PHOTOMETRIC ANALYSIS OF MONS GRUITHUISEN GAMMA USING LROC NAC OBSERVATIONS: PREPARATIONS FOR THE LUNAR-VISE MISSION. S. R. Burnette[1], K. L. Donaldson Hanna[1], L. Santori[1], A. Dove[1], J. M. Sunshine[2], [1]University of Central Florida (sburnette@ucf.edu), [2]University of Maryland.

Introduction: Areas on the Moon with strong ultraviolet (UV) absorption and high albedo have been previously categorized as "red spots" and suggested to be locations of silicic volcanism [e.g., 1,2]. The Gruithuisen domes (36°N, 40°W) are steep-sided red spots with distinct morphology from the surrounding mare. Morphological analysis suggests highly viscous magma similar to magmas that formed extrusive, silica-rich (>50% wt SiO_2) rhyolites and dacites on Earth formed these features [3]. While the formation mechanisms for silica-rich magmas on Earth are well understood, the formation of lunar silicic features remains an outstanding question and makes them compelling locations for future in situ exploration [4]. With the upcoming Lunar Vulkan Imaging and Spectroscopy Explorer (Lunar-VISE) mission to the Gruithuisen domes in the latter half of the decade [6], we focus our investigation on the planned landing site on Mons Gruithuisen Gamma, informally known as "the Gamma dome" [7]. To prepare for rover operations at the Gamma dome we examine Lunar Reconnaissance Orbiter Camera (LROC) Narrow Angle Camera (NAC) observations to characterize its photometric properties and the spatial scale over which the photometric properties of the dome are heterogeneous.

Methods: LROC NAC images are ideal for photometric studies as they offer a wide range of viewing geometries and have the best spatial resolution (< 2 meters per pixel or mpp). Ten NAC images with resolutions ranging from 0.5 to 1 mpp covering the Gamma dome were processed using the USGS Integrated Software for Imagers and Spectrometers (ISIS) calibration methods. LROC NAC Digital Terrain Models (DTMs) were also utilized to create the photometric backplanes [8]. We use MATLAB algorithms to fit Hapke parameters for each LROC NAC image tied to the NAC DTM covering the Gamma dome. This code was written by Hahn (2019) [9] and derives the Hapke parameters including the single scattering albedo.

Applications: Previous photometric analysis done by Clegg-Watkins et al. [10] has shown correlation between the single scattering albedo and mafic content ($FeO+MgO+TiO_2$) of geologic features including lunar red spots. Mapping the variation of single scattering albedo at the Gamma dome can therefore be used to infer surface composition and, combined with other spectral and morphological analyses, will enable the testing of silicic formation hypotheses as well as better understanding of lunar silicic volcanism as a whole.

Initial Results: We generated ten SSA maps across the Gamma dome, with five overlapping a previously published ROI [10]. Comparisons of the five SSA values (0.37 +/- 0.083) are consistent with the published value (0.38). Additionally, variation in SSA can be seen across the Gamma dome, although further work is needed to constrain the significance of this observation.

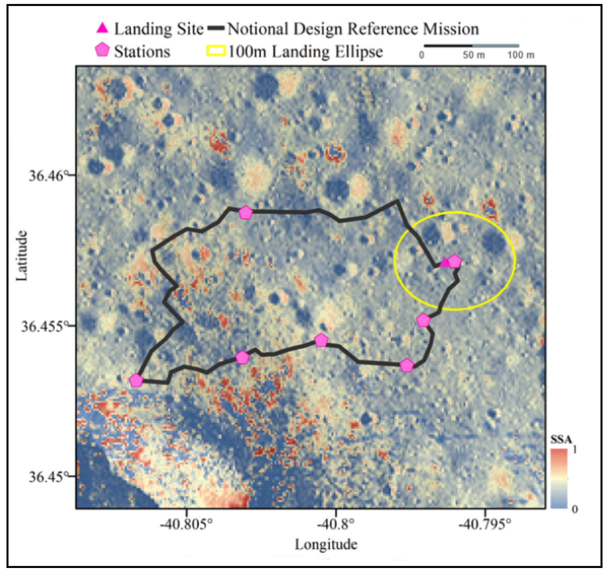

Figure 1: SSA map of the Lunar-VISE landing site with landing ellipse and notional rover traverse [11,12].

Future Work: Our aim is to construct a database of single scattering albedo and reflectance maps across the Gruithuisen domes region, as well as other silicic volcanic spots on the Moon. Future spectroscopic and morphological measurements from the Lunar-VISE rover will be used as ground truth for these maps and will allow for better constraints on the photometric properties of other silicic spots.

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