Abstract

We have studied Jupiter's injection phenomenon which is characterized as the enhancement of keV to MeV electron flux. The similar event is identified in Earth's magnetosphere, however Jupiter's injection is different from Earth's one in some respects. In Earth's magnetosphere, injections occur during the substorm, which has good correlation with the solar wind structure. On the other hand, it has been unknown what kind of magnetospheric phenomena generate Jupiter's injections. Therefore we have analyzed the Galileo data to reveal Jupiter's injection characteristics, and investigated the relation between the injections and other magnetospheric phenomena. We have clarified some new observational characteristics of Jupiter's injections as follows: 1.) Jupiter's injections are correlated with narrow band kilometric emissions (n-KOMs), which correspond to the encounter of the solar wind structure and/or Jupiter's substorm, and the correlation coefficient is about 0.8, while some injection events were observed without nKOM events. 2.) A few magnetic and plasma variations inferring the interchange motion, which is expected to have some relation with Jupiter's injection in it's generation process, are detected during the injection events. 3.) In the region from 9 to 14 R_J, 20 to 60 percents of the electron's pitch angle distributions (PADs) represented bi-directional (butterfly) distributions during injections. This feature is not confirmed in Earth's injections and the distributions are not expected from the simple adiabatic transport.

The result No. 1 suggests that the injections are initiated by some global magnetospheric variation, while the result No. 2 in-

dicates the possibility that some internal and local phenomena generate them. The result No. 3 indicates significant information to comprehend Jupiter's injection process. In order to interpret bi-directional PADs during the injections, we have made a numerical simulation using the 4 D salambô code.

The simulation results are summarized as follows; 4.) When a large scale electric field or multiple small scale flux tubes filled with large phase space density are set in the simulation, the simulation results are partially consistent with the observed pitch angle distributions. In order to fully interpret the observed PADs feature, it would be important to take into account the Coulomb interaction around the magnetic equatorial region or set a new multiple small scale flux tubes with some specific spacing. 5.) In order to transport the small scale flux tube filled with energetic particles without a large amount of the particle loss, the rapid inward flow from 16 to 10 R_J is required. It's velocity (200 - 1000 km/s) is approximately corresponds to the local Alfven velocity. This infers similarity of the bursty bulk flow (BBF) in Earth's magnetosphere which is small scale inward flux tube transportation and has comparable velocity with the local Alfven speed.

The results No. 4 result suggests that importance of the interaction with neutral particles and the inner part of the Jovian magnetosphere is characterized as a rigid dipole magnetic field region. Therefore it is difficult to reconfigure the magnetic field by the substorm, however the injection feature implies the magnetic flux tube must be transported outward from the Io torus.

The result No. 5 indicates the possibility to solves the Jovian magnetosphere's problem how to conserve the magnetic flux, be-

cause small scale flux tube can move inward without a significant magnetic field reconfiguration like Earth's substorm. BBFs also relate to the result No. 1 as regard of the spatial scale and the result No. 2 as regard of the magnetospheric condition when BBFs and Jupiter's injections occur. The small and rapid magnetic flow like a BBF might represent a common physical process in planetary magnetosphere.