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OBSERVATIONS OF 1991 SUPEROUTBURST OF WX Cet

Since its discovery as a possible nova (Strohmeier, 1964) and discovery of four outbursts of large amplitudes (Gaposchkin, 1976), WX Cet has been suggested to be closely related to an enigmatic dwarf nova WZ Sge (Bailey, 1979; Downes and Margon, 1981). This suggestion was confirmed by discovery of superhumps with a period of ∼80 min during the 1989 June superoutburst (O'Donoghue et al., 1991). In addition, this discovery has lead to an idea that WZ Sge-type stars are extreme SU UMa-type dwarf novae, rather than constituting a new class of dwarf novae. Although the classification of WX Cet based on superhump observation seems to be established, its seemingly unusual outburst behavior among SU UMa-type dwarf novae has not been well studied. The author undertook time-resolved CCD photometry during a faint outburst in 1991 July.

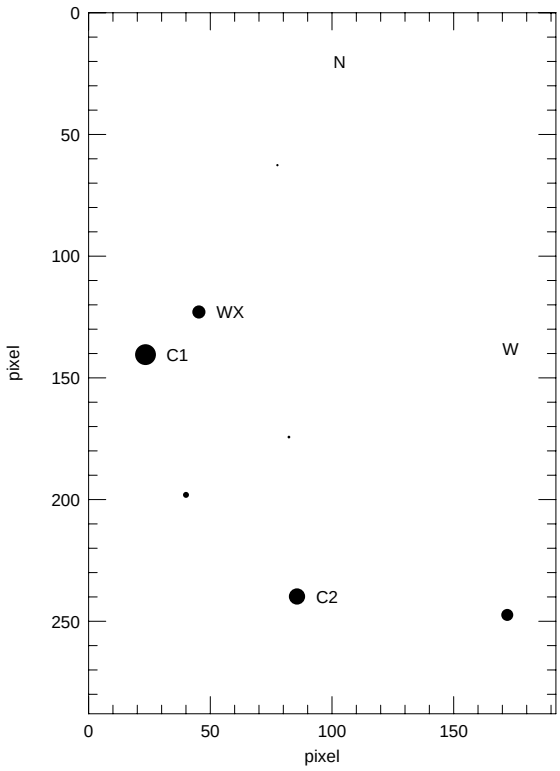

Figure 1. Finding chart of WX Cet drawn from a CCD image. North is up, and the field of view is about 10×7 arcmin. The primary comparison star (C1), check star (C2) and WX Cet (WX) are marked.

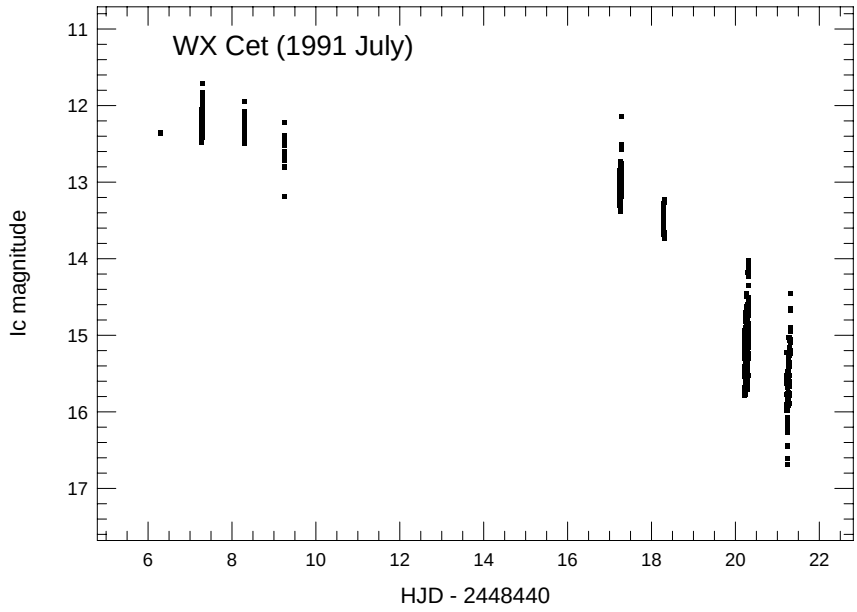

Figure 2. *I*-band light curve of WX Cet during a superoutburst in July 1991. The outburst lasted at least 12 days, followed by a more rapid decline whose rate anomalously slowed down far before reaching quiescence.

