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Non-Uniform Pion Tetrahedron Aether and Electron Tetrahedron Model

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Abstract

We propose that the QCD vacuum pion tetrahedron condensate density vary in space and drops to extremely low values in the Kennan, Barger and Cowie (KBC) void in analogy to earth's atmospheric density drop with elevation from earth. We propose a formula for the gravitation acceleration based on the non-uniform pion tetrahedron condensate. Gravity may be due to the underlying microscopic attraction between quarks and antiquarks, which are part of the vacuum pion tetrahedron condensate. We propose an electron tetrahedron model, where electrons are comprised of tetraquark tetrahedrons, $d\tilde{u}\tilde{d}d$ and $d\tilde{u}\tilde{u}u$. The $d\tilde{u}$ quarks determine the negative electron charge and the $\tilde{d}d$ or $\tilde{u}u$ quarks determine the electron two spin states. The electron tetrahedron may perform a high frequency quark exchange reactions with the pion tetrahedron condensate by tunneling through the condensation gap creating a delocalized electron cloud with a fixed spin. The pion tetrahedron may act as a QCD glue bonding electron pairs in atoms and molecules and protons to neutrons in the nuclei. Conservation of valence quarks and antiquarks is proposed.

Keywords

Standard Model (SM), QCD Vacuum Condensate, Electric Dipole Moment (EDM), KBC Void, Antimatter, MOND Theory, Aether

1. Non-Uniform Universe—The KBC Giant Voids

Kennan, Barger and Cowie (KBC) [1] found that galaxy counts and measurements of the luminosity density in the near infrared indicate the possibility that the local universe may be under-dense on scales of several hundred megaparsecs. The presence of a large scale under-density in the local universe could introduce significant biases into the interpretation of cosmological observables and into the inferred effects of dark energy on the expansion rate.

According to Kroupa and Banik [2] [3], we live in a giant void in space, an area with below average density that could inflate local measurements through outflows of matter from the void. Outflows would arise when denser regions surrounding a void pull it apart—they'd exert a bigger gravitational pull than the lower density matter inside the void. We are near the center of a huge void about a billion light years in radius and with density about 20% below the average for the universe. The Cosmic Microwave Background (CMB) suggests that matter should be uniformly spread out. However, directly counting the number of galaxies in different regions suggests that we are in a local void contradicting the CMB uniform and isotropic universe. Such a huge deep void was not expected in the standard model and is controversial. If the universe is not uniform and not isotropic, what about the QCD vacuum quark condensate, should it also be non-uniform and anisotropic?

2. Non-Uniform QCD Vacuum Quark Condensate

Brodsky *et al.* [4] [5] presented a new perspective on the nature of quark and gluon condensates in quantum chromodynamics where the QCD condensates are restricted to the interiors of hadrons. According to Brodsky these condensates arise due to the interactions of confined quarks and gluons leaving the external QCD vacuum empty, devoid of vacuum condensates that fill space-time. Lee [6] argues in favor of the non-vanishing QCD vacuum quark condensate and refutes the notion of Brodsky in-hadron only quark and gluon condensates. Halle *et al.* presented equations that reveal effects of modified gravity and dark matter with a non-uniform dark energy fluid [7]. Buballa and Carignano studied an inhomogeneous chiral condensate, which is constant in vacuum and may become spatially modulated at moderately high densities where in the traditional picture of the QCD phase diagram a first-order chiral phase transition occurs [8].

We propose that the QCD vacuum pion tetrahedron condensate [9] density in space is non-uniform and should drop in the KBC giant voids in analogy to earth's atmospheric density drop [10]. We propose to calculate the gravitation acceleration from the non-uniform pion tetrahedron condensate density variation. In the extreme MOND limit at the galaxies' edges with $r > \lambda$, the gravitational acceleration is stronger and given by $\frac{GM}{\lambda r}$ [11] and not $\frac{GM}{r^2}$.

3. Extremely Low Pion Tetrahedron Condensate Limit

In 1983 Milgrom proposed the Modified Newtonian Dynamics theory, MOND [12] [13] [14] [15], explaining the observed rotational curves of galaxies without adding dark matter, which Kroupa *et al.* suggest does not exist [16]. MOND is a phenomenological theory and does not provide a microscopic mechanism explaining the crossover to the extremely low accelerations limit far from the galaxy center. Milgrom proposed a new acceleration constant $a_0 = 1.2 \times 10^{-10}$ cm/sec^2 that fits well the observed galaxy rotation curves. The MOND gravitational force and acceleration in the limit where $a \ll a_0$ is proportional to a^2

