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

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COMPARISONS OF RADIATION SPECTRA ON THE ISS AND IN DEEP SPACE

Abstract

Exposure to highly energetic particle radiation in space is a concern for current and future human missions. To date, only the Apollo astronauts have ventured outside the protective effects of the Earth's magnetic field, but astronauts on future missions back to the Moon, or to Mars or other destinations in deep space, will not have this protection. In exploration class space missions, personnel and equipment are indeed fully exposed to space radiation, specifically galactic cosmic rays and sporadic solar energetic particle events. The consequent risk is, under present allowable exposure guidelines, a possible show stopper if not adequately mitigated. Radiation fields resulting from these particles are modified by shielding. Most radiation measurements in deep space have been made with unshielded or very lightly shielded detectors. In contrast, the space radiation environment in a habitat, such as the International Space Station (ISS), is more complicated. This is due to the timedependent modification of the incident flux by the geomagnetic field (not present in deep space) but also in the complex bulk shielding distributions; measured particle spectra inside the ISS are affected by both types of shielding. The geomagnetic field is also responsible for the existence of the South Atlantic Anomaly, a region of trapped energetic protons and electrons, and hence enhanced radiation dose, through which the ISS travels several times per day on average. The primary aim of this talk is to compare chargedparticle spectra at high linear energy transfer obtained by the ALTEA (Anomalous LongTerm Effects in Astronauts) silicon telescope detector system on ISS during highlatitude portions of the orbit to data acquired at the same time by the Cosmic Ray Telescope for the Effects of Radiation (CRaTER), in orbit around the Moon, and Radiation Assessment Detector (RAD), during its voyage toward Mars and during its long-term mission on the Mars soil. The hypothesis being tested (successfully) is that these spectra are the same, modulo shielding differences, since the effects of the geomagnetic field are expected to be minimal at high latitudes. This opens the possibility of using the ISS also as a radiation analog for exploration class space missions.