

TEMPORAL ANALYSIS OF RV TAURI AND SEMI-REGULAR VARIABLES USING KEPLER

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RV Tauri stars are luminous, supergiant variables with periods of pulsation that are sometimes predictable and sometimes not. Their lightcurves show alternating deep and shallow minima with a primary period of variability in the range of 30-150 days while their spectra vary across several spectral types. Semi-regular (SR) variables show some periodicity, but are even less regular than RV Tauri stars. RV Tauri and other SR variables occupy the region of the HR Diagram between the Cepheid instability strip to the left and the long period Mira types to the right. The evolutionary status of these objects is uncertain and an adequate explanation of the changes in their spectra and light curves is lacking. The presence of a number of RV Tauri stars in the Local Group of galaxies and their potential use in distance calculations adds cosmological significance to better understanding their luminosities and other characteristics. Studies to date are constrained by the limitations of ground-based data from AAVSO and the literature (e.g. Pollard et. al., 1996, MNRAS, 279, 949). Our own, modeling efforts (Cash et. al, 2009, AIP Conference Proceedings, CP1170, 146) include curve-fitting of the AAVSO data using Fourier and other methods to determine the periods of pulsation in the light curves and to examine the stability of the calculated periods. We propose to use Kepler to observe approximately 15 of these objects in its field of view through several of the stellar phase cycles over a time span of 12 months. Using Kepler's long cadence exposures of 30 minutes will provide unprecedented temporal detail and photometric precision. In order to provide insight into the underlying physical processes of these stars, we will combine the Kepler photometry with our modeling techniques and ~800 high signal-to-noise, archival spectra we have taken at the Coude-Feed telescope at Kitt Peak National Observatory over the past decade. This proposed research is relevant to the stated objective of the solicitation for the acquisition and analysis of new data that uses the high-precision photometry of Kepler for asteroseismology and other variability studies of Galactic sources. This in turn fits NASA's mission to pioneer the future in scientific discovery, in particular the Astrophysics Division's Focus Area for Stars that includes understanding how stars form and evolve. The NASA Strategic Plan and Goals for 2006-2016 include Sub-goal 3D to which this proposal is relevant "Discover the origin, structure, evolution, and destiny of the universe, and search for Earth-like planets."