Neutron to be Tightly Bound Proton-Electron Pair and Nucleus to be Constituted by Protons and Internal Electrons

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Abstract: - Original nucleus model in the 1920s was internal electron theory that the atomic nucleus is constituted by protons and electrons, and Rutherford already suggested in 1920 that an electron-proton pair could be bound in a tight state. Both of which were forgotten after the introduction of neutron as a fundamental particle by Heisenberg in 1932 because neither experimental nor theoretical study to prove such orbits were available at that time. I would like to inform the nuclear physics society of the latest experimental data to prove existence of the electron deep orbits(n=0) which bind electron-proton pair because the related experiments are conducted outside the nuclear physics community. One is "the high compressibility of hydrogen" and another is the soft-x-ray spectrum measurements during Cold Fusion, both of which showed the electron transition from n=1 to n=0. The latest experiments revealed that a proton has fine structure on its surface by quarks. Based on this experiments, it is reasonable to employ the tightly bound proton-electron pair in place of neutron, because this model can reasonably explain the characteristics of beta decay of neutron; the conversion of neutron to proton can be explained as it is caused by the emission of electron from the neutron due to the instability of electron at around the protrusion of proton surface due to the proton fine structure, and also the larger electron energy deviation of beta decay electron from neutron can be explained as the broader energy distribution due to the fine structure of proton, which was also observed in the soft-x-ray spectra during Cold Fusion. Thus, I presume that the introduction of neutron as a fundamental particle and change the nucleus model were mistakes and neutral particle found by Chadwick was proton-electron pair in a tight bound state with electron deep orbit and nucleus model that proton and internal electron constitute the nucleus is correct.

Keywords:- *Neutron, Beta Decay, Nucleus Model, Cold Fusion, Low-Energy Nuclear Reaction, Electron Deep Orbit, Coulomb Repulsive Force Shielding, Neutrino.*

I. INTRODUCTION

I would like to inform the nuclear physics society that the experiment to prove Electron Deep Orbit (EDO) because the current nucleus model that protons and neutrons constitute the nucleus is incorrect, and the original model in the 1920s that protons and internal electrons constitute the nucleus is correct judging from the latest experiments.

1. Historical Background

1.1 The nucleus model and neutral particle

A good summary of the history of the neutron is provided in the introductory section of Va'vra's research [1].

In the 1920s, when quantum mechanics was not yet established, there was an internal electron theory that the atomic nucleus is constituted by protons and electrons.

Rutherford suggested in 1920 that an electron and a proton could be bound in a tight state [2]. Rutherford experimentally confirmed the existence of atomic nuclei in 1911 and attracted attention [3]. In a lecture given at the Royal Society of London in 1920 [4], Rutherford predicted that the particles that constitute the nucleus include neutral particles, with almost the same mass as protons in addition to protons. He asked his team, including Chadwick, to search for this atom, and 12 years later, Chadwick discovered neutrons [5,6], as Rutherford expected. In response to their discovery, Dmitri Ivanenko changed his conventional view of the structure of the nucleus, saying, "Only neutrons and protons are in the nucleus and there are no internal electrons" [7].

Heisenberg also supported this, and his trilogy papers "Über den Bau der Atomkerne I-III (About the Structure of the Nucleus 1-3)" [8,9,10], which decided to adopt the current nucleus theory that proton and neutron constitute the nucleus as the basic assumption of the current nucleus model.

However, Dr. Yukawa wrote critically in a memo [11] about Heisenberg's abovementioned papers. He told that "these papers have not denied the internal electron theory but just mentioned that the possibility of protons and neutrons can stabilize the nucleus quantitatively. Therefore, we will have not reached the conclusion until the interaction between the unit particles that constitute the nucleus is revealed."

Although it must have been obvious to Schrödinger, Dirac and Heisenberg, that there is a peculiar solution to their equations, which corresponds to the small hydrogen, was in the end rejected [12], because the wave function is infinite at r = 0. The infinity comes from the Coulomb potential shape, which has the infinity at r = 0; it was a consequence of the assumption that the nucleus is point-like. In addition, nobody has observed a small hydrogen. At that point, the idea of a small hydrogen died.

