Unified Theory Composition-Structure of the Electron, Proton and Neutron

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An element is non-composite but composes other particles. None of the over 200 elementary particles of Modern Standard Model with Supersymmetry meets this definition. The elementary quarks & leptons of MSM are found to be compressible and assembleable, hence have composition and are non-element. These in Unified Theory are composed by new elements: positrino & negatrino, named cosminos of diameter 1.6156 x 10^{-33} cm, mass 2.596 x 10^{-48} gm, electric charge ± 1.3729 x 10^{-30} esu and spin ± ½. Mutual repulsion among cosminos of same electric charge, however, makes quarks fragile and non-existent as intact units. So color charge is not a basic cosmino charge. Weak too is not a basic cosmino charge as it does not conserve. The two cosminos constitute the new particle 'sharmon' which composes the light propagating 'sharmon medium' as the 'basic substance' composing all forms of energy and mass. The cosmino-sharmon composition-structures of electron, proton and neutron presented herein are defined by concentric regions and form factors describing spatial distribution of charge, mass, sharmons, diads, etc. It is shown that no ½-spin Fermion like neutron can be neutral. The electric dipole moment of neutron -5.83 x 10^{-45} esu.cm = -1.2 x 10^{-35} e.cm calculated from Unified Theory agrees with observations. An almost neutral neutron emits electron, never positron, because its outer region is negative. Hofstadter's positive outer region in neutron is inconsistent with negatron decay. Effect of superimposed magnetic field on neutron's negatron decay is explained without Electroweak Theory's weak charge and $W^{\pm}$ & Z^{o} particles. A new Hook's law mediated short-range nuclear force is suggested, which obviates the need for inter-quark strong nuclear force mediated via π-mesons.

1. Introduction

Gaseous steam, liquid water and solid ice have no commonality for a child but can inter-convert because all are made of the same water molecule H_2O. A medium composes the wave it propagates. Light-wave is a form of energy. Inter-conversions of various forms of energy E among themselves and/or with mass m follow $E = mc^2$. In Unified Theory, therefore, light medium is the subtlest basic substance composed by the new particle, sharmon, comprising positive positrino and negative negatrino, the two non-composite 'elements' which compose all forms of energy E and mass m otherwise no inter-conversion among E and m could occur. Basic substance marks the end of subtlety. Since endless infinite divisibility of matter is anti-intuitive the positrino and negatrino elements are indivisible and mark the end of subtlety . Basic substance composes and is composed by elements.

An element is itself non-composite but composes other particles. None of the over 200 elementary particles of the Modern Standard Model (MSM) with Supersymmetry satisfies this definition of 'element'. Under the MSM quarks and leptons are the non-composite elements, the proton and neutron being composed by them. But quarks were found to be compressible [1] and assembleable [2, 3] and hence are NOT non-composite elements, but are composed by the two new basic elementary cosminos, the positive positrino and negative negatrino of diameter 1.6156×10^{-33} cm, mass 2.596×10^{-48} gm, electric charge $\pm 1.3729 \times 10^{-30}$ esu and spin ±½. Mutual repulsion among their constituent cosminos with same kinds of electric charge, however, makes the structures of quarks loose and fragile. Therefore Unified Theory regards the quarks as non-existent and color charge is not taken as a basic cosmino charge. The weak is also not a basic cosmino charge as it does not conserve. Cosminos thus have only two basic charges: mass and electric charge [4].

A positrino and a negatrino constitute the neutral sharmon of mass 5.192×10^{-48} gm. Sharmon spin is 0 or 1 when the ½-spins of the constituent cosminos are anti- or co-directional respectively. Two negatrinos with opposed ½-spins can give rise to a negatrino-negatrino Cooper pair 0-spin negative (-ve) diad. Similarly two positrinos yield a positrino-positrino Cooper pair positive (+ve) 0-spin diad. A 0-spin ± ve diad can attract 0-spin sharmon to form a 0-spin ± ve diad-sharmon unit. The cosminos, sharmons, diads and diad-sharmon units go into the composition of the electron, proton and neutron. The spatial distribution of these constituents described by the form factors and concentric regions in Fig. 1 defines the structure of these basic particles.