$$F = m\frac{a^2}{a_0} \tag{1}$$

In a previous paper [9] we assumed that the QCD vacuum pion tetrahedron condensate drops like the atmospheric density due to gravity as shown in the **Figure 1** on the left-hand side. We proposed that similar to the gas kinetic theory, the pressure difference on a virtual box top and bottom surfaces that contains an infitisimal volume of the pion tetrahedron condensate is due to the difference in the number of collisions at the top and the bottom surfaces due to the non-uniform pion tetrahedron condensate density induced for example by a massive stars, where M is the star mass, r is the distance from the star, and ρ is the pion tetrahedron condensate density. A and dr are the surface area and height of the virtual integration box

$$p_{up}A - p_{bottom}A = -\frac{\rho AdhGM}{r^2} \tag{2}$$

Assuming an ideal gas state equation ($PV = nk_BT$) for the pion tetrahedron condensate ρ with particle mass m_π

$$\rho = \frac{m_\pi n}{V} = \frac{m_\pi p}{k_B T} \tag{3}$$

The differential equation for the non-uniform condensate pressure is

$$\frac{\mathrm{d}p}{p} = -\frac{Gm_\pi M}{k_B T r^2}\mathrm{d}r \tag{4}$$

We can rewrite equation 5 as

$$\frac{1}{p}\frac{\mathrm{d}p}{\mathrm{d}r} = -\frac{Gm_\pi M}{k_B T r^2} \tag{5}$$

The gravitational acceleration applied on a mass m inside the virtual box of **Figure 1** below due to the non-uniform pion tetrahedron condensate density is

$$g_N = -\frac{k_B T}{m_\pi}\frac{1}{p}\frac{\mathrm{d}p}{\mathrm{d}r} = \frac{GM}{r^2} \tag{6}$$

We propose below that particles are attracted to their antimatter particles and since the antimatter density at the bottom of the virtual box is higher than at its top (as part of the pion tetrahedrons), particles will have more frequent exchange reactions with pion tetrahedron condensate at the bottom of the virtual box and will move downwards.

However, far from the galaxy center with the MOND acceleration limit, $a \ll a_0$, the pion tetrahedron condensate is extremely diluted and we propose to scale up the virtual box height with the term $\frac{r}{\lambda} > 1$ to allow more collisions to occur in the extremely diluted virtual box. In the MOND limit, the antimatter

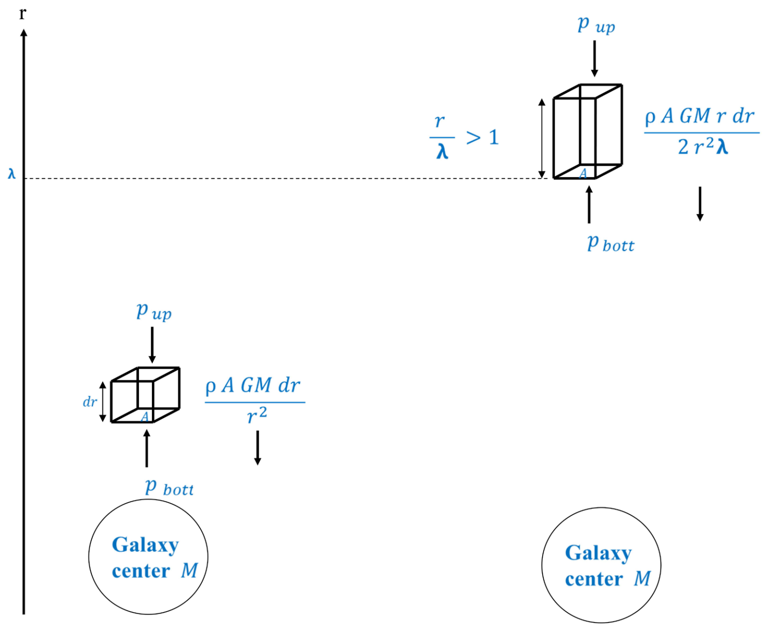

Figure 1. Illustrates on the left-hand-side the pressure difference on a virtual box of area A and height dr that contains the pion tetrahedron condensate close to the galaxy center and on the right-hand-side, the box height element dr is stretched by the term $r/\lambda > 1$ at the MOND limit.

density difference between the upper and lower virtual integration box surfaces is extremely low. The pion tetrahedrons have two chiral enantiomers and the pion tetrahedrons that will move downwards will increase the entropy of the pion tetrahedron condensate since they will have more collisions that will increase the frequency of flipping the chirality of the pion tetrahedron condensate. The differential equation for the non-uniform condensate pressure (Equation (4) above) with the scaling term $\frac{r}{\lambda}$ is

$$\frac{1}{p}\frac{\mathrm{d}p}{\mathrm{d}r} = -\frac{Gm_\pi M}{k_B T r^2}\left(\frac{r}{\lambda}\right) \tag{7}$$

