In CoRoTPub since last SC 43 (April the 18th)

Astronomy & Astrophysics manuscript no. HD51452˙Neiner
June 14, 2012

Stochastic gravito-inertial modes discovered by CoRoT in the hot Be star HD 51452⋆

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ABSTRACT

Context. Be stars are rapidly rotating stars with a circumstellar decretion disk. They usually undergo pressure and/or gravity pulsation modes excited by the κ-mechanism, i.e. an effect of the opacity of iron-peak elements in the envelope of the star. In the Milky Way, p-modes are observed in stars hotter or equal to the B3 spectral type, while g-modes are observed at the B2 spectral type and cooler.

Aims. We observed a B0e star, HD 51452, with the high-precision high-cadence photometric CoRoT satellite and high-resolution ground-based HARPS and SOPHIE spectrographs to study its pulsations in great details. We also use lower resolution spectra available in the BeSS database.

Methods. We analyzed the CoRoT and spectroscopic data with several methods: CLEAN-NG, FREQFIND, and a sliding window method. We also analyzed spectral quantities, such as the violet over red (V/R) emission variations, to obtain information about the variation of the circumstellar environment. We calculated a stellar structure model with the ESTER code to test the various interpretation of the results.

Results. We find that HD 51452 undergoes gravito-inertial modes that are not in the domain of those excited by the κ-mechanism. We propose that these are stochastic modes excited in the convective zones and that at least some of them are r-modes (i.e. sub-inertial modes mainly driven by the Coriolis acceleration). Stochastically excited gravito-inertial modes had never been observed in a massive star and theory predicted that their very low amplitudes would be undetectable even with CoRoT. We suggest that the amplitudes is enhanced in HD 51452 because of the very rapid stellar rotation. In addition, we find that the amplitude variations of these modes are related to the occurence of minor outbursts.

Conclusions. Thanks to CoRoT data, we have detected a new kind of pulsations in HD 51452, stochastically excited gravito-inertial modes, probably due to its very rapid rotation. These modes are probably also present in other rapidly rotating hot Be stars.

Key words. Stars: emission-line, Be – Stars: individual: HD 51452 – Stars: oscillations – Stars: rotation

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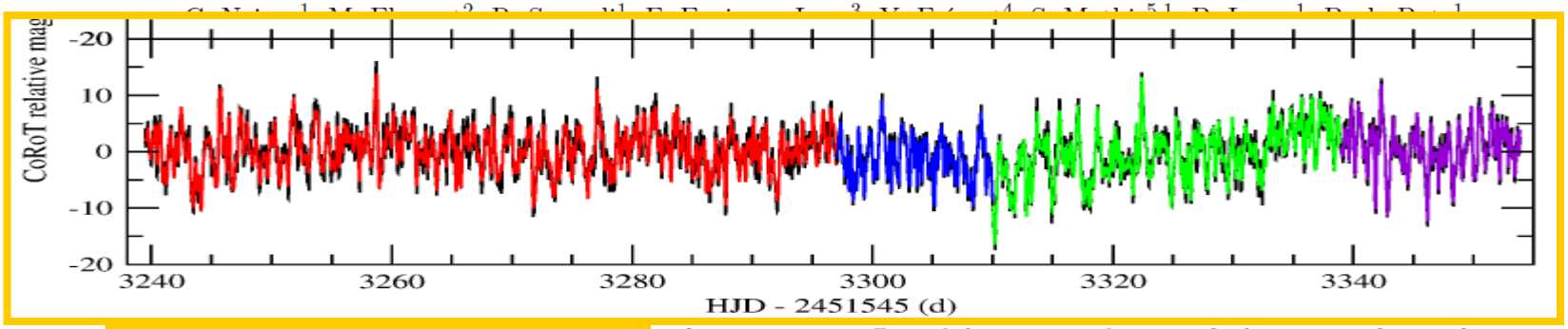

