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LENR mechanism based on femto-D₂

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LENR mechanism based on femto-D₂

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I. Abstract

Cold Fusion is caused by the femto-D₂ which covalent electron is in the deep electron orbit, deeper than n=1 orbit at a few femto meters from the nucleus. Femto-D₂ is created by the compression of D₂ at the reaction site on the surface with nano-roughness of FCC metal. Because inside the reaction site is negatively charged, D⁺ is attracted and occupies the T site, to be D⁻, and another D⁺ is attracted by D⁻ to join to be D₂ at the reaction site. D₂ is compressed by the surrounding metal atoms of the reaction site, and electron of n=1 transition to deep orbit to be femto-D₂.

Because the electron deep orbit is at a few femto meters from the nucleus, covalent electron between d-d of femto-D₂ can shield the coulomb repulsive force between d-d to cause Cold Fusion. With D₂ gas loading into FCC metal, femto-D₂ is created at the grain boundary of metal.

With loading H₂ into Pd by transmutation reactor developed by Dr. Ohmasa, femto-H₂ is generated in grain boundary of Pd. Because femto-H₂ is neutral, it can transmute the target element and it increase the atomic number of 2 because femto-H₂ has two protons. Transmutation reactor transmute ¹⁶₈O in H₂O to be ¹⁸₈O, which was experimentally probed by Mass analysis, with ¹⁸₈O peak and ¹⁸₈O clusters by adding two protons and atomic number reduction by electron capture to stabilize the nucleus. and engineering research on the film compression shows that hydrogen is compressive and to be smaller hydrogen. These studies have clearly prove the existence of deep orbit predicted theoretically know as a Deep Dirac Level.

LENR experiment to transmute with femto-D₂ shows that atomic number increase is 4 by adding two ds, which indicates that d has two charges, which contradicts the current standard nucleus model that d is constituted by proton and neutron. Therefore, the current nucleus model is incorrect and the nucleus is constituted only by protons and internal electrons, which is the original model before the introduction of neutrons.

The experiment of soft-X-ray emission during LENR shows that energy distribution at 500keV is very broad, which is the transition from n=1 to Deep Dirac Level (Deep Electron Orbit) because the coulomb potential between the vibrating quarks and electron in deep orbit can have the very broad energy distribution and its electron is unstable due to the vibrating coulomb potential. Therefore, neutrinos do not exist in a sense that fermi hypo is incorrect and are new particles.

Because current standard model that proton is constituted by 2 up quarks and one down quark, and “neutron” has one up quark and 2 down quarks, however “neutron” must have the same quark constitution as proton. I presumed that experiment by CERN was incorrect, and because the impact of LENR mechanism on physics is huge, CERN and Governments should rerun experiment to correct the incorrect nuclear physics and prove the LENR mechanism.

II. Mechanism of LENR

A) Expandable T site to generate Femto-D₂

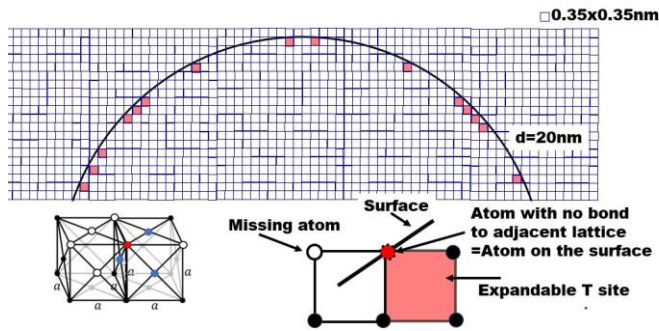


Fig.1 Expandable T site of FCC metal

LENR occurs on the metal surface with nano-roughness and metal has FCC lattice structure surface. Fig.1 shows the cross-section of the atoms on the surface with $d=20\text{nm}$ spherical surface to understand the feature of LENR. FCC lattice has T site (corner of FCC lattice) and O site (center in FCC lattice) and on the surface T site has the vertex atom which has no bond to the adjacent lattice. The atom can be moved outward to be expanded in case that D occupied at that T site. I call it expandable T site, which is the reaction site of LENR.

B) Femto-D₂ causes LENR by compression of d-d bond

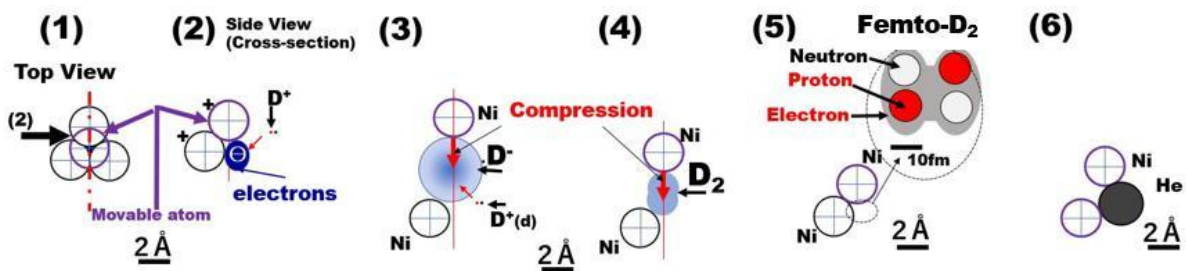


Fig.2 Mechanism of LENR by compression of D-D bond to generate femto-D₂

As is shown in Fig.2(2)-(3), D^+ occupies the expandable T site due to the attraction by its negative charge, and to be D^- , which expands T site as is shown in Fig.2(3), and attract another D^+ to join to be D_2 at the expandable T site shown in Fig.2(3)-(4). The compression of D-D bond shown in Fig.2(4) causes the transition of covalent electron of $n=1$ to deep electron orbit deeper than $n=1$. Because the electron density of deep electron orbit between d-d is so high that it shields coulomb repulsive force between d-d to cause fusion of $D+D=^4\text{He}+24\text{MeV}$, which is called Cold Fusion (LENR).

C) Mechanism of transmutation with Femto-H₂

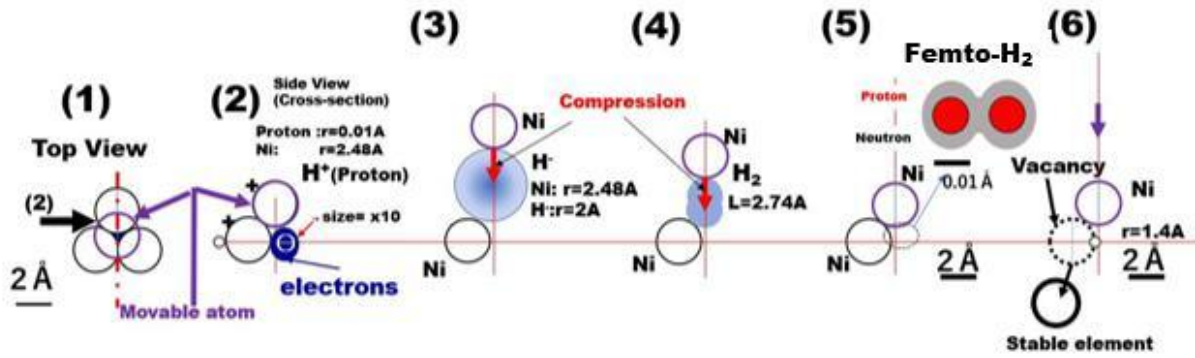


Fig.3 mechanism of femto-H₂ creation

As is shown in Fig.3, in case of H₂ gas loaded in positive Pd, femto-H₂ is generated which electron is so close to the nucleus femto-H₂ act as a neutral particle, which can transmute the surrounding metal atoms.

