

Genesis of Super-Dense Centroids and Kerneloids of Photons and Electrons from Quantum Vacuum: Theoretical Implications

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Abstract

The paper analyses the cold genesis of electron and of vector photon considered in a vortical model, from a primordial dark energy having a wind-like component ρ_v^0 giving magnetic vortex-tubes and a brownian component ρ^0 of an etherono-quantonic medium containing also heavy (sinergonic) etherons and quantons with energy $\varepsilon = h \cdot 1$. By two equation of dynamic equilibrium and by a “sinergonic” force of Magnus-type, it was deduced, in a cold genesis theory, that in the actual cosmic era would be necessary a critical density of sinergons: $\rho_s^0 + \rho_{sv}^0 \approx 7.2 \times 10^{18}$ kg/m³ and a critical induction associated to the formed vortex-tubes: $B^0(r_0^k) = 3.37 \times 10^{17}$ T, respective $-B^0(r_0) = 0.79 \times 10^{16}$ T, for the forming of light vector photons with mass $m_v \approx 2.3 \times 10^{-40}$ kg and of electronic centroids, but in the beginning of the Proto-Universe’ era these particles could have been formed from slowed quantons, confined by a less intense sinergonic vortex $\Gamma_{sv}(r)$, either with a density $\rho_s > \rho_s^0(r_v)$, at an associated vortex-field intensity: $B < B^0$, or at $\rho_s < \rho_s^0(r_v)$, by a gravito-magnetic potential $V_{gm}(r)$, if the rotation speed of vortexed quantons not exceed a critical value $v_c^c = k_c c$, with $k_c \sim \rho_s^c$ corresponding to a critical B_c -field associated to the etherono-quantonic vortex: $B_c \sim \rho_{sv}^c(r_v) > \rho_s^c$. Some theoretical implications of the magnetic field’s vortical nature, including the perpetual rotation of atomic electrons and the magnetic radius of proton are analyzed.

Keywords

Vortical Electron, Cold Genesis, Photon Model, Protouniverse Period, Copenhagen Vacuum, Magnetic Strings

1. Introduction

It is known in physics the concept of “Copenhagen quantum vacuum”, with string-like vortex-tubes of magnetic field generated as quantum fluctuations in the quantum vacuum [1] [2], this concept being connected to the Copenhagen interpretation (Bohr/Heisenberg’s view of measurement & reality) with the concept of “quantum vacuum” state, (the lowest energy state, filled with virtual particle-antiparticle pairs, generated by energy fluctuations and leading to effects like vacuum polarization).

It is also known the concept of “quantum turbulence”, related to the turbulent flow of quantum fluids at high flow rates, as in the case of a superfluid, in which a form of turbulence might be possible via the quantized vortex-lines [3], (idea first suggested by Richard Feynman).

The mathematical study of vortices began with Herman von Helmholtz’s pioneering study in 1858 and it was pursued by the Maxwell’s vortex analogy for the electromagnetic field and by William Thomson’s (Lord Kelvin) theory of the vortical atom, conceived as a vortex ring in the cosmic ether considered as superfluid, (perfect fluid) [4]. During the Maxwell’s life, the basic laws of vortices in a perfect fluid in three-dimensional Euclidean space had been established.

Superfluidity arises as a consequence of the dispersion relation of elementary excitations, in fluids that exhibit this behaviour flow without viscosity (which in classical fluids causes dissipation of kinetic energy into heat, damping out motion of the fluid).

Landau predicted [5] that if a superfluid flows faster than a certain critical velocity v_c (or if an object moves with $v < v_c$ in a static fluid), it becomes energetically favourable to generate quasiparticles and thermal excitations (rotons) are emitted, as in helium II, for example.

Quantum vortices were observed experimentally in type-II superconductors (the Abrikosov vortex [6]), liquid helium, and atomic gases (forming Bose-Einstein condensate), as well as in photon fields (optical vortex) and exciton-polariton superfluids.

A topological defect in three-dimensional space, which is characterized by the nontrivial first homotopy group, is known as the Abrikosov-Nielsen-Olesen (ANO) vortex [7], the vortex being described classically in terms of a spin-zero (Higgs) field that condenses and of a spin-one field corresponding to the spontaneously broken gauge group.

