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A comparative study of B-type pulsators and non-pulsating chemically peculiar Bp stars

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Abstract

We carry out a comparative study between a sample of confirmed and well-studied B-type pulsators and a sample of well-studied Bp stars with known periods and magnetic field strengths. Our study indicates that the group of Bp stars is younger than the group of SPB stars and that stars with stronger magnetic fields have much lower pulsation amplitudes.

Star samples and parameter determination

We selected our sample of magnetic Bp stars from the recent catalogues of Bychkov et al. (2003, 2005) and Hubrig et al. (2006a). We considered stars with masses between 3 and 9 $M_{\odot}$, for which the rotation periods and magnetic field strengths are known. The list of confirmed SPB stars was retrieved from De Cat (2002). The only consistent way to determine the position of the stars of both samples in the H-R diagram is to use Hipparcos parallaxes. We retained stars with sufficiently accurate parallaxes, i.e. where $\sigma(\pi)/\pi < 0.2$, and with available Geneva or Strömgren photometry. Our sample consists of 24 Bp stars and 24 SPB stars. Explanations on the determination of the fundamental parameters can be found in Hubrig et al. (2000).

Evolutionary state and magnetic field strength comparisons

The cumulative distribution of $\log g$ for the Bp stars and SPB stars in our sample is shown in Fig. 1. A Kolmogorov-Smirnov test shows that the distribution of the values of $\log g$ for the Bp stars differs from the distribution for SPB stars at a significance level of 98.3 %. We consequently conclude that the group of Bp stars is younger than the group of SPB stars.

It is well-known that magnetic fields are observed in most Bp stars. Recently, Hubrig et al. (2006b) performed a systematic search for magnetic fields in B-type pulsators with the FORS 1 instrument at the VLT. The histogram in Fig. 1 clearly shows that longitudinal magnetic fields in pulsating B stars are rather weak in comparison to the fields detected in Bp stars. This indicates that very strong magnetic fields are not co-existent with oscillations, or that stars with stronger magnetic fields have much lower pulsation amplitudes.

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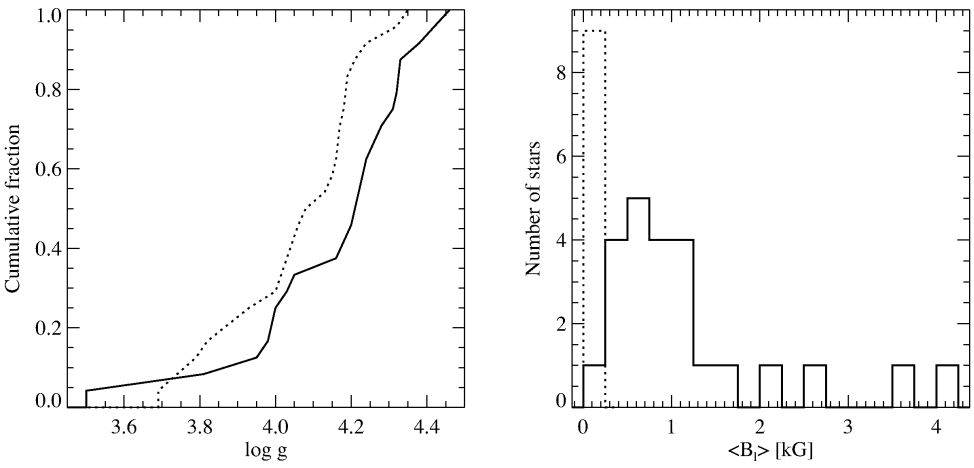

Figure 1: Left: Cumulative distribution of $\log g$ for the Bp stars (full line) and the SPB stars (dotted line). Right: Distribution of the longitudinal magnetic field values $\langle B_l \rangle$ for the Bp stars (full line) and the SPB stars (dotted line).

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