
The Hall dynamics of ions and their role in kickstarting the ion outflow

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Abstract

The Hall term in the generalized Ohm's law leads to fast magnetic reconnection. In this study, we investigate the motion of ions due to the Hall fields and try to quantify what role it plays in the formation of the outflow. Close to the X line, we show that the Hall fields kickstart the ion outflow and delay the Speiser mechanism. We present a simple Hall injection model based on the conservation of the total energy and the canonical momentum p_L , which predicts v_L/v_N (or the injection angle) based on some observable quantities. The first one is simply the energy, or speed, of the ion. The second one, which is a bit more complicated, is the ratio between the electrostatic potential, which is related to the Hall electric field E_N , and the magnetic vector potential A_L , which relies on the integration of the Hall magnetic field B_M in the direction normal to the current sheet.

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