INVESTIGATION OF THE ELECTRON RUNAWAY PHENOMENON IN A DENSE SEMICLASSICAL PLASMA

Seisembayeva M.M.,* Shalenov E.O., Kossymkyzy Zh., Ramazanov T.S., Dzhumagulova K.N.

KazNU, Almaty, Kazakhstan
**smm93.93@mail.ru*

The phenomenon of runaway electrons takes place in some astrophysical objects. Also it is an important problem in the realization of the thermonuclear fusion since the appearance of runaway electrons under certain circumstances can damage plasma installations. In order to prevent (mitigate) this, extensive theoretical and computer studies of the electron runaway phenomenon are required. This problem was firstly considered and analyzed numerically in Dreiser's work [1]. Nowadays, the mechanism of the appearance of runaway electrons and their behavior in the system are being intensively studied by scientists from many countries.

In the work [2], the influence of electron-ion, electron-electron collisions on the friction force acting on runaway electrons in plasma is investigated. To describe pair interactions of electrons with plasma particles (electrons, ions), effective interaction potentials were used. These potentials take into account the effects of diffraction at short distances and the effect of dynamic screening at large distances [3, 4]. On the basis of these effective potentials, the collisional properties of the dense nonideal plasma were investigated, namely, the scattering cross sections of particles and the collision frequency. The method of phase functions was used, where phase shifts were calculated based on the solution of the Calogero equation [5]. In turn, the phase shifts made it possible to calculate the transport scattering cross sections. As a result of the numerical investigation, the dependences of the electron mean free path and the friction force on the plasma density and the coupling parameter are obtained. A comparison of the data obtained taking into account static or dynamic screening was also carried out. It is shown that dynamic screening leads to an increase in the friction force acting on the runaway electrons.

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