Long cadence observations of cataclysmic variables with K2

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One of the greatest advantages of the re-purposed mission will be related to variability studies (both periodic and aperiodic) of accreting compact objects, including white dwarfs, neutron stars, and both stellar-mass and supermassive black holes at the center of galaxies. Arguably, the most suited systems to study accretion-driven variability with the K2 mission are cataclysmic variables (CVs), where a white dwarf accretes material from an accretion disk formed via Roche-lobe overflow of a secondary star. This is because these systems have brighter apparent magnitudes than the other classes of accreting objects and their intrinsic variability timescales range from seconds to months.

With this proposal we will seek to characterize the long-timescale properties CVs within Fields 2 & 3 using long cadence (LC) data by applying similar methods to those already used on *Kepler* (Wood et al. 2011, Cannizzo et al. 2012, Kato & Osaki 2013 and Scaringi et al. 2013, and references therein). This will include (i) studying the appearance of negative/positive superhumps and (ii) quantifying outburst durations, length, and brightness, all as a function of where they appear relative to the superoutbursts (see eg. Fig. 1 taken from Cannizzo et al. 2012). These observations will allow us to study the evolution of the disk size and precession in these systems. While we will not be able to accumulate the long time-histories available with the original *Kepler* objects, with the K2 observations we will verify how consistent this behavior is in a larger sample with a range of orbital periods. Specifically, the K2 observations will allow us to test models where the positive superhumps are generated by the viscous dissipation within the periodically flexing disk and/or the disk bright spot, and whether the negative superhumps are generated from accretion onto a tilted disk precessing in the retrograde direction (Wood et al. 2011). The LC observations will thus extend studies of accretion during quiescence and outburst that can advance the stringent tests of accretion dynamics that began within the original *Kepler* field.

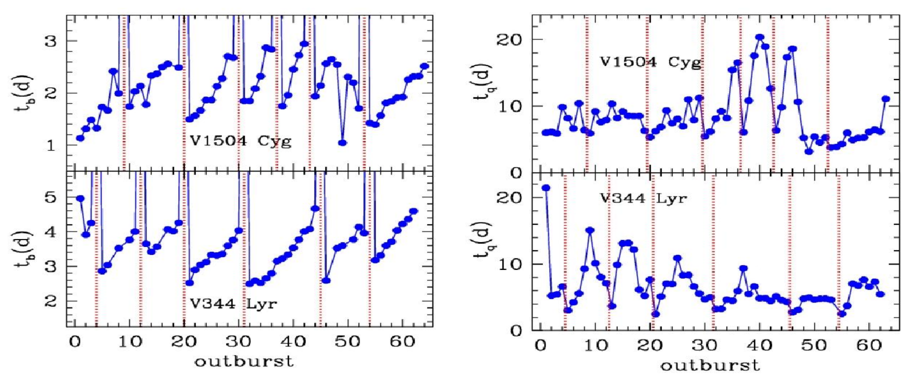

Figure 1: Left: Outburst durations for V1504 Cyg and V344 Lyr observed with *Kepler*. Right: Quiescent duration fro the same objects. All plots have the positions of super-outburst marked with vertical dashed lines. In both cases *Kepler* short cadence (SC) data was used, however LC data would also allow to characterize the behavior given the outburst/quiescent timescales are on the order of days. Although we will not be able to accumulate the long time-histories as for these two objects, the K2 observations will allow us verify how consistent this behavior is in a larger sample with a range of orbital periods. (Figures taken from Cannizzo et al. 2012).

In addition to studying periodic properties we will analyze the long-timescale flickering properties for all observed CVs, and specifically search for long-timescale quasi-periodic oscillations (QPOs) similar to those found in the *Kepler* lightcurves of MV Lyrae (Scaringi et al. 2012). Although these QPOs are still not explained by any theoretical model, the broad-band power spectra density (PSD) of CVs displays many similarities to those observed in X-ray binaries (XRBs) and Active Galactic Nuclei (AGN). Obtaining data on additional systems will allow us to systematically compare the PSDs of a larger sample of CVs to those already gathered for XRBs and AGN. This will enable us to (i) discover new phenomenological similarities within the variability properties of XRBs, AGN and CVs and (ii) potentially infer new scaling relations between the intrinsic timescales, mass and size of the different compact accretors.

In total, there are 5 and 6 CVs in Fields 2 & 3 respectively on active silicon using the K2FOV tool, all obtained from either the Ritter & Kolb 2003 catalog or the Catalina Real-Time Transient Survey (Drake et al. 2014), and all having K_p magnitudes brighter than 18.5.

References

•Ritter & Kolb 2003, A&A, 404, 301 •Drake et al. 2014, MNRAS, in press. •Cannizzo et al. 2012, AJ, 747, 117 •Kato & Osaki 2013, PASJ, 65, L13 •Scaringi et al. 2013, MNRASL, 435, 68 •Wood et al. 2011, ApJ, 741, 19 •Scaringi 2012, MNRAS, 427, 3396