D) Electron Deep Orbit Theory

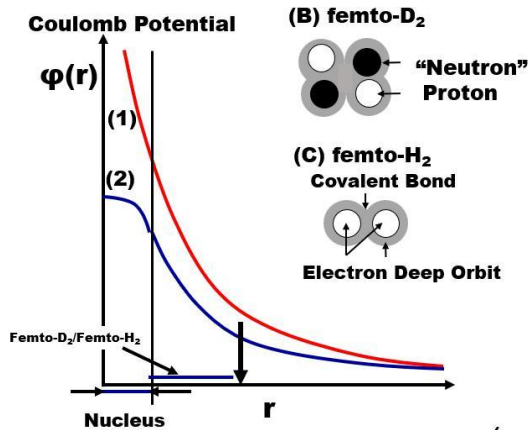


Fig.4 Modified Coulomb potential to prove electron deep orbit theoretically, and femto-D₂ and femtoH₂ coulomb potential.

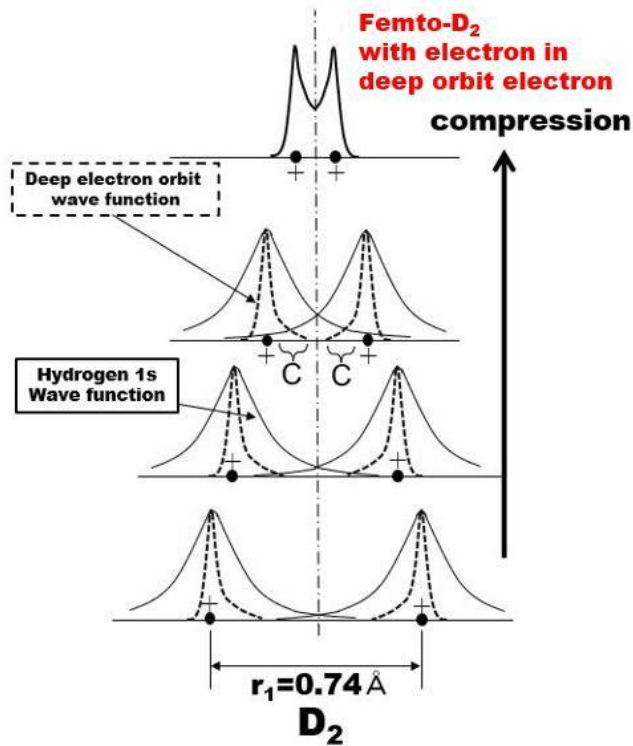


Fig.5 Compression of D-D bond transition D_2 to be femto- D_2 .

Maly and Vávra ELECTRON TRANSITIONS

TABLE I.A
Relativistic Schrödinger Levels for Hydrogen ($Z = 1$)*

	$E(N, Z)$	N	M	L	E_{1S}	E_{2S}
1s	-13.605826	1	0	0	-13.606597	-507 271.937500
2p	-3.501457	2	0	1	-3.401449	-13.605632*
2s	-3.401457	2	1	0	-3.401570	-13.603699
3d	-1.511759	3	0	2	-1.511747	-3.401425*
3p	-1.511759	3	1	1	-1.511755	-509 755.250000
3s	-1.511759	3	2	0	-1.511790	-3.401207
4f	-1.511764	4	0	3	-0.850357	-1.511744*
4d	-0.850364	4	1	2	-0.850358	-13.605434*
4p	-0.850364	4	2	1	-0.850361	-13.604666
4s	-0.850364	4	3	0	-0.850376	-1.511683
5g	-0.850364	5	0	4	-0.544228	-0.850356*
5f	-0.544233	5	1	3	-0.544228	-3.401415*
5d	-0.544233	5	2	2	-0.544229	-510 264.468750
5p	-0.544233	5	3	1	-0.544231	-3.401328
5s	-0.544233	5	4	0	-0.544238	-0.850331
6h	-0.544233	6	0	5	-0.377936	-0.544228*
6g	-0.377940	6	1	4	-0.377936	-1.511743*
6f	-0.377940	6	2	3	-0.377936	-13.605356*
6d	-0.377940	6	3	2	-0.377937	-13.604863
6p	-0.377940	6	4	1	-0.377938	-1.511719
6s	-0.377940	6	5	0	-0.377942	-0.544215

*In electron volts.

*Negative energy states, not observable.

Fig.6 Theoretical study of electron deep orbit

Deep Electron Orbit (Deep Dirac Level) has been proved by theoretical studies in ref [1],[2] and [3], and as is shown in Fig.6. J. Maly, J. Vávra solved the relativistic Schrodinger equation with modified Coulomb potential as is shown in Fig4(2) because point charge hypo has solution with diverged wave function.

The numeric simulation of energy is shown in Fig.6, which clearly shows the deeper orbit having around -500keV energy level.

E) Compressive hydrogen study to prove the existence of deep orbit [4]

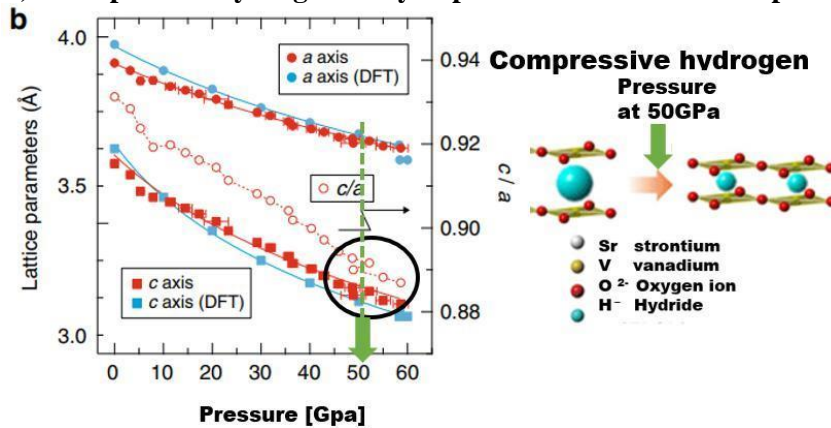


Fig 7 High-Pressure behavior of SrVO₂H and SrFeO

In ref [4] is the study of the compression of SrVO₂H film to be compressed by very high pressure (50 GPa). Fig. 7 shows the stress dependence of lattice parameters for the experimental (red) and the DFT-computed (sky blue) values of SrVO₂H – note that some error bars are smaller than the width of the symbols. The decrease in stress from 52 GPa to 49 GPa as the cell volume decreases suggests a phase transition to a denser phase.

