

## Long Cadence RR Lyrae targets – K2 Campaign 1

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Continuous, high-precision photometry revealed new, important insights into all types of RR Lyrae stars. However, given their rarity, so far only two double-mode stars and a handful of first overtone stars were observed with space telescopes [1,2,3]. Field 1 contains all three types of RR Lyrae stars (RRab, RRc, RRd) and therefore can in itself greatly extend our knowledge of these types of variables. The large number of fundamental-mode stars will allow for a variety of statistical studies as well with larger sample size than any previous space missions. These investigations will also bring us closer to the explanation of the century-old Blazhko enigma.

### Aims

- There is one confirmed double-mode star (EPIC 201585823) in the field. Period ratios of simultaneously excited radial modes provide strong constraints on the stellar parameters such as mass and metallicity.
- We identified 14 first overtone (RRc) stars. Ground-based data of two stars hint that they might experience modulation. RRd and RRc stars both show similar low-amplitude additional modes of uncertain origin that can only be studied from space.
- There are 118 fundamental-mode (RRab) stars in Field 1, about three times as much as the original Kepler field. They provide a great opportunity to perform reliable statistical analyses of several important aspects:
  - Determine the ratio of modulated and non-modulated stars. This ratio is not well known for long-period (0.6-0.8 days) stars. Occurrence of multiple or irregular modulation can also be constrained.
  - Investigate the phase relations of the pulsation amplitude and period modulations.
  - How frequent are the different additional modes, the dynamical effects (e.g. period doubling) and what is their relation to the Blazhko effect?
  - Hydrodynamic models indicate that the first overtone can be excited with small amplitude in RRab stars [4]. Field 1 may confirm the presence of such multimode stars.
  - Some stars display very strong amplitude and/or phase variations. Extreme modulation often coincides with irregularly varying modulation amplitudes and periods that can be followed with continuous observations only.

**Targets** Field 1 contains 133 Galactic RR Lyrae stars. We propose to observe all of them within the K2 Mission to allow for an unprecedented statistical study. The brightness of the stars spans a wide range between 12.0 and 19.2 magnitudes but most stars are fainter than 15 magnitudes, therefore require only moderate pixel usage. The target list includes the estimated maximum brightness in  $Kp$  magnitudes for all stars. A few targets are proposed in a separate short-cadence proposal with more detailed scientific justifications as well.

### References:

- [1] Gruberbauer et al., 2007, MNRAS, 379, 1498    [3] Moskalik et al., 2013, ASSP, 31, P34  
[2] Chadid, 2012, A&A, 540, 68    [4] Molnár et al., 2012, AN, 333, 950