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Micro-turbulence driven parallel plasma current in tokamaks[1]
W.X. WANG, S. ETHIER, PPPL — Global gyrokinetic simulations show that ion temperature gradient (ITG) and trapped electron mode (TEM) turbulence can drive a significant parallel current in meso-scale (zonal current). The underlying dynamics is closely related to nonlinear plasma flow generation [1] by turbulent residual stress [2]. However, unlike toroidal momentum which is mostly carried by ions, the turbulent current is mainly carried by electrons in the laboratory frame, and shows finer radial scale in comparison with poloidal and toroidal zonal flows. In both collisonless TEM and ITG turbulence, substantial electron current is first generated in the positive direction of magnetic field and remains quasi-stationary in post-saturation phase. The current generation by turbulence exhibits the similar characteristic dependence on plasma parameters as that of plasma flow generation [3]. Specifically, it increases with pressure gradient, decreases with equilibrium current Ip and increases with the radial variation of safety factor. 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, P. H. Diamond (UCSD), F. L. Hinton (UCSD), A. H. Boozer (Columbia U.), G. Rewoldt, W. M. Tang and W. W. Lee. [1] W. X. Wang et al., Phys. Plasmas **17**, 072511 (2010). [2] P. H. Diamond *et al.,* Phys. Plasmas **15**, 012303 (2008). [3] W. X. Wang *et al.,* Phys. Rev. Lett. **106,** 085001 (2011).

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