Polarization features of acoustic waves and Green functions in uniaxial nematic liquid crystals

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In the report the results of investigation of uniaxial nematic liquid crystals with rod-like and disc-like molecules are presented. The work is based on Hamiltonian approach which is characterized by establishment of the set of reduced description parameters, macroscopically full specifying investigated physical systems, Hamiltonian as the function of these parameters and obvious kind of Poisson brackets for the whole set of reduced description parameters. For the adequate description of nematic liquid crystals, besides densities of momentum, entropy and number of particles, additional dynamic parameters are introduced. They are the unit vector of spatial anisotropy (the director) and the conformational degree of freedom (rod length or disc diameter). On the basis of the approach, developed by as, the nonlinear dynamic equations taking into account molecules size and shape are derived. The acoustic spectra of collective excitations for investigated condensed matters are found out and it is shown, that taking into account molecules size and shape leads to the appearance of the second sound already in adiabatic approximation. The polarization features of acoustic waves in considered liquid crystals are investigated. It is clarified, that the first and second sounds are superposition of the longitudinal and transversal components. The nonlinear dynamic equations for the considered liquid crystals with regard to the anisotropy axis and conformational parameter in external alternating field are derived and the kind of sources in the dynamic equations corresponding to this field is determined. The analytic expressions for low-frequency asymptotics of Green functions are obtained. It is clarified, that in this case Bogolyubov theorem does not work, because orbital momentum is not the additive integral of motion and is not the part of the set of reduced description parameters.