R009-17
B 会場 ：11/7　AM1 （9:00-10:30）
09:45〜10:00

火星ディフューズオーロラの変動機構の研究

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Study of variation mechanisms of the Martian diffuse aurora

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The diffuse aurora at Mars (e.g., Schneider et al. 2015) is considered to be caused by solar energetic particles (SEPs) penetrating into the Martian atmosphere along the interplanetary magnetic field lines draped around the planet. The diffuse aurora emission consists of significant $CO_2{}^+$ ultraviolet doublet emission and having peak below 100 km altitude. Schneider et al. (2018) showed that the time variation of the auroral emission does not always correlate with the variation of the SEP electron flux. The emission correlates also with SEP protons in some events. The cause of the time variations of the auroral emission is far from understood. The horizontal induced magnetic field is developed when interplanetary magnetic field is draped around the Mars, and the structure of the magnetic field will change the flux of the penetrating SEPs. Therefore, one of the candidate mechanisms to cause the auroral variations is the change in the magnetic field orientation around Mars by affecting the vertical auroral emission profile. The purpose of this study is to investigate effects of magnetic field on the vertical emission profile of Martian diffuse aurora based on a Monte Carlo simulation and MAVEN observations.

We have developed a Monte Carlo model that calculates the vertical emission profile of $CO_2{}^+$ UVD, which is a typical emission line of the diffuse aurora. Our model used similar methods to the model by Bhardwaj & Jain (2009), which calculates the energy degradation of electrons below 1000 eV through collisions between CO_2 and electrons. The energy range of our models is expanded up to hundreds of keV by including the cross sections for collisional reactions between electrons and neutral atmosphere used in the model by Gerard et al. (2017), which reproduces vertical emission profiles of Martian diffuse aurora. A difference of our model from the previous models is to trace the trajectory of each electron in the given magnetic field structure including its cyclotron motion to investigate the effect of the draped magnetic field. We use MAVEN observational data, such as electron flux and magnetic fields, during the diffuse auroral event as inputs to our model. The results showed that the peak altitude of the emission intensity decreases with increasing dip angle of the magnetic field from the horizontal direction. Effects of the magnetic field strength are smaller than those of the dip angle. The result suggests that the magnetic field orientation in the vicinity of the planet is one of the important factors to cause variations of the vertical emission profile of the Martian diffuse aurora.