Poster 1 (No. 58) – The capture cross sections at the electron collisions with hydrogen atom in non Maxwellian dense semiclassical plasma

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Semiclassical plasma is a dense high-temperature plasma that appears inside giant planets, white dwarfs, in experiments on the compression of warm plasma. It has become the object of intensive experimental and theoretical research [1-2]. In this case, the extreme values of densities and energies lead to a significant deviation of the particle velocity distribution function from the equilibrium Maxwellian distribution. Spacecraft measurements have shown that deviations from the Maxwellian particle distribution are often found in the solar wind, in the plasma of planetary magnetospheres, and in some other astrophysical objects due to the presence of high-energy particles [2-4]. In many situations, the distribution has a "suprathermal" power-law tail at high energies. They were built several possible distributions corresponding to the empirical data. Among them, the family of κ (kappa) - distributions stands out, since they model well the "suprathermal" power-law tail and has found interesting applications in both space and laboratory plasmas.

To date, the κ - distribution is widely used to analyze a large number of different phenomena in plasma. For example, in Ref. [5], this distribution was applied to the study of the Landau damping phenomenon for ion-acoustic waves in cosmic plasma. And in Ref. [6], dust-acoustic solitons in dusty plasma with κ - distributed ions were investigated.

One of the elementary processes in plasma is the electron capture process. In this work the electron capture processes by the hydrogen atom was investigated. The motion of the electron in the field of the the motionless atom was considered on the basis of the solving of the equation of motion. The interaction potential between the electron and the hydrogen atom was presented in works [7-10]. This effective potential, taking into account dynamic screening, quantum mechanical effect of diffraction and kappa distribution effect, has finite values at the distances close to zero.

In this work the electron capture radius, which was determined by equating the kinetic energy of impacting electron and the interaction energy between the electron and the hydrogen atom, was presented [11]. The trajectories of the electron in the field of the atom was simulated. Obtained results of the electron capture by the atom without and with kappa distributions were compared. Using the electron capture probability, the electron capture cross section was calculated.

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Poster 1 (No. 84) – A charge-momentum-energy-conserving alternative numerical method for the Vlasov–Maxwell system

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Particle-in-cell (PIC) method has been widely used especially in communities of plasma physics, astrophysics, and beam acceleration. The law of charge-momentum-energy conservation is one of the most important principles in kinetic plasmas, and violation of the conservation results in numerical instabilities. This is the reason why many computational works have been carried out to develop conservative schemes. Although conservative finite-difference scheme for Vlasov–Maxwell system is relatively easy to be composed [1], fully-conservative PIC method has not been reported yet despite continuous effort [2].

The reason why conservative PIC method cannot be realized is inconsistency of