

A SPECTROGRAPHIC STUDY OF THE SHELL STAR EW Lac

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ABSTRACT

38 Zeeman spectrograms of the Be star EW Lac (HD 217050) were obtained in three successive years, 1978, 1979 and 1980. The investigated lines show long-time variations of the radial velocities, line widths, and line intensities. No hints at the occurrence of a global magnetic field larger than 150 Gauss were found.

OBSERVATIONS AND REDUCTIONS

During the new activity of EW Lac (Hadrava et al., 1978 ; Harmanec et al., 1979 ; Poeckert, 1980) spectrograms of this star were obtained with a Zeeman analyzer at the Coudé focus of the 2-m telescope at Tautenburg . The reciprocal linear dispersion is 7.9 \AA mm^{-1} the width of the slit was equivalent to 0.16 \AA . The Hydrogen line H β as well as all unblended lines in the spectral region from about $\lambda\lambda$ 4000 to 4600 \AA have been measured with an oscilloscope display machine ; the density data of few special lines were recorded using a Zeiss microdensitometer.

RESULTS

Magnetic field :

The search for an effective magnetic field B_{eff} on EW Lac had a negative result. More exactly, the mean values of B_{eff} determined in conventional manner are -22, +34 and +8 Gauss respectively for the years 1978, 1979 and 1980. The maximum absolute values of B_{eff} found for the several years are 260, 210 and 180 Gauss with an accuracy (rms) of nearly ± 250 Gauss for a single plate.

This negative result is supported by missing significant differences in the anticircularly polarized line contours of especially selected lines. Neither a different broadening nor a different asymmetry of the profiles could be detected.

Radial velocities :

- a) Absorption lines :

The result of the observed temporal changes in the radial velocities of the absorption cores of H β , H γ , H δ and the metallic lines, smoothed by fitting the observations to polynom, is represented in Fig. 1a.

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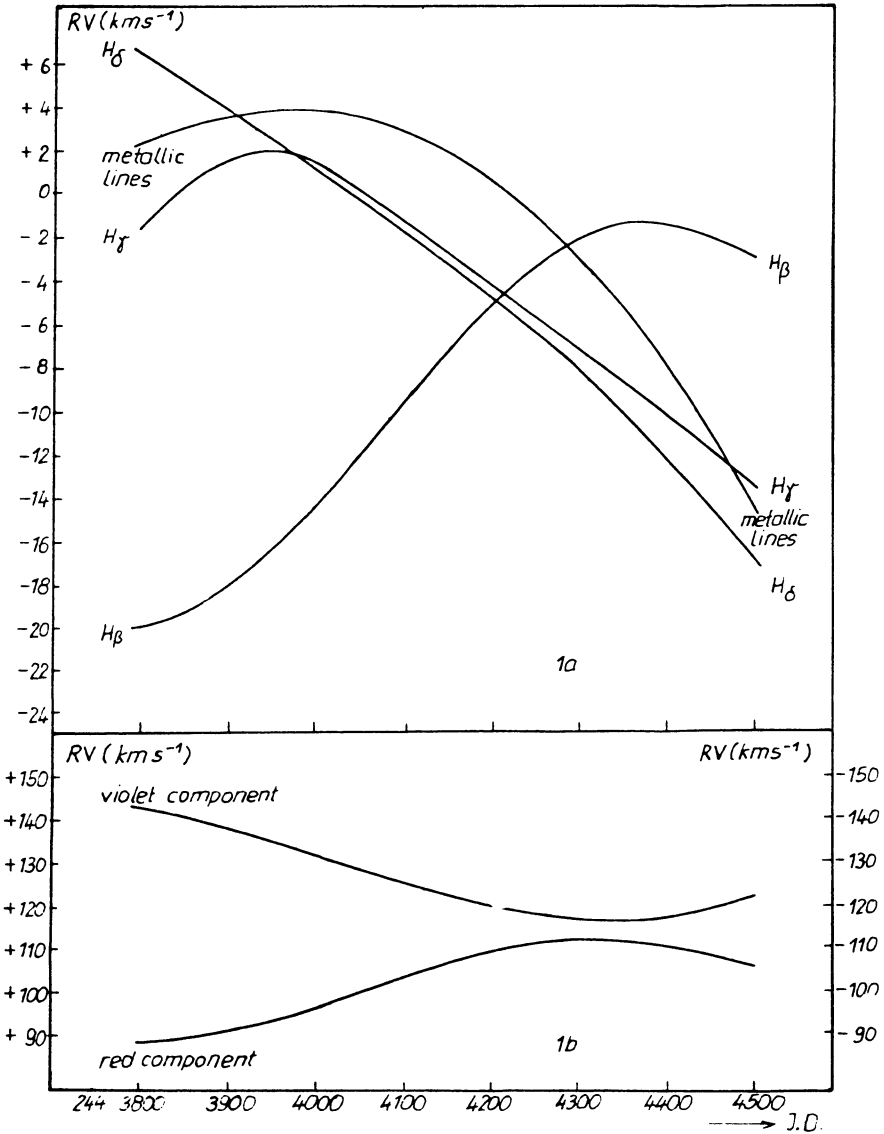


Fig. 1. Radial velocity of the absorption lines (1a) and radial velocity of the emission edges of H β (1b) in progress of time.

In 1978 H β yields velocities which are practically equal to those of the stable shell phase, that means, about -20 kms^{-1} while the velocity values of H δ are diminished by nearly 20 kms^{-1} . During 1980 the moving conditions are reversed to those of 1978. Besides the velocity variation, the metallic lines show also changes of the line widths equivalent to rotational velocity variations of 74, 99 and 82 kms^{-1} respectively for the years 1978, 1979 and 1980.

- b) Emission lines :

In Fig. 1b the velocity variations of the red and violet emission component of H β are represented. The observations reflect, what is expected by the variation of the absorption core of H β . No clear differences exist between the velocity values of H β and H δ , in the case the features of H δ could be measured. The V/R-ratio determined for some plates in each observational season changes from 2.2 for the year 1978 and 1979 to 1.0 in 1980.

DISCUSSION

The available data suggest that EW Lac is a single star. Obviously, an effect of a global magnetic field larger than about 100 Gauss on the dynamics of the envelope can be excluded. Concerning all observational results the simplest model for EW Lac seems to be an elliptical envelope revolving around the star connected with a strong disturbance crossing successively the inner and outer parts of the shell and indicating with this the presence as well of layers in contraction as in expansion. Furthermore, the existence of a fine structure of the shell is indicated by several peaks in the absorption cores of H β and H δ .

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