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Electron dynamics in large-scale reconnection layer with density asymmetric current sheet

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Recent Cluster observations have shown sub-ion/electron-scale fine structures in a reconnecting current sheet of the Earth's magnetopause. Motivated by those results, we have investigated the dependence of the electron dynamics on a reconnection layer structure with density asymmetric current sheet. Two-dimensional (2-D) particle-in-cell (PIC) simulations with an initial single X-line have been used to see electron dynamics in the density asymmetric current layer at the nonlinear stage. In order to do this survey, two key parameters of n_low and n_high are systematically varied, where n_low and n_high are the plasma densities at each lobe side. One asymmetric current layer (n_lobe = n_low, n_high) is compared to two different symmetric current layers, that is, the current layers with low lobe plasma density (n_lobe = n_low, n_low) and with high plasma density (n_lobe = n_high, n_high). It is found that in the asymmetric case, the Hall magnetic field of the high-density side penetrates into the low-density side. Electrons on the low-density side are highly accelerated along the separatrix, where the plasma density forms a dip structure. It is also found that the electron energization is controlled by the high-density lobe plasma. Magnetic islands are intermittently ejected from the mostly developed X-line only in a very large system size case.