R009-24
B 会場 ：11/7　AM2 （10:45-12:30）
11:45〜12:00

MAVEN および MEX による太陽風が駆動する ULF 波動の火星電離圏への伝搬の準同時多地点観測

#今田　馨 [1)], 原田　裕己 [1)],Fowler　Christopher M.[2)],Collinson　Glyn[3)],Halekas　Jasper S.[4)],Ruhunusiri Suranga[4)],DiBraccio　Gina[3)]
(1 京大・理,(2LASP, CU Boulder,(3NASA GSFC,(4Dept. Phys. & Astron., Univ. Iowa,(5Dept. Phys. & Astron., Univ. Iowa,(6Univ. of Iowa

MAVEN and MEX Quasi-Simultaneous Multipoint Observations of Propagation of Solar Wind-Driven ULF Waves into the Martian Ionosphere

#Kaworu Imada[1)], Yuki Harada[1)], Christopher M. Fowler[2)], Glyn Collinson[3)], Jasper S. Halekas[4)], Suranga Ruhunusiri[4)], Gina DiBraccio[3)]
(1Kyoto Univ.,(2LASP, CU Boulder,(3NASA GSFC,(4Dept. Phys. & Astron., Univ. Iowa,(5Dept. Phys. & Astron., Univ. Iowa,(6Univ. of Iowa

Electromagnetic waves generated upstream of bow shocks of unmagnetized planets such as Mars are important since the waves could have a significant impact on the planetary plasma by propagating through the magnetosheath into the ionosphere (Fowler et al., 2018, 21).

At Mars, it has been reported that so-called “Proton Cyclotron Waves” (PCW) are driven by cyclotron resonant interaction with newborn pickup protons in the upstream solar wind region (Russell et al., 1990,92; Barabash et al., 1991; Brain et al., 2002; Romeo et al., 2020). The waves are then advected downstream to the magnetic pileup boundary and drive compressional magnetosonic ultralow frequency (ULF) waves within the ionosphere at a similar frequency (Collinson et al., 2018; Fowler et al., 2018, 21). These compressional magnetosonic waves inject energy into the ionosphere and heat planetary ions via wave-particle interactions, possibly leading to ion escape to space (Fowler et al., 2018, 21). This series of processes have been actively studied as one of the mechanisms of ion escape from Mars, because the ion escape may play an important role in the long-term climate evolution of unmagnetized bodies.

However, previous studies of the solar wind-driven ULF waves at Mars have been based almost exclusively on single-spacecraft observations. Because of the orbital constraints of single spacecraft, it has been challenging to characterize the likelihood of the upstream waves propagating into the ionosphere.

In this study, we investigated the ULF wave propagation rate from upstream of the bow shock into the ionosphere of Mars with quasi-simultaneous multipoint observations of local magnetic fields. We identified 120 events in which Mars Atmosphere and Volatile EvolutioN (MAVEN) observed the PCWs with its magnetometers in the upstream region, while Mars Express (MEX) observed compressional fluctuations at a similar frequency in the ionosphere by measuring the local magnetic field magnitude from electron cyclotron echoes recorded by MARSIS (we utilized the method established by Akalin et al., 2010). We define these events as ”wave propagation events” and investigate the dependence of the wave propagation rate on various parameters such as MEX’s location and upstream drivers.

The results suggest that wave propagation into the ionosphere could be not an uncommon phenomenon on the dayside of Mars and the propagation rate was found to be highly dependent on SZA and the upstream solar wind dynamic pressure. It was also found that the rate depends on altitude and crustal magnetic field magnitude, although not as much as the former two.