2. Cosmino-Sharmon Structure of Electron in Unified Theory

The electron with mass $m_e = 9.109389 \times 10^{-28}$ gm and electric charge $q = e = -4.806532 \times 10^{-10}$ esu is a dynamic composition of $n_1 = 3.50 \times 10^{20}$ negatrinos plus $n_2 = 3.94 \times 10^{17}$ 0-spin sharmons. The actual distribution of charge, mass and charge-to-mass ratio

q/m in the electron are non-uniform. Because the experimental gyromagnetic ratio $g_e = -2.002319304$ for the free electron is different from the Dirac average -2.0, and from the -2.11×10^{-11} value for its 10^-20 cm Dehmelt [5] core. The time-averaged

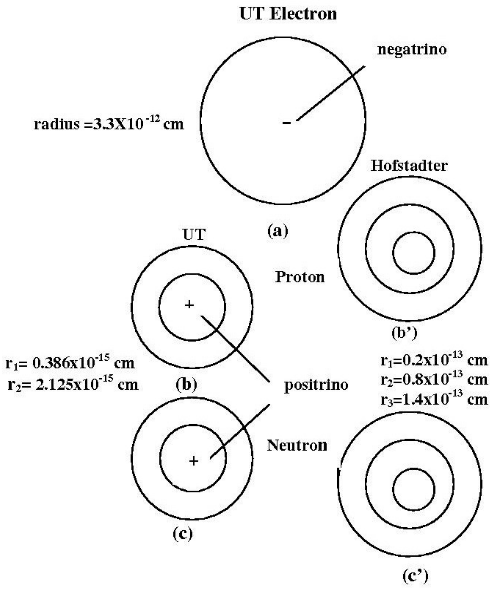

Fig. 1. Structures of the Electron, Proton and Neutron

(a) **UT electron**, radius 3.3×10^{-12} cm , whole region negative. A lone ½-spin negatrino at center (-); 0-spin -ve diads (=), 0-spin sharmons (o), 0-spin diad-sharmon units (=o) distributed throughout.

(b) **UT proton**, $r_1 = 0.386 \times 10^{-15}$ cm , $r_2 = 2.125 \times 10^{-15}$ cm , both regions positive. A lone ½-spin positrino at center (+); dynamic, interpenetrating, and overlapping two regions with 0-spin +ve diad-sharmon units (+o) distributed in both regions.

(c) (b') **Hofstadter proton**: static, non-penetrating, annular 3 regions:

- inner positive dense core; $r_1 = 0.2 \times 10^{-13}$ cm .
- middle positive region; +ve iso-scalar mesons; $r_2 = 0.8 \times 10^{-13}$ cm .
- outer positive region; +ve iso-vector mesons; $r_3 = 1.4 \times 10^{-13}$ cm .

(d) (c) **UT neutron**: lone ½-spin positrino at center (+); dynamic, inter-penetrating and overlapping two regions:

- inner positive region; $r_1 = 0.386 \times 10^{-15}$ cm ; 0-spin +ve diad-sharmon units (+o)
- outer negative region; $r_2 = 2.125 \times 10^{-15}$ cm ; 0-spin- ve diad-sharmon units (=o); individual 0-spin sharmons (o).

(e) (c') **Hofstadter neutron**: static, non-penetrating, annular 3 regions:

- inner positive dense core; $r_1 = 0.2 \times 10^{-13}$ cm .
- middle negative region; -ve iso-scalar mesons; $r_2 = 0.8 \times 10^{-13}$ cm .
- outer positive region; +ve iso-vector mesons; $r_3 = 1.4 \times 10^{-13}$ cm .

dynamic q/m value varies from $1.0 e/m_e = 5.276 \times 10^{17}$ esu/gm at the center (Dehmelt core) to that of a negative diad, or of a negatrino $q_n/m_n = 1.003415 e/m_e = 5.276 \times 10^{17}$ esu/gm at the periphery. That is, its dynamic mass-to-charge ratio

$$\frac{m}{q} = \frac{1}{2}\left(\frac{m_e}{e} + \frac{m_n}{q_n}\right) = \frac{2}{g_e} \times \frac{m_e}{e} \qquad (1)$$

is the mean of its value m_e/e at the center and m_n/q_n at the periphery as against $-1.0 m_e/e$ for the non-composite point electron of Dirac theory. Its ½-spin consistent with Dehmelt core suggests that it has odd numbered negatrinos comprising 1.75×10^{20} negatrino-negatrino Cooper pair 0-spin -ve diads surrounding a single ½-spin negatrino at the center.