The gravitational acceleration (Equation (6) above) in the MOND limit is

$$g_{MOND} = -\frac{k_B T}{m_\pi}\frac{1}{p}\frac{\mathrm{d}p}{\mathrm{d}r} = \frac{GM}{\lambda r} \tag{8}$$

Hence, the acceleration far from the galaxy center, at $r \gg \lambda$ where $g \ll a_0$, is $\frac{GM}{\lambda r}$ and not the Newtonian acceleration $\frac{GM}{r^2}$ with $\lambda = \sqrt{\frac{MG}{a_0}}$ like Milgrom proposed

$$g_{MOND} = \frac{GM}{\lambda r} = \frac{\sqrt{GMa_0}}{r} \tag{9}$$

The MOND gravitational acceleration at the galaxy edge is extremely small but will be larger than the Newtonian gravitation acceleration if $r \gg \lambda$. For the milky-way mass, $\lambda = 51.5$ parsecs where the galaxy radius is about 16 parsecs so the MOND limit is not reached.

4. Pion Tetrahedron Kinetics

In previous papers we proposed that the hadron quarks perform quark exchange reactions with the pion tetrahedrons [9] [10] [17] [18] [19] [20]. The pion tetrahedrons may also collide with each other like in kinetic gas theory and exchange gluons as shown in **Figure 2** below. The QCD gluon exchanges may flip the quark flavor from d to u and vice versa.

Baryonic particles, a neutron or a proton, may interact with the pion tetrahedron condensate via tunneling. For example, a hot d and u quarks of an accelerated neutron (dud) or accelerated proton (uud) can be exchanged with a cold d and u quarks of a pion tetrahedron via gluon exchanges as shown in Equations (10a) and (10b) and the Feynman diagram below. The two antiquarks of the pion tetrahedrons $\tilde{d}$ and $\tilde{u}$ are the active reagents that trigger the exchange reactions (**Figure 3**, **Figure 4**)

$$dud + u\tilde{d}d\tilde{u} \rightarrow ddu + u\tilde{d}d\tilde{u} \quad (10a)$$

$$uud + u\tilde{d}d\tilde{u} \rightarrow udu + u\tilde{d}d\tilde{u} \quad (10b)$$

Feynman diagrams are used typically to describe high energy scattering events where momentum and energy is transferred in high energy particle colliders. However, we propose here that the quark exchange reactions described above with the pion tetrahedron condensate occur at low energies via tunneling and contribute to the binding energy of the protons and neutrons that are surrounded by a cloud of pion tetrahedrons. In a previous paper we used a double well potential model to describe the binding between a neutron and a proton in a deuterium nucleus [10] and here we propose that the double well potential model may be also used for protons and neutrons surrounded by pion tetrahedron cloud. Accordingly, Equation (10a) and (10b) may be seen as dynamic equilibrium equations for tunneling reactions in a double well symmetric potentials and the potential barrier height may be proportional to the condensate energy gap Δ.

$$dud + u\tilde{d}d\tilde{u} \rightleftarrows ddu + u\tilde{d}d\tilde{u} \quad (11a)$$

$$uud + u\tilde{d}d\tilde{u} \rightleftarrows udu + u\tilde{d}d\tilde{u} \quad (11b)$$

5. Antimatter Attraction Is the Source of Gravity?

We hypothesize that the source of gravity is the microscopic attraction of matter to antimatter, e.g. the underlying attraction of antiquarks and quarks mediated by the vacuum condensate pion tetrahedrons. The protons and neutrons' quarks attract the vacuum pion tetrahedrons antiquarks and create clouds of pion tetrahedrons around them with a density drop similar to the atmospheric density drop. The protons and neutrons perform high frequency quark and antiquark exchange reactions with the pion tetrahedrons described by Equation (11a) and (11b) via tunneling through the gap barrier Δ. The protons and neutrons quarks

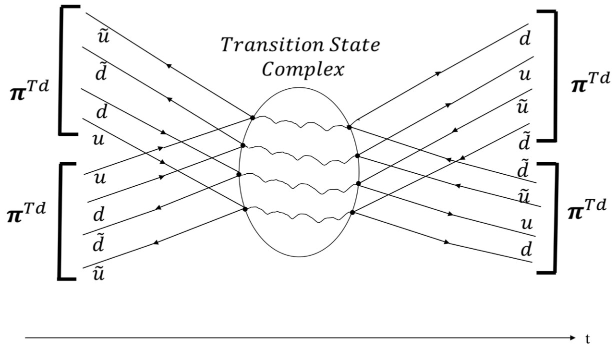

Figure 2. Illustrates scattering of two pion tetrahedrons with gluons exchanges that flip the quark flavors.

