LDEX OBSERVATIONS AND CORRELATIONS WITH ARTEMIS MEASUREMENTS. J. R. Szalay[1,2], M. Horanyi[1,2], A. R. Poppe[3], J. S. Halekas[3], [1]University of Colorado Boulder (jamey.szalay@colorado.edu), [2]Laboratory for Atmospheric and Space Physics, [3]Space Sciences Laboratory, University of California Berkeley

Introduction: The Lunar Dust Experiment (LDEX) aboard the Lunar Atmosphere and Dust Environment Explorer (LADEE) [1, 2] is an impact ionization dust detector capable of measuring the mass of sub-micron sized dust grains above the lunar surface. LDEX can also search for the putative population of grains with radii on the order of ~ 0.1 μm lofted over the terminator regions by measuring the collective current of dust grains that are below the detection threshold for single impacts. This current, intended to measure the collective impact plasma from multiple small grain impacts, has also shown considerable correlations with ARTEMIS plasma measurements.

Instrument Description: LDEX consists of a hemispherical target and a microchannel plate (MCP), shown in Figure 1. When a grain impacts the target, an impact plasma is generated. The target is positively biased and collects the electrons of the impact plasma, while the MCP collects the ions. LDEX also has a biased set of screens to prevent solar wind electrons from entering the instrument. The polarity of the MCP/Target is reversed for one second out of every ten, allowing for determination of the background current measured by LDEX. Due to the nature of the switching scheme, low-energy ions originating outside LDEX can also be measured by LDEX's MCP, allowing for coarse plasma measurements near the lunar surface.

LADEE/LDEX Operations: In the nominal science configuration, LADEE orbits the moon with a period of about 2 hours. LDEX is on for approximately 60% of the orbits. LADEE is configured to have LDEX in the ram-pointing direction. LDEX cannot be on and pointing directly into the Sun. Shown in Figure 2 are two orbits of LDEX data. Times which have color shown indicate when LDEX was collecting science data. In addition, not shown in the above plots, LDEX takes data in an anti-ram configuration roughly once per day to further characterize the noise environment.

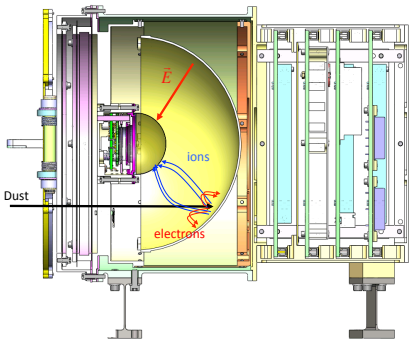

Figure 1. LDEX schematic showing dust impact plasma collection. Ions are collected by the MCP while electrons get collected by the hemispherical target.

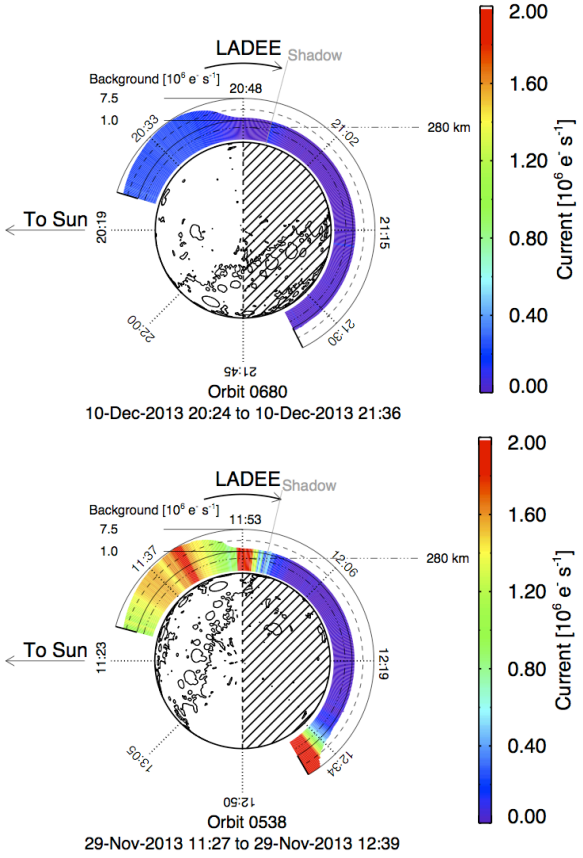

Figure 2. LDEX current measurements. Top: Quiet period in LDEX current data. Bottom: Orbit with high LDEX current variability.

