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The next step in the study of quantum chromodynamics by measuring the dependence of the strong interaction on the distance between nucleons

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In the twentieth century, the atomism became one of the most important principles in physics: matter consists of molecules, a molecule consists of atoms, an atom consists of a nucleus and electrons, a nucleus consists of nucleons (protons and neutrons), a nucleon consists of quarks, the most fundamental constituents of matter. Yet, the energy scale associated with new physics (NP) is unknown and therefore the experimental program for physics beyond Standard Model (SM) should be as broad as possible. Colliders are one of the main tools to study elementary particles and the LHC is pushing forward the energy frontier. A complementary and vital role is played by low energy experiments. In broader context atomic and nuclear physics probes have been used for this goal. In this way the isotope shift optical spectroscopy may probe spin - independent couplings of light bosons fields to electrons and neutrons. The discovery of the neutron by Chadwick in 1932 may be viewed as the birth of the strong nuclear interaction: it indicated that nucleus consists of protons and neutrons and hence the presence of force that holds them together strong enough to counteract the electromagnetic repulsion. In 1935 Yukawa have tried to develop a theory of nuclear forces. The most important feature Yukawa' forces is they have a small range (10 15m). It is well - known that the strong nuclear interaction - the heart of Quantum Chromodynamics (QCD) which is part of the SM. The SM of elementary particle physics presents an elegant and simple description of the interaction between fundamental constituents of nature: leptons and quarks. Following 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 nucleus. There are common place in nuclear and high energy physics that the strong force does not act on leptons. Our report is devoted to study the strong interaction via measuring the low - temperature (2K) photoluminescence spectra of LiH (Eg 4.992 eV) (without strong interaction in hydrogen nucleus) and LiD (Eg 5.095 eV) (with strong interaction in deuterium nucleus) as well as mixed single crystals. The uniqueness of LiH and LiD compounds is that they differ in only one neutron, i.e. lithium ions, electron and proton are the same for them and, therefore they have the same gravitational, weak and electromagnetic interactions. the addition of a neutron to hydrogen nucleus, generates according to Yukawa, a strong interaction between a proton and a neutron, the which effect on electron is manifested in the isotope shift (0.103 eV) of the zero - phonon emission line of free exciton in LiD crystals. We must emphasize that LiD crystals have a maximum strong coupling constant s, which according to our estimates, is equal 2.4680, as well as neutron - electron binding energy equals 0.103 eV

Biography

V.G. Plekhanov has graduated from Tartu State University (Estonia). He obtained Ph.D (physics and mathematics) 1972 as well as Doctor of Science (physics and mathematics) 1982 – both degrees from Tartu State University. He is author more than ten monographs in different field of physics and informatics. Main interest field: the origin of the mass and natuure of the residual strong nuclear interaction as well as science of the new materials