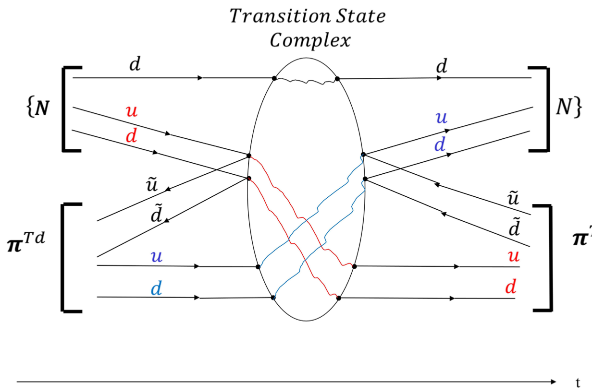

Figure 3. Illustrates quarks exchange reaction of a neutron and a pion tetrahedron where the antiquarks $\tilde{d}$ and $\tilde{u}$ are the active reagents that drive the exchange reactions via gluons.

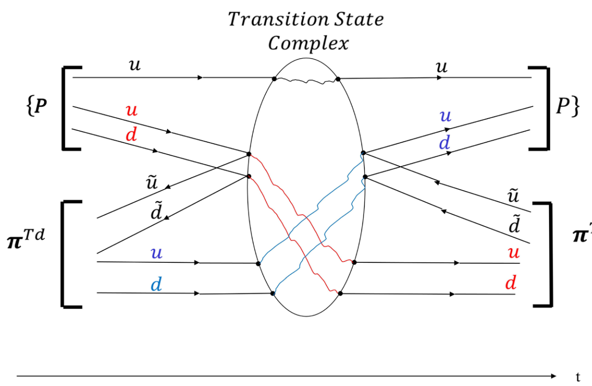

Figure 4. Illustrates quarks exchange reaction of a proton and a pion tetrahedron where the antiquarks $\tilde{d}$ and $\tilde{u}$ are the active reagents that drive the exchange reactions via gluons.

are attracted to the antimatter densities of neighboring particles' clouds as shown in **Figure 5** below. The source for gravity is the attraction between quarks and antiquarks that creates the pion tetrahedron atmospheric pressure drop around a massive body.

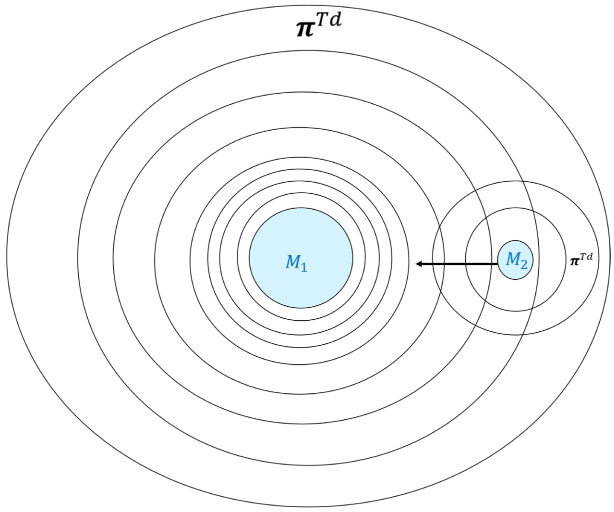

Figure 5. Illustrates the pion tetrahedron densities around two masses, $M_1 \gg M_2$. Since M_1 attracts higher density of pion tetrahedrons, M_2 will be attracted to it and will fall inwards in the direction of increasing pion tetrahedron density.

We proposed above to calculate the non-uniform pion tetrahedron condensate pressure based on the gas kinetic theory where the pion tetrahedrons gravitate and collide with each other in the field of a massive body. Then, based on the pion tetrahedron condensate pressure, a formula for the gravitational acceleration is proposed (see Equations (6) and (8)). The pion tetrahedron density far from galaxy clusters may be extremely reduced in the KBC giant voids and may reach the MOND acceleration limit. The ideal gas equation for the pion tetrahedrons in Equation (3) is only a rough approximation. We assume that the pion tetrahedrons collides with each other, exchange gluons with pion tetrahedrons and other particles and hence is reactive and it probably be better described for example by Sinha *et al.* invisible superfluid fermion and antifermions Aether [21]. We proposed that the pion tetrahedrons are comprised of the two light valence quarks and antiquarks, hence antiquarks, which are 50% of the pion tetrahedron condensate, fill space in huge quantities and have a central role also in low energy physics.

