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Title: The 'Keplerian' revolution in our understanding of RR Lyrae stars
Type: Poster
Session: Asteroseismology
Abstract: The Blazhko effect is the conspicuous amplitude and phase modulation of the pulsation of RR Lyrae stars. It had been discovered in the early 20th century and constitutes one of the most long-standing problems of stellar pulsation theory. The field of study of this
mysterious modulation has recently been invigorated thanks to the Kepler space telescope by providing long, uninterrupted, ultra-precise time series data.
In this talk I will give a brief overview of the new observational findings then turn to the latest theoretical efforts and advances that Kepler results induced. It turned out that if we look at RR Lyrae stars through the optics of Kepler, we can discern a fascinatingly diverse collection of dynamical phenomena that has been completely unknown before the space photometry era.

Most importantly, period doubling was found in most of the Blazhko-modulated Kepler stars offering a new handle on the tough Blazhko-problem, since we were able to prove that the origin of the period doubling is a high order resonance between radial modes. What is more interesting: by using the amplitude equation formalism, it can be shown that the same resonance is able to create the modulation itself. Thus, the radial resonance model is currently the most plausible explanation to this century-old enigma.

Besides the unexpected presence of period doubling, high radial overtones and high-order resonances, other resonances and triple-mode pulsation states were found in our hydrodynamical models. In particular, we predicted that in some RR Lyrae stars the first radial overtone must be present with a small amplitude. Indeed, we were able to detect for the first time the first overtone mode in the prototype, RR Lyrae itself in the Kepler short cadence data with an amplitude 100 times smaller than the dominant, fundamental pulsation mode. This surprising discovery has consequences on our understanding of the mode selection mechanism and the interaction between pulsational modes.

If more than two modes are present in a nonlinear dynamical system such as a high-amplitude RR Lyrae star, the outcome is often an extremely intricate dynamical state. To demonstrate this, I will close my talk by discussing our latest findings on low-dimensional chaos in the modulation of Kepler stars, a phenomenon which is also explained naturally by the radial resonance mechanism.