Oral | Symbol P (Space and Planetary Sciences) | P-EM Solar-Terrestrial Sciences, Space Electromagnetism & Space Environment

[P-EM37_30PM2]Structure and Dynamics of the Magnetosphere

Convener:*Yoshizumi Miyoshi(Solar-Terrestrial Environement Laboratory, Nagoya University), Hiroshi Hasegawa(Institute of Space and Astronautical Science, Japan Aerospace Exploration Agency), Chair:Yoshizumi Miyoshi(Solar-Terrestrial Environement Laboratory, Nagoya University), Shigeru Fujita(Meteorological College, Japan Meteorological Agency)

Wed. Apr 30, 2014 4:15 PM - 5:30 PM 414 (4F)

This session provides an opportunity to present recent results from satellite and ground-based observations, and theoretical and simulation studies, and discuss magnetospheric structures and phenomena including the solar wind-magnetosphere interaction, magnetosphere-ionosphere coupling, magnetic storms, and substorms. Discussion on planetary and satellite magnetospheres, future missions and instrument developments are also welcome.

5:00 PM - 5:15 PM

[PEM37-P08_PG]3D Full kinetic simulations of plasma flow interaction with meso- and micro-scale magnetic dipoles

3-min talk in an oral session

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Keywords:Magnetic dipole, Meso-scale, Plasma response, Boundary current layer, Plasma particle simulation

Plasma flow response to a magnetic dipole and the resulting formation of a magnetosphere depends on the intensity of the magnetic moment of the dipole. In this study, we examined plasma flow interactions with a magnetic dipole which is much smaller than the Earth's intrinsic magnetic dipole by performing three-dimensional full Particle-In-Cell simulations. The size of a magnetic dipole immersed in a plasma flow is characterized by distance L from its center at which the equilibrium is satisfied between the pressure of the magnetic field of the dipole and that of the plasma flow. In the Earth's magnetosphere, L implies the magnetopause location. We particularly focused on meso- and micro-scale magnetic dipoles in which L is comparable to and smaller than the gyroradius of ions in the flow. In the meso-scale case, ions kinetics should be dominantly considered while electrons whose gyroradius is sufficiently small can be treated as fluid. In the micro-scale, however, electrons as well as ions should be treated particles because L becomes small and the electron kinetics cannot be ignored either. Our interest is in the formation of current layer at the magnetosphere boundary in the both scales. Corresponding to the formation of a magnetosphere, the boundary current also depends on the size of the magnetosphere. In the meso-scale case, the boundary current is dominated by the electron diamagnetic current at the large density gradient found at the distance of L. This signature is similar to the case of the Earth's magnetosphere. In the micro-scale case, however, the trajectories of ions and electrons gyration play an important role to determine the boundary current. Since the ion's gyroradius is larger than L, charge separation between ions and electrons occurs in the upstream region. As particles approach to the inner dipole, the electron gyroradius becomes small and electron drift motion becomes dominant. It is also

confirmed that static electric field caused by the charge separation affect the plasma dynamics and the resulting current flow.