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LESSONS LEARNED FROM THE RADIATION MEASUREMENTS OF THE MARS SCIENCE LAB RADIATION ASSESSMENT DETECTOR (MSL-RAD)

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The Radiation Assessment Detector (RAD) was designed to characterize the radiation environment on the Mars surface and to contribute to an improved assessment of radiation risk for a future human mission to Mars. The flight was chosen to cover a period of solar maximum activity to allow besides the measurement of the galactic cosmic rays an intense study of exposures by solar particle events. The Mars Science Laboratory spacecraft (MSL), containing the Curiosity rover, in which RAD was integrated, was launched to Mars on November 26, 2011. Although not part of the mission planning, RAD was operated already during the 253 day and 560 million km cruise to Mars and made the first time detailed measurements of a radiation environment comparable to that inside a future spacecraft carrying humans to Mars and in other deep space missions. Exactly 100 years after the discovery of cosmic rays on August 7, 1912 RAD makes the first observation of the radiation environment on the surface of another planet and is still gathering data until today. Meanwhile the maximum activity of the current solar cycle has been passed and the solar activity is decreasing. Unfortunately the present solar cycle was an unexpected weak cycle. As a matter of fact only very small solar particle events could be observed during the still ongoing RAD measurements. The paper highlights the achievements of RAD by presenting selected data measured during the cruise and on the Mars surface and describes its impact on predictive models for health risks of astronauts during space missions.