Abstract Submitted
for the DPP19 Meeting of
The American Physical Society

Neoclassical and turbulence-driven ExB flow and macroscopic current structures in magnetic island[1] WEIXING WANG, M. G. YOO, E. A. STARTSEV, Princeton Plasma Physics Laboratory, P. H. DIAMOND, University of California, San Diego, T. S. HAHM, Seoul National University, Korea, C. H. MA, S. ETHIER, J. CHEN, Princeton Plasma Physics Laboratory — Global gyrokinetic simulations with self-consistent coupling of neoclassical and turbulent effects show turbulence can significantly reduce plasma self-driven current generation in collisionless regime, generate current profile corrugation near rational magnetic surface and nonlocally drive current in the linearly stable region – all these are expected to have broad impact on tokamak confinement and global stability. The magnetic island is found to strongly change ExB shear flow and self-driven current structures in the island region. A charge separation due to electron parallel transport induced finite electron density flattening in the O-point generates a strong radially localized ExB shear layer, which may facilitate the formation of a transport barrier near the resonant magnetic surface by decoupling plasma inside the shear layer from the outside. On the other hand, turbulence self-generated zonal flow shows a helical structure akin to the island in large island case, namely, a poloidal ExB shear flow on the perturbed magnetic surface, which may prevent the turbulence developed in the outside of the island from spreading into the O-point. The parallel mean current is also largely modified in the island region by both neoclassical and turbulent effects.

[1]Work supported by U.S. DOE Contract DE-AC02-09-CH11466 and SciDAC Tokamak Disruption Simulation project

Weixing Wang
Princeton Plasma Physics Laboratory

Date submitted: 03 Jul 2019 Electronic form version 1.4