Electron's q/m-distribution radius $r_d = (q_n/m_n)\ (h/2\pi c^3)^{1/2}$ .is the geometric mean of the $1/m$ dependent Compton radius $h/2\pi mc$ and the q^2/m dependent Classical radius q^2/mc^2 . Thus $r_d = 3.306 \text{x} 10^{-12} cm$ giving the electron volume $V_e = 1.517 \text{x} 10^{-34} cm^3$. The uniform volume density of diads is $d_D = 1.154 \text{x} 10^{54} cm^{-3}$, charge density $d_q = 3.168 \text{x} 1024 esu/cm^3$, and inter-diad distance is $r_d/(d_D)^{(1/3)} = 5.9 \text{x} 10^{-19} cm$. The volume density of sharmons $d_{sr} = d_{n2} - ar$, with $a = 7.858 \text{x} 10^{62} cm^{-4}$, decreases linearly with radius from $d_{n2} = n_2/V_e = 2.6 \text{x} 10^{51} cm^{-3}$ at the center $(r=0)$ to zero at the periphery $(r=r_d)$. The mass density d_m has two components $(d_m = d_{ml} + d_{mr})$: the uniform $d_{ml} = 5.99 \text{x} 10^6 gm/cm^3$ due to diads and variable $d_{mr} = d_{m2} - br$, with $b = 4.08 \text{x} 10^{15} gm.cm^{-4}$ due to sharmons decreasing with radius from $d_{m2} = 1.35 \text{x} 10^4 gm.cm^{-3}$ at the center $(r=0)$ to zero at the periphery $(r=r_d)$. See Fig-1 for comparison with proton and neutron structure.

The Cooper pair 0-spin negatrino-negatrino -ve diads are stable due to attractions at $10^{-33} cm$ distance for gravitational and opposite spins offsetting the electrical repulsion. The opposite spin, gravitational and electric attractions at $10^{-33} cm$ make the 0-spin sharmon stable with gregarious properties for other 0-spin sharmons and $0-spin-ve\ diads$. Bosonic condensations between 0-spin diad-sharmon combinations supported by gravitational attractions at $10^{-19} cm$ inter-diad distances, offsetting electrical repulsion, produce a dynamically stable spherical electron (Fig. 1).

Totality of 0-spin sharmons and 0-spin diads spin together with the lone $\frac{1}{2}-spin(-ve)$ negatrino at the center to impart a spin ½ to the electron as a whole.

The Form Factor, representing distribution of charge over spherical shells of the constant thickness dr around varying radius r from the center $(r=0)$ to periphery $(r=r_d)$, is $F_q = d_q.4\pi r^2 dr$. Here dr is arbitrarily chosen as a small but constant radial thickness and r varies for $r=0$ at the center to $r=r_d$ at periphery. The Form Factor for the diad distribution is $F_D = d_{D.4\pi} r^{2dr}$. Both F_q and F_D are parabolas. The sharmon distribution Form Factor $F_s = F_{s1} - F_{s2}$ is the difference of parabolic F_{s1} and cubic F_{s2} . In the mass distribution Form Factor $F_m = F_{m1} + F_{m2} - F_{m3}$, first two are parabolic and third is cubic.

3. The Structure of Nucleons in Unified Theory

The experimental values of gyromagnetic ratio $g_p = +2.79284738$ and $g_n = -1.93455491$ for proton and neutron suggest that the dynamic $(q/m)_p = +1.39642369 e/m_p$ and $(q/m)_n = -0.96727745 e/m_p$. The inter-convertibility between proton and neutron points to the common core with $q/m = +0.21457312 e/m_p$. This gives

$(q/m)_p = +0.21457312\, e/m_p + 1.18185057\, e/m_p$, and $(q/m)_n = +0.21457312\, e/m_p - 1.18185057\, e/m_p$.

The $(q/m)(h/2\pi c^3)^{1/2}$ *radii* of the two regions are $r_1 = 0.38578\text{x}10^{-15} cm$ and $r_2 = 2.12486\text{x}10_{-15} cm$. The common $\frac{1}{2}-spin$ of the nucleons arises from the common $+ve$ core with a lone ½-spin positrino at the center surrounded by $0-spin$ diad-sharmon units. Outer $0-spin$ region in both the nucleons spins together with the inner $\frac{1}{2}-spin$ region to yield an overall $\frac{1}{2}-spin$.

