Role of Inertial and Inductive Modes in Magnetic Reconnection Events

P. BURATTI, ENEA, B. COPPI, B. BASU, MIT — Recently, an accurate analysis of the database of magnetic island rotation performed with the JET machine [1] has revealed that, in the frame of zero radial electric field, the island rotation frequency is about $0.9\omega_{di}$, where $\omega_{di}$ is the ion diamagnetic frequency. The drift-tearing mode theory of reconnection in low collisionality regimes predicts a phase velocity in the opposite direction [2] and, under strictly collisionless conditions, stability in the presence of electron temperature gradients. To explain the observations, a “mode inductivity” $L_\parallel \equiv (4\pi/c^2)S_L$ has been introduced [3] whose effects replace those of finite resistivity. This has led to a linear instability [4] with $\omega$ close to $\omega_{di}$. The reconnection layer thickness is proportional to the inductivity [4] and the mode has a dissipative growth rate. When considering plasmas with ultrarelativistic energies, the inertial skin depth becomes significant. Thus the width of the reconnection layer can be considered as relevant to realistic theories.


1Sponsored in part by the U.S. DoE.

Bruno Coppi
MIT

Date submitted: 14 Jul 2015   Electronic form version 1.4