

CIRCUMSTELLAR PECULIARITIES IN INHOMOGENEOUS ENVELOPES OF THE YOUNG HERBIG Ae/Be STARS

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ABSTRACT

Circumstellar peculiarities of the young Herbig Ae/Be stars are analyzed using high-resolution CCD spectroscopic data, obtained in 1991–1996 at the ESO and the Crimean Astrophysical Observatory (about 450 spectrograms). The results of investigation of the rapid line variability in $H\alpha$, $H\beta$, HeI 5876 and DNaI lines are presented for AB Aur, HD 163296, HD 36112, HD 100546, and HD 50138. We conclude that the behaviour of these lines can be explained in the framework of the model containing an equatorially concentrated and azimuthally inhomogeneous stellar wind, and an external cool shell that occasionally loses matter in form of infall onto the star.

Key Words : pre-main sequence star, rapid variability, stellar wind, matter infall, circumstellar inhomogeneity

More than 400 high-resolution CCD spectra ($R = 30\,000 - 50\,000$) of 5 objects are analyzed. AB Aur and HD 163296 are the most wellknown A0e Herbig stars from PCyg-subclass. HD 36112 was included to the new catalog of Herbig stars by The et al. (1994), and HD 100546 and HD 50138 were proposed as candidates Herbig stars (Hu et al. 1989 and Grady et al. 1994, respectively).

The spectroscopic data were obtained at the ESO (CAT 1.4m telescope) and at the Crimean Astrophysical Observatory (Shajn 2.6m telescope) in 1991–1996.

The main goal of the programme was to investigate structural and kinematical peculiarities in the gaseous circumstellar envelopes around the young stars of intermediate mass. The method of investigation was based on the study of rapid variability of line profiles for lines originating from different regions of circumstellar environment (HeI 5876, DNaI, $H\alpha$, and $H\beta$ lines).

Analysis of the variability on the timescales from hours to days revealed that:

1. These objects possess equatorially concentrated stellar wind exhibiting itself as episodic disappearance of the P Cyg-structure of the $H\alpha$ line profile.
2. The signs of both a stellar wind and infalling matter are seen in the HeI 5876 line for two objects (HD 100546 and HD 50138).
3. Two stars (HD 36112 and HD 50138) demonstrate noticeable asymmetry of the DNaI line profiles. They are probably surrounded by an opaque circumstellar disk. It may be of protostellar origin, or generated by flattened equatorial wind of low velocity ($V < V_{\text{esc}}$).
4. Local stream-like inhomogeneities are likely to exist in the envelopes of all the objects. They are displayed in the profiles as monotonous variations of the intensity in different profile components.

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