3.1. Proton Structure in Unified Theory

Let q_1 , m_1 and q_2 , m_2 be the charge and mass of the two regions of radius r_1 , r_2 respectively. Here $q_1/m_1 = +0.21457312\, e/m_p$ and $q_2/m_2 = +1.18185057\, e/m_p$; $q_1 + q_2 = e = +4.806532\text{x}10^{-10} esu$ for $1.75\text{x}10^{20}$ *diads* and $m_1 + m_2 = m_p = 1.67252\text{x}10^{-24} gm$ comprising $1.75\text{x}10^{20}$ *diads* plus $2.6199\text{x}10^{23}$ *sharmons* .

The $q_1 = +0.19389675\text{x}10^{-10} esu$, $q_2 = +4.612635\text{x}10^{-10} esu$; $m_1 = 3.144377\text{x}10^{-25} gm$, $m_2 = 1.3580822\text{x}10^{-24} gm$. The number of diads and sharmons in the two regions are $D_1 = 7.06\text{x}10^{18}$, $D_2 = 1.6798\text{x}10^{20}$; $s_1 = 6.04886\text{x}10^{20}$, $s_2 = 2.613919\text{x}10^{23}$.

The number densities of diad population are $d_{D1} = 2.936\text{x}10^{28} cm^{-3}$, $d_{D2} = 4.18\text{x}10^{25} cm^{-3}$ for the two regions and $d_D = 2.94\text{x}10^{28} cm^{-3}$ as overall for the core. The three mass densities are $d_{m1} = 1.307\text{x}10^{21} gm/cm^3$, $d_{m2} = 3.379\text{x}10^{19} gm/cm^3$, $d_m = 1.34\text{x}10^{21} gm/cm^3$ (see $Fig-1$). The corresponding charge densities are $d_{q1} = 8.06\text{x}10^{34} esu/cm^3$, $d_{q2} = 1.18\text{x}10^{34} esu/cm^3$ and $d_q = 9.21\text{x}10^{34} esu/cm^3$.

The Form Factors representing distributions of mass, charge, and diads are obtained by multiplying $4\pi r^2 dr$ to the corresponding density, where the constant radial thickness dr is arbitrarily chosen but r^2 is varied continuously from $r=0$ at the center to $r = r_d$ at the periphery. All Form Factors are parabolic in this case.

3.2. Neutron Structure in Unified Theory

Its inner region is the same as for proton. But the outer region has a mixed population of two 0-spin species: $-ve\ diad - sharmon$ and individual sharmons (only). Thus, $q_1/m_1 = +0.21457312\, e/m_p$, $q_2/m_2 = -1.18185057\, e/m_p$, $q_3/m_3 = 0$. Since $m_1 + m_2 + m_3 = neutron\ mass$ $m_n = 1.67482\text{x}10^{-24} gm = 1.0013751\, m_p$ and $q_3 = 0$, $q_1 = +0.04034026 e = +0.19389675\text{x}10^{-10} esu = -q_2$; $m_1 = 3.144377\text{x}10^{-27} gm$, $m_2 = 1.35724\text{x}10^{-24} gm$, $m_3 = 3.1444\text{x}10^{-25} gm$. The number of $+ve\ diads$ in the inner region or $-ve\ diads$ in the outer region is $D_1 = D_2 = 7.06\text{x}10^{18}$. The number of sharmons bound to the diad-sharmon units ($+ve$ in the inner and $-ve$ in the outer) are $s_1 = 5.984\text{x}10^{20}$, $s_2 = 2.61398\text{x}10^{23}$; number of free sharmons in the outer region is $s_3 = 6.0559\text{x}10^{22}$.

For the two regions the densities of mass (m) work out as $d_{m1} = 1.3074\text{x}10^{21} gm/cm^3$, $d_{m2} = 1.4205\text{x}10^{19} gm/cm^3$, $d_m = 1.34127\text{x}10^{21} gm/cm^3$. The densities of charge (q) are $d_{q1} = 8.062\text{x}10^{34} esu/cm^3$, $d_{q2} = 4.8249\text{x}10^{32} esu/cm^3$, $d_q = 8.11\text{x}10^{34} esu/cm3$. And the densities of diads (D) are $d_{D1} = 2.936\text{x}10^{28} cm^{-3}$, $d_{D2} = 1.757\text{x}10^{25} cm^{-3}$, $d_D = 2.9537\text{x}10^{28} cm^{-3}$. See *Fig.1* for comparison with electron and proton.

