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Spectroscopic manifestation of the strong nuclear interaction in solids

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It is well - known that the interaction binding quarks into hadrons is called the strong interaction. It holds protons and neutrons together to form nuclei. For the strong interaction, gluons are the exchange particles that couple to the color charge of quarks. There are a common place in modern physics that the strong force does not act on leptons (electrons, positrons, muons and neutrinos). Our experimental results show the violation of this strong conclusions. Up to present time macroscopic manifestation of the strong nuclear interaction are restricted to radioactivity and the release of nuclear energy. Our report is devoted to the description of the significantly new kind manifestation of the strong force. It will be shown that an activation of the strong interaction by adding of one neutron to the nucleus causes the global reconstruction of the macroscopic characteristics of solids. We have studied the low - temperature optical spectra (luminescence -- Fig. 1 and reflection -- Fig. 2) of the $LiH_x D_{1-x}$, $0 \leq 1 \leq 0$ crystals which are differ by term of one neutron from each other. In dielectrics crystals an electron from valence band is excited into the conduction band. The attractive Coulomb potential btween the missing electron in valence band, which can be ragarded as a positively hole, and the electron in conduction band forms exciton which energy E_n=1s $<E_g$ where E_g is the energy of the band - to - band transition. As demonstrated early (see, e.g. [1]) most low - energy electron excitation in LiH (LiD) crystals are large - radius excitons [2]. In experiments we used the samples with clean surface cleaving in the bath of helium cryostat with normal or superfluid liquid helium. Exciton luminescence is observed when studied crystals are excited in the midst of fundamental absorption [3]. The spectrum of free exciton photoluminescence of LiH (LiD) crystals cleaved in superfluid helium consists of narrow phonoless emission line and its broader phonon replicas which arise due to radiative annihilation of excitons with the production of one to five LO phonons (in Fig. 1 it shows only two LO phonons).

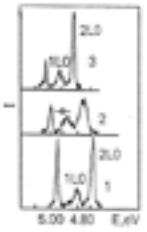

Fig. 1

Fig. 2

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4.V.G. Plekhanov, in, Proceed. ISINN -- 25, Dubna, Russia, 2018 (in Press).

Biography

Vladimir G Plekhanov was graduated Tartu State University in 1968, PhD. (Physics and Mathematics, 1972), Doctor of Science (Physics and Mathematics, 1982). Main interest fields: the origin of the mass (quantization of matter) as well as the experimental manifestation of the strong nuclear interaction in the spectroscopy of solids. He is author approximately 200 publications both in English and Russian. Main books:

1. Isotope Effects in Solid State Physics (Academic Press, San Diego, 2001).
2. Isotope - Based Quantum Information (Springer, Heidelberg, 2012).
3. Isotopes in Condensed Matter (Springer, Heidelberg, 2013).
4. Isotope Effect - Macroscopical Manifestation of the Strong Interaction (Lambert Academic Publishing, Deutschland, 2017) (in Russian).

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