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Edge plasma simulations for Large Helical Device with UEDGE

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Abstract

Magnetic configuration at the edge of a stellarator is very complex and contains a mixture of closed flux surfaces and stochastic field lines. At present, there is no complete plasma transport code that fully accounts for all of the features of this highly complex case. Moreover, it is even not very clear what kind of set of transport equations can be used for these purposes. At the same time, it is feasible that due to a strong anomalous cross-field plasma transport and convective plasma flows, a rather detailed features of stellarator magnetic topology do not matter much for averaged plasma parameters. Therefore, it is worth to try a simple approach to the modeling of stellarator edge plasma based on "averaging" of edge plasma parameters along the magnetic axis and introducing effective two-dimensional flux surfaces. In this sense, we substitute the stellarator edge with that what can be called stellarator-equivalent tokamak edge.

In the report, we apply this approach to edge plasma modeling for Large Helical Device. The LHD stellarator-equivalent tokamak is simulated with 2D multi-fluid transport code UEDGE. We consider the possible ways of construction of effective magnetic flux surface configuration that represent major features of LHD edge region as well as the usage of this configuration in UEDGE. We discuss the cross-field transport model adequate to ergodic edge plasma. We report preliminary results of UEDGE modeling and their comparison with experimental data for typical LHD shot.