

Moon Radiation Environment: a Comparison between Models and the CHANDRAYAAN-1 RADOM Experiment Data

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Lunar radiation environmental models have been obtained in the framework of the RADOM investigation that is onboard the CHANDRAYAAN-1 mission by the Indian Space Agency ISRO. The instrument is a miniature (98 grams, 100 mW) 256 channels spectrometer of the deposited energy (dose) in a single 2 cm² 0.3 mm thick silicon detector. The unit is managed by microcontrollers through specially developed firmware. RADOM instrument was switched on about 2 hours after the launch of the Chandrayaan-1 satellite on 22nd October 2008. When on 12th November 2008 the satellite entered a 100 km circular orbit around the Moon the GCR doses fall down because of the Moon surface shielding to about 8.8 µGy/h and remained stable around this value. In May 2009 the spacecraft was inserted on a 200 km circular orbit, and stayed on this orbit until failure. Models for the Moon radiation environment have been compared with the data coming from the RADOM experiment: models of Galactic Cosmic Rays (GCR) and Solar Particle Events (SPE) primary particles impinging on the lunar surface, transported through the subsurface layers, with backscattering taken into account, and interacting with some described targets. The lunar surface and subsurface has been modeled as regolith and bedrock, with structure and composition taken from the results of the instruments of the Luna, Ranger, Lunar Surveyor and Apollo missions, as well as from groundbased measurements. In order to perform the comparison with the RADOM spacecraft data, the models have been set to a 100 km altitude circular orbit, to the actual mission time frame (both punctual and averaged data), and to the actual environmental shielding inside the spacecraft. As a preliminary comparison, RADOM data at 100 km altitude around the Moon give a mean flux for GCR of 2.45 particles/cm²*sec. If for the comparison the above model is used, rescaled for CHANDRAYAAN-1 orbital conditions and timeframe, with a shielding pattern of 0.45 g/cm² on the 2π solid angle before the detector and more shielding on the other 2π solid angle at the back side of the detector, a value for GCR of 2.55 particles/cm²*sec is this way obtained. Further examples of comparisons between models and RADOM data on an extended location database will be shown.