Even if the superfluid is irrotational, if an enclosed region contains a smaller region with an absence of superfluidity, for example, with a rod, a vortex is generated, with the circulation:

$$\Gamma = \oint_{\partial S} \mathbf{v} \cdot d\mathbf{l} = \frac{\hbar}{m} \oint_C \nabla \phi_v \cdot d\mathbf{l} = \frac{\hbar}{m} \Delta \phi_v = \frac{2\pi \cdot \hbar}{m} n \quad (1)$$

where $\hbar = h/2\pi$, h is the Planck constant, m is the mass of the superfluid particle, and $\nabla \phi_v$ is the total phase difference around the vortex.

Because the wave-function must return to its same value after an integer number of turns around the vortex (similar to what is described in the Bohr model), then $\nabla\phi_v = 2\pi n$, where n is an integer. Thus, the circulation is quantized.

So, in a superfluid, a quantum vortex “carries” quantized orbital angular momentum, but in a superconductor, the vortex also carries a quantized magnetic flux, over some enclosed area S :

$$\Phi = \iint_S \mathbf{B} \cdot \mathbf{n} d^2x = \oint_{\partial S} \mathbf{A} \cdot d\mathbf{l} \quad (2)$$

where \mathbf{A} is the vector potential of the magnetic induction \mathbf{B} .

In a nonlinear quantum fluid, the dynamics and configurations of the vortex cores can be studied in terms of effective vortex-vortex pair interactions.

In an author’s Cold Genesis theory (CGT [8]-[10]), the sub-quantum medium—considered by the Bohm-Vigier’s theory, is composed by two main categories of etherons: gravitonic etherons, (pseudo-gravitons) with mass $m_s \approx 10^{-71} - 10^{-68}$ kg, considered as quanta of the gravitational field, (in a Fatio-LeSage type model) and “sinergonic” etherons, with mass $m_s \approx 10^{-61} - 10^{-58}$ kg, that contribute to the gravitational fields but which also give phenomenologically the magnetic potential \mathbf{A} by a wind-like (field-like) component.

It was argued that the “dark energy” which is considered as the cause of the cosmic expansion in astrophysics, can be considered a wind-like uncompensated component of the etheronic, sub-quantum medium [8]-[10].

In CGT it was also argued that the lightest photonic quanta, named “quantons”, of mass $m_h = h/c^2 = 7.37 \times 10^{-51}$ kg, can be attracted toward the kernel of a vector photons m_v (particularly—vectons’, of mass $m_v \approx 2.3 \times 10^{-40}$ kg, considered as E-field’ quanta) by a gravito-magnetic force F_{gm} given by the gradient of the gravito-magnetic potential $V_{gm}(r)$, produced by vortexes “sinergons”,

$$F_{gm}(r) = -\nabla V_{gm}(r); V_{gm}(r) = -\frac{1}{2} g_h \rho_{sv} w^2; \left(w = \gamma \cdot c \sqrt{2} \approx \sqrt{2} \right) \quad (3)$$

(with: $\gamma \rightarrow 1$; $v_h(r_h)$ —the quanton’s volume and: $p_\phi = \rho_\phi w$ —the impulse density of the vortexed sinergons), and by a “sinergonic” force of Magnus-type given by a magneto-gravitic potential, $V_{mg}(r)$:

$$F_{mg} = F_{sl}(r) = -\nabla V_{mg}(r) = 2r_h \cdot \Gamma_h(r_h) \cdot \rho_s(r) \cdot v_c; \left(\Gamma_h = 2\pi r_h v_h; v_c = c \right) \quad (4)$$

with: Γ_h —the sinergons’ circulation at the quanton’s surface, of radius r_h , rotated with c -speed around the vector photon’s kerneloid of mass m_b , through a brownian etheronic medium of density $\rho_s(r)$ having the same variation as that of the vortexed sinergons, $\Gamma_\mu(r) : \rho_s(r) = \rho_s^0 \cdot (r_0/r) \sim \rho_{sv}(r)$, this Γ_μ -vortex of quantons being stable by the condition:

$F_{sl} = F_{cf}$ of the quanton’s maintaining on the vortex-line of r -radius, with F_{cf} —the centrifugal force:

$$F_{sl}(r) = 2r_h \Gamma_h(r_h) \rho_s(r) \cdot c = 4\pi \cdot r_h^2 k_v c^2 \rho_s^0 \left(\frac{r_0}{r} \right) = m_h c^2 / r = F_{cf}(r) \quad (5)$$

$$(r \leq r_\lambda \Rightarrow \rho_s(r) = \rho_s^0 \cdot (r_0/r); \Gamma_h(r_h) = 2\pi r_h v_h; v_h = k_v \cdot c; k_v \leq 1)$$

with: ρ_s^0 —the density of “sinergons” at the surface of the vecton’s centroid, by considering the quanton as cylindrical, of length $l_h = 2r_h$ and density ρ_h [9] [10].

