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 : 28/11/12

Responsable du stage / *internship supervisor*:

Nom / *name*: CIARDI Prénom/ *first name* : Andrea

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Nom du Laboratoire / *laboratory name*: LERMA

Code d'identification : UMR8112 Organisme : Observatoire de Paris / ENS

Site Internet / *web site*: http://amrel.obspm.fr/~stehle/lap/

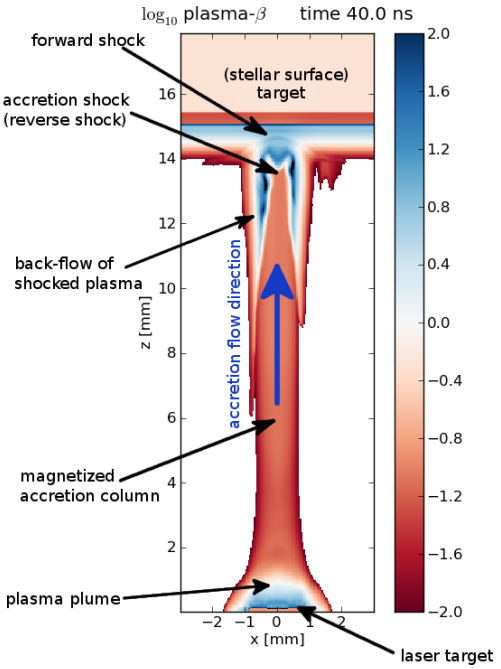
Adresse / *address:* 5 Place J Janssen, Meudon

Lieu du stage / *internship place*: ENS Paris and OBSPM Meudon

Titre du stage / *internship title* : Coupling laser plasmas and strong magnetic fields to study accretion columns in Young Stars

Résumé / *summary*

Young forming stars have an extended magnetosphere which connects them directly to their accretion disc. Magnetic arches (accretion columns) are loaded with disc material which free-falls towards the star, before being decelerated near the stellar surface by an accretion shock, and finally settling onto the star. By coupling laser produced plasmas with a strong magnetic field, the objective of this work is to develop a new experimental platform to study magnetized accretion columns and shocks. The laboratory "model" of an accretion column (shown in the Figure) consists of a laser-produced plasma that is channeled into a narrow beam by an externally imposed strong (5-40 T) magnetic field (parallel to z-axis in the image). This flow then impacts another solid target, which acts as the surface of the star, generating a reverse (accretion) shock.



The goal is to elucidate the complex interplay between the magnetic field and the accretion shock, and the feedback of the shocked plasma on the accretion flow itself.

The work is **theoretical/computational,** but involves a strong collaboration with the LULI group (Ecole Polytechnique) where experiments on the LULI100TW laser will take place in the spring 2013.

The objectives of the project are:

- to provide a detailed description of the plasma dynamics, such as the feedback of the shocked plasma on the accretion shock, the effects of radiation on its structure, the role of the magnetic field on the stability.
- to support to the **design** of the experiments and **interpretation** of experimental data.
- to help developing the framework for applications of the laboratory results to astrophysics.

Practically the study will involve running large-scale (multi-processor), numerical simulations using our three-dimensional, high-energy density plasma code GORGON, and interpreting the numerical result using a range of data visualization and analysis tools. Knowledge of FORTRAN and PYTHON would be an advantage.

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

Si oui, financement de thèse envisagé/ *financial support for the PhD* **: Region IdF ou autres**

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