

## **Announcing the Final Examination of Stephanie Jarmak for the degree of Doctor of Philosophy in Physics**

**Date:** April 1, 2020

**Time:** 10:30 a.m.

**Zoom link:** <https://ucf.zoom.us/j/523080113>

**Dissertation title:** Experimental and Numerical Investigations of Granular Dynamics in Microgravity

### **Abstract:**

During the first stages of planet formation small particles ( $\sim 0.1 - 1 \mu\text{m}$ ) in the protoplanetary disk collide at low relative velocities (less than 1 m/s) and tend to aggregate into cm-size “pebbles” through a combination of electrostatic interactions and gravitational streaming instabilities. Particles in this size regime also compose a layer of regolith on small, airless bodies that evolves under conditions very different than those on Earth. Characterizing the response of regolith to low-energy impacts in a microgravity environment is therefore critical to our understanding of the processes that lead to the formation of these objects and our ability to develop safe operation procedures on their surfaces. Flight-based microgravity experiments investigating low-velocity collisions of cm-size projectiles into regolith have revealed that certain impact events result in mass transfer from the target regolith onto the surface of the projectile. Characterizing the key parameters and their interactions that produce these events have important implications for the role of energy dissipation and accretion in planet formation processes and understanding the mechanical behavior of granular media composing the surfaces of small bodies. I carried out experimental and numerical campaigns designed to investigate these mass transfer events and found that accretion outcomes differ significantly depending on whether the projectile is launched into granular material or initially at rest before pulling away from the granular bed. I also found that interaction effects between various parameters must be taken into account when designing experiments to investigate these mass transfer events, and the assignment of the significance of a parameter is sensitive to the balance of the experiment design. I also present my contributions to a CubeSat mission that will provide the opportunity to observe tens of thousands of collisions between particles in the velocity and size regime relevant to the earliest stage of planet formation.

### **Outline of Studies:**

Major: Physics, Planetary Sciences Track

### **Educational Career:**

M. S. Texas A&M University-Commerce, TX, 2015

B. S. Massachusetts Institute of Technology, MA, 2013

### **Committee in Charge:**

Dr. Joshua Colwell (Chair)

Dr. Adrienne Dove

Dr. Julie Brisset

Dr. Christopher Bennett

Dr. Daniel Durda (External Committee Member)

Approved for distribution by Dr. Joshua Colwell, Committee Chair, on March 16, 2020.

The public is welcome to attend remotely.