

Dynamical Screening Approach to Strongly Correlated Multi-Component Plasmas

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A key problem in the description of nonideal, multi-component plasmas are the dramatically different r, t -scales, which are caused by the different masses of the plasma constituents (electrons, ions, micron-sized "dust" particles etc.).[1,2]

In dusty plasma physics, this problem has been effectively tackled by the 'Dynamical Screening Approach' (DSA), which allows for an accurate description of essential plasma properties including screening, wakefield oscillations, ion and electron thermal effects as well as collisional and Landau damping.[3,4]

Here, the DSA is extended to non-equilibrium situations in partially ionized Warm Dense Matter, where a full dynamic treatment of the pair correlations of the heavy particles is crucial. Considering the strongly coupled ions as classical (or weakly degenerate) and the electrons as quantum degenerate but only weakly correlated, the ion dynamics will be studied on first principles by classical Langevin Dynamics simulations, while the electrons are treated fully quantum-mechanically taking into account their dynamical screening of the ion-ion interaction in linear response on the basis of an extended Mermin formula.[5]

Like in streaming classical dusty plasmas, the effective wake-potential results in attractive (non-reciprocal) forces between equally charged plasma constituents, leading to remarkable structural and dynamical many-particle features.

[1] Introduction on Complex Plasmas, M. Bonitz, N. Horing, and P. Ludwig (eds.), Springer 2010

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[3] M. Lampe et al., IEEE Trans. Plasma Sci. **33**, 57 (2005)

[4] P. Ludwig, W.J. Miloch, H. Kählert, and M. Bonitz, to be published (2011)

[5] P. Ludwig, M. Bonitz, H. Kählert, and J.W. Dufty, J. Phys. Conf. Series **220**, 012003 (2010)