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CH Cygni - recent spectral variations

CH Cyg is a symbiotic star often observed and investigated in a wide spectral range during the last 30 years (Kenyon 1986, Selvelli 1988). It is a long-period (~5700^d) eclipsing binary (Mikolajewski, Tomov and Mikolajewska 1987) consisting of a late red giant and a white dwarf. A few high-activity periods of the star have been observed since 1963. An intensive hot continuum, strong permitted and forbidden emissions and absorption lines of single-ionized metals are typical during these active phases. In the quiet periods the spectrum is normally dominated by the M-giant features.

Until recently it was supposed that the observed active phases of the star are three (see for example Selvelli 1988). Mikolajewski, Mikolajewska and Khudyakova (1990), analyzing the long-term light curve of CH Cyg during 1885-1988 have not found evidence of the star's activity before 1963. They assumed that at least four active phases have been observed afterwards.

The last outburst has finished in 1987 and we expected a quiet period of a few years. But CH Cyg confirmed its unpredictable behavior very soon. In this short note the most prominent spectral changes during the last few years are described.

The low-resolution (~2A) spectra were obtained with the Canadian Copernicus Spectrograph (3400-5200AA) mounted at the Cassegrain focus of the 90cm telescope of the Torun Observatory. They have been reduced to the Hayes and Latham (1975) flux scale using standard methods. The high-resolution (~0.35A) spectra were obtained using the Coude-spectrograph (3600-4900AA) of the 2m telescope at National Astronomical Observatory Rozhen.

The M-giant spectrum is completely dominant in the optical during 1988 only. Since the summer of 1989, first indications of a new activity such as increasing of the hot continuum, appearance in the spectrum of noticeable emission lines of HI, FeII, [FeII], weak emissions of [NeIII] 3869A and [SII] 4068A as well as rapid brightness variations have been observed (Tomov et al. 1989, Mikolajewski et al. 1990). Later some other emission lines became observable. The predominant part of these features, varying in a different way, were present in the spectrum from the middle of 1989 until the last observations during March 1992.

The considerable changes of the hot continuum intensity are illustrated in Fig.1.

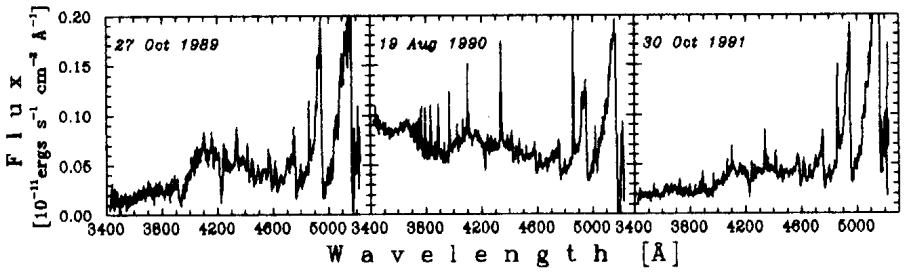

Figure 1

The lines and TiO-bands of the M-giant were dominant in the absorption spectrum. Varying in intensity and shape, the Balmer lines are present in the most spectra as single- component emissions. During 1989 they were visible up to H_{10-12} and in the next year they gradually became visible up to H_{20-22}. In the period June-August 1991 all Balmer lines showed quite different profiles. They were wider and with two emission peaks separated by a relatively weak absorption component (Fig.2). These two-component profiles of the higher Balmer series members appeared for the first time since 1986. The only exception is H_α which shows weak double-peaked emission profile even during the period 1987-1989 (Bopp

