Monte Carlo Simulations of Lunar Albedo Particles as a Function of Regolith Depth

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The nature of lunar albedo particles has been the primary concern of several recent studies since the launch of the Cosmic Ray Telescope for the Effects of Radiation (CRaTER) instrument aboard the Lunar Reconnaissance Orbiter (LRO) spacecraft in 2009. Using sophisticated algorithms to analyze the coincidences in its detectors, CRaTER is able to discriminate high energy lunar albedo particles (~60-400 MeV) from deep space GCR ions. Monte Carlo radiation transport codes like Geant4 and MCNP6 have been heavily used to analyze the angular and energy distribution of albedo particles to determine the detectable range of albedo particles in different CRaTER orientations and detector coincidences. In this work, we use the MCNP6 radiation transport code to provide a general understanding of the characteristics of lunar albedo particles as a function of depth. Also, since searching for evidence of lunar hydrogen is a primary interest for future human voyages to the moon, we use the results from MCNP6 to estimate the depth of production of lunar albedo particles detected by the CRaTER instrument. This study is important to understanding the depth distribution of hydrogenated material at depths of a few to 10's of cm.