

Announcing the Final Examination of Vanessa Lowry for the degree of Doctor of Philosophy in Physics

Date: July 6, 2022

Time: 12:30 p.m.

Room: <https://ucf.zoom.us/j/8341509050>

Dissertation title: Spectral Characterization and Age of the Moon and Primitive Asteroids

Abstract:

The focus of this dissertation is on four main topics: (i) determining the age of the Clarissa family from the Yarkovsky effect chronology, and whether it is a significant source of the near-Earth asteroid (NEA) population, (ii) assessing the effectiveness of a linear model in retrieving mineral abundances of primitive asteroid analogs, (iii) determining the silicate mineralogy and compactness of the Trojan and (944) Hidalgo regolith, (iv) and determining the effectiveness of a radiative transfer modeling approach to model lunar regolith.

To address (i) we implemented Solar System integration software that accounts for gravitational as well as thermal perturbations on the Clarissa asteroid family. This work constrained the age of the Clarissa asteroid family to be 56 ± 6 My and we determined that Clarissa is not a significant source of NEAs. In the study of (ii) we applied a sum to one constraint weighted least squares (STO WLS) model to thermal infrared (TIR) emissivity spectra of a suite of primitive asteroid analogs spectrally and volumetrically dominated by fine particulates ($<38 \mu\text{m}$). We demonstrated the need for a better approach to accurately model asteroid spectra containing $<90 \mu\text{m}$ particle sizes on their surface regolith. To investigate (iii) we modeled the prominent $10 \mu\text{m}$ plateau region in the Trojan and (944) Hidalgo asteroid spectra using the light scattering Multiple Sphere T-Matrix (MSTM) and Hapke reflectance models. We showed that the Trojan asteroids and (944) Hidalgo are compositionally consistent with spectrally similar bodies like comet Hale-Bopp (very high porosity) and CO3 and CY chondrite meteorites (relatively low porosity). However, our modeled porosities are similar to those present on the lunar surface. For (iv) we used a light scattering Mie and Monte Carlo radiative transfer approach to model ambient lunar regolith spectra. We determined that the appropriate minerals for lunar regolith and a dark proxy component that correctly simulates space weathering effects on TIR spectra are needed to assess the effectiveness of these models in modeling composition.

Outline of Studies:

Major: Physics, Planetary Science

Educational Career:

B. S. University of Central Florida, Orlando, 2016

Committee in Charge:

Dr. Kerri Donaldson Hanna (Chair)

Dr. Humberto Campins (Co-chair)

Dr. Yan Fernandez

Dr. Timothy Glotch (External Committee Member)

Approved for distribution by Dr. Kerri Donaldson Hanna, Committee Chair, on June 22, 2022.

The public is welcome to attend remotely.