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3D dynamics of Eruptive phenomena and Particle acceleration In a Solar flare

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Solar flares show intermittent time variability in nonthermal emissions, that means impulsive acceleration of particles in small regions of a fragmented current sheet. We performed 3D MHD simulation of a solar flare and investigated particle behaviors with test particle simulation. A flux rope ejection in 3D simulation generates a current sheet below, in which multiple small-scale plasmoids are formed and ejected upward and downward. These ejections play a role in making a current sheet turbulent and locally enhancing inflow and E-field inside the current sheet. Test particles move in several current sheets and are stochastically accelerated by enhanced E-field. Furthermore, we also found that both reconnection outflow and the additional force by kink instability, i.e. 3D effect, force a flux rope upward harder, resulting in larger ejection speed, larger inflow, larger E-field and harder acceleration of particles. Finally we compared our simulation result with recent Hinode and SDO observations of Solar Flares.

Keywords: Solar Flare, Particle Acceleration, Magnetic Reconnection, Coronal Mass Ejection, Hinode satellite, SDO satellite