The value of w-speed results in CGT as the maximal speed of photon’s “falling” in a gravitational field, at blue-shift, (in a Fatio/LeSage model of gravitation) corresponding to $m_f(v) = m_f^0 / (1 - v^2/w^2)$, ($w = \sqrt{2}c$ —apparent variation of photon’s mass [10]), giving:

$$\epsilon_f(c) = 2m_f^0 c^2 = m(c)c^2, \text{ for } w = \sqrt{2}c.$$

As argument for the vortical nature of the magnetic moment can be also mentioned the fact that at neutron’s transforming, the beta-electron is expelled with relativist speed, $v_e \rightarrow c$, ($\sim 0.92c$). As consequence, a system of three magnetically coupled atoms must have a rotation around its median atom, in vacuum, at $T \rightarrow 0 \text{ K}$, conform to CGT.

It results logically that in non-equilibrium conditions, when $F_{sl} > F_{ef}$, the sinergonic vortices can explain the forming of the photonic and electronic centroids and kerneloids.

In this paper, we analyze the critical values of etherono-quantonic vortex densities which can generate the confining of quantons up to the forming of centroids and kerneloids of electrons and vector photons, particularly—of “vectons”, ($m_v \approx 2.3 \times 10^{-40} \text{ kg}$ [8] [9]).

2. The Forming of Centroids and Kerneloids of Fermionic Leptons

In CGT, the relation: $2\pi a^3 \cdot \rho_a = m_e$, between the electron’s mass, its classical radius specific to its e-charge contained in its spherical surface,

($a = 1/2 a_{cl} = 1.4085 \approx 1.41 \text{ fm}$) and its photons’ density at its surface:

$\rho_a(a) = \mu_0/k_1^2 = 5.16 \times 10^{13} \text{ kg/m}^3$, ($k_1 = 4\pi a^2/e = 1.56 \times 10^{-10} \text{ m}^2/\text{C}$; e —electron’s charge), was obtained. [8] [9] from the relation:

$$\epsilon_E^0 = 4\pi \int_0^\infty r^2 \varnothing(r) dr = \frac{e^2}{8\pi \epsilon_0 a} = m_e c^2; \varnothing(r) = \frac{\epsilon_0}{2} E^2 = \frac{\epsilon_0}{2} \left(\frac{e}{4\pi \epsilon_0 r^2} \right)^2 \quad (6)$$

Because in CGT the electron’ mass is given by a quantity of photons confined by the etherono-quantonic vortex $\Gamma_\mu(r) = 2\pi r c$ of the electron’s magnetic moment, formed around its centroid, according to another relation of CGT which states that the density of confined photons, ρ_f , is proportional to the local value of the magnetic induction [8] [9]:

$$B(r) = k_1 \rho_c v_c = k_1 \rho_f c; (r \leq r_\mu \Rightarrow v_c = c; \rho_f(r) = \rho_c(r)) \quad (7)$$

($\rho_c v_c$ —the impulse density of the quantonic vortex $\Gamma_\mu(r)$), it results that the density: $\rho^2 = \rho(a)$ can be interpreted, by the relation: $m_e = 2\pi a^3 \cdot \rho_a$, as a mean density of a cylindrical electron of the same radius, a , and a high $l_a = 2a$, given by confined photons.

