The effect of wide binaries on planet occurrence - K2 Campaigns 4&5

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We plan to observe a sample of wide binaries spread across the K2 fields to constrain the effect of wide multiplicity on planet occurrence and to provide benchmark systems for gyrochronology.

Science Goal 1: Probe the effect of wide multiplicity on planet occurrence. Wide companions are common in the field; Raghavan et al (2010) found that >20% of solar-type stars have a companion wider than 100 AU. Any link between planet occurrence and wide multiplicity will have a significant effect on the number of habitable planets in the Galaxy. We propose to test the disruption of planetary systems caused by a wide companion proposed by Kaib et al. (2013). In this theory, wide companions interact with field stars and are sent into elliptical orbits bringing them close to their primary star, possibly close enough to disrupt a planetary system. This could eject planets from the system or provide an instigator for migration, moving giant planets closer to their parent star.

Science Goal 2: Provide benchmark gyrochronology systems. Wide binary systems contain stars which are physically isolated from each other yet share common metallicity and age. This means that the stars in these systems can be used to test age relations, which should give similar ages for both components. Kepler has already been used to accurately measure the rotation periods of thousands of stars. By including wide binary components as Kepler targets, we will produce a valuable legacy product to test and recalibrate gyrochronology relations allowing the ages of field stars to be more accurately determined.

We have used the proper motion catalog of Kraus et al. (2014) to select pairs of objects with common proper motion. We have restricted ourselves to objects with significant proper motions above 30 milliarcseconds per year and have also set a condition of common distance (using distance moduli derived from SED fitting). In Fields 4 and 5 we also specifically exclude objects in the Pleiades and Praesepe which could contaminate our sample. We then restricted our sample to pairs which were close enough to make them unlikely to be purely coincident pairings between unrelated field stars. This resulted in 246 targets on silicon in fields 4 and 5.

Over the course of the next two years we will target approximately 1000 stars across the 10 K2 fields yielding approximately 20 planets. We already have 116 targets accepted for Field 1 with 98 targets proposed for Field 3 (Field 2 suffers from crowding making clean target selection difficult). This will allow us to measure the occurrence of short period planets around stars in wide binaries and to test whether this deviates significantly from the field population. This will constrain the potential systematic bias on planet occurrence rates caused by multiplicity.