K2 OBSERVATIONS OF SUPERWASP ECLIPSING BINARIES

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Almost all of astrophysics is underpinned by our understanding of the physics of normal stars. The development of reliable theoretical models of stars, culminating in the 1990s and 2000s, is one of the great achievements of stellar physics. But a plethora of the physical phenomena implemented in modern codes are poorly understood and often reduced to fudge factors, some of which are calibrated on only one object: our Sun. Significant uncertainties surround our understanding of phenomena such as mixing length, convective core overshooting, mass loss, rotation, magnetic fields, and even stellar formation mechanisms.

Eclipsing binary stars (EBs) are our primary source of empirical measurements of stellar properties, and can yield mass and radius measurements to better than 1% (Southworth et al., 2005, MNRAS, 363, 529). They are thus used to calibrate theoretical models (Pols et al., 1998, MNRAS, 298, 525), provide real-world mass–radius–temperature relations (Torres et al., 2010, A&ARv, 18, 67), and identify parameter space where theoretical models fail (López-Morales, 2007, ApJ, 660, 732). Low-mass EBs show clear deviations from theoretical predictions which currently limit our understanding of extrasolar planets (Southworth, 2009, MNRAS, 394, 272).

Other important uses of EBs are as direct distance indicators (Pietrzynski et al. 2013, *Nature*, 495, 76), calibrators of asteroseismic scaling relations (Frandsen et al., 2013, A&A, 556, A138), probes of chemical evolution of massive stars (Pavlovski et al., 2009, MNRAS, 400, 791), and tracers of binary evolutionary processes (Maxted et al., 2013, *Nature*, 498, 463). We now know of circumbinary planets which have been found because they orbit EBs (Doyle et al., 2011, *Science*, 333, 1602).

The study of an EB is critically dependent on getting a good light curve, from which the radii can be measured to high accuracy. Ground-based studies are hindered by limited photometric precision and the inability to observe during bad weather or daytime, forcing observers to spend sometimes years chasing eclipses of the most interesting and important objects. The remarkable abilities of the *Kepler* satellite bypass these problems, yielding data of much greater quantity and quality than could ever be achieved from the ground. In addition to a K2 light curve, high-resolution spectroscopy is required to determine the masses (through radial velocity measurements) and atmospheric parameters of the stars in an EB. Spectroscopic data can straightforwardly be obtained from ground-based facilities, as continuous monitoring through the orbital period is not required.

The SuperWASP survey has built up a huge database of billions of photometric measurements of bright stars, which are systematically searched for transiting planets (Pollacco et al., 2006, PASP, 118, 1407). These data are also excellent for the identification of variable stars, particularly EBs. For example, Smalley et al., (2014, A&A, 564, A69) recently used SuperWASP data to identify 70 EBs within the Renson & Manfroid (2009, A&A, 498, 961) catalogue of Am stars.

We have searched the SuperWASP database for EBs in K2 fields 2 and 3 in order to identify the best candidates for follow-up observations from *Kepler* K2. We propose these as targets for *long cadence* slots. We have split them into three priority levels (1 = most important to 3 = least important) to aid in scheduling. In assigning priorities we have considered the eclipse depths (deeper eclipses hold more information so are more useful), spectral types (GKM dwarfs are particularly interesting as analogues of planet host stars) and orbital periods (longer period means weaker tidal effects so evolution is less influenced by binarity).

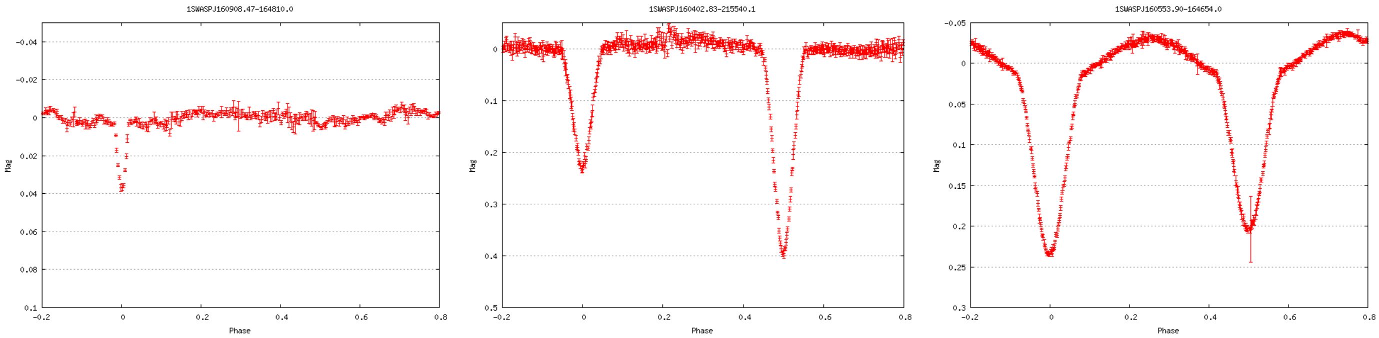

Figure 1: Gallery of light curves of eclipsing binaries from SuperWASP.