However, its idea was revived again ~70 years later [13,14], where Maly and Va'vra argued that the proton has a finite size, being formed from quarks and gluons and that the electron experiences a different non-Coulomb potential at a very small radius. In fact, such non-Coulomb potentials are used in relativistic Hartree–Fock calculations for very heavy atoms, where inner-shell electrons are close to the nucleus [15,16]. Maly and Va'vra simply applied a similar idea to the problem of small hydrogen, i.e., they used the Coulomb potential in the Schrödinger and Dirac equations to solve the problem outside the nucleus first, then, they used the above mentioned non-Coulomb potentials in a separate solution for small radius, and then matched the two solutions at a certain radius. Using this method, they retained solutions for small hydrogen, which were previously rejected. They called these new solutions “deep Dirac levels” (or electron deep orbits (EDOs)).

1.2 Beta decay of the neutron

In nuclear physics, beta decay (β-decay) is a type of radioactive decay in which a beta particle (fast, energetic electron or positron) is emitted from an atomic nucleus, transforming the original nuclide to an isobar of that nuclide.

Beta decay is a consequence of the weak force, which is characterized by relatively lengthy decay times.

The study of beta decay provided the first physical evidence for the existence of the neutrino. In both alpha and gamma decay, the resulting alpha or gamma particle has a narrow energy distribution since the particle carries the energy from the difference between the initial and final nuclear states.

In 1914, James Chadwick’s measurements showed that the spectrum was continuous. The distribution of beta particle energies was in apparent contradiction to the law of conservation of energy. If beta decay were simply electron emission, as assumed at the time, then the energy of the emitted electron should have a particular, well-defined value [17]. For beta decay, however, the observed broad distribution of energies suggested that energy is lost in the beta decay process. This spectrum was puzzling for many years.”

A second problem is related to the conservation of angular momentum. Molecular band spectra showed that the nuclear spin of nitrogen-14 is 1 (i.e., equal to the reduced Planck constant); and more generally, that the spin is integral for nuclei of even mass number and half-integral for nuclei of odd mass number. Beta decay leaves the mass number unchanged, so the change of nuclear spin must be an integer. However, the electron spin is 1/2; hence, the angular momentum would not be conserved if beta decay were simply electron emission.”

From 1920 to 1927, Ellis (along with Chadwick et al.) further established that the beta decay spectrum is continuous. In 1933, Ellis and Mott obtained strong evidence that the beta spectrum has an effective upper bound in energy. Now, the problem of how to account for the variability of energy in known beta decay products as well as for the conservation of momentum and angular momentum in the process became acute.

1.3 Neutrinos

In a famous letter written in 1930, Pauli attempted to resolve the beta particle energy conundrum by suggesting that, in addition to electrons and protons, atomic nuclei also contained an extremely light neutral particle. He suggested that this “light neutral particle” was also emitted during beta decay (thus, accounting for the known missing energy, momentum, and angular momentum), but it had simply not yet been observed.

In 1931, Fermi renamed Pauli's “light neutral particle” as “neutrino” (“little neutral one” in Italian). In 1933, Fermi published his landmark theory for beta decay, where he applied the principles of quantum mechanics to matter particles, supposing that they can be created and annihilated, just as the light quanta in atomic transitions. Thus, according to Fermi, neutrinos are created in the beta decay process rather than contained in the nucleus; and the same happens to electrons. The neutrino interaction with the matter was so weak that detecting it proved a severe experimental challenge. Further, indirect evidence of the existence of the neutrino was reported to be obtained by observing the recoil of nuclei that emitted such a particle after absorbing an electron. Neutrinos were believed to be detected directly in 1956 by Cowan and Reines in the Cowan–Reines neutrino experiment [18]. The properties of neutrinos were said to be (with a few minor modifications) as predicted by Pauli and Fermi.”

1.4 non-conservation of parity in weak interaction

In 1956, Lee and Yang noticed that there was no evidence that parity was conserved in weak interactions, and so they postulated that this symmetry might not be preserved by the weak force. They sketched the design for an experiment for testing the conservation of parity in the laboratory [19]. Later that year, Wu et al. conducted the experiment, showing an asymmetrical beta decay of cobalt-60 at cold temperatures that proved that parity is not conserved in beta decay [20]. This surprising result overturned long-held assumptions about parity and the weak force.

Therefore, the remaining problem of how to account for the larger energy deviation of electrons in beta decay became acute.

