# Triggering fast tearing: from MHD to kinetic effects

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One of the main questions about magnetic reconnection concerns how this mechanism may account for fast magnetic energy conversion to kinetic and thermal energies, resulting in explosive events in astrophysical and laboratory plasmas. Over the past decade progress has been made on the initiation of fast reconnection via the plasmoid instability and what has been called ``ideal" tearing, which sets in once current sheets thin to a critical aspect ratio: as shown by Pucci and Velli (2014) once the thickness reaches a scaling a/L ~ S^-1/3, the time scale for the instability to develop becomes of the order of the Alfvén time and independent of the Lundquist number. However, given the large values of the Lundquist number in natural plasmas, this transition might occur for thicknesses of the inner, singular layer, approaching the ion inertial length. When this occurs, Hall currents produce a three-dimensional quadrupole structure of magnetic field, and the dispersive waves introduced by the Hall effect accelerate the instability. Here we present a linear study showing how an "ideal tearing mode" is achieved when Hall effects are taken into account, including scaling laws for sheet aspect ratios and growth rates. We show that for an appropriate scaling of the aspect ratio in the parameter space (S, d_i/L), the instability develops on ideal timescales and the associated growth rate does not depend on the parameters, suggesting a revision of the phase diagrams describing different regimes for magnetic reconnection in space and laboratory plasmas.

Keywords: Plasma, Magnetic Reconnection, Heliosphere

 