Reconstruction of particle fluxes detected by the Radiation Assessment Detector onboard MSL

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One of the main science objectives of the Mars Science Laboratory (MSL) is to help planning future human exploration to Mars by constraining the radiation environment during the cruise
phase and on the planet's surface.

During the 253-day, 560 million km cruise to Mars, the Radiation Assessment Detector, RAD
[1] made detailed measurements of the energy spectrum deposited by energetic particles from space and scattered within the spacecraft. Two types of radiation pose potential health
risks to astronauts in deep space: a prolonged low-dose exposure to Galactic Cosmic Rays
(GCRs) and short-term exposures to the Solar Energetic Particles (SEPs). On the surface of
Mars such energetic particles penetrate through its thin atmosphere and generate secondary particles that can also result harms to humans.

In order to interpret the energetic charged particle flux coming into the detector, we have
developed the Detector Response Function (DRF) using GEANT simulations and employed a Maximum likelihood inversion technique [2] to invert the detected energy spectrum. This method will be applied to RAD detection of GCRs, SEPs, and secondary charged particles on the Martian surface, giving us an unique insight into their energy fluxes.

References

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