

Martian Metallic Ions Deposited by Comet Siding Spring Defy Expectations

Matteo Crismani (1), Nicholas Schneider (1), John Plane (2), Scott Evans (3), Sonal Jain (1), Justin Deighan (1), and Roger Yelle (1)

(1) Laboratory for Atmospheric and Space Physics, Boulder, United States (matteo.crismani@colorado.edu), (2) School of Chemistry, University of Leeds, United Kingdom, (3) Computational Physics Inc., Virginia, United States, (4) Lunar and Planetary Laboratory, University of Arizona, Tucson, United States

On October 19th 2014, comet C/2013 A1 (Siding Spring) had a close encounter with Mars and deposited hyper-velocity cometary dust particles into the Martian atmosphere. We report a comprehensive analysis of the resulting meteor shower and its perturbation on Mars' atmosphere and ionosphere. Using observations of ablated meteoric metallic species, we show this shower lasted less than three hours and was therefore limited to one hemisphere. Meteoric ablation occurred in a narrow altitude layer, with Mg+, Mg, Fe+, and Fe deposited at an altitude consistent with comet Siding Spring's relative velocity of 56 km/s. With regular observations over two Mars days, we show that horizontal winds globally redistribute this material and also suggest new vertical transport mechanisms for metallic ions. Such transport is more rapid than diffusion, and may be related to electrodynamic processes. The rapid loss of neutral species and presence of ions at high altitudes indicate our understanding of existing Martian meteoric chemistry modeling and ionospheric dynamics is incomplete.