IMAGING DETECTION OF ATMOSPHERIC SODIUM OVER THE LUNAR TERMINATOR. S. Alan Stern, Southwest Research Institute, San Antonio, Texas

We have achieved the first imaging of atmospheric Na in the sunlit column above the lunar terminator. This success required eliminating the lunar albedo signal (which is $\sim 10^4$ times as bright as the Na emission) using a combination of a narrow-band Na interference filter, unique observing geometry, and good internal scattered light suppression. The Na emission images were obtained using a CCD camera, custom-baffled for this experiment, mounted on the 0.9m reflector at McDonald Observatory on 22-24 November 1991.

The images have a FOV of $4 \times 4$ arc-min, corresponding to $\approx 450 \times 450$ km on the lunar surface ($\approx 13 \times 13$ degrees in longitude and latitude at the lunar equator). The spatial resolution is seeing limited to 2-4 km, which is much smaller than any atmospheric scale length. Images of the terminator region made in the Na interference filter bandpass, and in ratio to wide, neighboring continuum bandpasses will be shown to demonstrate the effectiveness of the technique.

Our dataset contains information on (i) the vertical distribution of the Na, (ii) the variation in Na column with distance across the steep, terminator-induced surface thermal gradient, and (iii) Na column differences between mare and highland terrains at the same local time of day. Initial analysis of the dataset indicates that the Na column is dominated by hot, coronal atoms, with at most a minor contribution from a cool, barometric component in thermal equilibrium with the surface. Such a non-thermal distribution argues for a charged particle sputtering or meteoritic impact source, as opposed to sublimation.

For the future, imaging of Na and K in the lunar atmosphere offers the possibility of studying the dynamical transport and horizontal distribution of these important alkali metal species on a near-global scale. Because the atmospheric Na and K column abundances are directly related to the surface concentration of Na and K, atmospheric composition gradients may occur between Maré and highland areas, and perhaps from Maré to Maré and among highland sites with different Na and K abundances. We will discuss the evidence for such gradients in our dataset. Future applications of lunar atmospheric imaging include the opportunity to study Na and K production rate changes, such as when the Moon enters and exits the Earth's magnetotail.