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O2.103 Comparison of three-dimensional plasma edge turbulence simulations in realistic double null tokamak geometry with experimental observations

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In the present work, global, three-dimensional edge plasma turbulence simulations of a MAST L-mode attached plasma discharge are presented. Our study is based on the driftreduced Braginskii equations, solved with the STORM module of BOUT++ for realistic MAST parameters in disconnected lower double null configuration. The plasma profiles are evolved self-consistently, with no separation between equilibrium and fluctuations, on a grid of approximately 14 million points and a resolution at the outer mid-plane up to kperpRhos~1. The simulations reveal that plasma turbulence is characterized by fluctuations showing a strong ballooning character. Because of the strong magnetic shear near the X-points, fluctuations at the divertor targets are not correlated with the mid-plane near the separatrix. On the other hand, filaments are more homogenous along magnetic field lines in the far scrape-off layer (SOL), consistently with theoretical expectations (e.g., see [Krasheninnikov et al., J. Plasma Fusion Res. 6, 139 (2004)]). Moreover, ExB counter flows are observed in the divertor legs near the separatrix. As a result, filaments are generated locally in this region, enhancing the radial transport and widening the radial profiles both in the SOL and in private flux regions (PFRs). The numerical results are then validated against experimental measurements both qualitatively and quantitatively. Filaments have previously been observed to exhibit different properties in the SOL, in the PFRs and in the divertor legs [Harrison et al., Phys. Plasmas 22, 092508 (2015)]. This is recovered in our simulations. Striations on the divertor plates, as are seen with infrared imaging diagnostics, are also reproduced. Plasma profiles and statistical properties are validated against Langmuir probe measurements both at the outer mid-plane and at the divertor targets. Overall, the numerical results are in good agreement with experimental observations and theoretical expectations. This study gives a deep insight into the mechanisms that govern the SOL plasma dynamics in diverted configurations, providing a consistent picture of the diverse phenomena observed at the tokamak periphery.

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