Japan Geoscience Union Meeting 2010
(May 23-28 2010 at Makuhari, Chiba, Japan)

PPS001-03 会場: 304 時間: 5月23日09:26-09:39

Simulation study of atmospheric escape from Mars and its application to extrasolar planets

Simulation study of atmospheric escape from Mars and its application to extrasolar planets

寺田 直樹[1*], Helmut Lammer[2], Yuri N. Kulikov[3], Maxim L. Khodachenko[2], 田中 高史[4], 品川 裕之[5]

Naoki Terada[1*], Helmut Lammer[2], Yuri N. Kulikov[3], Maxim L. Khodachenko[2], Takashi Tanaka[4], Hiroyuki Shinagawa[5]

[1]東北大学, [2]Space Research Institute, Austria, [3]Polar Geophysical Institute, Russia, [4]九州大学, [5]情報通信研究機構

[1]Tohoku University, [2]Space Research Institute, Austria, [3]Polar Geophysical Institute, Russia, [4]Kyushu University, [5]NICT

We have investigated solar wind-induced atmospheric escape on Mars both at the present and going backward in time using a three-dimensional multi-species magnetohydrodynamic model. The model is also applied to extrasolar planets exposed to intense X-ray and EUV radiation and stellar wind from an active M-type star. Because of the closer orbital distance of the habitable zones of low-mass active M-type stars compared to that of the solar system, terrestrial exoplanets within M-type star habitable zones are expected to be much more strongly influenced by stellar winds and dense plasma ejected from the host star by coronal mass ejections. Our study shows that intense X-ray and EUV radiation of active M-stars, together with the photochemical production of excited atomic oxygen results in atmospheric expansion and extended exospheres which can interact with the stellar plasma flow. We show the efficiency of nonthermal atmospheric erosion of CO2-rich exoplanets, having the size and mass similar to that of the Earth, due to dense stellar plasma flows within close-in habitable zones of an active M-type star. The consequences of our results for the evolution of habitable planets within active M-type star environments are discussed.

キーワード:太陽風相互作用,火星,系外惑星

Keywords: Solar wind interaction, Mars, Extrasolar planets