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SUPERSOFT SOURCE ACTIVITY AS A POSSIBLE INTERPRETATION OF TEMPORARY FADINGS OF CH Cyg

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CH Cyg is a well-known, but enigmatic, symbiotic variable, which is known to show complex activity (e.g. Mikołajewski et al. 1990). Superimposed on the increasing symbiotic activity, sudden short-term fadings in optical and ultraviolet have been observed. In order to explain this recurrent feature, various models involving eclipses of the hot component have been proposed (e.g. Hinkle et al. 1993; Skopal et al. 1996). However, the apparent presence of fadings not strictly following the suggested ephemeris suggests the possible presence of other mechanisms. Furthermore, the asymmetry of fadings (rapid fading and slower recovery) is also difficult to explain by the eclipse model.

Particularly noteworthy is the segment of recent light curve between 1998 and 2000 (upper panel of Figure 1). This figure clearly demonstrates that fadings are not strictly periodic. Two distinct minima occurred around HJD 2451360 and 2451690, separated by 330 d, while there was no hint of a fading at around HJD 2451030. The light curve also indicates the common feature of fadings: rapid decline followed by slower brightening. Between these transient fadings, the system spends most of time at bright state. All the above features of transient fadings of CH Cyg are strikingly similar to quasi-periodic fadings (or low states) of the peculiar binary V Sge (lower panel of Figure 1), in the recurrent time of semi-periodic fadings, the relatively short duty cycle of faint states, and in the depth.

V Sge has been recently recognized as a transient supersoft X-ray source (SSXS), in which supersoft X-ray emission was only observed during its low states (Greiner et al. 1998). The phenomenon is quite similar to the Magellanic SSXS, RX J0513.9-6951 (Reinsch et al. 1996). The cause of such recurrent fading episodes and the anti-correlation between supersoft X-ray and optical light has not yet been well understood, but Hachisu and Kato (1997) presents an interpretation by considering the limit-cycle formation of optically thick wind, which can reproduce, in particular, the asymmetric profile of fadings. The striking resemblance of the CH Cyg light variation to that of V Sge raises a possibility that fadings of CH Cyg may have been caused by transient SSXS phenomenon.

The relatively common optical features of SSXSs are the presence of strong HeII emission, and the appearance of jet features (for a recent review, see Gänsicke et al. 2000). The HeII emission has been usually regarded to be absent in CH Cyg, but Leedjärv et al. (1994) detected the emergence of the HeII emission during the fading episode. Furthermore, there are evidences of accompanying X-ray emission (Leahy and Taylor 1987) and the jet ejection (Taylor et al. 1986) during the fading occurring in 1984. These pieces

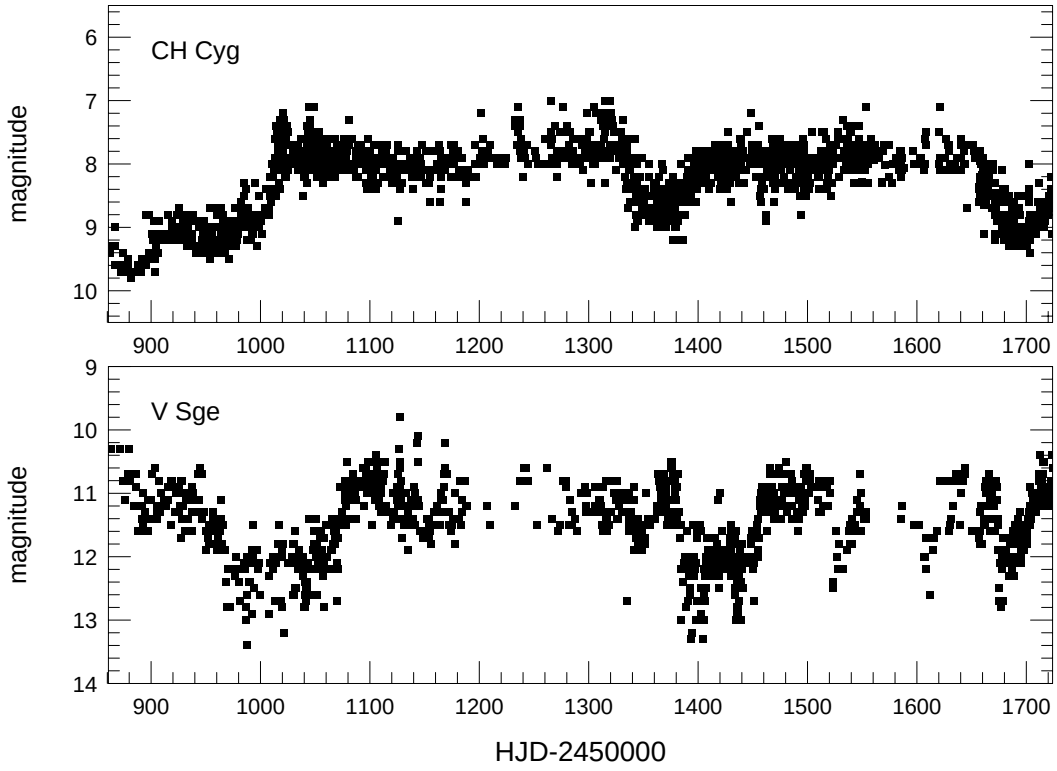

Figure 1. Light curves of CH Cyg and V Sge, drawn from visual observations reported to VSNET (http://www.kusastro.kyoto-u.ac.jp/vsnet/)

of evidence seem to strengthen the relationship to the transient SSXS phenomenon. One must note many of these signatures were recorded during the dramatic episode starting in 1984, which may be different in nature from the present milder fading episodes. However, it would be noteworthy that these high-energy events occurred during the optical low state, as in some transient SSXSs. The author has searched the public library of ROSAT observations (1WGA) in order to see the possible correlation between optical variation and the soft X-ray emission. There was only one available observation in late 1992 March, when CH Cyg was observed as a relatively hard source. CH Cyg was then in an extended low state, which is not comparable to the present high state with recurring faint states. Since V Sge is a hard X-ray source outside the transient SSXS phase (Greiner et al. 1998), it is not surprising that CH Cyg was recorded as a hard X-ray emitter at single-epoch observation. The present suggested relation between CH Cyg and SSXSs may lead to a unified understanding of various phenomena in SSXSs and symbiotic variables, particularly regarding the enigmatic high-velocity jet formation in CH Cyg-type symbiotic variables. The present interpretation is only one of possibilities, which requires further proofs from observations. Particularly crucial tests would include X-ray observations during the short fading episodes.

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