Statistics of Variability in Main-Sequence Stars of Kepler 2 Fields 6 and 7
Joyce Guzik
Los Alamos National Security

We propose to observe with the Kepler spacecraft in long-cadence mode about 1000 stars in Field 6 and 2600 stars in Field 7. Our goals are to discover pulsating variable stars, as well as eclipsing binaries and magnetically active stars with variability produced by rotating spots or flares. We use BV and JHK colors and magnitudes listed in the EPIC catalog to select main-sequence stars with Kepler magnitudes between approximately 8 and 12.5. Our selection of stars in this magnitude range will minimize the number of pixels required, yet the stars will be bright enough for ground-based follow-up observations, including high-resolution spectroscopic observations.

Observations by the Kepler spacecraft have turned out to be ideal for discovery and characterization of main-sequence stars pulsating in radial and nonradial pressure and gravity modes. The long time series and high precision of the photometry have enabled determination of frequencies of modes with periods of order a day (g modes) to a few hours (p and mixed modes), and amplitudes as low as tens of parts per million using long-cadence data (30-min integrations per data point). Analysis of the Kepler data has raised a number of questions about the possible pulsation driving mechanisms for gamma Doradus g-mode and delta Scuti p-mode pulsations, and revealed a surprising number of hybrid star candidates that show pulsations in both types of modes. The Kepler data have also been used to study slowly pulsating B (SPB) stars (g-mode pulsators), beta Cephei stars (p-mode pulsators) and their hybrids to test stellar pulsation theory in the presumably simpler case for these hotter stars with smaller inefficient envelope convection zones. The analysis has also revealed a number of apparently non-pulsating stars that lie within the pulsation instability regions established by theory that need to be explained. We expect to increase the numbers of these types of stars available for detailed study, especially for candidates brighter than those found in the original Kepler field. We also expect to discover additional eclipsing binaries and magnetically active stars.

Our sample selection is not biased toward known pulsators, and includes enough stars to derive statistics on the occurrence of variability. We will compare our results with similar surveys of stars in the original Kepler Cygnus-Lyra field, and with surveys of stars in young open clusters for K2 Fields 0, 4, and 5. For continuity with our K2 Cycle 1 proposal on ensemble asteroseismology of open clusters, we also propose to observe 96 member candidates of Ruprecht 147, the oldest nearby open cluster, which is accessible in Field 7. We will produce a catalog of all of the candidate variables, eclipsing binaries, and magnetically active stars that we find.