Fast reduced kinetic model for energetic particles beam transport in plasmas

J.-L. Feugeas, Ph. Nicolaï, M. Touati, J. Caron, D. Del Sorbo,
J. Breil, B. Dubroca, M. Olazabal-Loumé, J. Santos, L. Volpe,
V. Tikhonchuk

Univ. Bordeaux, CEA, CNRS, CELIA (Centre Lasers Intenses et Applications),
UMR5107, F-33400 Talence, France

One major issue to address in the context of Inertial Confinement Fusion is the detailed description of the kinetic transport of laser generated fast electrons in the time and space scales of the hydrodynamic evolution of the imploded target. A fast reduced kinetic model suitable to particles transport based on the angular moments of the relativistic Fokker-Planck equation is developed by our group [1, 2]. This model takes into account collective effects of the Lorentz force and the self-generated electromagnetic fields computed thanks to a generalized Ohm law. The slowing down of the relativistic electrons and their elastic collisions on ions and electrons are also taken into account. Thanks to the structure of this model, effects of electric and magnetic fields can easily be highlighted and the resistive fast electrons losses are directly compared with the collisional losses. In addition, this model provides kinetic description of particles beam transport. This multi-scales tool has been implemented into the hydrodynamic code CHIC [3] and has been used and validated in the context of Fast Ignition and Shock Ignition schemes. Because of its computing efficiency, various initial configurations can tested to reproduce experimental data.

References