Amplitude Modulation and Energy Conservation in Delta Scuti and Gamma Doradus Stars

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Abstract

Recent advances in asteroseismology are primarily due to the high duty cycle and photometric precision of CoRoT and Kepler, which are far superior to any of their ground-based counterparts. With micromagnitude changes in intensity for more than 190,000 stars over the last 4 years, the Kepler dataset is a goldmine for scientific discoveries. The length of this dataset is ideal to investigate the yet unsolved problem of pulsation amplitude modulation and energy conservation in Delta Scuti and Gamma Doradus stars.
Until recently, the pulsation excitation models for Delta Scuti and Gamma Doradus stars were thought to be independent. However, observations with Kepler have shown that at least 25% of all A- and F-type stars show hybrid behaviour (Uytterhoeven et al. 2011). Consequently, new models of pulsation and stellar structure must be generated, which will also have implications for stellar evolution theory.

Currently, there are only a handful of stars with published studies that are known to exhibit amplitude modulation. An example is 4 CVn, which is believed to have a periodic cycle of more than a decade (Breger 2000a). The length of the Kepler photometric time series is a major advantage when addressing the issue of pulsation mode stability. The process of finding case studies and a much larger sample of this behaviour has been automated for all stars hotter than 6500 Kelvin.
This project will contribute to the hunt for extra-solar planets and brown dwarfs as well. Since Delta Scuti and Gamma Doradus stars have high-amplitude pulsations, companions can be found by the frequency modulation (FM) technique (Shibahashi and Kurtz 2012). FM stars require long datasets and no automated routine currently exists to identify them.

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