DRF: Thesis SL-DRF-20-0258

RESEARCH FIELD

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

TITLE

Understanding density regimes and divertor detachment in ITER relevant conditions

ABSTRACT

Controlling heat exhaust is one of the biggest challenges magnetic confined fusion has to solve on its way to reactors. In the next generation’s experimental machines, whose flagship is the ITER tokamak currently under construction, heat fluxes to solid surfaces in the divertor will largely exceed the engineering limit of 10MW/m2 if no measure is taken to mitigate them. The foreseen strategy to cope with these conditions relies on the dissipation of the power flux carried by the plasma by taking advantage of the interaction of the plasma with neutral particles (naturally present in the vicinity of the plasma-surface interaction area) or impurities (either intrinsically present or purposely seeded). The ultimate goal is to run the plasma in a so-called detached regime in which most of (if not all) the power coming from the center of the plasma is converted into radiation before reaching the solid surfaces. In support to ITER’s, operation this PhD project aims at contributing to a better understanding of edge plasma operational regimes by applying advanced numerical codes to ITER cases. The SOLEDGE2D-EIRENE edge plasma code, developed at IRFM and Aix-Marseille University, will be used for that purpose. The code will be applied to a range of ITER relevant cases in order to extract and understand the key physical mechanisms at play. The model solved by the code will also be enriched during the project in order to address specific issues currently not tackled by existing codes.

LOCATION

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