Supervisor's comments on doctoral project of Michaela Walterová

Orbitální a vnitřní dynamika terestrických planet
Orbital and internal dynamics of terrestrial planets

I met Michaela Walterová (Káňová) in 2012 when she was looking for possible topics for her Bachelor thesis. She decided to work with me on exoplanetary problems, and I was her Bachelor's, Master's, and Ph.D.'s theses advisor. Throughout her studies, she earned expertise in geophysics and planetary sciences as well as in continuum mechanics, programming, and numerical methods. She went well beyond the study program requirements and attended classes in astronomy. She focused on terrestrial bodies and extrasolar planets and their coupled internal-orbital evolution. Her combined geophysics and astronomy skills provide a unique expertise for working on the coupled planetary sciences, geophysics, and astronomy issues. Michaela proved to be highly motivated. She impressed me with her remarkable ability to work independently, teach herself, and critically assess her results. She also put significant work into developing her ideas and searching for new topics.

From the scientific point of view, I believe that the thesis contains original results that are of great interest to the exoplanetary community. Her first independent work was dedicated to the numerical study of the tidal deformation and torque for rheologically-motivated models with a possible 3D mantle structure. Then she moved to coupled thermal-orbital-rotational evolution of single planet systems. She also shifted from numerical towards semi-analytical and analytical models. This transition was driven by better understanding the underlying processes, reconciling previously used models in astronomy and geophysics, and time-consuming considerations of the numerical approaches. She has developed a semi-analytical model for investigating the coupled evolution of terrestrial planets. This approach allowed for studying the preferred spin-orbital states of the planets' and the coupled evolution for terrestrial bodies without a companion. In yet unpublished work, she studied coupled evolution for model planets with highly inclined perturber. Parallel to the coupled evolution problem, she analytically derived the description of planet-planet tides not only in a special planar case, which is part of the thesis but even more general cases. This part was inspired by the observation of tightly pack exoplanetary systems. During the preparation of this approach and its applications, the work received a significant demotivation and setback as a similar study based on a numerical approach was published. Nevertheless, the analytical derivation itself is a very interesting and useful insertion into the literature, and I sincerely hope that this part will be published soon.

Her written work and presentations are exceptionally well-formulated, carefully prepared, clear, and concise. In the frame of outreach, she can communicate scientific and astronomy findings to a broader audience.

Michaela Walterová has clearly proved that she is able to independently solve complex scientific problems and present her results in the form of a concisely written text. I recommend her work to be accepted as a Ph.D. thesis.

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Marie Běhounková