Revisiting Bright δ Scuti Stars and their Period-Luminosity Relation with TESS and Gaia EDR3

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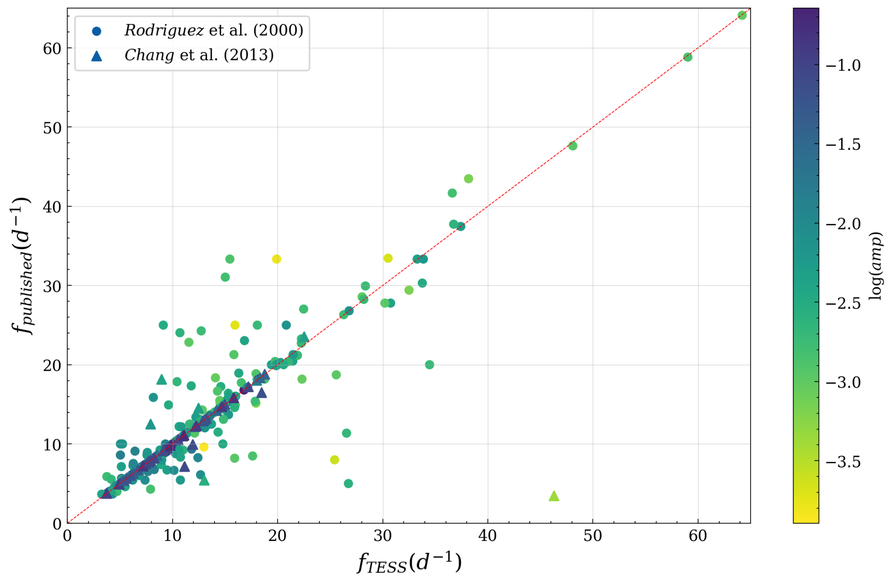
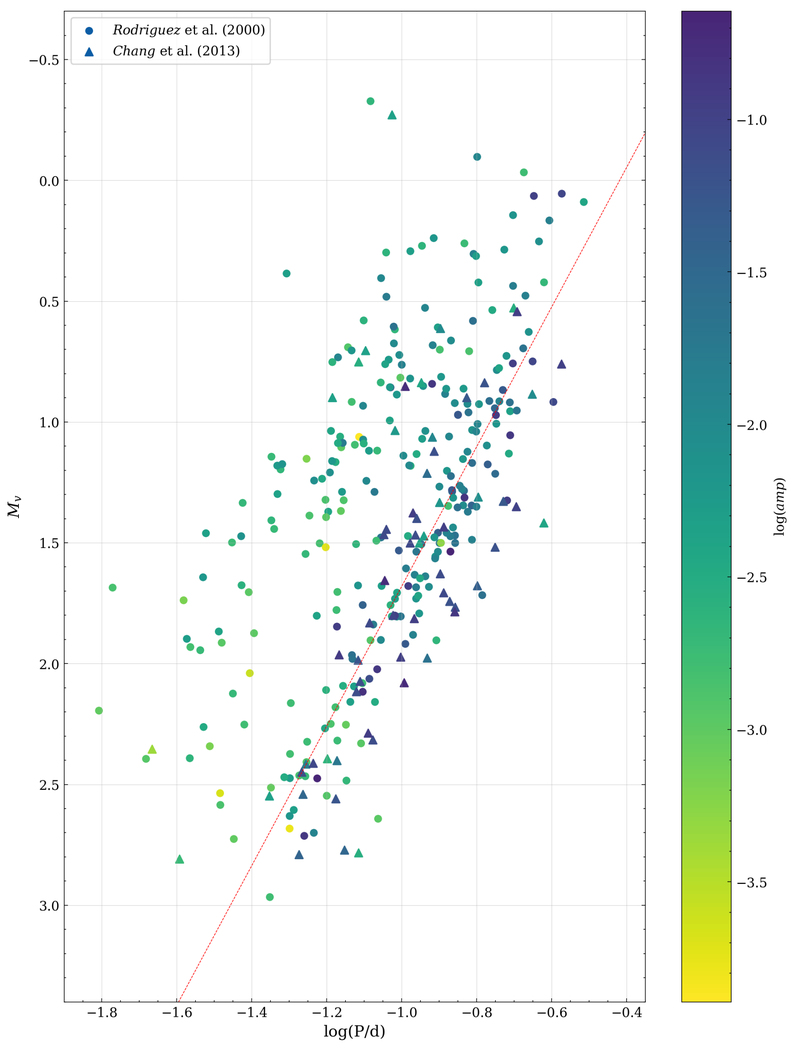
We have used TESS light curves to study δ Sct stars from the catalogues of Rodriguez et al. (2000) and Chang et al. (2013), and measure their dominant oscillation modes. We aim to use our revised data to place these targets more accurately in the period-luminosity diagram.

