Studies on energetic electron variation phenomena in the inner part of the Jovian magnetosphere with the Galileo data

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Jupiter's injection phenomena were observed by the Galileo satellite. 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.

We have analyzed the Galileo data to reveal Jupiter's injection characteristics, and investigated relation between the injections and other magnetospheric phenomena. As the result, some new observational characteristics of Jupiter's injections are clarified 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.

[2]. During the injection events a few magnetic and plasma variations inferring the interchange motion are detected, which is expected to have some relation with Jupiter's injection in its generation process.

[3]. In the region from 9 to 14 Rj, a maximum ratio of 60 percent of the electron's pitch angle distributions (PADs) represented bi-directional (butterfly) distributions during injections. This feature has not been 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 indicates a possibility that some internal and local phenomena generate the injections.

The result No. 3 indicates significant information to comprehend Jupiter's injection process. The PADs during Jupiter's injections are changed by effects of the magnetic drift motion, wave particle interaction and outward flow. In order to interpret the bi-directional PADs during the injections, we have made a numerical simulation using the 4D salambo code.

In this presentation, we will discuss how the unexpected PADs are made during an injection event based on the simulation result. We will also discuss a small scale flux transportation like 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 as a possible generation mechanism of the Jovian injection. The small scale flux transportation might solve the Jovian magnetosphere's problem how to conserve the magnetic flux, because a small scale flux tube can move inward without a significant magnetic field reconfiguration like Earth's substorm.