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Department of Physics and Astronomy • Faculty of Science

12 August 2014

Dear Prof. Jan Kratochvil,

Report on the PhD thesis
Dynamics of small bodies of the Solar System: from dust particles to asteroids
by Mr. Petr Pokorny

This letter is a report on the PhD thesis of Mr. Petr Pokorny entitled "Dynamics of small bodies of the Solar System: from dust particles to asteroids" submitted in August 2014.

The thesis treats two important problems, that of the collision probability of two bodies in our Solar System, and that of the background or 'sporadic' population of meteoroids within it. Both of these are substantial and long-standing problems that have and continue to receive interest within the scientific community, and the candidate has made significant new contributions to them both.

In the first part, the candidate calculates the collision probability between two bodies orbiting the Sun under more general conditions than has been done before. In particular, the incorporation of the Kozai-Lidov effect on the projectile significantly improves the result. The cases both of a target on a circular and an elliptical orbit are considered, which broadens the usefulness of the result considerably. The formula and algorithms that are derived are new results which will be of great use in the consideration of the dangers from impacts between meteoroids and asteroids and the planets, including the Earth, as well as in other astrophysical situations such as exoplanetary systems.

In the second part, the candidate considers how the meteoroid environment at the Earth is derived from its sources. Small meteoroid particles are released from larger bodies such as asteroids and comets by collisions, sublimation of ices and other processes. The particles then follow a complicated path to the Earth, where they may eventually appear as meteors. The candidate's work includes a comprehensive model of the sporadic component of the Earth's meteoroid environment. This model is quite sophisticated, incorporating a wide variety of physics including orbital dynamics, radiation effects and collisional lifetimes. The results of the candidate's modelling effort include a better understanding of the contributions of different comet populations, the so-called Oort Cloud comets and the Halley-Type comets in particular, to the sporadic meteor complex. Comparisons are drawn with observations in the form of the IRAS zodiacal dust observations and radar observations of the meteor sky, and the candidate's

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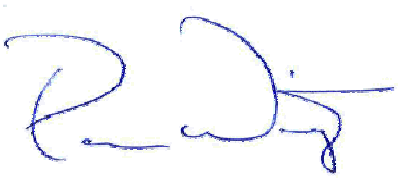
calculations compare favorably with observations. In addition, reasons for any differences are discussed cogently, and insights into related issues such as the collisional lifetimes of meteoroids and the size-frequency distribution of these particles (among others) were discussed.

In summary, the thesis presented by Mr. Petr Pokorny certainly contains substantial new results that provide useful information to workers in the fields of Solar System dynamics, asteroid and cometary studies and meteor/meteoroid environment studies. The work will also be of interest to researchers examining extra-solar planetary systems and engineers interested in the risk of meteoroids to spacecraft. The form of the thesis is of the highest academic standard and clearly demonstrates the candidate's ability to conceive, perform and analyze creative scientific work of high caliber. I recommend that the thesis be accepted as part of the candidate's requirements for a doctoral degree.

Sincerely,



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