

## Internship M2, 2023

### Investigation of the laser cross-talk in a magnetized plasma

#### Locations:

- LULI (<https://luli.ip-paris.fr/>), Ecole Polytechnique, 91128 Palaiseau cedex
- LULI, Sorbonne Université, Campus Pierre et Marie Curie, tour 23-33 4ème étage, boîte courrier 128, 4 place de Jussieu, 75252 Paris cedex 05
- LULI/APOLLON, Parc Les Algorithmes, bâtiment Euclide, route de l'Orme des Merisiers, 91190 Saint Aubin

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**Context.** Plasma is a non-linear medium [1], where light waves can couple to plasma waves. There exists a whole range of laser-plasma interaction (LPI) phenomena, from filamentation, stimulated Brillouin scattering (SBS), stimulated Raman scattering (SRS), to cross-talk and braiding between laser beams [2] or cross-beam energy transfer (CBET) [3] between neighbor laser beams. Improving our knowledge of all these effects is not only important from a fundamental perspective, but also from a practical one in the frame of Inertial Confinement Fusion (ICF), where it is critical that as much as possible of the laser energy be transferred homogeneously to the fuel.

**Proposed work.** The internship is part of an ongoing effort of investigating laser propagation and LPI in a magnetic field of tens of Tesla [4], both experimentally with high-power lasers worldwide, e.g., LULI2000 (FR) and TITAN (US); and numerically with fully kinetic particle-in-cell simulations performed with the code SMILEI [5] and magnetohydrodynamic (MHD) simulations with the code FLASH [6].

During the internship, the student will contribute to:

- Experimental data analysis (e.g., laser propagation from HISAC diagnostics, the plasma condition characterization from Thomson scattering, et al.).
- Numerical simulations for the laser propagation using FLASH and for the kinetic effects using SMILEI.

#### Required competencies and skills:

- knowledge in general physics and mathematics
- skills and interest in computational development and simulations

#### References:

- [1] Turnbull, D., et al., PRL 118, 015001 (2017).
- [2] Nakatsutsumi, M., et al., Nat. Phys. 6, 1010 (2010).
- [3] Michel, P., et al. Phys. Plas. 17, 056305 (2010).
- [4] Yao, W., et al. PRL 130, 265101 (2023).
- [5] Derouillat, J., et al., Comput. Phys. Commun. 222, 351-373 (2018)
- [6] Fryxell, B., et al. The Astrophysical Journal Supplement Series 131.1, 273 (2000)