COMPUTING METHODS FOR THE NONLINEAR LANDAU-FOKKER-PLANCK EQUATION AND APPLICATIONS FOR COLLISIONAL PLASMA PROBLEMS

I.F.Potapenko

Keldysh Institue of Applied Mathematics RAS,
Miusskaya Pl.,4 Moscow, 125047, Russian Federation

The kinetic equation of the Landau-Fokker-Planck type (LFP) as an approximation of the Boltzmann equation for the distant interaction potentials, including the Coulomb one, is the basic equation for a mathematical model of weakly collision plasmas.

The applications of the Landau-Fokker-Planck equation in high temperature laboratory and space plasmas, in semiconductor and plasmochemistry plasmas, as well, are well known.

The report reviews the mathematical models and computational methods in non equilibrium plasma dynamics that are based on the traditional approaches to solve a nonlinear LFP equation. Besides, the first illustrative results from the new Monte Carlo type method, probably being at present the most effective computational method for the LFP equation, are presented.

In this regard the following problems are considered:

- the two-temperature plasma relaxation for the strongly non equilibrium state and the distribution function high energy tail formation;
- electron acceleration and precipitation in the Earths's auroral zone and the distribution function extended plateau formation for magnetospheric plasmas;
- quasi stationary non equilibrium distribution functions in semiconductor plasmas irradiated by energetic ion beams.