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Properties of lower-hybrid range wave activity at reconnection jet edge: 3D PIC simulations

Andrey Divin (1), Yuri Khotyaintsev (1), Andris Vaivads (1), Mats Andre (1), Giovanni Lapenta (2), and Stefano Markidis (3)

(1) Swedish Institute of Space Physics, Uppsala, Uppsala, Sweden (andrey.div@gmail.com), (2) Center for mathematical Plasma Astrophysics, KU Leuven, Belgium, (3) High Performance Computing and Visualization (HPCViz), KTH, Stockholm, Sweden

Reconnection fronts are areas of intense currents and enhanced wave activity, since magnetic flux and plasma are piled up there when the accelerated flow encounters denser ambient current sheet. Observations and numerical simulations show that the fronts generate a variety of waves ranging from MHD frequencies up to lower hybrid frequency and above.

In the present study we use 2D and 3D Particle-in-Cell (PIC) simulations to investigate the properties of the lower hybrid range waves developing at hot reconnected plasma - current sheet interface. Calculations are performed using implicit parallel code iPIC3D starting from conventional Harris current sheet. Initial evolution of the jet is simulated using 2D approach to save computational time, but 3D calculations are implemented at later stages in order to observe instability linear stage, saturation and transition to turbulence.

Properties of the linear stage match closely theoretical predictions for the lower hybrid drift instability. During saturation, the mode produces intense electric fields (several Alfvén in electric fields normalized unit) that can provide an additional mechanism of electron heating at reconnection jet fronts.