2-year postdoc position at CEA/DAM France, to model relativistic laser- or electron beam-matter 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:
This two-year position will open in July 2021 (the exact date 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.

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