This compressive hydrogen research is the direct evidence that EDO exists. Based on this research, I hypothesized the small Hydrogen molecule (femto-H₂ and femto-D₂) exists, and hypothesized the mechanism of cold fusion as is explained in sec II.

III. Mechanism of hydrogen embrittlement

A) low temperature hydrogen embrittlement by Volumetric expansion at grain boundary

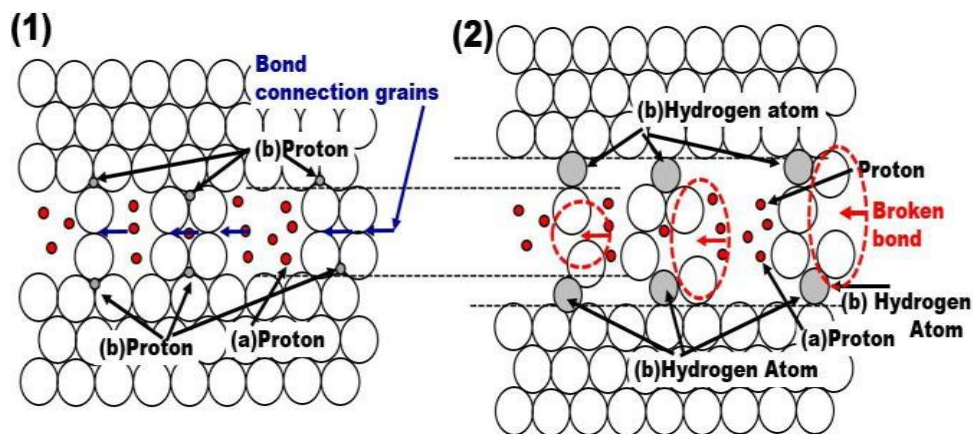


Fig.8 Mechanism of low temperature hydrogen embrittlement by volumetric expansion at grain boundary

I reported on the mechanism of hydrogen embrittlement based on LENR mechanism in ref [5].

Because of the positive metal potential, hydrogen becomes proton (H⁺), which segregates at grain boundary which has a lot of reaction sites of LENR. As is shown in Fig.8(1), and proton is captured by negatively charged expandable T site to be H⁻, which size is by far larger than T site space to expand grain boundary as is shown in Fig.8(2), and creates the stress to cause hydrogen embrittlement by volumetric expansion at the grain boundary.

The latest research in ref [6] proves the low temperature hydrogen embrittlement is caused by grain boundary.

A research group of Kenichi Takai et al developed a new test method to reproduce fracture surfaces similar to actual fracture in the laboratory, and clarified the fractured surface is the grain boundary surface, which is consistent with the mechanism of volumetric expansion at grain boundary.

B) High temperature hydrogen environmental embrittlement by transmutation with femto-H₂

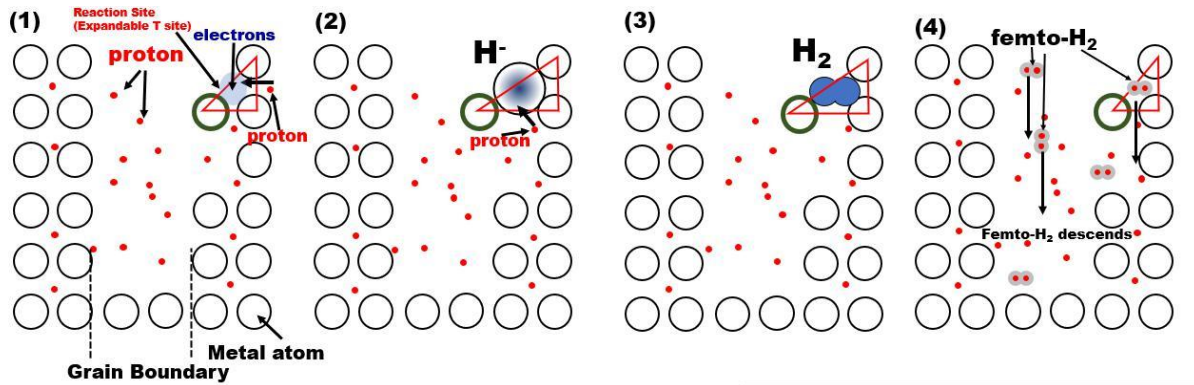


Fig.9 Mechanism of high temperature hydrogen embrittlement (transmutation with femto-H₂)

High temperature hydrogen embrittlement occurs during the manufacturing process of metals at ~700 degree.

And based on LENR Mechanism, at high temperature, generated femto-H₂ can transmute the surrounding metal atoms which lattice vibration is so high to have collision between metal nucleus and femto-H₂.

IV. Transmutation Experiment by femto-D₂

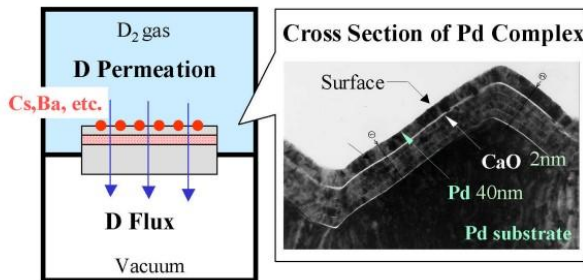
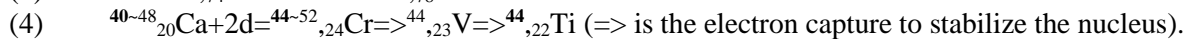
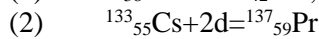
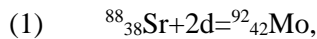


Fig.10 Transmutation Experiment by Iwamura [7]

Transmutation experiment of the stacked structure of target metal/Pd at 70degree to prevent cold fusion is reported in ref [7]. Transmutation is with femto-D₂, adding two ds to the target metal. The transmutation reactions below. Note that atomic number difference is 4 as in reported in ref [5].



Because all of the experiment above show that increase of atomic number is 4, d has two charges, showing that d is constituted only by 2 protons and 1 internal electron.

These results contradict the current nucleus model, and neutron model, and are consistent with the nucleus model prior to neutron introduction. Thus, current nucleus model is incorrect, in ref [8] and is explained in sec XII.

