K2 Campaign 1 Proposal for Monitoring Cataclysmic Variables

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The original Kepler field had 27 cataclysmic variables (CVs:close binaries with mass transfer from a late main-sequence star to a white dwarf). Kepler monitored 15 of these systems with results currently published for 8 (Howell et al. 2013; Scaringi et al. 2013a,b). The detailed coverage enabled unique studies of quiescent orbital and sporadic variability as well as the changes in the disk and stream impact area during short and long dwarf nova outbursts. Short cadence observations of V344 Lyr revealed superhumps that were used to test accretion disk dynamics and precession (Wood et al. 2011). Analysis of the phase and width of the eclipses in the Kepler data on V447 Lyr (Ramsay et al. 2012) and KISJ1927+44 (Scaringi et al. 2013b) showed evidence for a radial increase of the disk during outburst.

K2 will provide a much larger CV database of long-cadence, high time resolution observations, albeit for shorter intervals of months rather than years. An example of the type of Kepler data achieved with long cadence is shown in the Figure below for V523 Lyr. The cadence of the current sky surveys (CRTS, ASAS, PanSTARRS) is about 1-2 obs/24 hrs at best (assuming no weather interruptions). Since the orbital periods of most CVs are 1.5-3 hrs, these kinds of surveys provide some information on outbursts but little on orbital timescale variability during quiescence and outburst.

For K2-0, we searched the RK Cat (Ritter & Kolb 2003), SIMBAD, the Downes web catalog, ASAS, the CRTS database (Drake et al. 2009), and the SDSS database (Szkody et al. 2011) for all known CVs, finding 12 systems, of which 6 are now in the observation list (GO0025). The same searches for the K2-1 pointing resulted in 10 known objects, including 6 dwarf novae (3 well-known ones from RK and 3 new ones from the CRTS), one possible intermediate polar (IP) QZ Vir, one pre-CV and 2 peculiar CVs.

We request long cadence observations for 9 and short cadence for QZ Vir. The data on the known dwarf novae extend the studies of accretion during quiescence and outburst that will advance the stringent tests of accretion dynamics that began with the original Kepler field. The detailed data on the pre-CV and peculiar systems will resolve their true nature and extent of variability. QZ Vir shows an X-ray period of 414s (Vrielmann et al. 2004), the signature of an IP where accretion curtains rain material at the magnetic poles of the white dwarf, enabling a view of the spin. Kepler has yet to determine the short timescale variability of an accreting, magnetic white dwarf. If the short cadence is not possible at this time, the long cadence will still be useful to follow the 85 min orbital period over the 2.5 months.

References

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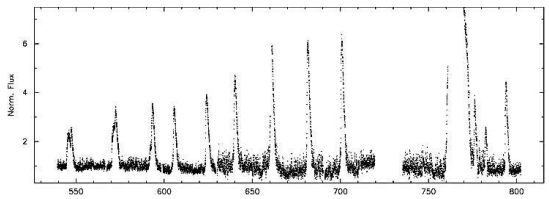

Fig. 1.— Long cadence Kepler light curve of the 17.7-20.2 mag dwarf nova V523 Lyr, Howell et al. 2013