Spécialité de Master « Optique, Matière, Plasmas »

Stage de recherche (4 mois minimum, à partir de début mars)

Proposition de stage (ne pas dépasser 1 page)

Date de la proposition :

Responsable du stage / *internship supervisor*: Julien Fuchs

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Nom du Laboratoire / *laboratory name*: LULI

Code d'identification :UMR7605 Organisme :CNRS

Site Internet / *web site*: http://www.luli.polytechnique.fr/

Adresse / *address:* Ecole Polytechnique, Palaiseau

Lieu du stage / *internship place*: LULI and CELIA (Bordeaux)

Titre du stage / *internship title*: **Magnetized laboratory astrophysics**

Résumé / *summary*

The overall project aims at addressing, for the first time, astronomy-relevant issues related to the coupling of expanding and colliding plasmas with dynamically important magnetic field. In particular (1) the collimation of compressible, magnetohydrodynamic flows by a magnetic field, and (2) the production of energetic particles and radiation by collisionless shocks, will be tackled. For this, the project will take advantage of newly available experimental capabilities (high-power lasers coupled to pulsed strong magnetic fields) and exploit the results using 2D and 3D hydrodynamic, MHD and kinetic numerical simulations to get a complete picture of the phenomena.

The internship will focus on the second topic, i.e. studying the production of energetic particles and radiation by collisionless shocks that develop during astronomical phenomena. The main motivation for such study is that collisionless shocks that are produced in these conditions, i.e. reflections of ions through high amplitude electric or magnetic fields developed by charge separation or instabilities in a regime where collisions have a limited effect, could be at the source of the emissions observed from Supernova Remnants shocks (SNRs). However, the possibility for such mechanism to be efficient remains the subject of intense debate and active research. Hence, to have the possibility for the first time to study all these effects in the laboratory is a great opportunity to bring significant new results to compare with existing observations and to simulations of these phenomena. During the internship, the candidate will use several numerical codes available at CELIA (Bordeaux) to study the underlying physics and bridge laboratory experiment and space observations, mostly in the view of preparing an experiment that our team will perform in the fall 2013 in the USA.

A continuation toward a PhD will be possible. In this frame, it is important to note that significant beamtime at several high-power laser facilities in France and in the USA have been secured for the project for 2013-2014.

Toutes les rubriques ci-dessous doivent obligatoirement être remplies

Ce stage pourra-t-il se prolonger en thèse ? *Possibility of a PhD* **? : Yes**

Si oui, financement de thèse envisagé/ *financial support for the PhD***: CEA/CNRS**

Lasers et matière	**x**	Lumière, Matière : Mesures Extrêmes	**x**
Optique de la science à la technologie	**x**	Plasmas : de l'espace au laboratoire	**x**

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