

THE LUNAR NEON EXOSPHERE SEEN IN LACE DATA. R. M. Killen¹, O. J. Tucker¹, D. R. Williams¹, J. Park² and S. J. Kim², ¹NASA Goddard Space Flight Center, Greenbelt, MD USA, ² School of Space Research, Kyung Hee University, Yongin 446-701, Republic of Korea

Introduction: Apollo 17 carried a miniature mass spectrometer, called the Lunar Atmospheric Composition Experiment (LACE), to the Moon as part of the Apollo Lunar Surface Experiments Package (ALSEP) to study the composition and variations in the lunar atmosphere. The instrument was deployed in the Taurus-Littrow Valley (TL) with its entrance aperture oriented upward to measure the downward flux of gases at the lunar surface. The instrument was turned on December 27, 1971, 50 hours after sunset, and operated throughout the lunar night. Details of the experiment are in the Final Report, NASA-CR-150946 [1]. The data from the LACE experiment were downloaded and archived at the NASA Space Science Data Coordinated Archive (NSSDCA).

Data: Nightside densities were plotted from approximately dusk to dawn for four lunations, the second through the fifth in the LACE data. The surface temperatures were read from the thermocouple placed on the surface near the mass spectrometer. The data were measured every 0.6 second. We determined dusk to be the time when the temperature plummeted and dawn where temperature rose abruptly. The plots of neon density through the night for lunation 3 (similar to lunation 2) is shown in Figure 1.

The neon densities on the second and third lunations increase during the night from dusk to dawn. This is consistent with the results from Benna et al. [2] and with theory of an exosphere in thermal equilibrium with the surface [3]. However, on the fourth and fifth lunations the neon density decreased from dusk to dawn. This is not consistent with previously published model results, but the measurement was noted by Hodges et al. [4].

Conclusions: Simulation using the artificial lifetime, 4.5 days (Figure 2), obtains results more consistent with LACE measurements during lunations 2 and 3, and the upper limit of densities observed near dawn by LAMP [5]. Simulations assuming the photoionization lifetime did not fit the data, indicating a different loss process.

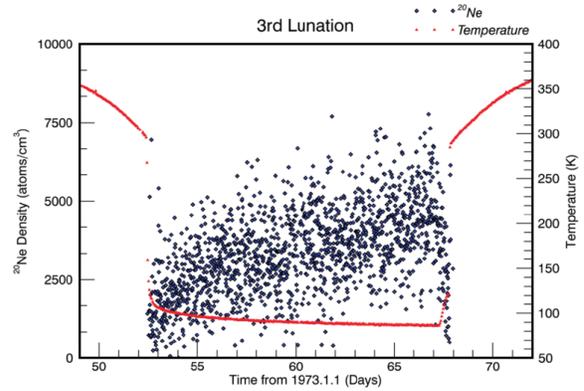


Figure 1. ²⁰Ne Density (blue dots) for the 3rd lunation increases during the night. Dawn and dusk were determined from the surface temperature (red) recorded by the thermocouple place on the surface with the ALSEP package.

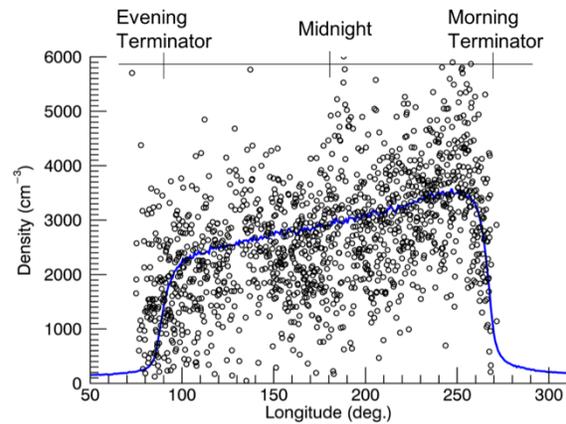


Figure 2. A simulation of Neon at TL using a lifetime of 4.5 days is plotted with the data.

References: [1] J. H. Hoffman, 1975, NAS 9-12074; [2] M. Benna et al., 2015. GRL 42; [3] R. R. Hodges 1973, JGR 78 [4] R. R. Hodges et al., 1974. Icarus 21 Planet. Space Sci. 18; [5] J. C. Cook et al., 2013 Icarus 225.

Acknowledgements: RMK and OJT were supported by the DREAM2 Team of SSERVI. SJK and JKP acknowledge support from the Ministry of Education, Science and Technology, Republic of Korea