Postdoctoral position in computational plasma physics at CEA
Investigating relativistic beam-plasma instabilities in laser and accelerator experiments

Context

The relativistic beam-plasma systems found in ultraintense laser-matter interactions or high-energy astrophysical phenomena are routinely prone to micro-instabilities, that is, coupled electromagnetic and current fluctuations growing at kinetic scales and entailing energy and momentum transfers between the plasma constituents, at a rate usually much faster than through Coulomb collisions.

The UnRIP (*Uncovering Relativistic Instabilities in Plasmas*) joint project between CEA/DAM, LOA and IAP, funded by the French National Research Agency (ANR), aims to investigate those processes using state-of-the-art laser (LOA, Apollon) and accelerator (SLAC) facilities, together with novel precision diagnostics and advanced numerical simulations. Two main experimental scenarios will be considered: relativistic laser-solid interactions probed by laser-wakefield-driven electron bunches, and high-density, GeV-level accelerator electron beams injected through solid or gas targets. These experiments will offer unprecedented insight into the instability dynamics, and this in a broad range of physical conditions. Notably, the E-305 experiment planned at the SLAC National Accelerator Laboratory (USA) will allow beam-plasma instabilities to be explored at beam energies and currents considerably increased over previous works. This should cause the instability-generated fields to induce bright synchrotron-type gamma-ray flashes, akin to those arising in high-energy astrophysics, and which we intend to evidence for the first time.

Objectives

The proposed postdoctoral position will provide numerical support to the UnRIP project, helping design and interpret the laser and accelerator experiments by means of multidimensional particle-in-cell (PIC) simulations, using the Calder code developed at CEA/DAM. More specifically, the postdoctoral fellow will address

- the development of the current filamentation instability in relativistic laser-solid interactions, as a function of the laser incidence angle, polarization and temporal contrast, and its probing by an external electron beam;
- the instabilities excited by the 10 GeV SLAC electron beam through a gaseous or solid target, and the resulting high-energy synchrotron-type emission;
- the instability dynamics and radiation in GeV electron-positron beam-plasma interactions as envisioned at next-generation multi-petawatt laser or accelerator facilities.

Besides performing and analyzing PIC simulations, the postdoctoral fellow will be expected to develop theoretical models and post-processing tools, or improve the simulation code by implementing refined physical models or numerical schemes.

Practical aspects

The position is to be filled as soon as possible, with a contract duration of two years (the exact dates can be negotiated).
The research work will be carried out at CEA/DAM (Arpajon, near Paris), with frequent visits at LOA (Palaiseau, near Paris) and IAP (Paris).
The salary will depend on education and years of experience. A PhD in computational plasma physics, astrophysics or a related field is required.
Candidates should send their applications electronically, including a CV, a publication list and a statement of research interests, and provide contact information for references.
Note that access to CEA/DAM requires the applicant to go through a security clearance process.
Review of applications begins immediately. Applications will be considered until the position is filled.

Contacts

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