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Charge ordering in two-dimensional ionic liquids

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Abstract

The structural properties of model two-dimensional (2D) ionic liquids are examined, with a particular focus on the charge ordering process, with the use of computer simulation and integral equation theories. The influence of the logarithmic form of the Coulomb interaction, versus that of a 3D screened interaction form, is analysed. Charge order is found to hold and to be analogous for both interaction models, despite their very different form. The influence of charge ordering in the low density regime is discussed in relation to well known properties of 2D Coulomb fluids, such as the Kosterlitz-Thouless transition and criticality. The present study suggests the existence of a stable thermodynamic labile cluster phase, implying the existence of a liquid-liquid "transition" above the liquid-gas binodal. The liquid-gas and Kosterlitz-Thouless transitions would then take place inside the predicted cluster phase.

1 Introduction

Two-dimensional fluids, although being of academic interest, provide an interesting system to study the influence of fluctuations on the stability of different phases[1], and in particular through the structural properties. Indeed, dimensionality plays a crucial role in the existence and nature of phase transitions[2]. Similarly, dimensionality conditions the form of the Coulomb interaction, through the