1.5 Latest situation concerning the electron deep orbit and nuclear physics studies

There are two reasons why the idea of small hydrogen was not theoretically investigated further: (1) experimentally, nobody has found it, and (2) the theory at a small distance from a proton is too complicated.

In the theoretical studies conducted by Va'vra, Meulenberg, Sinha, Paillet, Maly, and Zhang et al. in [13-14], [21-24], the issue at r = 0 was fixed by using a modified Coulomb potential, assuming the positive charge to be distributed uniformly inside the nucleus.

Experimentally EDO was proved in the experiment that Electron transition to EDO was found in the experiment as is discussed in sec 2.2.1, and regarding the complicated theory at a small distance from a proton, Research on the quark property and proton shape is progressing, and this can help to understand the correct nucleus mode as in sec 2.6.1.

II. EXPERIMENTAL EVIDENCE TO PROVE EXISTENCE OF ELECTRON DEEP ORBITS

2.1 High compressibility of the negative hydrogen ion

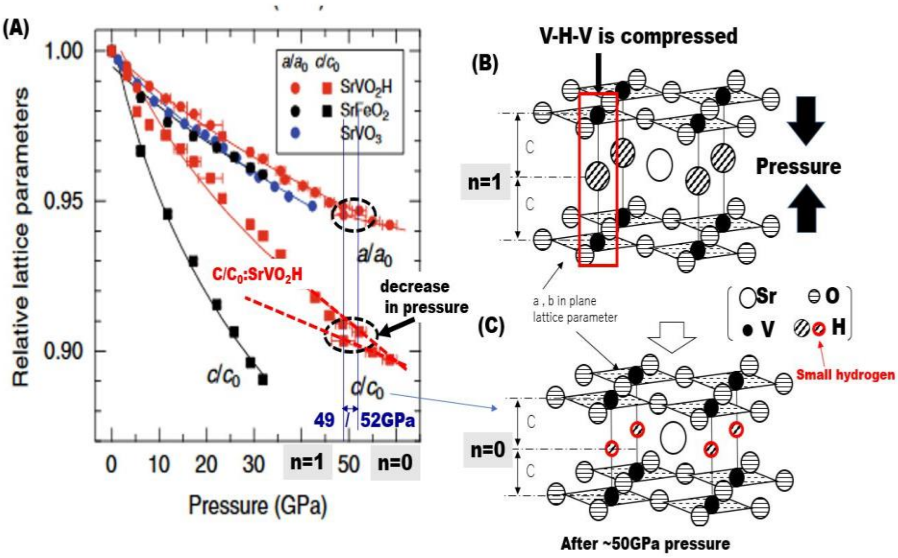

Fig. 1. High-pressure behavior of strontium vanadium oxyhydride ($SrVO_2H$) and strontium iron oxide ($SrFeO_2$), in ref [25].

(A) Pressure dependence of lattice parameters for the experimental (red) and density functional theory-computed (sky blue) values of $SrVO_2H$—note that some error bars are smaller than the width of the symbols. The decrease in pressure from 49 to 52 GPa as the cell volume decreases suggests a phase transition to a denser phase.
(B) Relative lattice parameters, a/a0 and c/c0, of $SrVO_2H$ (red), $SrFeO_2$ (black), and $SrVO_3$ (dark blue) as a function of pressure. The circles and squares correspond to the a and c axes, respectively. The solid lines in b and c represent linearized Birch–Murnaghan fits to the data.
(C) Crystal structures of the perovskite-related materials of $SrVO_2H$ and the mechanical stress direction.
(D) Crystal structures of perovskite-related materials of $SrVO_2H$ after the mechanical stress at 50 GPa, showing the hydrogen to be smaller.

Figure 1 is the engineering research on the property of separator, which is layered $SrVO_2H$ (Strontium Oxyhydride Oxyhydride) by applying pressure to $SrVO_2H$ and the authors have discovered two new properties that are unique to hydroid and found that it plays a role of the thinnest "metal atom separator" in the world.

Figure 1(A) shows the pressure dependence of lattice parameters for the experimental (red) and the density functional theory-computed (sky blue) values of $SrVO_2H$. Note that some error bars are smaller than the width of the symbols. The decrease in pressure from 52 to 49 GPa as the cell volume decreases suggests a phase transition to a denser phase.

