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ELECTROMAGNETIC CHARACTERIZATION OF LUNAR LAVA TUBES SIMULANTS FOR A FUTURE MOON BASE

Abstract

Lunar lava tubes, discovered by the Lunar Reconnaissance Orbiter in 2009, are natural tunnels of volcanic origin formed during the eruption of basaltic lava flows, consisting in deep holes on the moon that could open into vast underground caves. They could serve as a safe shielding from cosmic rays, solar radiation, and micrometeoroids for future human lunar explorers; moreover, mild temperatures are maintained in such environments, thus protecting from the savage heat of sunlight during the lunar day and the brutal chill of lunar night. An open issue is the understanding of how the Moon environment would be fit for communications systems daily used on Earth. Reproducing fully constrained chemical/physical background conditions in terms of pressure and soil composition and analyzing the free space EM field propagation characteristics within lunar simulated environment could be an answer to this question. Hence, the aim of this work is the characterization of an enclosed environment representative of future lunar habitats in terms of microwave chaotic propagation, focusing on how the EM scattering and absorption comes to be affected by the lunar lava tubes simulants. The study is performed by means of a space environment simulator connected to a microwave characterization equipment in order to evaluate the electromagnetic field attenuation inside a reverberating chamber in the range 1-6 GHz: the several materials and structures filling the chamber are conceived on the base of literature data regarding the lunar regolith composition.