

[Talk]

F-type stars, solar-like stars, and the Sun

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Fast rotating late F-type stars are fascinating objects which can be seen as the missing link between the cool dwarfs like the Sun and intermediate mass stars. Their shallow convective envelope still allows the excitation of detectable stochastic acoustic modes (p modes) as in cooler solar-like stars, while stochastically excited gravity modes (g modes) could have enough amplitude at their surfaces to be detectable. By characterising the properties of these modes or by analysing the light curve modulations due to spots and faculae, targets with short rotation periods (below eight days) have been studied with the NASA Kepler mission. Understanding the rotational behaviour of such targets, from the surface to the core, will shed light on the similarities and differences that exist with G-type solar analogs. Studying these stars on both modelling and observational levels could also help to improve our knowledge about large-scale dynamical mechanisms at stake in main-sequence solar-like stars, such as angular momentum transport, dynamo cycles, or surface magnetic braking.

Starting from a modelling point of view, we present the results of deep-shell hydrodynamical 3D simulations of a typical pulsating F-type solar-like star observed by Kepler. We will emphasise the key role that rotation plays concerning the model dynamics, for both the convective envelope and the radiative interior. Compared to similar simulations performed on a solar model, our results suggest that it could be easier to obtain constraints on the internal rotation for these F-type solar-like stars than for the Sun or cooler solar analogs. Indeed, these constraints can only be obtained through the characterisation of low-frequency low-signal-to-noise g modes. Searching for signatures of such modes in a working sample composed of F-type solar-like pulsators observed with the Kepler short cadence mode, we detect two targets with strong low-frequency modulations not related to surface rotation (0.6 and 0.9 days, respectively). These modulations can be interpreted as probable evidence for the presence of a non-transiting close companion. Such a detection represents an interesting perspective in order to characterise star-planet interactions and the possible tidal excitation of g modes. We present our first results concerning the analysis of these promising systems.