昼側磁気圏における二種のオープン機構（カスプ局所オープンと 大規模不完全オープン）の共存： フレイア衛星による観測から

*山内 正敏 [1],ルンディン リッカード [1],エリーアソン ラーシュ [1]
大谷 晋一 [2],リンクビスト ベルアーネ [3]

スウェーデン国立スペース物理研究所[1]
米国ジョンホプキンス大学 応用物理研究所[2]
スウェーデン王立工科大学 プラズマ物理研究所[3]

Double-openness Concept of the Dayside Magnetosphere: Indications from the Freja Cusp Observations

*Masatoshi Yamauchi[1] ,Rickard Lundin [1],Lars Eliasson [1]
Shin-ichi Ohtani [2],Per-Arne Lindqvist [3]

Swedish Institute of Space Physics[1]
Johns Hopkins University Applied Physics Laboratory[2]
Institute of Plasma Physics, Royal Institteu of Technology[3]

A controversial issue concerning the origin of the cusp particles is the relative importance of "direct entry" (non-MHD and non-adiabatic entry) and "reconnection" (MHD and linear drift entry). The difference can be attributed to the definition of "open" magnetosphere: the latter has one type of "openness" because of its one fluid assumption whereas the former predicts two types of openness in the dayside magnetosphere, namely, a global openness which allows the interplanetary electric field access the entire boundary layer (e.g., via reconnection and the viscous-like interaction) and a local openness which allows solar wind access only near the cusp. The global openness does not necessarily mean completely open compared to the openness in the cusp region, which causes the non-MHD type deceleration (stagnation) and the cusp plasma injection.

The "double openness" concept can be modelled with a multi-component plasma, in which the low-energy background component and the injecting hot component may have two different flow velocities. The wave-assisted cusp model (Yamauchi and Lundin, 1992; 1997) is one such attempt. Each "open" process carries its own FAC system: the dayside region 1 FAC for the global openness and the cusp region 1/0 FAC in the local openness. Therefore, the "double-openness" model predicts the independency between the cusp FACs and auroral oval FACs. Other differences between the direct entry (or "local") cusp model and the "global" MHD cusp model are the roles of waves, turbulence, and escaping ionospheric ions (due to wave-particle interaction). These are basically neglected in MHD models whereas they control the cusp in the local cusp model.

The key question is the level of observational support for the different models. In the presentation, we point out the independency between the cusp FACs and auroral oval FACs. We summarize past evidences for this independency, adding contributions from the Freja satellite to this issue. With its unique longitudinal cusp traversals during southward IMF due to its 63 degree orbit inclination, Freja reinforced past evidences that the field-aligned currents (FACs) in the cusp region are separated from the dayside region 1 FAC outside the cusp.