Simulation Study of the Causes of Plasmoid Acceleration and the Changes of Magnetic Reconnection Rate in Resistive MHD Plasmas

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Magnetic reconnection plays an important role on energy transfer in space plasma. In this study, we use MHD simulation with finite resistivity to study (1) the forces that lead to the acceleration of the plasma and the plasmoid and (2) the time evolution of the magnetic reconnection. Our results show that the fast flows are not limited to the direction perpendicular to the local magnetic field. The fast parallel flows are accelerated by the parallel component of the pressure gradient force. The net force perpendicular to the magnetic field can accelerate the plasma and the plasmoid along the current sheet. Our results also show that the magnetic reconnection in MHD plasma is due to the non-uniform magnetic annihilation rate along the current sheet. The fast ejection of the plasmoid can stretch the current sheet and consequently reduce the magnetic reconnection rate temporally before a new plasmoid is formed. The newly formatted plasmoids may be related to the continuous ejections of plasma blob during a transient magnetic reconnection event. The formation of the secondary plasmoids will also be discussed.