Announcing the Final Examination of Mr. Christopher Tyler Cox for the degree of Master of Physics.

Date: April 4, 2024
Time: 3:00 p.m. (15:00)
Room: 209 in Partnership I (12354 Research Pkwy.)
Zoom Link: https://ucf.zoom.us/j/98992283636?pwd=QUkxblRNc2Nacld6bnFkaURsYVl6Zz09

Dissertation title: The Case for Photothermal Spectroscopy in Planetary Science

Optical PhotoThermal InfraRed (OPTIR) is a relatively new spectroscopy method for studying materials. It produces transmission-like spectra using a remote reflectance technique that is rapid, requires little sample preparation and is well-suited for the technique to be adapted for a space flight instrument. The method involves a tunable pulsed IR laser creating a photothermal effect on the surface of a material and measuring the distortion of a probing visible laser the same region of the sample, which can be obtained at sub-micron spatial resolutions. A measurement campaign was performed utilizing Photothermal Spectroscopy Corporation's OPTIR instrument, mIRage. In this campaign, individual minerals of relevance to planetary science were analyzed using the OPTIR technique and their spectra were compared to existing transmission and reflectance spectra. Additionally, Lunar and Martian soil simulant mixtures were also analyzed to attempt to determine mineral contributions to the mixtures' spectra. Samples were prepared using cylindrical holders filled with granular sample material and adhered to a glass slide which were mounted into the instrument. Large hyperspectral maps were performed, and their spectra averaged to produce a single spectrum for each mineral and mixture. Constituent minerals were compared to available spectra based on spectral features and corresponding peaks. Various Exolith simulants representative of Lunar (LHS-2, LMS-2, and LSP-2) and Martian (JHZ-1 and MGS-1) surfaces were analyzed as well as their constituent materials in order to determine the contribution each mineral makes to the simulant mixture. It was found that data produced with the mIRage instrument closely resembled transmission spectra in most cases and shared spectral shapes with reflectance spectra at longer wavelengths. Further the instrument's performance was found to outperform commonly used techniques regarding speed, in some cases spatial resolution, and a significantly reduced need for sample preparation. This work will go to support future prototyping of an instrument for in situ material analysis.

Outline of Studies:
Major: Physics, Planetary Science Track
Educational Career: B.S., 2021, University of Central Florida

Committee in Charge:
Dr. Julie Brisset (Chair)
Dr. Christopher Bennett (Co-Chair)
Dr. Kerri Donaldson Hanna

Approved for distribution by Julie Brisset and Christopher Bennett, Committee Chair and Committee Co-Chair respectively, on March 18, 2024.

The public is welcome to attend.