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ON THE ORBITAL PERIOD OF EG CANCRI

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The dwarf nova EG Cnc was discovered by Huruhata (1983). He reported the detection of an outburst in 1977 November and no sign of any other outburst in his photographic archives taken between 1977 and 1983. McNaught (1986) indicated that the object in quiescence was 18.6 mag (red) and 18.0 mag (blue) on the Palomar Sky Survey prints. He pointed out that characteristics of the object, which are 1) the outburst amplitude over 6 mag, 2) the decline rate of 2 mag per 20 days, and 3) its blue color, were similar to those of WZ Sge and its group.

Although there had been no confirmed outburst in EG Cnc since the 1977 outburst, the object underwent a rare outburst on 1996 November 30 (Figure 1). The object was $m_{\rm vis} \simeq 12$ at the first detection by Schmeer (1996). The outburst was a superoutburst, and it is known that the wonderful six repeated mini-outbursts appeared in the latter half of the superoutburst (Kato et al. 1998). In the first half of the superoutburst, the object showed two types of superhumps, namely 1) a double-peaked early superhump and 2) a following "common" superhump (Matsumoto et al. 1998). The early superhump showed a slightly shorter modulation period of $0\overset{d}{.}0582$ than that of the superhump of $0\overset{d}{.}06036$, later appeared. Matsumoto et al. (1998) suspected the former period is the orbital period of the binary system, by an application of the discussion in the 1996 superoutburst of AL Com (Kato et al. 1996), and also discussed the similarities between EG Cnc and the WZ Sge type dwarf novae. The WZ Sge type dwarf novae have some peculiar characteristics such as 1) very long supercycle exceeding years, 2) showing only superoutbursts without normal outbursts, and 3) large amplitudes of the superoutbursts over 6 mag. They are also known to occupy the shortest orbital-period region among all CVs. Confirmation of the orbital period of EG Cnc is crucial because it will provide an additional, independent support to the claimed universal presence of "early superhumps" in WZ Sge stars. We report here our observations of EG Cnc in quiescence to detect orbital modulations.

The CCD photometric observations were made on four nights between 1997 December 27 and 1998 January 2, using the 101-cm reflector at Bisei Astronomical Observatory and the 60-cm reflector at Ouda Station, Kyoto University. The observations at Bisei and Ouda were carried out with Johnson V-band interference filters and liquid-nitrogen cooled CCD cameras of TEK 1024T (1242×1152 pixels) and Thomson TH 7882 (576×384 pixels) at the Cassegrain foci, respectively. For more details of the instruments, see Ayani

Table 1: The log of the observations

Date	HJD−2400000	No. of frames	Error (mag)	Observatory
1997 Dec 27	50810	46	0.06	Bisei
1997 Dec 27	50810	55	0.15	Ouda
1997 Dec 28	50811	22	0.20	Ouda
1997 Dec 31	50814	67	0.20	Ouda
1998 Jan 2	50816	50	0.18	Ouda

et al. (1996) for Bisei, and Ohtani et al. (1992) for Ouda. A summary of the observations is given in Table 1.

The frames obtained at Bisei were reduced in a standard way using the IRAF (distributed by the National Optical Astronomy Observatories, U.S.A.), and the instrumental stellar magnitudes were measured with the aperture photometry routine (APPHOT) in the IRAF. The reductions of the Ouda frames were carried out with a microcomputer-based automatic PSF photometry package developed by one of the authors (T.K.). We determined the relative magnitudes of the object using a local comparison star of 12.82 mag (V) lying $\sim 4'$ west of the object.

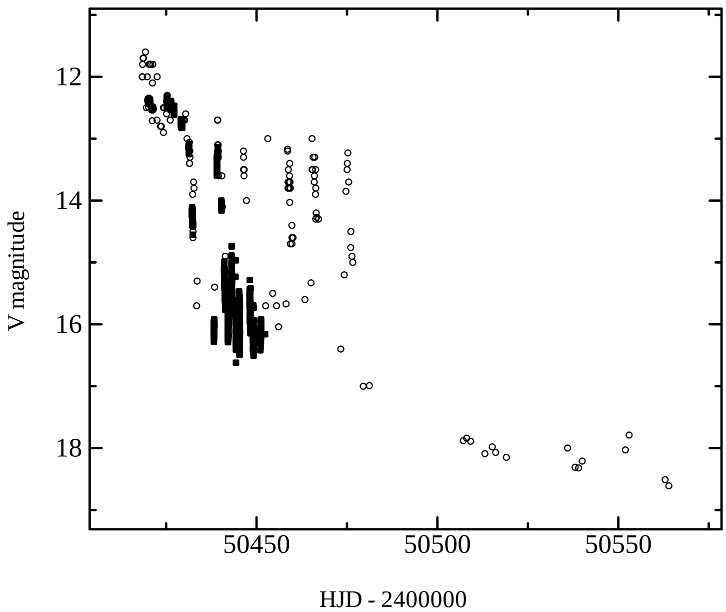

Figure 1. Overall light curve of the 1996 superoutburst of EG Cnc. The filled circles and squares respectively represent the CCD observations at Osaka Kyoiku University and Ouda station (Matsumoto et al. 1998, Kato et al. 1998). The open circles represent the reports by VSNET members.