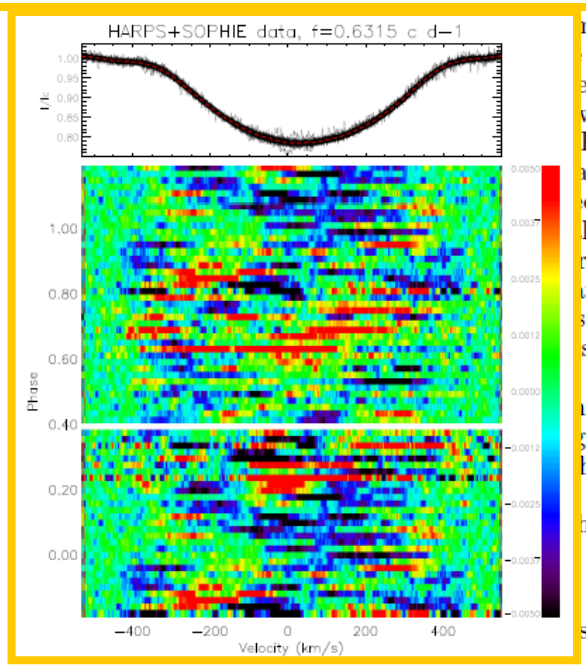

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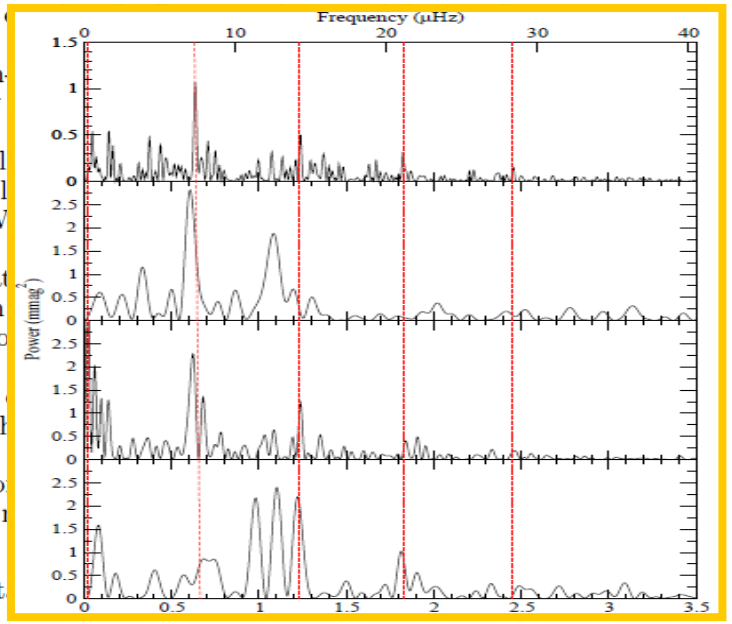

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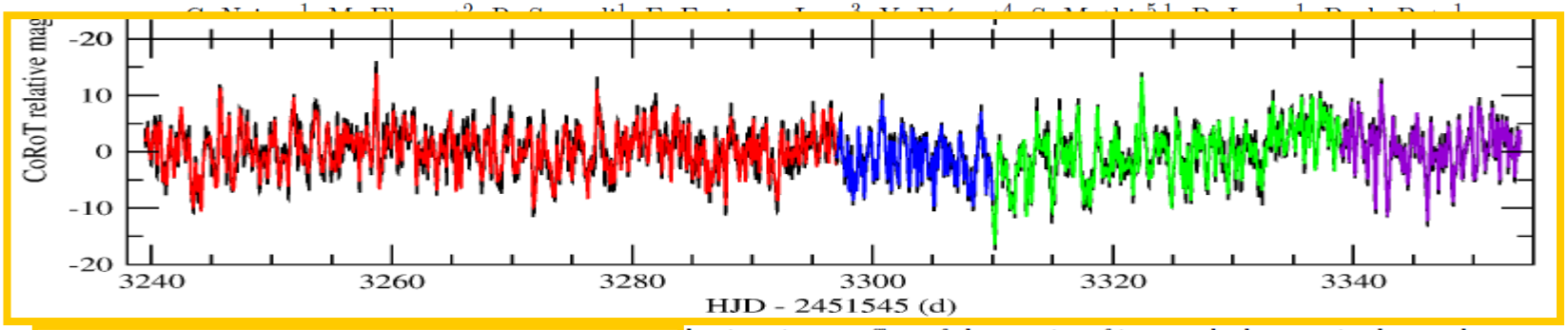


