Optical Flickering in Symbiotic Stars

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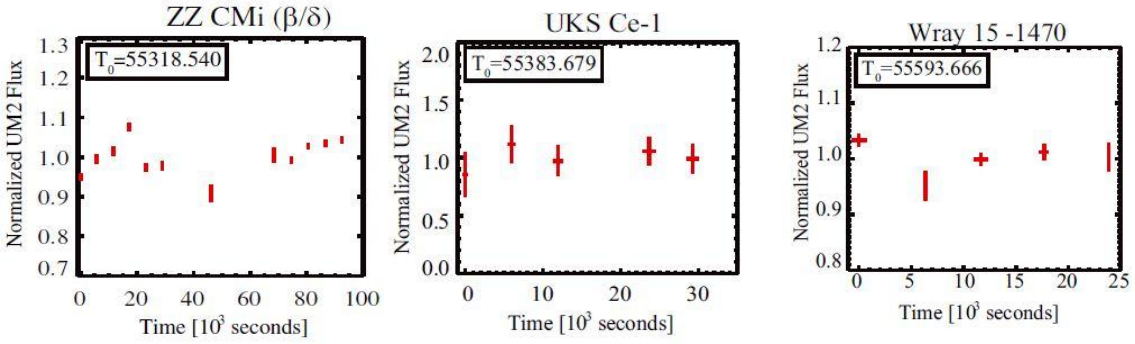
We propose that K2 monitor the only two symbiotic stars on silicon in the Campaign 2 Field for optical flickering. There are no symbiotics on silicon in the Campaign 3 Field.

Symbiotic stars comprise a heterogeneous set of wide binaries in which a compact object, typically a white dwarf (WD), accretes material from a late type companion. Symbiotic star binaries are an increasingly important place to study accretion onto WDs, since they are candidate Type Ia supernova progenitors. Unlike in most of the cataclysmic variables (CVs), the WDs in symbiotics typically accrete from a wind, at rates $\geq 10^{-9} M_{sun} yr^{-1}$. Ultraviolet aperiodic variability (flickering), which is usually associated with accretion through a disk, has been detected by Swift UVOT at the tenth of a magnitude level on timescales of thousands of seconds among a subset of symbiotic stars (Luna et al, 2013, A&Ap, 559, A6), especially for targets that are x-ray sources. However, of the more than 200 known symbiotic stars (Belczynski et al 2000, A&ApSupp, 146, 407), optical flickering has been observed in only five systems and displays amplitudes of several tenths of a magnitude which are comparable to levels in CVs. These few, optically flickering symbiotics are confined to the small set of symbiotic recurrent novae (e.g., T CrB) or have very low luminosity hot components where nuclear burning is not likely to be active at present. Current hypotheses suggest that in the majority of symbiotic stars light from quasi-steady nuclear burning on the surface of the WD hides the fluctuating optical emission from the accretion (Sokoloski, 2001, MNRAS, 326, 553) down to the ground-based accuracy levels of a few tens of millimag.

K2 long-cadence observations provide a unique opportunity to ferret out low-amplitude optical flickering in symbiotics at unprecedented levels. Establishing limits or the absence of optical flickering at millimag levels can be used to precisely constrain models of the physical conditions in the inner regions of symbiotic systems and disks and potentially constrain estimates of accretion energy release in comparison to the required nuclear burning levels. Stringent limits on the level of accretion-related flicker can help elucidate the differences between symbiotics and other white dwarf accretors.



Swift UVOT monitoring observations (Luna et al 2013) revealed UV flickering as in ZZ CMi above, but the signal levels for our two proposed K2 campaign 2 targets (UKS Ce-1 and Wray 15-1470, aka SS73_55) were insufficient to establish flickering firmly.

For the accompanying target list we have calculated Kepler magnitude (Kp) from Pan-STARRS (PS1) g and r photometry with a relationship calibrated at STScI by J. Valenti using 182,367 KIC stars (CQ=SCP) in the Kepler field.