Asteroseismology of Stars in Eclipsing-Binary Systems
- Selection of Targets for K2, Field 1 –

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This proposal follows that submitted for field 0 (#GO0073), which was awarded one target at short cadence and three others at long cadence. Even though the north galactic cap is not favorable for eclipsing binaries, we propose to observe a very interesting system (FM Leo) at short cadence.

Scientific Context

Binary systems hosting at least one star with detectable solar-like pulsations are becoming important astrophysical targets because they provide a way to calibrate asteroseismology. As illustrated by the CoRoT and *Kepler* missions, asteroseismology is an efficient method to measure masses, radii, and ages of large numbers of stars, which is of prime importance to test stellar evolution. However, a crucial test of both asteroseismic masses and radii of a large sample of stars with independent measurements of those quantities has not yet been carried out. Eclipsing binary systems (EBs) potentially permit such an exercise by allowing for accurate determination of masses and radii of both stars by combining photometric and radial-velocity measurements, provided that spectral lines are detectable for both components. EBs are also interesting for the physical processes resulting from tidal interactions, which may influence their evolution when the stars are close enough (e.g. Gaulme et al. 2014). So far, all the published stars known to both display solar-like oscillations and belong to EBs are red-giants (RGs), and all have been detected by the Kepler mission. The first detection was the 408-day period system KIC 8410637 (Hekker et al. 2010, Frandsen et al. 2013). Since then, Gaulme et al. (2013 & 2014) reported a list of 18 *bona fide* new RG eclipsing-binary candidates of which 14 displayed oscillations. More recently, Beck et al. (2013) reported the discovery of 18 new heartbeat stars, where each system has a RG component with oscillations, and three are also EBs. Provided that oscillations are detected, observing known EBs with K2 is a unique opportunity to extend the sample of systems to test asteroseismology.

Target Selection

We identified four eclipsing binaries in field 1 from the General Catalog of Variable Stars (GCVS). By considering only systems with known spectral types and magnitudes from 8 to 12 – bright enough to detect oscillations – *FM Leo* is the only appropriate system. It is an excellent opportunity for asteroseismology of main-sequence binaries because it is a detached system consisting of two nearly identical spherical components, whose parameters are already accurately characterized (Ratajczak et al. 2010). *FM Leo* is composed of two 3-Gyr old F-type stars orbiting in 6.73 days, with masses, radii and temperatures (M_1 = 1.318±0.007 M_{sun}, R_1 = 1.648±0.043R_{sun} T_1 = 6316±240 K) and (M_2 = 1.287±0.007 M_{sun}, R_2 = 1.511±0.049R_{sun}, T_2 = 6190±211 K). Its 8.47-magnitude should allow for detecting solar-like oscillations. Their predicted frequencies at maximum amplitudes are ν_{max1} = 1415 μHz and ν_{max2} = 1661 μHz, which implies that short-cadence data are mandatory. From the K2FOV tool, *FM Leo* is on the detector.