Impact of Magnetic Island - Turbulence Multi-Scale Interaction on Plasma Confinement and Magnetic Island Stability

L. BARDOCZI, ORAU, T.A. CARTER, UCLA, R.J. LA HAYE, General Atomics, T.L. RHODES, UCLA, G.R. MCKEE, U. Wisconsin — Recent measurements\(^1\) and gyrokinetic simulations\(^2\) reported the reduction of turbulent density fluctuations (\(\dot{n}\)) inside magnetic islands, and increase outside magnetic islands, when the island width (W) exceeds a threshold (\(W_T\)). As the cross-field transport is dominantly driven by \(\dot{n}\), this calls into question the conventional understanding of confinement (\(\tau_e\)) degradation and Neoclassical Tearing Mode (NTM) stability physics. We report that the increase in ion-scale outside the island correlates with higher heat and particle fluxes, i.e., increases temporarily when \(\tau_e\) is decreasing, while in the following stationary state is comparable to before NTM onset. This indicates that the decrease of the plasma stored energy results from -NTM interaction. On the other hand, simultaneous reduction at the O-point has a destabilizing effect on NTMs. These observations suggest that driving at the O-point could prevent small islands from growing large, allowing better plasma confinement and safer tokamak operation. [1]


\(^1\)Work supported by US DOE under DE-FG02-08ER54984 and DEFC02-04ER54698.

L. Bardoczi
ORAU

Date submitted: 13 Jul 2017

Electronic form version 1.4