Master M2

« Physique des Plasmas et de la Fusion »

Proposition de stage (5 à 6 mois à partir de mi-mars) **: oui**
Proposition de thèse : oui

Date de la proposition :

Ne pas dépasser une page / Do not exceed one page

Responsable du stage ou de la thèse / *internship or PhD supervisor*:

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Nom du Laboratoire / *laboratory name*: LULI
Code d'identification :UMR7605 — Organisme / *Institution* : CNRS

Site Internet / *web site*:
Adresse / *address:* Ecole Polytechnique
Lieu du stage ou de la thèse / *internship or PhD place*: LULI

Titre du stage (de la thèse) / **Heat transport in Magnetised High Energy Density Plasma**

Résumé / *summary*

The recent development of high energy lasers opened a new domain in physics (High Energy Density Physics) from Inertial Confinement Fusion (ICF) researches to Astrophysics. The most recent achievement in ICF (1) did show that ignition is on its way. However several fundamental processus are far from being well understood and need further investigations in order to improve significantly the path towards future fusion reactor.

In this context, one of the physical mechanisms not well understood is related to magnetic (B) field. Indeed, B-field has a strong influence on plasma properties in the domain of HEDP that might participate to the success or not for ignition. Today many efforts are being made to generate high amplitude controlled external B-field in HEDP either with a pulse power device or laser driver coils. Some fundamental processes are strongly affected by B fields heat transport being one of them. Transport is a key process that can significantly affect plasma dynamics in Inertial Confinement Fusion (ICF) and Astrophysics as it governs how the energy is carried in a system. Nowadays, only a few models have been established to include B-fields in the transport coefficients having short range of validity for plasma conditions and large error bars. There is a strong lack of comparison with experimental data in a wide range of plasma conditions. This internship will contribute to open a new line of research in HEDP domain. The student will study experimentally the influence of magnetic field on heat transport coefficients in a low density high temperature (expanding corona in laser driven foils). Indeed, a 3 weeks of experiment is scheduled on the LULI2000 from may 2nd up to may 20th. The objective here is to the limit with respect to the amplitude of the magnetic field, between local and non-local transport process for low density and hot temperature plasma parameters and measure how transport coefficients are modified with the B field. The student will actively participate to the set up of diagnostics and the all experiment. Analysis will be then be performed using both data processing tools that have been developed at LULI, improving them if necessary, and numerical simulations. The student will then interpret or design future experiments using 2D& 3D simulations from the Multidimensional Radiative Hydrodynamics Code FLASH in collaboration with the University of Chicago. Also, a strong link will be made with modelling of transport coefficient developped for HEDP and B field conditions in collaboration with scientists from CEA.

This work will be followed by a PhD thesis where experiments will be done both on LULI2000, on European XFEL or SACLA XFEL (Japan) where a large B field generators will be implemented as a high energy long pulse laser, both coupled to the x-ray beam.

We are looking for a highly motivated candidate interested in both ICF and laboratory astrophysics experiments using high power lasers and radiative magneto/hydro dynamics physics with the perspective to follow this internship with a PhD thesis.

https://lasers.llnl.gov/news/nif-experiment-puts-researchers-threshold-fusion-ignition

Toutes les rubriques ci-dessous doivent obligatoirement être remplies

Ce stage pourra-t-il se prolonger en thèse ? *Possibility of a PhD* ? **: oui**
Rémunération du stage/ *financial support for the internship* ***: oui***
Financement de thèse envisagé / *financial support for the PhD* **: Ecole doctorale IPP, EUR+CEA**
Type de stage et/ou de thèse (expérience/théorie/simulations) : expérience, simulations

Fiche à transmettre (fichier pdf **obligatoirement**) à Catherine Krafft, catherine.krafft@universite-paris-saclay.fr
Please send pdf file to catherine.krafft@universite-paris-saclay.fr