nogami et al. 1997; Kato et al. 1998b).

The dwarf nova SS UMi was discovered as an optical counterpart of Einstein IPC source E1551+718 (Mason et al. 1982). The existence of superhumps during long outburst revealed its SU UMa-type nature (Chen et al. 1991; Kato et al. 1998a). Richter (1989) studied the outburst statistics based on 4180 Sonneberg plates and suggested the possible outburst interval of 30–48 d. This value has been taken by Ritter and Kolb (1998) in their sixth edition of Catalogue of Cataclysmic Variables and Low-Mass X-ray Binaries. We continued to observe SS UMi as a part of VSNET Collaboration (http://www.kusastro.kyoto-u.ac.jp/vsnet/).

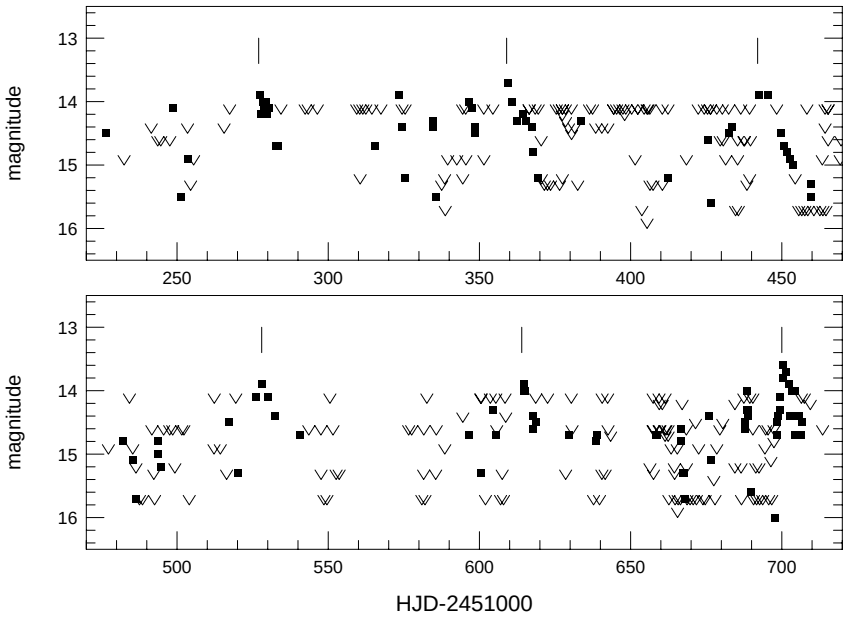

Figure 1. Overall light curve of SS UMi

Visual observations were performed using 46-cm (G.H.), 40-cm (G.P.), 20-cm (E.M.), 41-cm (M.R.) and 20-cm (P.A.D.) reflectors. All observations were done using photoelectrically calibrated V-magnitude comparison stars. The typical error of visual estimates were an order of 0.2 mag, which does not affect the following discussion. Upper limit observations were included for analysis which reached fainter than 14.0 mag. The total number of observations was 375 between 1999 February 17 and 2000 June 17, including other observations reported to VSNET.

The overall light variation is presented in Figure 1. Each filled square represents single estimates and '$\vee$' sign represents upper limits. The observations already clearly show the presence of regular outburst cycle. Since we know that SS UMi belongs to the SU UMa-type category, we can safely choose outbursts longer than five days as superoutbursts. These outbursts are marked with vertical bars. The intervals between successive superoutbursts are in the range of 82–86 d, $84\overset{\mathrm{d}}{.}7$ in average. All observations are well expressed by this representative supercycle of $84\overset{\mathrm{d}}{.}7$. Figure 2 presents a folded light curve by this period.

We have revealed that SS UMi is an SU UMa-type dwarf nova with one of the shortest known stable supercycles. Figure 2 suggests the existence of five normal outbursts between successive superoutbursts, whose interval corresponds to $\sim$ 11 d. The combination of supercycle length of $84\overset{\mathrm{d}}{.}7$ and the outburst recurrence time of 11 d lies on the natural extension of SU UMa-type dwarf novae toward ER UMa stars (Warner 1995; Osaki 1995). Considering that many outbursts recorded by Richter (1989) were long ones, the period by Richter (1989) may be interpreted to represent the half supercycle. The present observation has thus first proven the unique location of SS UMi among "normal" SU UMa-type dwarf novae toward ER UMa stars.

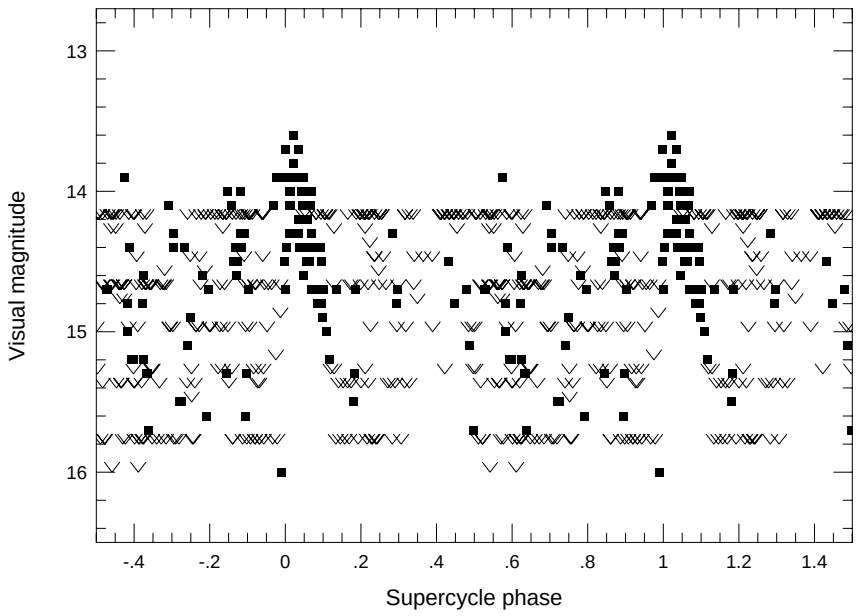

Figure 2. The 84.7-d supercycle of SS UMi

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