Vojtěch Patočka:

Maxwell-type viscoelasticity in small and large deformations of planetary mantles

Report of the supervisor

My cooperation with Vojtěch Patočka started already during his undergraduate studies when I supervised his bachelor and master thesis. During this cooperation I realized that Vojta has a very strong theoretical background and belongs among the rare physics students who are able to fully understand difficult physical concepts and to make significant progress in basic physical research. In spite of that I did not expect that after receiving his master degree, he would continue his physics studies as a PhD candidate. In parallel with his physics education, he received a master degree in law and I supposed that he would prefer the career of a well-paid lawyer to an uncertain future of a scientist. To my surprise, he abandoned his starting career of a successful lawyer and decided to fully concentrate on the geophysical research. He chose the challenging topic of Maxwell viscoelasticity, which has been used for many years in postglacial rebound studies, but the role of which has not been fully understood in the field of thermal convection due to its theoretical and computational complexity.

It was very beneficial for him that during his PhD studies he could spend one year at the ETH in Zurich, a leading European laboratory in mantle convection studies, and cooperate with Professor Paul Tackley who provided him with his 3d thermal convection code. This cooperation was fruitful for both sides because Vojta developed a viscoelastic version of this code which is now freely available to convection modelers in Zurich.

During his studies Vojta was very independent and he basically did not need my help to progress in his research. He also cooperated with Hana Čížková and Zdeněk Martinec, but he always worked on his own topics and remained stand-alone. We wrote two papers together and this was the only experience for me when our cooperation became somewhat difficult. Although Vojta was very rigorous when discussing equations, I found his written texts strikingly vague, inaccurate and not well-organized. Writing these papers was a struggle for all co-authors but I believe the final texts are not affected by the difficulties accompanying their birth. I should also

say that during the last two years, Vojta has made a great progress in this field, and I find his thesis reasonably well written.

From scientific point of view, the thesis contains original results that are interesting for the geophysical community. The energy analysis of a deforming rotating body is a great piece of theoretical research which provides a deep insight into the physics related to postglacial rebound and Earth rotation. The paper on viscoelastic convection shows interesting stress effects which may be important for understanding the thermal evolution of single plate planets, such as Mars or Mercury. I hope there will be an opportunity for Vojta to return to these topics in future, and to employ his great expertise in planetary research.

Vojtěch Patočka has clearly proved that he is able to independently solve complex scientific problems and present his results in the form of a concise written text. I recommend his work to be accepted as the PhD thesis.

In Prague, May 30, 2018

Ondřej Čadek

Professor of Geophysics