Review Article
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The nuclear force explaining by a bag model resulted from a vortexial, cold genesis model of nucleon

Abstract

In a pre–quantum theory developed by author, which considers the magnetic moment as etherono–quantonic vortex $\Gamma_M = \Gamma_A + \Gamma_B$ of etherons and of quantons with mass $m_h = h/c^2$ and argues a quasi–crystalline model of quark and particle, resulted as Bose–Einstein condensate of N gammons considered as pairs ($e^{*+} - e^{*-}$) of quasi–electrons with degenerate magnetic moment μ_e^*, the nuclear force results by the attraction of the nucleon's impenetrable volume in the field of (2N+1) superposed etherono–quantonic vortices $\Gamma(r)$. The quarks confining force results in a pre–quantum "bag" model, with repulsive shell of the impenetrable quantum volume of nucleon, in accordance with the known value of the deconfination temperature $T_d \approx 2x10^{12} K$, without the hypothesis of intermediary gluons, by the nucleon's intrinsic energy $m_n c^2$.

Keywords: pre–quantum model, bose–einstein condensate, bag model, repulsive shell, strong force

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Introduction

In a previous article[1] were presented shortly some basic models resulted from a pre–quantum cold genesis theory of matter and fields[2,3] of the author, (CGT), regarding the cold forming process of cosmic elementary particles, formed–according to the theory, as collapsed cold clusters of gammons–considered as pairs: $\gamma = (e^- e^+)$ of axially coupled electrons with opposed charges, which gives a preonic, quasi–crystalline internal structure of cold formed quarks, with hexagonal symmetry, based on $z^0 \approx 34\ m_e$ preon–experimentally evidenced in 2015 but considered as X–boson of a fifth force, resulted in the model as cluster of 21 gammons,[4] i.e–of 42 quasielectrons with degenerate mass: $m_e^* = 0.8091 m_e$, ($z^0 = 33.982\ m_e$), which explains the difference between the proton mass and the neutron mass ($\sim 2.6\ m_e$) as "wesonic" couple: $w^- = e^- + s$, σ being a "gluol", i.e, a linking degenerate gammon: $\gamma^* = (e^{-*} e^{+*}) = 2m_e^* \approx 1.62\ m_e$, which bind the neutronic electron to the protonic part: ($N^p m_e^* + 1 m_e$).

According to CGT, based on the galilean relativity, the magnetic field is generated by an etherono–quantonic vortex: $\Gamma_M = \Gamma_A + \Gamma_\mu$ of s–etherons (sinergons with mass $m_s \approx 10^{-60} kg$) giving the magnetic potential $\boldsymbol{A}$ by an impulse density: $p_s(r) = (r_s \times c)_r$ and of quantons (h–quanta, with mass: $m_h = h \cdot 1/c^2 \approx 7.37x10^{-51} kg$) giving the $\boldsymbol{E}$–field, the magnetic moment and the magnetic induction $\boldsymbol{B}$ by an impulse density: $p_c(r) = (r_c v_c)_r$:

$$E_s(r) = k_1 \cdot \rho_e(r) \cdot v_c^2 = \frac{1}{2} k_1 \cdot \frac{\Delta p_c}{\Delta t};\ q_s = \frac{4\pi \cdot r_q^2}{k_1};\ v_c \approx c$$
$$B = k_1 \cdot \rho_\mu(r) \cdot v_c;\ (k_1 = \frac{4\pi \cdot a^2}{e};\ a = 1.41 fm\ ) \quad (1)$$

the nuclear field resulting from the attraction of the quantum impenetrable volume υ_i of a nucleon in the total field generated according to fields superposition principle, by the (N^n+1) superposed vortices $\Gamma_\mu^*(r)$ of the degenerate electrons of another nucleon, having an exponential variation of quanta impulse density:

$$V_n(r) = -\upsilon_i \cdot p_d(r) = -V_n^0 \cdot e^{-\frac{r}{\eta^*}};\ V_n^0 = \frac{\upsilon_i}{2} \rho_n^0 \cdot c^2;\ r \le r_\mu^a \quad (2)$$

The possibility of a cold genesis of particles, results theoretically in a chiral soliton model as Bose–Einstein condensate of photons–in the electron's case and of "gammons": $\gamma_c = (e^+ - e^-)$ in the case of mesons and of baryons, with the inertial degenerate mass m_e^* formed by a superdense centroid m_0 contained by an impenetrable quantum volume and by vexons (vectorial photons composed by vortexed vectons: $m_v \approx 2x10^{-40} kg$ –the E–field quanta in CGT), contained by the electron's volume, υ_e of radius a=1.41fm, characteristic to a charge' distribution on the electron's surface.

In a previous paper of the author,[4] was argued the conclusion that at very low temperature $T \to 0K$, at the electrons clusterizing (interdistance: $d_i < a$), their inertial masses and magnetic moments are diminished because the decreasing of the density variation mean radius η^*, according to the relations:

$$\rho(r) = \rho^0 |\psi_e|^2;\ |\psi_e|^2 = \psi_e^- \cdot \psi_e^+ \quad (3a)$$

$$\psi_e^{\pm *} = R^* \times e^{\pm iS/\hbar}; (R^*)^2 = e^{-r/\eta^*} = k_d \times R^2 \quad (3b)$$

$$R^2 = e^{-r/\eta};\ \eta^* < \eta;\ k_d \approx e^{-(n \times \gamma / l) \times r} \quad (3c)$$

where: $(\Psi_e^+; \Psi_e^-) \sim \Gamma_\mu^\pm$ 'classic' wave function of the free positron and negatron structure; k_d –degeneration coefficient, which depends on the distance 'l_i' between the component electrons, for a system with more electrons, k_d depending also on the number 'n' of gammons forming the protonic neutral cluster N^p of the particle, formed as B–E condensate of $N^p = m_p / m_e^* = 1835{,}1/0{,}8091 = 2268$

quasi–electrons, (n=1134 gammons), according to an empiric relation (3b),in which $k_d < 1$, $\Psi_e^{\pm}$ being interacting fields.

The value of the constant γ in equation (3c) may be approximated by CGT with the case of a proton's N^p neutral cluster, formed with the decreasing of the η_e –mean radius of the electron' mass, from $\eta_e = 0.965\,fm$ (for the free electron)[2,3] to: $\eta_n \approx 0.87\,fm$ (the root mean square charge radius of proton, experimentally determined)[5]–for the nucleon's quasielectron, which results in the model, for a proton with a considered effective radius: $r_p \approx a = 1.41\,fm$, (equal to those of the electron with e–charge on surface, in accordance with equation (1) and with the nuclear radius formula: $R_N \approx r_p \cdot A^{1/3}$), by the mass integral equation:

$$m_p = \int_0^a 4\pi\, r^2 \rho_p(r).dr\ ;\ \rho_p(r) = \rho_p^o \cdot e^{-\frac{r}{\eta_n}} = \rho_p^o \cdot \left|\Psi_p\right|^2;$$

$$\Rightarrow \rho_p^{\,0} \approx (2n+1)\rho_e^{0*} = 4.54\,x10^{\,17} kg/m^3 \qquad (4)$$

with: $\eta_n = 0.87\,fm$ [5] and: $\rho_e^{\,0*} = f_c \cdot \rho_e^{\,0}$; $\rho_e^{\,0} = 22.24x10^{13} kg/m^3$, [2,3], $f_c \approx 0.9$ being a coefficient of density reducing in the center of the (quasi)electron at its mass degeneration, with the value resulted from equation (4). Also, because that–according to CGT, the degenerate electrons of the protonic B–E cluster are quasi–electrons, with the charge $e* = \left(2/3\right)e$ characteristic to the up–quark, by the specific dependence: $e \sim \rho_c(a)$, by equation (1) and (2), to the $\rho_c(r)$ –density variation of the quasi–electron's magnetic moment vortex $\Gamma_\mu^{\ *}$, it corresponds a mean radius of the $\Gamma_\mu^{\ *}$ –vortex: $\eta_\mu = 0.801\,fm$. With $l_i \approx (2 \div 3)x10^{-2} fm$,[1] (all m_0 –centroids in υ_i), it results that $\gamma = \gamma_e \approx 2x10^{-6}$ for the electron' mass decreasing and: $\gamma = \gamma_\mu \approx 3.8x10^{-6}$ for its charge and magnetic moment density decreasing.