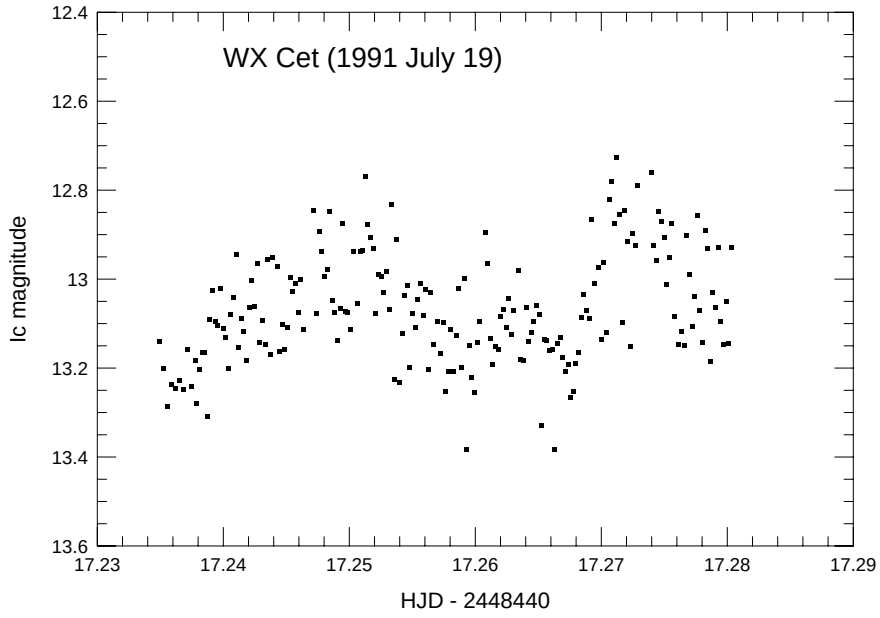

Figure 3. Enlarged light curve on July 19. Superhumps with a first broader and second sharp maxima were detected.

The 1991 July outburst was discovered by Jones and Bateson (1991) at m_v=12.2. The outburst was independently detected by the author. Due to the faintness, it became a focus of this research to test whether this outburst was a short-living one as in 1989 December which reached m_v=12.5 (cf. O'Donoghue et al. 1991). The observations were carried out using a CCD camera (Thomson TH 7882, 576 × 384 pixels) attached to the Cassegrain focus of the 60 cm reflector (focal length=4.8 m) at Ouda Station, Kyoto University (Ohtani et al., 1992). To reduce the readout noise and dead time, an on-chip summation of 3×3 pixels to one pixel was adopted. An interference filter was used which had been designed to reproduce the Kron-Cousins *I* band. The exposure time of 10–60 s was adopted depending on the brightness of the object; the dead time between exposures was 8–10 s. The frames were first corrected for standard de-biasing and flat fielding, and were then processed by a personal-computer-based aperture photometry package developed by the author. The differential magnitudes of the variable were determined against a local standard star marked as C1 in Figure 1. A comparison of the local standard star with a check star (C2 in Figure 1) in the same field has confirmed the constancy of the standard to 0.01 mag. The magnitude of C1 was determined as I_c=9.92 using equatorial standard stars (Landolt, 1983). One should, however, remember that this absolute value may contain a relatively large error due to large (∼2) air mass. The Ic-band magnitudes of WX Cet were determined using this local standard star.

The overall light curve is shown in Figure 2. The outburst lasted at least 12 days, with an average decline rate of 0.09 mag day^{-1} before starting a rapid decline. A time-resolved light curve obtained on July 19 (Figure 3) shows superhumps with a first broader and second sharp maxima. Although the shortness of the observing window did not allow us to improve the superhump period discovered by O'Donoghue et al. (1991), the present faint outburst is thus confirmed to be an unmistakable superoutburst.

The brightest (presumable) superoutburst of WX Cet reached m_{pg}=9.3 (Gaposchkin, 1976). The range of peak brightness of superoutbursts of WX Cet therefore reaches at least 2.9 mag, which exceeds most of ranges observed in SU UMa-type dwarf novae. Comparable cases can be found in SW UMa, VY Aqr and BC UMa, all of which are known to show 2–2.5 mag variation in the peak brightness of superoutbursts. This feature seems to be one of common characteristics of SU UMa-type dwarf novae bridging WZ Sge-like stars and classical SU UMa-type dwarf novae.

Another peculiar feature of WX Cet can be found during its terminal decline from a superoutburst. In contrast to most SU UMa-type dwarf novae, the rate of decline slowed down far before reaching quiescence. [Averaged decline rates of 0.80 mag day^{-1} and 0.41 mag day^{-1} were obtained for the intervals of July 20–22 and 22–23, respectively. Note that WX Cet was at I_c=15.5 on July 23, which was ∼ 2.0–2.5 mag brighter than quiescence.] Similar phenomenon was also observed in CT Hya (Nogami et al., 1995). Phenomenologically this feature seems to be related to a poorly understood long-fading tail observed in the terminal stages of superoutbursts of WZ Sge (Patterson et al., 1981), although its explanation should await further observational and theoretical works.

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