火星磁気シースへ入射する酸素ピックアップイオンの反射率の導出とその太陽風依存性

益永 圭 [1]; 関 華奈子 [2]; Brain David A.[3]; Fang Xiaohua[4]; Dong Yaxue[4]; Jakosky Bruce M.[4]; McFadden James P.[5]; Halekas Jasper S.[6]; Connerney John E. P.[7]
[1] 東大・理
; [2] 東大理・地球惑星科学専攻; [3] LASP, Univ. of Colorado at Boulder, USA; [4] LASP, CU Boulder; [5] SSL, UC Berkeley; [6] Dept. Phys. & Astron., Univ. Iowa; [7] NASA GSFC

Statistical analysis of reflection of incident O+ pickup ions at Mars: Reflection ratios and solar wind dependences

Kei Masunaga[1]; Kanako Seki[2]; David A. Brain[3]; Xiaohua Fang[4]; Yaxue Dong[4]; Bruce M. Jakosky[4]; James P. McFadden[5]; Jasper S. Halekas[6]; John E. P. Connerney[7]
[1] Univ. Tokyo; [2] Dept. Earth & Planetary Sci., Science, Univ. Tokyo; [3] LASP, Univ. of Colorado at Boulder, USA; [4] LASP, CU Boulder; [5] SSL, UC Berkeley; [6] Dept. Phys. & Astron., Univ. Iowa; [7] NASA GSFC

Analyzing ~1.3 year dataset (November 2014 to February 2016) of O+ ion velocity distribution functions obtained from the Suprathermal and Thermal Ion Composition (STATIC) instrument on the Mars Atmosphere and Volatile Evolution (MAVEN) spacecraft, we statistically investigate reflections of incident O+ pickup ions (>10 keV) from the Martian dayside magnetosheath. To quantitatively evaluate importance of the O+ pickup ion reflection, we estimate a reflection ratio by calculating average inward and outward O+ ion fluxes above the Martian bow shock. Our result shows that ~14 % of incident O+ pickup ions is reflected. We also investigate dependences of the reflection ratio on the solar wind. We find that the reflection ratio strongly depends on the magnitude of the interplanetary magnetic field (IMF): ~6 % for the weak IMF case and ~18 % for the strong magnetic field case. We suggest that this dependence is caused by differences of O+ gyroradii. Since the magnetic field in the magnetosheath also becomes strong for the strong IMF case, O+ ion gyroradii become small and thus more incident O+ pickup ions can experience partial gyrations in the magnetosheath to go back to the solar wind compared to the weak IMF case. Since the incident O+ pickup ions are a major source of atmospheric sputtering escape from Mars, this result suggests that ion reflections might have a role to reduce the sputtering escape from ancient Mars if the young sun had a stronger IMF than that of the current sun.