The virtual radius: r_μ^n, of the proton μ_p –magnetic moment, compared to the electron, decreases when the protonic positron is included in the N^p cluster volume, from the value: $r_\mu^{\ e} = 3.86x10^{-13} m$, to the value: $r_i = r_\mu^{\ p} = 0{,}59\,fm \approx 0.6\,fm$, as a consequence of the increasing of the impenetrable quantum volume mean density in which is included the protonic positron centroid ("centrol"): m_0 , from the value: $\overline{\rho}_e$ to the value: $\overline{\rho}_e \cong f_d \times N^p \times \overline{\rho}_e$, conformed with the equations:

$$\mu_p = k_p \frac{m_e}{m_p} \mu_e = k_p \frac{\overline{\rho}_e}{\overline{\rho}_n} \mu_e \approx k_p \frac{1}{f_d \cdot N^p} \mu_{Bp} = \frac{e.c \cdot r_\mu^p}{2};$$
$$k_p = \frac{g_p}{g_e} = 2.79 = \frac{\rho_n(r^+)}{\rho_n^0} = e^{\frac{r^+}{\eta_d}};\ \upsilon_n \approx \upsilon_e = \frac{m_e}{\overline{\rho}_e} \qquad (5)$$

in which: k_P –the gyromagnetic ratio; $\overline{\rho}_e$; $\overline{\rho}_n$ –the mean density of electron and nucleon; r^+ –the position of protonic positron centrol in report with the proton centre; f_d –the degeneration coefficient of the quasielectron mass m_e^* ; υ_n –the nucleon' volume, (containing all its inertial mass).

The dependence: $\mu \sim m^{-1}$ is explained in the model by the fact that the intensity of the electron's magnetic moment $\Gamma_\mu^e = 2\pi r_\lambda^e c$, is distributed to all ($N^n + 1$) degenerate electrons which composes the proton, i.e.:

$$\Gamma_\mu^e = 2\pi r_\lambda^e c = \left(N^n\right) \times \Gamma_\mu^* + \Gamma_\mu^{\ e*};\ \Gamma_\mu^{\ e*} \approx k_p \times \Gamma_\mu^{\ *} \qquad (6)$$

but because N^n are paired vortexes, only the remained unpaired vortex $\Gamma_\mu^{e*} = 2\pi r_\mu^p c$ of the protonic positron gives the proton's magnetic moment. The virtual radius of the proton' magnetic moment: $r_\mu^n = 0.59\,fm$ –resulted from equations (5) & (6), may be considered approximately equal to the radius of the impenetrable nucleon volume, of value: $r_\mu^{\ n} \cong a_i \cong 0.6$fm–used in the Jastrow expression for the nuclear potential,[6] by the conclusion that the impenetrable nucleon' volume, ($\upsilon_i(r_i) = 0.9\,fm^3$), being supersaturated with heavy photons, limitates the radius decreasing to the quantonic vortex $\Gamma_\mu^p = \Gamma_\mu^{e^*} = 2pr_\mu c$, at the value: $r_\mu = r_\mu^n \approx a_i = 0.6\,fm$.

The relation (5) also gives: $r_e^+ \approx 0.9\,fm$ for the protonic positron axial position inside the protonic quantum volume. The superposition of the ($N^p + 1$) quantonic vortices: Γ_μ^* of the protonic quasielectrons, generates inside the volume with the radius: $r_\mu^a = 2.35\,fm$,[2,3] a total dynamic pressure: $P_n = (1/2)\rho_n(r) \times c^2$ which gives a nuclear potential in an eulerian form (2), with: $\eta* \approx 0.8\,fm$ and $V_n^0 = ½\upsilon_i.\rho_n^0 c^2 = 109.8 \div 114.9\ MeV$, (the potential well), specific to $\upsilon_i(a_i = 0.59 \div 0.6\,fm)$.

At the distance $d \cong 2\,fm$ between deuteronic nucleons (generally considered as the dimension of the nuclear potential well), it results from the relation (2) that the scalar nucleonic potential has the value: $V_s^n(d) = 8.98 \div 9.4\ MeV$ (for $a_i = 0.59 \div .6\,fm$) which corresponds to the known mean binding energy inside the stable nuclei: 7.5….8.8 MeV and to those of the most strongly bound nucleons (56Fe, 60Ni,): $\sim 9.15\ MeV/nucleon$.

According to equation (2), it results also that the deuteronic self–resonance decreases the value of scalar nuclear potential, until a value: $V_s^{0'} = k_v \times V_s^0$, with $k_v \approx 0.72$.[2,3]

It is known also the MIT bag model of particle,[7] based on Bogoliubov's model (1967) and on the Quantum Chromodynamics, which consider the quarks moving inside a „bag" volume of radius R ≈1fm, with the normal component of the pressure exerted by the free Dirac particles inside the bag balanced at the surface by the difference in the energy density of the quantum vacuum inside and outside the "bag":

$$E = (4\pi/3)B \times R^3,\ with\ B \approx 60MeV/fm^3, \qquad (7)$$

The B–constant having the meaning of a quantum vacuum pressure. The "bag" model allowed in particular a string model of hadrons, which describes the interaction force between two quarks by a potential of the Cornell form:[8]

$$V_{qC} = -\frac{k_1}{r} + k_2 \cdot r \qquad (8)$$

(with a pseudo–Coulombian term of gluon exchange and a strong force term), considering that when two color charges are separated, a string (flux tube) is formed in between, k_2 representing the string tension: ~1GeV/fm, according to the quarkonium model, and $\sim 0.5\ GeV/fm$

and $B \approx 8x10^{33} N$ according to some other authors.[9] According to another approach of asymptotic freedom, the force between quarks considered in QCD is of a value: $F_{qq} \approx 10^4 N$.

It is known also that the nucleonic impenetrable volume is repulsive at distances between nucleons less than 0.7 fm, and attractive at higher distances, with maximum at $\sim 0.9\, fm$. But it is known also that the d–quark current mass (corresponding to the quark's mass inside the "bag") is only $2.3\, MeV / c^2$ for u–quark and $4.8\, MeV / c^2$ for d–quark, the rest nucleonic mass being given by gluons, the cross–over temperature from the normal hadronic to the quarks–gluons phase being about: $T_d \approx 2x10^{12} K$, value at which the quark–gluon plasma can be created by heating matter up to T_d–which corresponds to 172 MeV per particle.[10]

But even if we consider only two gluons, with an intrinsic energy $\epsilon = (939 - 2x2.3 - 4.8)/2 \approx 465\, MeV$, it results that almost entire intrinsic energy of the gluon must be used for the quarks retaining inside the nucleon's quantum volume, being raised a bigger question, regarding the possible natural mechanism for this energy→mechanic work conversion.

In this case, a question which may be raised is: why it results as necessary an inter–quarks force of ~10^4N for maintain the quarks confination until $T_d \approx 2x10^{12} K$ and how the color charge of the hypothetical gluons–considered by the Quantum Chromodynamics, generates phenomenologically the quarks binding potential? A relative correspondence between the vortexial model of nuclear force generating, resulted in CGT and the Bag Model of strong potential value increasing with the distance between quarks inside the particle, may result in concordance with the known quarks deconfination temperature $T_d \approx 2x10^{12} K$.[10]

Theoretical "bag" model of quarks confining force

Because the fact that the internal vortexiality of the photonic sub–structures forming the nucleonic quantum volume–according to CGT, are energetically maintained by the energy of the superposed vortices $\Gamma^*_\mu(r)$ of the degenerate electrons, the difference between the values γ_μ and γ_e resulted by the vortexial model of nucleon in CGT for the γ constant used in the equation (5) suggests that a proportion: $k = \Delta m / m_n \leq 0.13$ of the nucleon's mass is in the form of kinetized quantonic clusters $m_{vi} \approx 10^{-40} kg$, (vectonic inertial masses, resulted from destroyed vexons, according to CGT), vortexially retained at the surface of the impenetrable quantum volume of the nucleon υ_I , of radius $r_i^* = a_i \approx 0.6\, fm$, by the total dynamic quantonic pressure: $P_{di}{}^0\left(r_i^*\right)$ of the Γ^*_μ vortices of the protonic quasielectrons and they generates a static quantum pressure of quantonic clusters, of maximal value: $P_{si}{}^0 = \rho_c{}^i\left(r_i^*\right) \cdot c^2$, acting uniformly on the surface of the nucleonic impenetrable volume $\upsilon_i\left(a_i\right)$ for a free proton or neutron.[11]

It is possible to argue this conclusion considering the case of a simple stable vortex Γ_c of quantons–for example, particularly with an exponential variation (given by a Boltzmannian distribution around its (super) dense kernel) and with the impulse density $p_r = \rho(r) \cdot c$, for which we consider a small volume δυ containing a small mass $\delta m_v = \rho_v(r) \cdot \delta u$ of the vortex.

