Abstract Submitted
for the DPP11 Meeting of
The American Physical Society

Kinetic Theory of Oblique Collisionless Tearing Instabilities[1]
SCOTT BAALRUD, AMITAVA BHATTACHARJEE, University of New Hampshire — Recent 3D PIC and linear Vlasov-Maxwell simulations [1] have shown that conventional kinetic tearing mode theory [2] vastly overestimates the growth rate of oblique modes, i.e., those with nonzero $\phi = \arctan(k_z/k_y)$ where k_z is the wavenumber in the guide field direction and k_y is the wavenumber perpendicular to this in the plane of the current sheet. Thus, doubts have been cast on the validity of asymptotic boundary-layer analysis in collisionless kinetic theory. We show that this disagreement is a consequence of a strong guide field assumption made in conventional theories. We relax this assumption and obtain a dispersion relation that accounts for oblique angles. Focusing on a Harris equilibrium, Ref. 1 discusses modifications in the ideal MHD region outside the $\mathbf{k} \cdot \mathbf{B_o} = \mathbf{0}$ surface [1]. Here we complete the necessary modifications by correcting the inner layer solution. These show that obliquity has a stabilizing effect in all but the strongest guide field cases. Our theoretical predictions are compared to the previous simulation results. [1] W. Daughton *et al.*, Nature Phys. **7**, 539 (2011). [2] J. Drake and Y. C. Lee, Phys. Fluids **20**, 1341 (1977).

[1]Work supported by appointment to the US DOE Fusion Energy Postdoctoral Research Program administered by the Oak Ridge Institute for Science and Education and DOE Grant No. DE-FG02-07ER46372.

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Date submitted: 08 Jul 2011 Electronic form version 1.4