

Study of the pulsational behaviour of a sample of F and G stars

- Name and affiliation of proposer:
Anne Thoul, Institute of Astrophysics and Geophysics, University of Liège, 17 allée du 6 Août, B-4000 Liège, Belgium
- Additional team members:
Conny Aerts, Caroline Barban, Joris De Ridder, Marc-Antoine Dupret, Anwesh Mazumdar, Andrea Miglio, Josefina Montalban, Arlette Noels, Richard Scuflaire, and additional BAG members

Science case:

There is considerable evidence in favour of the presence of convective core overshooting in intermediate mass stars. Indeed, overshooting is necessary to remove the discrepancy between non-overshooting isochrones and cluster data. It is also believed that the amount of overshooting in stars with masses slightly larger than 1 solar mass is related to the stellar mass. The theory of the overshooting is still very crude and so far there are no good explanations for it and its relation to the stellar mass. If a very small overshooting is used to model the Sun, it will keep a small convective core, yet it is believed that the Sun does not have a convective core. It would be useful to study the pulsations of stars from 1 to 1.4 solar masses, and of slightly different chemical compositions, in order to study the overshooting and its relation to stellar mass and metallicity.

Another yet unsolved problem is the influence of diffusion. It has been found that diffusion is necessary to explain the helioseismic data. There is a large consensus that it is important to include the diffusion of Helium, but there is a large debate over whether to include the diffusion of heavier elements. In addition, the effects of mixing due to rotation can reduce the effects of diffusion. The study of the pulsations of a sample of several stars with masses close to the solar mass and slightly different element abundances and rotation rates should give us further insight on the effects of diffusion in those stars.

Type of observations:

All observations of F and G stars from the long runs in the exoplanet field, and from the short runs. Short integration times are not needed for higher mass stars or giants, so the 32 sec windows should be placed around as many as possible F and G stars.

Targets:

All F and G stars.

5 relevant publications:

1. Thoul, A., Scuflaire, R., Noels, A., Vatoquez, B., Briquet, M., and Dupret, M.-A., J. Montalbán, 2003, A new seismic analysis of Alpha Centauri, *Astronomy & Astrophysics* **402**, 293 – 297.
2. Thoul, A.A., Bahcall, J.N., & Loeb, A. 1994, Element Diffusion in the Solar Interior, *Astrophysical Journal* **421**, 828 – 842
3. Miglio, A., Christensen-Dalsgaard, J., di Mauro, M. P., Monteiro, M. J. P. F. G., Thompson, M. J., 2003, Seismological analysis of the Helium ionization zones in low- and moderate-mass stars, in *Asteroseismology Across the HR Diagram*, 537 – 540
4. Noels, A., Scuflaire, R., Gabriel, M., 1984, Influence of the equation of state on the solar five-minute oscillation, *Astronomy & Astrophysics* **130**, 389–396
5. Gabriel, M., Scuflaire, R., Noels, A., 1982, The solar structure and the low l five-minute oscillation. I. and II., *Astronomy & Astrophysics* **110**, 50 – 53 and *Astronomy & Astrophysics* **113**, 219 – 222.

Needed ground-based observations plan:

We will apply for UVES time at the VLT for the FG stars that will turn out to be the most promising targets for asteroseismology (large number of frequencies), in order to determine their surface abundances and upper limits of V sini.