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STANDSTILL OF THE HELIUM ER UMa STAR, V803 Cen

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A small group of helium-rich variable stars, known as AM CVn stars, are considered as ultra-short period interacting binary white dwarfs (for a review, see Warner 1995). Some of AM CVn stars show large-amplitude variations, and have been considered to be analogous to (hydrogen-rich) dwarf novae. The authors have revealed that two of these systems (CR Boo and V803 Cen) show regular alternations of bright and faint states (Kato et al. 2000a, 2000b), which bear characteristics of ER UMa stars, hydrogen-rich SU UMa-type dwarf novae with very short supercycles (for a review of ER UMa stars, see Kato et al. 1999). The overall and phased light curves of V803 Cen in Kato et al. (2000b) clearly showed these features. However, the behavior of V803 Cen suddenly changed after 2000 June outburst. The star did not return to its faint states as observed in Kato et al. (2000b), but varied mostly between $13^{m}_{.}3$ and $14^{m}_{.}0$, with some short occasional excursions to brighter maxima. Figure 1 show the overall light curve by the VSNET Collaboration (http://www.kusastro.kyoto-u.ac.jp/vsnet/), as an extension of Kato et al. (2000b).

In order to check the persistence of the 77-d supercycle as reported by Kato et al. (2000b), the data of the best-sampled period of JD 2451873–2452040 were analyzed. The observations were done as described in Kato et al. (2000b) and with a 32-cm reflector by (P.N.). The total number of observations in this period was 206. Neither Fourier nor Phase Dispersion Minimization (PDM) method (Stellingwerf 1978) gave no clear periodicity between 10 and 100 d, indicating that the 77-d supercycle has completely disappeared (see Figure 2). This change is very reminiscent of a standstill of Z Cam-type dwarf nova. The possibility that these helium ER UMa stars spend some time in their "standstill" state has been proposed by Kato et al. (2000a) from past observations of CR Boo, and is also consistent with the locations of these object close to the thermal stability border predicted by the disk instability theory (Tsugawa and Osaki 1997). The present observation first clearly demonstrate such a standstill actually appears in helium ER UMa stars. Such standstills have not been observed in hydrogen-rich ER UMa stars (ER UMa, V1159 Ori, RZ LMi and DI UMa). This may suggest that mass-transfer rates are more variable in helium ER UMa stars than hydrogen-rich ER UMa stars.