Relation (7) can be also obtained by the equality: $E = B \cdot c$ which is valid for $r \leq r_\mu = \lambda/2\pi$, ($\lambda = h/m_e c$), and which gives: $\varepsilon_0 E^2 = B^2/\mu_0$, $\Rightarrow \varepsilon_E^0 = \varepsilon_B^0$, *i.e.*:

$$m_e = 2\pi a^3 \cdot \rho_f(a) = \frac{2\pi a^3 E_a}{k_1 c^2} = \frac{2\pi a^3 B_a}{k_1 c} = 2\pi a^3 \cdot \rho_c(a) \quad (8)$$

From Equation (7), it results that $\rho_f(a) = \rho_c(a)$, (meaning that the mean density of a cylindrical electron is equal to the density of quantonic vortex $\Gamma_\mu(r)$ at $r = a$), and by generalizing, we can conclude that between the radius r_k and the mass m_k of a centroid or kerneloid of an electron or of a vector photon and the induction B_k of the magnetic field which generate a such centroid or kerneloid exists the relation:

$$m_k = 2\pi r_k^3 \cdot \rho_k(r_k) = 2\pi r_k^3 \cdot B_k/k_1 c \quad (9)$$

where—because $m_k < m_k(e)$, ρ_k cannot be lower than the density of the electronic centroid, respective—kerneloid (the centroid of the kerneloid being considered as stably formed when its density exceed a critical density, higher than that corresponding to an electronic centroid, respective—kerneloid, *i.e.*:

$$\rho_k(r_k) m_k / 2\pi r_k^3 = B_k/k_1 c > \rho_k(e) \quad (10)$$

In CGT [8] [9], the electron's centroid resulted as a half of an electron neutrino, considered with upper limit of rest mass $m_\nu \approx 10^{-4} m_e$, (mass limit: 60 eV/c²), according to older experiments [11], so—with a mass: $m_0 \approx 5 \times 10^{-35}$ kg, and it was identified with the scattering centers considered as nucleonic current quarks, in the Standard Model, so—with a radius: $r_0 = 0.43 \times 10^{-18}$ m, according to the experimental data [12], this value being concordant with that of the centers of X-rays scattering on electrons [13], (considered as the real radius of electron, in the Standard Model, but as radius of the electron's centroid, in CGT).

So, in CGT, the density of the electron's centroid—considered as quasi-cylindrical, in CGT, results of value: $\rho_0 \approx \frac{m_0}{2\pi r_0^3} = 10^{20}$ kg/m³.

By Equation (10) this corresponds to a value of B-induction of the confining magnetic field, of value: 42.18×10^{17} T—a very high value, compared also to that of the highest magnetaric field considered in astrophysics: more than 10^{11} T [14].

The question is: if after an intermediary critical density: $\rho_i < \rho_k = 10^{20}$ kg/m³, the centroidic pre-cluster of confined photons could form the final centroid by an auto-confining process.

The answer to this question can be obtained by the CGT's model of vector photon forming, with kerneloid containing its inertial mass and an evanescent shell of quantons (for the light photons) or mixture of quantons and kerneloids of light photons—for the heavy vector photon. We identify two theoretical cases:

A. The forming of centroids and kerneloids of photons and of electrons from a vortex of quantons having the mean speed $v_c = c$

a1) The B⁰-field values of the forming of photonic and electronic centroids and

kerneloids

- It is known that the drag force in a superfluid is complex and often results in cancellation (zero drag) in the pure superfluid regime, but can appear as viscous-like ($F \propto v$) at low speeds or as turbulent/wave-like ($F \propto v^2$) at higher speeds, involving quasiparticles, quantized vortices [15].
- In CGT [8] [9], from Equation (5) it results that the dynamic equilibrium which maintains the quantonic vortex around the electron's centroid m_0 is realized by the resulting condition: $4\pi r_h^2 k_v \rho_s^0 \cdot r_0 = m_h = h/c$, i.e.—by the condition: $\rho_s^0 k_{v_0} = m_h / 4\pi r_h^2 = \frac{1}{2} \rho_h \cdot r_h = \text{constant}$.

With the value resulting from Ref. [9] for the ratio: $k_h = 2\pi r_h^2 / m_h = 27.4$, (giving $r_h = 1.79 \times 10^{-2}$ m—the gauge radius of the quanton), it results [10]:

$$\rho_s(r) k_v \cdot r = \rho_s^0 k_{v_0} r_0 = m_h / 4r_h^2 = 1 / (2k_h) = 1.825 \times 10^{-2} \text{ [kg/m}^2 \text{]} \quad (11)$$

The quanton's c-speed can be maintained by a dynamic equilibrium of etheronic pressure forces F on the tangent direction, considered of Stokes type ($F \sim v$), specific to a laminary flowing of the sinergonic fluid in report to the quantons, and given by the Γ_a —vortex having an impulse density $\rho_s(r) = \rho_s(r)w$ and by the density $\rho_s(r)$ of Brownian (pseudostationary) sinergonic medium which generates a drag force: $F_r^t = F_a^t(r)$.

