Abstract Submitted
for the DPP15 Meeting of
The American Physical Society

Understanding rotation profile structures in ECH-heated plasmas using nonlinear gyrokinetic simulations[1] WEIXING WANG, Princeton Plasma Physics Lab, B. BRIAN, S. ETHIER, J. CHEN, E. STARTSEV, PPPL, P. H. DIAMOND, Z. LU, UCSD — A non-diffusive momentum flux connecting edge momentum sources/sinks and core plasma flow is required to establish the off-axis peaked ion rotation profile typically observed in ECH-heated DIII-D plasmas without explicit external momentum input. The understanding of the formation of such profile structures provides an outstanding opportunity to test the physics of turbulence driving intrinsic rotation, and validate first-principles-based gyrokinetic simulation models. Nonlinear, global gyrokinetic simulations of DIII-D ECH plasmas indicate a substantial ITG fluctuation-induced residual stress generated around the region of peaked toroidal rotation, along with a diffusive momentum flux. The residual stress profile shows an anti-gradient, dipole structure, which is critical for accounting for the formation of the peaked rotation profile. It is showed that both turbulence intensity gradient and zonal flow ExB shear contribute to the generation of k// asymmetry needed for residual stress generation. By balancing the simulated residual stress and the momentum diffusion, a rotation profile is calculated. In general, the radial structure of core rotation profile is largely determined by the residual stress profile, while the amplitude of core rotation depends on the edge toroidal rotation velocity, which is determined by edge physics and used as a boundary condition in our model. The calculated core rotation profile is consistent with the experimental measurements. Also discussed is the modification of turbulence-generated Reynolds stress on poloidal rotation in those plasmas.

[1]Work supported by U.S. DOE Contract DE-AC02-09-CH11466.

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Date submitted: 24 Jul 2015 Electronic form version 1.4