

Changes in particle transport as a result of Resonant Magnetic Perturbations

Resonant magnetic perturbations (RMPs) have successfully been employed to suppress Edge Localized Modes (ELMs) in multiple Tokamak devices and are being considered as the main technique for mitigating and suppressing ELMs on ITER. RMPs are small steady-state magnetic perturbations that add a radial component to the equilibrium magnetic field. These small magnetic fields are optimized to be resonant with the rational surfaces at the plasma edge. RMPs reduce the large gradients at the plasma edge to values below the stability limit that is responsible for the creation of ELMs. However, adding RMPs to H-mode plasmas in DIII-D results in a strong reduction of the overall particle confinement, a so-called 'density pump-out'. The effects of RMPs are thus not just limited to the plasma edge. In this talk, I will first show how these RMPs create a stochastic edge and how a comparison between neoclassical theory and experimental observations can tell us something about the extent of the stochastic layer. Next, I will show that the creation of a stochastic layer is not sufficient to explain the changes in particle confinement. Finally, I will show that the increases in turbulent transport are substantial and contribute to the overall decrease in particle confinement, not just to a reduction in confinement at the plasma edge.