In Figure 1(A), a small but distinct anomaly is observed in the plot of lattice parameters vs. pressure just below 50 GPa, the discontinuity in the plot arises because at this point a reduction in the volume of the sample space causes a decrease in the measured pressure, which observation is consistent with a phase transition to a denser state.

As shown above, the authors showed via a high-pressure study of anion-ordered strontium vanadium oxyhydride $SrVO_2H$ that H^- is extraordinarily compressible, and that pressure drives a transition from a Mott insulator to a metal at ~50 GPa.

Figure 1(A) shows that C/C0 became smaller at 50 GPa; hence, the connected hydrogen with the upper and lower layer of SrV_2 became smaller, as is shown in Fig.1(C)-(D).
In other words, electron transitions from H (n = 1) to H (n = 0) by the mechanical pressure from above and below results in a hydrogen with the smaller size.

I presume that this experiment is the direct evidence to prove the existence of the EDO, as discussed in Section 2.3.

In other words, the mechanical stress on the V–H–V bond caused the electron transition from n = 1 to n = 0 (EDO), causing the size of the hydrogen to be smaller. This mechanism of the compression of the bond is common in cold fusion experiments as is explained in Section 2.2.2.

2.2 Low-energy nuclear reaction

2.2.1 Low-energy nuclear reaction mechanism

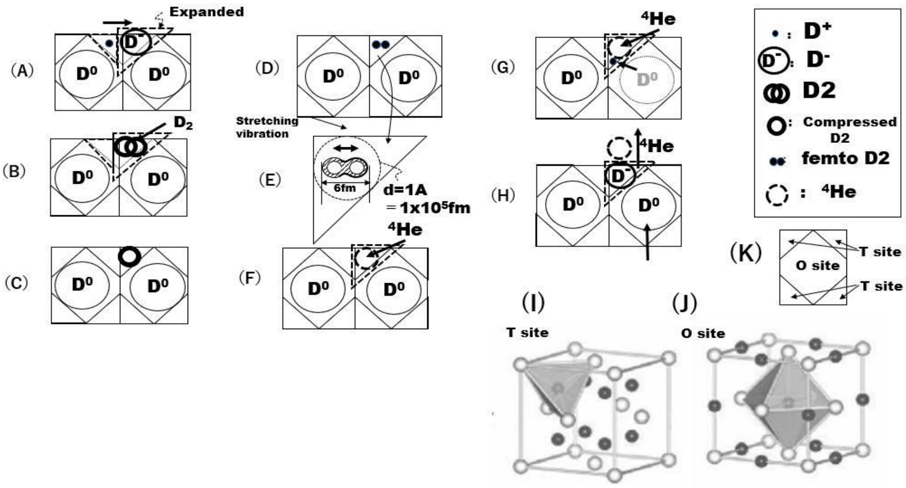

Fig. 2. Proposed cold fusion mechanism.

(A)A negatively charged deuteron (D^-) in a surface T-site and D^+ in the adjacent surface site. D^+ at a surface T-site tends to move toward D^- at a surface T-site.
(B) T-site occupied by D^-, with subsequent formation of D_2 molecule when the D^+ hops to T-site occupied by D^-.
(C) The D_2 is compressed.
(D)-(E) The D_2 transforms into a small D_2 in EDOs based on EDO theory.
(F) ^{4}He forms due to cold fusion.
(G) The ^{4}He is ejected from the metal and another D^- occupies the surface T-site.
(H) D^+ moves into a T-site with ^{4}He and D^- enters there by ejecting the ^{4}He.
(I) T(Tetrahedral)-site of fcc metal.
(J) O(Octahedral) site of fcc metal.
(K) 2-D schematics of the corresponding T, O site.

Figure 2 shows the mechanism of LENR. Firstly, I shall explain briefly the mechanism of LENR in Fig. 2 because I intend to utilize cold fusion studies to prove the existence of the EDO.

