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Title: Long-Term Quadrature Light Variability in Algol-Type Binary Systems
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Abstract: Four years of Kepler observations have revealed a phenomenon in the light curves of short-period Algol-type eclipsing binaries that has never been reported from ground-based photometry. These systems display unequal brightness at their quadrature phases that numerically reverses over a time scale of about 100-400 days. We call these systems L/T (leading hemisphere/ trailing hemisphere) variables. Twenty-one such systems have so far been identified in the Kepler database. The prototype is WX Draconis (A8 + K0IV, P=1.8 d) which shows L/ T light variations of 2-3%. A short cadence observation of WX Dra reveals prominent delta Scuti-like pulsations on the primary star (P = 41 m) with a light amplitude of 2-3% of its mean quadrature light. The Kepler light curves are being analyzed with the 2013 version of the Wilson- Devinney (WD) program that includes major improvements in modeling star spots (i.e. spot motions due to drift and stellar rotation and spot growth and decay). Preliminary analysis of the WX Dra data suggests that the L/T variability can be fit with either an accretion hot spot on the primary (T = 2.3 T_phot) that jumps in longitude or a magnetic cool spotted region on the secondary. If the latter model is correct the dark region must occupy at least 20% of the surface of the facing hemisphere of the secondary if it is
completely black, or up to 50% or more if it is gray. In both hot and cool spot scenarios magnetic fields must play a role in the activity. Echelle spectra were recently secured with the KPNO 4-m telescope to determine the mass ratios of the L/T systems and their spectral types. This information will allow us to assess whether the hot or cool spot model explains the L/T activity. At least three classes of L/T behavior have been identified. In this presentation I will review the L/T phenomenon and provide an up-to-date report on its likely explanation. This project is being carried through in collaboration with R. E. Wilson, University of Florida, and T. Vaccaro, St. Cloud State University. Support from NASA grants NNX11AC78G and NNX12AE44G is greatly appreciated.