Announcing the Final Examination of Autumn N. Shackelford for the degree of Doctor of Philosophy in Physics

Date: July 3rd, 2025
Time: 2:00 p.m.
Room: PSB 445 (https://ucf.zoom.us/j/7331505698?omn=97946044533)
Dissertation title: From Microns to Mons: Investigating Airless Body Surface Properties and Processes
Abstract:
Understanding how airless bodies have evolved in the space environment is essential for interpreting remote sensing data and constraining the weathering processes that alter airless body surfaces over time. This dissertation utilizes coordinated experimental, observational, and analytical techniques to investigate airless body surface properties and processes.

Our first study seeks to characterize mechanical breakdown of the lunar regolith caused by ice-regolith interactions within the lunar polar regolith environment. The second and third studies investigate the effects of simulated micrometeorite bombardment via a novel dual pulsed laser experimental setup on iron-poor, carbon-rich Mercury and carbonaceous asteroid analogs. We analyze the spectral, chemical, and microstructural properties of these analogs in an aim to understand 1) the space weathering products that might be generated on highly reduced planetary surfaces and 2) how these space weathering products impact spectral features. The final study outlines efforts to perform ground-based, mid-infrared telescopic observations of the Moon so that we might elucidate compositional anomalies across under-explored wavelengths. We present a new open-source data reduction pipeline for hyperspectral grism observations and a first-look at multispectral filter imaging observations of the lunar surface.

From kilometer-scale remote sensing observations to nanometer-scale elemental analyses, this dissertation aims to prove that a coordinated analytical approach is essential to understanding the composition, geological history, and formation of airless bodies from Mercury to the asteroid belt.

Outline of Studies:
Major: Physics, Planetary Sciences Track

Educational Career:
B. A. The University of Alabama in Huntsville, 2020

Committee in Charge:
Dr. Kerri Donaldson Hanna (Chair)
Dr. Adrienne Dove
Dr. Daniel Britt
Dr. Humberto Campins
Dr. Rachel Klima (External Committee Member)

Approved for distribution by Dr. Kerri Donaldson Hanna, Committee Chair, on June 11, 2025.

The public is welcome to attend.