A detailed paper describing this process will be published elsewhere; hence, I have summarized the mechanism of low-energy nuclear reaction (LENR) here. As shown in Fig. 2, LENR occurs at the surface spaces of a metallic lattice, which is the T-site. Figure 2(A) shows a negative deuterium (D^-) ion at T-site, which is the narrowest space available for hydrogen storage in the metal. Figure 2(B) shows the creation of a D_2 molecule when a D^+ ion hops to join the D^- ion at the surface T-site. Figure 2(B)-(C) show D_2 being compressed by the mechanical stress exerted by the metal atoms around the T-site, which is the same compression mechanism of the D–D covalent bond as is the compression of V–H–V bond in case of Section 2.2.1. Figure 2(C)-(E) show that the compression of D_2 molecule at the surface T-site causes a transition from normal D (n = 1) atoms to small D atoms with EDO (n = 0) electrons, which can shield the repulsive Coulomb force completely because the EDO is located closer than a few femtometers from the center of d nucleus as shown in Section 2.4 in Fig. 3 and Fig. 4. This final compression step (Fig. 2(B)-(F)) is the most important one, and it occurs during cold fusion in the electron transition in Fig. 2(B)-(F), producing the soft x-ray spectrum in sec. 2.5.

2.2.2 Electron deep orbit shields deuteron–deuteron repulsive Coulomb force

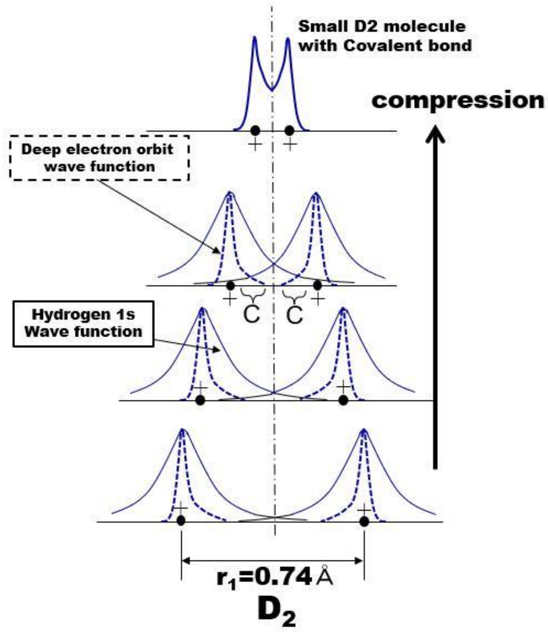

Fig. 3. Mechanism of small atom (molecule) generation by the compression of the deuterium–deuterium bond to enable transition of electron from n = 1 to n = 0.

Figure 3 shows the mechanism of electron transition from n=1 to n=0(EDO) by the compression of D_2 covalent bond. I briefly explain my LENR mechanism based on small hydrogen model based on Fig. 3. I presume that due to compression stress at the surface T-site, a normal D_2 molecule turns into a small D_2 molecule with an EDO by the same mechanism shown in Fig. 1 in Section 2.2.1. The hypothetical structure of a small D_2 molecule is shown in Fig. 2(D), (E). Maly and Va'vra explained that the existence of EDOs was predicted many decades ago from the relativistic Klein–Gordon and Dirac equations [13,14]. The size of a D_2 molecule at a surface T-site is determined by the balance between the compressive stress produced by the lattice of metal atoms and the elastic rebound force of the covalent bond. Due to the nature of the covalent bond, compression can cause the deuteron–deuteron (d–d) distance to decrease along the d–d vibration direction or the covalent bond direction, and compression brings the two ds closer together than the transition distance from n = 1 to n = 0 (EDO) due to less Coulomb repulsive force shielded by electron in EDO, as is shown in Fig. 3, and Fig. 4.

Figure 3 shows the mechanism of LENR based on small D_2 generation by the compression of the d–d bond. When a D_2 molecule is compressed by external pressure, the d–d distance can decrease, and the tail of the D_{1s} wave function can extend sufficiently far inward to overlap with the EDO wave function, which is localized at a distance of a few femtometers from the nucleus. Because the d–d distance is so small, the overlap (region C in Fig. 3) of the wave functions can be large enough to achieve a high tunneling probability of electrons from the D_{1s} state to the EDO (the D_{0s} state). The EDO radius is calculated to be a few femtometers [13,14], which is far smaller than the 0.53 pm Bohr radius of the D_{1s} state.

