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Radiation Fields, Effects and Risks in Human Space Missions (5)

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THE RADIATION ENVIRONMENT NEAR THE SURFACE OF THE MOON: COMPARISONS BETWEEN CRATER MEASUREMENTS AND MULTIPLE RADIATION TRANSPORT CODES

Abstract

Since its launch into lunar orbit in 2009, the Cosmic Ray Telescope for Effects of Radiation (CRaTER) instrument aboard the Lunar Reconnaissance Orbiter (LRO) spacecraft has been continually monitoring the radiation environment near the lunar surface. The CRaTER instrument measures the energy deposited from galactic cosmic rays and solar energetic particles in its silicon detectors. These measurements are then converted to linear energy transfer (LET) providing a very useful database for not only space radiation risk analyses, but also for radiation transport code validation and benchmarking studies [1,2]. A previous study found differences between various transport codes when comparing them with measurements taken at Mars by the Mars Science Laboratory – Radiation Assessment Detector (MSL-RAD) [3]. This work extends the previous work by studying the radiation environment near the surface of the Moon and comparing the measurements of LET spectra taken by the CRaTER instrument with simulated results from several transport codes, well-known for being used for space applications. These codes include PHITS (The Particles and Heavy Ion Transport code System), HETC-HEDS (The High Energy Transport Code – Human Exploration and Development of Space), and MCNP6 (The Monte Carlo N-Particle code).

[1] Porter, J., Townsend, L., Spence, H., Golightly, M., Schwadron, N., Kasper, J., et al. (2014).

Radiation environment at the Moon: Comparisons of transport code modeling and measurements from the CRaTER instrument. Space Weather, 12(6), 329–336. https://doi.org/10.1002/2013SW000994

[2] Looper, M., Mazur, J., Blake, J., Spence, H., Schwadron, N., Golightly, M., et al. (2013). The radiation environment near the lunar surface: CRaTER observations and Geant4 simulations. Space Weather, 11(4), 142–152. https://doi.org/10.1002/swe.20034

[3] Matthiä, D., Hassler, D., de Wet, W., Ehresmann, B., Firan, A., Flores-Mclaughlin, J., et al. (2017). The radiation environment on the surface of Mars - Summary of model calculations and comparison to RAD data. Life Sciences in Space Research, 14, 18–28. https://doi.org/10.1016/j.lssr.2017.06.003