ACTIVE PHENOMENA OF THE Be STAR EW LAC OBSERVED IN 1978–1982*

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Abstract. The long-term variations of EW Lac in the Hγ and Hβ line profiles are presented. The active phase observed in 1978–1982 is characterized by the strengthening of emission lines accompanied by variations of radial velocities and V/R asymmetries. A model of a rotating elliptic ring is proposed.

EW Lac (HD 217050, B2IIIpe-shell, \(V \sin i = 350 \text{ km s}^{-1}\)) has been known as a typical shell star for many decades. The long-term variability of emission lines (V/R variations) has been inspected and an anomalous variation was found in 1978–1982 (Kogure and Suzuki, 1984; Kogure et al., 1984). Poeckert (1980) also reported spectrum variation in the early phase of this period. In order to examine the variability for the period 1970–1982 more closely, a series of coudé spectrograms obtained at the Okayama Astrophysical Observatory, with the dispersion of 10 Å mm\(^{-1}\) at Hβ, has been measured by PDS microdensitometers at the Kwasan Observatory and Tokyo Astronomical Observatory. Data reduction is carried out at the computer centers in Kanazawa Institute of Technology and Kyoto University.

In this paper we show a part of our measurements for the long-term variation of the Hγ and Hβ line profiles. First we consider the Hγ line which is characterized by double-peaked emission and a sharp central shell absorption feature, superimposed on a broad dish-shaped photospheric absorption. For the smoothed line profile the following quantities are defined and measured:

\(V_r\) and \(V_v\), heliocentric radial velocities of the red and violet emission peaks, respectively; \(V_m\), mean velocity of the two emission peaks; \(V_a\), heliocentric radial velocity of the center of the shell absorption component at its half depth; \(I_r\) and \(I_v\), relative intensities of the red and violet emission peaks, respectively, corrected with respect to the broad photospheric absorption; and \(\log(I_v/I_r)\), logarithm of the ratio of \(I_v\) and \(I_r\).

Figure 1 illustrates the time variations of these quantities, from which one may obtain the following conclusions:


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(1) Before 1976 the line profile was stable and quite symmetric, and the envelope could be represented by a circular gaseous ring or disk.

(2) Since 1978, the change of radial velocities and line asymmetry is remarkable. According to Huang (1973, 1975), this type of variation could be attributable to a rotating elliptic gas ring.

Although the highly asymmetric shell line in the active phase suggests a complicated structure of the envelope, we will simply assume a single elliptic ring, as a zeroth approximation. We can then obtain the following ring parameters: orbital period of the ring $P = 4.7$ yr, the ring ellipticity $e = 0.15$, and the semi-major axis of the ring $a = 9.5 R_\ast$, where we adopted Poeckert's values of $M_\ast = 9 M_\odot$ and $R_\ast = 7 R_\odot$ for the central star.