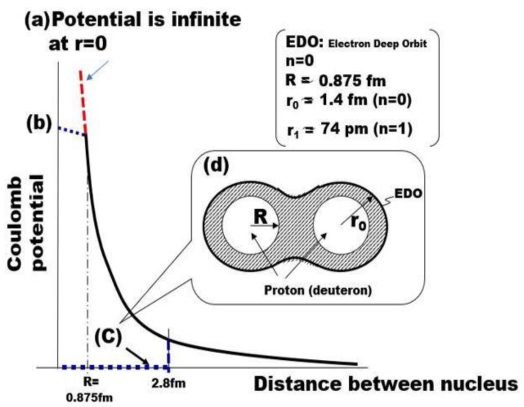

Fig. 4. Mechanism of Coulomb repulsive force shielding to generate small atom (molecule) by compressing the deuterium–deuterium covalent bond.

(a) Coulomb potential at r=0 is infinite due to the point charge assumption
(b) Modified coulomb potential to have uniform distribution of charge inside the nucleus.
(c) Complete Coulomb potential shielding due to the small H_2/D_2 molecules
(d) Schematic small H_2 molecules with covalent bonding to shield coulomb repulsive force; Nota that in case of d, the nucleus is 2 protons and internal electron.

Figure 4 shows the mechanism of complete coulomb potential shielding with small molecule. A small D_2 molecule can be created by the simultaneous transition of both D atoms into small D atoms so that the D_2 molecule can transform into a small D_2 molecule with the covalent electron in the EDO, as shown in Fig. 4(d).

Because the electron in EDO is the relativistic electron and electron n>=1 is the non-relativistic electron, thus, the electron transition probability is very low due to the electron speed difference. For this reason, the nuclear physics study has not found this orbit. However, the compression of the bond can transition electrons to n=0 due to the longer time to keep the distance closer for a long time.

2.3 Soft x-ray spectra from low-energy nuclear reaction

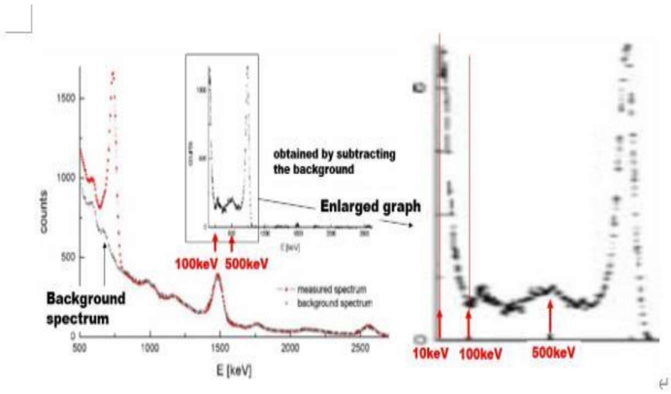

Fig. 5. γ-ray spectrum measured using a sodium iodide scintillator, showing a peak superimposed on the background, in ref [26].

Figure 5 is the soft x-ray spectra from LENR experiment [26] which also prove existence of the EDO. The inserted graph in Fig. 5, obtained by subtracting the background, shows the typical γ-ray structure, which consists of a photoelectric, Compton, and backscattering peak. Many x-ray measurements have been performed to study LENR, and among them, the authors provide clearest information about the energy of the electron orbit; the existence of EDO was proved by the EDO theoretical study by the comparison with the theoretical study of the orbit energy based on EDO theory [13-14] as follows.

The position of the spectral peak can be calculated from the EDO theory, with the following results. The theoretical calculation is currently under study by Va'vra et al., and preliminary results (from private communications) show that the photon energies obtained from the relativistic Schrödinger equation are ~507.27, ~2.486, ~0.497, or 0.213 keV, depending on which transition is involved. From the Dirac equation, the corresponding energies are 509.13, 0.932, 0.311, 0.115, or 0.093 keV, again, depending on which transition is involved.

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The study [25] contains an overview of the experimental activity during the last 12 years. The authors have been studying the nickel–hydrogen system of LENR Reactor at temperatures of approximately 700 K. The experiments have been performed in several laboratories.

As shown in Fig. 5, the soft x-ray spectra have a broad peak at 500 keV and a single sharp peak at around 10keV. These roughly match the theoretical calculations, except that the 500 keV peak is broader than the peak at around 10keV. This indicates that the energy distribution in the deepest orbit is larger than in other orbits. I noticed that this can be related to the proton shape and Coulomb force can be different from the conventional orbit (n = 1), as is mentioned by Vavra [1] and Yukawa [11].

