

EFFECT OF NON-LINEAR SCREENING ON COMPLEX PLASMA THERMODYNAMIC STABILITY REGIONS

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Thermodynamic stability of complex plasma is under discussion. We obtained huge negative total pressure and compressibility areas in the initial phase diagram [1] of complex plasma using the equations of state [1, 2]. Questions of thermodynamic stability and an existence of an additional phase transition of gas–liquid and (or) gas–crystal types in two-component systems are discussed. The present work is devoted to the analysis of the applicability range of a basic assumption in the phase diagram [1], i.e., linearized (Debye) screening of macroions by microions, which leads to the Yukawa form for effective interactions between macroions. Parameters of non-linear screening of macroions were calculated within the direct Poisson–Boltzmann approximation. Two effects were revealed as a result of such calculations: (1) decomposition of all microions onto two subclasses, free and bound ones, and (2) significant reduction of effective charge Z^* of initial bare macroion Z . The corresponding thermodynamic effects based on the non-linear screening and the resulting reduction of the negative total pressure and negative total compressibility regions are discussed. The work is supported by the Presidium RAS Scientific Program of Fundamental Research "Condensed matted and plasma under high energy density".

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