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Title: Fast computation of transit times, and application to Kepler multi-planet systems
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Abstract:
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Abstract: Transit timing variations (TTV) have proven to be a powerful technique for confirming Kepler planet candidates, for detecting non-transiting planets, and for constraining the masses and orbital elements of multi-planet transiting systems. These TTV applications require the numerical integration of orbits for computation of transit times (as well as impact parameters and durations); frequently tens of millions to billions of simulations are required when running statistical analyses of the planetary system properties. Thus, speed is of the essence when carrying out dynamical integrations. We have created a fast code for transit timing computation, ttv_fast, which uses a symplectic integrator with a time step interpolator (Nesvorny et al. 2013), which we have pared down to the bare essentials in order to make the code as fast as possible. The speed comes at the expense of precision, but the time step can be tuned to give sufficient precision for any particular Kepler system. We find a speed-up of at least an order of magnitude relative to dynamical integrations with machine precision using a Bulirsch-Stoer integrator. We will present results on a multi-planet system to which we have applied this code.