V. Transmutation Reactor developed by Dr. Ohmasa

A) Gas generated by transmutation reactor

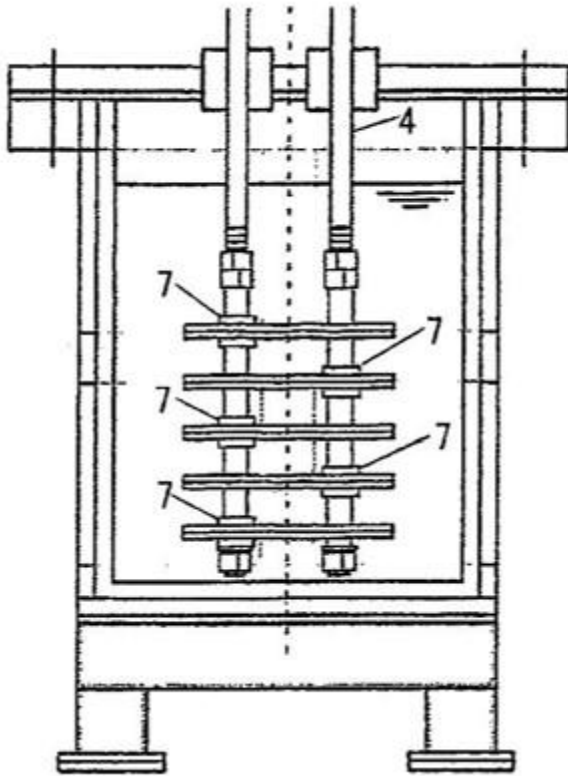


Fig.11 Transmutation Reactor by Dr. OHMASA in ref [9]

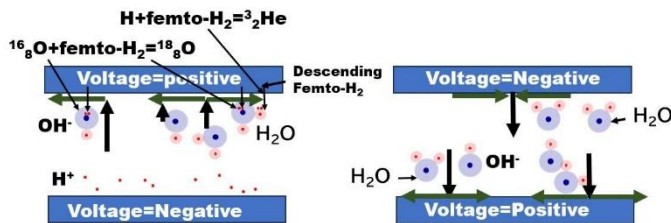


Fig.12 Brown Gas generation by transmutation reactor with positive pulsed Voltage

I reported in ref [10] that femto-H₂ exists probed by transmutation experiments by Dr Ohmasa with the mass analysis of the gas produced by his transmutation reactor.

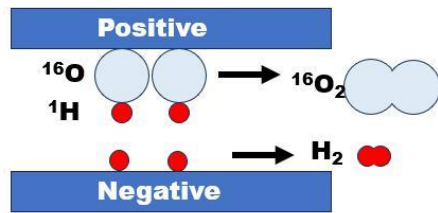
Dr. Ohmasa invented transmutation reactor to transmute tritium from Fukushima nuclear power plant,

and I discovered the mechanism of transmutation with femto-H₂ generated in metal by loading H from water by electrolysis, and it transmute ¹⁶₈O in H₂O to be ¹⁸₈O and T in T₂O or THO to be helium-4. In fig.13, Lateral metal plate vibrates vertically to move H₂O between the plates. During the plates moves downward, H₂O moves along the upper plate to cause transmutation with femto-H₂ descending from the grain-boundary.

B) Mass analysis of Brown gas generated by transmutation reactor developed by Dr. Ohmasa

Ohmasa did the experiment to produce brown gas and I reported the mechanism of brown gas generation in ref [11].

(1) H₂ and O₂ generation



(2) Atomic O-18 and O-18 cluster generation

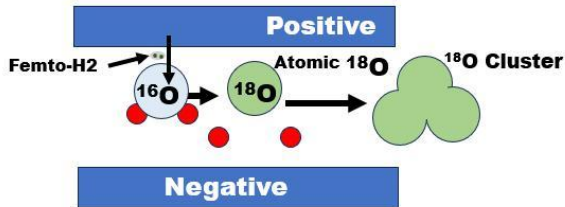


Fig.13 Mechanism of atomic oxygen-18 and oxygen-18 cluster generation

By the transmutation of oxygen-16, O-H bond break and oxygen-16 is transmuted to atomic oxygen-18, and they cluster.

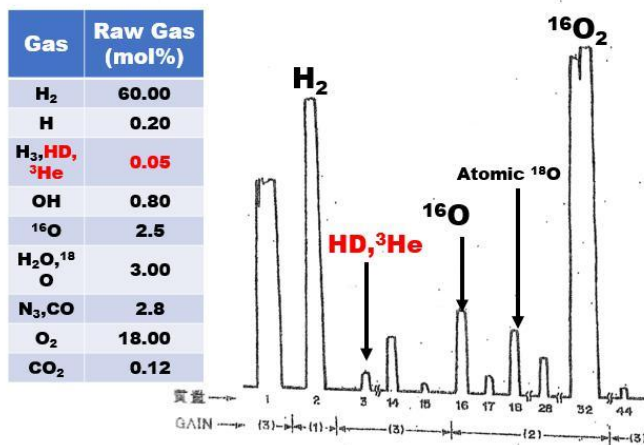
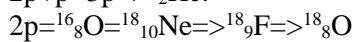
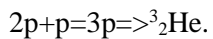


Fig.14 ICP-MS histogram of gas generated by transmutation reactor

Dr. Ohmasa shows the mass analysis spectra which has mass=18 peak and cluster of mass=18, which is atomic ¹⁸O and ¹⁸O clusters in ref [12].

Based on transmutation with femto-H₂, the following fusion reaction occurs based on its mechanism.



=> is electron capture

As is shown in Fig.16, mass=18 exists, which is impossible mass numbers by conventional electrolysis, however mass=3 is not clear in Fig.16 by conventional ICP-MS due to the interfering ions of HD.

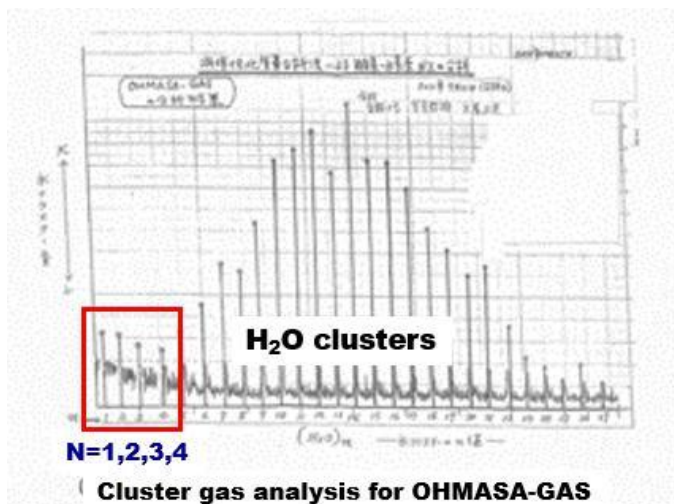


Fig.15 Cluster gas analysis of OHMASA GAS in ref [11]

