AN EXTENDED STUDY OF RV TAURI AND SEMIREGULAR VARIABLES

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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. Semiregular (SR) variables show some periodicity, but are even less regular than RV Tauri stars. Both the RV Tauri and SR categories contain members that also exhibit Long Secondary Periods (LSP). 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. Investigations of RV Tauri and SR stars for possible non-radial modes associated with the LSPs may resolve current uncertainty about the underlying cause of these features. We propose to combine the efforts of two research groups from Cycles 2 and 3 into a single program and ask to continue to observe thirteen of these objects in Cycle 4. The additional observations will be combined with the Cycle 2 and 3 data as well as archival data from Cycle 1 to form the long base line needed to determine the presence of LSPs, related higher order non-radial modes, the stability of the light curve features over time, as well as the level of amplitude and period variations occurring in the SR stars. The light curve analysis will be supplemented with ground-based spectroscopic and BVRI photometry to map the changes in Teff and log(g) of the stars as a function of the phase of pulsation determined from the Kepler data. Future collaborations with a team of modelers will allow us to expand on our phenomenological approach. 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."