Biaxial nematic liquid crystals: Green functions and polarization features of acoustic waves

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In the report the results of investigation of biaxial (with ellipsoidal and discoidal molecules) nematic liquid crystals 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 biaxial nematic liquid crystals, besides densities of momentum, entropy and number of particles, additional dynamic parameters are introduced. They are two unit vectors of spatial anisotropy and three conformational degrees of freedom (lengths of molecule axes and an angle between them). On the basis of the approach, developed by us, 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 one up to three sounds in biaxial nematics already in adiabatic approximation. The polarization features of acoustic waves in considered liquid crystals are investigated. The nonlinear dynamic equations for the considered liquid crystals with regard to the anisotropy axes and conformational parameters 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. Asymptotics of Green functions in the region of small wave vectors and frequencies essentially depend on the character of spatial anisotropy of considered condensed matter.