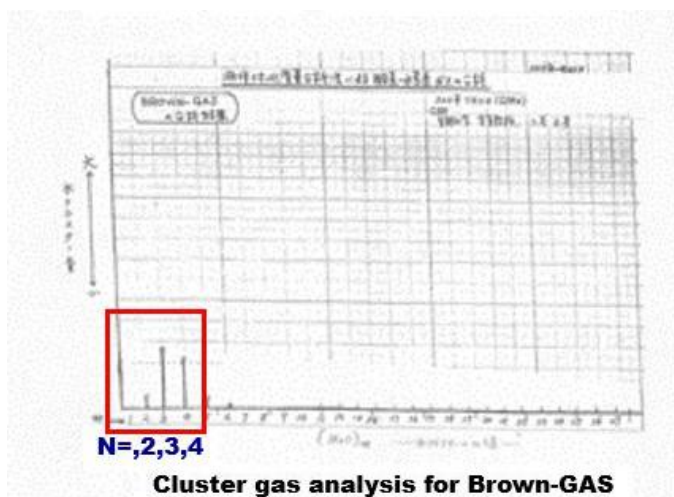


Fig.16 Cluster gas analysis of OHMASA GAS in ref [11]

Since Ohmasa has not understood the difference between OHMASA GAS and Brown Gas. OHMASA GAS generated by conventional electrolyzer by stirring H₂O to improve electrolysis rate is conventional H₂/O₂ mixed gas (HHO gas or OHMASA Gas). Gas generated by transmutation reactor is Brown gas, which mechanism is similar; both vibrates H₂O between metal plates as is shown in Fig.12. For Brown gas is generated by the transmutation of H₂O by the vibration of H₂O between the metal plate by applying an AC voltage between the electrodes.

Dr. Ohmasa claims that upper mass histogram in Fig8 and Fig.7 are Ohmasa Gas. However, it must be brown gas based on authors mechanism of transmutation.

Note that Brown gas has no H₂O cluster because Ohmasa's Transmutation reactor vibrates the entire water in the tank, gas contains moisture, which was detected in upper mass histogram in Fig.11, and no H₂O cluster in Brown gas and both has oxygen-18 clusters with cluster number is 2,3,4.

Dr. Ohmasa generated brown gas in his transmutation reactor with pulsed voltage and its Brown gas contains (mass=18)_n; cluster(n=2,3,4) by mass analysis in Fig.14,15,16, which probes that femto-H₂ exists.

VI. Poor reproducibility of Cold Fusion Experiment

A) Incorrect setting of metal potential by FPE experiment

I reported the mechanism of Cold Fusion (LENR) in ref [12].

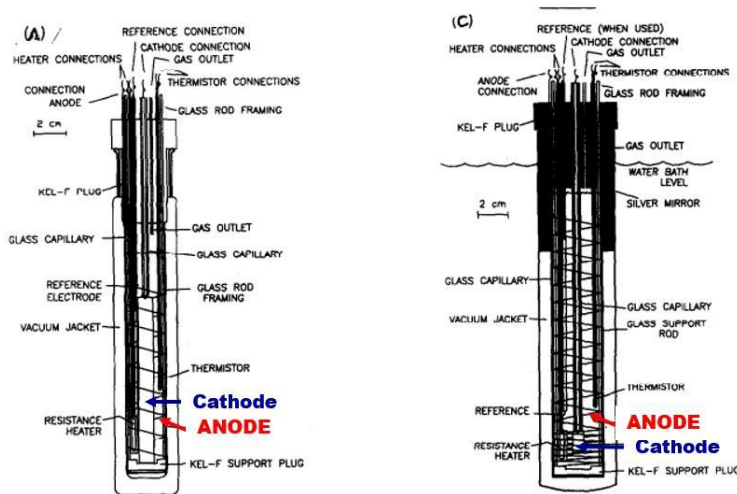


Fig.17 Original setting of Cold Fusion in strong alkaline D2O in ref [13]

Original setting of LENR in D2O is in ref[13], and I reported the incorrect setting of LENR experiment in strong alkaline D2O in ref [14].

In LiOD/D₂O Electrochemical Cells, LiOH (s)+D₂O=Li(aq)+OD (aq), thus it is strongly alkaline. Therefore, Pd need to be positive to load D⁻ into Pd, however it is almost impossible to trigger Cold Fusion due to very small amount of D loaded in Pd with smaller amount of [D⁺]. This causes the very low reproducibility of experiment and need very long time to load D into Pd under the Pd is positive.

B) Cause of trigger of LENR in strong alkaline D₂O of FPE

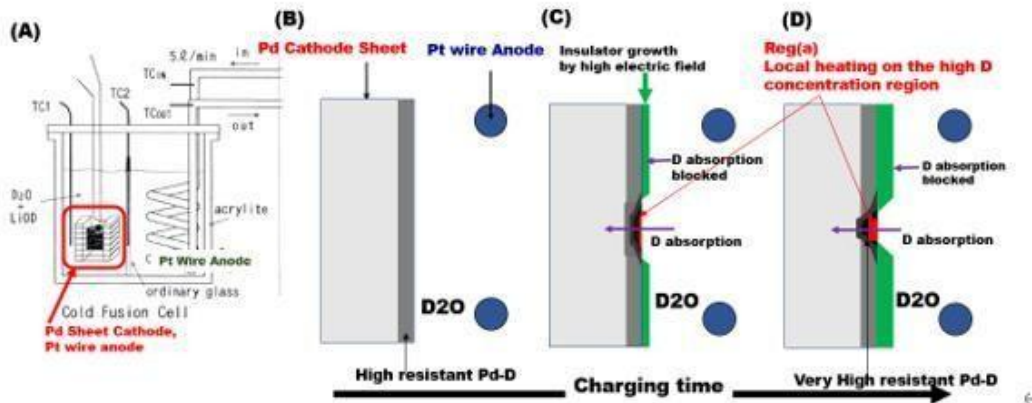


Fig.18 mechanism of trigger Cold Fusion by local heating due to Pt wire and Pd with negative voltage [15]

As is reported above, although it takes very long time to load D into negative Pd rod due to very low D⁺ I reported the mechanism of LENR triggering in ref [15]. LENR occurs with heat burst in Fig.17, indicating that LENR can be triggered. Thus, I discovered the mechanism of triggering LENR in Fig.18 under the incorrect setting in Fig.17.

The original report of LENR mentioned that insulator grows on the negative metal surface during the electrolysis by the strong electric field in H₂O. Thus, based on this information I discovered the mechanism of the trigger reported in Fig.18.

Counter electrode of electrolysis is Pt wire with positive potential and Pd rod is surrounded by Pt wire, thus electric filed on the surface of Pd Rod is inhomogeneous, and it has the stripped insulating film on Pd rod surface as is shown in Fig.18, which cut the current path of OD^- , and by the feedback of voltage to maintain the constant current, voltage increased and the current concentration on the opening area of the Pd surface can be heated locally to increase the local temperature to trigger LENR.

