Transport coefficients of Dense Helium Plasmas

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The study of a dense plasma with helium ions and atoms is a great importance for the inertial confinement fusion (ICF) and astrophysics [1–2]. Experimental investigations of helium under extreme conditions include shock compression [3–4] and laser heating [5].

Accurate values of the transport coefficients of high temperature dense plasmas are necessary input data for the reliable numerical simulation of thermal plasmas. Therefore, in this work we present the results of calculations of the viscosity, diffusion, thermal conductivity, and electrical conductivity of helium plasma at high temperatures. Transport properties are studied on the basis of screened pair interaction potentials using the Coulomb logarithm [6-7]. In the case of a singly-ionized helium, the pair interaction potential between an atom and a proton during the elastic collision is considered as a sum of attractive and repulsive terms [8-9]. The former is the result of the polarization and the latter is due to a Coulomb repulsion of nucleus. A screening by free electrons is taken into account using the quantum polarization function in the random phase approximation. Further, this pair potential was used for the calculation of the Coulomb logarithm. To show the correctness of the model, its results are compared with the results of QMD and OFMD simulations.

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