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Flickering activity in CH Cyg

CH Cyg is a long-period (~ 5700^d) symbiotic binary, consisting of a late red giant semiregular variable (with pulsation period ~ 100^d) and a white dwarf probably possessing strong magnetic field (Mikołajewski, Mikołajewska and Khudyakova 1990). At least four high-activity periods of CH Cyg have been observed since 1963. The last outburst ended in 1987, but since 1989 the star shows again erratic intermittent activity (Mikołajewski *et al.* 1992 and references therein). The erratic character of activity of CH Cyg is clearly visible in Figure 1, where the *U* band light curve reveals many irregular rises and deep local minima. Such sudden unexpected drop of *U, B* magnitudes occurred in mid September 1992, followed by deep minimum at the beginning of October 1992. We expect it is a temporary gap in activity. Such events are not expected in the framework of normal steady accretion. We surmise that highly unstable accretion from the giant's wind (Livio et al. 1991, Matsuda et al. 1991) could be responsible for the irregular behavior.

At the same time, the brightness of the M giant continued to increase in the *I* and *R* bands (see Figure 1 for the *R* light curve), which can be explained by rotation ($P = 770^d$) of the giant's photosphere covered with a large dark spot, presently turning away from us (Mikołajewski, Mikołajewska and Khudyakova 1992). The next maximum of this cycle we predict for the end of 1993.

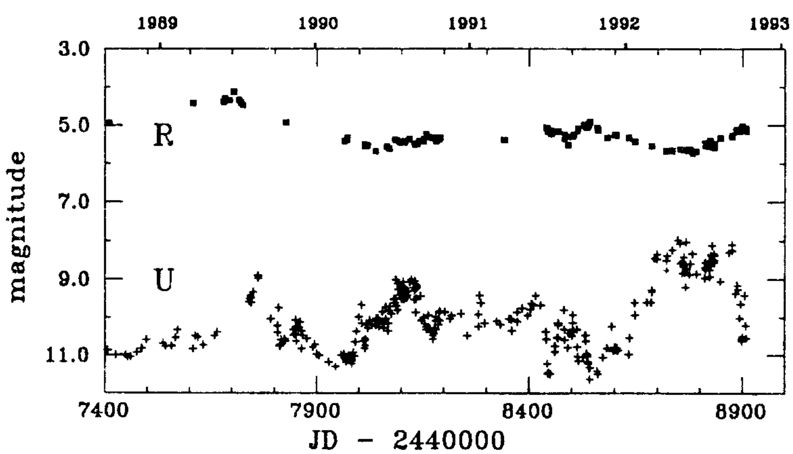

Figure 1. The *UR* light curves of CH Cyg during 1989–1993, mostly based on data obtained at Torun and Tartu Observatories (Tomov et al. 1992, in preparation).

