Core Measurements of Magnetic Fluctuation-Induced Particle and Momentum Flux in MST

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Magnetic reconnection is characterized by discrete sawtooth-like bursts in both tokamaks and the reversed field pinch. For MST, particle and momentum are transported faster than can be explained by classical collisional processes during reconnection. Core measurements of the particle flux $\frac{<\delta j_{//,e}\delta b_r>}{eB}$ along stochastic magnetic field lines are made using a newly developed differential interferometer in combination with a Faraday rotation system, where $\delta j_{//,e}(= en\delta V_{//,e} + eV_{//,e}\delta n)$ is parallel electron current density fluctuation and $\delta b_r, \delta n$, $\delta V_{//,e}$ is radial magnetic field fluctuation, density fluctuation and electron parallel velocity fluctuation respectively. The differential interferometer allows us to measure the gradient of density fluctuations with high spatial resolution and Faraday rotation is used to measure core magnetic fluctuations. The measured convective particle transport $V_{//,e}\frac{<\delta n\delta b_r>}{B}$ can account for the equilibrium density change at the magnetic axis. In addition, the convective part of momentum flux $\frac{<\delta p_{//}\delta b_r>}{B}$ due to stochastic magnetic field also acts to redistribute parallel momentum during magnetic reconnection, consistent with measured flows.