LUNAR & PLANETARY LABORATORY

May 15, 2023

Dear Evaluation Committee,

I am writing to provide an evaluation of Dr. Souček's Habilitation Dissertation, with a particular emphasis on his important work in the field of tidal deformation. As a professor at the Lunar and Planetary Laboratory at the University of Arizona, my research expertise closely aligns with Dr. Souček's, making me well-suited to evaluate his contributions.

First, I would like to address any concerns regarding the originality of Dr. Souček's work. The high percentage of matches in the Trunitin check is solely attributable to the fact that his thesis consists of a collection of previously published papers. Thus, there are no grounds for doubting the originality of his research.

Dr. Souček's research encompasses a wide range of topics within planetary science, and having reviewed his work, I can attest to its high scientific quality and strong impact on the field. For the purpose of this evaluation, I will focus primarily on his significant contributions to the field of tidal deformation, an area where our research interests strongly coincide.

The exploration of icy satellites in the outer solar system has revealed promising evidence of subsurface oceans, rendering these moons potential habitable worlds. To evaluate the long-term stability of such subsurface oceans, an understanding of tidal deformation and tidal heating is crucial. In this regard, Dr. Souček has developed novel models that extend previous works, notably the development of finite-element (FE) models. This advancement allows for the inclusion of realistic lateral shell thickness variations and heterogenous localized features, providing significantly more realistic tidal deformation models.

Using his novel FE model, Dr. Souček illustrated that the interaction between lateral shell thickness variations and faults in the south polar terrain of Enceladus magnifies the amplitude of tidal deformation by an order of magnitude. Additionally, his research suggests that a deep source of tidal heating is likely required to explain the observed heat flux, providing important insights into the underlying mechanisms at play.

Furthermore, Dr. Souček has investigated the widely adopted tidal walking model for the generation of faults on Europa using his FE model. His work revealed that fault formation requires stress levels higher than those currently observed, indicating that these features likely developed during periods characterized by higher eccentricity and larger forcing stresses.

Additionally, Dr. Souček's research includes the development of FE methods for modeling ice melting, meltwater freezing, and melt transport—important processes governing planetary ice shell dynamics. He has developed a two-phase formulation for ice-water mixtures and demonstrated that ice permeability is a critical parameter governing melt extraction. Using FE models, he has shown that the previously suggested long-term stability of meltwater reservoirs in ascending plumes is unlikely. Furthermore, he has identified Europa's double ridges as more probable regions for the presence of shallow water, which could potentially be detected by upcoming missions equipped with ice-penetrating radar instruments.

In summary, Dr. Souček's Habilitation Dissertation, along with his accompanying papers, constitutes an impactful contribution to the field of planetary science. His innovative research in tidal deformation, as well as his advancements in modeling ice dynamics, demonstrates his strong skills and potential for future breakthroughs. I strongly endorse Dr. Souček's work and eagerly anticipate his future contributions to the field.

Sincerely,

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