LDEX Current Measurements: Figure 2 shows two different orbits with the LDEX collective current represented by the color. Through LADEE's many orbits, LDEX sees time periods with very low variability, having almost no activity (top plot) as well as periods with very high variability (bottom plot). Since this type of high activity is also observed in anti-ram pointing measurements, much of this current cannot be explained by collections of small dust grain impacts. Given this, comparisons to ARTEMIS data provide a promising way to explain such measurements.

Ion Sources: There are a variety of ion sources which could be contributing to the background and current LDEX is measuring. Such sources include: solar wind ions, ions reflected from lunar crustal magnetic fields, and exospheric pickup ions. In addition to the nominal solar wind plasma environment, LADEE transits through the lunar wake and takes measurements during times when the Moon is in Earth's magnetotail and corresponding sheath. Each of these regions have a significantly modified plasma environment and add to the complexity of LDEX's current measurements.

ARTEMIS: The ARTEMIS (Acceleration, Reconnection, Turbulence, & Electrodynamics of Moon's Interaction with the Sun) mission [3] consists of two probes from the THEMIS mission, repurposed in 2011 to perform plasma science around the Moon. ARTEMIS is able to provide measurements of the lunar charged particle environment as well electric and magnetic fields during the entire LADEE mission and provide some insight into the LDEX current measurements.

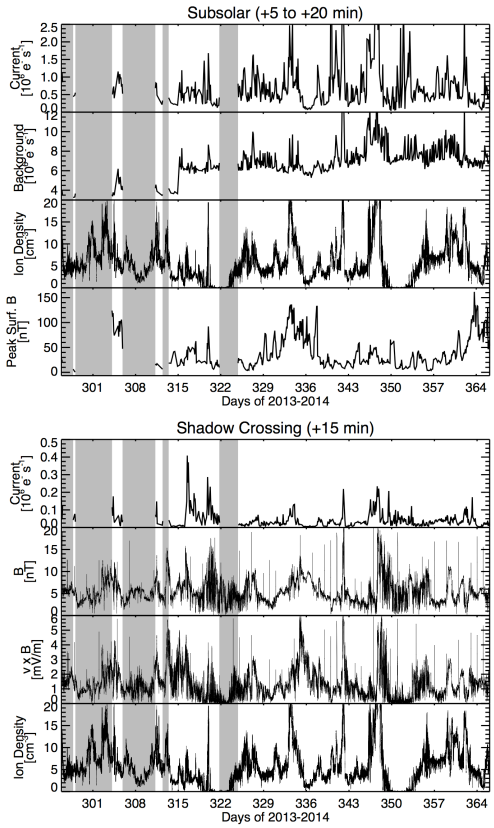

Figure 3. Top: Subsolar LDEX average current. Bottom: Umbral shadow crossing average current. Gray areas denote when LDEX was off for more than a full day.

ARTEMIS Comparison: ARTEMIS provides a variety of plasma measurements which show a high degree of correlation with LDEX current measurements. There are two regions in the LDEX data that show consistent correlation: 1) the subsolar point and 2) the time LADEE crosses into umbral shadow. Shown in Figure 3 are the average LDEX current for 15 minutes from subsolar and shadow crossing time respectively. Additionally, the component of the convection electric field parallel to the LDEX boresight appears to be significant in LDEX's current measurements and will be discussed in this presentation. This talk will focus on the correlations between LDEX and ARTEMIS data.

References: [1] Elphic *et al., Proc. Lunar. Sci. Conf.* 44th, 1719 (2013)., [2] Horanyi *et al*., *Proc. Lunar. Sci. Conf.* 43th, 1659 (2012), [3] Angelopoulos, V. (2011), *Space Sci Rev*, doi:10.1007/s11214-010-9687-2.