CEA/CADARACHE
DIRECTION DES SCIENCES DE LA MATIÈRE (DSM)
INSTITUT DE RECHERCHE SUR LA FUSION PAR CONFINEMENT MAGNETIQUE (IRFM)
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PROPOSITION DE STAGE 2011

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Équipe de Recherche : SCCP/GCHF		

Niveau du stage :	MASTER
Durée du stage :	2-4 mois

sujet du stage :

Titre : Modeling of electron multipactor in Lower Hybrid Current Drive antennas

Contexte et objectifs : Fusion by magnetic confinement requires high powers to be coupled to the plasma for heating but also for non-inductive current drive (CD). Lower Hybrid (LH) range of frequency waves (1-8GHz) are widely used in present tokamaks to drive a part or the whole plasma current. The wave is launched from an array of waveguides facing the plasma. The power handling is mostly limiter by the so-called multipactor effect which occurs when the transit time of an electron from one waveguide wall to another is equal to half the period of the wave. In that case electron avalanche and arcing may occur in the waveguides.
The electron dynamics in the RF field with the boundary conditions imposed by the waveguides walls can be modelled assuming the secondary electron emission coefficient Y(E) of the surfaces is known
From either an existing code or from a new tool to be developed with COMSOL multiphysics package, the multipactor power threshold can be determined for the present or next tokamaks. In particular the scaling of this threshold with the operating frequency but also with the dimensions of the waveguides is important to predict the power handling capability of the ITER LHCD antenna. The effect of the surface contamination by oxides is also a very important issue.
In a tokamak environment, the electron trajectory is more complicated because the static magnetic field needs to be considered which is scarcely the case in the available literature.

Nature du travail à réaliser par l'étudiant :

Analysis of the multipactor from literature in order to master the problem. Depending on the length of this training and the ability/wishes of the student, the problem will be studied either from the existing code or from a new code built with COMSOL. Parametric studies to establish the scaling with f (2-8 GHz) , waveguide dimensions, Y(E) , static magnetic field.

Domaine de spécialité, compétences :	Physics with ability in mathematics and computing
Prolongement possible thèse :	NON