The Form Factors representing distributions of *m*, *q*, *D* over spherical shells of constant thickness dr but varying radius *r* from center ($r = 0$) outwards for the two regions are obtained from the above densities by multiplying with $4\pi r2\, dr$. All these Form Factors are parabolas.

4. Nature of the Atomic Nucleus

Stable $0-spin\ diads(\pm ve)$, $0-spin\ sharmons$, $0-spin\ diad-sharmon\ units$ with mutual inter-couplings are basic to the stability of free proton, electron and positron. But the large number 10^{23} of their constituents makes their cosmino-sharmon composition fluctuable and NOT fixed. Hence the mass and charge of electron, proton, neutron and their anti-particles may slightly vary or even split. The upcoming 'Hadron Collider' at CERN, Geneva will show how the sharmon-cosmino content of the mass and kinetic energy of the smashingly colliding protons redistributes and reassembles as new particles, their energies and sharmon-cosmino dust.

The proton and neutron should therefore loosen their unchangeably rigid composition and structure, allowing for emission and absorption of small aggregates of $0-spin\ diads(\pm ve)$, $0-spin\ sharmons$, $0-spin\ diad-sharmon\ units$ and tend to mutually merge inside a nucleus. The $+ve\ diads$ and $+ve\ diad-sharmon\ units$ compose the net positive charge of the nucleus. This supports and is supported by the following facts of observation.

First, the radius R of a (spherical) nucleus of mass number A is given by the formula:

$$R = 1.3 \text{ x } 10^{-13} A^{1/3} \text{ cm} \tag{2}$$

Secondly, the nuclear volume is proportional to the number A of the nucleons (proton + neutron), obliterating the inter-nucleon space.

Thirdly, the density of the nuclear matter in all nuclei is nearly the same [4].

4.1. The Mass Defect

The observed mass defect D_m for a nucleus of mass m_{nuc} , mass number *A* and atomic number *Z* (number of protons) is:

$$D_m = Zm_p + (A - Z) m_n - m_{nuc} \tag{3}$$

That is, in forming a nucleus the nucleons (protons & neutrons) lose some nucleonic mass D_m comprising small aggregates of 0-spin sharmons. The loss of some electric charge D_q comprising $0-spin\ diads(\pm)$, $0-spin\ diad-sharmon\ units$ also is not ruled out.

5. Radioactivity is a Nuclear Phenomenon

In some nuclei, called the radioactive nuclei, even after their formation the cosmino-sharmon composition and the number of nucleons change. Emission of gamma photons composed by 0-spin sharmons suggests variation and readjustment in nucleonic mass. The $(\pm)\beta$ decay (emission of $+ve$ positron & $-ve$ negatron) and the capture of an orbital negative electron involve variations in the mass and charge or the cosmino-sharmon composition of some nucleon(s). Emission of energetic alpha particle (nucleus of the atom helium having two protons and two neutrons) or of the proton or neutron changes even the number of nucleons.

The environment within a nucleus differs from outside affecting the composition of outer fringe and radioactive nature of a nucleon. Sufficient cosminos and sharmons are available only inside some nuclei for a proton to decay into a heavier neutron plus energetic positron and neutrino. The neutron, which in its free state is unstable, becomes stable in most of the nuclei.

Therefore Radioactivity is a nuclear rather than a mere nucleonic phenomenon.

6. The Negatron Decay of the Neutron

Instability of a free neutron arises from the randomly moving sharmons in the outer region having electrical attractions of their constituent negative negatrinos with the positive inner region and of their positive positrinos with the negative diad-sharmon units in the outer region. Therefore the free neutron, though almost neutral, exhibits only negatron-decay because its outer fringe is negative.

The outer negative charge is supported by observation [6]. Hofstadter's [7] positive outer fringe of the neutron is inconsistent with observation [6] as well as with the negatron decay.

It can now be seen that during negatron decay of the neutron some 3.50x10^20 0-spin sharmons split into ±3.50x10^20 cosminos. The 1.412x10^19 positive positrinos neutralize the same number of negative negatrinos or 7.06x10^18 negative diads in the outer region of the neutron, and the rest create the surplus 1.6798x10^20 positive diads for the outer region of the proton. The 3.50x10^20 negative negatrinos plus 3.94x10^17 0-spin sharmons constitute the beta-particle or negatron. The 2.68x10^20 0-spin sharmons compose the total energy of 0.782 MeV of the emitted negatron plus anti-neutrino.

