DPP19-2019-001214

Abstract for an Invited Paper
for the DPP19 Meeting of
the American Physical Society

Microtearing Turbulence: Properties of Instability, Saturation, and Transport[1]

M.J. PUESCHEL, University of Texas at Austin

Transport driven by microtearing (MT) modes has been found to be significant in an array of applications, ranging from large-scale modes in tokamak core plasmas to spherical tokamaks to the H-mode pedestal. A brief overview of linear MT physics is given, distinguishing between different drives and mode branches, such as collisionless vs. collisional and toroidal vs. slab-like. Nonlinearly, the role of zonal flows and zonal fields – i.e., zonal shear-magnetic fluctuations – is investigated. While zonal flows can reach very large amplitudes, it is found that the zonal fields are responsible for a non-commensurately larger share of the energy transfer and thus saturation of the instability, providing an essential ingredient in transport modeling. An analysis of a DIII-D-relevant pedestal scenario is conducted, with particular focus on resonant magnetic perturbations (RMPs). For common electrostatic instabilities, zonal flows are a key regulator of turbulence and transport. In the presence of RMPs, zonal flows are eroded due to radial streaming of electrons, leading to increased fluxes, as can be illustrated via simulations of DIII-D L-mode plasmas. For MT turbulence, however, the RMP response to transport changes, as no zonal-field erosion occurs. Consequences for pedestal evolution are discussed in light of the transport fingerprint model.

[1]Supported by DOE grant DE-FG02-04ER-54742.