Variability in 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 short proposal, we ask to observe **3 CVs obtained from the Ritter & Kolb 2003 catalog, in short cadence (SC) mode, including 1 intermediate polar.**

These systems will form the basis for both periodic and aperiodic variability analysis. Specifically, we will seek to characterize the outbursting properties of the CV sample by applying similar methods to those already used on *Kepler* data by Cannizzo et al 2012, Kato et al. 2013 and Scaringi et al. 2013 (and references therein), by quantifying the outburst durations, length, and brightness as a function of where they appear relative to the superoutbursts. This will allow to study the disk size and precession in these systems.

Additionally, the broad-band variability properties (flickering) will be analyzed using the same tools as those used on the *Kepler* lightcurve of MV Lyrae (see Fig. 1, Scaringi et al. 2012a, Scaringi et al. 2012b), which will result in the characterization of the rms-flux relations present in the variability as well as the power-spectral density (PSD) shapes. This will include both phenomenological as well as theoretical fitting of the PSDs, where we will seek to obtain the characteristic frequencies of potential quasi-periodic oscillations, as well as the high-frequency breaks in the PSDs. Furthermore, we will seek to apply the physical model used in Scaringi 2014 to infer accretion disk parameters for the sample, such as the scale height, size and viscosity parameter of the inner-most accretion disk region. This same model has also been used to study the X-ray flickering behavior of X-ray binaries (XRBs), and the new K2 dataset will allow the first comprehensive comparison between the already known XRB results to a sample of CVs. One system of particular interest in the sample (QZ Vir) is a known intermediate polar: a CV with a magnetic WD displaying spin modulations. As no such system has ever been discovered in the original *Kepler* field, the K2 observations will provide the best ever lightcurve for such a system, and we will determine whether the WD is spinning down as expected from the work of Norton et al. 2008, and be able to compare these results to X-ray observations of accreting, spinning, neutron stars. Since the intrinsic aperiodic variability timescales for all 3 CVs is on the order of a few minutes, they can only be probed with SC data.

All objects in the proposed target list have m_V magnitudes brighter than 18.7. The attached K2 target list has them arranged in order of priority. We request all objects in SC mode.

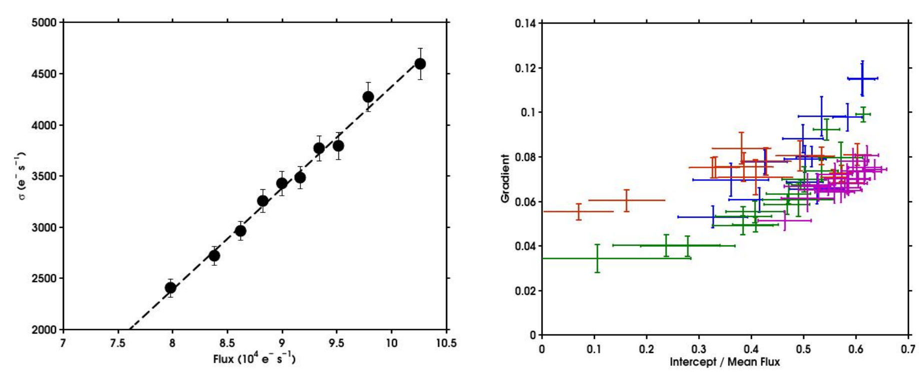

Figure 1: Left: Single rms-flux relation obtained from a 10-day segment of SC *Kepler* data on MV Lyr. Right: Gradient vs. intercept fits for the individual rms-flux relations obtained in MV Lyr. The color-coding represents the evolution of the relations from blue, green, red to magenta.

References

•Ritter & Kolb 2003, A&A, 404, 301 •Cannizzo et al. 2012, AJ, 747, 117 •Osaki & Kato 2013, PASJ, 65, 95 •Scaringi et al. 2013, MNRASL, 435, 68 •Scaringi et al. 2012a, MNRAS, 421, 2854, •Scaringi 2012b, MNRAS, 427, 3396 •Scaringi 2014, MNRAS, 438, 1233 •Norton et al. 2008, ApJ, 672, 524