III. SHAPE OF THE PROTON

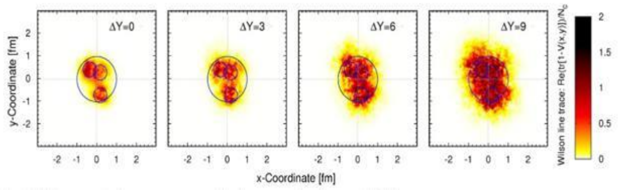

Fig. 6. Shape of the proton at high energies in ref [27]

Figure 6 is the shape of proton study in ref [27]. The different panels (dY = 0 to dY = 9) in Fig. 6 show a contour plot of the real part of the trace of the Wilson line as a function of the transverse coordinates x and y. The small (large) circles show the position and size of the three constituent quarks (the proton).

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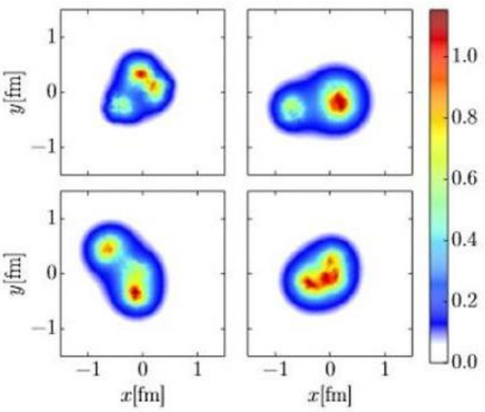

Fig. 7. Four configurations of the proton in the X–Y plane in ref [28].

The Figure 7 also shows the proton shape of non-true spheric shape with the protrusions by quarks. and several other reports on the shape of the proton show that the proton shape can reflect the effects of the three quarks on the proton shape under the experimental condition, and I think that proton can have the protrusions on the surface in the stationary state. Thus, I have discussed the effects of these protrusions on the EDO energy qualitatively in the next section.

IV. ELECTRON ENERGY IN THE DEEPEST ELECTRON ORBIT BASED ON THE SHAPE OF THE PROTON

We have evidence for the existence of the EDO obtained from matching the soft x-ray peak to the theoretical calculations. More importantly, the spectra at the deepest energies have broader peaks in the deepest orbits. Thus, I will interpret this experiment and soft-x-ray experiment based on the original nucleus model in sec 4.1.

4.1 Electron energy in the deepest electron orbit based on the shape of the proton

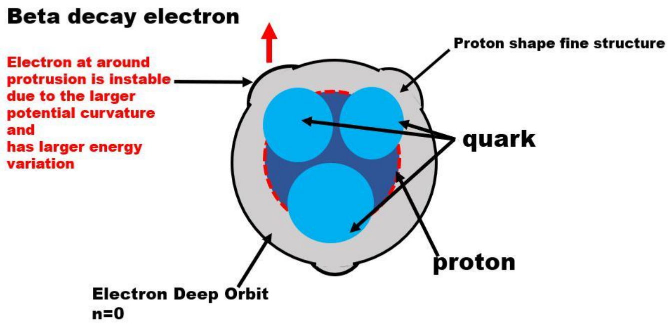

Fig. 8 Schematic illustration of the tightly bound electron–proton pair, which has a fine structure owing to three quarks causing deviations in the electron deep orbit and the energy distribution of beta decay.

Figure 8 shows a schematic illustration of a tightly bounded proton–electron pair, with an electron in the EDO, which is now believed to be a neutron. From this illustration, the electron appears to be unstable at the protrusions of the proton, and the energy deviations due to these protrusions must be very large, so an isolated particle can easily undergo beta decay.

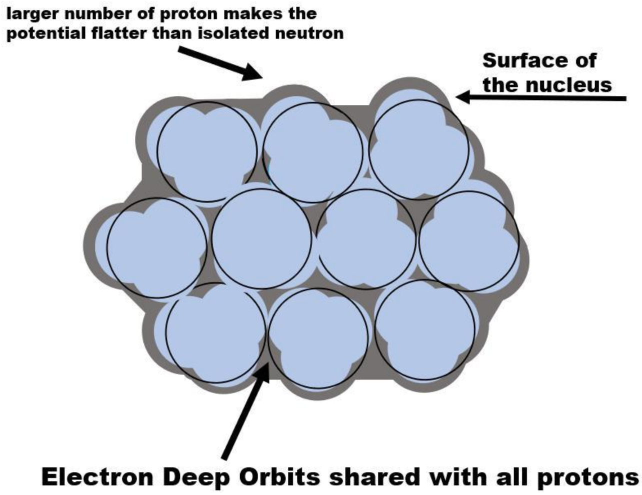

Fig. 9. Model of a nucleus composed of protons with electron deep orbits.