VII. Helium-3 in plasma fusion

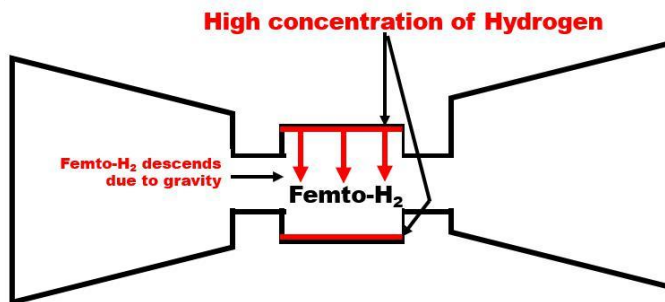
A) Helium-3 exists in HELION's plasma fusion reactor

HELION's helium-3 fusion reactor is different from conventional fusion reactor. I reported the mechanism to generate helium-3 in Helion's helium-3 plasma fusion reactor based on femto-H₂ transmutation, which I reported in ref [16].

Transmutation reaction below generate helium-3 in their fusion reactor.

Femto-H₂+proton=³Li=>³He (=> electron capture)

HELION's fusion reactor operates in pulsed mode without igniting the plasma, unlike conventional fusion reactors. This approach facilitates the construction and operation of fusion reactors, including installation in standard containers. Since this fusion reactor generates electricity through induction by the interaction of the plasma magnetic field and magnets, damage to the inner wall by high-energy protons should have been reduced.



Plasma accelerator

Fig.19 Hydrogen embrittled wall of plasma fusion reactor [16]

The presence of helium-3 in the plasma fusion reactor is recognized as a publicly known fact, and the author reported the mechanism in ref [16]. Author thinks that the cause is by the mechanism of helium-3 generation can be explained by the fusion of femto-H₂ molecules to proton and deuteron based on Cold Fusion mechanism. Because high energy H plasma loads H into the metal on the reactor surface to generate femto-H₂, which descends by the gravity into the reactor, and femto-H₂ fuses to high temperature proton plasma-H₂. **Conceptualized helium-3 generator with femto-H₂**

B) Conceptualized Helium-3 generator

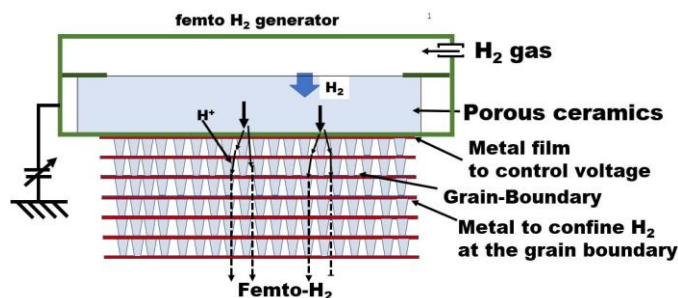


Fig.20 Femto-H₂ generator with polycrystalline metal stacks

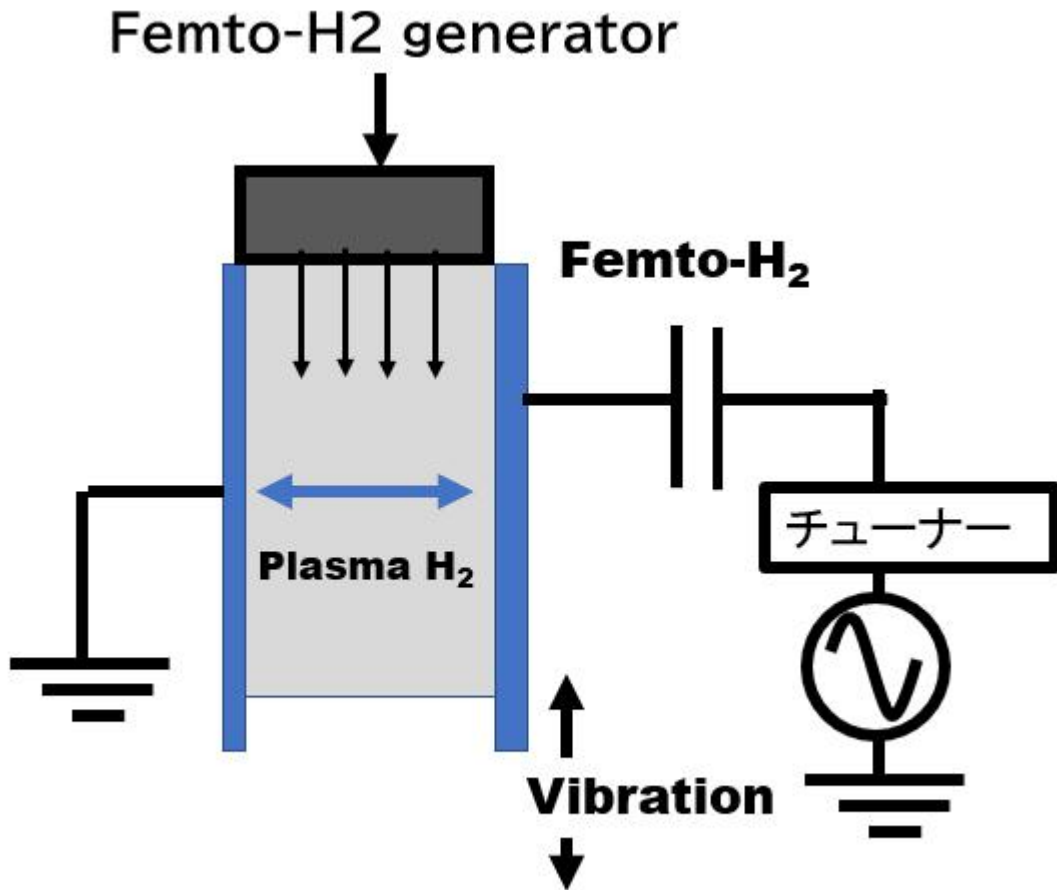


Fig.21 Helium-3 generator in high temperature hydrogen plasma with femto-H₂ generator

Although Helium-3 is needed to cold down quantum computer, however supply of helium-3 is declining. Helium-3 plasma fusion also requires a method to produce helium-3 inside the reactor. Therefore, author proposed to develop helium-3 prouder equipped with femto-H₂ producer as is shown in Fig.20, and Fig.21. for helium-3 plasma fusion reactor to have femto-H₂ generator inside the top side of the reactor.

