Mem. S.A.It. Vol. 77, 470

Memorie della

Asteroseismology of γ Doradus stars and the COROT mission

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Abstract. We present results of multisite ground-based observations of a γ Doradus, and the potential of the COROT EXO-field for these stars.

Key words. Line: profiles – Stars: variables: γ Doradus – Stars: oscillations

1. The γ Doradus stars

Among the g-pulsators, γ Doradus stars represent very interesting targets. First, their location between solar-like and δ Scuti stars offers new constrains to stellar structure in the same range of masses. Second, they are much more numerous, closer, and luminous than other g-pulsators such as SPBs or SdBs.

However, g-modes imply numerous long-periods (typically 1 d) thus a time basis of observations of the order of months or even years. With "Long Runs" of 150 d duration, the COROT mission (e.g. (Michel et al. 2005)) has a decisive potential in the framework of asteroseismology since many frequencies should be derived.

2. Ground-based observations

Due to their pulsation properties, observations of γ Doradus stars require intensive monitoring campaign. We undertook a multisite (Haute-Provence Observatory and Kitt Peak National Observatory) spectroscopic campaign (1 week) for HD 211699 in order to derive the main frequencies. We performed a frequency analysis directly on the line profile using the CLEAN algorithm (Fig 1). The dominant peak occurs for a frequency of $0.93\,\mathrm{d}^{-1}$, and is of course present in both lines. This frequency corresponds to the main one detected with Hipparcos (Handler 1999). Frequency analysis is the first step towards mode identification (see (Jankov et al. 2005)).

3. The COROT EXO-field

The COROT satellite is dedicated to both asteroseismology and planetary transits through respectively the SISMO field (accuracy around 1 ppm, depending on the magnitude, between 6 and 9) and the EXO field (accuracy around 100 ppm, for magnitudes between 10 and 16). The EXO-field consists in 2 CCD covering each 1.7^o close to the Galactic plane. 6 000 main targets will be systematically monitored on each CCD.

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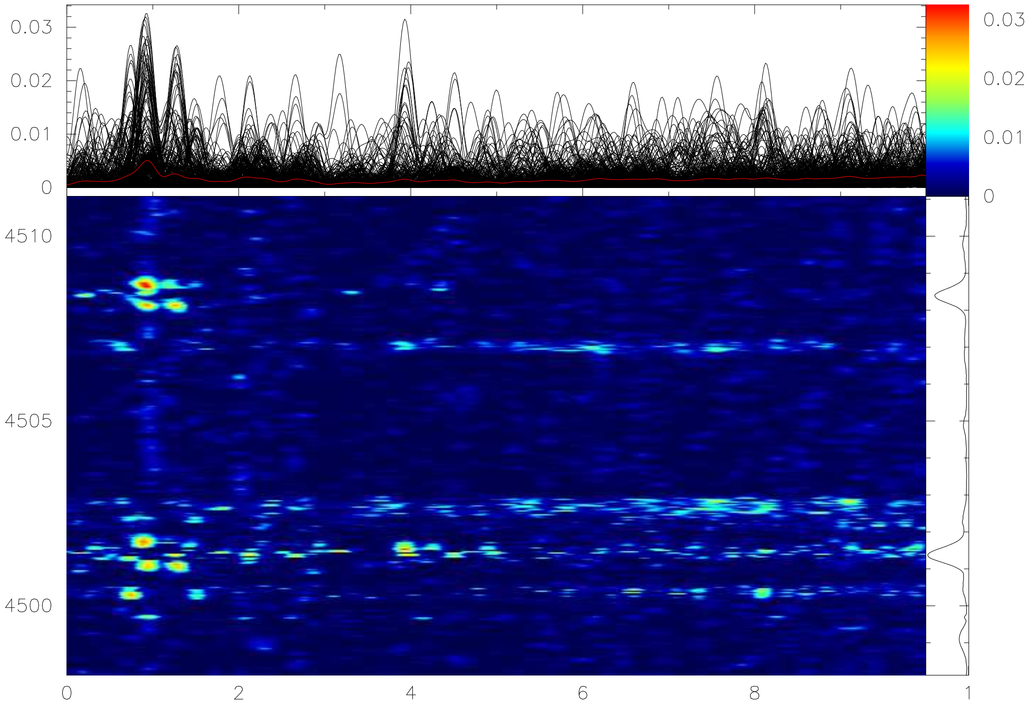

Fig. 1. Lower right: mean profile of the two considered lines: Ti II (4501 Å) and Fe II (4508 Å). Bottom: Fourier transform considering each wavelength. Top: the different periodograms associated to each pixel, the continuous line representing the average.

We simulated the stellar field for the winter 2006 long run (1 CCD) with the Besançon Stellar Population model (Robin et al. 2003). The model provides a sample of 26 000 stars in the field up to V=19. We considered 7 classes of pulsating stars selected upon simple criteria (absolute magnitude, spectral type and luminosity class). The sampling shows a potential (100 % of the stars in a given instability strip are pulsating) of 2 β Cepheids, 29 SPBs, 3749 δ Scuti, 2059 γ Doradus, 930 hybrids δ Scuti/γ Doradus, 1 Cepheid and 46 Long Period (essentially Miras) stars.

4. The Corot γ Doradus Team

In order to have the better scientific return of the COROT mission, a specific project[1] devoted to γ Doradus stars has been initiated with the following objectives:

- Characterization of γ Doradus stars in the SISMO FoV: variability (spectroscopy and photometry: time scales, LPV...), mode identification (moments, FDI, photometric amplitudes...) and fundamental parameters (abundances, rotation, binarity...)
- Simulation of γ Doradus stars in the EXO FoV: expected variables (pulsating, geometric, cataclysimic), signal determination (relative photometric precision $\simeq 10^{-4}$), mode identification from CDC 3-colour lightcurves

[1] The team includes more than 30 researchers, see `www.obs-nice.fr/gdor_corot/index.html`

References

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