Dynamical and transport properties of dense plasmas on the basis of Coulomb logarithm and effective potentials

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We have carried out an extensive research on studying both static and dynamic screening in non-ideal dense plasmas. As the result, the model for the accurate calculation of the stopping power as well as other transport properties is presented. In the former case, the main idea is to use a cold plasma model with thermal and quantum effects taken into account in a screened pair interaction potential, where screening is due to partially or totally degenerate (possibly non-ideal) electrons [1]. By comparison with other more involved calculations, which clearly shows a very good agreement at low velocities, the applicability range of the model is discussed. The main advantage of the model is that the strong ion-electron scattering is treated accurately and, hence, applicable for the description of the stopping power at the critical velocity, i.e. when the stopping power has its maximum value. The Coulomb logarithm obtained within this model is used for the computation of the dynamical and transport properties of dense plasmas. In the range of the applicability of the model, our data is in close agreement with the DFT-MD and OFDFT-MD results. Therefore, our model makes the calculation of the aforementioned effects much easier and sheds a light on the most important plasma features which govern a relevant microscopic process. Additionally, the impact of the electronic non-ideality in a quantum regime on the static and dynamic screening of an ion charge, obtained in collaboration with the Kiel group, is discussed [2]. Further, the screened ion potential was used to study the structural properties of the strongly coupled ions in a quantum plasma with correlated electrons [3]. Finally, the recent results of the investigation of the screening of an ion by the electrons oscillating in an external alternating field are presented [4].

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