Figure 9 is the correct nucleus model that the proton and internal electron constitute the nucleus and internal electrons are in the shared Electron deep orbit. Because the new nucleus model is too complicated to be proven theoretically, so I have just discussed it quantitatively.

In this model, a nucleus is composed solely of protons accompanied by EDOs, together with some electrons occupying the EDOs. The total charge is, thus, equal to the total number of protons minus the total number of electrons. The EDOs are shared with adjacent protons via the contact region between protons.

Inside the nucleus, the protrusions of the protons are covered by the EDOs of protons and the surface potential around the nucleus is smoother and flatter than an isolated proton with an EDO. Thus, I presume that an isolated proton with an EDO has a much larger possibility of beta decay because, at a protrusion, an electron can be unstable as is shown in Fig. 8.

In summary, I presume that the very wide electron energy distribution during beta decay is caused by a proton for which an EDO electron encounters a protrusion on the surface of the proton. This leads to large energy deviations, as observed in the 500 keV soft x-ray peak during cold fusion experiments in Fig. 5.

Figure 9 shows the nucleus model based on the previous model at the time of Rutherford, after considering the studies of the EDO and proton shape. From the schematic illustrations, a larger nucleus can experience less impact from the proton protrusions on the Coulomb potential because of the flatter surface of the nucleus. Thus, the smaller isolated proton with an electron in an EDO at the location of protrusion can have a larger impact on the Coulomb potential as is shown in Fig. 8 and Fig. 9. If so, the beta decay electron has very large energy distribution from the location at the protrusion, and it can be instable for the isolated proton with an electron in the EDO.

V. PROPOSITION TO THE PHYSICS COMMUNITY

5.1 Discussion on the correct nucleus model and correct "neutron" model.

As explained in the historical background section, at the time of the decision to introduce a neutron, we had no experimental data on EDO and no theoretical study to verify EDO, hence, a neutron as a fundamental particle was introduced and a neutrino was introduced to explain the very large electron energy distribution of the beta decay electron. However, we have solid experimental data to prove the EDO, the theoretical study to show the possibility to have the EDO, and the deep knowledge on the nucleus of quarks, which affects the proton's shape and affects the phenomena of nuclear physics. Now is the time to resume the discussion on the correct nucleus model by the nuclear physics community. Thus, I would like to propose the theoretical study of this nucleus model in Fig. 9 to predict the stability of the nucleus (magic number etc.) and study the feature of beta decay of isolated neutron in Fig. 8 to predict the beta decay feature based on QED Simulation with relativistic Shroedinger equation.

The mechanism of cold fusion (LENR) is based on EDO, so the physics community needs to change the nucleus model first and introduce the EDO theory to be the standard theory.

5.2 Contemplation about neutrinos

A neutrino was introduced to explain the very large energy distribution of the beta decay electron. However, a tightly bound proton-electron pair can explain the broader electron energy distribution of beta decay which was observed in the soft-x-ray spectra during LENR, thus I presume that neutrinos do not exist in the sense that the neutrino hypothesis does not hold.

Lots of experiments believed to have discovered neutrino should be revalidated based on the condition that the neutrino hypothesis does not hold. Because there is no doubt that the experiment was done properly, the experiments can have discovered unknown elementary particles or the experiments can be explained based on known phenomena.

VI. SUMMARY

I have shown the experimental evidence of an EDO based on and the high compressibility of the hydrogen study, soft-x-ray study, and high compressibility of hydrogen study combined with the theoretical study on EDO.

I showed that these experiments prove that EDO exists, and neutral particle is tightly bound proton-electron pair, it explains the mechanism of beta decay and its electron has very large energy distribution based on the latest study of proton shape shows that the proton shape has the protrusion caused by three quarks. Thus, I presume that neutral particle found by Chadwick is tightly bound proton-electron pair, and the nucleus model that proton and internal electron constitute the nucleus is correct.

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