Abstract Submitted
for the DPP11 Meeting of
The American Physical Society

The kinetic structure of collisionless slow shocks and reconnection exhausts YI-HSIN LIU, Los Alamos National Laboratory, JAMES DRAKE, MARC SWISDAK, University of Maryland, WILLIAM DAUGHTON, HUI LI, Los Alamos National Laboratory — A 2-D Riemann problem is designed to study the development and dynamics of the slow shocks that are thought to form at the boundaries of reconnection exhausts. Particle-in-Cell (PIC) simulations are carried out with different propagation angles with respect to the upstream magnetic field. When the angle is sufficiently oblique, the simulations reveal a large firehose-sense ($P_\parallel > P_\perp$) temperature anisotropy in the downstream region, accompanied by a transition from a coplanar slow shock to a non-coplanar rotational mode. In the transition region the firehose stability parameter $\varepsilon = 1 - \mu_0(P_\parallel - P_\perp)/B^2$ tends to plateau at 0.25. An explanation for the critical value 0.25 is proposed by examining the Anisotropic MHD equations. The anisotropy value of 0.25 is significant because it is closely related to the degeneracy point of the slow and intermediate modes, and corresponds to the lower bound of the transition point in a compound slow shock(SS)/rotational discontinuity(RD) wave. This work implies that it is a pair of compound SS/RD waves that bounds the reconnection outflow, instead of a pair of switch-off slow shocks as in Petschek's model. In large-scale PIC reconnection simulations, the signature of $\varepsilon = 0.25$ at the downstream exhausts is also identified. Its implication for in-situ observations of earth's magnetotail is discussed.

Yi-Hsin Liu
Los Alamos National Laboratory

Date submitted: 12 Jul 2011

Electronic form version 1.4