

# 1 Asteroseismic constraints on mixing processes in B-type stars

Stellar interiors are one of the most inaccessible place in the universe. Our telescopes can reach further and further into the deep space but how we can look into the interior of the stars? How should we examine hidden from the observer stellar interiors with extreme physical conditions? It turns out that the solution is stellar pulsations, i.e. propagating waves that create vibrations of stellar matter. The effects of these vibrations can be observed and used to study stellar structure. It is similar to guessing what kind of musical instrument produce sound we hear. And this is the idea of asteroseismology.

Asteroseismology can be also compared to the seismology, which is a study of our planet internal structure through earthquakes. By measuring the type of a wave and the time the wave travels a given distance we can derived physical parameters of our planet. A similar analysis can be made in case of pulsating stars. These object are characterized by periodic brightness changes (as well as temperature and other physical quantities). These changes can be observed and then translated into the language of mathematics and physics. Analysis of such changes gives the opportunity for studying stellar interiors.

In our project, we will focus on massive, bright and hot stars (so-called B stars). Many such stars are pulsating and we will try to use the observed changes in brightness to reconstruct their internal structure. We will examine primarily the mixing processes of the stellar matter in different layers and the profile of rotational velocity. In addition, we will study the physical properties of the ions forming the stellar plasma by analyzing their opacity coefficients, i.e. the way they transmit light.

To achieve our goals, we will choose a sample of B-type stars pulsating simultaneously with many long periods. The waves responsible for such brightness changes penetrate the deep interiors of the stars, so they are perfectly suited for our analysis. We will use observational data collected by space missions such as Kepler, BRITE and TESS.

The problems we are going to investigate are important and still poorly understood in the theory of the structure and evolution of massive stars. And such stars largely determine the evolution of their host galaxies including our Milky Way.