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Spectral changes in the probable SB 60 Cygni [1]

The probable spectroscopic binary 60 Cyg (=HD 200310) has long been known as a variable Be star.* Copeland and Heard (1963) mention a double emission at Hβ and Hγ in 1946. According to Hubert-Delplace and Hubert (1979), the Hα emission, which remained weak between 1955 and 1958, increased up to the year 1964. Occasionally, Fe II emissions are seen. Harmanec *et al.* (1986), both from light and radial-velocity curves find a most probable period of 2.48257 days. The energy distribution between 0.33 and 1.06 μm is given by Gunn and Stryker (1983). At that time (most likely in the early eighties) Hα is a moderately bright line and the blue part of the spectrum looks like a rotationally broadened early B-type. The star is classified as B1.5 IV-Vne by Schmidt-Kaler (1967). Beyond Hα, observations are very scarce but on our spectrum obtained in 1965 (Andrillat and Houziaux,1967), the double emission at Hα is the only bright line up to 8800 $\AA$; Paschen lines appear as broad and shallow absorption features. Andrillat *et al.*(1988) publish a 1982 spectrum in the same region, which displays "filled in" Paschen lines.

The spectrum still seemed very stable when we secured a CCD spectrum at 1$\AA$ resolution around 1μm in August 1991. However, by the end of October, the Hydrogen Paschen 7 photospheric absorption line at 1.0049μm had been replaced by an asymmetric double emission (Fig. 1), and the 0.9997μm Fe II line appeared with the same type of structure. Further observations in the 0.7 to 0.74 μm and 0.835 to 0.878μm ranges showed the higher members of the Paschen series to exhibit a similar line profile, i.e. a rather ill-defined double peaked emission (with a $\sim$ 6$\AA$ separation), not inconsistent with a ring-shaped emitting region. The P18 line is severely blended with the neighbouring O I line at 0.8446 μm, the maximum of which peaks at 35 percent above the local continuum. We can also identify neutral nitrogen emission lines at 8629, 8683-86, 8704 and 8714 $\AA$, belonging to multiplets 1 and 8. (see Fig. 2). A thirty minute exposure further to the infrared (1.05 to 1.09 μm) did not reveal any structure either in absorption or emission at the location of the He I 1.083μm line.

While such features make the near-infrared spectrum rather unusual, there is nothing in the blue-violet region (0.39 to 0.525μm) that distinguishes the star's spectrum from a bona fide B1.5 type. The He I lines are

[1] Based on observations obtained at Observatoire de Haute-Provence (CNRS, France)

* Its variable star name is V1931 Cyg (the Editor).

