R009-31
Zoom meeting D ：11/2 AM2 (10:45-12:30)
11:45-12:00

Study of proton escape from Mars based on MAVEN observations

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Mars is considered to have had water on surface in ancient days, while there is no surface water at present. Escape of atmospheric gases to space is considered to play an important role in this climate change. Particularly, hydrogen loss is closely related to the water content on Mars. Its main mechanism is thought to be Jeans escape of hydrogen atoms, which are dissociated from hydrogen molecules, sourced from odd-hydrogen reactions with near-surface water vapor. Since the molecular hydrogen is long-lived, the seasonal variation of hydrogen escape is predicted to be typically less than a factor of two (Krasnopolsky, 2002). However, Halekas (2017) reported unexpectedly large (about one order of magnitude) seasonal variations in the hydrogen corona. The cause of the large seasonal variation is not understood. A candidate mechanism is rapid transport of water to upper atmosphere due to the Martian dust storms. The enhancement of the hydrogen corona will increase the proton escape originated from the neutral hydrogen. In order to assess the hypothesis, we investigated proton escape from Mars based on MAVEN (Mars Atmosphere and Volatile EvolutioN) observations from November 2014 to March 2019. We also investigated if the seasonal variation depends on size of the dust storms by comparing MY32, 33 and 34, since Martian global dust storm occurred only in MY34. The result shows that planetary proton density in the optical wake and solar wind regions has a seasonal variability, and the variations in MY32, 33 and 34 are similar. It suggests that the size of dust storm does not affect proton escape. The results of the statistical analysis show that the variations in the wake region are more than one order, while those in the solar wind region are small. In order to understand the cause of the large seasonal variation in the wake region, we investigated proton density in the ionosphere during the same period. Based on comparison between proton observations in the ionosphere and wake region, we will discuss possible causes of seasonal variation of proton escape in the wake.
References:
Krasnopolsky (2002), J. Geophys. Res., doi:10.1029/2001JE001809. 5128.
Halekas (2017), J. Geophys. Res. Planets, doi: 10.1002/2017JE005306