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CHANGES IN THE BRIGHTNESS AND THE SPECTRUM OF CH CYGNI

The longest active phase of the symbiotic star CH Cyg, of the three known so far, lasted 10 years and ended in 1987. The activity is characterized by the presence of strong, hot continuum, strong emission and absorption lines of HI, HeII, ionized metals, and emission lines of [FeII], [SII], and [OI] in its spectrum (Selvelli, 1988). Rapid brightness changes of various characteristic times and amplitudes were observed during the active phases of CH Cygni (Slovak and Africano, 1978; Skopal, 1987), whereas such variations were not observed only at the time of eclipse in the system in 1985 (Mikolajewski et al., 1987).

The star's behaviour, after the latest active phase ended, was typical for its "quiet" periods. The M6-type spectrum of the main star and faint emissions in Hα and Hβ (Hack et al., 1988; Bode and Meaburn, 1988) dominate the optical spectra. No rapid brightness changes have been observed. During July 1988, particularly, the variations were not larger than 3% in UBV (Garnavich and Goldader, 1988). According to Skopal (1988) the brightness in UBV is practically constant during each individual night.

Spectroscopic observations of CH Cygni have been carried out with the 2-m RCC telescope's Coudé spectrograph of the Bulgarian National Astronomical Observatory since 1981. The spectra discussed in this paper were obtained from July 1987 to July 1989; they cover the spectral range 3600-4900 Å with a dispersion of 18 Å/mm. Before July 1989, the spectra showed practically a normal M6 III spectrum, with no traces of any veiling hot continuum but a faint one-component Hβ emission line was superimposed on the red giant's spectrum. Its intensity, relative to the local continuum, during the period July 1987 - July 1989 is 3.0 ± 0.3. Significant changes were revealed in the spectrum obtained on July 11, 1989. The Hβ emission increased up to 5.0, but it was still one-component. Fainter, one-component emission Balmer lines up to H12 appeared, whereas only a weak emission FeII 4233 Å was present undoubtedly. The absorption line CaI 4227 Å and the TiO bands typical of an M giant spectrum had intensities showing that there was no obvious hot continuum longward 4000 Å.

In order to check if the spectral changes were coupled with photometric variations, observations of CH Cyg were performed during August 01-06, 1989, with the 1.2 m Kryonerion telescope of the Athens National Astronomical Observatory, using a single channel photon counting photometer (Dapergolas and Korakitis, 1987). UBV photometry has been made using HD182691 ($V=6^m.52$, $B-V=-0^m.08$, $U-B=-0^m.23$) as a standard star whereas the absolute calibration was made using the photoelectric sequences of Landolt (1973). Table I lists the dates, the corresponding number of observations, the average UBV-values for each night, and their standard deviations.

Table I

Date (JD 2447700.0+)		No.	U	B	V
01-Aug-89	(40.31)	4	$9^m.59 \pm 0.09$	$9^m.18 \pm 0.06$	$7^m.96 \pm 0.03$
02-Aug-89	(41.32)	5	9.51 ± 0.05	9.11 ± 0.04	7.94 ± 0.03
04-Aug-89	(43.33)	6	9.44 ± 0.09	9.12 ± 0.05	7.92 ± 0.03
05-Aug-89	(44.32)	6	9.49 ± 0.06	9.13 ± 0.04	7.94 ± 0.02
06-Aug-89	(45.31)	4	9.62 ± 0.06	9.20 ± 0.03	7.98 ± 0.01

Additionally, a monitoring for U-flickering of CH Cygni was performed each night where BD+49°2997 was used as a check star and HD182691 as a standard; the integration time was 10 seconds, the duration of each patrol was about 1 hour. Figure 1 shows the U-data for CH Cyg, for the check, and for the standard star (shifted by $+3^m.0$ in this figure) for two nights - 01 and 06 Aug. Significant continuous variations observed in the U-brightness can be considered as long- and short-term variations. The long-term ones show continuously increasing (Aug 01) or decreasing (Aug 02, 04), or nearly constant U-magnitude during the night, but different value from night to night (Aug 05, 06). The superimposed short-term variations show irregular decreases or increases in U with a duration from 1 to about 15 minutes and amplitudes up to $0^m.3$. Both variations, together, give changes in the U up to $0^m.5$. A periodogram analysis using a program of Deeming's method (Kreidl, 1980) was performed. No characteristic time of the variations can be seen in the "power spectra" obtained for each night, whereas from the observations of all the nights (about 1600 U-values) a doubtful maximum at about 15 minutes can be suggested in the periodogram.

The appearance of remarkable emission Balmer lines in the spectrum of CH Cyg and the rapid brightness variations only two years after the latest phase of enhanced activity are very interesting observational facts. Such

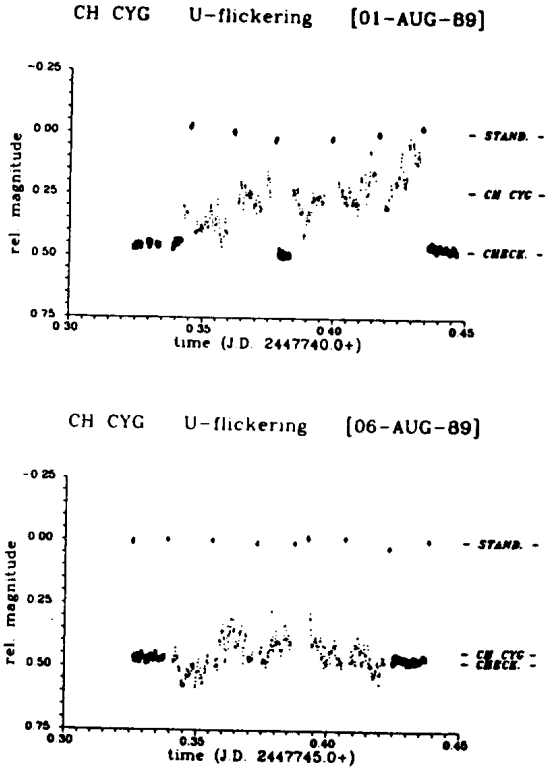

Figure 1.

phenomena seem not to be unique for this star. Relatively intense emission lines from Hα to Hε and HeI 5016Å (Rodriguez, 1984) and rapid brightness variations (Luud et al., 1977) have been observed between its active phases in 1974. For this period, JD 2442000 - JD 2442200, the light-curves in the V and, especially, in B-V and U-B show a local maximum (Luud et al., 1986).

The above mentioned and the fact that our recent observations do not show a noticeable hot continuum in the optical spectrum, make us to suppose that the spectral and the brightness changes of CH Cyg during July-Aug. 1989 are not associated with the beginning of a new active phase. It is more likely that this is only a short-duration increase of the activity like the one observed in 1974, most probably due to a temporary increase of the mass-transfer rate in the system of CH Cygni.

From our observations it has been realized once more that CH Cygni is an extremely interesting object that has to be observed during its "quiet" phases as intensively as it is during its high activity.

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