OFFRE DE STAGE / ALTERNANCE

* Champ bloquant

Information générales

Entité de rattachement*	SPPF/GTS
Référence interne/ Plan Emploi	Sans objet
Description de l'unité	The *Institut de Recherche sur la Fusion par Confinement Magnétique* (IRFM) is part of the Fundamental Research Department at CEA. For more than 50 years, its has been its mission to drive research on a novel energy source, magnetic confinement fusion, by participating in the European fusion programme. IRFM is located at the Cadarache CEA research centre. Its activities are structured around three axes : - contribute the ITER project and the accompanying programme (mainly the JT-60SA tokamak), - prepare the scientific ITER operation through experiment and control activities as well as theory and modelling, - establish a sound basis for a future nuclear fusion reactor. These activities are intimately connected with a particular effort of training future generations of fusion physics and technology experts. IRFM maintains and uses numerous R&D and test platforms, among which the main one is the WEST (Tungsten (W) Environnement Steady-State Tokamak) tokamak , designed as a testbench for ITER. It allows to test one of the key ITER components and to pursue plasma physics research in an international context, thanks to the numerous collaborations with the fusion teams worldwide.
Délai de traitement	3 mois

Description du poste

Domaine*	Physique du noyau, atome, molécule
Intitulé de l'offre*	Kinetic physics of the scrape-off layer in tokamak plasmas
Sujet de stage*	Theory and kinetic simulation of the plasma-wall interaction. Physics characterization and identification of key parameters for an accurate numerical description.
Description de l'offre*	At the periphery of tokamak plasmas, magnetic field lines intercept the wall. This so called "scrape-of layer" (SOL) is characterized by a rich physics mainly governed by the difference of inertia of ions and electrons in their motion parallel to the guiding magnetic field. The plasma-wall interaction gives rise to supersonic flows and strong parallel electric fields which are suspected to play a key role in the overall confinement of the plasma, and in the buildup of edge transport barriers leading to improved confinement regimes. The non-Maxwellianity of such plasmas requires a kinetic treatment, which reveals challenging owing to the broad spectrum of spatial and time scales spanned by electrons and ions; these range from the Debye length (tenth of millimeter) to parallel connection lengths of several tens of meters, and from plasma frequency (of order 10^9 s^{-1}) to sound wave frequency (of order 10^4 s^{-1}). While the fluid description of such plasmas is subject to a large consensus resting on the Bohm criterion, its kinetic counterpart is much less well known. The theory is still debated, and relevant simulations are very few. This issue is all the more critical since the European fusion community is launching a 5 year program which precisely aims at tackling the interplay between SOL and confined regions within the gyrokinetic description. The objectives of the training period are twofold: (i) characterizing the kinetic properties of the plasma-wall interaction and of the entire SOL by means of nonlinear simulations, with a comparison to the existing theoretical predictions, and (ii) identifying the parameter range which would allow one to extract relevant and robust physical features**. Simulations will be performed with the 1D-1V kinetic code VOICE, which self-consistently models the electron and ion parallel dynamics in the SOL, the electric field resulting from the Poisson equation. The plasma-wall interaction is treated via immersed boundary conditions by using penalization terms. Numerical developments should mainly include those of physically relevant diagnostics. ** Incidentally, point (ii) constitutes the necessary step before the electron kinetic dynamics can be implemented in the SOL region in the 5-dimensional gyrokinetic code GYSELA (developed at our institute within international collaboration) which models turbulent and collisional transport in tokamak plasmas. Studying the interplay of SOL and confined plasmas in the turbulence regime will be at the core of the PhD thesis associated to this training period.
Moyens / Méthodes / Logiciels	Theory, simulations, VOICE code
Profil du candidat	Knowledge in plasma physics, preferably in controlled fusion Taste for theory and simulations

Localisation du poste à pourvoir

Site	Cadarache
Lieu	F-13108 SAINT PAUL LEZ DURANCE cedex

Critères candidat

Diplôme préparé	Bac+5 - Master 2
Formation recommandée	Physique des plasmas de Fusion
Possibilité de poursuite en thèse	oui

Programme

Segment CEA	Fusion nucléaire

Langues

Langues souhaitée*	Français et/ou Anglais
Niveaux*	Courant

Suivi RH

Suivie par (nom du tuteur)	Coquillat Anne
Disponibilité de poste*	mars-21