PROJECT FOR POST-DOCTORAL FELLOWSHIP ON CREEP TIDES THEORY

PROJECT TITLE: **3D EXTENSION OF THE CREEP TIDE THEORY**

Supervisor: Prof. Sylvio Ferraz-Mello

Summary and Goals: The foundations of the hydrodynamical creep tide theory in development at IAG-USP were laid in 2013 and different aspects of the theory were developed since then. The existing results have been already applied to several different problems of tidal evolution, but there is yet a large number of situations waiting for study. There is an extensive to-do list of topics in need of urgent consideration. This post-doc is open for dedication in the development of one of these topics: the development of the theory in cases where the rotation axes are inclined with respect to the plane of the orbital motion. All results published on the interplay of tide and star activity were restricted to the systems discovered during the CoRoT mission and to the cases where the rotation axis of the stars is perpendicular to the plane of the orbital motion. The observation of the Rossiter-McLaughlin effect in several systems indicates a significant inclination. To study these cases, the full theory including the inclination effects, for which only a sketch exists, must be completed. The full theory needs to be completed and tested long before the launch of the PLATO spacecraft.

Work plan:

Step 1. Revision of the 3D static tide model (Folonier et al. 2022) and of the parametric version of the creep tide theory (Ferraz-Mello et al. 2020). The results of these papers are the bases for the construction of the 3D creep tie theory.

Step 2. Revision of the existing attempts of extension of the creep tide theory to study the 3D dynamic tide.

Step 3. Theoretical construction of a complete 3D model for the tidal evolution (orbital and rotational) of close-in planets and their host stars.

Step 4. Coding of the 3D model and comparison of the results to those obtained with the parametric creep theory of the coplanar case..

Step 5. Application to some typical exoplanetary systems with nonzero obliquity, e.g. CoRoT 3.

Step 6. Study of the interactions between close-in giant planets and host stars.

Schedule:

Semester I. Steps 1 and 2. Start of step 3.

Semester 2. Steps 3 and 4

Semester 3. Steps 5 and 6. Submission of paper(s) with results.

Semester 4. Generic applications to be defined..

How the postdoc fellowship fulfill the goals of the FAPESP postdoctoral fellowships:

We intend to attract young scientists having obtained a doctorate degree no earlier than seven years ago, to work with the Brazilian PLATO team.
We will conduct an international selection process, by advertising on a well-known international job database, thus fulfilling the goals and rules of FAPESP.

The project is part of the thematic project FAPESP 2016/13750-6 that deals with the Brazilian participation in PLATO mission. We have to prepare scientists to explore the data that will be made available from that mission as well as to prepare the theories to be used in the analysis of the dynamics of close-in exoplanets discovered during the mission (as done in the past for the mission COROT).

Bibliography

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