Call for applications for PhD student position in the laboratory of excellence, labex plas@par

Title: **Electromagnetically-launched strong shocks relevant for accretion shocks in astrophysics : experimental study and numerical approach**

Project description

Strong shocks are present in various astrophysical contexts, from stellar infancy where matter is accreted from the stellar disk to the young star and ejected in the form of powerful plasma jets, up to stellar supernovae explosion in their final stage. Their topology and dynamics is quite complex as, beside the fact that they are strongly influenced by radiation, the role of NLTE cooling or magnetic field effects may have an important role. Thus it is of importance to study such hypersonic shocks (M > 20) in the laboratory [1], in various controlled conditions, to inspect the influence of these effects and to compare them with simulations. So far, such laboratory astrophysics studies are mainly performed on large-scale laser facilities, addressing pure hydrodynamic radiative shocks, at very high velocity (50 - 150 km/s) and moderate pressure (0.1 - 1 bar) [2].

The project mainly aims to extend this study to a wider class of shock regimes in the radiative regime, at slightly lower velocities, using a dedicated experimental setup presenting a high flexibility and a far larger repetition rate, which allows a wider understanding of shock physics in conditions of astrophysical interest, for instance in the context of stellar jets. Part of the project also concerns the study of laser generated radiative shocks.

The PhD student will first perform an experimental work around a unique and versatile kJ-class generator, which is already able to launch quasi-planar shocks up to 20 km/s in low density noble gases (Mach 100 or more) [3]. The setup is currently being upgraded and higher velocities are expected. The table-top device will allow to study various regimes of shock waves, depending on the gas composition and pressure as well as external magnetic field. The main part of the work will be to design, to implement and to exploit a comprehensive suite of diagnostics of the shock plasma. Then, the recorded data will be used to build a model of the shock and to benchmark 2-D and 3-D codes developed by the astrophysicists' community.

In parallel, the electromagnetically-launched shocks will be useful to prepare new diagnostics in view of foreseen experiments on laser-driven radiative shocks. The preparation will benefit from a shared supervision by two specialists in electrical engineering, plasma physics and astrophysics, in strong link with their collaborative network.

[1] D.D. Ryutov and B.A. Remington, Plasma Phys. Control. Fusion, 44 B, 407 (2002); [2] C. Stehlé, Kozlova M., Larour J., et al., , Optics Comm., 285, 64 (2012); [3] K. Kondo et al., Rev. Sci. Instrum., 77, 036104 (2006)

Requirements for the candidate: The successful candidate must have a master of science in engineering, physics, astrophysics or equivalent. A previous experimental experience, in data acquisition or computer simulation is a merit, as also a high level in French or English.

Location and starting date: LPP in Palaiseau (http://www.lpp.fr), and LERMA in Meudon (http://lerma.obspm.fr), Paris region, France, October 1st, 2013

Application with detailed CV, copies of degree diplomas and grades, two reference letters, copies of any previous research-related work and personal statement explaining your motivation. Application deadline is *May 15, 2013*. The application should be sent preferably by e-mail to the following address:
jean.larour@lpp.polytechnique.fr with a copy to chantal.stehle@obspm.fr