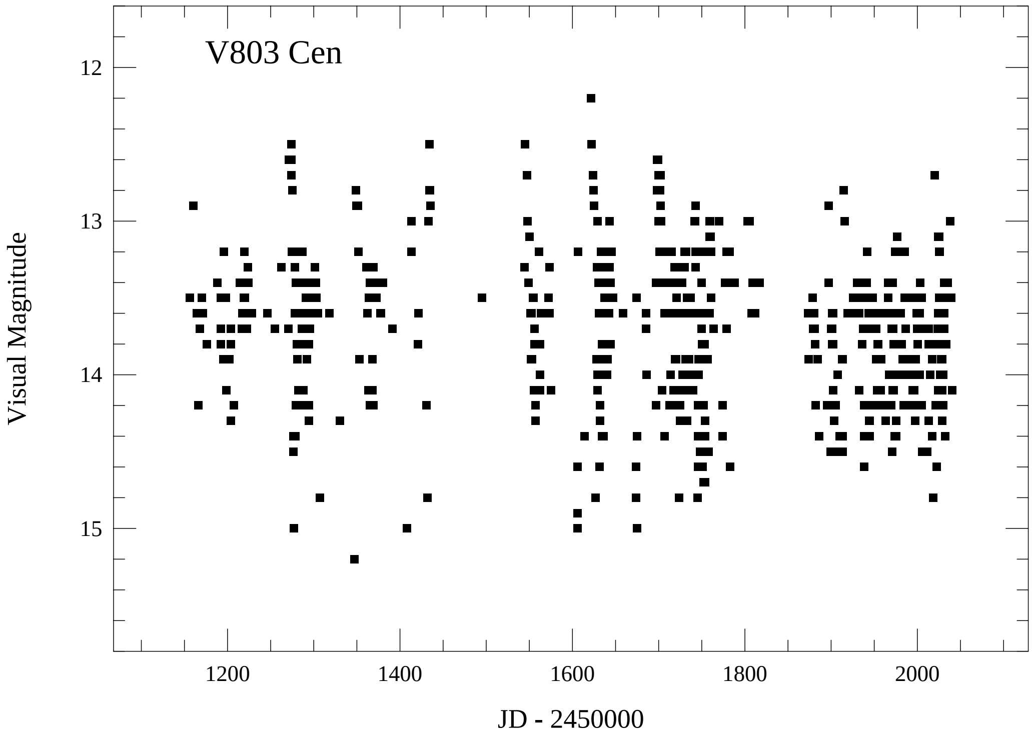

Figure 1. Overall light curve of V803 Cen

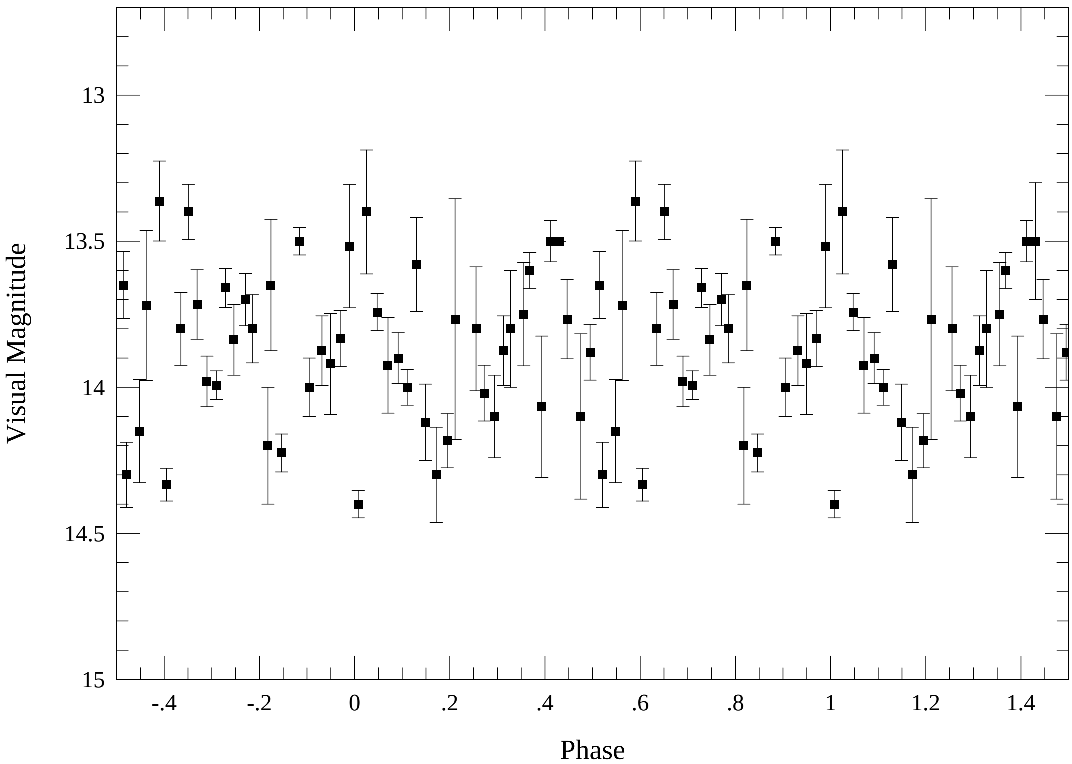

Figure 2. Phase-averaged light curve at a period of 77 d. The 77-d supercycle has completely disappeared

