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New anisotropic electron pressure closure implemented in two fluid simulations of collisionless reconnection[1] O. OHIA, J. EGEDAL, A. LE, MIT, PSFC, Camrbridge,MA, S.V. LUKIN, NRL, Washington, DC — Collisionless magnetic reconnection plays an important role in space and laboratory plasmas. The study of reconnection is aided by both fluid simulations and fully kinetic particle simulation. When comparing the various simulation schemes, it is found that the structure surrounding the electron diffusion region and the electron current layer differ vastly between kinetic and fluid simulations [1]. Recently, a new fluid closure has been obtained that relates parallel and perpendicular pressures to the density and magnetic field [2]. This closure is obtained using an adiabatic solution of the Vlasov equation which includes a field aligned electric potential that traps electrons and regulates their density. The closure agrees with fully kinetic simulations of guide-field reconnection and is likely to allow for new fluid simulations in better agreement with kinetic results. The new "equations of state" are now being implemented in two-fluid codes using the HiFi framework [3].
[1] W. Daughton, et al., Phys. Plasmas 13, 072101 (2006).
[2] A. Le, et al., Phys. Rev. Lett. 102, 085001 (2009).
[3] V.S. Lukin, et al., J. Comput. Phys. Submitted (2009)

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