DANCING IN THE STELLAR GRAVEYARD: KEPLER ULTRA-HIGH PRECISION OBSERVATIONS OF WHITE DWARF-M DWARF BINARIES

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We propose Kepler long cadence ultra-high precision photometry of 60 carefully selected candidate white dwarf - M dwarf (WDM) binaries not yet observed with Kepler. These suspected close binaries are unresolved point sources (indicative of their proximity) and were identified through multi-band photometry, including griz observations and GALEX NUV detections. There have been no major time-domain studies that have targeted these objects, and the current physical understanding of these systems is very limited. The precision, cadence and long baseline of Kepler observations provide the ideal dataset for conducting the following investigations: 1) Identifying periodic phenomena associated with both components of the binary, including eclipses, rotation/orbital periods, ellipsoidal variations, doppler boosting, and accretion hotspots; 2) quantifying the observable properties due to magnetic fields in the secondary, including starspots and flares; 3) Likely doubling the known number of eclipsing WDM systems and measuring the fundamental properties of both components from eclipse lightcurves and follow-up radial velocity measurements; 4) Detecting and measuring pulsations from the white dwarf primary (e.g., ZZ Ceti stars), and possibly from the M dwarf secondary. Our new observations target early-type M dwarfs (< M4) and complement existing Kepler studies which have focused on later M dwarfs. We will employ ground--based follow-up photometric and spectroscopic observations with guaranteed telescope time of confirmed eclipsing systems and other astrophysically interesting stars. This study will have far-ranging implications on the understanding of these stars and binary star evolution, including post-common envelope and pre-CV stages.