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Collisional Ejection of Helium Atoms in the Martian Atmosphere

Non-thermal escape via hot oxygen production, primarily from the dissociative recombination of O_2^+, significantly influences atmospheric loss on Mars. These hot oxygen atoms can collide with other atmospheric species, such as helium and minor gases, affecting their energy distributions and contributing to escape processes. Previous studies have indicated that solar wind helium contributes significantly to Mars'atmospheric helium through the neutralization of α-particles, with an estimated deposition rate of approximately 1.5×10^{23} atoms s^{-1} (Chanteur et al., 2009). It has also been suggested that nearly 95% of helium escape occurs below the exobase, primarily due to energy transfer from hot oxygen atoms (Gu et al., 2020). In this study, we expand upon previous work by employing a Monte Carlo simulation integrated with our established hot oxygen model to investigate the collisional ejection of solar wind–originated neutral helium atoms, tracking their evolution in the Martian upper atmosphere.

Section

Solar System/Exoplanets

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