The equilibrium condition imposes that the centrifugal potential: $V_{cf} = ½\delta mc^2$ to be equilibrated by a static pressure potential of eulerian form:

$$V_{cf} = ½\delta m_v c^2 = V_a = \delta\upsilon \cdot P_s \text{ with } P_s = \rho_s(r) \cdot c^2 \qquad (9a)$$

resulting the condition: $P_s = P_d = ½\rho_v c^2 ; \rho_s(r) = ½\rho_v(r)$. This condition may results also by a non–linear Schrodinger equation with soliton–like solution resulted by a self–potential $V_a = V_a{}^0 \cdot |\psi|^2 ; |\psi|^2 = \rho / \rho^0$ [2,3] and corresponds to a simple Bernoulli equation:

$$P_s(r) + P_d(r) = \rho_m(r) c^2 ; \Rightarrow \rho_m(r) = 3\rho_s(r) \qquad (9b)$$

If a heavier mass: $\delta m = \rho(r) \cdot \delta\upsilon > \delta m_v$, having its own impenetrable quantum volume, obtains in the Γ_c–vortex an upper kinetic energy E_c than those imposed by the equation (9), it may be expelled from the vortex, but when $E_c(r)$ is close to $V_a(r)$ resulted from (9), the δm–mass loose quickly the kinetic energy excess and return to the initial vortex–line of circulation, resulting in this case also a radial vibratory displacing of the δm–mass. In the nucleon case, this effect is sustained by the vortex $\Gamma_\mu{}^p(\mu_p)$.

Because for an unperturbed nucleon $P_{si}{}^0\left(r_i^*\right)$ cannot exceed $P_{di}{}^0\left(r_i^*\right)$, according to equation (9), in a simplified model, we will consider that $P_{si}{}^0\left(r_i^*\right)$ is approximate equal with $P_{di}{}^0$–given by the vorticity of internal substructure, i.e:

$$P_{sc}(r) + P_{dc}(r) = \rho_n(r) \cdot c^2 ; P_{si}{}^0 \approx P_{di}{}^0 \approx ½\rho_n{}^i \cdot c^2 ; \qquad (10a)$$

$$\rho_n{}^i\left(r_i^*\right) = \rho_n{}^0 e^{-r_i/\eta^*} \qquad (10b)$$

with $\rho_n{}^i$ –the nucleon's density at the surface of the impenetrable nucleonic volume, $\eta^* = \eta_n = 0.87\, fm$ and Psc(r) , Pdc(r) –the static and the dynamic quantum pressure of the quantonic clusters (paired vectors) inside the nucleon.

The previous considered phenomenon may explain microphysically the repulsive property of the impenetrable quantum volume of the nucleon, evidenced by the experiments of nucleon–nucleon scattering at high energy and used by the nucleon model with repulsive kernel, experiments which indicated a value: $r_i^* = 0.45\, fm < r_\mu^n \cong a_i \cong 0.6\, fm$,[12] the value $a_i \cong 0.6\, fm$ being used in the Jastrow nuclear potential.[6]

In the sametime, considering an gaussian variation of the $P_{sc}(r)$ in the considered repulsive "shell" it may be explained by the gradient: $\nabla P_{sc}(r)$, also the strong nuclear force acting over a quark inside the nucleonic impenetrable quantum volume.

This force may be calculated in the model by the equations:

$$V_q = V_{q\mu} + V_{qr} = -(\mu_q^r \cdot B_q^r(d_i) + \upsilon_q \cdot P_{si}) ; \; P_{si} \approx P_{si}^0 \cdot e^{-\left(\frac{r - a_i}{\delta}\right)^2} ; \qquad (11)$$
$$P_{si}^0 \approx \frac{1}{2}\rho_n^i(r_i^*) \cdot c^2 \approx 10.2x10^{33} \frac{N}{m^2} ; \; a_i \approx 0.45 fm$$

$$F_{qr} = -\nabla V_{qr} = -\upsilon_q \cdot \nabla P_{si} = 2\frac{\upsilon_q \cdot (r - a_i)}{\delta^2} P_{si}^0 \cdot e^{-\left(\frac{r - a_i}{\delta}\right)^2} \qquad (12)$$

In which $\upsilon_q\left(r_q, m_q\right)$ is the quantum impenetrable volume of the quark and: $\delta = \sqrt{2}c$, (c–the gaussian standard deviation) $a_i \approx r_i^* \approx 0.6\, fm$ and $V_{q\mu} = \mu_q{}^r \cdot B_q{}^r$ –the magnetic potential of interaction between two quarks with relative magnetic moment $\mu_q{}^r = ½e_r{}^* \cdot d_i \cdot c$ which generates an induction:

$$B_q^{\ r} = k_1 \rho_\mu c = B_q^{\ 0} \cdot e^{-r_i/\eta^*}; \rho_\mu = (f_c \cdot \rho_e^{\ 0}) \cdot e^{-r_i/\eta^*}; \eta^* \approx 0.8\, fm$$

The mass $m_q(r_q \approx 0.2\, fm)$ may be considered the equivalent of the current mass of d–quark. We may consider also that: $m_q \approx \upsilon_q \cdot \rho_n^{\ 0} \approx 1.52x10^{-29} kg$, ($m_q \approx 8.5 MeV / c^2$), is equivalent to the current mass of u and d–quark, being close to those considered by the Standard Model of Q.M. for the d–quark, according to CGT. If we maintain the value of the impenetrable quantum volume given by equation (6) with $\eta = 0.87\, fm$, the density $\rho_n^{\ *}$ between quarks results in this case of $\sim 2.83x10^{17} kg / m^3$, close to those at $a_i \cong 0.6\, fm : \rho_i\left(0.6\, fm\right) = 2.27x10^{17} kg / m^3$.

The sense of $F_q(r < a_i)$ is toward the nucleon center and its variation (increasing with r) corresponds qualitatively to the „asymptotic freedom" of the "bag" model of nucleon, the remained non–quark mass of the nucleon's impenetrable quantum volume being the equivalent of the „confined gluons", considered in the MIT bag model, (Figure 1).

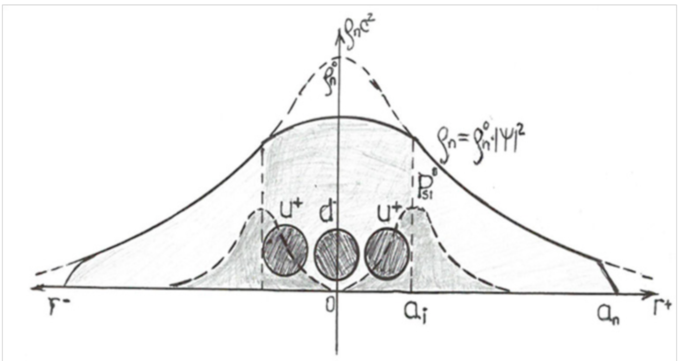

Figure1 Model of nucleon with repulsive kernel.

According to the model, for quarks deconfination is enough the energy necessary to the considered current quark mass $m_q \approx 8.5 MeV / c^2$ for penetrate the repulsive shell with repulsive potential V_{qr} , because that in the exterior of the impenetrable quantum volume, we have: $\mathbf{F}_{qr} // \mathbf{r}$ and after the distance $r_\eta = \eta \approx 0.87\, fm$, the attractive nuclear force acting toward $\upsilon_q\left(r_q\right)$ is of $(r_\mu^n / r_q)^3 \approx 27$ times smaller than those acting over $\upsilon_i(r_\mu^n)$.

