Low-frequency dynamics of one-dimensional systems with hydrogen bonds

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The frequency dependence of the dynamical susceptibility of the dipole-dipole type of the one-dimensional systems with hydrogen bonds is calculated using the Green's function formalism. The consideration is based on the hard-core boson model. We take into account short-range interactions between particles, and their transport along hydrogen bonds with the two minima local anharmonic potential as well as their inter-bond transfer. Calculations are performed for finite one-dimensional cluster with periodic boundary conditions using exact diagonalization technique. The vibrational spectra are studied depending on the particles (protons) tunneling frequency on the bond; the influence of transfer of particles between the bonds on these spectra is also investigated. The density of vibrational states is found, its frequency dependence is analyzed. In our 1d case we see, however, the absence of behaviour of the soft mode type. Instead of that, the new branch appears; it frequency is determined by energy of repulsion of protons.