DRF: Thesis SL-DRF-20-0779

RESEARCH FIELD

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

TITLE

Permeability of the boundary layer of fusion plasmas to heavy ions produced by plasma wall interaction: toward the elaboration of a predictive model from experiments on the tokamak WEST.

ABSTRACT

In a tokamak reactor, magnetic confinement aims at sustaining a plasma of hydrogen isotopes at temperatures of about 10keV, while preserving the integrity of the reaction chamber. The confined plasma is commonly described as a state of concentric layers supporting strong thermodynamic gradients, while the boundary layer acts as a critical interface between the hot core and the solid wall of the reaction chamber. In this boundary plasma layer, plasma ions impact solid surfaces of refractory materials (tungsten), resulting in physical sputtering of impurity atoms towards the plasma. These impurity particles are detrimental to confinement performances if they reach the central plasma volume. In that respect, the permeability of the boundary layer to these particles is of critical importance. This permeability results from the competition between antagonist processes: screening effects repealing particles toward the source target, collisional forces attracting them away, and turbulent fluctuations transporting them across plasma layers. Important topological effects are also on task regarding the position of the source in the boundary layer. This PhD project will aim at elaborating a comprehensive model of impurity production and transport in the boundary plasma layer of tokamaks. This theoretical and numerical activity will be supported by and confronted to experimental observations from the tokamak WEST.

LOCATION

Institut de recherche sur la fusion par confinement magnétique
Service Intégration Plasma Paroi
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FIND OUT MORE

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