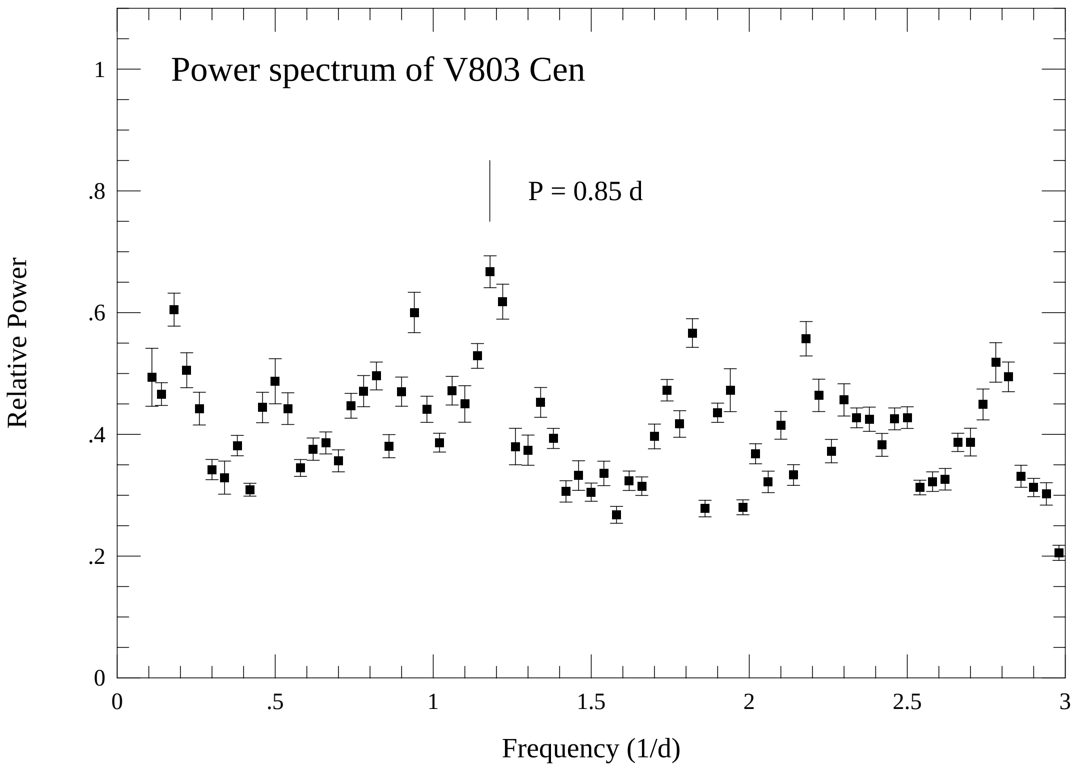

Figure 3. Power spectrum between frequencies 0.1 and 3.0 d^{-1}. Each point represents power and error averaged over 0.04 d^{-1} frequency bin. The signal at frequency close to 0.15 d^{-1} is the one-day alias of the main signal, which is likely to be reject as a true signal, as this disappears in better-sampled data (Figure 4)

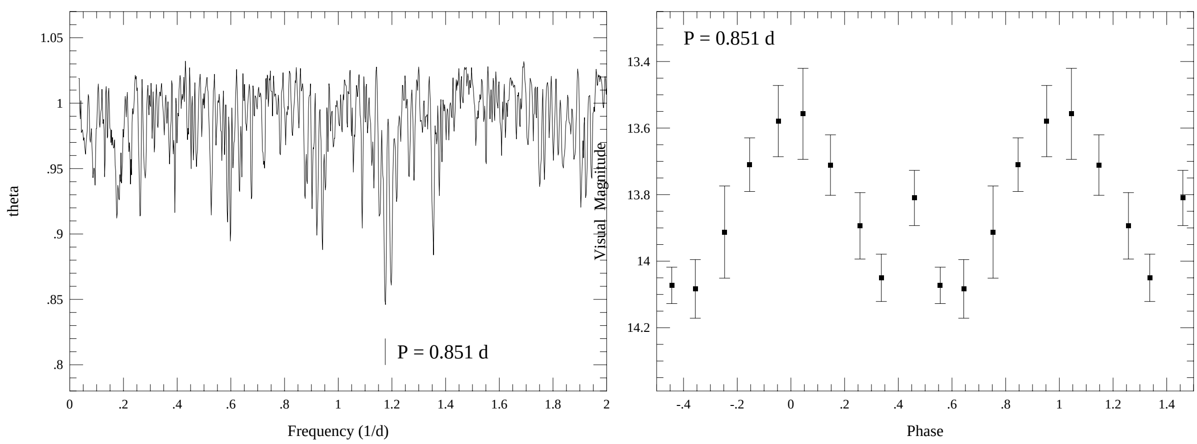

Figure 4. Period analysis (left) and phase-averaged light curve (right) at $P = 0^{\mathrm{d}}.851$ (frequency = 1.175 d^{-1}) for JD 2451971–2452040

During this standstill, low-amplitude ($\sim$ 0.5–1 mag) variations were present throughout the period. This may be equivalent to the 22 ± 1 hr period reported by Patterson et al. (2000). Fourier analysis of the data shows a significant increase of the power near this period, but has a maximum power at a shorter period of $\sim$ 20 hr (Figure 3). Detailed period analysis of the data, by dividing them into several shorter segments, has yielded the strongest power in the period of JD 2451971–2452040, during which the period of $0^{\rm d}.851$ is dominantly seen (Figure 4). However, this period was less significant between JD 2451873–2451970. In the period of JD 2451873–2451930, the variation has possibly had a longer period of $0^{\rm d}.96$. These findings indicate that the $\sim$ 20 hr variation is one of major causes of variation in this standstill, but the nature of this variation was highly variable both in amplitude and period.

References:

Kato, T., Nogami, D., Baba, H., Masuda, S., Matsumoto, K., Kunjaya, C., 1999, *Disk Instabilities in Close Binary Systems*, p. 45, eds. S. Mineshige, J. C. Wheeler (Universal Academy Press, Tokyo)

Kato, T., Nogami, D., Baba, H., Hanson, G., Poyner, G., 2000a, *MNRAS*, **315**, 140

Kato, T., Stubbings, R., Monard, B., Pearce, A., 2000b, *IBVS*, No. 4915

Patterson, J., Walker, S., Kemp, J., O'Donoghue, D. B., Stubbings, R., 2000, *PASP*, **112**, 625

Stellingwerf, R. F., 1978, *ApJ*, **224**, 953

Tsugawa, M., Osaki, Y., 1997, *PASJ*, **49**, 75

Warner, B., 1995, *ApSS*, **225**, 249