Laboratory Analysis of Neutral and Ion Sputtering of Lunar Soils J. W. Keller[1], D. J. Chornay[1,2], J. L. McLain[1,2] [1]NASA Goddard Space Flight Center, [2]University of Maryland College Park

Introduction: Surface bounded exospheres around solar system bodies are comprised of atom populations from distinct sources that are not in equilibrium with each other due, to the (by definition) collisonless nature of exospheres. These populations include evolved gases from planetary interiors (e.g. radionuclides such as ^{40}Ar from the decay of ^{40}K), sputtering from the solar wind, micrometeorite impacts, electron and photon desorption processes, and thermal reemission from the surface of exospheric volatiles. Because these populations remain distinct, they exhibit differing thermal properties with information on the particle's sources and energetics preserved. Thus, the study of exospheres can yield global and regional information on their sources including surface composition, the processes that create them, and can inform models of the transport of volatiles on these solar system objects.

Interpretation of *in situ* data such as has been returned by the LADEE and Artemis missions or remote observation is aided by laboratory observations of the response of surfaces to interactions with the external environment, such as radiation, UV photons or impacts, when an understanding of the characteristic energetics of particles introduced into the exospheres can help separate the sources in the *in situ* data.

In this presentation we will describe progress on laboratory experiments to determine the energetics of sputtering from lunar regolith samples and simulants.

Experimental An ion beam designed to simulate the solar wind is directed toward samples under ultra-high vacuum, fig. 1. Using a pulsed beam to effect sputtering and through phased extraction of the sputtered

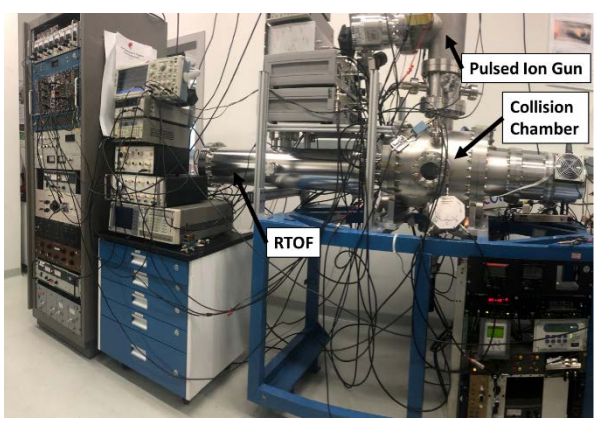

Figure 2 Image of the experimental apparatus

particles we determine their composition and velocity distribution. We compare ion sputtering yields and velocity distribution from primary ions Ar^+ and H_2^+ from 1 amu to ~100 amu from target JSC1a and lunar soil 76055. The sample, 76055 is a vesicular breccia soil collected during Apollo 17. An example multidimensional TOF spectrum is shown in Fig. 2. In this presentation we will discuss the experiment, preliminary results and implications for interpreting astronomical observations and orbital data.

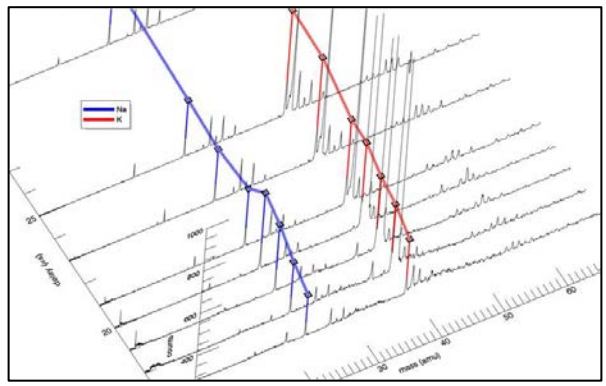

Figure 1Reflectron-Time-of-flight spectra of sputtered ions from altered Apollo sample 76055. The different delay times sample different portions of the evolving ion plume. Two ions, sodium and potassium are highlighted in this image.