Lunar swirls: The enigma

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Swirls range from large groupings of many complex loops and ribbons to a single isolated feature covering tens to hundreds of kilometers and is always associated with magnetic anomaly regions [e.g., 1-3]. These features are of specific interest because their origin is still unknown. Swirls are commonly assumed to have formed due to magnetic shielding of the surface from the solar wind [e.g., 4]. Another plausible mechanism proposed is resurfacing due to one or multiple cometary impacts [e.g., 5, 6]. The spectral characteristics of swirls have been extensively studied in UV-VIS-NIR wavelength region [e.g., 7, 8]. Swirls exhibit high 415 nm reflectance, and low UV/visible ratios [7]. The NIR spectral response of swirls is inconsistent with fresh crater suggesting different optical effects that need to be study in detail [8]. In this work, overview of our current understanding on swirl formation will be discussed with main emphasis on the questions yet to be answer in order to understand formation mechanism of swirls. The spectral variability across Reiner Gamma using Moon Mineralogy Mapper (M3) observations of the Chandrayaan-1 mission will be discussed in detail. Reiner Gamma (7.5° N, 59° W) is a specific case with a fully evolved structure of high-albedo curve-shaped line markings extended across an area of about 200 km^2. Our attempt is to understand regolith alteration processes inside and outside Reiner Gamma in order to reveal implications for the formation mechanisms of swirls. We found two different spectral trends from locations comparable in albedo, indicating the presence of two different surface alteration processes [9]. Implications of spectral observations in NIR wavelength region will be discussed.

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