VIII. Transmutation heat generator by clean planet

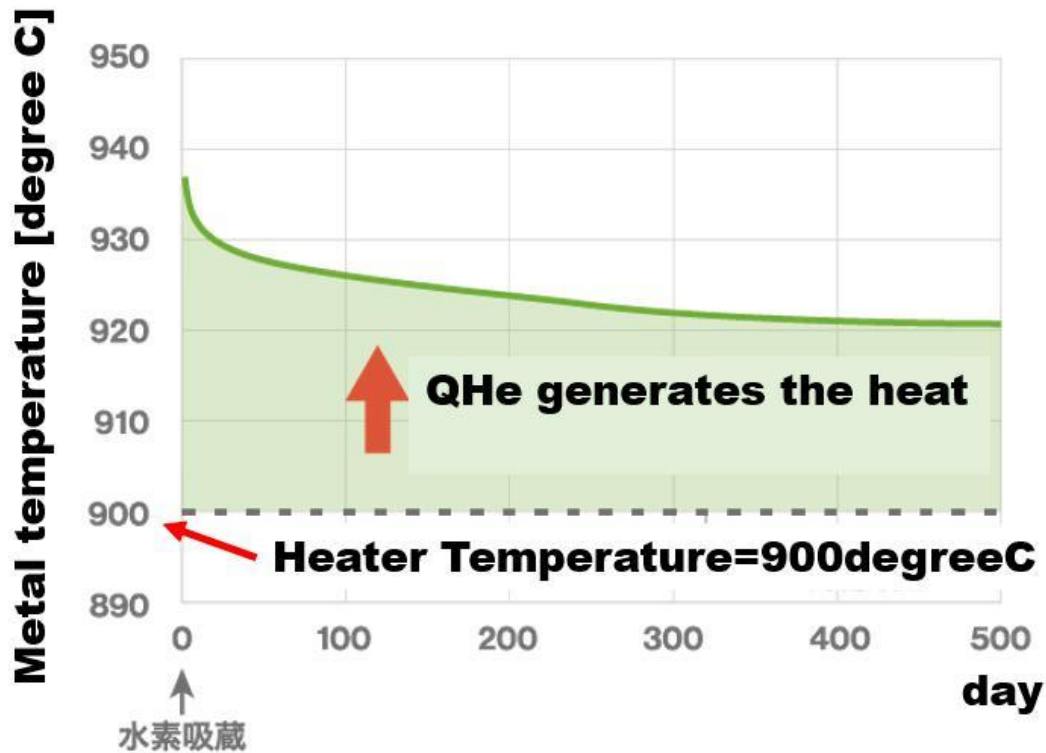


Fig.22 heat generation of Heat generator by QHe (clean planet) with femto-H₂ transmutation [17]

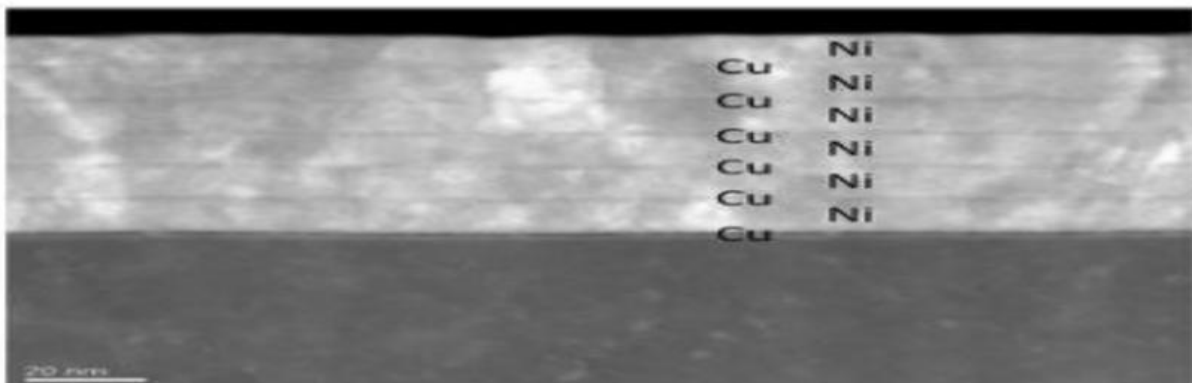


Fig.23 metal stacks by clean planet to generate heat

Although transmutation with femto-H₂ can generate heat comparable with femto-D₂ per reaction, femto-H₂ transmutation need to increase the metal temperature because of lower reaction rate than femto-D₂. Femto-D₂ can fuse D+D by the D-D vibration which is the collision direction of d-d. However, femto-H₂ transmutation need to vibrate metal to increase the reaction rate, which need the heater at 900degreeC as is shown in Fig.22. In case of D+D fusion need the Instantaneous Trigger Temperature of ~700 degree C, which causes the D+D fusion and Fusion can be sustained by its heat generation. In order to generate electric power heating metal need to be cooled. Thus, since the temperature of the heating metal cannot be lowered below the temperature of the external heater, only a very small amount of power can be extracted.

Author thinks that clean-planet's metal stack is excellent to produce femto-H₂ as is shown in Fig.23.

IX. Conceptualized power generator with femto-D₂[18]

Because power generator based on LENR has very low efficiency because they were developed without understanding the mechanism of LENR, thus, author strongly recommends that clean-planet should adopt our power generation method using deuterium.

(1) Metal surface

(2) Grain boundary

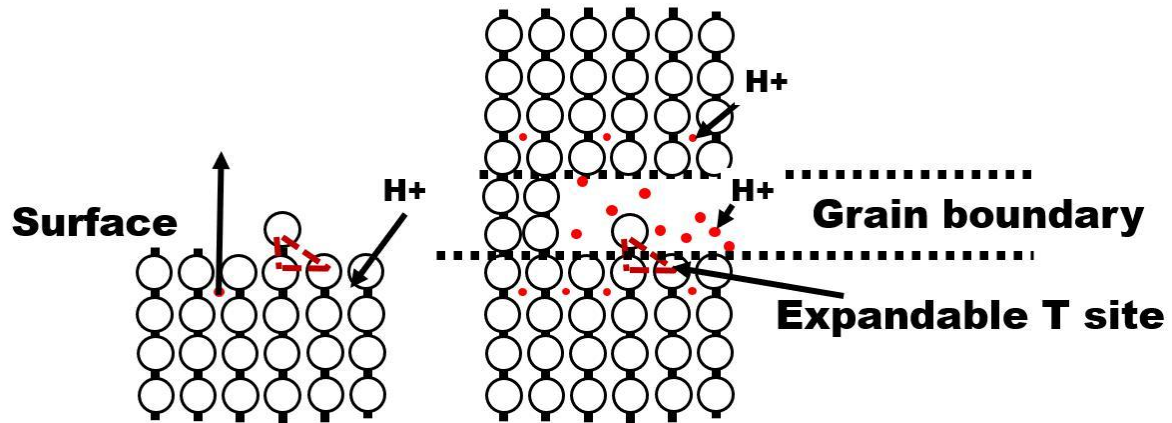


Fig.23 Mechanism to improve heat generation efficiency in ref [18]

