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Holistic approach for analyzing the power spectrum of pulsating stars with PLATO

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Abstract

Current harmonic analysis techniques applied to the high-quality space data of classical pulsators have yielded an unexpected distribution of modes in the observed frequency spectra. Furthermore, it has been shown recently (Balona, 2023) that the observed pulsation spectrum of δ Scuti stars is degenerate with respect to luminosity and effective temperature, raising concerns about the consistency of theoretical models for these stars.

In order to solve these challenges, we are developing new algorithms based on the smoothness and fractal properties of the observed signal (i.e. brightness variations) to detect anomalies in the frequency analysis of pulsating stars. A pipeline for the analysis of the data that will be gathered by PLATO (ESA M3 mission) is in progress. In addition to data processing algorithms, the pipeline will include the characterization of the statistical properties through advanced analysis techniques to detect time-frequency variability of the signal, nonlinearities and complex dynamics. These tools will be essential pieces of a complete pipeline following a holistic approach to interpret the observed frequency spectrum of pulsating stars.

The aim is to achieve the most precise asteroseismic characterization of intermediate mass stars to date.

My poster in zenodo.org can be found here