

## Proposal for Observations of Eclipsing Binaries in Kepler K2 Fields 2 & 3

Geraldine J. Peters

Space Sciences Center & Dept. of Physics & Astronomy, University of Southern California  
Los Angeles, CA 90089-1341

We propose *Kepler* LC observations of eclipsing binary systems in K2 Fields 2 and 3. All observations are in the long cadence mode. As part of a wider study of the detailed physics of mass transfer in Algols, we are modeling the *Kepler* light curves of short-period systems observed during Cycles 1-4. The observations have revealed that several systems display unequal brightness at their quadrature phases and that the quadrature brightness ratio varies from  $> 1$  to  $< 1$  on a time scale of about 100-400 days (<http://nexsci.caltech.edu/conferences/KeplerII/posters/peters.pdf>). To the best of our knowledge such behavior (called L/T - leading/trailing hemisphere - variability) has never been reported from ground-based photometry. The *Kepler* light curves are being modeled with the Wilson-Devinney program (Wilson & Devinney 1971, Wilson 2012 and references therein) and we are exploring whether a migrating hot accretion spot on the primary and/or cool spots on the secondary can explain the quadrature light variability. Observations of additional Algols and related eclipsing binaries in *Kepler* K2 Fields 2 and 3 will allow us to investigate the prevalence of the L/T phenomenon in short-period systems, look for the behavior in longer-period Algols in which the gas stream misses the primary star, and study variability in the secondary as at least one system shows a total eclipse.

Following the guidelines on the K2 webpage ([keplerscience.arc.nasa.gov/K2/ProposeTargets.shtml](http://keplerscience.arc.nasa.gov/K2/ProposeTargets.shtml)) we searched the regions centered on  $\alpha$  (2000) =  $16^{\text{h}} 24^{\text{m}} 31.2^{\text{s}}$ ,  $\delta$  (2000) =  $-22^{\circ} 27' 00''$  and  $\alpha$  (2000) =  $22^{\text{h}} 26^{\text{m}} 40.8^{\text{s}}$ ,  $\delta$  (2000) =  $-11^{\circ} 06' 00''$  for eclipsing binaries with EA (eclipsing Algols), EB (eclipsing binaries of the beta Lyr type), and EW (eclipsing binaries of the W Uma type) designations using a  $8.5^{\circ}$  search radius. Several catalogs of variable stars were consulted including Avvakumova et al. (2013), Malkov et al. (2006), Budding et al. (2004), the General Catalog of Variable Stars (Samus et al. 2013), and Simbad. A check was then made using K2fov to determine whether the object will fall on a *Kepler* CCD chip. Systems with Kepler magnitudes between 4.0-15.0 were considered candidates for observation. Four of the nine objects in Field 2 qualified for observation, while five of the eleven binaries in Field 3 are predicted to fall on one of the CCD detectors. In total there are six EA systems, two EBs, and one Be star in both fields. The Be star,  $\chi$  Oph, might turn out to be too bright for observation though it is slightly fainter than the quoted bright limit on the *Kepler* K2 website.  $\chi$  Oph (HD 148184, B1.5Ve) is a well-known active Be star (cf. Rivinius et al. 2003, Hubert & Floquet 1998) that is viewed at an intermediate to pole-on angle to our line-of-sight. Photometric and spectroscopic periods of less than one day have been reported that may be associated with nonradial pulsation. Observation of this star will yield information on mass loss at high latitudes in Be stars.

### References:

- Avvakumova, E. A., Malkov, O. Yu., & Kniazev, A. Yu. 2013, *Astr. Nach.*, 334, 860
- Budding, E., Erdem, A., Çiçek, C., Bulut, I., et al. 2004, *A&A*, 417, 263
- Hubert, A.M., & Floquet, M. 1998, *A&A*, 335, 565
- Malkov, O. Yu., Oblak, E., Snegireva, E. A., & Torra, J. 2006, *A&A*, 446, 785
- Rivinius, T., Baade, D., & Štefl, S. 2003, *A&A*, 411, 229
- Samus N.N., Durlevich O.V., Kazarovets E V., Kireeva N.N., Pastukhova E.N., Zharova A.V., et al. 2007-2012 ( General Catalogue of Variable Stars, VizieR On-line Data Catalog: B/gcvs)
- Wilson, R.E. 2012, *AJ*, 144, 73 (9pp)
- Wilson, R.E., & Devinney, E.J. 1971, *ApJ*, 166, 605