Optimization of the ergodization structure

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Abstract

One of the main tasks of the dynamic ergodic divertor in the 12/4 mode TEXTOR is to establish proper scrape-off layer to control heat and particle exhaust from the plasma core [1]. It is achieved by destroying magnetic flux surfaces in the plasma edge by means of currents flowing in the sixteen perturbation coils. The magnetic perturbation creates an open stochastic layer in the plasma boundary, which consists of an ergodic and a laminar layer. The topology of the magnetic field is substantial for the transport properties and plasma parameters. It is expected that the formation of the proper laminar zone – the region with short wall-to-wall connection lengths of the field lines – allows to decouple the plasma edge from the core. Due to enhancement of the radial electron heat transport in the ergodic region the electron temperature in the plasma boundary is reduced. Therefore one needs to find the proper ratio of the ergodic and laminar zone, which gives optimal performance of the divertor. The complex structure of the ergodic region and the laminar zone with the helical divertor at the high field side of TEXTOR can be well correlated with the magnetic field topology as calculated by mapping techniques. In this work the studies on the role of the magnetic structures for the properties of the plasma boundary are carried out. The topology of the perturbed volume is modeled with the ATLAS [2] and basing on the results of modeling the experiments are performed and compared to the calculated structures. It was found that positive influence of the DED onto the plasma boundary is achieved by shifting the plasma towards the perturbation coils by few centimeters and adjusting the safety factor at the plasma edge to $10/4 > q_a > 12/4$.

[1] K.H. Finken (*editor*), Dynamic Ergodic Divertor (special issue), *Phys. Eng. Des.* **37** (1997)

[2] M. Jakubowski *et al.*, *Nucl. Fus.*, **44** (2004) S1.