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Breakdown of adiabatic electron behavior in expanding magnetic fields[1] EMILY LICHKO, JAN EGEDAL, University of Wisconsin - Madison, WILLIAM DAUGHTON, Los Alamos National Labs — During magnetic reconnection the incoming magnetic flux tubes expand in the inflow region. If this expansion is sufficiently slow the results are well described by a previously developed adiabatic model [1]. Using kinetic simulations in a simple geometry and applying rapid magnetic perturbations, this study investigates the point at which the adiabatic assumption fails. To this end a 2D VPIC simulation was constructed, where the magnetic field in a uniform plasma is perturbed by externally driven currents. By varying the onset speed of the magnetic perturbation and the electron thermal speed, we found a sharp threshold at which this model breaks down. We believe that this point is determined by the time of the magnetic pumping compared to the electron transit time through the region, i.e.$\omega \sim \dot{B}/B \sim v_{the}/L$. This threshold was also characterized by the launching of Whistler waves and with time domain structures, such as electron holes and double layers, which agree with those seen during magnetic reconnection and may relate to similar structures in the Van Allen Belts [2,3].

[1] J. Egedal, et al, Phys. Plasmas 20, 061201 (2013)
[2] J. Egedal, et al, Phys. Plasmas, in press (2015)
[3] F.S. Mozer, et al, Phys. Rev. Lett. 113, 035001 (2014)

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