Abstract

This research delves into the pulsational characteristics of subdwarf stars, a unique class of compact, hot, and luminous extreme horizontal branch stars. Employing a combination of observational data and theoretical models, our study aims to unravel the intricate dynamics of pulsations within these stars, shedding light on their interior structures, evolutionary paths, and the intricate relationship between pulsation and the galactic environment. This research aims to discover new pulsating stars of this class using the high precision data from the most modern space telescopes.

We conduct an in-depth analysis of high-precision TESS photometric and on-ground spectroscopic observations, focusing on discovering new pulsating subdwarf stars. Through sophisticated mode identification techniques, we identify pulsation modes, providing valuable insights into the underlying physical processes governing these phenomena. We fit our observationally derived results with the `MESA` pulsation grid to derive the physical parameters of these stars. Apart from the TESS short cadence data analyses, we extract the light curves from TESS full frame images (FFI) and find new pulsating hot subdwarfs and other types of variables. This work is the first of its kind in the hor subdwarf field using TESS FFI. We collect the *Gaia* astrometric data for all known subdwarfs and try to find correlations between the pulsation properties and the galactic populations of these stars.

This work provides a detailed pulsation analysis of nine pulsating subdwarfs observed in TESS short cadence mode, and the discovery of 11 pulsating hor subdwarfs from TESS FFI. We create a robust method to separate the discovery of real variable stars we detect in TESS FFIs from the false positives. In this survey, we confirmed the variable status of 1403 stars. From our correlation study between the pulsations and galactic populations, we found that all types of pulsating hot subdwarfs are located in all galactic populations, which gives us a hint that the pulsations may not be correlated with the galactic environment.

In conclusion, this research advances our knowledge of pulsating subdwarf stars, providing a deeper understanding of their pulsational dynamics and offering new perspectives on the broader landscape of stellar astrophysics. The implications of our findings extend beyond the realm of hot subdwarf stars, contributing to the collective knowledge of stellar evolution and structures.