Dynamics of Plasmoid in Fast Magnetic Reconnection

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When the fast magnetic reconnection is developed, a plasmoid is formed and then propagates to downstream in the current sheet. At the time, as well-known in the Petschek model, a switch off shock drives the reconnection jet. However, the plasmoid is mainly driven by a slow shock formed around the plasmoid itself, which is clearly separated from the switch off shock. In other words, the plasmoid is not pushed by the reconnection jet in the steady state fast reconnection. According to the steady state Rankine Hugoniot analysis of those slow shocks, the supersonic or subsonic adiabatic expansion acceleration region formed between the reconnection jet region and plasmoid region is always required to balance the pressure of those two regions. It suggests that, if a fast shock is steadily formed in the fast magnetic reconnection, the adiabatic expansion acceleration region is always formed and promotes to clearly separate the reconnection jet and plasmoid. MHD simulation and Rankine Hugoniot analysis are shown and discussed.