A Plasma Suite for the Lunar Surface. D. Gershman[1] (daniel.j.gershman@nasa.gov), M. Sarantos[1], G. Collinson[2], E. Zesta[1], E. Sittler[1], M. Collier[1], [1]NASA Goddard Spaceflight Center, Greenbelt MD, 20771 [2]Catholic University of America, Washington DC, 20064

Introduction: There are a number of open questions about the space environment near the lunar surface. First, radio occulations have suggested that the moon has a near-surface electron density of up to ~300 particles per cubic centimeter. If these density estimates are accurate, there should be high densities (tens of thousands of particles per cubic centimeter) of volatile gases such as water, CO_2, and CO near the poles [1]. Second, the space weathering of the lunar surface has not been fully characterized. Such knowledge is not only important for understanding lunar surface charging and modeling the release of volatile materials. And, finally, the tenuous atmosphere, produced as the surface of the moon is bombarded by the solar wind and sporadic meteoroids, is still not well characterized despite recent LADEE, LRO, and Chandrayaan-1 measurements. Two key knowledge gaps identified by The Lunar Exploration Analysis Group (LEAG) are to *"Determine the global density, composition, and time variability of the fragile lunar atmosphere before it is perturbed by further human activity" (8a),* and to *"learn how water vapor and other volatiles are released from the lunar surface and migrate to the poles where they are adsorbed in polar cold traps" (8d.)* [2]. Measurements of the polar exosphere are especially required to address these gaps.

As shown in Figure 1, we present a plasma suite (~20 kg and ~20W) intended to be deployed on the lunar surface to address these open questions. Specifically, the goals would be to (1) characterize the charging of the lunar surface, (2) characterize the near-surface plasma environment, and (3) study the interaction of the solar wind with lunar regolith.

Low energy electron sensors will quantify the charging and electron stimulated desorption of the lunar surface. In addition, an ion analyzer will provide energetic and composition information about precipitating solar wind and ionized volatiles and metals. This sensor would be complemented by an energetic neutral atom imager to measure neutralized solar wind hydrogen scattering off of the lunar surface. Finally, a magnetometer would provide information about the local magnetic field strength and direction. The in situ measurements of magnetic fields, combined with measurements of solar wind speed and direction from the ion mass spectrometer, will enable models to determine the origin of volatile ions from energy spectra and their scale heights.

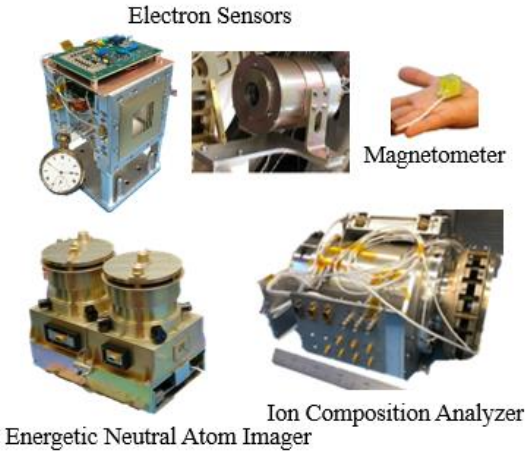

Figure 1. A plasma suite intended for deployment on the lunar surface.

References:

[1] Choudhary, R. K., et al.(2016), *Geophys. Res. Lett.* 43, 19.

[2] NRC (2007), The scientific context for exploration of the Moon, NRC, Washington, DC.