Abstract Submitted
for the DPP09 Meeting of
The American Physical Society

Analytical model for fast reconnection in large guide field plasma configurations A.N. SIMAKOV, Los Alamos National Laboratory, L. CHACÓN, Oak Ridge National Laboratory, D. GRASSO, CNR-INFM, Italy, D. BORGOGNO, Politecnico di Torino, Italy, A. ZOCCO, Culham Science Centre, UK — Significant progress in understanding magnetic reconnection *without a guide field* was made recently by deriving quantitatively accurate analytical models for reconnection in electron [1] and Hall [2] MHD. However, no such analytical model is available for reconnection *with a guide field*. Here, we derive such an analytical model for the large-guide-field, low-β, cold-ion fluid model [3] with electron inertia, ion viscosity μ, and resistivity η. We find that the reconnection is Sweet-Parker-like when the Sweet-Parker layer thickness $\delta_{SP} > (\rho_s^4 + d_e^4)^{1/4}$, with ρ_s and d_e the sound Larmor radius and electron inertial length. However, reconnection changes character otherwise, resulting in reconnection rates $E_z/B_x^2 \approx \sqrt{2\eta/\mu}(\rho_s^2 + d_e^2)/(\rho_s w)$ with B_x the upstream magnetic field and w the diffusion region length. Unlike the zero-guide-field case, μ plays crucial role in manifesting fast reconnection rates. If it represents the perpendicular viscosity [3], $\sqrt{\eta/\mu} \sim \beta^{-1}\sqrt{(m_e/m_i)(T_i/T_e)}$ and E_z becomes dissipation independent and therefore potentially fast.
[1] L. Chacón, A. N. Simakov, and A. Zocco, *PRL* **99**, 235001 (2007).
[2] A. N. Simakov and L. Chacón, *PRL* **101**, 105003 (2008).
[3] D. Biskamp, *Magnetic reconnection in plasmas*, Cambridge University Press, 2000.

Andrei Simakov
Los Alamos National Laboratory

Date submitted: 15 Jul 2009 Electronic form version 1.4