COMMISSIONS 27 AND 42 OF THE IAU
INFORMATION BULLETIN ON VARIABLE STARS
Number 3951

Konkoly Observatory
Budapest
17 November 1993
HU ISSN 0324 - 0676

CH CYGNI IN 1992–1993: HIGH LEVEL OF ACTIVITY

CH Cyg is a long-period (5700^d) symbiotic binary consisting of an M type semiregular variable and a white dwarf probably possessing strong magnetic field (Mikolajewski et al., 1990). At least four activity periods or outbursts have been observed since 1963. The most conspicuous active phase took place from 1977 to 1987. Since 1989 the star has again shown some episodes of erratic activity with the strongest episode in 1992 (Mikolajewski et al., 1992b and references therein; Kuczawska et al., 1992; Panov & Ivanova, 1992). In 1993 the activity seems to be still increasing. In the present paper some preliminary results of new photometric and spectroscopic observations of CH Cyg obtained at Tartu observatory in 1992–1993 are described.

Photoelectric UBV observations of CH Cyg at Tartu observatory were carried out with a 0.5-m telescope using HD 182691 (V=6$^m_.$525, B−V=−0$^m_.$078, U−B=−0$^m_.$240) as a comparison star (see Leedjärv, 1990). U, B and V magnitudes of CH Cyg from 1992 to 1993 are shown in Fig. 1. Variations in the U magnitude are the most prominent ones.

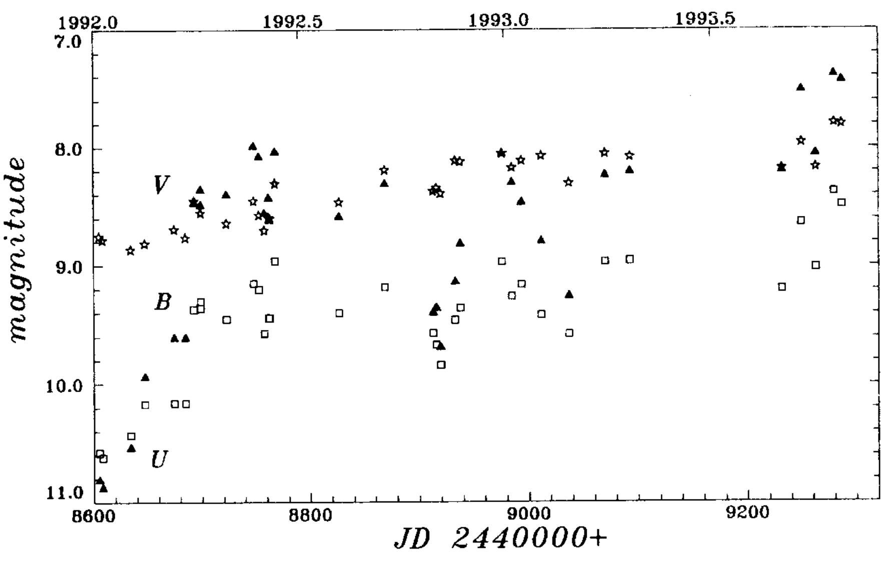

Figure 1. U, B and V light-curves of CH Cyg from 1992 to 1993.
U magnitudes are shown by filled triangles, B – by open squares, V – by pentagons.

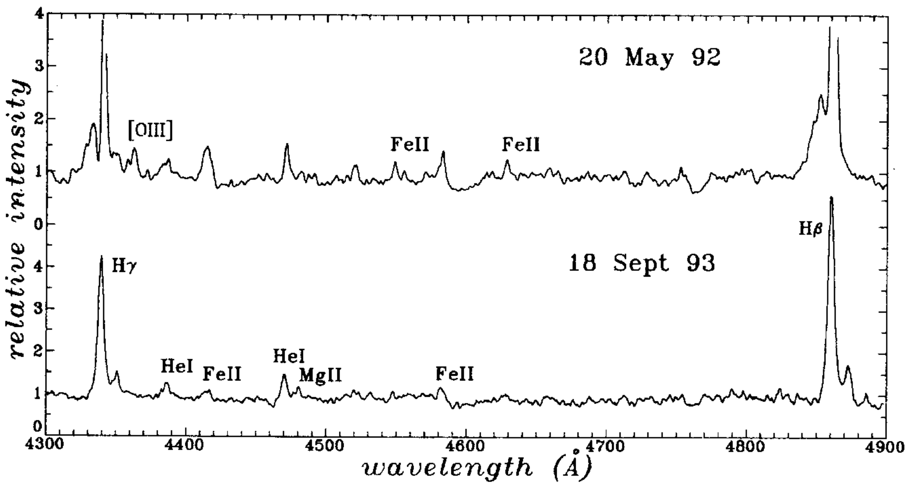

Figure 2. Examples of the spectra of CH Cyg. On the spectrum from 20 May 92 the Hγ and Hβ lines have been truncated.

