PROFILE VARIABILITY OF Hα IN THE B3E HERBIG STAR HD 200775 AS INDICATION OF MATTER INFALL AND INHOMOGENEOUS STELLAR WIND

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Abstract. Significant profile variability of Hα on the timescale of months is investigated on the basis of high-dispersion CCD spectra of the B3e Herbig star HD 200775 . Variations in position and shape of the central absorption component are considered to indicate complex structure of circumstellar environment, containing infalling streams and inhomogeneous stellar wind.

The well-known B3e Herbig star HD 200775 is situated in the centre of a compact region of star formation and associated with the reflection nebular NGC 7023. The circumstellar matter around the star has a rather complex structure. A rotation gaseous disc and stellar wind are likely to exist in the envelope. Distinct indications of their outer parts can be seen on the radio map of a molecular cloud in the vicinity of the star (Watt *et al.* 1986).

52 high-resolution ($R \sim 30\,000$) CCD spectra were obtained at the coude focus of the 2.6 m telescope of the Crimean Astrophysical observatory in 1986–1990. The normalization of all the spectra was performed relative to the level of quasicontinuum F_{qc} (a straight line drawn across narrow spectral bands, centered on two velocity values $-600\,\mathrm{km\,s^{-1}}$ and $+600\,\mathrm{km\,s^{-1}}$).

The results of our observations confirm the presence of strong Hα profile variations on the timescale of a month (Fig. 1–8). Positional shift of the central absorption was ranged from $-9 \pm 0.5\,\mathrm{km\,s^{-1}}$ (May 1986) upto $\sim 70\,\mathrm{km\,s^{-1}}$ (September 1990). This gives evidence of the existence of the radial motions in the circumstellar envelope in both directions—towards and outwards the star.

The variability, observed in July, 1986 (appearence of a number of discrete details, moving from $-50\,\mathrm{km\,s^{-1}}$ upto $+40\,\mathrm{km\,s^{-1}}$ in Fig. 3, 4) can be qualitatively interpreted as a portional matter infall to the star as a result of a stellar wind interaction with a cool outer envelope.

References

Watt,G.D., Burton, W.B.,Choe, S.-U., List, H.S.: 1986, *Astron.Astrophys.* **163**, 194

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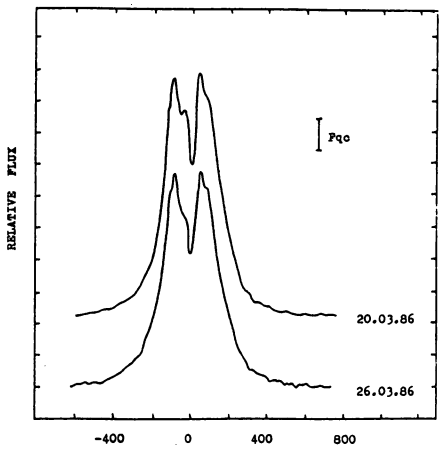

Fig. 1. Line profiles of Hα observed in HD 200775 in March, 1986. The vertical bar provides the flux scale in the units of quasicontinuum F_{QC} (see in the text). No attempts have been made to remove telluric water vapour lines.

