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*	Thermohydraulique et mécanique des fluides
Intitulé de l'offre*	Realistic transport models in non-linear magneto-hydrodynamic simulations of instabilities in tokamaks
Sujet de stage*	Improvement of the non-linear MHD code JOREK to include first principle transport due to small-scale turbulence.
Description de l'offre*	The plasma in tokamak fusion reactors, such as ITER, will be subject to large scale instabilities. These instabilities are well described by modelling the plasma as an electrically conducting fluid embedded in a magnetic field. The model is called magneto-hydro-dynamics (MHD). Computer simulations allow the study of these MHD instabilities to better understand the physics and the methods for controlling them. The MHD simulation code JOREK has been developed within the European fusion program for this purpose. The code is applied to so-called edge localised modes (ELMs) and disruptions, MHD instabilities that will need to be controlled in ITER. The simulations require high performance computers, using several thousand CPUs. At present, the JOREK code accurately describes the MHD aspect of the instabilities. However, the transport due to underlying turbulence (not included in the MHD model) is modelled by a very simple, ad hoc, diffusion coefficient for the energy and density. To improve the fidelity of the MHD simulations, a better model for the turbulent transport is needed. Transport due to turbulence is calculated by very large scale so-called gyro-kinetic simulation codes. It is not feasible to couple a turbulence code and MHD code directly to obtain the relevant transport. This would be computationally out of reach. However, recent progress has allowed capturing the results of a large number of gyro-kinetic simulations in a compact form using neural network representations. It has been shown, in other applications, that these neural nets can accurately reproduce the transport coefficients on a very fast timescale. The subject of the stage is to implement the transport model from the neural network into the JOREK code. A first step will be introduction to the JOREK code and the neural net transport routines. It has to decided how the output (i.e. energy fluxes) of the neural net can be included in the MHD equations. After its implementation, the improved JOREK code will need to be benchmarked against an existing transport code, not including the MHD instabilities to verify the implementation. Time permitting; the final step will be an application of a 3D MHD instability including realistic transport from the neural net model.
Moyens / Méthodes / Logiciels	Fortran, parallel computing
Profil du candidat	Physicist with some experience in compuational physics and numerics.

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	Numerics, Plasma Physics
Possibilité de poursuite en thèse	non

Programme

Segment CEA	Fusion nucléaire

Langues

Langues souhaitée*	Anglais
Niveaux*	Courant

Suivi RH

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