

Roles of plasma instabilities and particle kinetic effects in collisionless reconnection in an open system

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Roles of anomalous resistivity and particle kinetic effect in collisionless reconnection have been investigated by using 2D and 3D particle simulation for an open system in which plasma inflow and outflow exist through the boundary. From two-dimensional simulation it is found that there are two causes of violation of frozen-in constraint. One is the anomalous resistivity generated by drift-kink instability (DKI), and the other is the pressure tensor term originating from complex particle motion around the neutral sheet. In driven case two-scale structure of current layer is generated due to meandering orbit effect. The Hall term effect is suppressed due to the gyroviscous cancellation in two-fluid MHD region.

The relationship between anomalous resistivity due to DKI and pressure tensor term has been investigated from three-dimensional simulation. Anomalous resistivity generated by DKI is main cause of violation of electron frozen-in constraint, while pressure tensor term (meandering orbit effect) sustains reconnection electric field in ion fluid.