The ½-spin of the anti-neutrino comes from the sole or odd numbered $(2n+1)$ negatrinos to give it a negative electric charge. Hofstadter's neutron with positive outer region cannot account for its negatron decay, or for its negative Electric Dipole Moment (see sec.7 below).

7. Electric Dipole Moment of the Neutron

The lone positrino at the center of the inner region neutralizes the charge from one negatrino from the negative diad-sharmon and sharmon units, leaving a net negative charge of one negatrino $q_n = -1.3729\text{x}10^{-30} esu$ on the neutron. So, the lower limit of neutron's Electric Dipole Moment (EDM) is $-5.83\text{x}10^{-45} esu.cm = -1.2\text{x}10^{-35} e.cm$, as actually observed [8, 9]. Due to natural fluctuations, however, the neutron can also acquire a few extra $-ve$ diads giving it the net charge of $(2n+1)$ negatrinos. This also slightly affects its q_2/m_2 ratio and the radius r_2 of the outer region. We thus get a variable $EDM = (2n+1) q_n . r_2$, as actually observed [8, 9]. Due to smallness of the charge, neutron appears "neutral" within allowed experimental errors.

7.1. No Fermion can be Neutral

The agreement between Unified Theory and experiment on the existence of electric charge on the neutron leads to the verifiable generalization that no fermion can be neutral. A fermion, with spin ½ , 1½ , etc., has to comprise odd numbered (2n+1) cosminos, with spin ½ , of which at least one is un-neutralized. Therefore the neutron, anti-neutron, neutrino, anti-neutrino &c with spin ½ , which in currently accepted theories are neutral, should actually carry $\pm 1.3729 x 10^{-30} esu$ charge of a cosmino. This imparts an Electric Dipole Moment (EDM) to the fermion. As above, the neutron carries a negative electric charge and anti-neutron a positive electric charge. The anti-neutrino emitted during neutron's negatron decay is electrically negative. That is why it is repelled by the $-ve$ negatron. Neutrino emitted with the +ve positron during proton's positron decay is likewise positive.

Unified Theory's predicted lower limit of the neutron's EDM $-5.83\text{x}10^{-45} esu.cm = -1.2\text{x}10^{-35} e.cm$, e being the electron charge, agrees with experimental findings [8, 9]. This observation on neutron distinguishes Unified Theory from, and establishes its superiority over, the current theories. Other fermions can test and verify this Unified Theory prediction further.

7.2. The Effect of Superimposed Magnetic Fields on Neutron Decay

During negatron decay of neutron (n- → p+ e- υ-) the slightly negative neutron n- splits into positive (+ve) proton p+, negative (-ve) negatron (electron) e- and slightly negative (-ve) anti- neutrino υ- at the same space-time point. The imposed magnetic field electromagnetically interacts with the mechanisms of creating three electrically charged particles (p+, e-, υ-). It also interacts with these mutually interacting particles themselves at the moment of beta decay. These interactions are basic to the inequality in the rates of beta emission from the Co-60 atoms for two opposite directions of the imposed magnetic field, as actually observed by Wu et al [10]. This is because υ- has only right handed spin but both p+ and e- can be right or left handed. This Unified Theory explanation does not need the weak charge or weak forc e.

The above Unified Theory explanation of the neutron beta decay can be compared with the following set of mutually inconsistent and manifestly unrealistic speculations of the Electro-Weak theory. The neutron (udd) comprises one up (u) and two down (d) quarks. One d-quark (mass $0.35 GeV$, charge $-1/3 e$) emits a "virtual" boson W- (mass $78 GeV$, charge $-1 e$) and itself becomes a u-quark (mass $0.39 GeV$, charge $+2/3 e$) transforming neutron (udd) into proton (uud). The W- decays at a different space-time point, to emit one electron e- and anti-neutrino υ-. Spontaneous break in the vacuum symmetry creates the W- out of nothing. The mass to W- is imparted by the Higgs boson, whose mass, nay even existence is indefinite. Heisenberg's objective indeterminism and Uncertainty Principle, which UPT rejects, are invoked to validate the underlying violations of otherwise inviolable conservation of mass and energy, because W^- is outside its mass shell!