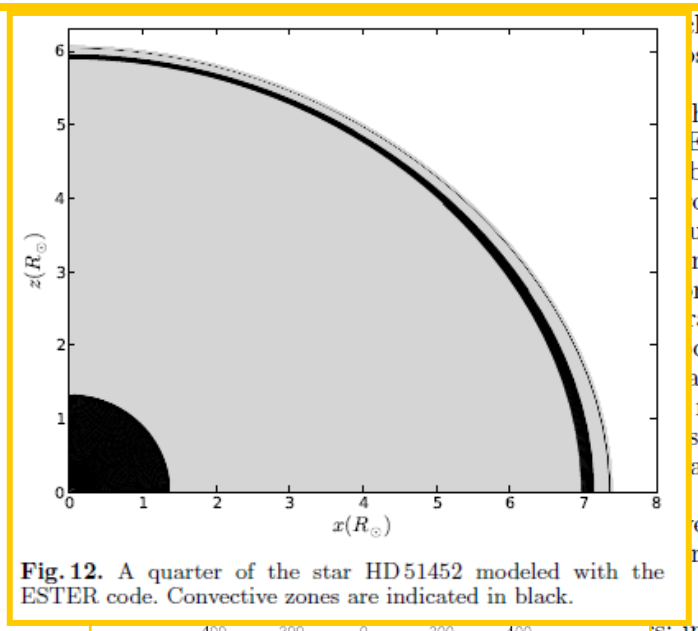
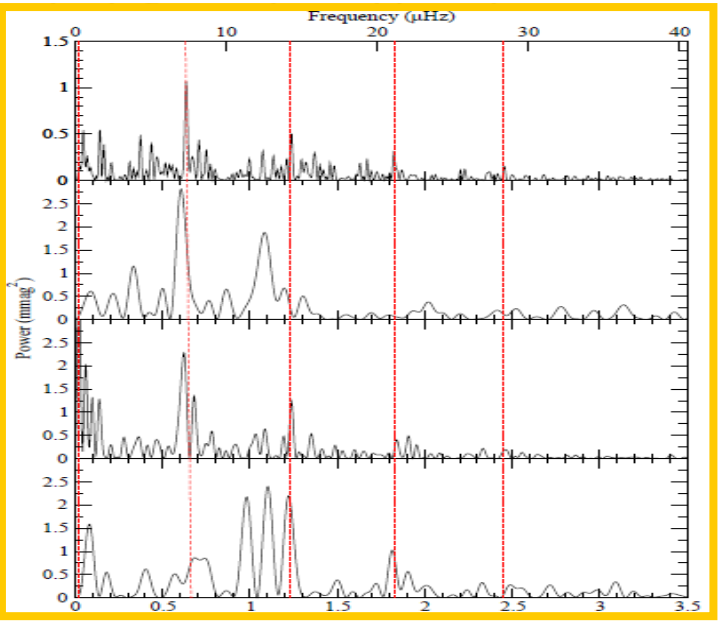


Fig. 12. A quarter of the star HD 51452 modeled with the ESTER code. Convective zones are indicated in black.



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Astronomy & Astrophysics manuscript no. HD169392˙v7
May 23, 2012

Study of the binary system HD169392 observed by CoRoT ⋆ and HARPS⋆⋆

S. Mathur[1,2], H. Bruntt[3], C. Catala[4], O. Benomar[5], G. R. Davies[2], R. A. García[2], D. Salabert[6], J. Ballot[7,8], B. Mosser[4], C. Régulo[9,10], W. J. Chaplin[11], Y. Elsworth[11], R. Handberg[3], S. Hekker[12,11], L. Mantegazza[13], E. Michel[4], E. Poretti[13], M. Rainer[13], I. W. Roxburgh[14], R. Samadi[4], M. Stęślicki[15,1] K. Uytterhoeven[9,10], G. A. Verner[11], M. Auvergne[4], A. Baglin[4], Sebastiá Barceló Forteza[9,10], F. Baudin[16], and Teodoro Roca Cortés[9,10]

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ABSTRACT

Context. The numerous results obtained with asteroseismology thanks to space missions such as CoRoT and *Kepler* are providing a new insight on stellar evolution. After five years of observations, CoRoT is still providing high-quality data. We present here the analysis of the binary system HD 169392 combined with spectroscopic observations done with HARPS.
Aims. This work aims at characterizing the fundamental parameters of the two stars, their chemical composition, the acoustic-mode global parameters including their individual frequencies, and their dynamics.
Methods. We have analyzed HARPS observations of the two stars to retrieve their chemical compositions. Several methods have been used and compared to measure the global properties of acoustic modes and their individual frequencies from the photometric data of CoRoT.
Results. We obtain the spectroscopic parameters of the two components of the binary system. However, only the p-mode signature of HD 169392 A has been measured within the CoRoT data. We were able to extract p-mode parameters of modes for ℓ=0, 1, 2, and 3. We detect two avoided crossings. Finally, the study of the splittings and inclination angle gives two possible solutions with splittings and inclination angles of 0.4-1.0 μHz and 20-40° for one case and 0.2-0.5 μHz and 55-86° for the other case.

