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Abstract: Analytic Approach to ETV Analysis of Eccentric Binaries with Close Tertiaries

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We report eclipse timing variation analyses of a sample of compact hierarchical triple stars comprised of an eccentric eclipsing binary and a close tertiary component found in the Kepler field. We simultaneously fit the primary and secondary O-C curves of the selected systems for the geometrical light-travel time effect (LTTE), and dynamical perturbations caused by the third companion on different time-scales. For the first time, we include those contributions of three-body interactions which originate from the eccentric nature of the inner binary. These effects manifest themselves both on the long (outer-) period, and the "apse-node" timescale. We demonstrate that considerationof the dynamically forced rapid apsidal motion in these systems not only yields an efficient and independent tool for the determination of the inner orbit's eccentricity and orientation, as well as the 3D orbital configuration of the triple, but also helps to resolve the degeneracy between the amplitudes of the LTTE and the long-period dynamical term, due to the strong dependence of the apsidal motion period on the triple's mass ratio.

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