DETAILED MODELING OF EXOPLANET TRANSITS

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The P.I. proposes to continue to use state-of-the-art transit modeling software to measure the properties of Kepler discovered exoplanets. The P.I. will provide the Kepler Team with the following products: (1) accurate system parameters for the high signal-to-noise planets and host stars (e.g.~planet masses and radii); (2) precise transit timings to be used by the Kepler Science Team to confirm planets, measure their masses, and detect other non-transiting bodies; and (3) characterization of stellar activity and its impact on exoplanet science (e.g.~how starspots affect transit timing). The PI has an outstanding record as a Participating Scientist, having generated products that have been used in several key discovery papers (most notably Kepler-9 and Kepler- 11). The P.I. has also lead two significant discovery papers (ellipsoidal variation in HAT- P-7, and the remarkable system KOI-54). The proposed work is a refined version of the PI's original PSP activities, but refined and tailored to the specific needs of the post- launch era. The P.I. will analyze a subset of the Kepler observations at a level that is impossible to do for a large set of systems. These short-period systems will be scrutinized with painstaking attention to detail. For the larger planets with very high signal-to-noise ratios, the investigation will emphasize accuracy not just precision, and will focus on measuring subtle but important astrophysical effects. For the smaller planets, the focus will be more on robust determination of the planetary characteristics. This narrow focus adds a strong complement to the broader Kepler Mission objectives. The eclipse modeling software ``ELC'' will be the primary tool employed by the P.I. and will be used to measure planetary radii, masses, temperatures, reflections/albedo, orbital elements, transit timing variations, and other characteristics of the planet-star system. As part of this project, ELC will be improved to take full advantage of the unprecedented level of precision of the Kepler light curves, and the high occurrence of multi-transiting systems in the Kepler data. Thus a fourth product will be generated: (4) the enhanced ELC code will be made available to the Kepler Science Team. The PI of this proposal is well--versed in skills relevant to this research, as evidenced by the Kepler papers he has led and contributed to, and the many Working Groups he actively participates in. The proposed investigation is directly related to the objectives of the Kepler Mission, and to NASA interests as a whole, as the work will help the Kepler Team achieve the principle goals of the Mission.