Galactic archaeology of solar-type stars with the NASA TESS mission

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The goal and the sample

- The high degrees of **spectral resolution** of the ESO spectrographs (R=115e3 for HARPS) and the high **photometric precision** of the **TESS** space telescope for asteroseismology (200 ppm) allows today to obtain estimates of **stellar ages** with a confidence level of **30%** (Serenelli 2017).
- The goal of this work is to study the age-metallicity relation for solar-like stars in the solar neighborhood. which is critical for understanding the formation and evolution of our Galaxy
- We used TESS's **Asteroseismic Target List** (Schofield 2019) as an initial stellar sample and **cross-match** this sample with **ESO** archival spectroscopic data. for my analysis.

Asteroseismic analysis

- Using the LightKurve package from the python distribution we downloaded all available light-curves for stars located in TESS southern continuous viewing zone.
- Using a pipeline from this package we obtained periodograms of the light-curves. We could visually detect excess of power in the Fourier transforms. An excess of power reveals an oscillatory pattern;

Fig1: Periodogram of a light-curve

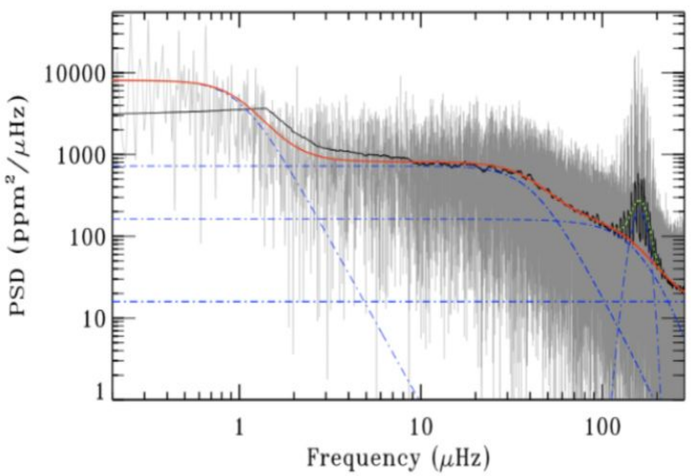
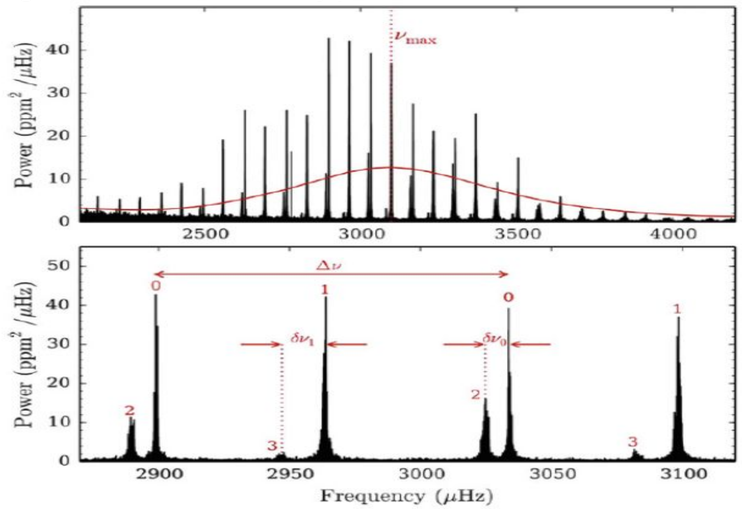


Fig2: Zoom on an oscillatory pattern



- To obtain clean oscillatory plots we had to fit the background signal with Harvey functions (blue components in fig1) and a constant noise signal.
- The best fit is obtained with the Bayesian Inference software : DIAMONDS (Corsaro 2014). Each fit gives an estimate of the νmax and **Δν** parameters (fig 2)

Spectroscopic analysis

- We sued the code Stepar to determine atmospheric stellar parameters (**Teff,log(g),ξ,[Fe/H]**) by using a classical curve of growth technique under assumption of Local Thermodynamic Equilibrium

Fig3: Plot of spectroscopic parameters

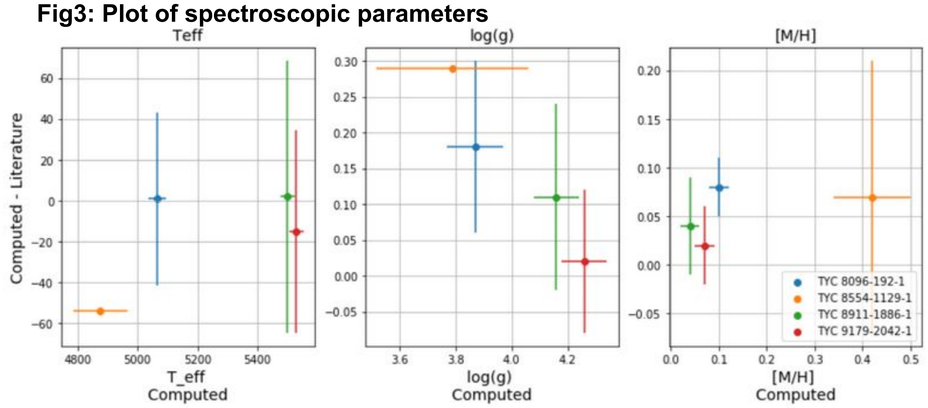
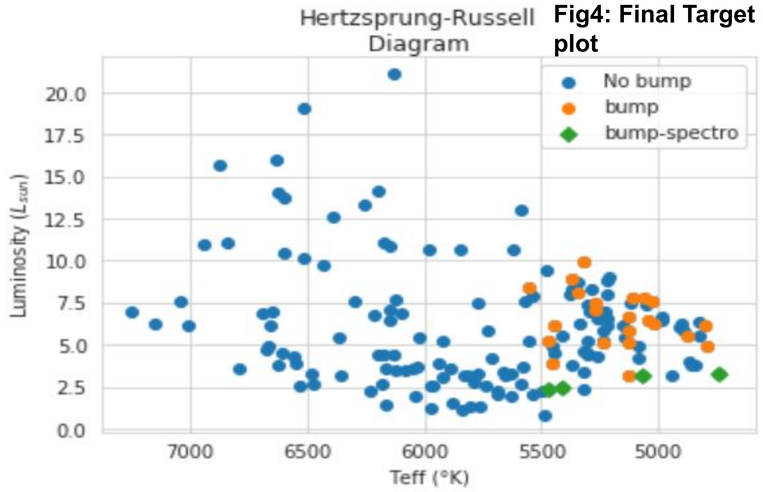


Fig4: Final Target HR plot



- The plot of the differences between spectroscopic computed values and corresponding literature ones is shown on fig3.

Results

- **162 targets** found inside the southern **continuous viewing zone** of TESS, **24** among them have their νmax and Δν computed and **4** had **publicly available** spectra with high enough resolution to have their spectroscopic parameter calculated. These information are summarized on fig4

Work in progress

- Planning an observational proposal for the missing spectra in southern hemisphere;
- Expanding the analysis to the entire field of view of TESS.
- Performing an automatic peak bagging analysis of the individual oscillatory modes for more information on stellar interiors.