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Magnetohydrodynamic discontinuities and expansion waves in the outflow region of asymmetric reconnection

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Magnetic reconnection can take place between two plasma regions separated by antiparallel magnetic field components. It has been demonstrated that magnetic reconnection triggers jets in the outflow region by means of converting magnetic field energy to plasma kinetic and thermal energy. The jet generates several magnetohydrodynamic (MHD) discontinuities and expansion waves which are results of Riemann problem in ideal MHD. Observations and simulations have demonstrated that the propagation speed of slow shock(SS) can be larger than that of rotational discontinuity(RD) for anisotropic plasma $P_{||}/P_{\perp} > 1$, which is caused by leakage of downstream particles to upstream region of slow shock. We used hybrid simulation to study the outflow region of magnetic reconnection in both symmetric and asymmetric current sheets. Here we present several MHD discontinuities and expansion waves in our simulation results.