DRF: Thesis SL-DRF-20-0725

RESEARCH FIELD

Plasma physics and laser-matter interactions / Corpuscular physics and outer space

TITLE

Interaction between turbulence and flows in fusion plasmas

ABSTRACT

Plasma turbulence plays a crucial role in the performance of present and future fusion devices. In particular, turbulent transport determines the typical size of the hot confined plasma expected to sustain economically viable fusion reactions. Predicting and possibly optimizing the confinement in next step machines remain the primary challenges for transport models and first principle codes, which need to be validated against experiments.

In present experiments, turbulence control is achieved in High confinement regimes thanks to a spontaneous bifurcation at the edge of tokamak plasmas. However the mechanisms that underlie this bifurcation are still elusive. The dominant mechanism for turbulence reduction/saturation is supposed to rely on the shear of the plasma flows, expected to tear apart turbulent eddies hence reducing the deleterious transport across magnetic surfaces. Both these flows and their interaction with turbulence are however hardly and then poorly diagnosed.

The thesis will focus on the study of the interaction between flows and turbulent fluctuations, in well characterized experiments – from small laboratory experiments to medium size tokamaks. State-of-the art diagnostics will be used, especially Doppler back-scattering reflectometry. These measurements will be confronted to the improved theoretical understanding gained by the development of reduced nonlinear models and the analysis of first principle simulations.

LOCATION

Institut de recherche sur la fusion par confinement magnétique
Service Chauffage et Confinement du Plasma
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