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Kinetic modeling of asymmetric reconnection

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At dayside magnetopause, magnetic reconnection takes place between the terrestrial dipole field and the solar-wind magnetic field. In such an configuration with asymmetric upstream conditions, reconnection behaves differently from the standard symmetric reconnection in the magnetotail. Since the upcoming MMS mission will extensively probe dayside magnetopause during its first phase, it is of immediate importance to understand key properties of asymmetric reconnection. In the MHD regime, the CSB (Cassak-Shay-Birn) theory is very successful to approximate reconnection properties with asymmetry. However, in the kinetic regime, recent simulations have reported that the reconnection rate is substantially lower than the CSB prediction. We investigate the anomalous slow-down with particle-in-cell simulations. This is attributed to the kinetic dissipation mechanism around the electron-scale dissipation region. In this contribution we discuss the electron motion near the dissipation region, its impact on the global reconnection rate, and the influence of the guide-field geometry.

Keywords: Magnetic reconnection, Kinetic simulation, Magnetic dissipation, Magnetopause