Key words. Asteroseismology – Methods: data analysis – Stars: oscillations – Stars: individual: HD 169392

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, G. R. Davies[2], R. A. García[2], D. Salabert[6], J. Ballot[7,8], B. Mosser[4],
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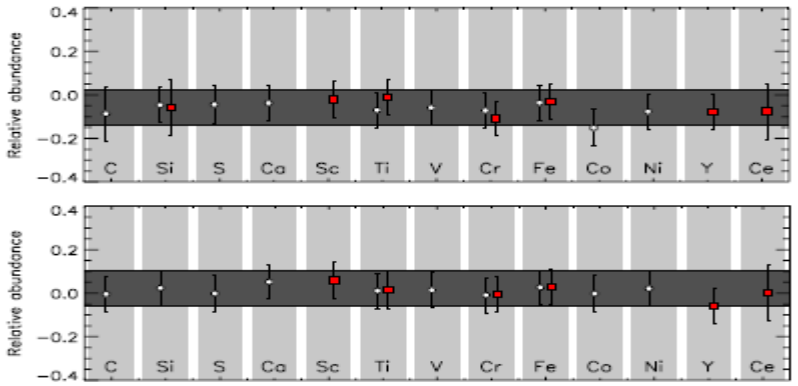
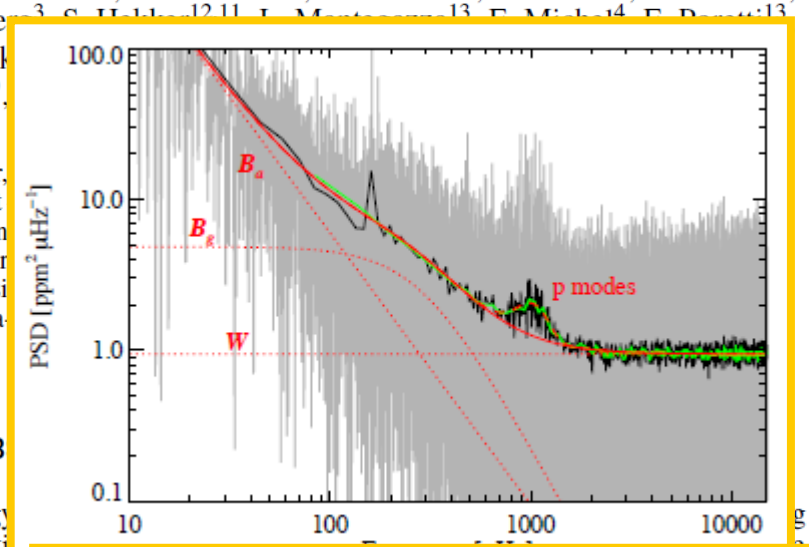
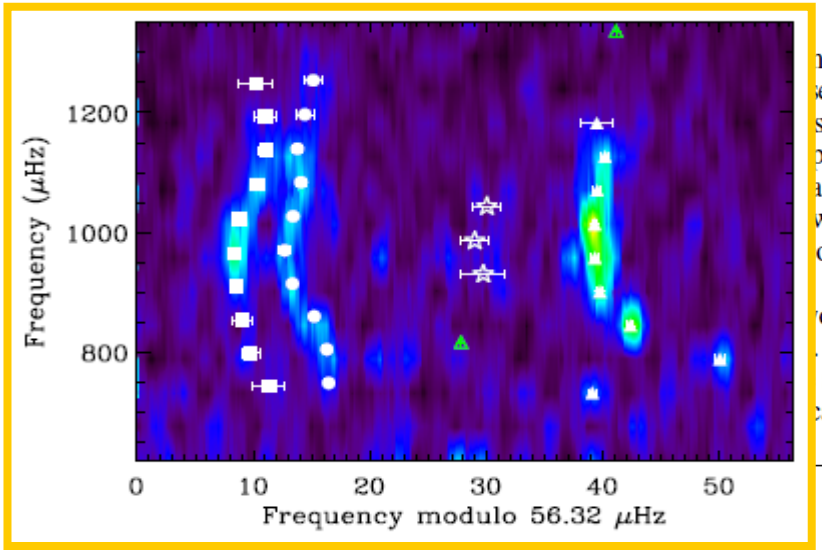


Fig. 1. Abundances for 14 elements relative to the Sun for the A (top) and B (components) of the system. Circles and box symbols are used for





AB

We measured the global parameters of the p modes of HD 169392A leading to $\langle\Delta\nu\rangle$ of $56.3 \pm 1.2\,\mu$Hz and ν_{max} of $1030 \pm 55\,\mu$Hz. This allows us to have a first estimation of the mass and radius of the star using scaling relations based on solar values: $1.34 \pm 0.26\,M_\odot$ and $1.97 \pm 0.19\,R_\odot$.

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1336 μHz. From these avoided crossings, we derive the gravity spacing $\Delta\Pi_1 = 477 \pm 5$ s. We conclude that this star is quite evolved but not yet on the red-giant branch.

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Also:

- Red Giants: Miglio et al. In prep…('Galactic archeology: mapping and dating stellar populations with asteroseismology of giants' to be submitted to Nature

- HD43587 (MS solar-like pulsator)…in prep (aiming at submission by end of July)

- NGC2264: …(cf Annie and Konstanze)