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Spectral and photometric study of Be Stars in the first exoplanet fields of CoRoT

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Abstract. First we investigate the spectral and photometric properties (colours, magnitudes) of a sample of faint Be stars observed in the first exoplanet fields of CoRoT (IR1, LRA1 and LRC1). We determine the fundamental parameters by fitting ESO-FLAMES/GIRAFFE spectra with synthetic models taking account for non-LTE effects. After that we correct these parameters from fast rotation effects. We also study the location of each star in the (logL vs logT) HR diagram. Second we start to analyse the CoRoT light curves to investigate further the possible correlation between the pulsating properties and the fundamental parameters of the stars.

Keywords. stars: emission-line, Be, stars: fundamental parameters

1. Introduction

A spectroscopic survey has been initiated to characterize the variable faint stars discovered in exoplanetary fields of CoRoT (PI: C. Neiner). Thanks to this programme we obtained spectra for a fraction (about 10%) of the stars observed by CoRoT in the first exoplanetary fields (IR1 and LRA1 toward the Galactic anticentre direction and LRC1 toward the Galactic centre direction). In these 3 fields CoRoT observed 31286 variable stars and we obtained a spectral coverage for 4005 ones. The spectra were recorded at medium resolution with the multi-object spectrograph FLAMES/GIRAFFE mounted at the ESO-VLT/UT2. In the majority of the cases we acquired one spectrum in the blue domain (R=6400; $\lambda\lambda$= 3964-4567 Å) and two spectra in the red one (R=8600; $\lambda\lambda$= 6438-7184 Å). Our goal is the detection of emission line stars (ELS) by observation of Balmer lines, the identification of Be stars and the determination of their fundamental parameters. We discovered 17 OBAe in the IR1 and LRA1 and only one in the LRC1. We have been able to determine the fundamental parameters for only 10 stars due to the lack of spectra in the blue domain.

2. Determination of the parameters

To determine the fundamental parameters of Be stars we use the procedure developed by Frémat *et al.* (2005), which takes account for veiling and fast rotation effects. The method is decomposed in 3 parts :

Apparent fundamental parameters determination: We use the GIRFIT programme to derive the effective temperature, surface gravity, projected rotational velocity and radial velocity. This programme adjusts the observations between 4000-4500 Å with theoretical

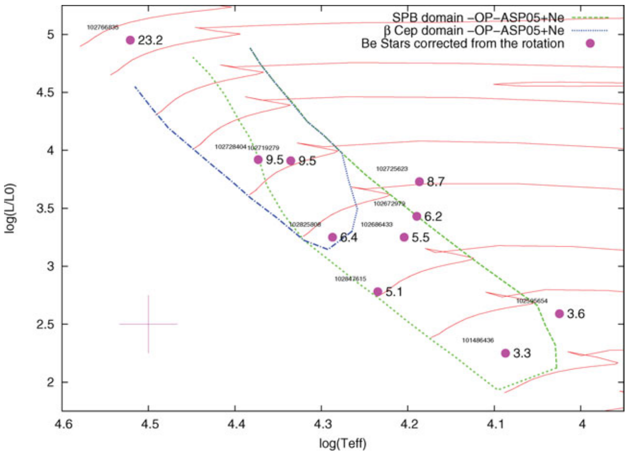

Figure 1. Location of the Be stars corrected from veiling and fast rotation.

spectra interpolated in a grid of stellar fluxes computed with the SYNSPEC programme and from model atmospheres calculated with TLUSTY Hubeny & Lanz (1995) or / and ATLAS9 Kurucz (1993).

Correction of veiling: The spectra of the Be stars are affected by emission lines. When the emission is strong in lines, the continuum is also affected. We use an empirical approach developed by Ballereau *et al.* (1995).

Correction of fast rotation effect: Be stars are very fast rotators. This rotation induces a modification of the shape of the star (flattening) and different physical processes (gravitational darkening). We correct parameters by adopting a rate of 90 % of the breakup velocity.

3. Results

The 18 ELS detected in the first exoplanetary fields of CoRoT are probably classical Be stars. We determine the apparent fundamental parameters and correct them from veiling and fast rotation ($\omega/\omega_c = 0.9$). The mass, luminosity, radius of each target have been derived from evolutionary tracks from Schaller *et al.* (1992). In the HR diagramme 6 Be stars are located in the first part in the main sequence and 4 Be stars are close to the end of the main sequence (TAMS) (Fig. 1). The instability strips for β Cephei and SPB stars taken from Miglio *et al.* (2007) are depicted in Fig. 1. We have begun a global analysis of the CoRoT light curve of the Be stars. Generally the frequency spectrum shows a forest of frequencies around one or two main frequencies as well as several isolated frequencies. However we note that two Be stars, which are at the frontier of the SPB domain, show a very poor frequency spectrum. In a next step, we will study the global characteristics of the frequency spectra derived from the CoRoT light curves for these objects in relation to their location in the HR diagramme.

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