General Poster

Dynamical modeling of transiting planets in multi-planet systems

J. Freudenthal[1], S. Dreizler[1], C. von Essen[2]

[1]*Institut fuer Astrophysik, Georg-August-Universitaet Goettingen, Germany*
[2]*Stellar Astrophysics Centre, Aarhus University, Denmark*

The detection of transit timing variations indicates an interaction between different objects in these systems. Therefore it is not longer sufficient to assume Keplerian orbits for modeling these planets. The orbital integration of multiple planet systems provides a tool to include the dynamical interaction. The comparison of these models with observations leads to the characterization of the observed system parameters and the evidence of interaction between the planets would serve the purpose of verifying their existence.
Our characterization of multi-planet systems with dynamical models was done in three steps. The first step was to prepare follow-up observations of known systems with transit timing variations. Modeling of all old data was done by comparing two sequent transit lightcurves simultaneously with the *Mandel & Agol* transit model (2002) using a *Markov Chain Monte Carlo* algorithm. Modeling all data of a system with this method gave us a distribution for each parameter from which we derived a median value and the standard deviation as starting parameter for modeling the new transit lightcurves.
The next step was the modeling of transit timing variations considering the dynamical interaction between different planets to get a better system characterization and its validation. The dynamic model was derived from the *mercury 6* code written by John E. Chambers and the comparison with data was done with the *Levenberg Marquardt*.
The last step was to combine the dynamical modeling of transit timing variations and transit lightcurves. That means the model consist of orbital parameters for each transit individually derived from *mercury 6* for which *Mandel & Agol* models are computed. All transit lightcurves from one system can then be compared with this model simultaneously using the *Levenberg Marquardt* algorithm.
Using Kepler 9 we demonstrate the performance of the modeling.