PROPOSITION DE STAGE 2024

☐ Licence ☐ Master 1 ☑ Master 2 ☐ Fin d'études

Intitulé / Title : Design of tailored gas distribution for laser driven electron acceleration in plasma

NOM DU LABORATOIRE / LABORATORY NAME :
Laboratoire de Physique des Gaz et des Plasmas

Code d'identification : UMR8578

Organisme/institution : CNRS et UPSaclay

Adresse du lieu de stage / Lab adress : Univ. Paris-Saclay, Bât 210, Rue Henri Becquerel, 91405 Orsay

Site Internet / Web site : https://www.lpgp.universite-paris-saclay.fr/

RESPONSABLE DE STAGE / INTERNSHIP SUPERVISOR :

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STAGE / INTERNSHIP :

Durée / Duration : 5 à 6 mois à partir de début mars

Prise en charge du transport / Payment for transport : OUI / NON

Rénumération / Scholarship : OUI / ~~NON~~

Possibilité de thèse : NON

RÉSUMÉ / SUMMARY :

Laser Wakefield Acceleration (LWFA) relies on the excitation of high amplitude accelerating fields in plasmas to produce relativistic electron beams with high intensity and short duration. This physical phenomenon relies on the nonlinear coupling of multiple parameters, and can be achieved for a large number of parameter sets, depending on the desired electron beam properties and final use [1].

A fundamental element of LWFA experiments is the gas target, where a specific gas distribution is created in a confined volume where the intense laser beam is focused. Over a short timescale after ionization by the intense laser beam, the resulting plasma density profile is the same of the original one of the gas. To optimize the quality of the accelerated electron of LWFA, the gas density distribution can be designed through numerical simulation, experimentally achieved in gas cell and characterized through optical diagnostics.

The group ITFIP at LPGP is deeply involved in a numerical and experimental program aiming at designing gas cells that can reliably provide the desired gas density distribution for LWFA experiments at European laser facilities [2].

The proposed internship includes contribution to numerical modeling and experimental characterization of the filling of gas cells for LWFA. The desired candidate profile has a deep knowledge of compressible and uncompressible fluid dynamics, the capacity and the motivation to adapt and write well-structured and documented Python scripts for data analysis, critical thinking and some experience in writing reports with LaTeX.

Depending on the candidate's background, numerical and experimental activities can be performed, and preferably combined through the comparison between simulations and experimental data. For the numerical studies, experience with Computational Fluid Dynamics software used for research (e.g. OpenFOAM, COMSOL, Fluent) is highly desirable.
For the experimental studies, some experience with experimental data analysis is required.
Preference will be given to candidates able to perform both numerical and experimental activities.

[1] E. Esarey et al., Rev. Mod. Phys. 81, 1229 (2009), https://journals.aps.org/rmp/abstract/10.1103/RevModPhys.81.1229

[2] L. T. Dickson et al., Phys. Rev. Accel. Beams 25, 101301 (2022), https://journals.aps.org/prab/abstract/10.1103/PhysRevAccelBeams.25.101301