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Measurements of the Charged and Neutral Particle Spectra on the Martian Surface with MSL/RAD

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The Radiation Assessment Detector (RAD) onboard Mars Science Laboratory's rover Curiosity is the first ever instrument to measure the energetic particle radiation environment on the surface of Mars. Charged particles are a major component of this environment, both galactic cosmic rays propagating to the Martian surface and secondary particles created by interactions of these cosmic rays with the atoms of the Martian atmosphere and soil. Another important factor for determining the biological impact of the Martian surface radiation is the specific contribution of neutrons, which possess a high biological effectiveness. In contrast to charged particles, neutrons and gamma rays are generally only measured indirectly. Their measurement is the result of a complex convolution of the incident particle spectrum with the measurement process. We apply an inversion method to calculate the gamma/neutron spectra from the RAD neutral particle measurements. Here we show first surface measurements of the Martian particle spectra and compare them to theoretical predictions. Measuring the Martian particle spectra is an essential step for determining the mutagenic influences to past or present life at or beneath the Martian surface as well as the radiation hazard for future human exploration, including the shielding design of a potential habitat.