Call for applications for a PhD position

Laboratory of Excellence PLAS@PAR

Title of the PhD project: Study of magnetic reconnection dynamics using laser-produced B fields in plasmas

Project description (Context and objectives of the project, possibly with 2-3 references)

The thesis subject lies in the frame of “laboratory astrophysics”, which aims studying plasma processes with e.g. high-power lasers to help deciphering astrophysical phenomena. The focus here will be on magnetic reconnection, a long standing problem in space plasmas. Most of our knowledge of collisionless reconnection comes from numerical studies and, to a smaller extent, from space observations where it is however difficult to measure all the relevant physical parameters and to follow their temporal evolution. Laboratory experiments, in particular laser experiments that offer small and versatile setups, which are moreover relevant for ICF, hence provide an interesting alternative to investigate reconnection. The project is supported by an LPP-LULI-CEA collaboration [R. Smets et al, Phys. Plasmas 21, 062111 (2014)]. We have already started to lay the basis, experimentally and numerically, for this work, demonstrating that magnetic fields in laser-produced plasmas offer an adequate platform for investigating magnetic reconnection. The proposed work will focus on quantitative measurement of reconnection rate and energy partition in the plasma, at intermediate-scale facilities (GSI [Germany], LULI [France] or Titan [USA]) as well as the large-scale LMJ/Petal [France] facility where our group gained access for shots planned in 2017 and 2018.

The two main objectives for the proposed thesis project will be: (1) quantitatively measure reconnection dynamics in High-Energy-Density plasmas (HEDP) by having an appropriate long-drive laser pulses and laser irradiation spots not too close to each other so that the plasma β is not too high when the two B fields loops meet, and (2) measure reconnection dynamics in non-ideal (i.e. non-coplanar) conditions. This will uniquely allow to gauge the influence of the Hall component on the reconnection dynamics. All these measurements will be used to test the predictions coming from HECKLE numerical simulation of 2D reconnection.

We look for a student that is motivated to investigate this scheme. The work will be partially experimental and theoretical and will be done in collaboration between the LULI and LPP laboratories. The student will have the opportunity to use the state-of-the-art laser facilities at LULI, CEA and also in other facilities where our group is applying for beamtime, in the EU or the USA.

Requirements for the candidate: The applicant will have a master, with specialization in experimental physics, plasmas physics. Due to restriction of access to some laboratories, the applicant should be nationals from a EU country.

Location and starting date: Ecole Polytechnique [south of Paris], with stays abroad [EU and USA] for experiments.

The application should be sent by e-mail to the following contacts:
Julien Fuchs, LULI, julien.fuchs@polytechnique.fr

Applications with CV, statement of motivation, copies of degree diplomas and grades, two reference letters, and copies of any previous research-related work. Deadline is May 31st 2016.