

Internship M2, 2023

Investigation of 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 [7].

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)
- [7] Fryxell, B., et al. The Astrophysical Journal Supplement Series 131.1, 273 (2000)