Category: Energy and particle transport in stochastic magnetic fields
Oral contribution

Comparison of heat and particle transport of an ELMing versus an RMP H-mode*

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In this paper, we compare changes in the particle and electron heat transport between an ELMing and a Resonant Magnetic Perturbation (RMP) H-mode. RMPs in low collisionality H-mode experiments lead to a density pump-out, whereas the electron temperature remains nearly unaffected or increases slightly [1]. This does not agree with theoretical predictions based upon fully stochastic field lines [2]. In experiments, the pedestal density profile is reduced by RMPs across the entire plasma, which suggests a change in transport, whereas the electron temperature pedestal height increases and the gradient from the top of the pedestal inward decreases. The SOLPS5[3] code is being utilized[4] to quantify changes in the pedestal transport. SOLPS5 is a 2D axisymmetric transport code that typically uses an adhoc cross-field transport model to simulate the changes in the edge temperature and density profiles. The coefficients are determined by matching midplane density and temperature profiles.

We find that the cross-field particle transport needs to be increase by about a factor 2 in the transport barrier region (ψ_N between 0.9 and 1) when comparing an ELMing H-mode to an RMP H-mode. Although the code assumes axisymmetric flux surfaces, the ad hoc transport coefficient can be thought of as either due to cross-field processes (collisions or fluctuations) or the result of open field lines and free streaming of the electrons to the target plates.

We now calculate the magnetic diffusion created by the RMPs from non-axisymmetric field-errors and coils. We calculate the fraction of field lines that hit the divertor target plates within the free streaming limit and multiply the magnetic diffusion coefficient by this fraction. We observe that the increase in cross-field particle transport calculated by SOLPS5 matches the increase in the free streaming magnetic diffusion to within the uncertainty of the experimental profile data.

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*This work supported in part by the U.S. Department of Energy Cooperative Agreement under DE-FC02-04ER54698 and in part by DE-FG02-07ER54917.