Category 2) Transport of energy in stochastic fields

Stochastic Transport Modeling for DIII-D*

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The TRIP3D field-line tracing code is combined with the E3D two-fluid transport code in order to calculate the effect of resonant magnetic perturbations (RMPs) on heat transport in DIII-D H-mode plasmas. RMPs have been shown to suppress and eliminate edge localized modes in high-performance DIII-D discharges at ITER-similar collisionalities and shapes by decreasing the pressure gradient at the top of plasma pedestal. E3D uses Monte Carlo integration to accurately compute the stochastically enhanced heat and particle transport caused by the induced 3D magnetic geometry. The simulations show that the heat flux is efficiently guided to the divertor targets by the invariant manifolds of the magnetic field. Qualitative agreement with observations of nonaxisymmetric magnetic footprint structures by IR-TV, Xpt-TV, and high resolution Langmuir probe array strike point sweeps have been verified and demonstrate increased plasma-wetting of the divertor target. However, the predicted magnitude of the parallel transport is too large to match the pedestal plasma profiles determined by Thomson scattering measurements and charge exchange recombination spectroscopy. Two possible explanations are currently being explored: (1) since the mean free path is much longer than the Kolmogorov length, the fluid treatment overestimates the expected heat transport, and (2) the resonant fields and, thus, the regions of connected stochasticity, are being modified by the inductive response of the rotating plasma.

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