At dynamic equilibrium, with $k'_\rho \approx k_\rho$ (proportionality coefficient), we have [10]:

$$F_t = F_r \Rightarrow k_\rho \rho_{sv}(r) \cdot (w - c) = k'_\rho \rho_s(r) \cdot c; (w = \gamma \cdot c \sqrt{2} \approx c \sqrt{2}), \quad (12)$$

$$\Rightarrow \rho_{sv}(r) \approx \rho_s(r) / (\sqrt{2} - 1)$$

with $\gamma \rightarrow 1$ and $k_\rho \ll 1$ —coefficient which take into account the particle's radius (and its surface of interaction with the sinergonic medium, S_i) and the superfluidity of the etherono-quantonic medium by its low kinematic viscosity (the d'Alembert paradoxe [16]), the same type of medium and the same interaction surface implying the equality $k'_\rho \approx k_\rho$.

Particularizing for the case of the electron's magnetic moment vortex, Γ_μ^e , for which Refs. [8] [9] gives a density: $\rho_c(a) = \rho_\mu(a) = \rho_e(a) = \mu_0 / k_1^2 = 5.16 \times 10^{13}$ kg, ($a \approx 1.41$ fm), and by using the formula: $B = k_1 \rho_c v_r$ for the electron's B -field [8] [9], with $v_r = c$ for $r \leq r_\lambda^c$, using Equation (7) for the magnetic induction, it results that the magnetic potential is :

$$A(r) = \frac{1}{2} B(r) \cdot r = \frac{1}{2} k_1 \rho_c c \cdot r = \frac{1}{2} k_1 \rho_{sv} w \cdot r \Rightarrow \rho_{sv}(a) = \rho_c(a) / \gamma \sqrt{2}; \quad (13)$$

$$\rho_s(a) = \rho_{sv}(a) (\gamma \sqrt{2} - 1) = \rho_c(a) (1 - 1/\gamma \sqrt{2}), (\gamma \rightarrow 1) \quad (14)$$

By taking $\gamma = 1$, ($w = \sqrt{2}c$ [9] [10]), it results:
 $\rho_s(a) = 0.29 \rho_c(a) \approx 1.5 \times 10^{13}$ kg/m³.

From Equation (11) we also have: $\rho_s(a) = 1.825 \times 10^{-2} / a \cdot k_v$, resulting that: $k_v \approx 0.86$ [10], ($v_h \approx 0.86c$ —plausible value, being close to c), so—for

$r_0^e \approx 0.43 \times 10^{-18}$, (considered as electron centroid's radius, in CGT[10]), by Equation (11) we obtain: $\rho_s^0(r_0^e) \approx a \cdot \rho_s(a) r_0^e \approx 0.49 \times 10^{17} \text{ kg/m}^3$, for the electron's centroid, (of radius r_0^e).

Also, for the electron's kerneloid, of radius: $r_k^e \approx 10^{-17} \text{ m}$, in CGT [10], (corresponding to the experimentally determined electron's radius reported by Milloni [17]), we obtain: $\rho_s^0(r_k^e) \approx a \cdot \rho_s(a) r_k^e \approx 0.21 \times 10^{16} \text{ kg/m}^3$.

- Also, with the obtained values, considering and the possibility of vecton's attraction in the magnetic field of the electron's centroid/kerneloid, if we take the same k_v —value for the sinergonic vortex formed around the vecton's centroid and around the quantons and quantonic cluster of smaller mass which form its kerneloidic shell, considering that the electron's centroid is formed as compact cluster of centroids of vectons of mass m_v^0 having approximately the same density: $\rho_v^0 \approx \rho^0 = 10^{20} \text{ kg/m}^3$, it is possible to estimate the radius: r_{v0} of the vecton's centroid by Equation (5) in which we replace r_b with r_{v0} and m_b with m_v^0 , *i.e.* by the resulting relation of vecton's maintaining at the surface of electron's centroid, m_0 :

$$F_{sl} = F_{cf} \Rightarrow 4\pi \cdot r_{v0}^2 k_v \cdot c^2 \cdot \rho_s^0(r_0) \cdot r_0 = m_v^0 c^2 \Rightarrow r_v^0 = 2k_v \cdot \rho_s^0(r_0) r_0 / \rho^0 \quad (15)$$

which gives: $r_{v0} \approx 3.6 \times 10^{-22} \text{ m}$; $\rho_s^0(r_{v0}) \approx 5.8 \times 10^{19} \text{ kg/m}^3$, (the density of sinergons which maintains vortexed quantons at the vectonic centroid's surface) and: $m_v^0 = 2.93 \times 10^{-44} \text{ kg}$.

