Non - accelerator measurement of the long - range quark - lepton interactions in solids

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The primary task amongst other nuclear physics fundamental tasks is experimental measuring of nuclear force interacting between nucleons (protons and neutrons) and their dependence on nucleons' distance in between. The discovery of the neutron by Chadwick in 1932 may be viewed as the birth of the strong nuclear interaction. In 1935 Yukawa have tried to develop a theory of nuclear forces. The most important feature Yukawa's forces is that they have a small range ($\sim 10^{-15}$ m). However, up to present time phenomenological Yukawa potential can not be directly verified experimentally. We should remind that the strong nuclear interaction - the heart of the Quantum Chromodynamics (QCD) which is the part of the Standard Model (SM). According to SM the nuclear force is a result of the strong force binding quarks to form protons and neutrons. Residual part of it holds protons and neutrons together to form nuclei. There are common place in nuclear and high energy physics that the strong force does not act on leptons. Our non - accelerator experimental results show the violation of this strong conclusion. Our report is devoted to study the low - temperature 2K (reflection and luminescence) spectra of LiH (E_g=4.992 eV) (without strong interaction in hydrogen nucleus) and LiD (E_g = 5.095 eV) (with strong interaction in deuterium nucleus) single crystals which are different by term of one neutron from each other. The experimental observation of isotope shift (0.103 eV) of the phononless free excitons emission line in LiD crystals is a direct non - accelerator manifestation of the long - range nuclear interaction on the leptons. We must emphasize that LiD crystals have a maximum strong coupling constant α_s, which, according to our estimates, is equal 2.4680. According to the proposed model the main mechanism of the long - range neutron quark - lepton interaction is their magnetic - like long - range interaction. Moreover, we have measured the dependence of the nuclear force on the distance between nucleons in deuterium nucleus, which, as would expect, has a nonlinear character of dependence on distance. Since the isotope effect is a direct manifestation of the mass effect in microphysics, it is natural expect here the origin of mass in Nature. In this regard, we note that the measured appearance of masses in massless fermions in graphene is directly proportional to the energy of interband transitions opened by the isotope effect. The hypothesis of theorists about the emergence of mass due to the self-action of gluons - a kind of cannibalism of gluons - sounds very plausible. Present report continuos to develop between nuclear, high energy and condensed matter physics. The obtained experimental results can open new avenue in nuclear and elementary particles physics.