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Magnetic Flux Transport and Pressure Variations at Magnetotail Plasma Flow Bursts during Geomagnetically Quiet Times

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The fast plasma flows in the geomagnetotail are observed during both geomagnetically active and quiet times. However, it has been unclear about the fundamental difference in the plasma fast flows between at two different geomagnetic conditions, that is, the generation mechanism of, and pictures of the energy transport and balance at the fast plasma flows. Magnetic reconnection in the magnetotail has been believed as one of the most possible mechanisms to generate the fast plasma flows regardless of the geomagnetic conditions. Recently, $Nowada\ et\ al.$ [2012], however, demonstrated that the magnetotail magnetic reconnection does not always contribute to the generation of the fast plasma flows at geomagnetically quiet times based on the THEMIS measurements. It is very important to reveal how the energy transport and balance in the magnetotail in association with these plasma fast flows are on obtaining a clue to elucidate an essential difference in the plasma fast flows between during active and quiet geomagnetic conditions. Based on three events of the magnetotail plasma flow bursts, which are transient fast plasma flows with the durations between 1 and 2 minutes, during geomagnetically quiet times, observed by THEMIS, we examined detailed variations of the electric field as a proxy of the flux transport aspect, and associated pressure. The main characteristics of these events are shown as follows; 1) the GSM-X component of the plasma velocity (V_x) was higher than 300 km/s 2) associated parallel ($V_{//}$) and perpendicular ($V_\perp$) velocities to the local magnetic field line were higher than 200 km/s 3) the flow bursts were observed during which AL and AU indices were lower than 40 nT, and simultaneous K_p index range was between -1 and 1. For almost events, the parallel ($E_{//}$) and perpendicular ($E_\perp$) components of the electric field to the local magnetic field line were much stronger than the dawn-dusk electric field component (E_y). This result implies that a larger amount of the magnetic flux was transported into the parallel and perpendicular directions to the local magnetic field line than the dawn-dusk direction at the flow bursts. However, in the E_y component, the contribution from the dawn-to-dusk electric field (V_xB_z) was much greater than that from the dusk-to-dawn component (V_zB_x). Furthermore, for two events, significant reduction of the plasma pressure, and enhancement of the north-south magnetic field component (B_z) were observed at/near the flow bursts. Simultaneous total pressure was well-balanced, indicating that the magnetotail during the plasma flow bursts was in the state of equilibrium. Based on these results, “bubble” might play a crucial role for generating the plasma flow bursts at geomagnetically quiet times.

Reference:
Nowada, M., S. -Y. Fu, G. K. Parks, Z. -Y. Pu, V. Angelopoulos, C. W. Carlson, H. -U. Auster (2012), Plasma flow bursts in the magnetotail during geomagnetically quiet times 2: Relation to the magnetic reconnection and substorm process, *to be submitted to Journal of Geophysical Research -Space Physics-.*

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