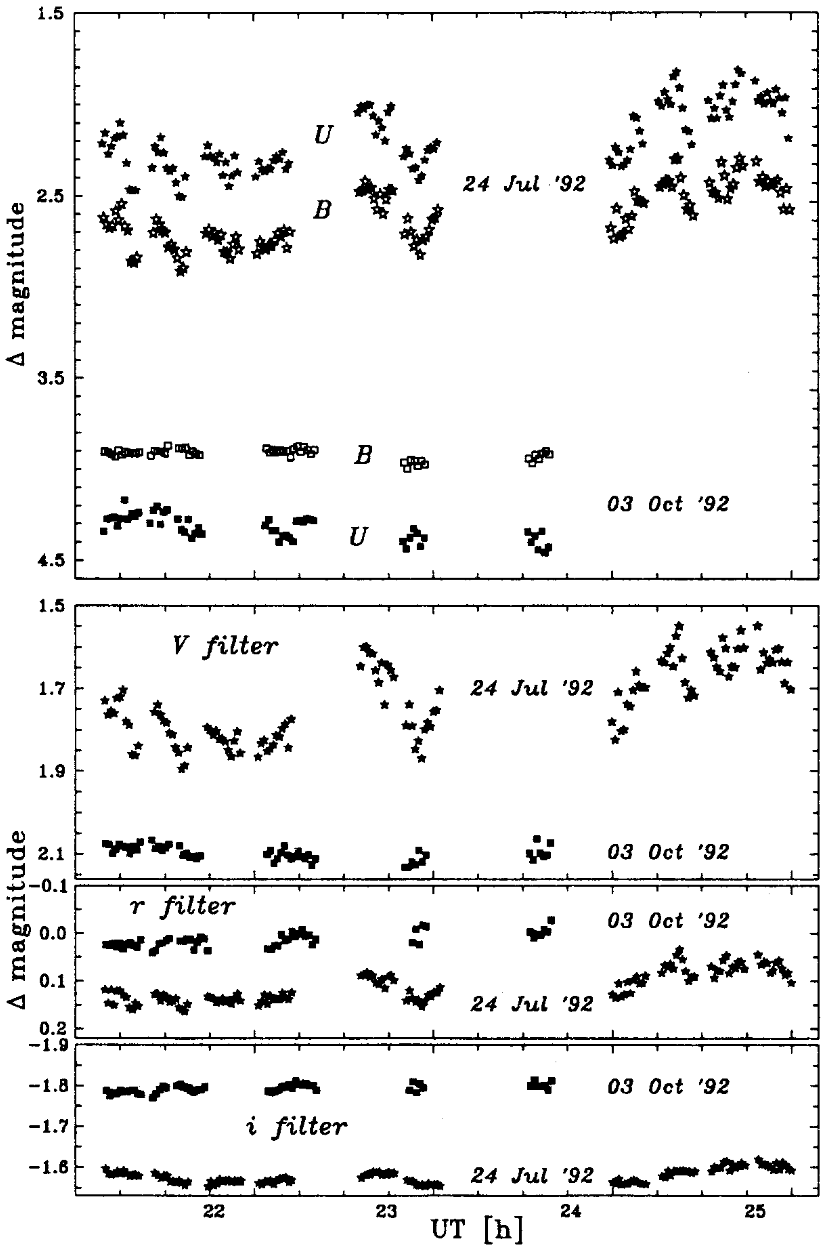

Figure 2. The U, B, V, r (λ=690nm) and i (λ=780nm) light curves of CH Cyg (in instrumental system), observed with 60cm telescope at Torun Observatory.

The increase in the hot component brightness is usually accompanied by flickering activity. This time, however, the flickering surprisingly appeared at wavelengths as long as $\lambda = 690$ nm and $\lambda = 780$ nm, corresponding to the effective wavelengths in r and i bands of our instrumental photometric system. The flickering in the r, i bands showed the same features as the flickering in the U, B, V filters (Figure 2). Typical amplitudes of flickering in summer 1992 were similar to those observed on 24 July : $\Delta U \approx 0.^m7$, $\Delta B \approx 0.^m7$, $\Delta V \approx 0.^m35$, $\Delta r \approx 0.^m15$, $\Delta i \approx 0.^m07$. The flickering in the r, i bands

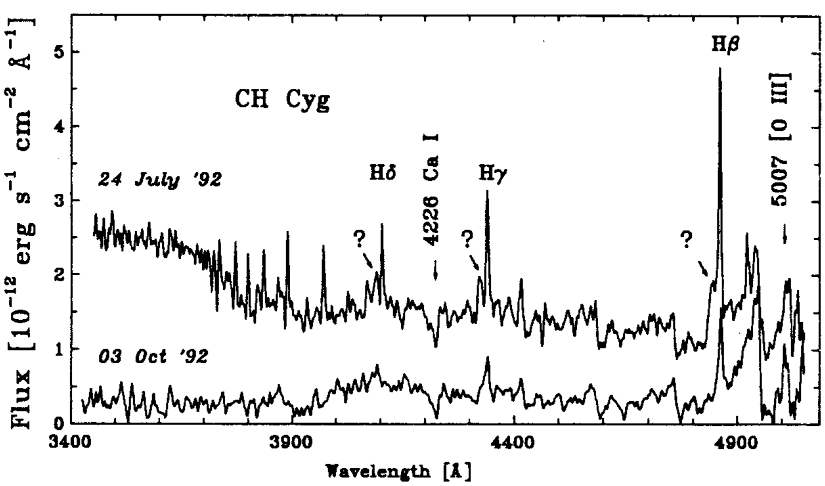

Figure 3. Low resolution (2–3Å) spectra of CH Cyg obtained with the Canadian Copernicus Spectrograph mounted at the Cassegrain focus of the 90cm telescope of Torun Observatory.

