

Suppression of Hall term effects by gyroviscous cancellation in collisionless magnetic reconnection

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The formation of an ion-dissipation region, in which motions of electrons and ions decouple and fast magnetic reconnection occurs, is demonstrated during a steady state of two-dimensional collisionless driven reconnection by means of full-particle simulations. The Hall term effect is suppressed due to the gyroviscous cancellation at scales between the ion-skin depth and ion-meandering-orbit scale, and thus ions are tied to the magnetic field. The ion-frozen-in constraint is strongly broken by nongyrotropic pressure tensor effects due to ion-meandering motion, and thus the ion-dissipation region is formed at scales below the ion-meandering-orbit scale. A similar process is observed in the formation of an electron-dissipation region. These two dissipation regions are clearly observed in an out-of-plane current density profile.