DENSITY OF STATES AND ENERGY DISTRIBUTION OF THE ELECTRON IN NON-IDEAL ATOMIC PLASMA: THEORY AND NUMERICAL MODELING DATA.

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Recently a numerical simulation data have appeared for model Coulomb systems («Coulomb with a shelf») in which direct measurement defined distribution of electrons energy in range of energies: from subzero to the positive numbers. These data (Norman G.E, Larkin A.V - 2 regimes, and Bobrov A, Zelener B.V. - 2 regimes) allow to check a number of principle questions of the theory of non-ideal atomic plasma.

As well-known, electrons in atomic plasma are occupied by states with major subzero and positive energies. In real plasma the deep states are quantum and bound, as ensures convergence of calculated quantities. In due time the Coulomb model «with a shelf» have been suggested for the description of the charged component of partially ionized plasma and non-ideal fully ionized plasma. It was supposed, that the bound states below a bottom of a shelf, are considered as the ideal-gas component, and for the description of non-ideal effects in an ionized component it is possible to use this model. The possible formation of the bound states immediately in the model originally was not taken into consideration.

The energy distribution functions (DFE) received as a result of molecular dynamics (MD) simulations are shown, that the bound states are in the model also and their number is considerably.

We have calculated density of states and DFE in nearest neighbor approximation for “Coulomb model with the shelf”. The calculation was made in the canonical assembly: the total number of ions (electrons) and temperature are set. Necessity of the long-range interaction cut-off and its bond with free charges density give the specificity contribution to calculation. As a result, received theoretical DFE was compared with numerical modeling one. The executed comparisons with theoretical calculation enable to draw a conclusion on equilibrium of received distribution and to analyze their features.

Using the reduced per unit DFE, an ionization degree was received and compared to that, received by the formula Saha. Though precision of the received distributions is low, we have tried to receive the lowering of the ionization potential.

DFE received by direct methods confirmed the statement formulated by authors: the formation of bound states is always take place in non-ideal fully ionized plasma. The bound states disappeared only at overlapping of classically accessible fields of electrons move in the ground state.