Projet COLLISION

In the context of the interaction of intense, short laser pulses with solid targets, Inertial Confinement Fusion (ICF), or Fast Ignition (FI) schemes, the energy transport is an important issue. In these latter applications (ICF and FI), it determines the efficiency of plasma heating and the possibility to achieve the fusion conditions. The appropriate scales under consideration here are about one hundred of micrometers for the typical spatial sizes, and one hundred of picoseconds for the time scales.

A wide range of collisional regimes should be dealt with to describe the propagation and the deposit of energetic electrons from the underdense corona of the target to its dense and compressed core. The collisions are important even if the beam particles themselves are collisionless : these particles, when propagating in a plasma, trigger a return current that neutralizes the incident current. For non-relativistic laser intensities, smaller than 1018 W/cm^2, a small angle description for collisions between the two populations is well suited, leading to the classical Fokker-Planck-Landau collision model.

The Coulomb potential involves a large amount of collisions with small energy exchanges between particles, so that the Landau form of the Fokker-Planck operator is required here. Such a configuration with two counter-streaming beams typically leads to the development of microscopic instabilities that can modify strongly the beam propagation.

The goal of this project is to developp efficient algorithms to deal with different collision regimes : from a collisionless plasma to a fluid regime. To this aim we ant to follow the method recently developped by F. Filbet and S. Jin for the numerical simulation of the Boltzmann equation.

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Références

[1] F. Filbet, S. Jin, *A class of asymptotic preserving schemes for kinetic equations and related problems with stiff sources*, preprint.