火星磁気圏周辺における酸素イオン反射
O^+ ion beams reflected below the Martian bow shock

*益永 圭[1]、関 華奈子[1]、Brain David[2]、Fang Xiaohua[2]、Dong Yaxue[2]、Jakosky Bruce[2]、McFadden James[3]、Halekas Jasper[4]、Connerney Jack[5]
*Kei Masunaga[1], Kanako Seki[1], David Brain[2], Xiaohua Fang[2], Yaxue Dong[2], Bruce Jakosky[2], James McFadden[3], Jasper Halekas[4], Jack Connerney[5]

1.東京大学大学院理学研究科地球惑星科学専攻、2.Laboratory for Atmospheric and Space Physics, University of Colorado Boulder, USA、3.Space Science Laboratory, University of California Berkeley, USA、4.Department of Physics and Astronomy, University of Iowa, USA、5.NASA Goddard Space Flight Center, USA
1.Department of Earth and Planetary Science, Graduate School of Science, University of Tokyo, Japan, 2.Laboratory for Atmospheric and Space Physics, University of Colorado Boulder, USA, 3.Space Science Laboratory, University of California Berkeley, USA, 4.Department of Physics and Astronomy, University of Iowa, USA, 5.NASA Goddard Space Flight Center, USA

We investigate a generation mechanism of O^+ ion beams observed above the Martian bow shock by analyzing ion velocity distribution functions (VDFs) measured by the Superthermal and Thermal Ion Composition (STATIC) instrument on the Mars Atmosphere and Volatile EvolutioN (MAVEN) spacecraft. In the solar wind near Mars, MAVEN often observes energetic O^+ ion beams (~10 keV or higher). Accompanied with the O^+ ion beam events, we sometimes observe characteristic ion VDFs in the magnetosheath: a partial ring distribution or a hook-like distribution. The partial ring distribution corresponds to pickup ions with a finite initial velocity (i.e. not newborn pickup ions). Thus the partial ring distribution is most likely to be produced by the reflection of the precipitating O^+ ions below the bow shock. After being injected into the magnetosheath from the solar wind, the precipitating O^+ ions are subject to the significantly enhanced magnetic field in this region, and consequently, a part of precipitating O^+ ions are reflected back to the solar wind, generating O^+ beams in the solar wind. The hook-like distribution contains two ion populations: a mixture of local O^+ pickup ions and O^+ pickup ions precipitating from the solar wind right above the bow shock, and O^+ pickup ions precipitating from the upstream solar wind and being reflected below the bow shock. The latter population also generates the O^+ ion beams in the solar wind. The reflected O^+ beams are reaccelerated by the convection electric field in the solar wind and may escape Mars.

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