- With the obtained values of ρ_s^0 it results by Equations (12), (14), with $\gamma = 1$, that:

$$\rho_{sv}^0 \approx \rho_s^0 / (\sqrt{2} - 1), \quad (\rho_c^0 = \sqrt{2} \rho_{sv}^0) \quad (16)$$

- So, for the electron's centroid, Equation (16), gives: $\rho_{sv}^0(r_0) = 1.2 \times 10^{17} \text{ kg/m}^3$, which by Equation (7) for B^0 corresponds to:

$$\rho_c^0(r_0) = \sqrt{2} \rho_{sv}^0 = 1.69 \times 10^{17} \text{ kg/m}^3, \text{ and to a magnetic induction:}$$

$$B^0(r_0) = 0.79 \times 10^{16} \text{ T} \text{ at } r = r_0 \text{ from the center of the vortex-tube } \xi_B^0 \text{ which can form the electron's centroid, considering a vectonic kerneloid as pre-kerneloid, (with } r_v^k \approx 10^{-20} \text{ m).}$$

- Similarly, for the forming of electron's kerneloid ($\rho_s^0(r_k^e) \approx 0.21 \times 10^{16} \text{ kg/m}^3$) it results: $\rho_{sv}^0(r_k^e) = 0.51 \times 10^{16} \text{ kg/m}^3$ and $\rho_s^0(r_k^e) = \sqrt{2} \rho_{sv}^0 = 0.73 \times 10^{16} \text{ kg/m}^3$, corresponding by Equation (7), to: $B^0(r_k^e) = 0.34 \times 10^{15} \text{ T}$.

- For the forming of the vecton's centroid, we obtain by Equations (15) and (16): $\rho_s^0(r_{v0}) \approx 5.8 \times 10^{19} \text{ kg/m}^3$ $\rho_{sv}^0(r_v^0) = 1.41 \times 10^{20} \text{ kg/m}^3$, which—by Equation (13), corresponds to:

$$\rho_c^0 = \sqrt{2} \rho_{sv}^0 = 1.98 \times 10^{20} \text{ kg/m}^3 \text{ and to a magnetic induction:}$$

$$B^0(r_v^0) = 9.3 \times 10^{18} \text{ T} \text{ of the vortex-tube } \xi_B^0 \text{ which can form the vecton's centroid, conform to CGT.}$$

Also, considering a vecton's kerneloid of radius (r_v^k) $\approx 10^{-20} \text{ m}$, containing its inertial mass, (value corresponding to a density $\rho_v^0 \approx 3.6 \times 10^{19} \text{ kg/m}^3$ of its inertial mass:

$$m_v \approx 2.3 \times 10^{-40} \text{ kg} \text{ [8] [9]), similarly are obtained the values:}$$

$\rho_s^0(r_v) \approx 2.1 \times 10^{18} \text{ kg/m}^3$; $\rho_{sv}^0(r_v) = 5.12 \times 10^{18} \text{ kg/m}^3$; $B^0(r_v^k) = 3.37 \times 10^{17} \text{ T}$, for the vecton's kerneloid forming.

Because the increasing of the ratio ρ_s/ρ_{sv} lowers the quantons' v_c -speed (at $\rho_s' > \rho_s^0(r_v)$, conform to Equation (12)) permitting the forming of a vectonic centroid inside a partially collapsed vectonic pre-kerneloid, we can consider the value $B^0(r_v^k)$ as critical value for the vecton's forming from quantons having the c -speed.

