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Magnetic Reconnection Regimes at the Real Proton-to-Electron Mass Ratio[1] A. LE, J. EGEDAL, MIT, W. DAUGHTON, LANL, H. KARIMABADI, UCSD — New fully kinetic simulations of magnetic reconnection demonstrate that the electron dynamics vary qualitatively between simulations at the physical proton mass ratio of 1836 and at mass ratios even as high as 400. Several regimes exist depending on the characteristics of thermal electron orbits in the reconnecting current sheet, which depend on the mass ratio, strength of the guide magnetic field, and upstream electron beta. In all cases, electron pressure anisotropy develops in the inflow following previously derived equations of state [1]. For the lowest guide fields, effective pitch angle scattering causes the outflow electron pressure to become nearly isotropic. Above a certain threshold guide field, the electron orbits remain magnetized in the exhaust and the pressure anisotropy extends into the outflow. At the physical proton mass ratio, these cases include a new regime where electron pressure anisotropy drives magnetized electron current layers [2] longer than 15 ion inertial lengths similar to those inferred from spacecraft observation [3].

[1] Le et al., PRL 102, 085001(2009).
[2] Ohia et al., PRL (2012).
[3] Phan et al, PRL 99, 255002 (2007).

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