

γ Doradus stars in the exoplanets fields: first inspection

γ Doradus Thematic Team

http://www.oca.eu/gdor_corot/index.html

Introduction

The γ Doradus Thematic Team involves about 40 persons in 30 institutes, brought together through the COROT AoO for the APs.

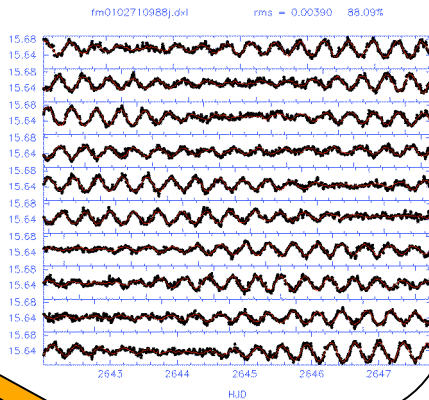
The aims of the AoO were:

- Instability Strip (IS): observational borders, fraction of variables
- Stellar parameters defining the IS (rotation, Z, tides, evolution, α , ...)
- Hybrid detection
- Mode identification
- « Blazhko » effect

Preliminary consequences

As the colour information, when available, was poor, we mixed the data of the three filters in only one dataset. Also, the jumps and trends seriously perturb the frequency analysis. Up to now the crucial step for correcting these perturbations was performed in a non-automatic way. Indeed, all the groups used algorithms based on Fourier transform, and it is easily noted that even if frequencies are in good agreement between the different groups, some differences remain after the detection of about 10-20 frequencies; therefore, special care should be taken when preparing the data set. It is also noted that the satellite orbital frequency together with many harmonics are easily detected.

As can be seen on the figure, a fit using 50 first frequencies (PM ones, including those related to the COROT orbital frequency) accounts for about 88% of the variance of the sine-fit.

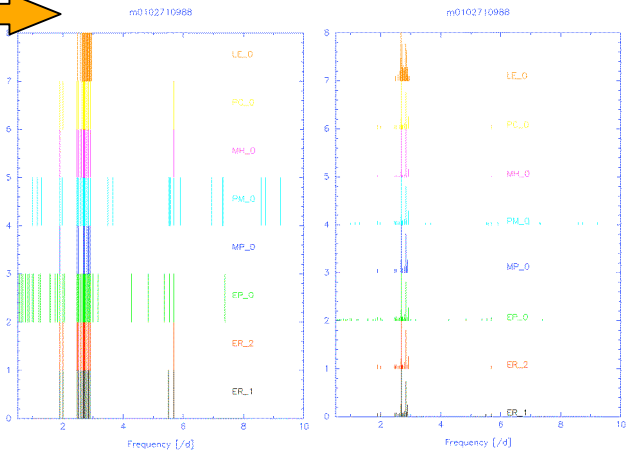


After an iteration of the CVC group, it turned out that none of the 6 considered stars was a first priority γ Doradus candidates, with 2 stars being not at all classified as a γ Doradus star.

First exercise

We first started with an exercise within the team: in the first sample provided by the CVC for the IRa01 run (33 candidates), we selected 6 stars for which the behaviour was interesting in the γ Doradus frame. The different groups treated the data using their recipes (jumps, trends), and proceeded to a frequency analysis.

Here is an example of the resulting analysis for the star 0102710988:

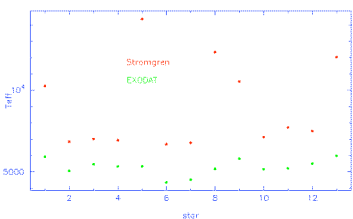
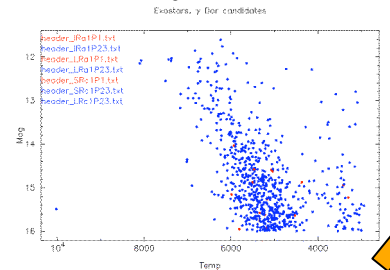


The left panel represents the resulting frequencies (all amplitudes normalized to 1) obtained by different groups under the responsibility of E. Rodriguez (ER1 & 2), E. Poretti (EP), M. Paparo (MP), P. Mathias (PM), M. Hareter (MH), P. De Cat (PC) and L. Eyer (LE). The right panel shows the same region, typical for γ Doradus frequencies, scaled to the maximum detected amplitude.

Candidates in the 4 first runs

The CVC classification of the first four runs was released in August 2008: IRa1, SRc1, LRa1 and LRc1.

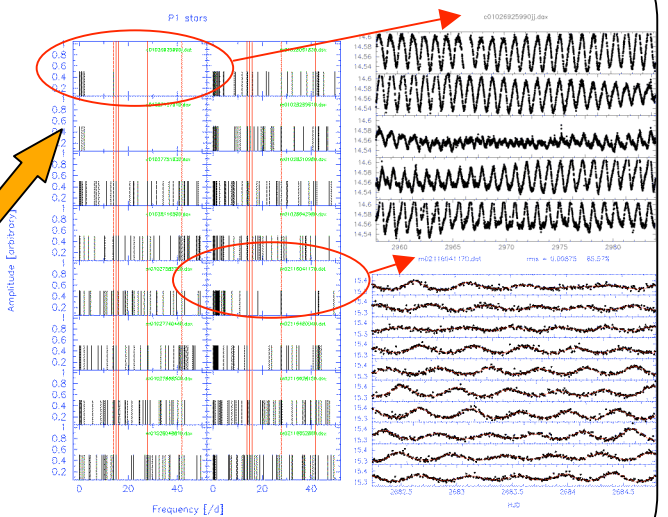
There were more than 1000 stars being classified by the CVC as possible γ Doradus candidates, among which 32 being first priority candidates, the others (about 1000) being balanced between 2nd and 3rd priority targets. Using the data provided in the header of the N2 files, we represent in the right panel the HR diagram of these candidates. Most of the candidates are indeed within the γ Doradus IS.



However, these kind of data, as provided in the headers following the EXODAT catalog, should be treated with caution. The left panel shows T_{eff} values represented as given in the N2 headers, together with values derived from Strömgen photometry (C. Aerts, private communication, photometric data provided by the Binary Team).

Preliminary analysis of the 32 P1 candidates

Following the conclusions of the previous exercise, we performed a frequency analysis on the 32 P1 candidates in a semi-automated way.



The left panel provides the frequencies (all amplitudes normalized to 1) for some of the 32 stars. The vertical red lines show the frequencies related to the orbital motion. It appears that 0102692599 is probably not a γ Doradus star (activity?) while 0211604117 may indeed be a good candidate.

Prospectives

In order to manage such an enormous amount of data, it is essential to develop an automated procedure to take care of the flags (some "0" flags correspond to incorrect data, and vice-versa), the trends, outliers, and, very tricky, the jumps.

However, a fundamental problem is to be sure that the star is indeed a γ Doradus star: the frequency spectrum itself does not seem enough to conclude γ Doradus membership (the confusion with SPB stars is obvious). We are part of the proposal by C. Neiner concerning the classification of stars using ESO's FLAMES instrument, using spectroscopic methods. In addition, such measurements are fundamental for modelling of the corresponding instability strip: see poster by A. Miglio et al.

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