Multi-channel transport due to blobby turbulent structures in the tokamak edge*

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Blobby transport in the edge region (pedestal foot + scrape-off layer) could greatly affects global plasma performance, yet is not completely understood at a fundamental, predictive level. Recent XGC1 simulations of the ITER-like tokamak plasma were undertaken to further our understanding of the edge region, including blobby transport and its effect on the SOL heat-flux width. Here we explore this ITER-like simulation, focusing on the transport resulting from blobby turbulent structures in the edge region (“blobs” and “holes”). These structures are identified and tracked throughout the simulation, and the fraction of the total particle, momentum, and energy transport caused by these structures calculated. Previous XGC1 simulations on the present-day tokamaks showed blobs moving outwards, entraining higher energy particles, while holes moved inwards with lower energy particles with a net inward particle pinch. The extent to which this picture holds in the ITER XGC1 simulation will be presented. Novel techniques will also be presented to explore the large data set of particle distribution functions, including identifying regions of velocity space which are correlated across different spatial and temporal points. These techniques aid in understanding the common kinetic signatures of, for example, spatial regions where blobs are generated, ultimately giving insight into the underlying generation and transport mechanisms.

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