PROPOSITION DE THESE
Ph.D. offer

Date limite de candidature / application until : 1er mai 2021 / May 1st 2021

Responsable de la thèse / *PhD supervisor*:

Nom / *name*: MINEA — Prénom / *first name* : Tiberiu
Tél : 01 69 15 66 54 — Courriel / *mail*: tiberiu.minea@universite-paris-saclay.fr

Nom du Laboratoire / *laboratory name*: Laboratoire de Physique des Gaz et des Plasmas (LPGP)

Code d'identification : UMR 8578 — Organisme / *Institution* : CNRS/U Paris Saclay
Site Internet / *website*: www.lpgp.u-psud.fr
Adresse / *address:* bât. 210, université Paris-Saclay, ORSAY

Lieu de la thèse / *PhD place*: idem

Titre de la thèse / *PhD title*

Modélisation des décharges HiPIMS et instabilités ExB / *Modelling of HiPIMS discharges and ExB instabilities*

Résumé / summary

TMP-D&S team of LPGP is developing several models using different approaches aiming to describe and understand the behaviour of pulsed high power ExB discharges. The best example is the high Power Impulse Magnetron Sputtering (HiPIMS) discharge, operating at low pressure (< 1 Pa) and very high current (~100A) during the pulse. The dynamic of this kind of discharge is very fast (~µs) and the time dependence is required in all the models to capture the main phenomena gouvering the discharge.
Several 0D and 2D models have been successfully developed but especially the 3D modeling of the electron instabilities was the major achievement. The thesis program will focus on the non-standard operation condition, exploring the particularities of the plasma in these extreme situations.
It becomes thus possible not only to describe the magnetized plasmas but also to quantify the electron transport across the magnetic barrier, the aim of this thesis.
The modeling of pulsed high power ExB discharges using 2D is already performed in TMP-D&S team for very short pulses and in standard operation conditions. We developped a global model describing the average behaviour of the plasma in the Ionization Region (IR), but also a novel approach called 'pseudo-3D' allowing to model very high-density plasma, but particularly interesting to describe the electron instabilities in magnetized plasmas and the electron transport across the magnetic barrier.
New approaches are possible to be implemented, for instance implicit PIC (Partcile-in-Cell).
(Year 1): IR Model (IRM) will be run for non-standard operation conditions followed by the Pseudo-3D model implementation for very high plasma density and several magnetic field configurations.
(Year 2): Development of specific routines for the data processing allowing the numerical diagnostic of the plasma (e.g. electron diffusion, plasma oscillations, flares propagation, etc.)
(Year 3): Optimization of the model and comparison to experimental results obtained in other European research teams, partners of this project.

Début de la thèse / *starting* of the *Ph.D. contract*: ***01/10/2021 / October 1st, 2021***
Financement de thèse / *financial support for the PhD*: **concours EDOM / 'Doctoral School Matter and Waves'**, after application and oral defense of the application