FIRST DETECTION OF DUST IN THE LUNAR TAIL: LADEE UVS MEASUREMENTS. A. M. Cook[1], D. H. Wooden[2], A. Colaprete[2], D. A. Glenar[3], T. J. Stubbs[4], [1]Millenium Engineering & Integration Company, 350 North Akron Road Building 19, Suite 2080, Moffett Field, CA 94035, [2]NASA Ames Research Center, Moffett Field, CA 94035, [3]University of Maryland Baltimore County, 1000 Hilltop Circle, Baltimore, MD 21250, [4]NASA Goddard Space Flight Center, 8800 Greenbelt Rd, Greenbelt, MD, 20771

Introduction: The Lunar Atmosphere and Dust Environment Explorer (LADEE) was a lunar orbiter launched in September 2013 that investigated the composition and temporal variation of the tenuous lunar exosphere and dust environment. A major goal of the mission was to characterize the dust exosphere prior to future lunar exploration activities, which may alter the lunar environment. The Ultraviolet/Visible Spectrometer (UVS) onboard LADEE addresses this goal, utilizing two sets of optics: a limb-viewing telescope, and a solar-viewing telescope[1].

Lunar sodium tail (i.e. anti-solar) observations were among several types of activities undertaken with the LADEE UVS instrument; a schematic describing the geometry of these observations is shown in Figure 1. The goal of these observations was to confirm and expand upon previous ground based observations of a sodium signature extending hundreds of lunar radii in the anti-sun direction[2],[3]. However, the data also reveals evidence of not just sodium in the tail, but also a sparse popuation of dust grains on the order of ~20 nm in radius.

Analyses: We examine two tail observation activities – one in January 2014, immediately after the Quantrantid (QUA) meteoroid stream encounter, and one in April 2014, during an extended hiatus in meteoroid stream activity[4]. Just after the Quadrantids, UVS spectral data show a "blue slope" at 230-475 nm. This blue slope fades away as the spacecraft's line-of-sight moves out of the tail. The 230 to 475-nm region blue-sloped spectra are well-modeled by backscattering of sunlight from nanoparticles with radii less than 20 or 30 nm.

Spectral data from mission times coinciding with low meteoroid stream activity (e.g. the April 2014

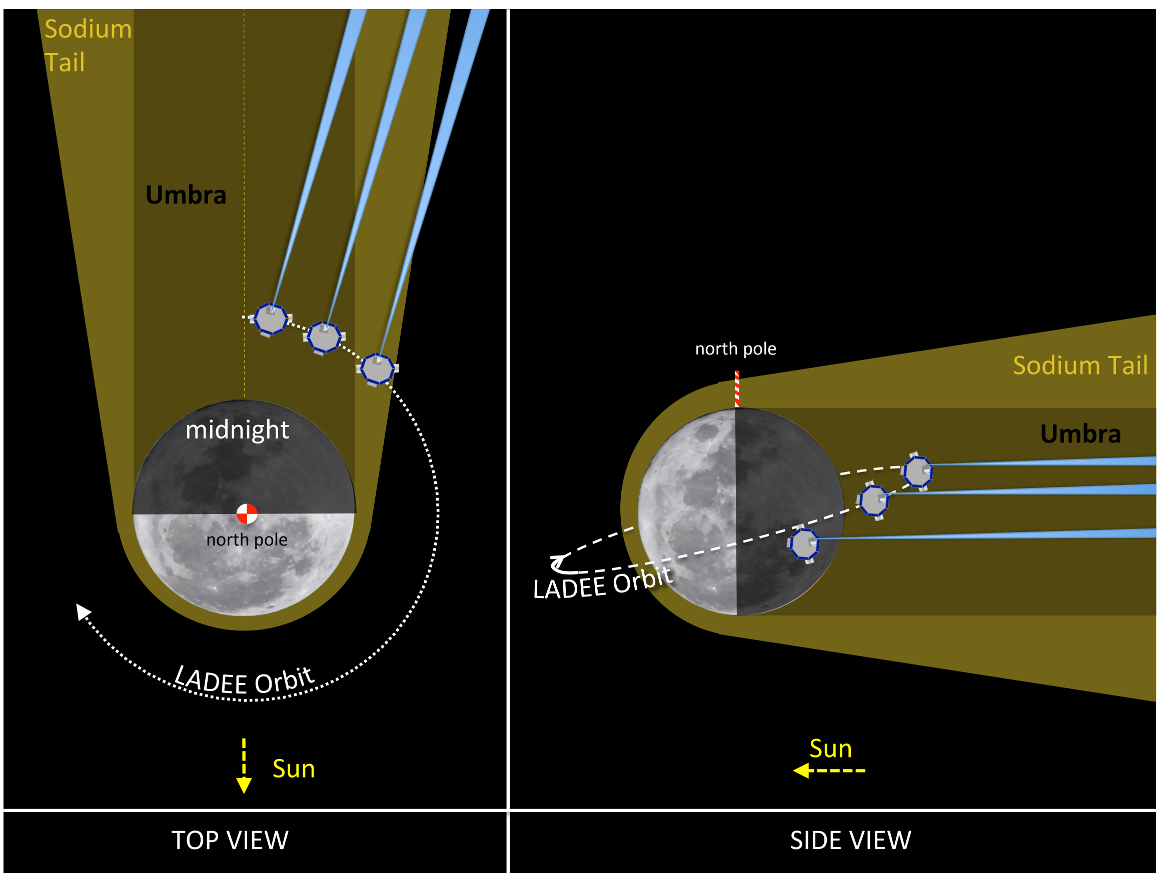

Figure 1. UVS tail observations started just after lunar midnight, with the limb-viewing telescope pointing a few degrees from the anti-sun vector at all points in the LADEE orbit. As the activity progressed, and LADEE orbited toward the sunset terminator, the UVS telescope field of view observed different regions (and varying path lengths through) the sodium/dust tail.

dataset) still indicate the presence of dust, but at lower concentrations than seen after the Quadrantids.

We will present the latest iteration of these spectral datasets and results of this analysis, as well as data from other observations of the tail.

We will also consider the processes that result in the formation of the dust tail. One working hypothesis is that the nanoparticles are released from the Moon by meteoroid impacts and comprise a component of the ejecta cloud enveloping the Moon[5]. Due to their extremely small size, it is likely that forces other than gravity could have an important influence on the particle trajectories. These nanoparticles are electrostatically charged, whether by the surrounding space plasma and incident solar UV, or the impact-generated plasma and triboelectrification occurring during the ejection process. Their large charge-to-mass ratio could make their trajectories sensitive to electrostatic forces due to electric fields in the near-lunar space environment, as well as the Lorentz forces due to ambient magnetic fields. Similarly, the large cross-sectional area-to-mass ratio could allow radiation pressure to provide some significant acceleration in the anti-sunward direction.

References: [1] Colaprete A. et al (2015) *SPAC, 90,* in press. [2] Smith S. M. et al. (1999) *GRL, 26,* 1649. [3] Wilson J. K. et al. (1999) *GRL*, 1645. [4] Stubbs T. J. et al. (2014) *LPSC*, 45, 2705. [5] Horányi, M. et al. (2014) *LPSC*, 45, 1313.