INVESTIGATING THE PULSATION CHARACTERISTICS OF HOT VARIABLE STARS

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Upper main sequence pulsating stars are divided into four basic classes: gamma Doradus, delta Scuti, slowly pulsating B (SPB) and beta Cephei stars. The gamma Doradus and SPB stars are generally thought to be g-mode pulsators, while the delta Scuti and beta Cephei stars are p-mode pulsators. With the increased photometric precision available from space-based missions such as Kepler, many hybrid stars have been discovered, which show either gamma Dor/delta Scuti pulsations or SPB/beta Cephei pulsations. All of these stars, make excellent candidates for analysis using asteroseismology. In particular, the B stars (beta Cephei and SPB stars) provide great potential for determining interior structure. These stars are massive enough to have convective cores, and pulsation frequencies have been shown to be capable of probing the extra mixing around the convective core. Many B stars, particularly among the beta Cephei stars, are rapid rotators, and the effects of rotation also leave an imprint on the frequency spectrum of the star. As a result, asteroseismology can be used to measure the rotation rate in pulsating stars. For a few stars, seismic analysis has even constrained the interior rotation profile of the star. Better constraints on the interior structure will help us better understand the physics of rotation and convection in stars. We propose to observe a sample of 55 stars that have shown variability in a series of 8 full-frame images taken over 34 hours during Quarter 0. We have placed constraints on the sample to focus on the B stars discussed above, but expect the targets will also include A-F stars, probably showing gamma Doradus and/or delta Scuti pulsations, as well as rotating, chemically peculiar, and binary stars. We will classify the stars in the sample according to the origin of the variability, and perform stellar modeling on the main sequence pulsators in the sample. Using 2D techniques, we can include the effects of rotation on the pulsation spectrum in a self-consistent manner, and constrain the mass, age, rotation rate and convective core overshoot for these stars. Asteroseismological techniques are currently the only method capable of constraining all of these properties simultaneously for single stars. Long-cadence data is capable of detecting periods in the B stars and gamma Doradus pulsators, as well as periods longer than 1 hour in the delta Scuti stars. Previous studies of B stars have shown that the frequency spectrum looks very different when observed from space, as more low amplitude and high order frequencies become visible. Observations of this sort are only available with Kepler, and with no similar projects in the planning phase, this may be our last opportunity to observe stars to this level of precision.