

PEM027-08

会場:103

時間:5月25日 18:15-18:30

IMFの南北反転に伴う磁気圏ダイナミクス Magnetospheric Dynamics on Southward/Northward Turning of IMF

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One of important problems in space plasma physics is to understand relationships among magnetic reconnection and initiation of substorm processes and magnetospheric dynamics when the IMF turns from northward to southward or vice versa. When the IMF is northward, a dipole-like magnetic field configuration is formed in a steady state and magnetic reconnection occurs in high latitude tail region. On the other hand, when it is southward, a tail-like configuration is formed and reconnection occurs at the dayside magnetopause and plasma sheet. The reconnection site shifts to subsolar region in the dayside magnetosphere when the IMF turns southward from northward. Then, reconnected magnetic flux transfers from the subsolar region to lobes through polar regions and is accumulated in lobe regions of magnetotail. As the result, plasma sheet thinning is happened and successively tail reconnection as formation of near-earth neutral line (NENL) begins and fast jet flows appear in both directions in the plasma sheet.

How do the processes of magnetic reconnection proceed at the dayside magnetopause and in the magnetotail? What are causal relationships satisfied in processes such as the initiation reconnection, formation of NENL, full spread of neutral line up to flank magnetopause, start of lobe reconnection? What do the plasma, momentum and energy carry toward the earth and how do the plasma sheet configuration change? We have studied the detail processes on magnetic reconnection in the plasma sheet and successive magnetospheric dynamics from a high-resolution and 3-dimensional global MHD simulation of interaction between the solar wind and earth's magnetosphere when the IMF turns from northward to southward and vice versa. As the results, the first reconnection occurs in closed field lines in the magnetotail and proceeds to full spread of reconnection line up to flank magnetopause and lobe reconnection in a few minutes, and then fast plasma flows appear in the plasma sheet. We will discuss what are important to carry the plasma, momentum and energy in the plasma sheet and to change the configuration of near-earth plasma pressure and magnetospheric convection.

キーワード: MHD シミュレーション, 惑星間磁場, 磁気リコネクション, 磁気圏ダイナミクス, サブストーム, エネルギー輸送

Keywords: MHD Simulation, Interplanetary Magnetic Field, Magnetic Reconnection, Magnetospheric Dynamics, Substorms, Energy Transport