CORONAGRAPHIC OBSERVATIONS OF THE LUNAR SODIUM EXOSPHERE 2018-2019. R. M. Killen[1], T. H. Morgan[1], A. E. Potter[2], Giovanni Bacon[3], Irima Ajang[4], and Andrew R. Poppe. [1]NASA Goddard Space Flight Center, Greenbelt, MD 20771, [2]National Solar Observatory, emeritus (1035 Scott Dr., Prescott, AZ 86301), [3]Embry-Riddle University, Daytona Beach, FL [4]Howard University, Washington, DC , [5]Univ. California Berkeley, Berkeley, CA (rosemary.killen@nasa.gov).

Introduction: In order to observe the lunar sodium exosphere out to one-half degree around the Moon, we designed, built and installed a small robotically controlled coronagraph at the Winer Observatory in Sonoita, Arizona. Details of the instrument and data reduction procedure are given in Killen et al., 2019 [1]. A 1.5 Å bandpass filter centered at 588.995 Å measures the sodium D_2 line and a 1.5 Å bandpass offband filter centered 3 Å blueward of the onband filter measures the continuum. Our observations were obtained from approximately 143 km off the lunar surface to about one lunar radius above the surface, 1738 km.

Results and Discussion: We report on observations taken during fall and spring, 2018, and spring, 2019. The data were reduced following procedures given in [1]. We observed on 44 nights in 2018, 33 of which were successful, and 11 nights in 2019, 8 of which were successful. Line of sight intensity (kR) at the surface as a function of latitude on the dayside is shown in Figure 1 for waning phases and Figure 2 for waxing phases. Waxing phases are those when the Moon is moving from New Moon to Full Moon, and waning from Full Moon to New Moon. Our observations are shown as solid lines. A cosine latitude function, normalized to the equatorial intensity at that date, is shown as asterisks with the same color as the corresponding date of observation. This shows that the data are not strictly symmetric about the equator nor do they follow a $\cos^2$ as expected from theory or a $\cos^3$ functional form as found by Potter and Morgan. The highly N/S asymmetric sodium profile seen at many lunar phases is consistent with observations published by Potter and Morgan on Feb. 21, 1989. When reduced to surface number density or column abundance the values are consistent with previous work. The largest column abundance was obtained on March 3, 2018, when the Moon entered the Earth's magnetosheath and the ion fluxes measured by ARTEMIS suddenly increased. This is PA 14° at 7 AM on Figure 1, labeled CME.

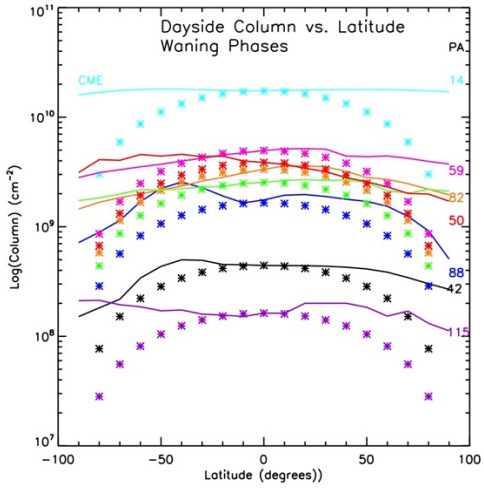

Figure 1. Dayside column abundances of lunar sodium D_2 at the limb observed in 2018 are shown for waning phases. The local times at the limb are shown. The observations are shown as solid lines while the asterisks are a cosine function normalized at the equator.

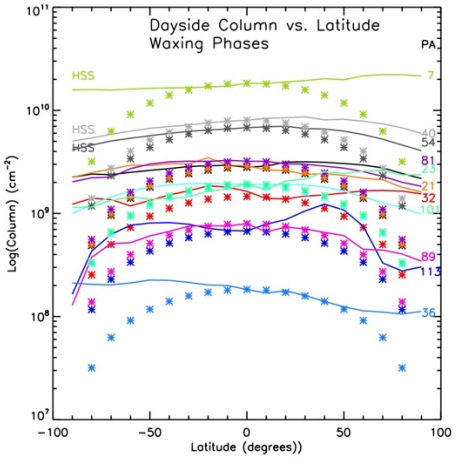

Figure 2. Dayside column abundances of lunar sodium at the limb are (solid lines) for waxing phases for 2018 data (from Full Moon to New Moon). Only one afternoon observation has a lower column abundance than the morning side.