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Title: *"How periodic orbits influence the co-existence of terrestrial planets with giants on eccentric orbits"*

Abstract. Hitherto unprecedented detections of exoplanets have been triggered by missions and ground based telescopes. The quest of "exo-Earths" has become intriguing and the long-term stability of planetary orbits is a crucial factor for the biosphere to evolve. Planets in mean-motion resonances (MMR) prompt the investigation of the dynamics in the framework of the three-body problem (TBP), where the families of stable periodic orbits constitute the backbone of stability domains in phase space. Here, we address the question of the possible co-existence of terrestrial planets with a giant companion on circular or eccentric orbit and explore the extent of the stability regions, when both the eccentricity of the outer giant planet and the semi-major axis of the inner terrestrial one vary, i.e. both non-resonant and resonant configurations. Our study exploits the restricted three-body problem (RTBP). Starting from the circular family and its bifurcation points, the families of periodic orbits in the circular and elliptic RTBP are computed for the 3/2, 2/1, 5/2, 3/1, 4/1 and 5/1 MMRs. We construct maps of dynamical stability to identify the boundaries of the stability domains where such a co-existence is allowed. We also compute the vertical critical periodic orbits (i.e. bifurcation points that can generate spatial families of periodic orbits) and provide hints with respect to vertically stable planetary orbits, as islands in their neighbourhood can host resonant mutually inclined exoplanets. Finally, the maximum mutual inclination of stably evolving planets that can be attained by spatial families of periodic orbits is also discussed.

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