Oscillations in Red Giant Stars

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Abstract

Asteroseismology can be used to find information on distant stars based on the modes that propagate through them. By measuring the global parameters of these oscillations and combining them with the effective temperature of the stars we can obtain estimations on Mass, Radius and Luminosity. Studies of these parameters with enables the study of higher evolved stars and how the structure of stars changes with time. The structure of red giant stars is less well known than that of solar like stars. The study of the acoustic mode and the mixed modes of red giants can lead to insights into the structure of these stars, and the study of surface rotation can show how the transport of angular momentum evolves over time.

The NASA mission *Kepler*, the first goal of which is to search for exoplanets, is monitoring over 150,000 stars. The photometric data provided by the mission allows us to use asteroseismology. In this study we analysed 416 red giants observed by the *Kepler* mission. We built a pipeline to automatically analyse these stars and measure the acoustic mode mean large frequency spacing ($\Delta\nu$) and the frequency of maximum power of the modes, (ν_{max}). These are necessary to obtain mass and radius estimates after reading in the effective temperature from the Kepler Input Catalog (KIC). It then checks for outliers based on the known relationship between $\Delta\nu$ and ν_{max}. Outliers are either corrected or removed.

We also investigated the surface rotation of these stars with wavelet analysis. This analysis is based on the presence of active regions or "starspots" which periodically cross the surface of the star because of its rotation. In the stars where rotation was clearly present the rotation was of the order of 100 days, as is expected for such large stars.