

MAVEN-STATIC observations of ion temperature and initial ion acceleration in the Martian ionosphere

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November 23, 2022

Abstract

Though ion escape to space is an important mechanism for atmospheric loss on Mars, the processes that accelerate ions to escape velocity have not been fully identified and quantified. The lowest altitude where suprathermal planetary ions appear is an important source region for ion escape, where electromagnetic forces and waves begin to energize ions to escape velocity. We have conducted a statistical study of O₂⁺ distribution functions measured by Mars Atmosphere and Volatile Evolution SupraThermal And Thermal Ion Composition (MAVEN-STATIC) in order to identify the region where suprathermal tails appear. At all solar zenith angles, suprathermal ions appear just above the exobase region, where the mean free path between collisions exceeds the neutral gas scale height. O₂⁺ temperature profiles are also presented. We also investigate the effects of crustal magnetism, finding that crustal fields protect planetary plasma on the dayside and enhance energization on the nightside.