The model has partially phenomenological correspondence also with the "chiral bag" model, which replaces the interior of a skyrmion with the "bag" of quarks, of a radius smaller than the nucleon radius, with a pionic field outside of the bag, with a "bag" radius ≈ 0.6 fm.[13]

The magnetic potential $V_{q\mu}$ of equation (11) depends on the value of the relative magnetic moment $\mu_q^{\ r}$ of the quark and on the B–field generated by the interacting quark, with the inter–distance $d_i = r^* = 0.45\, fm$, which in CGT, has the form:[14]

$$\mu_q^{\ r} = \tfrac{1}{2}\left(2/3\right) e^* \cdot d_i \cdot c; e^* = 4\pi d_i^2 / k_1 = e\left(d_i / a\right)^2 \qquad (13)$$

$$B_q^{\ r} = k_1 \rho_m\left(d_i\right) \cdot c\ ; \rho_\mu\left(d_i\right) = \left(1/3\right) \rho_e^{\ 0} \cdot e^{-d_i/\eta^*}; \qquad (14)$$

resulting: $\mu_q^{\ r} \approx 0.05 \mu_p$; $B = 1.98x10^{12} T$; $V_{q\mu} \approx 0.0087 MeV$. For $\eta^* = \eta_n = 0.87\, fm$ and $r_q \approx 0.2\, fm$,[15] (i.e. $\upsilon_q \approx 3.35x10^{-47} m^3$), with a value: $a_i = r_i^{\ *} \approx 0.6\, fm$, by equations (10) and (11) it results that:

$$P_{si}^{\ 0} = \tfrac{1}{2} \rho_i\left(a_i\right) c^2 \approx 10.2x10^{33} N / m^2 ; V^0_{\ qr} \approx 2.13\ MeV.$$

It is observed that the resulted value of P_{si}^0 is close to but bigger than the B–constant value resulted from the MIT Bag model: $60\ MeV / fm^3 \approx 9.6x10^{33} J / m^3$, (N / m^2). The maximal value of the force $F_{qn} = -\nabla V_{qn}$ is obtained when the quark enters with its surface in the repulsive shell $S\left(a_i\right)$, i.e. when its center is positioned at $r^* \approx 0.45\, fm$ from the nucleon center, position in which the quark is "attracted" toward this center by a potential given by equation (11).

Because for $r_q < r < a_i$ the value of F_{qr} decreases, we may approximate that–for a low centrifugal potential, the quarks deconfination at T_d is produced when the total kinetic energy of the quark becomes equal with the value of $V_{qr}\left(r^*\right)$ with: $r_i \approx r^* = 0.45\, fm$, ($E_{qv}^* \approx V_{qr}^*\left(r^*\right)$).

At $T \rightarrow 0K$, i.e. in unperturbed conditions, because the un–compensed vortex of the proton's magnetic moment, two nucleonic quarks are rotated around the third quark, with supposed charge $e^* = 2/3 \cdot e$, by the density of Γ_μ^* vortex $\rho_\mu\left(r_i^*\right)$, in dynamic equilibrium with the resistance force given by the quanta remained in the impenetrable nucleonic volume $\rho_n^*\left(r_I^*\right)$:

$$\rho_\mu(r_i^*) \cdot c^2 = \rho_n^* \cdot v_f^2\ ;\ \rho_\mu(r_i^*) \approx \frac{2}{3} \rho_\mu^0 \cdot e^{-\frac{r^*}{\eta_\mu}};\ r_i^* \approx 0.45 fm \qquad (15)$$

$$\rho_\mu^0 = \rho_\mu^0 = 22\,.\,24\, x10^{13}\ kg/m^3;\ \rho_n^* \approx 2.8x10^{17} kg/m^3$$

With: $\rho_\mu^*\left(r_i^*\right) \approx 12.6x10^{13} kg / m^3$ and $\rho_n^*\left(r_i^*\right) = 2.8x10^{17} kg / m^3$, (CGT) $\Rightarrow v_r = 2.12x10^{-2} c \approx 6.36x10^6 m / s$ and correspond to a centrifugal potential: $V_c^* = (\tfrac{1}{2}) \cdot m_q v_r^2 \approx 1.9x10^{-3} MeV$.

Supposing that a supplementary kinetic energy of quark: E_{qv}^* is obtained by a vibration energy of the nucleon E_{nv}^* , this kinetic energy of the quark at T_d must be comparable with $V_{qr}\left(r_i\right)$, according to the equations:

$$E_{qv}^* = \tfrac{1}{2} m_q v_q^{\ 2} \approx (V_{qn}\left(r^*\right) + V_{qm} - V_c^*), \qquad (16)$$

$$E_{nv}^* = \frac{1}{2} m_n v_q^2 = \frac{m_n}{m_q} E_{qv}^* = \frac{m_n}{m_q}\ (V_q^*(r^*) + V_{q\mu} - V_c^*) \approx k_B T_d \qquad (17)$$

(m_n –the nucleon mass), because only a fraction $k_q = m_n / m_q$ of E_{nv}^* is transmitted to the current mass of the quark, (contained into the impenetrable quantum volume of the quark). It results in consequence–by the model, that the known quarks deconfination temperature: $T_d \approx 2x10^{12} K$, (10, Karsch, 2001)[8] is given in the model in accordance with the equation (17) in which $E_{nv}^* = E_D \approx 172\ MeV$ resulting that:

$$E_{qv}^* = \tfrac{1}{2} m_q v_q^2 \approx \left(m_q / m_n\right) \cdot E_D = 1.565\ MeV \qquad (18)$$

With $V_c^* \approx 2.1x10^{-3} MeV$ and $r^* \approx 0.45\, fm$, it results:

$$V_q^*\left(r^* = 0.45\, fm\right) = (E_{qv}^* + V_c^* - V_{q\mu}) \approx 1.56\ MeV; \qquad (19)$$

resulting by equation (11), with $V_{qr}^0 \approx 2.13\ MeV$ that: $\delta \approx 0.27\, fm < r^*$. It is observed also that because the fraction: m_q / m_n , the previous result for E_q value not depends on the speed–depending mass variation: $m = m_0/\beta$. Considering–according to CGT, a classical expression of β, in the form: $\beta = \beta_c = 1 - v^2/2c^2$, it results from eqn. (19), that: $v_q(r^*) = v_q^* \approx 0.56 \cdot c$ and for an einsteinian form: $\beta = \beta_e = \sqrt{(1 - v^2/c^2)}$, it results that: $v_q^e \approx 0.45 \cdot c$. It results also, by equation (12), that the quark is "pushed" toward the nucleon center with a force: $F_{qr} = -\nabla V_{qr} \approx 1029\ N$ (compared to: $F_{qr}{}' = (\pi r_q^2) P_{si}^0 = 1256N$), which corresponds to a centrifugal force acting over a quark current mass m_q with almost the same speed: $v_q^r = v_q^m \approx 0.54c$, (with $\beta = \beta_c = 1 - v^2/2c^2$).

The potential V_q^* explains similarly the results of quarks–gluons plasma production experiments using lead or gold nuclei collision,[16] by the conclusion that a fraction m_q/m_n of the nucleon's kinetic energy was maintained by each internal quark in report with the rest of the nucleon's mass contained by the stopped nucleonic volume.

Also, the vortexial structure of the nucleon, considered in CGT, indicates that during the p–p or n–n collision, when the distance between nucleons centers becomes: $d_n < 2a_i \approx 1.2 fm$, the proportion of destroyed internal vexons is increased, increasing also the value of P_{si}^0, until a value $P_{si}^{0'}$:

$$2P_{si}^0 \geq P_{si}^{0'} > P_{si}^0; \quad (20a)$$

explaining by equations (18)–(20) the value of the usual energy necessary for strong interactions and for quarks–gluons plasma production by gold nucleus of $\sim 100GeV$, ($m_{n(V)}c^2 \approx 1.26GeV/nucleon$, $T_D \approx 2T_d$, $E_D{}' \approx 321MeV$).[16] This effect may be equated by CGT multiplying the repulsive shell potential $V_{qr}(r)$ with a term $e^{k \cdot l^*}$,[2] in which $l^* \sim \sqrt{T}$ is the vibration 'liberty' (amplitude) of the quark inside the 'bag':

$$V_{qr}(\mathrm{r,T}) \approx V_{qr}^0 \cdot e^{-\left(\frac{r-a_i}{\delta}\right)^2} e^{k \cdot l_v} = V_{qr}^0 \cdot e^{-\left(\frac{r-a_i}{\delta}\right)^2} e^{\sqrt{\frac{T}{T_C}}}; \ \frac{1}{2}\mathrm{k_v l}^{*2} \approx \frac{1}{2} k_B T \quad (20b)$$

Considering the limit: $e^{\sqrt{(T/T_C)}} = 2\ for\ T = T_D \approx 2T_d$, it results: $T_C \approx 4T_d \rightarrow V_q^{0'}(T_d) \approx 1.65 \times V_q^0(0)$. At usual nuclear temperatures $T \approx 10^{10}K$, $V_q{}^0 e^{(T/T_C)} \rightarrow V_q{}^0$. According to the model, when the first u–or d–quark penetrates the repulsive shell of the impenetrable quantum volume at T_d, it will carry $\sim 1/3$ from the rest of the nucleon, $({}^1/_3(m_n - m_i) \approx 0.46x10^{-27}kg = 259\ MeV/c^2)$, representing the vexonic mass which is the equivalent to the "gluonic" field considered in QCD and giving a constituent mass: $m_q^c \approx 267.5\ MeV/c^2$.