TESS-Updated Dominant Modes

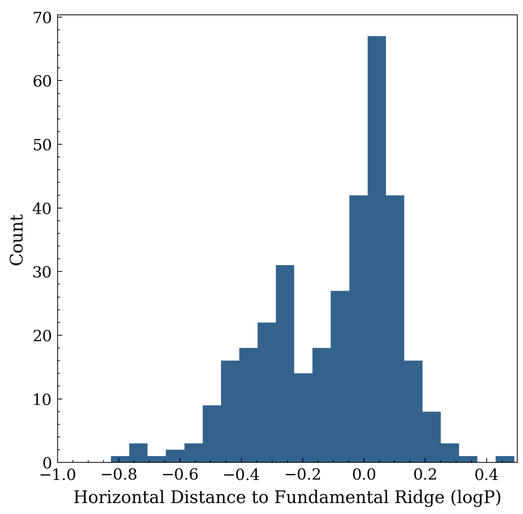
- High-precision space photometry from TESS enables more precise and homogenous measurements of dominant δ Sct pulsations
- Our final sample includes 410 stars, from which 54 stars are removed for showing no evidence of δ Sct pulsations
- 71 percent of our sample have updated dominant modes within a 90 percent threshold of the original value
- Lower amplitude stars show larger differences between the original and updated values
    - Greater error in identifying the dominant modes of low amplitude stars, likely due to poor SNR from ground-based observations
    - Some δ Sct stars are also known to undergo amplitude modulation



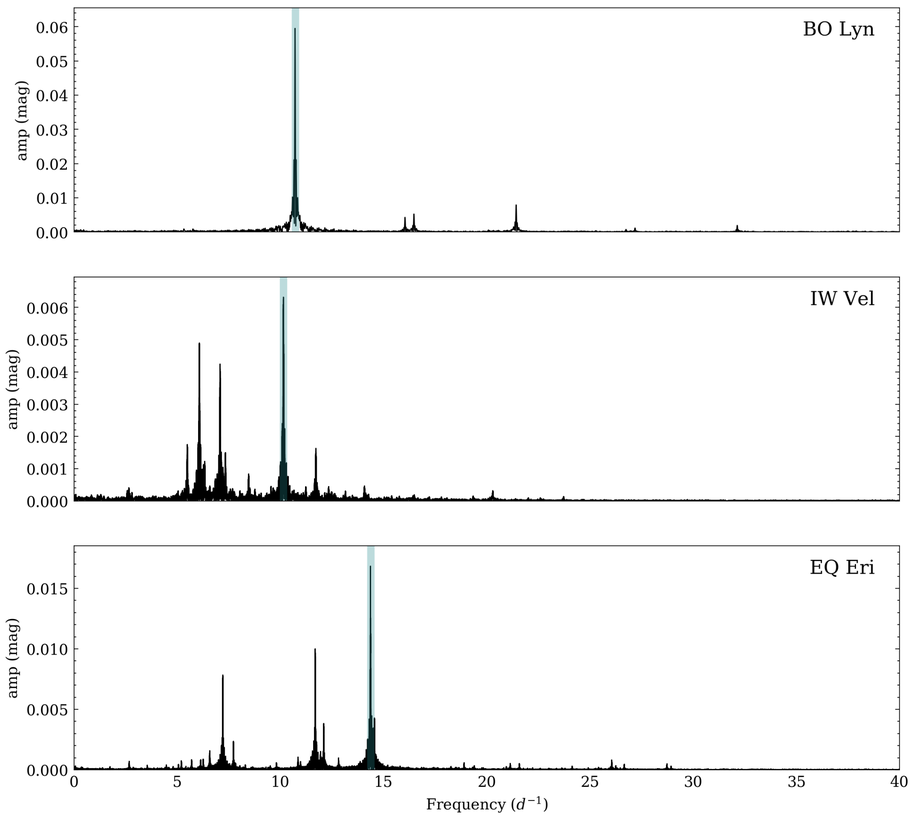
The Period-Luminosity Relation



- Revising the dominant modes of our sample allows them to be placed more accurately in the period-luminosity diagram
- We see that many stars fall in the main ridge, close to the red line
    - This corresponds to the fundamental mode
    - The ridge is sharper than that of Ziaali et al. (2019), which was calculated using the catalogued pulsation modes
- Higher amplitude stars tend to fall closer to the main ridge, while lower amplitude stars show more scatter across the diagram
- Ziaali et al. (2019) identified an excess of stars falling in a second ridge, lying to the left of the fundamental-mode ridge
    - The revised modes also sharpen this second ridge
- This secondary ridge is displaced horizontally by -0.3 in log*P*, as seen in the histogram



Second-Ridge Stars



- Some stars falling on the second ridge appear to be displaced vertically, in absolute magnitude
    - BO Lyn looks like a typical HADS, which should fall on the main ridge
    - Li et al. (2018) suggest it has an A-type companion in a 35-year orbit; photometric effect due to companion could shift the star vertically in the diagram
- Other stars appear to be 'true' second ridge stars, where the dominant mode falls on the second ridge, but there is a peak at the predicted fundamental mode
    - IW Vel and EQ Eri are two such stars
    - Mechanism for excitation of overtone mode? Ziaali et al. (2019) suggest resonance
- Some stars also appear to show amplitude modulation of the second-ridge mode between observations separated by years
    - Limited by length of TESS observation
- **Future work**
    - Further examination of second ridge stars
    - Comparison with second ridge δ Sct stars observed by Kepler, from the sample identified by Murphy et al. (2019)