LDEX OBSERVATIONS OF THE DUST ENVIRONMENT OF THE MOON. M. Horányi[1], J. Szalay[1], S. Kempf[1], J. Schmidt[2], E. Grün[1], R. Srama[3], Z. Sternovsky[1], [1]Laboratory for Atmospheric and Space Physics, U. of Colorado, Boulder, CO 80303, USA, [2]Department of Astronomy and Space Physics, University of Oulu, FI-90014 Oulu, Finland, [3]Institut für Raumfahrtsysteme, Universität Stuttgart, Germany, (horanyi@colorado.edu).

Introduction. The Lunar Dust Experiment (LDEX) onboard the Lunar Atmosphere and Dust Environment Explorer (LADEE)[1] mission (9/2013 - 4/2014) discovered a permanently present dust cloud engulfing the Moon. The size, velocity, and density distributions of the dust particles are consistent with ejecta clouds generated from the continual bombardment of the lunar surface by sporadic interplanetary dust particles. Intermittent density enhancements were observed during several of the annual meteoroid streams, especially during the Geminids. LDEX found no evidence of the expected density enhancements over the terminators where electrostatic processes were predicted to efficiently loft small grains.

LDEX observations. LDEX is an impact ionization dust detector with a sensor area of ~ 0.01 m^2. It captures coincident signals and full waveforms to reliably identify dust impacts [2]. LDEX recorded average impact rates of ≃ 1 and ≃ 0.1 hits/minute of particles with impact charges of q ≥ 0.5 and q ≥ 5 fC, corresponding to particles with radii of a ≈ 0.3 and a ≈ 0.7μm, respectively (**Figure 1**).

Several of the yearly meteor showers generated sustained elevated levels of impact rates, especially if their radiant direction intersected the lunar surface near the equatorial plane, greatly enhancing the probability of crossing their ejecta plumes. The peculiar velocities of dust particles in the cloud are on the order of ~100 m/s which we neglect in this first analysis, compared to the typical spacecraft speeds of 1.6km/s. Hence, with the knowledge of the spacecraft orbit and attitude, impact rates can be directly turned into particle densities as functions of time and position. **Figure 2** shows the preliminary derived averaged number density as function of height. LDEX observations are the first to identify the ejecta clouds around the Moon sustained by the continual bombardment of interplanetary dust particles. Most of the dust particles generated in impacts have insufficient energy to escape and follow ballistic orbits, returning to the surface, 'gardening' the regolith. Similar ejecta clouds are expected to engulf all airless planetary objects, including the Moon, Mercury, and the moons of Mars: Phobos and Deimos.

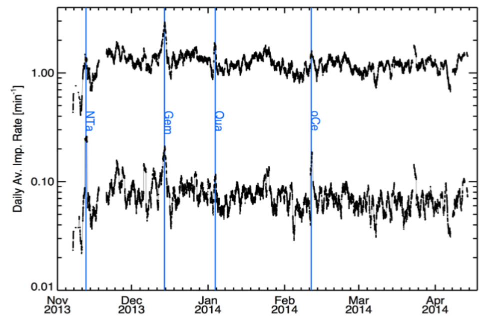

Figure 1: The daily running average of impacts per minute of particles that generated an impact charge of q ≥ 0.5 fC (radius a ≈ 0.3 μm) and q ≥ 5 fC (radius a ≈ 0.7 μm) recorded by LDEX. The labeled annual meteor showers are: Northern Taurids (NTa); Geminids (Gem); Omicron Centaurids (oCe).

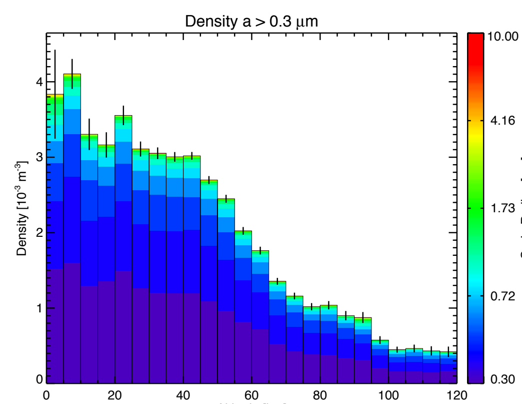

Figure 2. The average dust density of the lunar ejecta cloud as function of altitude and size (color code).

References: [1] R. C. Elphic, *et al.,* The Lunar Atmosphere and Dust Environment Explorer (LADEE): Initial Science Results, 45th *Lunar and Planetary Science Conference* (2014), Abstract #2677, [2] M. Horanyi, *et al.*, The Dust Environment of the Moon as Seen by the Lunar Dust Experiment (LDEX), 45th *Lunar and Planetary Science Conference* (2014), Abstract #1303.