Announcing the Final Examination of Leos Pohl for the degree of Doctor of Philosophy in Physics

Date: June 30, 2020
Time: 2:30 p.m.
Room: Online Zoom Meeting
URL: https://zoom.us/j/6280749306
Dissertation title: The Physical Properties of Asteroids

Abstract:
The Small Bodies of the Solar System are leftover material from the formation of planets. Compared with planetary bodies, they have undergone relatively little transformation. Embedded in their physical properties, are clues to the conditions and processes that took place since the condensation of the Solar Nebula. Furthermore, asteroids are sources of raw materials that have become a topic of significant interest. In this dissertation, I explore several properties of asteroid material: strength of asteroids, their shielding properties against high energetic particles and their water content.

First, I gather all available data on strength of meteoritic material from original papers, unify them into a single data source. Several sources have suggested to apply the Scale Effect to extrapolate the measurements on meteorites to the strength of asteroid size objects. I show that such claims are not supported by available measurements and argue that the strength of asteroids is mostly driven by their extreme heterogeneity. Additionally, I observe inverse relationship between porosity and compressive strength for Ordinary Chondrites. This is not observed for Carbonaceous Chondrites.

Next, I study how well material of carbonaceous chondrites acts to decrease and potentially stop charged particles that are found in Cosmic Galactic Rays and Solar protons. Using relativistic quantum mechanical treatment by Bethe with additional high energy corrections, it is found that phyllosilicate materials with hydroxyl interlayer outperform Aluminium in the ability to slow down charged particles of energies typical for Solar protons and Galactic Cosmic Rays.

Finally, I investigate the loss of water on asteroids on two fronts, experimental and theoretical. I quantify how the major components of Carbonaceous Chondrites dehydrate. Then, I demonstrate the possibility of loss of water due to orbits that are close to the Sun.

Outline of Studies:
Major: Physics

Educational Career:
M. S. Charles University, The Czech Republic, 2014
B. S. Charles University, The Czech Republic, 2011

Committee in Charge:
Dr. Daniel Britt (Chair)
Dr. Yanga Fernandez
Dr. Adrienne Dove
Dr. Gal Sarid
Dr. William Bottke (External Committee Member)

Approved for distribution by Dr. Daniel Britt, Committee Chair, on June 3, 2020.

The public is welcome to attend only remotely.