Active OB stars: structure, evolution, mass loss, and critical limits
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Asteroseismology and rotation in the main sequence

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Abstract. In this project, we study the effects of stellar rotation on the pulsation predictions for stars in the Main Sequence following the series δ Scu, γ Dor, SPB, Be and β Cep. The objects' rotation in this series span from a few km/s to a few hundreds of km/s. We will compare theoretical predictions yielded by the codes CESAM/FILOU with published data from the MOST and CoRoT satellites. A better diagnostic of the rotation effects on stellar pulsations will help to improve the oscillatory models.

Keywords. stars: oscillations (including pulsations), stars: rotation

1. Introduction

The behavior of the oscillations is determined by the cavity where they are formed, giving direct information of the internal structure of the star (Christensen-Dalsgaard, 2003). Non-radial oscillation has been detected in almost all types of stars in many stages of stellar evolution (e.g., Aerts *et al.*, 2008).

The physical nature of the oscillations are either of the nature of standing acoustic waves (commonly referred to as pressure modes or p modes) or internal gravity waves (g modes). The oscillations modes are described by spherical harmonics with numbers l and m in a radial field with number n (Unno *et al.*, 1989).

2. Rotation

A star with uniforme angular velocity has a coordinate system in the frame rotating with the star (r', θ', ϕ') related with the coordinates (r, θ, ϕ) in an inertial frame through (e.g., Christensen-Dalsgaard, 2003)

$$(r', \theta', \phi') = (r, \theta, \phi - \Omega t) \tag{2.1}$$

Thus the frequency is split uniformly according to m by

$$\omega_m = \omega_0 + m\Omega \tag{2.2}$$

3. Purpose

The project aim to study the effect of rotation in the oscillation spectrum predicted theoretically for stars in the main sequence.

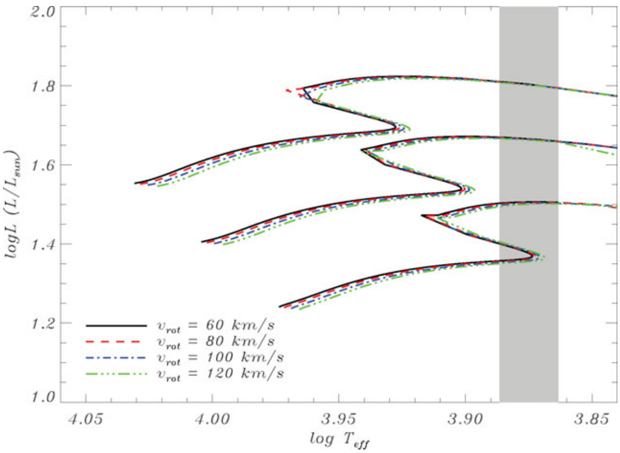

Figure 1. Evolutionary tracks of stars models with masses of 2.0 $M_\odot$ (bottom lines), 2.2 $M_\odot$ and 2.4 $M_\odot$(upper lines). The grey box represents the uncertainty in effective temperature by Poretti *et al.* (2009).

4. Methods

The theoretical predictions are yielded by the codes

- CESAM (Morel, 1997) that calculate the stellar internal structure and evolution;
- FILOU (Suárez & Goupil, 2008) that calculate the oscillations frequencies.

5. Preliminary Results

The preliminary results are for the δ Scu star HD 50844 observed with CoRoT and published by Poretti *et al.* (2009). The evolutionary tracks for a star with masses of 2.0 - 2.4$M_\odot$ and rotational velocity 60 - 120 km/s were calculated with CESAM. Figure 1 shows the models that falls inside the uncertainty box. The oscillations frequencies were already calculated with FILOU and are been analyzed.

6. Future Prospects

Compare the frequencies calculated for the star HD 50844 with the observations with CoRoT. Do the same analysis with other stars (different masses and rotation velocity) in the main sequence.

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