A possible signature of neutron quarks – lepton interaction in solids.

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As is well – known the strong nuclear force is responsible for holding the protons and neutrons together in the nucleus. On the other hand the nucleons are themselves made up of quarks. According quantum chromodynamics (QCD) the force holding quarks together by gluons – mediators of the strong interaction [1]. Our report is devoted to the description of the significantly new mechanism the strong force manifestation. 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 (reflection – Fig. 1 and luminescence – Fig. 2) of the LiH and LiD crystals which are differ by term of one neutron from each other. As demonstrated early (see, e.g. [2]) most low - energy electron excitation in LiH crystals are large - radius excitons [3]. 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 [4]. The spectrum of 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. As an example the picture shows the low - temperature (T 2K) photoluminescence specta of LiH and LiD crystals

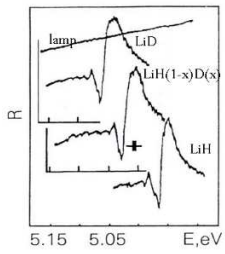

Fig. 1

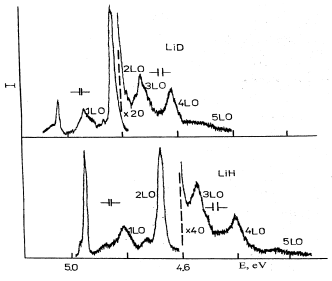

Fig. 2

Comparison the experimental results on the luminescence spectra in the crystals which differ by a one neutron only is allowed to the next conclusion.

At the adding one neutron (using LiD crystals instead LiH ones) is involved the increase exciton energy on 103 meV, (both in reflection and luminescence spectra)

As far as the gravitation, electromagnetic and weak interactions are the same of both kind crystals it only changes the strong interaction therefore a logical conclusion is made that the renormalization of the energy of electromagnetic excitations (excitons, phonons) is carried out by the strong nuclear interaction [5], which caused by quarks – lepton mechanism. The last conclusion indicates the necessity consideration the strong nuclear interaction in quantum electrodynamics (QED).

1. E.M. Henley, A. Garcia, Subatomic Physics (World Scientific, Singapore, 2007).

2. V.G. Plekhanov, Phys. Rev. B54, 2869 - 2877 (1996).

3. R.S. Knox, Theory of Excitons (Academic Press, New York - London, 1963).

4. V.G. Plekhanov, Isotopes in Condensed Matter (Springer, Heidelberg, 2013).

5. V.G. Plekhanov, in, Proceed. ISINN – 25, Dubna, Russia, 2018 (in Press).