K2 Campaign 0 Proposal for Monitoring Cataclysmic Variables

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The original Kepler field contains 27 previously known and/or subsequently discovered (Howell et al. 2013; Scaringi et al. 2013a,b) 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. 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 positive and negative 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.

The change in Kepler parameters will allow a much broader implementation of long-cadence, high time resolution data for CVs, 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 (a 17.7-20.2 mag variable in the Kepler field). While sky surveys are currently operating (CRTS, ASAS, PanSTARRS), the cadence of these fields is on the order of 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.

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 within the nominal pointing of K2-0 (and possible small shifts). This resulted in 12 objects, which include 10 dwarf novae, 1 old nova and the intermediate polar (IP) V418 Gem. IPs have magnetic WDs with fields of a few MG and accretion curtains which rain material at the magnetic poles, enabling a visible modulation of the white dwarf spin. We request long cadence observations for 11 of the CVs and short cadence for V418 Gem. The short cadence will resolve the 480s spin period and 4 hr orbital period (Patterson et al. 2011) of this 16th mag object and allow the first long term monitoring of the variability of a magnetic white dwarf. The long cadence observations will extend the studies of accretion during quiescence and outburst that can advance the stringent tests of accretion dynamics that began with the original Kepler field.

References

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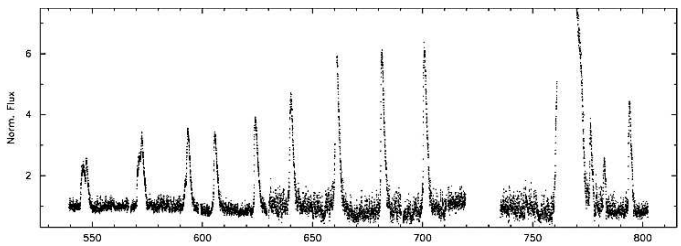

Fig. 1.— Long cadence Kepler light curve of the 17.7-20.2 mag dwarf nova V523 Lyr, Howell et al. 2013