
DRF: Thesis SL-DRF-20-0787

RESEARCH FIELD

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

TITLE

Spectroscopic determination of tungsten density in magnetically confined fusion plasmas

ABSTRACT

To pave the path towards electricity production with the energy emitted by fusion reactions into hydrogenoid plasmas confined magnetically, the ITER research tokamak is being built at Cadarache. Its internal walls will be made of tungsten to cope with the large heat flux of the plasma edge. Despite their expected low erosion, performance of the fusion plasma core could be significantly reduced. In this context, WEST (W(tungsten) Environment in Steady state Tokamak) aims at understanding plasma-wall interactions and characterizing the behaviour of ITER tungsten components. Hydrogenoid plasma impurities are measured with Extrem Ultra-Violet spectrometry. For tungsten ($Z=74$), atomic transitions leading to this radiation are not well known yet, with possibly a huge number of lines in some spectral regions.

The goal of this PHD is to determine a spectroscopic method to evaluate the tungsten density in the WEST plasma core and to compare it to theoretical predictions. The work will be articulated around 3 axes: mastering and using a physics atomic code dedicated to heavy ions; actively participating to WEST experimental campaigns through the use of its spectrometers; developing a procedure to determine tungsten density profiles from the measured spectra. This work will allow one to answer to the crucial question of the tungsten quantity determination into the plasma center and to improve the understanding of the ionised tungsten spectral emission.

LOCATION

Institut de recherche sur la fusion par confinement magnétique
Service Chauffage et Confinement du Plasma
Transport Turbulence et MagnétohydroDynamique
Place: Cadarache
Start date of the thesis: 01/10/2020

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