Migdal studied π condensation in nuclear matter and suggested that neutral and charged pions condense to superfluid in neutron stars [22]. Sinha *et al.* invisible superfluid Aether [21] pervades the entire universe and may account for the missing matter. Sinha *et al.* assumed that the density of visible matter in the universe is about $2*10^{-31}$ gram/cm^3 where the density of the invisible superfluid Aether is much higher and is on the order of 10^{-29} gram/cm^3. The pion tetrahedron condensate may be the invisible superfluid Aether that may account for the missing matter with no need to add new dark matter particles and its density may be related to Einstein's equation cosmological constant Λ. However, Sinha's superfluid Aether model did not specify explicitly if the superfluid density may be non-uniform, $\Lambda(\bar{x})$, and did not specify the attraction mechanism between the matter and antimatter pairs that triggers the condensation and creates the energy gap.

6. Electron Tetrahedron Model and Electron Cloud

According to the Standard Model (SM), the electron is an elementary, point-like, spin-half fermion. The SM Electric Dipole Moment (EDM) is related to CP violation and is expected to be extremely small below experimental sensitivity [23], $d < 10^{-34}$ e cm, based on Czarnecki and Krause three-loop calculation of the EDM of the u and d quarks [24]. If the electron has an internal structure, which is beyond the SM, its EDM will be larger. We propose an electron tetrahedron model, where the electron is comprised of tetraquarks, $d\tilde{u}\tilde{d}d$ and $d\tilde{u}\tilde{u}u$, and it performs high frequency quark exchange reactions with the pion tetrahedron condensate forming a delocalize electron cloud. We assume that the $d\tilde{u}$ quarks determine the negative electron charge and the $\tilde{d}d$ or $\tilde{u}u$ quarks determine the electron spin. Similarly, the positron two spin state tetraquarks may be $u\tilde{d}\tilde{d}d$ and $u\tilde{d}\tilde{u}u$. Dirac electron is represented by a four component Spinor wavefunction, $\hat{\Psi}(\vec{x})$, that describes the spin and the negative energy solution positrons [25], however, a constraint should be forced on the electron tetrahedron spin as described below in **Figure 11**. The proposed electron tetrahedron model gives the following interesting results:

a) High-frequency quark exchange reactions may transform electron tetrahedrons to pion tetrahedrons and vice versa by tunneling through the vacuum condensation gap as shown in **Figure 6** with the exchange of a single quark flavor u and d.

b) An electron and the pion tetrahedron condensate may form a delocalized electron cloud with a fixed spin state *σ*, or -*σ*, described by Equations (12a) and (12b) and illustrated in **Figure 7**.

$$d\tilde{u}d\tilde{d}\left(e_{\sigma}^{-}\right)+d\tilde{u}u\tilde{d}\left(\pi^{Td}\right)\rightleftarrows d\tilde{u}u\tilde{d}\left(\pi^{Td}\right)+d\tilde{u}d\tilde{d}\left(e_{\sigma}^{-}\right) \tag{12a}$$

$$d\tilde{u}u\tilde{u}\left(e_{-\sigma}^{-}\right)+d\tilde{u}u\tilde{d}\left(\pi^{Td}\right)\rightleftarrows d\tilde{u}u\tilde{d}\left(\pi^{Td}\right)+d\tilde{u}u\tilde{u}\left(e_{-\sigma}^{-}\right) \tag{12b}$$

c) Two electrons with opposite spins may form a **pion tetrahedron QCD bond** where the pion tetrahedron, $u\tilde{u}d\tilde{d}$, acts as a QCD glue (**Figure 8**).

$$d\tilde{u}d\tilde{d}\left(e_{\sigma}^{-}\right)+d\tilde{u}u\tilde{u}\left(e_{-\sigma}^{-}\right)\rightleftarrows d\tilde{u}u\tilde{u}d\tilde{d}d\tilde{u} \tag{13}$$

d) Electrons and positrons annihilation may create two pion tetrahedrons that join the vacuum pion tetrahedron condensate.

$$d\tilde{u}d\tilde{d}\left(e_{\sigma}^{-}\right)+u\tilde{d}u\tilde{u}\left(e_{-\sigma}^{+}\right)\rightleftarrows 2d\tilde{u}u\tilde{d} \tag{14}$$

However, if the electron and positron have the same spin state, the result are more energetic $d\tilde{d}d\tilde{d}$ or a $u\tilde{u}u\tilde{u}$ tetraquark combinations that will decay fast to two γ rays that propagate in the underlying pion tetrahedron condensate.

