Description of the onset and damping of transverse collective excitations in Yukawa plasmas within the self-consistent relaxation theory

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This work is devoted to the development of a theoretical description of transverse collective excitations in liquid state strongly coupled Yukawa plasmas. Liquids are known to be characterized by a constant volume without shape conservation, they can flow. The latter implies that the liquid should lack shear stiffness. However, as a number of experiments show, the presence of shear stiffness is characteristic of liquids on small spatial and temporal scales. This is due, first of all, to the presence of near-order in the arrangement of liquid particles, which leads to the manifestation of quasi-solidification properties. Obviously, these properties will be most pronounced for liquids in states close to the phase transition to the solid state. The paper will present a theoretical formalism that allows us to describe the conditions for the origin and existence of transverse collective excitations in a model Yukawa liquid. The approach is based on the self-consistent relaxation theory of collective dynamics of multiparticle systems. In the framework of the proposed formalism, analytical expressions describing the spectra of transverse collective excitations and the corresponding dispersion characteristics are obtained for the first time for the intermediate screening regimes and near the melting curve. The conditions of onset and damping of quasi-solid-state collective excitations are described.
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