ON THE FORMATION OF BALMER EMISSION LINES IN THE MODEL ENVELOPES OF Be STARS

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Abstract. We consider the formation of the Balmer emission lines and the decrement $H\alpha/H\beta/H\gamma$, by solving the non-LTE problems in elementary regions of the envelope divided by equal line-of-sight velocities. These envelope-elements are characterized by different optical depths in the Balmer lines and by different dilution factors for the incident stellar radiation. It is shown that the decrements sensitively depend on these parameters of the envelope-elements. We show that the observed spectral-type dependence and large scatter of the decrements among Be stars can be explained in terms of the variation of these physical parameters.

Recently Dachs et al. (1990) and Slettebak et al. (1992) have made spectroscopic observations of Be stars and derived the Balmer decrements. They used the homogeneous plane-parallel slab model of Drake and Ulrich (1980) to discuss the physical properties of the envelope of Be stars. In this model the free parameter was only the electron density, so that it was not sufficient to explain the spectral-type dependence and large scatter of the Balmer decrements among Be stars. This shows the importance of full consideration for the radiation field of the envelopes in order to discuss the properties of Be star envelopes.

In this paper, we consider the basic problems of the formation of emission lines, based on the non-LTE treatment for the radiation field of the envelope of Be stars. Our approach is as follows:

1) The envelope is simplified by a hollow cylinder with finite vertical thickness and outwardly decreasing electron density.

2) The envelope is divided into the elements characterized by the line-of-sight velocity and dilution factor.

3) The radiation field of the envelope is solved for the Balmer lines based on the non-LTE treatment of Kogure (1959). Stellar parameters are taken from Kurucz (1979) model atmospheres.

4) The Balmer decrements $H\alpha/H\beta$, $H\gamma/H\beta$ are derived as a function of the optical depth $\tau(H\alpha)$, dilution factor W of the envelope-element and of the stellar effective temperature.

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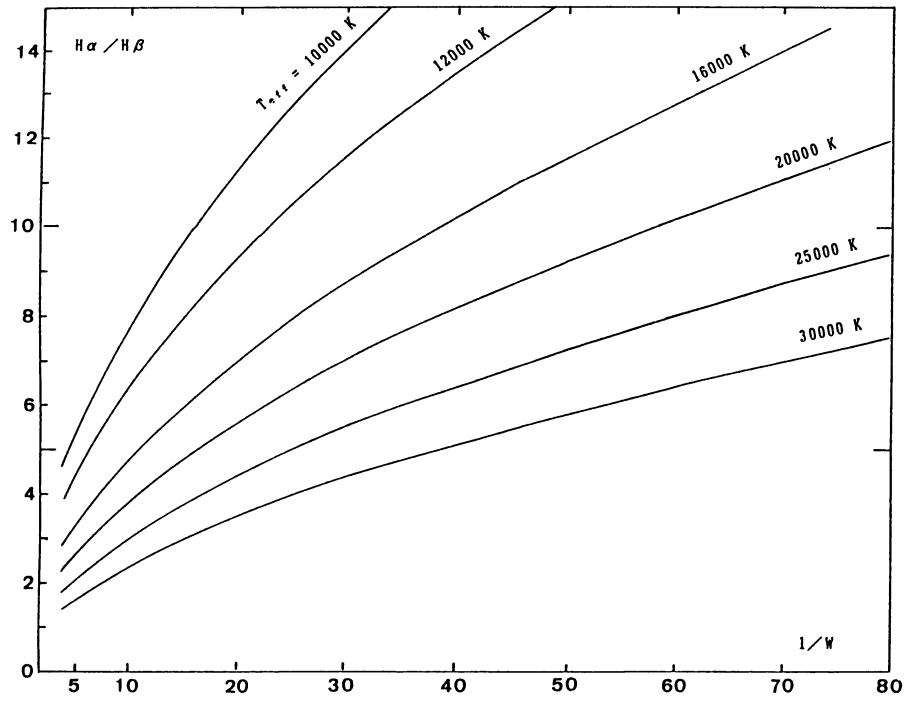

Fig. 1. Balmer decrement $H\alpha/H\beta$ formed in envelope-elements

The decrements $H\alpha/H\beta$ thus derived are shown in Fig. 1, for an optically thick envelope-element with $\tau(H\alpha) = 100$. Here we can see the specral-type dependence of the decrement. The construction of the model envelope as an integration of the envelope-elements will be given in future.

References

Dachs, J., Rohe, D., and Loose, A.S.: 1990, *Astronomy and Astrophysics* **238**, 227
Kogure, T.: 1959, *Publications of the ASJ* **11**, 127 and 278
Kurucz, R.L.: 1979, *Astrophysical Journal, Supplement Series* **40**, 1
Slettebak, A., Collins II, G.W., and Truax, R.: 1992, *Astrophysical Journal, Supplement Series* **81**, 335