$$d\tilde{u}d\tilde{d}\left(e_{\sigma}^{-}\right)+u\tilde{d}d\tilde{d}\left(e_{\sigma}^{+}\right)\rightleftarrows d\tilde{u}u\tilde{d}+d\tilde{d}d\tilde{d} \tag{15a}$$

$$d\tilde{u}u\tilde{u}\left(e_{-\sigma}^{-}\right)+u\tilde{d}u\tilde{u}\left(e_{-\sigma}^{+}\right)\rightleftarrows d\tilde{u}u\tilde{d}+u\tilde{u}u\tilde{u} \tag{15b}$$

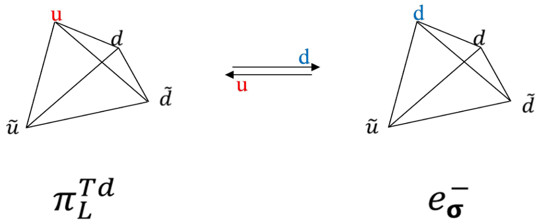

Figure 6. Illustrates an electron and a pion tetrahedron models where a single quark flavor is changed (u and d).

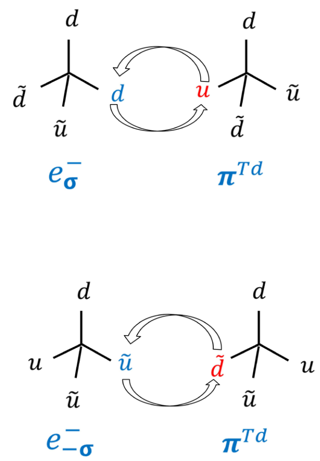

Figure 7. Illustrates the quark exchange reaction between electrons and pion tetrahedrons with the two fixed spin states σ or -σ that form delocalize electron clouds.

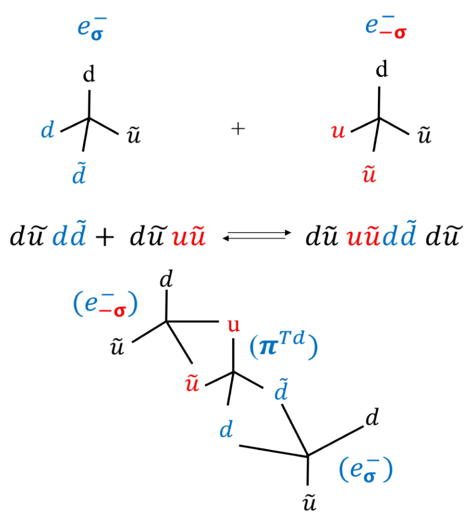

Figure 8. Illustrates the pion tetrahedron bond between two electrons with opposite spins mediated by a pion tetrahedron QCD glue.

e) The protons and neutrons two spin states may also be determined by the $\tilde{d}d$ or $\tilde{u}u$ quarks. Protons and neutrons may be pentaquarks and may also form a **pion tetrahedron bond** in the deuterium nuclei for example [10] as shown in Equation (16) and illustrated below in **Figure 9**

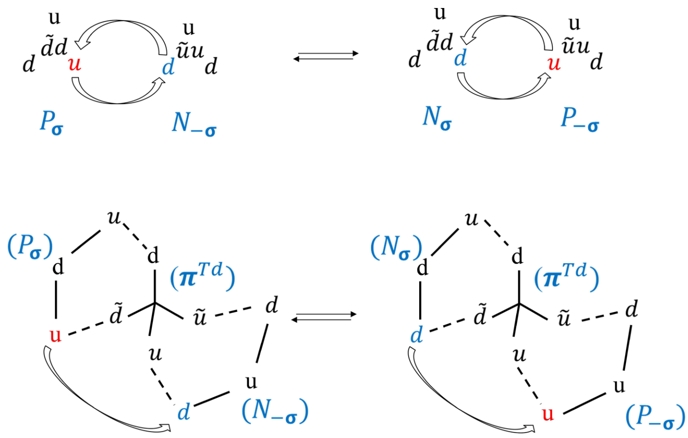

Figure 9. Illustrates a proton and a neutron as pentaquarks with two spin states determined by the $\tilde{d}d$ or $\tilde{u}u$ quarks performing quark exchange that transform a proton to a neutron and vice versa on the top and where the $\tilde{d}d$ and $\tilde{u}u$ quarks may form a pion tetrahedron QCD glue tetraquark $\tilde{d}d\tilde{u}u$ as shown in the bottom that may represent a deuterium nuclei.

$$uud\tilde{d}d\left(P_{\sigma}\right)+udd\tilde{u}u\left(N_{-\sigma}\right)\rightarrow uddu\tilde{d}d\tilde{u}uud \tag{16}$$

Nature seems to duplicate its tricks. The difference between a proton and a neutron is a single quark flavor exchange, a d flavor quark in a neutron is replaced by a u flavor quark in a proton. Similarly in the proposed electron tetrahedron model, the difference between an electron and a pion tetrahedron is the same quark flavor exchange. A d flavor quark in the electron tetrahedron model is replaced by a u flavor quark in the pion tetrahedron as illustrated in **Figure 10** below.

