The molecular dynamics calculations of an electron states density and a diffusion coefficient in energy space for ultracold strongly coupled plasma

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We propose a plasma model wich allows us to calculate kinetic characteristics of a two-component ultracold plasma using classical molecular dynamics. Electrons and protons in this model of nonequilibrium plasma are interacted by Coulomb law. In the case of electron-proton interaction and distance between particles $r<r_{cut}$ (r_{cut} is about several Bohr radii) the interaction energy is constant e^2/ r_{cut} (e is the charge of electron). The motion equations in periodical boundary condition for this system has been solved by molecular dynamics method.

We considered densities $n_e=n_i=10^{10}$-10^{12} cm^{-3}, proton temperatures T_i=1-10 K, electron temperatures T_e=5-30 K.

We have calculated the electron state density in the region near the ionization threshold depending on a coupling parameter $\gamma = e^2n^{1/3}/k_BT$. The electron state density is being described using the nearest neighbor approximation.

We have also calculated the diffusion coefficient D(E) for energy range E = $-2k_BT$...$+2k_BT$, depending on γ.