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# Circumstellar magnetic fields in Herbig Ae stars

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**Abstract.** We present the results of our latest studies of circumstellar magnetic fields in Herbig Ae stars, and briefly discuss the cause of the failure of another recent study to confirm the Zeeman features in our spectra.

**Key words:** stars: pre-main sequence – stars: magnetic fields

## 1. Observations and results

Numerous theoretical studies predict the presence of a global magnetic field of complex configuration around Herbig Ae stars. Our determinations of longitudinal magnetic fields for these stars were carried out with FORS 1 at the VLT in service mode from April 2003 to June 2005, at a resolving power of 2000 to 4000. A magnetic field at a level higher than $3\sigma$ was diagnosed for the stars HD 31648, HD 139614, and HD 144432 (Hubrig *et al.*, 2004; 2006; 2007). We also showed that the Ca II H&K lines in the Stokes $V/I$ spectra of the Herbig Ae stars HD 31648 and HD 190073 display multi-component complex structures. These lines are very probably formed at the base of the stellar wind, as well as in the accretion gaseous flow. In our studies we concluded that a magnetic field is present in both stars, but that it is mostly of circumstellar origin. Using only the Ca II H&K lines for the measurement of circular polarization in HD 190073, we were able to diagnose a longitudinal magnetic field at $2.8\sigma$ level, $\langle B_z \rangle = +84 \pm 30$ G. That value is in full agreement with the high-resolution spectropolarimetric data obtained with ESPaDOnS by Catala *et al.* (2007), who measured a longitudinal magnetic field $\langle B_z \rangle = +74 \pm 10$ G using metallic lines. Unfortunately, the $S/N$ ratio of the ESPaDOnS polarimetric spectra is too low in the spectral region containing the Ca II doublet, and thus it was not used to measure the circumstellar magnetic field.

## 2. Discussion

Recently, Wade *et al.* (2007) reported that their FORS 1 spectra of the same Herbig Ae stars do not show Stokes $V$ signatures in the Ca II H&K lines. They commented that their measurements used broad slit widths, up to $1''$, which greatly degrade the resolution of the Stokes $V$ spectra and could cause the wrongly deduced longitudinal magnetic fields. However, the authors also claimed

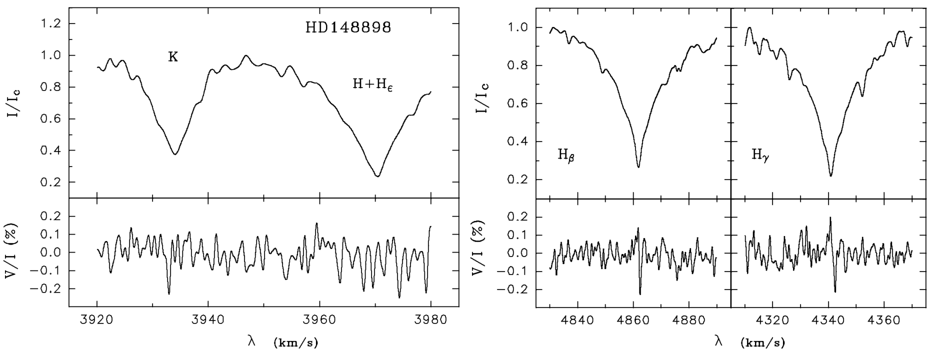


**Figure 1.** The Ca II H&K profiles (left panel) and H$\beta$ and H$\gamma$ profiles (right panel) of HD 148898 and the corresponding Stokes $V$ spectra.

that they were not able to find the polarization features in our FORS 1 spectra, which they had downloaded from the ESO archive. Quite puzzled by their report and even more by their apparent problem with the reduction of FORS 1 spectra, we compared our measurements of Herbig Ae stars with those of other A-type stars. In Fig. 1 we present an example of Stokes $I$ and Stokes $V$ spectra of the weak magnetic A-type star HD 148898 with strong Ca II H&K lines observed by us with FORS 1 with a resolving power of 2000. Our reduction has been carried out in the same way as for the Herbig Ae stars. No Zeeman features could be detected at the positions of the Ca II doublet, confirming that the presence of distinct Zeeman features in Herbig Ae stars is not a reduction artefact. However, noticeable Zeeman features appear at the position of the hydrogen H$\beta$ and H$\gamma$ lines. It is not clear to us why Wade *et al.* (2007) did not find the polarisation Ca II H&K features which we have repeatedly found in Herbig Ae stars, but not in other stars with strong Ca II H&K lines. Since we do not know their exact data reduction software, we can neither blame nor rule out a problem with their routines.

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