Isotope and Disorder Effects in Lattice Dynamics of LiH_xD_{1-x} Mixed Crystals.

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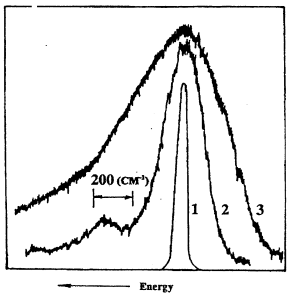
The crystals of LiH_xD_{1-x} has a giant isotope effects both in electron and phonon states. Therefore these crystals are standing on the first place for studying isotope effects in solid state physics [1]. As is well-known isotope substitution offers new possibilities to understand the lattice dynamics and phonon properties in details [1].
Present report is devoted to the vibrational properties of pure LiH and LiH_xD_{1-x} mixed crystals in wide range of the isotope concentration ($0<x<1$). The scattering lines in the Raman spectra of isotopically mixed are not only shifted (the shift of LO lines exceeds 100 cm^{-1}) but are also broadened (see Fig. 2LO(Γ) in LiH (2); 3- LiH_xD_{1-x}).
Phonon frequencies and line widths are influenced by two basic mechanisms, namely anharmonicity and isotope mass disorder. The first is due to phonon decay (two-, three-



and so on processes). The latter contributes to the broadening due to elastic phonon scattering at mass fluctuations. It will be shown that the degree of a change in the scattering potential is different for different isotopic mixed crystals. In the case of Ge (Si) and diamond crystals, phonon scattering is weak which allows one to apply successfully the CPA for describing the shift and broadening lines. In the case of LiH the change in the scattering potential is so strong that it results in phonon localization which is directly observed in experiments [1].
In the report we'll briefly discuss next topics:
1.Dependence of frequencies and width in the Raman lines on isotopic disorder.
2.The restriction of the CPA theory based on the discrepancy between our experimental results and CPA theory.

[1] V.G. Plekhanov, Isotope Effects in Solid State Physics, Academic, NY, 2001.