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Atomic processes gaseous media: Ion and secondary-electron transport from swift ion precipitation into the Jovian upper atmosphere

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Understanding of plasma and gaseous environments, such as those in astrophysical environments, technical plasmas, and fusion energy devices, rests in large part on modeling and diagnostics based on fundamental atomic processes. Here a description is given of work to provide a wide and detailed range of atomic data for inelastic processes in the interaction of swift ions precipitating into the atmosphere of Jupiter. In fact, a rich ion population exists in the magnetosphere of Jupiter, with species originating from the Galilean moons and as well from the solar wind. These populations give rise to precipitation of ions, accelerated by Jupiter's prodigious magnetic field, into the planet's upper atmosphere. Evidence of this precipitation comes directly from observations of auroral x-ray line emission in the polar regions coming from radiative de-excitation following charge transfer between the precipitating ions and atmospheric molecules Results of work to produce and utilize in simulations data describing secondary-electron production in keV to MeV O^{q+} (q=0-8) and S^{q+} (q=0-16) + H_2 collisions is described [1,2]. O and S ions slow down in their passage through the atmosphere, produce secondary electrons, heat atmospheric molecules, lead to dissociation of H_2, and contribute to the atmospheric currents, linking the Jovian ionosphere and atmosphere. Incorporation of such data into models has been timely considering the arrival of the NASA Juno probe at Jupiter in July 2016 with the unique orbital characteristics to enable observations of the precipitating ion populations and their interactions with the upper atmosphere. [1] Schultz, Ozak, Cravens, and Gharibnejad, At. Data Nucl. Data Tables, 113, 1 (2017); Schultz, Gharibnejad, Cravens, and Houston, At. Data Nucl. Data Tables 126, 1 (2019) [2] Houston, Cravens, Schultz, Gharibnejad, Dunn, Haggerty, Rymer, Mauk, Gladstone, and Ozak, J. Geophys. Res.: Space Physics 125, e2019JA02700 (2019).