The influence of three-dimensional stochastic magnetic boundaries on plasma edge transport and the resulting plasma wall interaction

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Abstract

The three-dimensional features of the magnetic topology induced by edge resonant magnetic perturbation fields are discussed comparing TEXTOR and DIII-D. We show that the scrape off layer (SOL) profiles and decay lengths depend on the RMP spectral properties indicating modification of SOL transport by the 3D stochastic boundary because the particle and heat efflux is channelled along the perturbed field lines into a completely re-arranged, 3D divertor footprint. The measured divertor heat and particle fluxes at DIII-D match the vacuum modelled magnetic footprint in L-mode while in H-mode it exceeds the modelled footprint width by 10-20%. Initial first quantification of the net-erosion within the 3D footprint shows in L-mode a 40% decrease of the chemical erosion and evidence for a comparably small 5-15% increase in physical sputtering. Extrapolation of these findings to ITER by modelling of the magnetic footprint for the actual ELM control coils shows a similar footprint topology as found at DIII-D during RMP ELM suppression. However, the open field lines escape the CFC covered ITER divertor area and hit the Tungsten divertor domain.

PACS numbers: 52.25.Fi, 52.55.Fa, 51.60.+a