

Investigation of collisional processes in dense semiclassical plasma

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Abstract: In this work we study kinetic processes of dense semiclassical plasma with the collective effect and screening. Collisional characteristics of plasma are obtained numerically by using several effective pseudopotential models with clear difference arising between them.

1. Introduction

Currently, a clear and accurate theoretical description of dense plasma remains an actual problem. Kinetic properties are the most important characteristics of dense plasma, the study of attract more and more interest. Finding the particle distribution function is one of the main problems in plasma physics. In work [1] the form of the particle distribution function determined by various parameters and processes. The main mechanism that determines the fastest part of the distribution function is the escape of electrons to the walls. Also, electron energy distribution functions have a rich structure induced by super elastic collisions between excited species and cold electrons. Super elastic vibrational collisions play an important role in affecting the electron energy distribution function in a wide range of the electric field [2].

2. Results

Due to the influence of external forces the particle distribution function deviates from the equilibrium leading to the change of the average energy and directional velocity of the particles and the distribution function, which depends on the velocity components. To describe this processes, the pseudopotentials was used that takes into account the charge screening at long distances and quantum effect of diffraction, which occurs in dense systems. As well, mean energy of the electrons was calculated by the Coulomb logarithm by using the distribution function in a strong field [3] for continuous collision cross section. The Coulomb logarithm determines by the scattering angle of particle in plasma. By solving the scattering angle of particle we got collisional characteristics of dense plasma such as scattering sections, free lengths and frequencies of particles on the basis of effective pseudopotential models. The results obtained in this work are compared with the results of other theoretical methods and computer simulations.

3. Conclusion

The tail of distribution function of particles in external electric field increases with the decrease of

plasma density parameter when we take into account quantum mechanical and screening effects. This effect is possibly connected with decrease of the collision frequencies [4] and with the formation of some ordered structures in dense plasma.

4. References

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