Without this part of vortexial energy ($m_q c^2$), the nucleon becomes an unstable hadron with the repulsive potential of the impenetrable quantum volume decreased to a value: $V_q{}' \approx \left[\left(m_n - m_q^c\right)/m_n\right] \cdot V_q^*$, which is easier penetrated–at the same T_d deconfinement temperature, by the current mass (m_q) of a remained quark.

In this way, the observed quark–gluons droplets explosion with almost the speed of light may be explained by the releasing of the remained intrinsic energy of the impenetrable quantum volume:

$$\Delta E_i \approx \left(m_i - 3m_q\right)c^2 = 117.7\ MeV,$$

which increases locally the quantum static pressure during the quarks deconfining and gives to each quark $\sim 39MeV$ kinetic energy, being the equivalent of the "quarks binding energy", according to the model.[11] Inversely, at quarks confination, T_d corresponds to a plasma of quarks with m_q^c –constituent mass, previously kinetized to a relativistic speed $v_d \approx 0.88c$, (with $\beta = \beta_c$) and their confination occur when the energy released by destroyed internal photons (vexons) during the quarks collision becomes lower than the binding energy given by the potential $V_q(r^*)$ generated by the interacting quarks.

It results that initially, at T close to T_d, are formed unstable systems with two quarks, with the $V_q(r^*) \approx ({}^2/_3) \cdot V_q{}^* \approx 1.04\ MeV$, which becomes more stable when T decreases at $T_c = ({}^2/_3) \times T_d \approx 1.33K$ and may form a baryon by a third quark.

It is observed that–even if the potential V_{qn} is much smaller comparative with those used by the Standard model and the Quantum chromodynamics, if the quarks are not kinetized at a relativistic speed $v_q{}' > v_q{}^*$, the resulted force is still enough strong for retain the quark inside the impenetrable quantum volume of the nucleon. It is logical also that–without high energy of kinetic interactions between nucleons, the kinetic energy E_q of quarks inside the nucleon's impenetrable quantum volume cannot exceed the critical value $E_q{}^*$, because that the high density of light quanta (quantons and vectons) inside the nucleon's impenetrable quantum volume generates a deceleration force: $F_d \approx S_q \rho_n v_q{}^2$ which equilibrates the acceleration force given by the quantonic vortex of the proton's magnetic moment: $F_d \approx S_q \rho_\mu c^2$, ($S_q \approx \pi \cdot r_q{}^2$, equation (15)), explaining–by the model, the high stability of the proton.

It results in consequence, according to the proposed model of CGT,[11] that the hypothesis of quarks interaction by intermediary gluons is more formal than natural, the nucleon mass part which corresponds to a "gluonic" shell of the quarks being explained in the model as a vexonic mass, vortexially confined. A strong argument for the model–comparative with the known model of QCD, is the natural conclusion that the interaction energy between quarks inside the impenetrable quantum volume of the nucleon, cannot be equal with or higher than the intrinsic energy: $m_i c^2$, of this quantum volume, so–cannot be higher than $m_q c^2 \cong 8.5\ MeV$ –because the quantum volume of a hypothetic gluon must be smaller than υ_q and–in consequence, its intrinsic energy cannot be higher than $m_q c^2$. Extremely, supposing a superdense gluon with $E > m_q c^2$, it would be necessary to re–explain the 'color' force.

The nuclear force between two nucleons

Because in accordance with equation (10a), the gradient of the total dynamic quantum pressure: ∇P_{di} produced by another nucleon and acting over the impenetrable quantum volume $\upsilon_i(r_i)$, generates an equal but inverse gradient of static quantum pressure of quantonic clusters:

$$\nabla P_{si} = \nabla \rho_c (r_i) \cdot c^2 = -\nabla P_{di}, \quad (21)$$

the previous model of nucleon explains microphysically–by equation (8) of CGT, also the nuclear force of nucleon attraction in the field of another nucleon, by the conclusion that the difference of the total dynamic quantonic pressure: $\Delta P_d(r) = P_d(r - r_i) - P_d(r + r_i)$ produced by the total vortexial field of a nucleon, generates in the positions: $r \pm r_i$ in which is found another nucleon, an equal but opposed difference of static pressure of quantonic clusters: $\Delta P_{sc}(r) = \Delta P_d(r)$, acting over the impenetrable quantum volume of this nucleon, which–in this way is „attracted" by the first nucleon, with a force:

$$F_N(r) = -\nabla V_N(r) = -\upsilon_i \cdot \nabla P_{sc} = \upsilon_i \cdot \nabla P_d(r); \Rightarrow$$

$$F_N(r) = -\frac{1}{\eta^*} V_N^0 \cdot e^{-\frac{r}{\eta^*}}; \ \upsilon_i = \upsilon(r_i); \ r_i \approx 0.6\,\mathrm{fm} \quad (22)$$

(difference of static quantum pressure generated by difference of dynamic quantum pressure, introduced by the vortexial field). For example, if the intrinsic energy: $\delta m_n c^2$ of the parts δm_n of the nucleon' quantum volume is given as in CGT,[2,3] by internal vexonic pairs ("naked"photons), by the kinetic energy of vortexed vectons which composes the vexons:

$$E_v = ½\sum m_v (\omega_v \cdot r)^2 = ½\delta m_n c^2$$

and the kinetic energy of vortexed quantons of the vexon's magnetic moment:

$$E_c = ½\sum m_c (\omega_c \cdot r)^2 = ½ d m_n c^2$$

which is maintained by the vortexial energy of the nucleonic degenerate electrons' magnetic moments, $\mu_e^* : \Gamma_\mu^*(r)$, it results that the transforming of the vortexial energy E_v into an internal Boltzmannian energy: $E_v^*(a_i) \approx E_v = \sum m_v k_B T$, at surface of impenetrable quantum volume of the nucleon $\upsilon_i(a_i)$ not decreases in the same measure the vortexial quantonic energy of the degenerate electrons' magnetic moments, (maintained by the action of quantum and subquantum winds), so the force of dynamic quantum pressure gradient which retains the quantity $\sum m_v = \delta m_n$ of vectons at the surface of υ_I –quantum volume is still enough strong, resulting–at the surface of υ_I, according to equation (10a), that:

$$P_s^i(r) + P_d^i(r) = \rho_n(r) \cdot c^2 \quad (23a)$$

$$P_{si}^0(a_i) \approx P_{di}^0(a_i) \approx ½\rho_n^i \cdot c^2 \quad (23b)$$

When an adjacent nucleon positioned on the direction **r** at the distance d_i intervenes with a supplementary dynamic quantonic pressure: $P_{de}(d_i) \approx ½\rho_n^0 c^2 \cdot e^{-d_i/\eta^*}$ given by equation (2), the equation. (10a) is transformed in the form:

$$P_{si}(a_i) + \left(P_{di}(a_i) + P_{de}(d_i)\right) = P_i^0 = \rho_n(a_i) \cdot c^2; \quad (24)$$

with: $P_{de}(d_i) \approx ½\rho_n^0 c^2 \cdot e^{-d_i/\eta^*}$ resulting that $P_{si}(a_i)$ is decreased by $P_{de}(d_i)$. But because P_i^0 and $P_{di}(a_i)$ have null difference between two diametrically opposed points: $x_1 = d_i - a_i$ and $x_2 = d_i + a_i$ of the υ_I –volume' surface $\left(P_{di}(d_i - a_i) = P_{di}(d_i - a_i)\right)$, it results that only $P_{de}(d_i)$ is variable on the direction **r,** between x_1 and x_2 the nuclear force: $F_n^i = -\nabla V_n = -\nabla \upsilon_i \cdot P_{si}(a_i)$ resulting in the form:

$$F_n^i = -\nabla V_n = -\upsilon_i \nabla P_{si}(a_i) = \upsilon_i \nabla P_{de}(d_i); \quad (25a)$$

$$V_n = -\upsilon_i P_{de}(d_i) \approx -½\upsilon_i \rho_n^0 c^2 \cdot e^{-d_i/\eta^*} = -V_n^0 \cdot e^{-d_i/\eta^*} \quad (25b)$$

being retrieved the form (2) of the nuclear potential. The fact that the nuclear interaction is still attractive al distance $d_i^a = 2a_i$, is explained by the fact that the $P_{si}(a_i)$ is reciprocally reduced between the interacting nucleons (in the point x_1), by their vortexial field, being maximally reduced when the "impenetrable quantum volumes υ_i are in mutual contact, (at $\sim 1 \div 0.9\,fm$ –when $P_{si}(a_i)$ action only to the surface $S_x(x_2)$), (Figure 2–the red zone), the interaction becoming repulsive only when is realized the mechanic interaction between the quarks of an nucleon and the quarks of another nucleon, at relative high interaction energies which may reduce the inter–distance d_i at the value: $d_i^l \approx 4r_q \approx 0.8\,fm$, according to the model.