The nucleons spin is used to study their internal structure and is due not only to the valence quark angular momentum but also includes contributions from gluons and the quark sea [25]. We propose the following constraint for the electron tetrahedron spin. We assume that the electron tetrahedron rotates around the axis of the quark on the top of the tetrahedron structure illustrated in **Figure 11**. The three other quarks, which have the same flavor, rotate in a plane and the electron tetrahedron total spin is constrained to be $1/2\hbar$. The electron tetrahedron rotation model may also explain the electronic energies split in a magnetic field since the anti-up quark has a −2/3 charge while the down quark has a −1/3 charge and the two electron tetrahedrons configurations will respond differently to an external magnetic field.

7. Valence Quarks and Antiquarks Conservation

Feynman rules allow both descriptions of the electron propagation in the vacuum illustrated below in **Figure 12**. In the first diagram (a) an electron-positron pair is created from a virtual photon, the positron propagates backwards in time and annihilates an incoming electron that created the photon earlier. In the second diagram (b) an electron emits the virtual photon and later absorbs it.

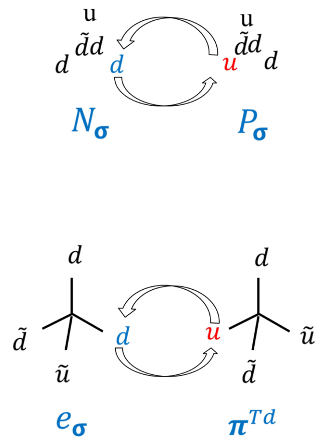

Figure 10. Illustrates on the top a proton and a neutron exchanging d and u quarks and similarly at the bottom an electron tetrahedron and a pion tetrahedron exchanging the d and u quarks.

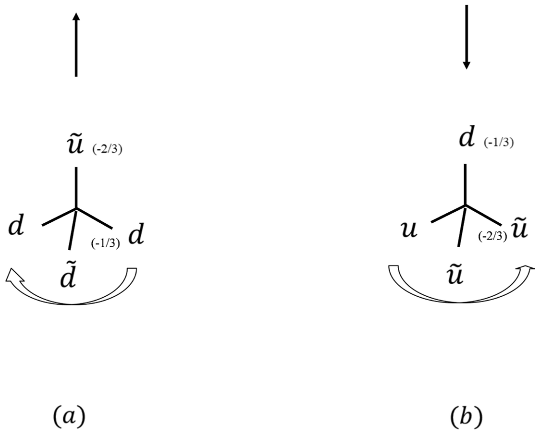

Figure 11. Illustrates the spin constraint for the electron tetrahedron model. The out of plane charge is $-2/3q$ in (a) and $-1/3q$ in (b).

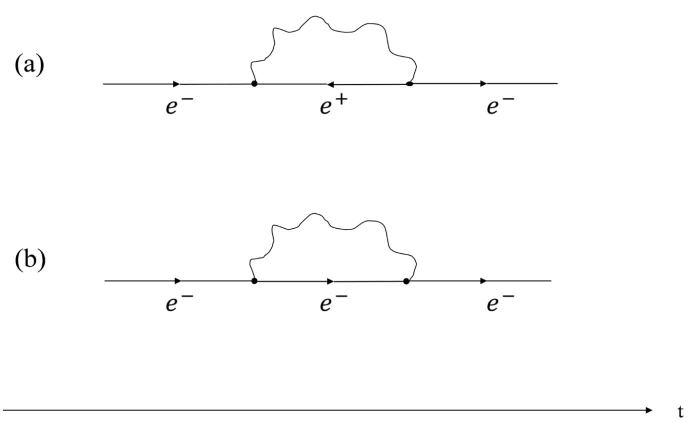

Figure 12. Illustrates (a) an electron-positron pair created by a virtual photon, the positron propagates backwards in time and annihilates the incoming electron that created the virtual photon earlier; and (b) an electron emits a virtual photon and later absorbs it.

