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The role of kinetic effects and parallel electric fields within the Hall current system of collisionless reconnection[1] J. EGEDAL, A. LE, MIT, PSFC, Cambridge, MA, W. DAUGHTON, LANL, Los Alamos, NM — Aided by spacecraft observations in the Earth's geotail one of the main accomplishments in reconnection research is the identification of the Hall effect. While fluid models provide important insight into the Hall physics of the ion diffusion region, in-situ measurements of the electron distribution function reveal the presence of cold beams directed towards the X-line while energized electrons move away from the reconnection region. We present a new model that can account for these kinetic effects. The cornerstone of the model is a field aligned acceleration potential $\phi_{\|}$ introduced in Ref. [1]. This potential becomes large when the upstream electron beta is small [2]. Electrons accelerated in this potential can reach energies much larger than their ambient temperature. The combination of the direct parallel acceleration by $\phi_{\|}$ and pitch angle scattering in the exhaust region generates the characteristic signatures in the electron distribution function observed by spacecraft along the separatrix layers. Our studies are aided and supported by fully kinetic simulations of reconnecting current sheets.

[1] Egedal J, et al., (2009) Physics of Plasmas 16, 050701.
[2] Le A, et al., (2010) Geophys. Res. Lett. 37, L03106.

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