木星磁気圏ダイナミクスに関する研究-III：内部磁気圏へのエネルギー輸送過程の解明

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Study of dynamics of the Jovian magnetosphere-III: energy transportation process to the inner magnetosphere

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We have researched response of the Jovian inner magnetosphere to the substorm-like event which occurred in the night side of the middle/outer magnetosphere. The transport of magnetic flux tube is one of important issues in the global dynamics of the Jovian magnetosphere [Kivelson et al., 2005]. The magnetic flux tubes are carried outward from the Io plasma torus with the slowly outflowing plasma. As they move outward, alternative flux tubes should be returned to the torus through rapid inflow of lower-dense flux tubes. Goal of this study is to reveal the role of the substorm-like event in the transport of magnetic flux tube in the Jovian magnetosphere and proceeding processes of the global-scale magnetospheric variations.

In this study, substorm-like events were identified by using the in-situ observation data obtained by the Plasma Wave Subsystems (PWS), Energetic Particle Detector (EPD) and Magnetometer (MAG) onboard the Galileo orbiter. X-lines where the substorm-like events are thought to start were located at around 60-80 R_J [Woch et al., 2002]. Narrowband KilOMetric radiation (nKOM) which was remotely observed by PWS was used to find response of the inner magnetosphere to the substorm-like event. The source of nKOM is suggested to be located at the outer edge of the Io torus (8-10 R_J) [Reiner et al., 1993].

In the preceding studies, Louarn et al. (2001, 2014) reported nKOM correlated with inward flow burst during Jovian substorm-like event reported by Woch et al.(1998) and Krupp et al.(1998). The report implies that the generation mechanism of nKOM relate with the return of magnetic flux tube to inner magnetosphere. However, it has not been revealed well yet how inner and outer magnetospheres couple each other during substorm-like event. On the other hand, Dubyagin et al.(2011) reported about deeply penetrating flow burst at the terrestrial magnetosphere. They reported that an inward flow burst penetrated into the inner magnetosphere when its entropy was less than that of the inner magnetosphere, while flow burst did not penetrated when its entropy was larger than that of the inner magnetosphere.

We have analyzed Jupiter's several inward flow events which are expected to relate with tail reconnection and nKOM radiation by using the data obtained by Galileo in order to reveal that how reconnection events at the outer magnetosphere couple with the inner magnetosphere. We have applied Dubyagin's entropy analysis method to Jupiter's cases to investigate penetration of inflow plasma, and also have analyzed correlation between the spatial structure of nKOM source regions and that of inward flow burst to investigate proceeding processes of the global-scale events.

In this presentation, we will show preliminary results on relations of inward flow burst caused by Jovian substorm-like event and energetic phenomena of the inner magnetosphere.