Does the electron emit a virtual photon and absorb it later as diagram (b) suggests or the interaction vertex should involve also an antimatter particle that creates or annihilates the matter particle and creates or annihilates the interaction particle as diagram (a) suggests? Diagram (a) seems more consistent with the Dirac equation. Antimatter and matter components cannot be separated, and antimatter particle should be part of the interaction vertex with a matter and an interaction particle and maybe should not be omitted.

Feynman diagrams describe reactions amplitudes between incoming reactants and outgoing products where a transition state complex may be created for a short time and may involve exchanging one or more interaction particles (for example gluons) as shown in **Figure 13** for electron and pion tetrahedron scattering. The overall energy, momentum and spin must be conserved and we propose here that the number of valence quarks and antiquarks should also be conserved constants of motion. The valence quarks and antiquarks are not created or destroyed during the interactions and may only be exchanged between the reactants forming the products.

8. Summary

1) **Non-uniform pion tetrahedron Aether:** The $u\tilde{d}d\tilde{u}$ pion tetrahedrons fill space and form a non-uniform condensate with an atmospheric like density drop. The $u\tilde{d}d\tilde{u}$ pion tetrahedron mass may be calculated by measuring the β decay rate variability [9]. In the limit of infinite number of coupled pion tetrahedrons, the pion tetrahedron vacuum polarization integral vanishes and the vacuum pion tetrahedrons do not decay [10].

2) **Source of gravity:** The attraction between quarks and antiquarks may be the source of gravity. The pion tetrahedrons density in space vary according to the gravitational field and the gravitational force is transferred by interactions with the pion tetrahedron condensate. Far from the galaxies' centers in the KBC voids for example, the condensate density may be extremely small and the MOND limit may be obtained with no need for dark matter.

3) **Electron tetrahedron cloud model:** The electron may be a tetraquark tetrahedron, two quarks determine the electric charge and two quarks determine the electron spin. High frequency quark exchange reactions may transform the electron tetrahedrons to pion tetrahedrons and vice versa and form together an electron cloud with a fixed spin state.

4) **Pion tetrahedron bond:** Electron pairs that form chemical bonds and proton-neutron pairs in the nuclei having opposite spins determined by the $u\tilde{u}$ and $d\tilde{d}$ quark pairs may be the result of a pion tetrahedron bond, where the $u\tilde{d}d\tilde{u}$ pion tetrahedron acts as a QCD.

5) **Valence quarks and antiquarks conservation:** Feynman diagrams describe reaction transition state complexes, where in addition to the conservation of total energy, momentum and spin, the number of valence quarks and antiquarks are conserved during the reaction and may only be exchanged between reactants forming the products.

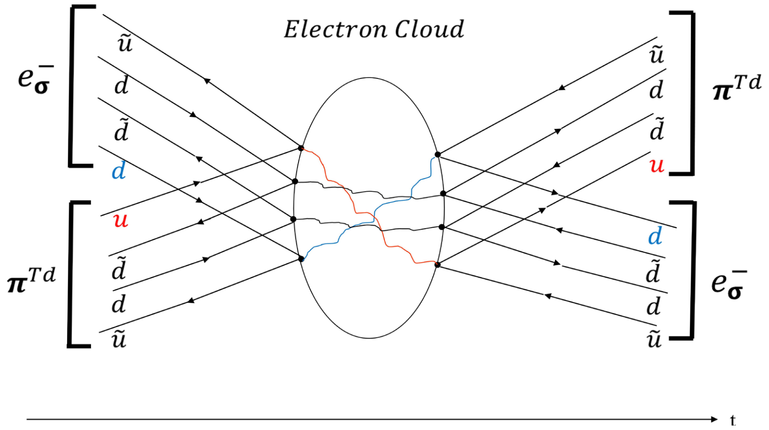

Figure 13. Illustrates free electron propagation in the pion tetrahedron condensate, the QCD vacuum. The electron tetrahedron is scattered on a pion tetrahedron exchanging the d and u quarks transforming the electron tetrahedron to a pion tetrahedron and vice versa forming an electron cloud by the high frequency quarks exchange. The electron may be a many-body cloud that includes a plurality of pion-tetrahedrons that perform rapid quark exchange reactions with the electron tetrahedron and conserve the charge and the spin.

QCD is a high-energy theory of the sub-nuclear particles, but it may have a critical role also in low energies due to the non-empty QCD vacuum condensate. Antimatter particles discovered by Dirac [26] play a significant role in physics in general, and more specifically, they are assumed to be 50% of the non-uniform pion tetrahedron condensate Aether that fill space. In the 1960's Dirac said that understanding electron dynamics requires understanding the structure of the vacuum because the electron is never bare [27]. The proposed electron tetrahedron embedded in the pion tetrahedron Aether creating together a delocalized electron cloud may be the model Dirac was looking for.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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