

CONFIRMING SMALL PLANETS AND MEASURING THEIR MASSES WITH TRANSIT TIMING VARIATIONS

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I propose to analyze the transit times of Kepler planets to confirm the planet nature of small planets in systems with multiple planet candidates, to constrain or identify the presence of additional nontransiting planets in those systems, and to eliminate astrophysical false positive systems that can produce transit timing variations (TTVs). I propose augment my existing, fast TTV software to incorporate additional bodies and apply it to all suitable Kepler data to give mass measurements for the planets in TTV systems. With the data from the extended mission, these TTV studies, which have already confirmed most of the smallest Kepler planets, will be able to confirm yet smaller planets and those with longer orbital periods---especially planets within and around the habitable zone of the host stars. I propose to study possible long-term correlations between the age of a planetary system and its orbital architecture and planet sizes. The proposed research specifically addresses one of the scientific goals of the Kepler extended mission: 'Characterize the size and orbital distributions of small planets ($R < 2.5 R_{\text{Earth}}$)' and contributes to the other two: 'Identify correlations between the characteristics of planetary systems and their host stellar systems'; and 'Provide a statistically significant determination of the frequency of Earth-size planets in and near the habitable zone of their host stars.'