SIMULATION OF ULTRACOLD PLASMA BY THE PARTICLE DYNAMICS METHOD

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In ultracold (nonideal) classical Coulomb system the recombination is due to complex many-body interactions, the result of which is its sharp slowdown. This phenomenon of slowing the rate of recombination, as well as many other processes have been studied by molecular dynamics in a series of papers in 1986 - 1996 (see. [1 - 4]). Discovered a new state of the Coulomb system in which the plasma is not recombined according to a known law of 9/2 at low temperatures. This state of classical Coulomb systems has been called metastable ultracold plasma. At that time there was no real physical object, consisting of classical Coulomb particles, for which we would have the strong-coupling condition.

In this paper, based on the molecular dynamics calculations, studied two problems:

Evolution of ultracold plasma at the initial stage, when a cloud formed after photoionization of fixed ions and electrons takes a fixed amount. We consider the time evolution of the Coulomb system, the total energy is the initial time is zero. Molecular dynamics method obtained the solution for a system of particles in the range of 2000 to 8000 inverse plasma frequency. It is shown that under conditions typical for experiments with ultracold plasma component strongly coupled plasma can not reach high values due to the recombination heating, and the process of relaxation is not described in the traditional model of three-body recombination.

The system of equal masses of the electron-positron plasma.

The formation of a metastable state passes through a stage of slow recombination filling related ion-electron states. Recombination rate and the character does not correspond to the usual notion of three-body recombination, and are caused by a complex interaction of many-particle.

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References

1. Maiorov S.A., High Temperature, Vol. 52, No. 4, 609–611 (2014)
2. Maiorov S.A., Bulletin of the Lebedev Physics Institute, Vol. 41, No. 3, 81 (2014)
3. Maiorov S.A., Tkachev A.N., and Yakovlenko S.I.,Mat. Model., vol. 4, no. 7, p. 3. (1992)
4. Maiorov S.A., Yakovlenko S.I.// Russ. Phys. J., No. 11, 44-56 (1994)
5. Maiorov S.A., Tkachev A.N., and Yakovlenko S.I.// Russ. Phys. J., No. 11, 3 (1991); No. 2, 10 (1992); No. 11, 76 (1992); No. 1, 68 (1993)
6. Maiorov S.A., Tkachev A.N., and Yakovlenko S.I.// Phys.- Usp., vol. 37, no. 3, 279 (1994)