

Challenges and successes in modelling Edge plasma turbulence

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The modeling of turbulence in the edge and SOL region, that is in the gradient region and in the Scrape Off Layer of magnetically confined plasmas has made some tremendous progress in the last years. It is now better than ever understood that the time and space averaged profiles of temperature, particle density, momentum are in the scrape off layer determined by the intermittent transport generated at the edge shear layer. We have recognized that the distinction between profiles and fluctuations becomes arbitrary for situations where the transport is highly intermittent and shows long range correlations. Without this distinction the full range in parameter variability has to be taken into account for simulations, posing extreme demands on the used models. Only recently methods become available to include the variation in the ratio of ion to electron temperature in edge turbulence simulations. In the SOL this is an important parameter for the influence of finite larmor radius effects on the propagation properties of blobs. Numerical investigations indicate that these effects can lead to an increased self-confinement and radial reach of these structures.

Numerical investigations and experimental results show how the interplay between radially propagating structures and parallel transport sets up the observed profiles and how intermittency influences edge conditions. Turbulence simulations can now be run for similar parameters as given by experiment and can be compared in detail. This allows also investigating proposed mechanisms for the generation of oscillating states between turbulence and flows, such as the I-mode and opens up the way towards new understanding of LH transition dynamics.

[1] Steady-state and time-dependent modelling of parallel transport in the scrape-off layer, Havlickova E., Fundamenski W., Naulin V., et al., *Plasma Physics and Controlled Fusion* **53** 065004, 2011

[2] Direct Observation of Current in Type-I Edge-Localized-Mode Filaments on the ASDEX Upgrade Tokamak, Vianello N., Naulin V., Schrittwieser R., et al., *Physical Review Letters* **106** 125002 2011

[3] Experimental and numerical characterization of the turbulence in the scrape-off layer of MAST, Militello F., Tamain P., Fundamenski W., et al., *Plasma Physics and Controlled Fusion* **55**, 025005, 2013