

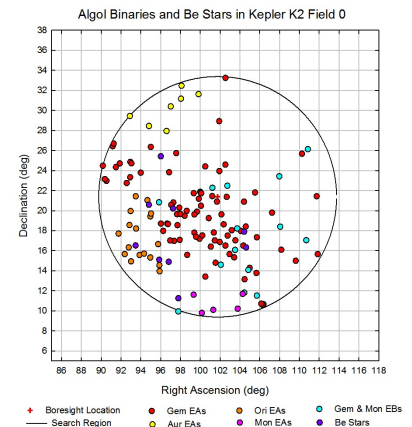
Proposal for Observations of Algol Binaries and Be Stars in Kepler K2 Field “0”

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We propose *Kepler* LC observations of Algol binary systems and Be stars in K2 Field “0”. SC observations are proposed for five especially interesting objects. 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 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 in *Kepler* K2 Field “0” 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 some systems show total eclipses.

Following the guidelines on the K2 webpage (keplerscience.arc.nasa.gov/K2/ProposeTargets.shtml) we searched the region centered on α (2000) = $06^{\text{h}} 47^{\text{m}} 00^{\text{s}}$, δ (2000) = $+21^{\circ}22' 47''$ for binaries of the Algol type and Be stars using a 12° 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. One hundred and thirty-six objects listed as types EA (Algol-like light curves), EB (β Lyr-type light curves), AL (Algols), and Be in the constellations of Gemini, Orion, Monoceros, and Auriga (plotted in the Figure to the right) were found. LC observations are proposed for all of these objects.



One month of SC observations are proposed for three of the Algol binaries that display total eclipses (RW Gem, B5V+F5, $P=2.87^{\text{d}}$, totality duration = 1.5^{h} ; RX Gem, A3IIIea+K1:, 12.21^{d} , 4.4^{h} ; and RY Gem, A2Ve+K2IV, 9.30^{d} , 5.1^{h}). In the first system the gas stream directly impacts the mass gainer’s photosphere. The other two binaries are systems with significant disks and prominent $H\alpha$ emission. So far no totally-eclipsing system has been confirmed in the *Kepler* database preventing us from investigating flare, spot, and pulsational activity on the secondary independent from activity on the primary. We also propose a month of SC observations of two of the early Be stars (HD 45314, O9:pe; HD 253659, B0.5V:nne) that have disks as well as significant stellar winds. Such objects are intermediate between the O stars and Be stars and SC data would allow us to characterize their optical variability and study disk-wind-star interactions. HD 45314 (PZ Gem) appears to be an active γ Cas variable with erratic hard X-ray variability on a time scale of a few ksec, and may be a close binary (Rauw et al. 2013). HD 253659 is a rapidly-rotating disk system in which we will look for rotational modulation of the light curve and pulsational activity (a suggested cause for the Be phenomenon).

References:

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