

Weak decaying collective-excitation approximation for strongly coupled Coulomb and Yukawa one-component plasmas

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Multiparticle systems with pronounced long-range interactions exhibit the following characteristics in their density fluctuations. The dynamic structure factor of such systems is characterized by the near absence of a central (Rayleigh) peak and consists primarily of side (Brillouin) peaks, which correspond to propagating collective excitations. Simultaneously, high-density systems are also marked by significant interparticle spatial correlations. Consequently, traditional approaches based on the mean field approximation [1] become inapplicable. It was recently demonstrated in [2, 3] that an approach based on self-consistent relaxation theory can yield analytical expressions describing the DSF spectra of strongly coupled Yukawa and Coulomb plasmas across a wide range of wavenumbers. In this paper, we present an algorithm that simplifies the previously obtained expressions for the DSF, describing collective excitations in these systems from the hydrodynamic regime down to scales on the order of the interparticle distance. This new approach is termed the weak decaying collective-excitation approximation.

- [1] Ichimaru S 2004 *Statistical Plasma Physics: v. 1: Basic Principles*. (London.: Westview Press)
- [2] Mokshin A V F I I and Tkachenko I M 2022 *Phys. Rev. E* **105**(2) 025204
- [3] Fairushin I I Mokshin A V 2023 *Phys. Rev. E* **108**(1) 015206