We can verify the previous conclusion calculating the nuclear force for $d_i = 2r_i^* = 0.9\,fm$ with the equation (22) but also with the relation:

$$F_N(d_i) \approx S_i \times \Delta P_{si} \approx S_i \times P_{si}(r_i^*); \ d_i = 2r_i^*; S_i = \pi (r_i^*)^2 \quad (26)$$

obtaining: $F_N(d_i) = 4.66x10^3 N$ with equation (22) and with $\upsilon_i(a_i \approx 0.6\,fm) = 0.9\,fm^3$ and the same: $F_N'(d_i) = 4.66x10^3 N$ –with equations (26) and (11).

According to the previous results, we may conclude that $a_i \approx 0.6\,fm$ is the radius of the equivalent quantum impenetrable volume, specific to the form (2) of the nuclear potential, ('equivalent radius' or 'interaction radius', characteristic to the nuclear interaction with the field of another baryon or meson), and the value $r_i^* = 0.45\,fm$ is the 'effective radius' of the impenetrable quantum volume υ_i, of mechanical interaction with other nucleons, experimentally determined.[12]

The previous model of nucleon, with repulsive shell of the impenetrable volume, explains also why a lepton like the electron is not incorporated into the impenetrable volume of the nucleon but may be incorporated into the nucleon' surface (in the case of neutron–according to CGT).[2,3]

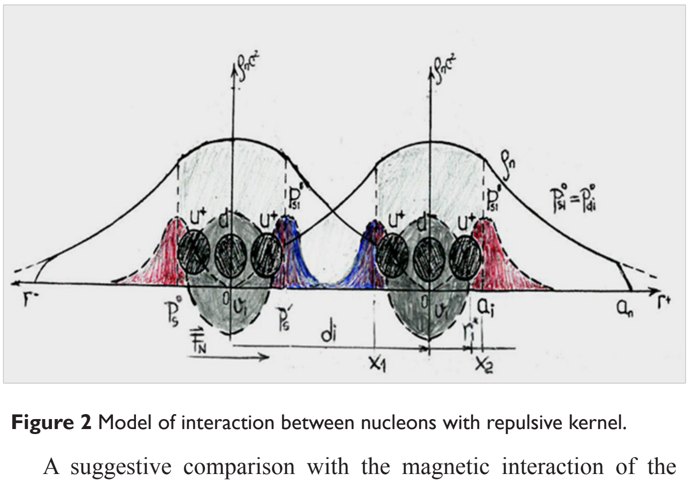

Figure 2 Model of interaction between nucleons with repulsive kernel.

A suggestive comparison with the magnetic interaction of the nuclear potential may be given associating to the repulsive shell of the υ_i –volume a static repulsive (pseudo)charge q_s and to the attractive shell–given by the vortexial field an attractive (pseudo)charge q_s which in CGT has the expression:

$$q_{a,s} = k_1 4\pi\varepsilon_0\varepsilon_r\rho_{a,s}(a_i)\cdot v_c^2;\ \varepsilon_r\cdot v_c^2 \approx c^2 \quad (27)$$

resulting that:

$$q_{a,s}/e = (a_i/a)^2(\rho_s/\rho_a)\ ;\ S(a_i) = 3\upsilon_i/a_i \quad (28)$$

$$V_n = -½\upsilon_i\rho_n(r)c^2 = -\left(1/3\right)\cdot\mu_p^*\cdot B_n(d) \quad (29)$$

in which:

$$B_n(d) \approx \left(N^p + 1\right)B_e^*(d) = k_1(\rho_n^0)c\cdot e^{-d/\eta^*} \quad (30)$$

$$\mu_p^* \approx (a_i/a)^2\mu_p = ½(e^*\cdot a_i\cdot c)\ ;e^* = (a_i/a)^2 e \quad (31)$$

$B_e^*(d)$ being the B–field of a single quasi–electron and μ_p being the proton' magnetic moment. By equations (24) and (27) it results also that:

$$q_a(\rho_a) + q_s(\rho_s) = q_0(\rho_n)\ ;\mu_a + \mu_s = \mu_0(\rho_n) \quad (32)$$

If we consider a degenerate pseudo–charge and a degenerate magnetic moment:

$$e^*_a(d) = \left(e^*\right)\cdot e^{-d/\eta^*};\mu_a^* = \mu_p^*\cdot e^{-d/\eta^*} \approx ½(e_a^*\cdot a_i\cdot c) \quad (33)$$

associated with the total dynamic pressure at the surface of the impenetrable volume υ_i, given by equation (24), the gradient: $\nabla e^*_a(d);\nabla\mu^*_a(d)$ explains the nuclear F_N–force generating by the gradient of "coldness" between the points x_1 and x_2 of the $S(a_i)$ surface of the nucleon' impenetrable volume υ_I, (marked by blue and red colors in Figure 2) in correlation with equation (32), in the form:

$$F_n = ½\upsilon_i\nabla\rho_n(r)c^2 = \left(1/3\right)\times\nabla\mu^*_a(d)\cdot B_n^0 \quad (34)$$

with $B_n^0 = k_1(\rho_n^0)c$–in accordance with equation (1).

Other explicative implications of the model

The antigravitation

A direct explicative consequence of the quasi–electrons cluster model of mesons and baryons proposed in CGT, is the conclusion that the nuclear energy generated in a nuclear fission or fusion reactions consists in fluxes ϕ_E of emitted photons, quantons and sinergons by destruction of bounded photons of the nucleonic quantum volume, the sinergonic (etheronic) component ϕ_s of this flux generating an antigravitic pseudocharge of the emitting nuclei.[2,3]

The hypothesis may explain–according to the theory, the field–like nature of the "dark energy", evidenced by astrophysical observations[17] identifying the quasars and the super/hyper–novae as possible sources of "dark energy" , by the hypothesis of a pulsatory antigravitic (pseudo)charge generating,[2,3] by periodically repeated phases of matter accretion and destroying at the surface of a massive "black hole" and energy releasing , also in the form of quantonic and etheronic winds, particularly detectable as gravitational waves.

Particularly, in the quasar's case, it is considered that the power of quasar results from the accretion disk of a central supermassive black holes, that are believed to exist at the core of all galaxies and which can convert on the order of 10% of the mass of an object into energy–compared to 0.7% for the p–p chain nuclear fusion. But because that even the light cannot escape from the black hole's field, it results the conclusion that the escaping energy is actually generated outside the event horizon, by gravitational stresses and immense friction on the incoming material.

But this hypothesis is not enough fitted with the fact that–for create a luminosity of 10^{40} watts (the typical brightness of a quasar), a super–massive black hole must consume the material equivalent of 10 stars per year. So, the hypothesis regarding the pulsatory antigravitic (pseudo)charge generating, may explain better the quasar's energy.[3]

According to this hypothesis, the generation of an antigravitic (pseudo)charge releases also gammons from the nucleon's structure, partially transformed into electronic neutrinos (by the loose of the quantum volume, (CGT),[2,3] even in the case of a "black hole", the frequency of the pulses being logically proportional with the star' mass, because the field force to accelerate the process.

Is relevant in this sense also the case of the supernova SN1987A, which released an intense flux of gamma rays and electronic neutrinos[18] and the case of "kilonova" star SSS17 (of 1,000 times stronger than a typical nova) which quickly changed from bluer to redder light—a sign that its debris expanded rapidly at speeds close to the speed of light and cooled as it went, for which the researchers estimated that about 30 percent of future neutron–star mergers will generate bright gamma–rays detectable from Earth.[19]

A discovery which is concordant with the considered hypothesis[2,3] is the detection of ripples known as gravitational waves resulted from a colliding pair of neutron stars,[19] with a period sensible higher than those produced by a "black hole" (almost 1minutes, compared to 1–2 seconds in the case of BH).[19] According to CGT, these gravitational waves but also the "dark energy" which generates cosmic expansion, have resulted as sinergonic winds, (s–etherons, with $m_s \approx 10^{-60}kg$), by the destruction of quasielectrons from the nucleon's sub–structure, more probable than as fluxes of gravitons ($m_g \approx 10^{-69}kg$), even if it is logical that the density of gravitons is higher than the density of sinergonic etherons.

The hypothesis has concordance with the hypothesis of 'dark energy star',[20] which also supposes the matter conversion into 'dark energy giving a negative pressure, specific to Λ –constant.

