HYDRATION OBSERVATIONS OF REINER GAMMA LUNAR SWIRL IN PARTIAL ECLIPSE Abigail Flom[1], Paul Lucey[1], Casey Honniball[1], Chiara M. Ferrari-Wong[1] [1]Hawaii Institute of Geophysics and Planetology, University of Hawaii at Manoa, 2500 Campus Rd, Honolulu, HI 96822 (aflom@hawaii.edu)

Introduction: A common view of the Moon as inherently dry abruptly changed when hydration was detected in lunar regolith; a Moon-wide 3 μm absorption band has been detected by multiple remote sensing instruments: EPOXI High Resolution Instrument, Cassini Visual and Infrared Mapping Spectrometer (VIMS), and the Moon Mineralogy Mapper (M^3) [1, 2, 3]. This band signifies the presence of OH and possibly H_2O (collectively referred to as total water or hydration), which is supported by the discovery of hydroxl with solar wind hydrogen in lunar agglutinate glasses[4]. The study of this surface water and how it behaves on the Moon has important implications for understanding volatiles on airless bodies throughout the Solar System.

An important hypothesis for the origin of lunar surface water is the chemical interaction of solar wind hydrogen with lunar surface oxygen [5] and key geologic features for the understanding of the origin of detected total water and the influence of solar wind are lunar swirls. Lunar swirls are bright albedo features on the lunar surface that have been linked to the presence of local magnetic fields [6, 7, 8] A magnetic field could shield the surface from the solar wind, which is believed to decrease the amount of space weathering that the surface beneath it undergoes, causing that material to remain brighter than the surrounding material. Solar wind is also hypothesized to be the source of the observed water via hydrogen implantation onto exposed oxygen in fractured mineral surfaces. A swirl's unique ability to potentially show differences in the water band due to differences in solar wind intensity while keeping other parameters constant make it a natural laboratory for studying solar wind interaction.

This project focuses on the behavior of water on and around the Reiner Gamma swirl (figure 1). In a previous study with Moon Mineralogy Mapper (M^3) data by Kramer et al. 2011, they found that there was a greater band depth at 2.82 μm off swirls versus on swirls. In fact, it was suggested that swirls can be better identified with this feature than with other methods [9]. This correlation of water abundance and inferred solar wind intensity supports the hypothesis that solar wind hydrogen reactions is a source of lunar surface water.

However, data in the 3 μm region is complicated by the presence of both emitted and reflected radiation, and there is debate about how to best correct for thermal emission in M^3 data, which does not contain any wavelengths beyond 3 μm to constrain thermal models for the data. Bandfield et al. [10] found a 3 μm feature across the Moon, but do not see differences with latitude

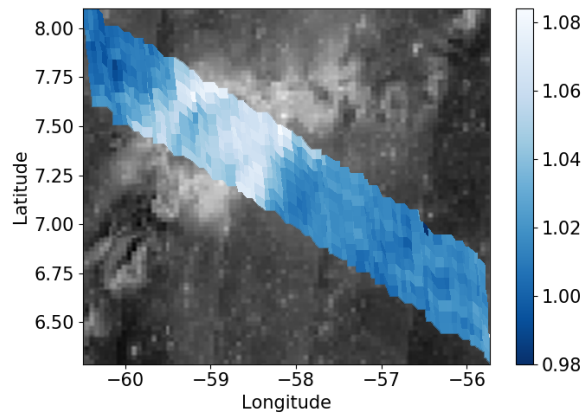

Figure 1: *Map of Reiner Gamma at 1550 nm from Kaguya Multiband Imager (gray tones) overlaid with a band ratio map of 3 micrometers to the continuum (blue tones). Darker Blue represents a deeper absorption feature which indicates more hydration..*

or lunar time of day. On the other hand, Li et al. [11] and Wohler et al. [12] see strong strong differences with these parameters.

However, M^3 data is limited in its wavelength coverage. A strong test of thermal corrections is their quality at longer wavelengths where thermal emission is increasingly dominant. To deal with this thermal modeling problem, this work uses observations that are taken from the Mauna Kea Observatory using the SPeX infrared cross-dispersed spectrograph at the NASA InfraRed Telescope Facility (IRTF). This instrument collects data from 1.67 to 4.2 μm and the spectral range provides more constrained thermal correction compared to Moon Mineralogy Mapper data on the same region of the Moon.

Results: There is a difference between band ratio of the water band to the continuum on the swirl versus off of it (Figure 1). The regolith surrounding the swirl has a deeper band by about 6% compared to the bright portions on the swirl which indicates greater hydration. The dark lanes within the swirl also have lower band ratio compared to the other bright portions of the swirl.

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