

Impacts of solar energetic particles at Mars: Global diffuse aurora and atmospheric chemistry

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After 2020s, human activities in space exploration will be extended to Mars. For future exploration, it is important to assess the impacts of solar energetic particles (SEPs) on spacecraft and biological systems (e.g., radiation doses to crews, prebiotic synthesis of organic compounds) in the near-Mars environment.

The space environment of Mars is remarkably different from that of the Earth. Energetic particles can easily penetrate deep into the atmosphere to reach the surface owing to insufficient magnetospheric and atmospheric shielding of Mars. Recently, the Mars Atmosphere and Volatile Evolution (MAVEN) spacecraft discovered a new type of diffuse aurora that spanned across nightside Mars, resulting from the interaction of SEPs with the Martian atmosphere [Schneider et al., 2015, 2018]. This new type of diffuse aurora on Mars is characterized by global brightening and by its low peak altitude of ~ 60 km, which indicates more energy is deposited deep in the Martian atmosphere than previously thought. This presentation will provide an overview of the impacts of SEPs on the Martian environment observed by orbiters and rovers, and give some implications for the effect of crustal magnetic fields and atmospheric chemistry based on our Monte-Carlo and photochemical models.

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