Another phenomenon implying a possible antigravitic force is linked to an un–desired enigma of the Tchernobyl accident,[21] consisting in the fact that is not known the nature of the force which had pushed the cover of almost 2000 tons of the reactor called Elena, moved without distortion of the reactor walls in the accident, being formulated the hypothesis of the generation of an un–known anti–gravitic force.[19] This conclusion is consistent with the experiments performed by Shaw & Davy[22] who have obtained a relation for the decreasing of the gravitational mass with the temperature:

$$F_G(T) = F_0(1-\alpha T);\ F_0 = -G\cdot(M\cdot m)/r^2 \quad (35)$$

with an experimentally determined value of the coefficient: $\alpha = 1/T_G = 2x10^{-6}$,($T_G = 5x10^5 K$). Other research[23] indicated a decrease with $\sqrt{(T/T_g)}$ with $T_g \approx 6.25x10^6 K$ for vibrated dural, which is the temperature of nuclear fusion in stars.

We may suppose that–because the negentropy given by etherono–quantonic winds, an antigravitic charge is generated at temperatures comparable with the nuclear temperature, i.e: $T > 6x10^6 K$. According to the model, the released binding energy in the form of quantum energy producing static quantum pressure, may explain the kinetic energy of the U–fission products but also another Tchernobyl accident enigma: the disappearance of 90% of nuclear fuel and the discovery of 10 tons of aluminum, with the increasing of U235 amount and of Pu239/U235 ratio.[21]

The problem of dark matter

As it is known, a 'dark matter' particle must be low interacting with the usual matter and with upper stability, a proposed candidate being the neutrino particle. A known reaction: $\left(e^{+}+e^{-}\right)\rightarrow(\mu^{+}+\mu^{-})$ suggests that the muonic neutrino pairs: ($\nu_{\mu}\overline{\nu}_{\mu}$) may exists in the quantum vacuum as bosons with null charge and magnetic moment and null spin, (‚sterile' boson), as paired ‚rings' of $6z^{0}$–preons–according to CGT,[1] which–by electron caption, gives a muon, resulting also the conclusion that z^{0}–preons (of $\sim 34m_{e}$)[1] may be dark matter components of the quantum vacuum. We may suppose in this case that also bigger neutral quasi–cystallin clusters of z^{0}–preons or cubic clusters of magnetically paired gammons, may constitute dark matter bosons.

The problem of the black hole's density

As it is known, it is believed that a 'black hole' have usual densities of $10^{18}\div10^{19}kg/m^{3}$, because a neutron stars with mass above the limit TOV (Tolman–Oppenheimer–Volkoff) would collapse further, being formulated also the hypothesis that the neutronic matter degeneracy into a quark network state, may stop the star's collapse, creating a 'quark star'. According to CGT,[1] this scenario is plausible , because the 'zeroth' vibrations of superdense kernels (centroids) of quasielectrons forming the B–E (collapsed) condensate of gammons which gives the neutronic quarks, vibrations which stop the quark collapse by the generating of an internal short range repulsive field.[1] Because this phenomenon, it results in consequence that the current quark mass density: $m_{q}/\upsilon_{q}\approx\rho_{n}{}^{0}=4.54x10^{17}kg/m^{3}(\mathrm{CGT})$ is a plausible value for the density of a collapsed star even in the case of a 'black hole', excepting the case in which we consider also a decreasing of interdistance l_{i} between the quasielectrons' kernels–caused by the internal pressure in the collapsed star's center, until the forming of a heavy–quark star (with heavier quarks with approximate the same quantum volume as u–and d–quarks, for example–with double density: $2\rho_{n}^{0}$, corresponding to v–quark–in CGT),[1] process which may indicate as plausible also the value of 10^{18} kg/m^{3} .

The resulted limit is–in this case, a 'neutrinic star', formed by totally collapsed nucleons, i.e.–only by electronic centroids m_{0} having–in CGT,[2,3] the $mass\approx0.5x10^{-4}m_{e}$ (half of the electronic neutrino rest mass resulted from the old experiments), the $radius\approx10^{-18}m$ (resulted by X–rays scattering to electron and confused with the effective electron radius–by some theoreticiens) and the density $\rho_{v}^{0}\approx10^{19}kg/m^{3}$–resulted as the maximal density of a ultra–cold 'black hole'. We may suppose that also the m_{0}–centroids results as formed 'at cold', as compact cluster of quantons–in CGT.

A new model of pulsar

It results–from the previous conclusions regarding the antigravitic charge generation, the possibility of a periodically (pulsatile) radiative "black hole" , (pulsating "black hole", PBH), as consequence of the antigravitic (pseudo)charge generation (by matter→energy conversion) at maximal values comparable with the gravitic charge (with the BH's mass), which emits simultaneously and omni–directionally but intermittently not only gamma–rays, X–rays and visible light but also z^{0}–preons, neutrinos fluxes, and gravitational waves, in form of periodic fluxes of sinergons (s–etherons, $m_{s}\approx10^{-60}kg$, (CGT)), generated at the transforming of gammons into electronic neutrinos: $\left(e^{-}e^{+}\right)\rightarrow(\mathrm{v}_{e}\overline{\mathrm{v}}_{e})+\phi_{G}$,[3] by losing the photonic quantum volume of electrons. For example, considering an accretion disk with n_{0} nucleons density at the Schwarzschild radius: $r_{s}=2.95x10^{5}km$ of a super–massive 'black hole' of $M=10^{5}M_{s}$ (solar masses), with the equilibrium equation:

$$G\cdot M\cdot\rho/r=P^{0}=n_{0}k_{B}.T_{e};\ (r=n_{0}m_{p})\quad(36)$$

it results as necessary for impede the gravitational collapse of the accretion disk, a temperature $T_{e}\approx5x10^{12}K>T_{c}$, which may transform also the quarks into preons according CGT, so the matter destroying occurs certainly in this case.

More probable, the cosmic sources which may have a PBH–according to the hypothesis, are some super/hypernovae–known as potential sources of gravitational waves,[24] such as the collapsar SN 1998bw–known as source of gamma–rays bursts, the OVV quasars (optically violent variable quasars), having emissions of high–energy photons, cosmic rays and neutrinos, and some blazars, (active galactic nuclei) such as BL Lac., (BL Lacertae) characterized by rapid and large–amplitude flux variability and the blazar TXS 0506+056 having neutrinos emission–recently observed as being coincident in direction and time with a gamma–ray flare from it,[25] (phenomenon predicted by the author[3] in CGT–p. 90 and 99, as resulted from the matter-energy conversion at $T\geq10^{11}K$, by gammons→neutrinos transforming).

According to the model the effect is increased by particles acceleration in the BH's field, particularly–by increasing the rotation of an accretion disk (transforming 10÷40% of matter into energy) in a magnetic or gravistaric field (vortex of primordial, etherono–quantonic dark energy' around a rotating BH).[3] (In CGT, the inertial, 'material' mass results by the mass of electronic centroids and the mass of the vexons+vectons forming the particle's quantum volume as bound vectorial photons, their transforming into energy meaning that they are converted into un–bound (quasi)free quanta or into fluxes of (quasi)free quantons and sinergonic etherons).

This hypothesis may explain also the excess of 0.511 MeV gamma rays coming from the galactic center, observed by the INTEGRAL satellite,[26] considered as arising from positron annihilation,[27] by the conclusion of matter destroying in the field of a massive PBH star, with neutronic matter transforming into z^{0}–preons–detectable as γ–rays of energy $\approx17MeV(CGT)$, but also into constituent γ^{*}–gammons resulted in CGT as degenerate ($e^{-}e^{+}$) pairs which may be transformed–at high energies, into electronic neutrinos, ν_{e} (which is pseudo–scalar–in CGT, but also into pairs of γ–quanta of 0.511MeV, by mutual annihilation of the e–charge of the ($e^{-}e^{+}$)–pairs.[1]

The conclusion is in accordance with the fact that it is argued[27] that the observed γ–rays emission correspons to the presence of a dark matter with a mass less than about 20 MeV, (given by neutral z^{0}–preons–according to CGT). The proposed hypothesis is also in concordance with those formulated by Boehm et al.[28] which have argued that all of the characteristics of the observed signal of γ–rays could be well fit by a scenario in which light dark matter particles (1−100 MeV) annihilate only into ($e^{-}e^{+}$) pairs, but also with the observations[29] that in the energy range: $100\ keV\div10MeV$ of γ–rays is not known the type of sources, in the context in which for γ–rays with energies below 100 keV it is believed that the main contribution comes from Seyfert galaxies and for energies above 10 MeV a simple model for blazars reproduces both the amplitude and the slope of the data.[29]

The 'bag' model's generalizability

A quescion which may be raised is: if the used nucleonic 'bag' model, may gives a generalized model, with scalar repulsive field superposed on a vortexial field at the impenetrable quantum volume's surface, for the explaining of other fundamental field forces of attractive type. Because that the model is based on the magnetic interaction between (quasi)electrons and because in CGT even the electron has a small impenetrable quantum volume of radius: $r_{ie} \approx 3x10^{-2} fm$,[4] it results that the magnetic interaction may be explained by the considered generalizable model, because that the magnetic potential **A** (which is parallel with the impulse density p_c of the Γ_B quantonic vortex of the particle's magnetic moment, μ), for two antiparallel magnetic moments μ_1 and μ_2, has reciprocally opposed sense between μ_1 and μ_2, which indicates that the quantonic static pressure is increased by reciprocally partial destruction of laminarity , determining repulsion between μ_1 and μ_2. At the antiparallel orientation of μ_1 and μ_2, $\mathbf{A}_1$ and $\mathbf{A}_2$ have reciprocally parallel sense between μ_1 and μ_2, the quantonic static pressure being decreased by reciprocally partial increasing of laminarity (of quantonic dynamic pressure), determining attraction between μ_1 and μ_2.

