R006-26
A 会場 ：11/27　PM1 （13:15-15:15）
14:15〜14:30

昼側地球磁気圏の軟 X 線イメージングによる磁気リコネクションレートの推定

#百瀬 遼太 [1)], 松本 洋介 [2)], 三好 由純 [3)]
([1] 千葉大学大学院融合理工学府, [2] 千葉大高等研究基幹, [3] 名大 ISEE

An Estimation of Magnetic Reconnection Rate from Soft X-ray Emission in the Earth's Dayside Magnetosphere

#Ryota Momose[1)], Yosuke Matsumoto[2)], Yoshizumi Miyoshi[3)]
([1]Graduate School of Science and Engineering, Chiba University, [2]Institute for Advanced Academic Research, Chiba University, [3]Institute for Space-Earth Environement Research, Nagoya University

Magnetic reconnection is a physical mechanism that converts magnetic energy into plasma internal and kinetic energies in various astrophysical phenomena. The reconnection rate is a physical quantity that characterizes the energy conversion efficiency during the reconnection process. The reconnection rate can be measured by the time variation of the magnetic flux, the reconnection electric field, the Alfvén Mach number of the inflow speed toward the diffusion region, or the aspect ratio of the diffusion region (Cassak et al., 2017). This rate has been estimated by various numerical, experimental, and observational data. From observational data, they have been estimated from plasma inflow and outflow velocities estimated by solar flare imaging (Takasao et al., 2011) and from reconnection electric fields measured by in-situ observations in the Earth's magnetosphere (Nakamura et al., 2018; Burch et al., 2020).

In addition to these methods, we propose a new approach to estimating the rate geometrically by using soft X-ray emission in the Earth's magnetopause. The X-rays are emitted during charge exchange between high charge-state ions in the solar wind and the Earth's exosphere (geocorona). This emission process, termed SWCX (Solar Wind Charge eXchange), is useful for visualizing the dayside magnetosphere and its response to solar wind variations. The SMILE and GEO-X missions have been proposed to provide soft X-ray images of the magnetosheath and cusps and will contribute to a better understanding of the dynamic response of the Earth's magnetosphere.

For this purpose, we have developed a global magnetohydrodynamic simulation model of the magnetosphere (Matsumoto and Miyoshi, 2022). The model can provide three-dimensional distributions of the soft X-ray intensity from the plasma parameters. Then line-of-sight integrations of the intensity distribution give a two-dimensional X-ray map as a virtual observation in the simulation domain. By using this model, we examined the SWCX emission around the dayside magnetopause under a coronal mass ejection event. We found that the current sheet around the dayside reconnection region is bright as 10 keV/cm^2/s/str so that we could identify the reconnection outflow region. By calculating the opening angle of the reconnection region estimated from the bright area, we obtained the reconnection rate as R˜0.13. This value is close to the aspect ratio δ/L˜0.1, as assumed in a previous study (Cassak and Shay, 2007) and consistent with values obtained by PIC simulations (Zenitani et al., 2011). Furthermore, we confirmed that there is a difference in emission intensity depending on the dipole tilt; we expect that the larger the tilt, the clearer the bright reconnection region will be. In this presentation, we present a new approach to estimating the reconnection rate geometrically by the soft X-ray imaging of the dayside magnetosphere and discuss its seasonal dependence.