

Particle dynamics in the electron current layer in collisionless magnetic reconnection

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Particle dynamics in the electron current layer in collisionless magnetic reconnection is investigated by using particle-in-cell simulations. Electron motions and velocity distribution functions are studied by directly tracking self-consistent particle trajectories. New classes of electron orbits are discovered: a figure-eight-shaped regular orbit inside the electron jet, another regular orbit on the jet flank boundaries, a Speiser-like noncrossing orbit, and nongyrotropic electrons in the downstream of the jet termination region (a remagnetization front). Based on these discoveries, we will discuss the composition of electron velocity distribution functions, fluid properties of a super-Alfvénic outflow jet, and implications for upcoming MMS observation in the magnetotail.

Keywords: Magnetic reconnection, PIC simulation, Particle dynamics