I proposed the conceptual LENR power generator in ref [18]. In positive metal, D is charged positively to be D⁺ and it segregates at grain boundaries due to the very small size of d. Because the concentration of d is very high at grain boundary and the number of reaction site (expandable T site) is larger, and because the D⁺ supply to the reaction site is large and fast, the total amount of reaction of D+D is very high

X. Incorrect Standard model of Physics

A) Correct nucleus model and neutron model

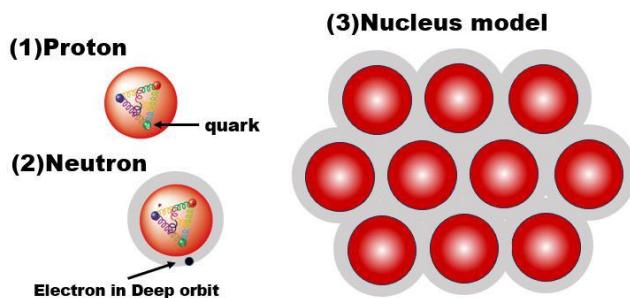


Fig.24 Correct neutron model and nucleus model in ref [8]

Before the introduction of neutron, the nucleus is believed to be constituted only by protons and internal electrons, and neutral particle emitted from the nucleus is believed to be a pair of proton and tightly bounded electron.

Because no direct evidence of electron deep orbit, Fermi thought that beta-decay of neutron has the particle with energy which cause the broad energy distribution of emitted electron from the neutron. However based on the LENR mechanism explained in this report, we have many experimental data that electron deep orbit exist, including LENR experiment. Based on these experiments, the nucleus is constituted only by protons and internal electrons and no neutrons exist. Based on the correct nucleus model, it is easy to explain the beta decay of “neutron” because it is a pair of proton and electron.

B) Correct quark composition of the neutron

By the experiments by CERN, proton is constituted by 2 up quarks and one down quark, and “neutron” is believed to be constituted by 1 up quark and 2 down quarks. However, because “neutron” is a pair of proton and electron in deep orbit, quark constitution must be the same as proton. This need to be reevaluated to prove that physics is incorrect, and prove the mechanism of LENR.

C) Neutrinos is a new particle(no neutrinos exist)

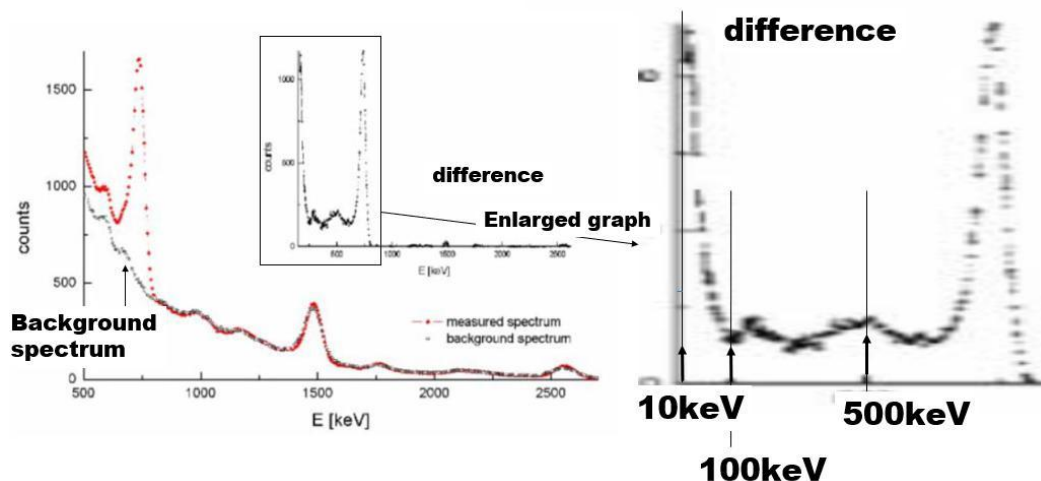


Fig.25 NaI γ -rays spectrum showing a peak superimposed to the background. The insert, obtained by subtracting the background, shows the typical structure of a γ -ray: photoelectric peak, Compton and backscattering peak.

Wolfgang Pauli proposed the hypothesis that “neutrinos” exist in the beta decay of a neutron, so that the laws of conservation of energy and angular momentum hold true. The name “neutrino” comes from “neutral” and was coined by Enrico Fermi, who conducted research into beta decay. Neutrino’s existence was proven through experiments by Frederick Reines and others.

However, Soft x-ray spectra during Cold Fusion have a broad peak at around 500keV, which shows that energy distribution of deep electron orbit is very broad. Simulation study on Deep Dirac Level in Fig.6 shows that Deep Level is about 500keV, which is consistent with broad peak at 500keV in Fig.12. This indicates that broad peak is the electron transition to the deep orbit. Therefore, Fermi hypo is incorrect.

Based on the correct nucleus model neutron is constituted only by proton and electron in deep orbit, thus the electron energy in deep orbit is broad due to the coulomb potential between quarks and electron in deep orbit is unstable by vibration of quarks, therefore deep orbit of electron should have the broad energy which cause the broad energy of emitted electron, and this broad energy can be shown in Fig 25. This indicates that Fermi hypo is incorrect and no neutrinos exists in a sense that Fermi hypo is incorrect. Thus, neutrino theory needs to be re-examined considering that neutrino is a new particle generated by proton decay.

XI. Proposition to prove the correct nucleus model

Proton is believed to be constituted by two up (u) quarks and one down (d) quark, while neutron is believed to be constituted by one u quark and two d quarks. Because no one suspected the existence of neutron at the time of this experiment, and because neutron is unstable alone, CERN used deuterons in place neutron, under the assumption that deuteron is composed of proton and neutron.

Therefore, I think that CERN reached the incorrect conclusion without verification of the possibility that a deuteron is made up of two protons.

Thus, I would like to propose re-experiment with the possibility of deuteron to be constituted by two protons.

For neutrino, theoretical study needs to examine the theory of neutrino with the assumption that neutrinos do not exist in the sense that Fermi hypothesis is incorrect.

SUMMARY

Femto-D₂ is generated at expandable T site on the surface of FCC metal with nano-roughness. Because femto-D₂ has covalent electrons at a few femtometer from the nucleus to shield the coulomb repulsive force. The existence of femt-D₂ has been proved by several experiments and theoretical study.

Transmutation experiment with femto-D₂ shows that the nucleus is constituted only by protons and internal electrons, and no neutrons exist, and no neutrinos exist in a sense that Fermi hypothesis is incorrect.

Because the impact of correct mechanism of LENR on the physics is so significant, I propose that governments and research institutes should launch an international project to discuss the correct physics and mechanism of LENR to be verified

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