Effects of the intrinsic magnetic field on the atmospheric escape from terrestrial planets

*Kanako Seki[1], Shotaro Sakai[1], Shogo Inui[1], Ryoya Sakata[1], Naoki Terada[2], Hiroyuki Shinagawa[3], David A. Brain[4]

1. Graduate School of Science, University of Tokyo, 2. Graduate School of Science, Tohoku University, 3. NICT, 4. LASP, University of Colorado, Boulder

Mechanisms of atmosphere escape from Mars to space is one of important problems to understand drastic climate change in the ancient Mars. The geological studies suggest that the climate change occurred from 4 to 3.5 billion years (Ga) ago. It is known that the time period interestingly corresponds to the period just after the ancient Mars lost its global intrinsic field between 4 and 4.1 Ga ago. Observations by NASA's Mars Atmosphere and Volatile EvolutioN (MAVEN) have provided new insights about the atmospheric escape processes in operation at Mars. Among them, the cold ion escape is a promising candidate to enable a large number of heavy ions to escape from the ionosphere. In this study, we present an overview of the results of a statistical analysis of the ion composition measurements by MAVEN as well as global multi-species MHD simulations of solar wind-Mars interactions with a focus in effects of the intrinsic magnetic field. Based on these results, we will discuss the effects of the intrinsic magnetic field on the atmospheric escape from terrestrial planets.

Keywords: intrinsic magnetic field, Mars, Atmospheric escape, climate change, ion outflow, multi-species MHD simulation

