Statistical analysis of plasma filaments in the Wendelstein 7-X stellarator

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Blobs or filaments are well known phenomena in tokamaks. These magnetic-field-aligned structures seem to be born near to the separatrix on the low field side of the plasma, and they move radially towards the wall, carrying density with them. Due to the charge separation effect of the curved magnetic field, their radial propagation is driven by the $\underline{E} \times \underline{B}$ drift.

The Wendelstein 7-X stellarator has a complex magnetic topology, and the plasma is bounded by magnetic islands, forming an island divertor. With alkali beam emission spectroscopy (ABES) diagnostic [1] the electron density can be reconstructed with 20 μs time resolution from the SOL through the island until the inner side of the separatrix, thus the density fluctuations can be determined. Although Wendelstein 7-X has complicated three-dimensional magnetic structure, there are similarities [2] with the behavior of plasma filaments in fusion devices with toroidal symmetry.

In the present contribution the properties of plasma filaments in the Wendelstein 7-X stellarator are discussed using conditional averaging techniques and other statistical methods. Comparison between filament behavior in discharges with different magnetic configurations and electron density levels are performed. Similarities and differences between ABES and Langmuir probe measurements [3] regarding to plasma filaments are also discussed.

References

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This work was carried out within the framework of the EUROfusion Consortium and has received funding from the Euratom research and training programme 2014–2018 and 2019–2020 under grant agreement No 633053. The views and opinions expressed herein do not necessarily reflect those of the European Commission.