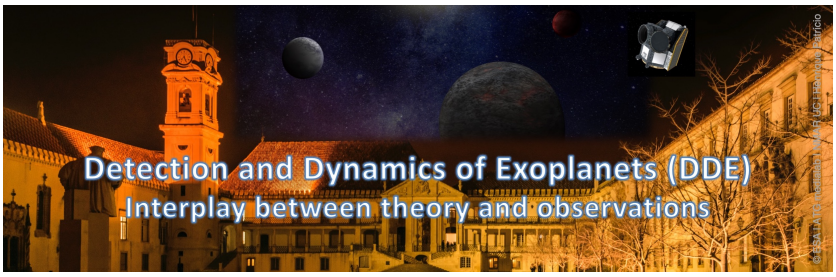

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Predicting the stability of planetary systems through chaos indicators

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The growing number of exoplanets detected over the past three decades has created a need for fast, reliable methods to study the long-term survival of planetary systems. Here, we investigate the challenging problem of the stability of compact three-planet systems, in which resonant and chaotic processes are intrinsically linked. Four completely different chaos indicators are tested on a data set of 10,000 three-planet configurations that are in or near mean-motion resonance. On the one hand, we consider two well-established chaos indicators, namely the mean exponential growth factor of nearby orbits (MEGNO) and a modified chaos indicator based on Lagrangian descriptors. On the other hand, two non-variational chaos indicators which do not require the tangent vector computation are considered for the first time for compact systems. We evaluate the performance of each chaos indicator in correctly predicting the stability of the planetary systems, and also highlight their differences by studying the dynamics of system configurations that are inconsistently classified by different indicators. Finally, we discuss how these chaos indicators could be combined to improve overall performance and how they could be useful for imposing constraints on the orbital parameters of observed planetary systems. This is a joint work with A.-S. Libert.

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