The sinergono–quantonic vortex Γ_μ of the electron' magnetic moment may explain also the electric interaction as in CGT,[2,3] by the capture of vectonic pairs ('naked' 3k photons) which generate a homogenous static pressure at the free electron surface S(a), but which are ‚splitted' into vectons with opposed chirality (pseudo–charge), the vectons with the pseudo–charge' sign as the electron's surface being rejected as E–field quanta which interact attractive or repulsive with the vectonic quanta of another $e^{\pm}$ –charge, reducing or increasing the pressure on the corresponding surface generating electric attraction or repulsion.

A verifying experiment may be made by measuring the electrostatic force between two different charged balls placed in a electrically isolated cavity, with walls of lead (Pb). If external fluxes of quanta pairs are the cause of electrical attraction, the electric force must be diminished. If it is not diminished, it means that the E–field quanta results from the quantum vacuum existent inside the cavity or that they may penetrate a dense matter such as a wall of lead.

In the case of gravitation, it seems that the Fatio/LeSage model of "pushing" gravity, is enough for explain phenomenologically the gravitation force. However, it exists theories that try to explain the gravitation force by a 'holographic' scenario, deducing the gravitation force from space's entropy: $F_G = (\partial S / \partial x) \cdot T$.[30] But if we associates the entropy S with the quantum or sub–quantum static pressure $P_s = n_0 k_B T$ (equation (36)), i.e: $S = \upsilon P / T = n_0 k_B$, (the negentropy being associated with the dynamic pressure, P_d), F_G results in the form:

$$F_G = -\nabla V_G = \upsilon (\mathrm{k_B} / \mathrm{m_c}).(\partial \rho / \partial \mathrm{x}).\mathrm{T} \approx \upsilon \mathrm{c}^2 (\partial \rho / \partial \mathrm{x}) \quad (37)$$

i.e.: $V_G \approx \upsilon_m \cdot \rho_c c^2$ (as in equation (22)), with: $\rho_c \sim M$ and $\upsilon_m \sim m$, but as repulsive force. So–the gravitational force cannot result from entropy but from negentropy, i.e–either from the energy of cosmic etheronic winds, as in the Fatio/LeSage theory, or in a ‚gravitovortex' type theory,[31] i.e–by the dynamic quanta pressure of the sinergonic Γ_A –vortex of particles, (gravito–magnetic force–in CGT).[2,3] It is known also the Casimir effect, of attraction between two parallel plates of A–surface, caused by the quantum fluctuations in the zero–point electromagnetic field energy[32] according to equation.

$$\Delta P_C = F_C / A = \eta R / d^4 ; R = \hbar c \pi^2 / 240 \quad (38)$$

in which d–the distance between plates. If we consider that $\Delta P_C = P_e - P_i$ results as quantum pressure difference between external A_e and inter–plates A_i faces, we may interpret its form (38) as resulted from the reducing of quantum pressure P_e by an additional dynamic quantum pressure P_d in the inter–plates interval, at the level of A_i face, by thermalised photons attraction (considered as standing waves of quantum vacuum) by superposed Γ_μ remanent vortexes of atomic particles magnetic moments of the ajacent plate and by supplementary dynamic quantum pressure P_d^* at the nuclear level of A_i (on the '*i*' nuclear face, according to equations (10a) and (21)), introduced by Γ_μ –quantonic vortexes.

This interpretation is concordant with the CGT's explaining of the electrostatic interaction and with the fact that the variation with d^4 is characteristic also to the magnetic force between two e–charges. The resulted interpretation is in accordance also with the known conclusion that the Casimir energy is the difference in zero–point energies between any two well defined physical situations a, b, i.e.:

$$E_C(a|b) = \sum(n) = ½\hbar\left[\omega_n(a) - \omega_n(b)\right] \quad (39)$$

identifying–by CGT, the zero–point energy of photon with the intrinsic, vortexial energy of its rest mass ($½\hbar\omega = ½ m_f c^2 = m_0 c^2$; CGT).[2,3,33] A connex quescion is if the decreasing of the nuclear potential V_n by deuteronic self–resonnance of a weakly linked nucleon inside a nucleus, which reduces periodically and locally the inter–nucleons potential at a mean value $V_d(d) \approx 2.226 MeV$,[2,3] (explaining also the nuclear fission) reduces periodically also the electric charge of the vibrated nucleon or/and nucleus at a mean value $Q_v < Q_i$. The hypothesis of nuclear electric charge value oscillating was formulated in a previous paper[34] in another way for explain the Kervran effect of biological nuclear transmutations and is in concordance with the used vortexial model of nucleon, with electric charge in the nucleon's surface shell of destructible vectorial photons.

Conclusion

It is argued in the paper that both strong forces: between quarks and between nucleons, may be satisfactory described in a gluonless and pionless vortexial cold genesis model of nucleon, resulted as collapsed Bose–Einstein condensate of gammons of cold formed preonic quarks–based on z^0 –preon resulted as cluster of 21 gammons–considered as ($e^- e^+$)–pairs of degenerate electrons with vortexial structure, the nuclear force resulting by the gradient of static quantum pressure generated on diametrically opposed parts of the impenetrable quantum volume of the nucleon resulted in the nuclear interaction, of radius $a_i \approx 0.6 fm$, with the aid of the dynamic quantum pressure gradient generated by an interacting nucleon, by the etherono–quantonic vortexes Γ_i , of s–etherons and of quantons with mass $m_h = h / c^2$, of the nucleonic quasielectrons.

The resulted model explains the nuclear force generating in correlation with the fact that the normal density of the quantum vacuum must be enough low ($\rho_c^0 \sim 1 / c = \sqrt{(\varepsilon_0 \mu_0)}$) for permit the receiving of photons emitted by far galaxies. The quarks confining force results–by the same model of nucleon, in a pre–quantum "bag" model, with repulsive shell of the impenetrable quantum volume of nucleon, in accordance with the known value of the deconfination temperature $T_d \approx 2x10^{12}K$, without the hypothesis of intermediary gluons.

The basic model of z^0–preon–resulted in CGT as B–E condensate of $n_z = 42$ degenerate electrons incomplete collapsed, with non–collapsed kernel of 42 electronic centroids m_0 with a supposed twisted bar form (instead of a single superdense centroid) results in accordance with the interpretation by equation (5) of the proportionality: $\mu \sim m^{-1}$ (distribution of the $\Gamma_e^*(\mu_e^*)$ intensity of a quasi–electron' magnetic moment to $n_z/2$ paired quasielectrons +1, equation (6)) and with the existence of an intrinsic energy $E = m_p c^2$ of the particle. Compared with the MIT "bag" model or with the known chiral "bag" model, the "classical bag" model resulted in CGT is unitary and more natural, explaining by the natural intrinsic energy and properties of the nucleon also the nuclear force between nucleons.

The previous result imply the conclusion that the model of strong interaction by gluons is more formal than natural, in relative accordance with the fact that free gluons have never been observed and with the known conclusion that the quarks may locally deform the quantum vacuum–conclusion which corresponds–in the quasielectrons cluster model of quarks, (by the vortexial model of electron), to the property of vacuum quanta confining by the sinergono–quantonic vortices Γ_μ^* of the nucleonic quasielectrons. It results also that if the proton's charge is given by an attached positron (explaining the β^+ radiation), the quarks deconfining temperature T_d generates neutral (pseudo) quarks.

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Conflict of interest

Author declares there is no conflict of interest.

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