# DIFFERENT TRENDS OF VARIATION IN CHRISTIANSEN FEATURE ON THE LUNAR SURFACE: EFFECTS OF IRON CONTENT AND PARTICLE SIZE

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**Introduction:** Bulk silicate mineralogy of the Moon has been estimated from Lunar Reconnaissance Orbiter Diviner Lunar Radiometer data using the Christiansen feature position calculated from three bands covering 7.55-8.05 µm, 8.1-8.4 µm and 8.38-8.68 µm. Being an indicator of silicate polymerization [1], CF is very useful tool for understanding the bulk silicate mineralogy of the Moon and other airless bodies.

In this study, we have tried to understand the trends in variation of CF due to particle size [2] and space weathering [2]. To achieve this, we selected 23 well distributed locations comprising of lunar swirls and rayed craters across the lunar surface with same bulk silicate mineralogy but different albedo.

**Results:**

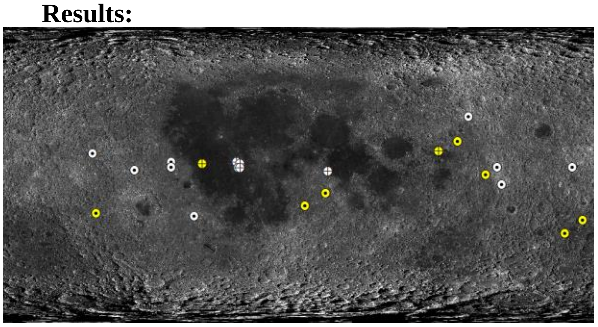

Figure 1. Location of investigated sites across the Moon, the white dots represent rayed craters and the yellow dots represent lunar swirls. The circles with cross are located in Mare and the ones with a concentric dot are located in highlands.

Comparison of CF from the location on and off-swirl indicates that the position of CF shifts to longer wavelengths upon space weathering [3]. A similar trend is displayed by the rayed craters when compared to their background. This redshift in CF varies systematically between mare and highlands and swirls and rayed craters. The mare and highland craters display different changes in albedo for the same amount of variation in CF position, indicating that the highland craters have to undergo increased space weathering to cause the same change in CF as mare craters. In addition, we also observed that mare craters display more variation in CF for on-ray and off-ray location compared to highlands swirls with comparable variation of albedo.

**Discussion**: The position of CF is affected by compactness of regolith, space weathering, particle size and solid-state greenhouse effect [2,4].

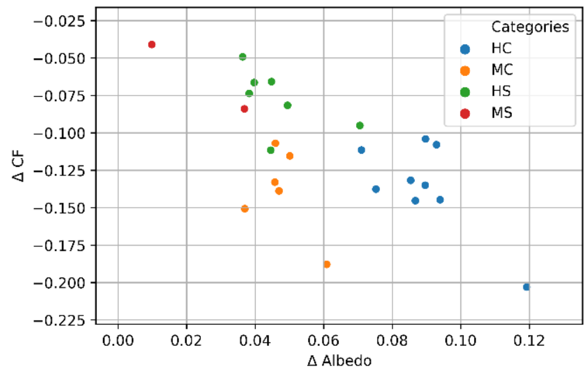


**Fig 2**. Different trends of variation with respect to particle size and primary composition of the surface, C stands for crater, S for swirls, H for Highlands and M for Mare

Studies by [5] show that the quantity of nanophase metallic Fe ($npFe^0$) particles formed due to space weathering is proportional to the Fe content of the initial composition. It is also well-understood that the lunar mare has higher Fe content that lunar highlands. Therefore, space weathering of mare regions on the Moon would lead to higher production of $npFe^0$ compared to highlands. However, to produce the same amount of $npFe^0$ particles, the highlands would need to undergo much more extensive space weathering than mare. This could help us understand the comparable variation in CF we see for the different variations in albedo among highland and mare craters. The ejecta of the rayed craters has higher rock abundance than the fine-grained swirls. This could help us understand the reason behind the high CF variation for comparable changes in albedo among mare craters and highland swirls. For craters, the redshift may be increased by the particle size effect in addition to space weathering.

**Conclusion:** There are different trends of variation in the CF in lunar mare and highlands and with lunar rayed craters and swirls. These differences are likely due to differences in initial iron content and particle size.

**References** [1]Conel,J.E(1969),JGR,73,1614-1634, [2]Shirley K. A.& Glotch T.D(2019),JGR,124,970-988 [3]Glotch, T.D et al., (2015), Nature Communications 6,6189[4]Lucey P. G. et al. (2017) Icarus, 283, 343-351 [5]Allen, C.C. et. al.,(!993), Icarus,104, 291-300