DPP07-2007-000409

Abstract for an Invited Paper
for the DPP07 Meeting of
the American Physical Society

Measurements and implications of particle and momentum transport from magnetic stochasticity in MST

WEIXING DING, Department of Physics, University of California, Los Angeles

Magnetic stochasticity associated with radial magnetic field fluctuations (δb_r) is expected to have significant effects on plasma transport. Particle and momentum transport due to stochastic magnetic fields are defined as $\frac{<\delta j_{//,e}\delta b_r>}{eB_0}$ and $\frac{<\delta p_{//,i}\delta b_r>}{B_0}$, respectively, where $\delta j_{//,e}$ and $\delta p_{//,i}$ are parallel electron current density fluctuations and parallel ion pressure fluctuations. A recently developed differential interferometer method is used to measure local density fluctuations, while a fast Faraday rotation diagnostic measures radial magnetic field fluctuations and current density fluctuations. Direct measurements of particle and momentum transport during reconnection events (the crash phase of a sawtooth oscillation) in the MST reversed field pinch show that; (1) the magnetic fluctuation-induced particle flux accounts for the change in the core equilibrium density, and (2) the convective component of the *momentum* transport from stochasticity is of sufficient magnitude to contribute to the known anomalous momentum transport in the plasma core. Furthermore, the difference between magnetic fluctuation-induced electron flux and ion flux, ($\frac{<\delta j_{//}\delta b_r>}{eB_0}$), has been experimentally determined by measuring Maxwell stress directly in the plasma core. It is nonzero (transport is locally nonambipolar) and produces a large radial electric field (and field shear) localized to the reconnection (resonant) surface. This electric field implies the existence of a localized *zonal flow* that reverses direction about a reconnection surface – a new mechanism for zonal flow generation. Author acknowledges contributions from D.L. Brower, B.H. Deng, T.F. Yates, UCLA, and the MST team. Work is supported by DoE and NSF.