Simple description of collective modes in strongly coupled plasma fluids

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Collective dynamics in strongly coupled plasmas is an important research topic with interdisciplinary relations (e.g. to collective motion in other condensed matter systems). The purpose of this presentation is to introduce a simple analytical approach to the description of collective modes in strongly coupled plasma-related fluids. The approach is based on the quasi-crystalline or quasi-localized charge approximation, which relates wave dispersion relations to the pairwise interaction potential and the equilibrium radial distribution function (RDF), characterizing the fluid structural properties. It turns out that for soft long-ranged interactions occurring in the plasma-related context a simplest model RDF, which takes into account the excluded volume (correlational hole) effect, can be very useful. It allows to obtain simple and elegant analytical expressions for the dispersion relations, which demonstrate good accuracy at long wavelengths. Several examples will be presented, including one-component plasmas in two and three dimensions and weakly screened Yukawa systems (dusty plasmas) in three dimensions. Detailed comparison with the results from numerical simulations will be given. Applications to other systems with soft pairwise interactions will be briefly discussed.

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