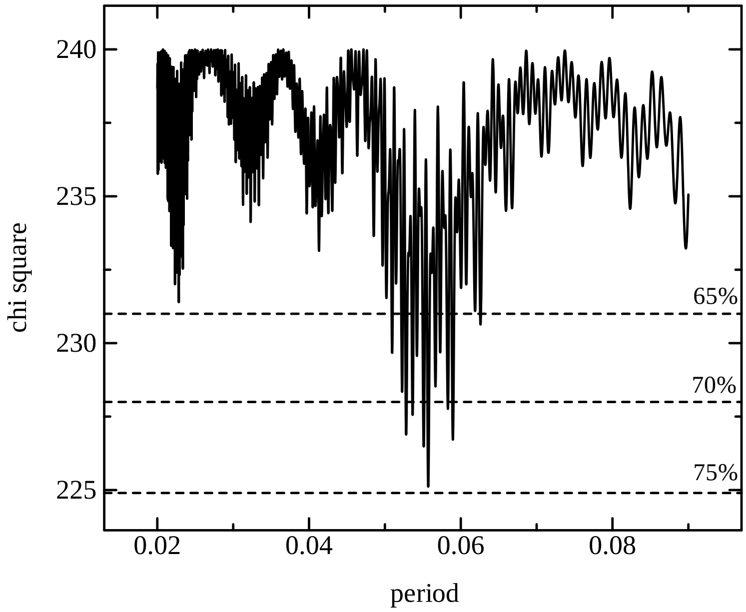

Figure 2. χ^2 tests for periods of the orbital hump

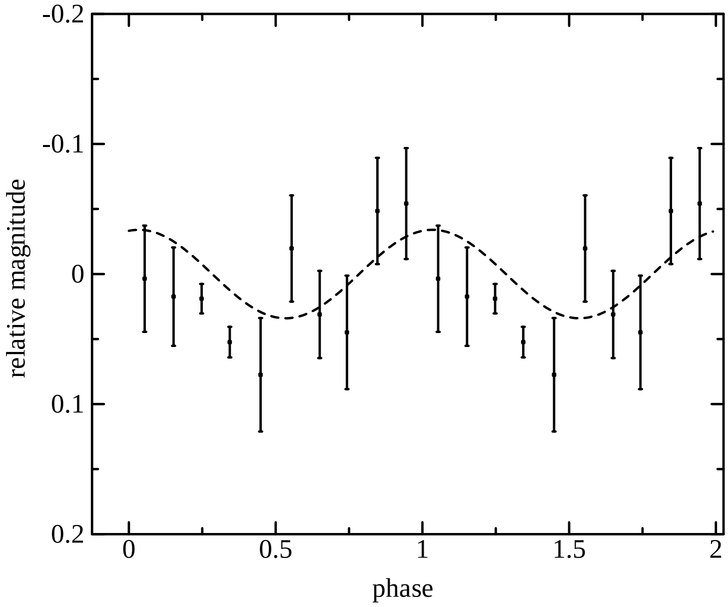

Figure 3. Folded light curve

In order to find a period of modulations in quiescence of EG Cnc, sine-curve fittings were applied to the obtained light curve with trial periods between 0.02–0.09 d. Figure 2 presents the results of χ^2 for the each trial period of the fittings. The confidence levels are represented by the dashed-lines with their value in the figure. The χ squares indicate a minimum at around 0.05–0.06 d, and there are four possible periods of 0.0528, 0.0551, 0.0557, and 0.0589 day over 70% confidence level. By knowing the superhump period of $0^{\mathrm{d}}.06036$ during the 1996 superoutburst of this object (Matsumoto et al. 1998; Patterson et al. 1998), the period of $0\overset{\mathrm{d}}{.}0557$ corresponds to an 8.4% fractional superhump excess, $(P_{SH} - P_{orb})/P_{orb}$. This excess value is far beyond the usual relation (excess versus P_{SH}) among SU UMa-type dwarf novae (eg. see Table 1 in Nogami et al. 1997), and each period less than $0\overset{\mathrm{d}}{.}0557$ will not be a good candidate for the orbital period. Therefore we consider that the $0\overset{\mathrm{d}}{.}0589$ with a 2.5% fractional superhump excess is the most likely period which reflects the orbital period of the system from the present data. The present result consequently supports that the period of the early superhump in the 1996 superoutburst corresponded to the orbital period.

Figure 3 is the light curve of the all data folded by the $0\overset{\mathrm{d}}{.}0589$ period and binned to 0.1 phases. The dashed-line in the figure represents the best-fit sine curve based on the result of the χ^2 tests. According to the fitted curve, the times of photometric maxima are expressed by the following ephemeris:

$$\mathrm{HJD\ (Maximum)} = 2450810.0912 + 0.0589 \times E, \qquad (1)$$

and the orbital modulation of EG Cnc in quiescence has an amplitude of ~ 0.06 mag.

The observation at Bisei Astronomical Observatory was made as a part of the 3rd observational program in 1997 of the observatory (K.M.).

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