

# Electrostatic Turbulence Driven Plasma Current

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Global gyrokinetic simulations show that ion temperature gradient (ITG) and trapped electron mode (TEM) turbulence can drive a significant parallel current in meso-scale. The underlying dynamics is closely related to nonlinear plasma flow generation by turbulent residual stress. However, unlike toroidal momentum which is mostly carried by ions, the turbulent current is mainly carried by electrons in the laboratory frame. In collisionless TEM turbulence, a substantial electron current is first generated in the positive direction of magnetic field and remains quasi-stationary in post-saturation phase. The slow evolution of the current towards negative  $\mathbf{B}$  direction occurs in a time scale much longer than that of turbulence, partially due to electron-ion momentum exchange and partially due to turbulent flow generation. The characteristic dependence of the current generation rate on plasma parameters will be reported. Also discussed are interesting phase space structures between TEM and ITG turbulence driven current to elucidate the roles of resonant and non-resonant electrons. In collaboration with T. S. Hahm, S. Ethier, P. H. Diamond (UCSD), F. L. Hinton (UCSD), A. H. Boozer (Columbia U.), and W. M. Tang. Work supported by U.S. DOE Contract DE-AC02-09-CH11466 and the SciDAC GPS-TTBP project.