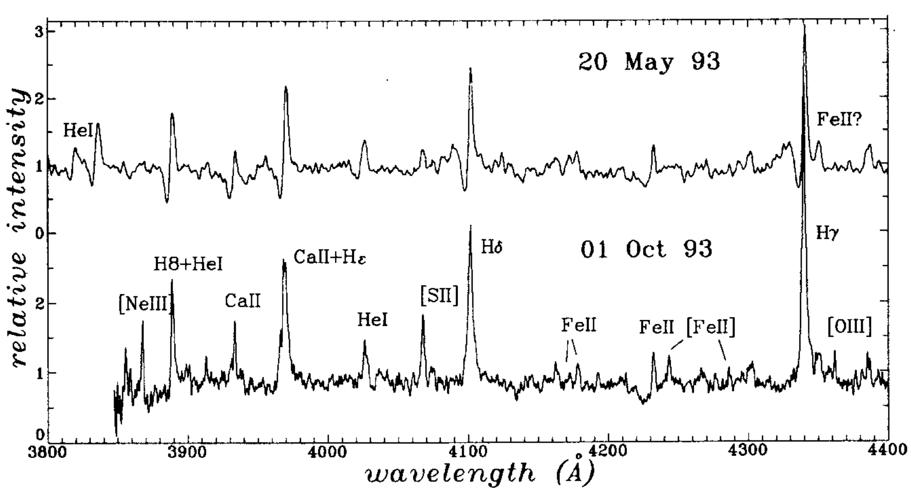

Figure 3. Examples of the spectra of CH Cyg.

Being at quite low level in the beginning of 1992, the U brightness began to increase, reaching U $\approx 8^{m}_{.}0$ by May 1992. The high U brightness has persisted till the present days, being interrupted by short period minima in October 1992 and February 1993. The latest observations on Oct. 18 and 25, 1993 have shown U=$7^{m}_{.}38$ and U=$7^{m}_{.}43$, respectively. Unfortunately, no observations have been made from May to August 1993, but at least in the beginning of June the star was very bright with U=$7^{m}_{.}57$ (Skopal et al., 1993).

The 100-day pulsations of the M giant (see Mikolajewski et al., 1992a) are not well visible in our quite sparse V data. In part, also, strong hot continuum masks the behaviour of the M giant in the V filter bandpass. The 770-day periodicity in the V brightness of CH Cyg has been ascribed by Mikolajewski et al. (1992a) to the rotation of the giant's photosphere covered with a large dark spot. Presently the spot is thought to be turning away from us; Kuczawska et al. (1992) have predicted the next maximum of this cycle for the end of 1993. This prediction seems to be confirmed by our observations as in September and October 1993 the V brightness has risen above 8th magnitude for the first time since October 1989.

Spectroscopic observations of CH Cyg have been carried out by the 1.5-m telescope and Cassegrain spectrograph ASP-32. Spectra in 1992–1993 have been recorded on Kodak 103aO and 103aF plates, except the spectrum from May 20, 1992 which has been recorded on ORWO ZU-21 plate. The blue-region spectra have dispersion about 86 or 37 Åmm^{-1} (at Hγ) and the spectra at Hα about 75 or 28 Åmm^{-1}. All spectra of CH Cyg in 1992 and 1993 show more or less pronounced hot continuum and a wide variety of permitted and forbidden emission lines.

Hydrogen Balmer emission lines are the most prominent ones in the spectrum of CH Cyg. On May 20, 1992 these lines show weak blue-shifted emission peaks besides strong emission components, with a sharp absorption component between them. In higher members of Balmer series such profiles remind of P Cygni profile, while in Hβ, Hγ and Hδ the two emission peaks are clearly visible (Fig. 2). Average radial velocities of the red emission, the absorption and the blue emission were about +30, −257 and −492 kms^{-1}, respectively. Similar Balmer line profiles are visible in all our spectra obtained till May 20, 1993, with variable radial velocities and intensities of the components (Fig. 3). However, as announced by Kuczawska et al. (1992), in September 1992 the Balmer lines have demonstrated weak red-shifted emission peaks. Also, our spectrum from Sept. 18, 1993 shows red-shifted emission components with mean radial velocity +678 kms^{-1} (Fig. 2). One can suspect that in our low-dispersion spectra the possible red emission component of Hγ may be contaminated by the FeII λ 4351 line. But on Sept. 18, 1993 the Hβ line demonstrates very pronounced emission at λ 4872 Å, where no known emission line exists, so we consider the emission at λ 4350 Å as belonging mostly to Hγ provided that all FeII emission lines in that spectrum are weak. Balmer lines on Oct. 1, 1993 have one-component asymmetrical emission profiles without any noticeable absorption or additional emission.

At the same time, Hα has been quite symmetric single emission line. For instance, Aufdenberg et al. (1993) have seen blue-shifted emission components of Hα only since Oct. 8, 1993. Up to this time Hα has been a single strong emission line with essentially constant profile. This is confirmed by our Hα observations on Apr. 3, May 12 and Sept. 20, 1993. To a first approximation, the blue-shifted components of Balmer lines can be explained as arising in a matter, expelled out from the white dwarf's magnetosphere by the propeller mechanism (Mikolajewski et al., 1990; Kuczawska et al., 1992). Origin of the red-shifted components as well as different behaviour of Hα is not so clear. Probably, at times we can see the matter just falling onto the white dwarf's magnetosphere, or, alternatively, ejected out in bipolar jets.

Intensity of forbidden lines varies during the time interval considered. At least [SII] λ 4068 lines are visible in all spectra. In most of the spectra, also [FeII], [NeIII] λ 3869 and [OIII] lines are present. All forbidden lines are single emission lines having radial velocities close to the γ-velocity of the CH Cyg system -58 kms^{-1}. This indicates that forbidden lines have their origin in an extended rarefied gaseous nebula surrounding the whole system.

Unpredictable behaviour of CH Cyg has surprised astronomers for several times. Continuing observations, especially in UV and X-ray regions must show whether the activity episode in 1992–1993 is a transient phenomenon or the beginning of a new extended active period.

This project was in part supported by the Estonian Science Foundation grant No. 175/93.

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