Magnetohydrodynamical study of instability at leading part of reconnection jet

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The leading part of a reconnection jet is known to become unstable. We have conducted three-dimensional MHD and Hall-MHD simulations and have clarified the nature of this instability.

From MHD simulation results we have found the driving mechanism of the instability to be essentially the same as the Rayleigh-Taylor instability.

Hall-MHD simulation results show more complicated structures and nonlinear development to turbulence-like state is observed. We have also found that the wavelength of the fastest growing mode is fixed at about 15 ion inertia length. As such, this work reveals that the instability of reconnection jet-leading part is significantly affected by the Hall effects and small thickness of the current sheet is not necessarily required for this to be true.

The leading part of a reconnection jet is known to become unstable as the jet interacts with the standing plasma ahead of it. We have conducted three-dimensional MHD and Hall-MHD simulations and have clarified the nature of this instability.

From MHD simulation results we have found the driving mechanism of the instability to be essentially the same as the Rayleigh-Taylor instability, with the excess Lorenz force at the jet-leading part being a counterpart of gravity.

While the driving mechanism of seems to stay the same, Hall-MHD simulation results show more complicated structures and nonlinear development to turbulence-like state is observed. We have also found that the wavelength of the fastest growing mode is fixed at about 15 ion inertia length independent of the current sheet thickness that is varied between 2 and 12 ion inertia length. As such, this work reveals that the instability of reconnection jet-leading part is significantly affected by the Hall effects and small thickness of the current sheet is not necessarily required for this to be true.