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2. CRs at Earth and planets (GEO)

RADIATION MEASUREMENTS DURING THE CRUISE TO AND ON THE SURFACE OF MARS WITH MSL/RAD

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The Radiation Assessment Detector (RAD) on board the Mars Science Laboratory's (MSL) Curiosity rover is the first ever instrument to measure the energetic particle radiation on the surface of Mars. The main scientific goal of the RAD instrument is to characterize the radiation environment on the surface of Mars by making detailed measurements of the radiation dose, linear energy transfer (LET) spectra, and charged and neutral particle spectra. In addition to the surface measurements, RAD was also operating for large parts of the 253-day cruise to Mars. Combined, these measurements give unique insight to the expected radiation exposure for a potential manned mission to the red planet. The average absorbed tissue-equivalent dose rate during the cruise was found to be 0.48 $\pm$0.08 mGy/day, while for the first 300 days of surface operations the measured dose was 0.21 $\pm$0.04 mGy/day. By measuring the LET spectrum the absorbed dose can be converted into the biologically-relevant dose equivalent, resulting in values of 1.84 $\pm$0.30 mSv/day during cruise and 0.64 $\pm$0.12 mSv/day on the surface of Mars. RAD further encountered several solar energetic particle (SEP) events during cruise and surface operations. SEP events can create significant enhancements of the radiation exposure on short time scales, depending on the magnitude of such an event. For example, the five SEP events encountered during cruise contributed about five percent to the total measured dose equivalent in 253 days. The occurrence rate of SEP events strongly depends on the state of the solar activity, emphasizing the importance of continued radiation measurements throughout the solar cycle.