Abstract Submitted
for the APR12 Meeting of
The American Physical Society

Supersonic regime of the Hall-MHD tearing instability[1] J.J. RAMOS, Massachusetts Institute of Technology, E. AHEDO, Universidad Politecnica de Madrid — An earlier analysis of the Hall-MHD tearing instability [E. Ahedo and J.J. Ramos, Plasma Phys. Controlled Fusion 51, 055018 (2009)] has been extended to cover the regime where the growth rate becomes comparable or exceeds the sound frequency. Like in the previous subsonic work, a resistive, two-fluid Hall-MHD model with massless electrons and zero-Larmor-radius ions is adopted and a linear stability analysis about a force-free equilibrium in slab geometry is carried out. The most salient feature of the supersonic regime is that the mode eigenfunctions become intrinsically complex, but the growth rate remains purely real. More surprisingly, the dispersion relations remain of the same form as in the subsonic regime for any beta value, provided only that the ion inertial length is sufficiently small for the mode ion inertial layer width to be smaller than the macroscopic length scales (an extremely generous bound scaling like a positive power of the Lundquist number) thus allowing a boundary layer analysis. These results will allow further verification studies in very low beta regimes, including the zero-beta limit where there is disagreement among some older analytic results.

[1]Work sponsored by the U. S. Department of Energy

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Date submitted: 10 Jan 2012 Electronic form version 1.4