Detection of $W^{\pm}$ and Z^{o}, not in the beta decays but in particle smashing experiments, has been hailed [11, 12] as a strong (but Unified Theory views it as the weakest) experimental support to the Electro-Weak theory. It treats them as "virtual" or unreal, being outside their mass shell and not conserving energy and momentum. But in Unified Theory the assembly of W^± and Z^o follow realistically from the totality of positrinos, negatrinos and sharmons generated from the masses and kinetic energies of the colliding particles. For example W+ is made of $3.49x10^{20}$ positrinos $+2.59x10^{25}$ 0-spin sharmons, W- of $3.49x10^{20}$ negatrinos + $2.59x10^{25}$ 0-spin sharmons and Z^o of one 1-spin sharmon + $2.99x10^{25}$ 0-spin sharmons.

8. Hofstadter vis-à-vis Unified Theory

By curve fitting, Hofstadter [7] got three regions of 0.2 f, 0.8 f and 1.4 f (fermi $f=10^{-13}cm$) radii with central +ve dense core and a $+ve$ outer fringe for both proton and neutron. The middle region is $+ve$ in proton and $-ve$ in neutron. Outer two regions in proton comprise iso-scalar and iso-vector meson clouds but vice versa in neutron. These three regions are static, annular, and non-penetrating as against Unified Theory's dynamic, overlapping and interpenetrating ones (Fig.1). Hofstadter sought the evidence from other scientists for his theory's $+ve$ outer fringe of neutron but observational evidence [7] is for the $-ve$ outer fringe in support of Unified Theory.

However, Hofstadter radii of $10^{-13}cm$ represent the range of electrical influence in elastic electron scattering, whereas Unified Theory radii of $10^{-15}cm$ indicate physical $q/m-distribution$. Their relative magnitudes are therefore mutually consistent and supportive.

Hofstadter [7] gives no reason for not considering the composition-structure of electron.

9. Nature of the Large Angle Electron Scattering Center in Proton

As against the conclusions of Friedman et al [13], sec 2.1 above shows that proton has no -ve center to scatter electrons at large angles. But the $3.9x10^{20}$ negatrinos comprising every incident electron and the $3.42x10^{14}$ negatrino-positrino pair sharmons per eV of its kinetic energy transform into short lived -ve, neutral, and $+ve$ pre-hadronic units which later reassemble into the hadrons. The $-ve$ units scatter the $-ve$ electrons at large angles, neutral units at small angles and $+ve$ units at smaller angles.

This Unified Theory also eliminates the "ignorance box" from the explanation [12] of hadron jets produced in electron-positron (e+e-) collider. The colliding e+ and e- have only 0.51 MeV rest mass energy each, hence cannot generate the GeV hadrons. This leaves 1 to 3 TeV kinetic energy as the only source substance to create hadrons, as out lined above. Modern Physics offers no physical mechanism except the relation $E = mc^2$. Likewise follows the creation of some Quarks and Leptons from the collisions of 1.8 TeV kinetic energy protons-anti-protons. This was reported by D-Zero [2] and CDF [3] collaborators.

10. Hook's Law Mediated Short-Range Nuclear Force

In Unified Theory the atomic nucleus is a dynamic composite whole comprising 0-spin diads $(\pm ve)$, 0-spin sharmons, 0-spin diad-sharmon units with mutual inter-couplings. The diads and $+ve$ diad-sharmon units account for the net positive charge of the nucleus. Therefore the Unified Theory rejects the existence of quarks as isolated intact rigid units to compose the nucleons and discards the inter-quark strong nuclear force mediated via $\pi-mesons$.

The short-range nuclear force operates during small deformations of the nucleus. Here the nucleus behaves like a highly condensed elastic mass whose deformation follows the Hook's law of elasticity wherein stress is proportional to the strain. So the short-range deforming force is proportional to the deformation. It is slightly modified by the added electrical repulsions among the diads with like charges and electrical attractions among oppositely charged diads, both varying as inverse square of the intervening distance according to the Coulomb's law. The Newton's law based gravitational force also operates weakly. So the net short-range nuclear force appears as an attractive force whose magnitude increases with distance, as actually observed.

Its exact mathematical form depends on the actual distribution of the composing units, namely the charged and neutral diads. In the present stage of lack of knowledge it is therefore difficult to deduce the mathematical expression from the first principles.

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