Spatio-temporal dynamics of coherent turbulent structures in sheared E×B-flows

T. Windisch[1], O. Grulke[1], T. Klinger[1] and V. Naulin[2]

[1] *Max-Planck-Institute for Plasma Physics, EURATOM Association, Greifswald, Germany*

[2] *RISØ National Laboratory, Roskilde, Denmark*

The fluctuations in the plasma edge of the linearly magnetized helicon device VINETA are characterized by intermittent large-amplitude density bursts. These events are caused by propagating coherent turbulent structures. While the azimuthal propagation of the structures is caused by the background E×B-drift, their radial propagation is driven by the self-consistent potential perturbation, which arises from resistive drift-wave dynamics [1].

In this contribution investigations of the dynamics of turbulent structures in a E×B-shear region are presented. In the VINETA device the shear layer is generated externally using emissive $m = 0$ filaments. The drop of the plasma potential is approximately 20% of the local plasma potential and the width is typically 2 cm close to the filament and increases for larger distances to the filament due to diffusion of the emitted electrons. The filament is placed in the far plasma edge in order to minimize the perturbation of the turbulent fluctuations in the maximum density gradient region, which generates the radially propagating turbulent structures.

The character of the fluctuations outside the shear layer changes significantly, e.g. the skewness of density fluctuations drops by a factor of three and the probability distribution function is close to a Gaussian if the filament is used. At the same time the fluctuation induced transport changes sign (directed radially inwards) if compared to the situation without filament. Special attention is paid to the radial evolution of the parallel dynamics of the structure across the shear layer, which strongly affects the phase relation between density and potential fluctuations and hence determines the turbulent transport. The current along the ambient magnetic field is either measured directly using a miniaturized Rogowski-coil or reconstructed from measurements of magnetic field fluctuations using a 3D magnetic induction resp. $\dot{B}$-probe.

The findings are compared with results of numerical simulations using the CYTO code [2], which solves the global three-dimensional two-fluid equations in cylindrical geometry.

References

[1] T. Windisch, O. Grulke, and T. Klinger, *Phys. Plasmas* 13, 122303 (2006)

[2] V. Naulin, T. Windisch, and O. Grulke, *Phys. Plasmas* 15, 012307 (2008)