

P5.1098 Effects of magnetic island on ExB shear flow structure and plasma self-driven current in tokamaks

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See the full abstract here <http://ocs.ciemat.es/EPS2019ABS/pdf/P5.1098.pdf>

Global gyrokinetic simulations with self-consistent coupling of neoclassical and turbulent dynamics show that turbulence can significantly affect plasma self-driven mean current generation in tokamaks. The current amplitude, profile and phase space structure can all be modified. Turbulence can significantly reduce the 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 a radical impact on broad tokamak physics. Both electron parallel acceleration and residual stress from turbulence play crucial roles in turbulence-induced current generation. The magnetic island is found to strongly change ExB shear flow structure and current generation in the island region. It is shown that charge separation due to electron parallel transport induced finite electron density flattening in the O-point generate 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 surfaces, 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. Its impact on island evolution will be discussed.

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Presenter: WANG, W. (EPS 2019)

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