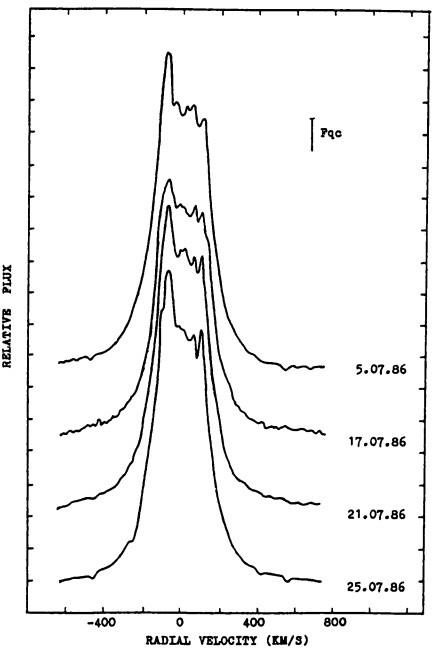

Fig. 3. The same as Fig. 1 except for July, 1986

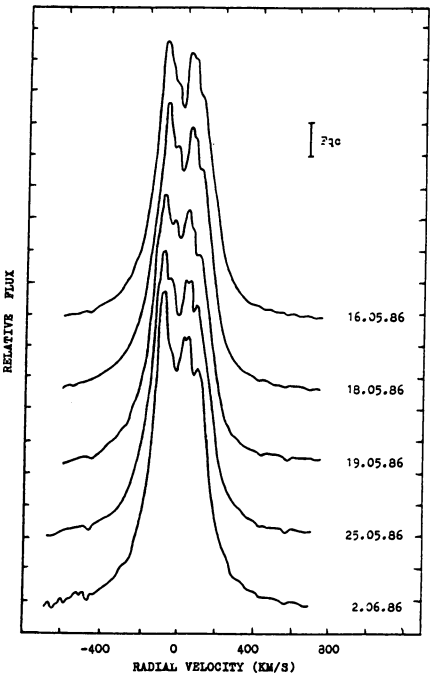

Fig. 2. The same as Fig. 1 except for May–June, 1986

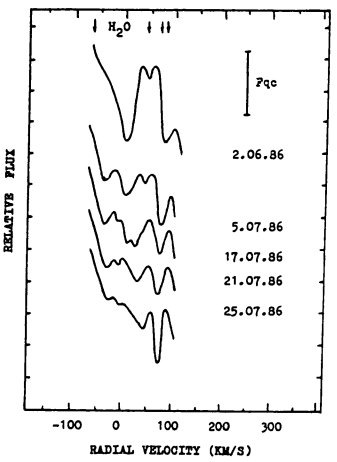

Fig. 4. The large-scale fragments of the line profiles, observed in July, 1986 in comparison with the spectrum of June,2 1986. Discrete emission and absorption features display variations with characteristic time less than a day. Water vapour lines are marked by arrows.

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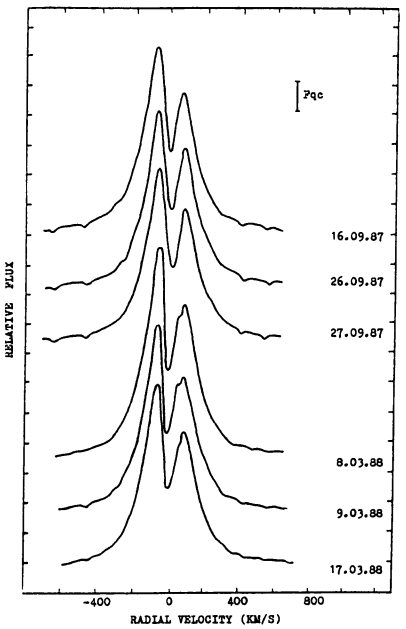

Fig. 5. The same as Fig. 1 except for September, 1987 and March, 1988.

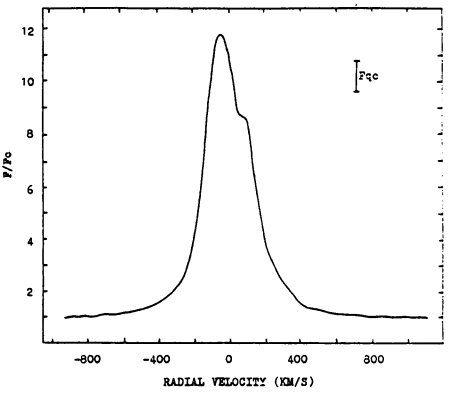

Fig. 6. Line profile of Hα, observed on September,1 1990 in the units of real local continuum F_C. The vertical bar shows the level of quasicontinuum F_{qc}.

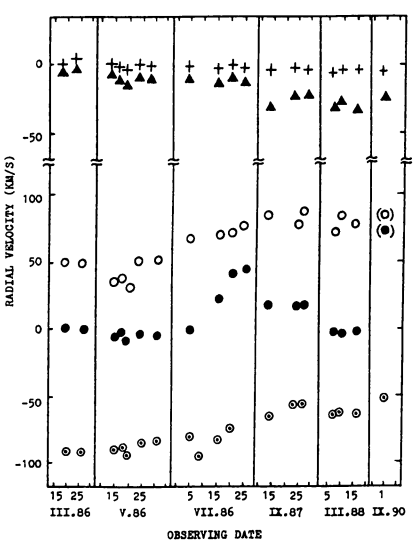

Fig. 7. Time dependence of radial velocities for different profile components, denoted by:
(+)—for the centre of gravity (V_c),
(△)—for the bisector at the $4F_{qc}$ level (V_{bis}),
(⊙)—for the blue emission peak (V_{be}),
(○)—for the red emission peak (V_{re}) and
(○—for the central absorption (V_a).

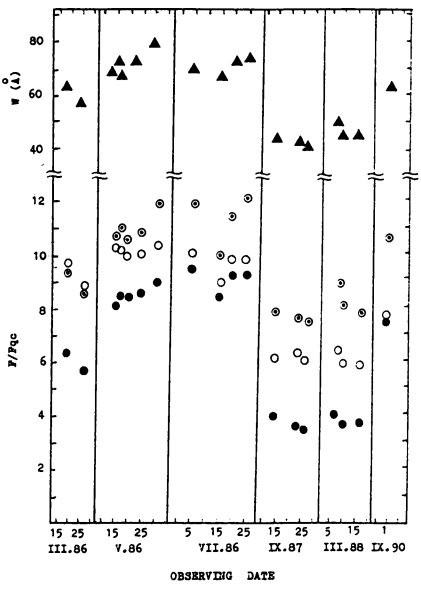

Fig. 8. Time dependence of emission equivalent width W (△) and of relative flux for the blue emission peak (⊙), the absorption component (○), and the red emission peak (○). All the values are calculated using the quasicontinuum level.

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