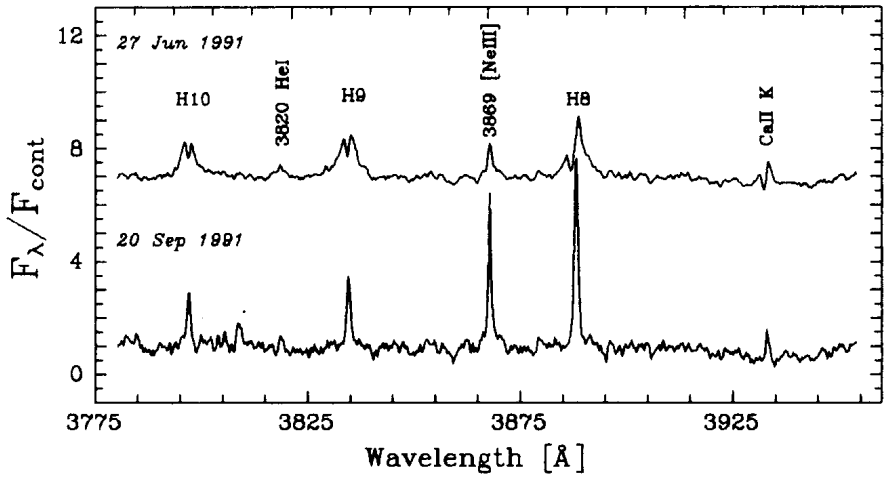

Figure 2

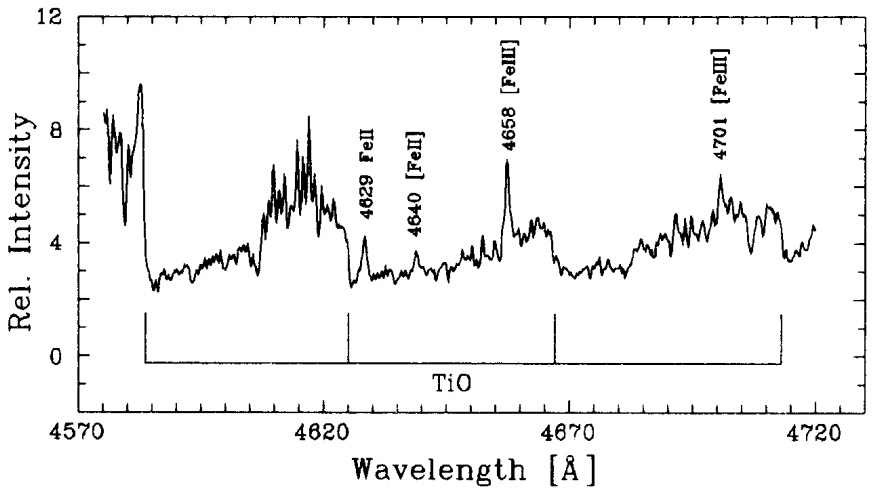

Figure 3

1990; Bode et al. 1991; Tomov et al. 1992, in preparation). A new significant change of the Balmer lines occurred in September 1991 when the emissions were one-component again. They were considerably stronger in comparison with June 1991 and their shapes were the sharpest in the whole period July 1989 - March 1992 (Fig.2).

Now, as it is typical for the high-activity phases of CH Cyg, the permitted and forbidden lines of FeII are the most numerous in the spectrum. Occasionally, intensity variations of these lines with characteristic times of a few days are noticeable. A similar behavior shows the [SII] 4068Å emission line.

It should be mentioned that the emission lines of [FeIII] 4658Å and 4701Å appear in the spectrum of CH Cyg for the first time. As it is shown in Fig.3 they are very prominent in the spectrum on September 20, 1991.

A few emission lines of HeI such as 4713Å, 4471Å, 4026Å and 3820Å appeared in the spectrum in the beginning of 1990. They are variable in intensity too, but they remain single-component all the time in contrast to the Balmer lines.

In the spectrum obtained on July 11, 1989, a weak and sharp emission component located near the center of the wide and intensive absorption of CaIIK belonging to the M-giant, was visible. Its intensity remarkably increased in May 1990. During the next two months this single-component emission line of CaIIK gradually transformed into a profile with two emission peaks separated by an absorption component. This shape is typical for CaIIK in our spectra with two exceptions: on September 20 and 27, 1991 (Fig.2).

Besides the nebular emission [NeIII] 3869Å, the high-resolution spectra includes the line [OIII] 4363Å as well. All the time after July 1989 [NeIII] 3869Å existed in the spectrum of CH Cyg certainly. Sometimes this

line was rather weak but at times it was one of the most intensive emissions in the spectrum (Fig.2). The nebular emission [OIII] 4363A can be clearly identified after the middle of June 1990. Changing its intensity it reached the maximum in September 1991.

Of course, the spectral variations of CH Cyg described here demonstrate only one side of the activity during the last three years. In addition, considerable brightness variations of the system, as well as the typical for the active stages flickering have been observed (Tomov et al. 1992, in preparation).

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