EJECTA MASS PRODUCTION AND VELOCITIES IN LOW-ENERGY IMPACTS INTO SIMULATED LUNAR REGOLITH. Laura M. Seward[1], Joshua E. Colwell[1], Michael T. Mellon[2], and Bradley A. Stemm[1], [1]Department of Physics, University of Central Florida, Orlando, Florida, lauramseward@knights.ucf.edu [2]Southwest Research Institute, Boulder, Colorado.

Summary: Impacts and cratering in space are vital to the formation and evolution of planetary bodies and can be a consequence of human and robotic exploration of the planetary bodies within our solar system. We are conducting a program of laboratory experiments to study low-velocity impacts on the order of 1 m/s into JSC-1 lunar regolith simulant in normal 1 g and in microgravity. We use direct measurement of ejecta mass and high-resolution video tracking of ejecta particle trajectories to derive ejecta mass velocity distributions. We wish to characterize and understand the collision parameters that control the outcome of low-velocity impacts into regolith, including impact velocity, impactor mass, target size distribution, regolith depth, and target relative density, and to experimentally determine the functional dependencies of the outcomes of low-velocity collisions (ejecta mass and ejecta velocities) on the controlling parameters of the collision. Our goal is to understand the physics of ejecta production and regolith compaction in low-energy impacts and experimentally validate predictive models for dust flow and deposition.

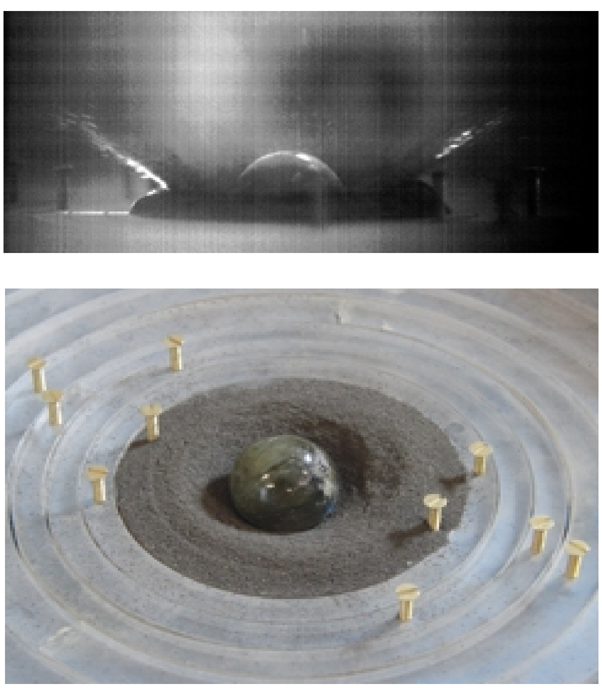

Figure 1: Impacts into JSC-1 target material create an ejecta blanket over the collection rings. High-speed, high-resolution imaging captures the spherical impactor colliding with the JSC-1 target material.

Our results show the outcomes of varying impact parameters on ejecta production. We conducted a series of low-velocity impact experiments in 1 g with velocities ranging from 1.1 m/s to 2.8 m/s into JSC-1. We varied the spherical impactor mass, type, drop height, and initial velocity to create impacts at a variety of energy ranges. For a small number of impact events, we kept all impact parameters consistent but varied the pressure of the environment. For a subset of experiments, we varied the density of the JSC-1 target samples. We determined that ejecta mass production is linearly dependent on impact energy. Our initial study on the effect of target material relative density suggests a density threshold that produces a maximum amount of ejecta mass. We found that ejecta mass velocity distributions fit a power-law or broken power-law distribution, and in some cases, exhibit a dependence on impact energy. We are also conducting a series of similar experiments in a drop tower to create microgravity conditions. Understanding the collisional outcomes of these low-velocity impacts into dust will help us understand the collisional evolution of planetary rings, the conditions that lead to accretion in the early stages of the protoplanetary disk, and the outcome of disturbances on regolith planetary surfaces.

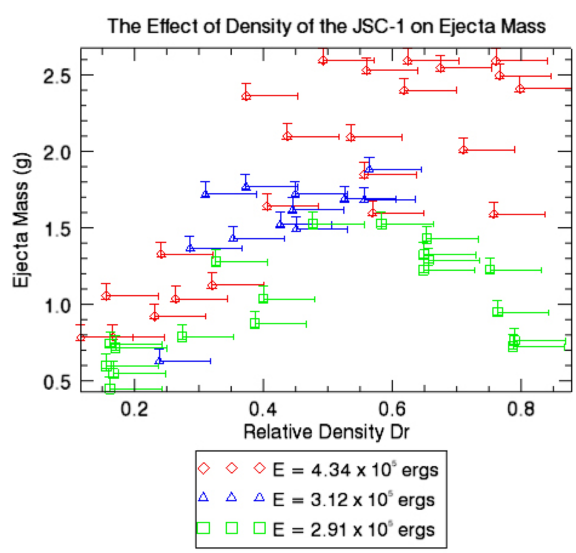

Figure 2: The effect of relative density of the target material JSC-1 on ejecta mass production is shown for three energy ranges. For each energy value, there is a range of maximum ejecta mass production.