Experimental observation of the residual strong nuclear interaction via renormalization of the elementary excitations energy of solids which are differ by one neutron from each other

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Keywords: strong interaction, quarks, gluons, excitons, phonons, quantum chromodynamics and electrodynamics. When nuclear physics developed, two new short – ranged interactions joined to the well – known long – ranged interactions of the gravitational and electromagnetic forces. These are the nuclear force, which acts between nucleons (protons, neutrons) and the weak force which manifests itself in nuclear β – decay. The nuclear force is a result of the residual strong force binding quarks to form protons and neutrons. There are a common place in contemporary physics that the strong force does not act on leptons. Our experimental results show the violation of this strong conclusion. Our report is devoted to the description of the significantly new kind manifestation of the residual strong force. We have studied the low – temperature (2 K) optical spectra (luminescence, reflection and scattering of light) of the LiH and LiD crystals which are differ by term of one neutron from each other. In isolators crystals an electron from valence band (Fig. a) is excited into conduction band. The attractive Coulomb potential between the missing electron in valence band, which can be regarded as a positively hole, and 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 most low – energy electron excitation in LiH (LiD) insulating crystals are large – radius excitons. In our experiments we used the samples with clean surface cleaving the crystals in the bath of helium cryostat with normal or superfluid helium. Free exciton luminescence is observed when studied crystals are excited in the midst of fundamental absorption. The spectrum of free exciton luminescence of LiH (LiD) crystals cleaved in superfluid helium consists of narrow phononless emission line and its broader phonon replicas which arise due to radiative annihilation of excitons with the production of one to five LO phonons. At the adding one neutron (using LiD crystals instead LiH ones) is involved the increase exciton energy on 0.103 eV. As far as the gravitation, electromagnetic and weak interaction are the same of both kind crystals it only changes the residual strong interaction therefore a doubtless conclusion is made that the renormalization of the energy of electromagnetic excitation (excitons, phonons) is carried out by the residual strong nuclear interaction. According to quantum chromodynamics electric – like color forces should be confined inside nucleons given that gluons have their emission and absorption in individual colored quarks. On the other hand, perhaps magnetic – like strong fields are by their very nature difficult to be contained within nucleons and may be could be acting, at least in principle, far beyond nucleon realm.Thus, the direct observation of the residual strong nuclear interaction in the optical spectra of solids open a new avenue in nuclear and elementary particles physics.

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Biography. Professor Vladimir G. Plekhanov was graduated Tartu State University in 1968, Ph. D. (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 mechanism of strong nuclear interaction in the spectroscopy of solids. He is author approximately 200 publications both in English and Russian.