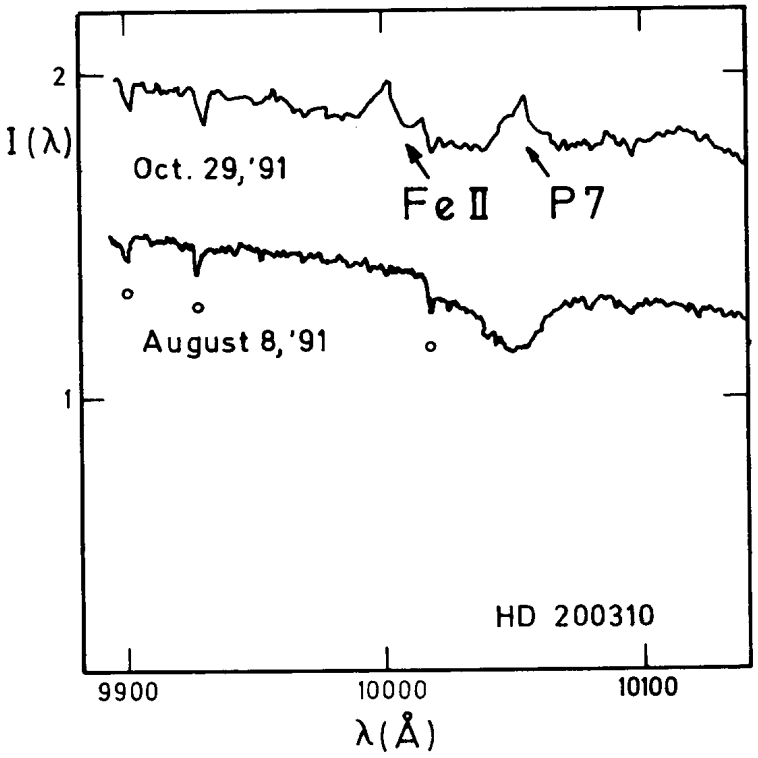

FIG 1. Changes in the $1\mu m$ region between August and October 1991. Note the strength of the Fe II line at 9997Å. The circles denote atmospheric features.

strong and rotationnally broadened at 4009, 4026, 4121, 4144, 4388, 4471, 4713, 4922, 5015 and 7065Å. Both the triplet and the singlet systems are well represented and it is quite likely that the undetected first line of the *2s - 2p* series is filled-in with emission. However, the presence of Si III, O II, N II and C II absorption lines in the visible spectrum seems to indicate a higher luminosity class than the one mentioned by Schmidt-Kaler. The equivalent width of Hγ points to the same direction. Its value of 3.7Å would better suit to a B 1.5 III-IV star rather than to a main-sequence object. If such is actually the case, the usually admitted $vsini$ value of 320 km/s seems indeed somewhat high .

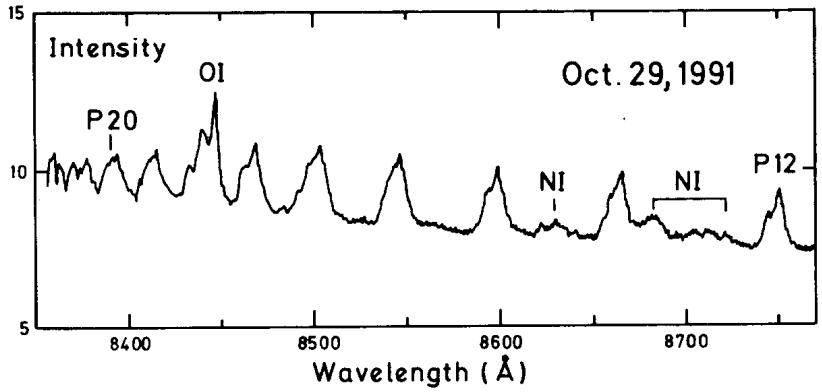

FIG. 2. Spectrum of 60 Cyg in the region of the higher members of the Paschen series. Intensity is on a linear scale. One intensity unit corresponds to 1.42 $10^{-12} erg cm^{-2} s^{-1} Å^{-1}$

In conclusion, it seems that 60 Cygni has started some time after August a new emission episode which develops at a rate that has not yet been observed. Therefore this object deserves a continuing interest from Be star observers, both photometrically and spectroscopically, especially in the red and in the infrared.

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References

ANDRILLAT Y., HOUZIAUX L. 1967 J. Observateurs, **50**,107
ANDRILLAT Y., JASCHEK M., JASCHEK C. 1988 Astron. Astrophys. Suppl. Ser. **72**, 129
COPELAND E , HEARD J.F. 1963 Publ. David Dunlap Obs.**2**, 11
GUNN J.E., STRYKER L.L. 1983 Astrophys.J. Suppl. Ser. **52**, 121
HARMANEC P.,HORN J., KOUBSKY P., BOZIC,H. 1986 I.B.V.S. 2912
HUBERT-DELPLACE A.-M., HUBERT H. 1979 Un atlas des étoiles Be, Obs. Paris-Meudon
SCHMIDT-KALER TH. 1967 Publ. Astron. Soc. Pacific, **79**, 181