The role of 3D fields on edge and SOL turbulence

Vianello, N.; Agostini, M.; Carralero, D.; Cavazzana, R.; Masi, G. de; Furno, I.; Ionita, C.; Hidalgo, C.; Martines, E.; Momo, B.; Müller, H.W.; Naulin, Volker; Rasmussen, Jens Juul; Scaggion, A.; Scarin, P.; Spagnolo, S.; Schrittwieser, R.; Spizzo, G.; Spolaore, M.; Thelier, C.; Zuin, M.

Publication date:
2012

The role of 3D fields on edge and SOL turbulence

N. Vianello, M. Agostini, D. Carralero[2], R. Cavazzana, G. De Masi, I. Furno[3]
C. Ionita[4], C. Hidalgo[2], E. Martines, B. Momo, H. W. Müller[4], V. Naulin[5], J. J. Rasmussen[5], A. Scaggion,
P. Scarin, S. Spagnolo, R. Schrittwieser[4], G. Spizzo, M. Spolaore, C. Thelier[3], M. Zuin
Consorzio RFX, Associazione Euratom-ENEA sulla Fusione, C.so Stati Uniti 4, Padova, Italy
[2] *EURATOM-CIEMAT Association, Madrid, Spain*
[3] *CRPP, EPFL, Association Euratom Suisse, Lausanne, Switzerland*
[4] *Association EURATOM/ÖAW, Institute for Ion Physics and Applied Physics, University of Innsbruck, Austria*
[5] *Max-Planck-Institut für Plasmaphysik, EURATOM Association, Garching, Germany,*
[6] *Association EURATOM/Risø-DTU, Roskilde, Denmark*

Plasma turbulence represents one of the main topical issue in fusion relevant plasmas, considering also the strong role played in particle and energy transport in the edge and Scrape Off Layer regions. Furthermore in recent years a strong effort has also been devoted to the studies of the effects of non-axysimmetric magnetic perturbation on plasma turbulence, externally induced as it is the case of RMPs experiments [1, 2], or naturally present as the case of stellarators or helical configurations obtained in high current RFP regimes [3].

This contribution will present some of the most recent results on the interaction between, turbulence, transport and 3D magnetic perturbation. Most of the results have been obtained in high current helical plasmas in RFX-mod devices, which is equipped with a comprehensive tool for turbulence analysis at the edge including complete toroidal array of internal electrostatic and magnetic sensor, insertable probes including mach probes, GPI and reflectometer. The 3D effects are induced by the residual helical ripple developed in helical shaped plasmas, and this ripple is found to modulate edge plasma density and pressure and edge radial electric field. An helical flow, with the same spatial periodicity of the dominant one is observed, with a complex space phase relation with respect to the magnetic perturbation.

Magnetic perturbation modifies also turbulence radial correlation length and turbulent structures localization and distribution. A complete electromagnetic characterization of these blobs or filaments will be provided, focusing on their 3D features. Similarities and differences of these filaments with those observed in other axysimmetric and non-axysimmetric magnetic configuration, such as Tokamaks, Stellarators and Simple Magnetized Torus, will be addressed.

References

[1] T. E. Evans *et al*, Nat. Phys. **2**, 419 (2006)
[2] M. Lehnen *et al*, Plasma Phys. Contr. Fusion, **47**, B237 (2005)
[3] R. Lorenzini *et al.*, Nat. Phys. **5**, 570 (2009)