On the problem of a consistent description of kinetic and hydrodynamic processes in dense gases and liquids:
Collective excitations spectrum

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A lot of investigations were devoted to the problem of constructing a consistent description of kinetic and hydrodynamic processes in dense gases, liquids, and plasma. In this study within the framework of consistent description of kinetic and hydrodynamic processes we consider a set of kinetic equations for the potential of interaction of the system presented by the sum of hard spheres potential and a certain smooth one [1]. In this case, we can separate the Enskog-Boltzmann collision integral describing a collision dynamics at short distances from the collision integral of the kinetic equation for the nonequilibrium distribution function. Applying the procedure of projecting onto the moments of the nonequilibrium distribution function we obtained a set of equations for hydrodynamic variables with separated contributions of kinetic and potential energies. Based on this set of equations a spectrum of collective excitations was obtained in the hydrodynamic limit. It contains two transverse diffusive modes, two sound modes as well as heat mode due to heat conductivity. In contrast to [1], it also contains nonhydrodynamic mode because of separated contributions of kinetic and potential parts of energy. We showed that, besides the contribution from the hard spheres potential, modes contain contributions from the long-range part of potential. When a spectrum of collective excitations is known, a whole set of time correlation functions can be investigated.

1. Markiv B.B., Omelyan I.P., Tokarchuk M.V., Condens. Matter Phys., 2012, **15**, 14001.