Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

The Importance of Collisions in the Simulation of Lunar Soil Ejection during Spacecraft Landing KYLE BERGER, University of Colorado Boulder, PHILIP METZGER, NASA Kennedy Space Center, CHRISTINE HRENYA, University of Colorado Boulder — When a spacecraft lands on the Moon, the rocket exhaust causes lunar soil to be ejected. Due to the lack of atmospheric drag and reduced gravity, the ejected soil can be extremely hazardous to equipment and/or persons both close and far from the landing point. Current models for the ejection are based on single-particle trajectories. Here we critically assess the impact of collisions on erosion. Specifically, the discrete element method (DEM), which incorporates collisions directly, is used. The system examined is located 6m from the impingement point of the rocket and includes the lift and drag forces from the exhaust plume, as well as lunar gravity. A one-way coupling is utilized to describe how the plume affects the particles. Two versions of the DEM are used: one which resolves collisions using a soft-sphere model and another which ignores the collisions (and is thus similar to the single-particle trajectory calculations). In addition, both non-dissipative and dissipative collisions are considered in the collisional model. Somewhat surprisingly, the erosion rate of the collision-less case lies between that of the dissipative and non-dissipative collisional cases. In addition, a sensitivity analysis to collisional input parameters is also performed.

Kyle Berger
University of Colorado Boulder

Date submitted: 01 Aug 2012 Electronic form version 1.4