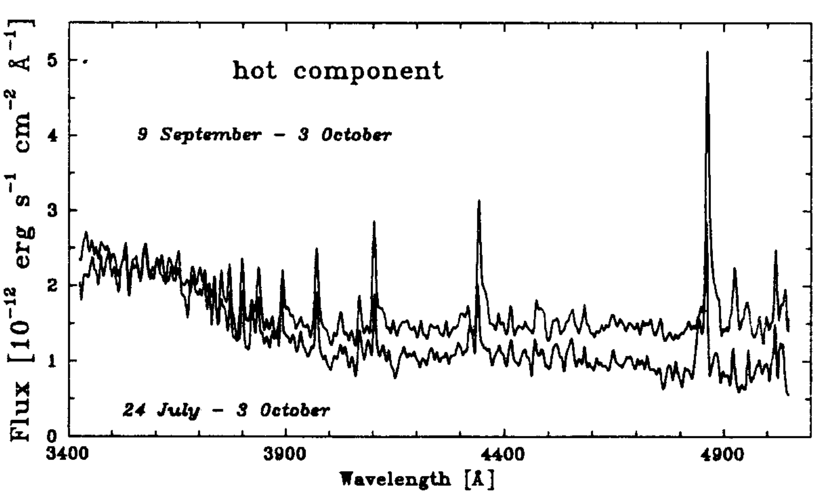

Figure 4. The spectrum of the hot component obtained by subtraction of the spectrum during minimum (3 October) from the spectra obtained during an active phase (9 September and 24 July).

has not been thus far observed for CH Cygni, and we were skeptical whether it is real or not. Subsequent observations, carried out with the same instrument at the beginning of October i.e. during the local minimum of activity, did not show such fluctuations. They show only noise without any correlation between respective filters (Figure 2). So, the only explanation is that the previously observed flickering in *r, i* bands was real. The *r, i* magnitudes during the gap of activity (3 October) has increased comparing to brightness on 24 July, which can be explained by a larger contribution of the M giant's flux (see the *R* light curve in Figure 1). Thus, during active phase the flux originating from the hot companion can change by 50% on timescales of tens of minutes, at all wavelengths starting from 355 nm up to 780 nm.

Such conclusion is also supported by our spectroscopic observations. In particular, the energy distribution obtained during recent maximum shows significant contribution of the hot component also longward of the Balmer jump (Figure 3). On the spectrum obtained on 3 October all permitted emission lines decreased in strength, following the decline of the hot continuum, while the forbidden lines ([O III], [Ne III], [S II]) remained clearly visible. So, we can expect that the spectrum observed during the minimum consists of the M giant photosphere and weak hydrogen continuous emission originating from a large extended nebula. To obtain the spectrum of the active component, we have neglected the variability of the M giant and subtracted the spectrum made on 3 October from the spectra obtained on 24 July and 3 September (maximum). The resulting spectra (Figure 4) show the expected H II continuum (typical for this star in 1989-91) and an F-type supergiant pseudophotosphere. It must originate from a large amount of accreted matter, accumulated around the magnetic white dwarf, and already beginning to be optically thick. It is consistent with the model of three step accretion onto an oblique rotator (for details see Mikołajewski *et al.* 1990). It is a contribution of the F-pseudophotosphere that is responsible for the prominent maximum on 9 September (compare to the spectrum obtained on 24 July in Figure 4), whereas the H II emission remains practically constant.

4 spectra made between 19 and 29 July revealed the presence of puzzling emission structures, possibly associated with H I Balmer emission lines (question marks in Figure 3). If they are blueshifted components of H I Balmer lines, their formation region approaches us with $V_{rad} \sim 1000$ km/s, which is comparable to the escape velocity from the white dwarf's surface or magnetosphere. Similar, but redshifted components in Balmer emission lines seem to be visible on the spectrum obtained on 9 September (Figure 4). Would it be caused by ejection of fast (precessing ?) jets, similar to that in July 1984 (Taylor *et al.* 1986, Solf 1987)?. High resolution spectra would explain the nature of these features.

Since one can expect new active phases, further optical, X-ray and UV observations are strongly needed.

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