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Experimental and numerical studies of the scrape-off layer power width in EAST

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The scrape-off layer (SOL) power width is an important parameter to characterize the divertor heat load. Previous multi-machine study predicts a much smaller SOL power width for ITER H-mode baseline scenario [1-2], making the divertor power handling an even more crucial issue. A statistical analysis of the divertor probe data in EAST has been performed to evaluate the divertor particle flux fall-off length (used to approximate the SOL power width). It is found that the SOL power width has the same negative scaling dependences on the plasma stored energy divided by the line-averaged electron density, a proxy for the line-averaged electron temperature, but a stronger scaling dependence for H-mode plasmas compared with L-mode plasmas, which might result from the change of the state of electron parallel conduction according to the simulation results using 2D electrostatic edge turbulence code [3-4]. The simulations indicate that the negative scaling dependence of the SOL power width on the electron temperature is a combination of the enhancement of the parallel electron conduction and the reduction of the radial turbulent transport in the SOL. The code without contribution to the radial transport by magnetic drift could reproduce the experimental scalings for L-mode plasmas [5], suggesting that the dominance of radial heat flux in the SOL by turbulence instead of magnetic drift might also be used to explain the experimental scalings [6]. The experimental results also show that the diverter material, the confinement regime, and the divertor geometry seem to have no significant influences on the SOL power width in EAST, which will be further investigated in future studies.

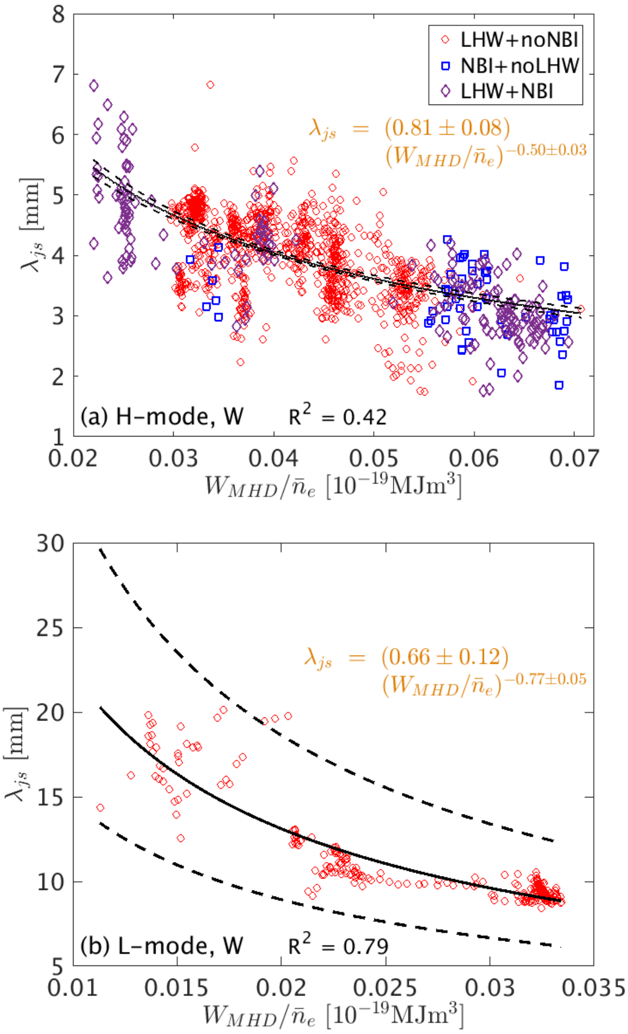

Figure 1 The experimental scalings of SOL particle flux fall-off length (used to approximate the SOL power width) in (a) H-mode and (b) L-mode plasmas in EAST.

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