Abstract for an Invited Paper
for the APR06 Meeting of
The American Physical Society

Momentum transport from magnetic reconnection in flowing plasmas[1]

FATIMA EBRAHIMI, University of Wisconsin-Madison

Magnetic fluctuations arising from MHD instabilities can cause momentum transport both in laboratory and astrophysical plasmas. We investigate momentum transport from current-driven reconnection, likely a powerful mechanism in laboratory fusion plasmas and possibly important in astrophysical venues. Momentum transport is examined, both analytically and numerically, using the Maxwell stress associated with tearing instabilities. We study momentum transport from single tearing modes, and transport from multiple tearing modes. We find that spontaneous reconnection of a single tearing mode in a plasma with equilibrium flow can transport momentum, but that transport is substantially enhanced in the presence of multiple modes due to nonlinear mode coupling. It is shown that the major contribution of single tearing mode to momentum transport arises from the inner layer solutions. The nonlinear, 3D, resistive MHD code DEBS, with an ad-hoc term added to the momentum equation, is employed to study momentum transport from multiple tearing modes. The role of coupled spontaneous and nonlinear driven reconnection are examined. Theoretical results are compared with measurements of momentum transport and Lorentz forces in the MST reversed field pinch experiment.

[1]In collaboration with S. C. Prager, V. V. Mirnov, and C. R. Sovinec, University of Wisconsin and Center for Magnetic Self-Organization in Lab and Astrophysical Plasmas.