OFFRE DE STAGE / ALTERNANCE

* Champ bloquant

Information générales

Entité de rattachement*	SPPF/GTSN
Référence interne/ Plan Emploi	Sans objet
Description de l'unité	L'Institut de Recherche sur la Fusion par Confinement Magnétique est l'un des départements de la Direction de la Recherche Fondamentale du CEA. Depuis plus de 50 ans, son rôle est de mener des recherches sur une nouvelle source d'énergie : la fusion par confinement magnétique, en s'associant avec le programme Fusion européen. L'IRFM est installé sur le Centre CEA de Cadarache. Les activités de L'IRFM sont structurées autour de trois axes de recherches de développement : - contribuer à la réalisation du projet ITER et ceux de l'Approche Elargie (tokamak JT-60SA principalement), - préparer l'opération scientifique d'ITER, à travers des activités d'expérimentation et de contrôle, ainsi que de théorie et de modélisation, - établir les bases du futur réacteur de fusion. Ces activités sont intimement connectées à un effort tout particulier de formation des générations futures de physiciens et de technologues de la fusion. L'IRFM a à sa disposition de nombreuses plateformes de R&D et de tests, dont le tokamak WEST (pour Tungsten (w) Environnement Steady-State Tokamak), transformation de Tore Supra en banc de test pour ITER, le nouveau tokamak du CEA va permettre de tester l'un des composants clé d'ITER et de poursuivre les recherches en physique des plasmas, dans un contexte international grâce aux nombreuses collaborations mises en place.
Délai de traitement	3 mois

Description du poste

Domaine*	Physique du noyau, atome, molécule
Intitulé de l'offre*	Self-heating meets turbulence: nonlinear feedback loops in burning fusion plasmas
Sujet de stage*	Burning plasmas, heated by their own fusion reactions, are the next frontier of magnetic fusion. With ITER's deuterium–tritium operation still years away, modelling must be ready before the experiments. In a burning plasma, fusion-born α-particles heat the fuel and dilute it. The fusion power, in turn, depends nonlinearly on the density and temperature that turbulent transport sets, and feeds back on them with a delay owing to the different time scales at play. This nonlinear feedback loop with memory has never been explored in turbulence simulations, where heat and particle sources are prescribed.This internship is the prelude to a PhD that will take the first steps into this new regime, with a deliberately simple description of α-particles and minimal code development, so that the effort goes into the physics. Using GYSELA, a global, flux-driven, full-f gyrokinetic code in which profiles, sources and turbulence evolve together, the student will implement fuel dilution and a fluid α-source that follows the evolving turbulent plasma and heats it after a tunable delay, first in electrostatic then in electromagnetic simulations. The delay will be scanned up to the local slowing-down time of α-particles, a few tens of milliseconds, which is within reach of today's supercomputers. Four questions will drive the work. How do self-consistent sources, and the nonlinear feedback loops they create, reshape profiles and turbulence? Do they trigger new confinement regimes, including possible oscillations or bursts? How does the delay with which α-particles heat the plasma compete with turbulence and confinement time scales? Does the strong degradation of the plasma energy confinement when increasing the heating power, as observed in present-day tokamaks, also occur in self-heated plasmas? Reduced models of delayed transport will guide the interpretation. The internship, hosted at CEA-IRFM (Cadarache) and supervised by G. Dif-Pradalier and Y. Sarazin, combines theory, high-performance computing and fusion physics. It prepares the ground for the first self-consistent simulations of turbulence in self-heated fusion plasmas.
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Moyens / Méthodes / Logiciels	
Profil du candidat	Physicien des plasmas; physique théorique; physique statistique; mécanique des fluides

Localisation du poste à pourvoir

Site	Cadarache
Lieu	F-13108 SAINT PAUL LEZ DURANCE cedex

Critères candidat

Diplôme préparé	
Formation recommandée	
Possibilité de poursuite en thèse	

Programme

Segment CEA	Fusion nucléaire

Langues

Langues souhaitée*	Anglais
Niveaux*	Intermédiaire

Suivi RH

Suivie par (nom du tuteur)	
Disponibilité de poste*	