General moment system for plasma physics based on minimum entropy principle

Jessy Mallet [*] Stéphane Brull [†] Bruno Dubroca [‡]

In plasma physics domain, the electrons transport can be described from a kinetic and from an hydrodynamical point of view. Both methods present disadvantages and thus cannot be considered in practical computations for Inertial Confinement Fusion (ICF). That is why we propose, a new model which is intermediate between these two descriptions. More precisely, the derivation of such models is based on an angular closure in phase space and retains only the energy of particles as a kinetic variable. The closure of the moment system is obtained from a minimum entropy principle. The resulting continuous model is proved to satisfy fundamental properties such as the distribution function positivity, conservation of mass and energy and local dissipation of entropy. Moreover the model is discretized in the energy variable and the semi-discretized scheme is shown to satisfy conservation properties and entropy decay. Finally, we finish by considering a coupling of this model with Maxwell equations.

Références

[1] J.Mallet, S.Brull, B.Dubroca *An entropic scheme for an angular moment model for the classical Fokker-Planck equation of electrons.* Comm. Comput. Phys. To appear

[2] J.Mallet, S.Brull, B.Dubroca *General moment system for plasma physics based on minimum entropy principle.* Submitted

[*]Univ. Bordeaux, CELIA, UMR 5107, F- 33400 TALENCE, FRANCE. Univ. Bordeaux, IMB, UMR 5251, F- 33400 TALENCE, FRANCE (mallet@celia.u-bordeaux1.fr).

[†]Univ. Bordeaux, IMB, UMR 5251, F- 33400 TALENCE, FRANCE, (Stephane.Brull@math.u-bordeaux1.fr).

[‡]Univ. Bordeaux, CELIA, UMR 5107, F- 33400 TALENCE, FRANCE. Univ. Bordeaux, IMB, UMR 5251, F- 33400 TALENCE, FRANCE (dubroca@celia.u-bordeaux1.fr).