HOT SPOT MIGRATION AND PULSATION IN ALGOL-TYPE INTERACTING BINARIES

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Kepler observations during Cycles 1 & 2 have revealed a set of short-period eclipsing binaries with Algol-type light curves that display unequal brightness at their quadrature phases. The relative brightness of the quadrature light varies and numerically reverses over a time scale of about a 100-400 days. We call these systems L/T (leading hemisphere/trailing hemisphere) variables. To the best of our knowledge such behavior has never been identified from ground-based photometry. Preliminary analyses of targets in our Cycle 2 program suggest that the L/T behavior is due to a migrating hot spot on the primary star. To study the L/T phenomenon and assess its importance in mass transfer, angular momentum loss, and the evolution of Algols, we propose Kepler observations of 21 L/T systems. We will investigate variability in the size of the hot spot and whether it is always present or episodic and perhaps is correlated with enhanced mass transfer events. The prototype is WX Dra which shows L/T variations of 2-3% of the quadrature flux on a time scale of 1-2 years. Modeling of the light curve reveals that the L/T variability is caused from a migration of a hot spot toward larger phases. One short cadence observation of WX Dra reveals prominent delta Sct-like pulsations on the primary star with a period of 40 min and light amplitude variations of about 2% of its mean quadrature light. All 21 systems will be monitored at the long cadence for the duration of Cycle 4, while one short cadence observation will be secured for each system to investigate its pulsation activity. WX Dra will be observed three times at the short cadence to investigate whether spot location influences the pulsation mode/period. We will determine whether the L/T variations are periodic or episodic. The data will be modeled with a contemporary version of the Wilson-Devinney program. This project will provide important information for theoretical research on Algol binaries as hot spots can drive mass and angular momentum out of the system and influence the evolution of the binary (Van Rensbergen et al. 2008, 2010). Insight on mass transfer dynamics will also be gained.