Spécialité de Master « Optique, Matière, Plasmas »

Proposition de stage M2 dans le cadre du Labex Plas@Par

(ne pas dépasser 1 page)

Date de la proposition :

Responsable du stage / *internship supervisor*:			
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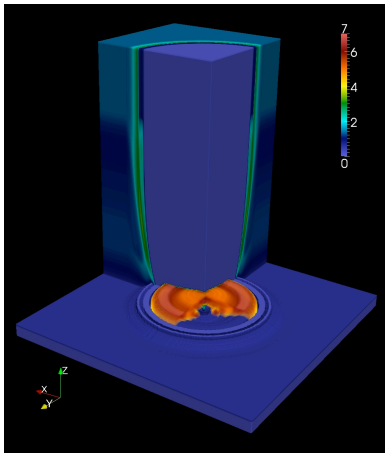
Nom du Laboratoire / *laboratory name*: LERMA dans le cadre du LABEX Plas@Par			
Code d'identification : LERMA	Organisme : Observatoire de Paris		
Site Internet / *web site*: http://lerma.obspm.fr/index.php?page=poles/pole2.php			
Adresse / *address:* Observatoire de Paris, 5 Place J. Janssen, 92195 Meudon, France			
Lieu du stage / *internship place*: *mainly at Osservatorio Astronomico di* Palermo (**supervisor: S. Orlando**)			

Titre du stage / *internship title*: Simulating mass accretion of young stars: shocks and radiation

Résumé / *summary*



Many young low-mass stars still accrete material from surrounding disks. The accretion builds up the star to its final mass and is also believed to power the mass outflows, which may in turn remove the excess angular momentum from the star-disk system. Now it is well-established that the material flows along magnetic channels that connect the disk to the star. The flow accelerates by gravity to very high speeds and terminates in a shock when it hits the photosphere of the protostar. In this general and quiet simple scenario, many details are not clear and several questions are still open: is the flow homogeneous? Does the impacting plasma absorb its own radiation? Does it interact with the surrounding stellar atmosphere?

To answer the above questions it is necessary to develop and apply advanced models of plasma flows that interact with the ambient magnetic fields. Also the radiative transfer is expected to play a crucial role in the accretion process and in the evolution of the post-shock plasma. For instance, the distribution of the optically thick material around the impact region may determine a non-trivial absorption of the emission emerging from the shocked plasma, and the irradiation of the unperturbed stream by the shocked plasma may produce a shock precursor with detectable emission. The models are implemented in numerical codes that run on high performance computing systems with thousands of CPU cores.

This stage operates in this framework, and its primary aim is to study the details of how matter accretes and how its energy is radiated away in young stars. The methodology will include:
1) to study the dynamics, stability, and radiative properties of the post-shock plasma through multi-dimensional MHD modeling including radiative transfer;
2) to synthesize the emerging spectra to be compared with available observations.

The candidate will be trained to use state-of-art numerical tools, with new improvements to properly include the description of radiation transport, and will setup and run simulations describing the impact of accretion streams onto the surface of a protostar.

This internship will be supported by the Labex PLAS@PAR with a grant up to 4500 or 6500 € for 4 or 6 months respectively.

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***:** Italian Ministry of University and Research (after selection)

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

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