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Hall magnetohydrodynamic effects for three-dimensional magnetic reconnection with finite width along the direction of the current

Takuma Nakamura (1), Rumi Nakamura (2), Alexandra Alexandrova (2), and Yasubumi Kubota (3)

(1) Japan Aerospace Exploration Agency, Institute of Space and Astronautical Science, Kanagawa, Japan (takuma@stp.isas.jaxa.jp, +81-42-759-8456), (2) Space Research Institute, Austrian Academy of Sciences, Graz, Austria, (3) National Institute of Information and Communications Technology, Tokyo, Japan

We have performed three-dimensional Hall magnetohydrodynamic (MHD) simulations of magnetic reconnection with finite width along the current direction. Previous MHD simulations have revealed that such localized three-dimensional situations produce the so-called fast reconnection process, in which an Alfvenic fast and narrow jet flows from the localized reconnection region, and the reconnected field lines are strongly piled-up at the head of the jet. Our Hall MHD simulations also confirmed a similar fast reconnection process. On the other hand, our Hall MHD simulations also revealed that the Hall effects critically change the results obtained from MHD simulations regarding the physics of the reconnection region; in the Hall MHD cases, the reconnection region itself broadens and moves in the current and anti-current directions due to the plasma flow related with the current. This means that the location and the size of the reconnection region are unsteady features in Hall MHD regime. In this presentation, we will show the detailed results of our Hall MHD simulations and discuss their implications to the observations in the planetary magnetotail.