- So, the obtained values for $\rho_s^0(r_v)$, $\rho_{sv}^0(r_v)$ and $B^0(r_v^k) = 3.37 \times 10^{17} \text{ T}$ can be considered as critical values specific to the actual cosmic era, (specific to $v_c \approx c$), for the forming of centroids and kerneloids of vectons and of electrons from a primordial dark energy composed by an etherono-quantonic brownian component and a wind-like etherono-quantonic component with quantons having $v_c \approx c$, because we observe—by Equation (12), that for a density of the etheronic medium: $\rho_s > \rho_s^0$, the attractive etheronic force F_{sl} exceeds the centrifugal force $F_{cf}(v_h)$ and the quanton' speed decreases to a value $v_h < c$, so we can conclude that in this case ($\rho_s > \rho_s^0$) the cluster of vortexed quantons or of quantons and light photons vortically attracted by the etherono-quantonic vortex of a pre-centroid approximated as being a vectonic centroid, could generate centroids and kerneloids of heavier vector photons and of electrons, also by auto-confining, *i.e.* by the vortex-tubes ξ_B of the B -field formed around its pre-centroids, of mass given by the confinement of slowed quantons, (*i.e.* by the force $F_{gm}(r)$), at intensities of the B -field lower than that given by Equation (10), with: $10^{20} \text{ kg/m}^3 \geq \rho_k > \rho_c^0(r_v^k) \approx 7.2 \times 10^{18} \text{ kg/m}^3$, *i.e.* lower than $46.6 \times 10^{17} \text{ T}$ but higher than $3.37 \times 10^{17} \text{ T}$ —for the cold forming of vectons and of electron centroids.

- The A -value which characterizes the density of the sinergonic winds which generate etheronic vortex around a vectonic kerneloid in the process of its forming results—according to the previous conclusions, of value given by Equation (13):

$$A^0(r) = A^0(r_v^0) = \frac{1}{2} B^0(r_v^k) \cdot r_v^k = \frac{1}{2} (3.37 \times 10^{17} \text{ T} \times 10^{-20} \text{ m}) = 1.685 \times 10^{-3} \text{ T} \cdot \text{m}$$

This A -potential associated to sinergonic winds of the quantum vacuum can also explain the inertial forces: $F_i = ma_i$ in the form: $F_i \sim m(dA/dt)$, (Aharonov-Bohm effect for photons).

a2) The vortical model of vector photon and of electron with $v_c = c$ for $r \leq r_l$

- From Equation (5) it also results that if the density $\rho_s(r_0)$ of sinergons accumulated by the Γ_μ -vortex is lower than the critical value $\rho_s^0(r_k)$ specific to the kerneloid's forming by a vortex-tube ξ_B , (for example—as consequence of the electron's spin precession), the attracted vectons are thereafter expelled from the electron's quantum volume of a -radius, as consequence of the variation with r^1 of the centrifugal force, explaining the electron's electric field, $E(r)$, conform to CGT [8] [9].

The force $F_{gm}(r) = -\nabla V_{gm}(r)$, of etheronic density gradient, acting over the

vortexed quantons, results of negligible value compared to the etheronic force of Magnus type, $F_{gm}(r) = F_{sl}(r)$, given by Equation (12).

For example, for the electron's vortex of quantons, by the values obtained in CGT: $r_h = 1.79 \times 10^{-25} \text{ m}$, $r_0 = 0.43 \times 10^{-18} \text{ m}$, $\rho_{sv}^0(r_0) \approx 1.2 \times 10^{17} \text{ kg/m}^3$, it results by Equation (3) that: $F_{gm}(r_0) = 0.6 \times 10^{-21} \text{ N}$, which can confine only quantons having the speed: $v_h(r_0) = \sqrt{(r_0/m_h)F_{gm}(r_0)} < 1.87 \times 10^5 \text{ m/s}$, while for $F_{gm}(r) = F_{sl}(r)$, with the corresponding value: $\rho_s^0(r_0) \approx 0.49 \times 10^{17} \text{ kg/m}^3$, obtained by (11), by Equation (4) it results: $F_{sl}(r_0) = 1.54 \times 10^{-15} \text{ N}$, with five size order higher (which can confine and quantons with $v_c \rightarrow c$).

However, the force $F_{gm}(r)$ is enough strong for maintain the confined quantons, slowed to $v_h(r_0)$, in the volume of formed centriod/kerneloid, when $\rho_s > \rho_s^0(r_0)$.

We can also conclude that after the forming of the electron's centroid and of its kerneloid and the decreasing of the density of sinergons to the value $\rho_s^0(r_v) \rightarrow 2.1 \times 10^{18} \text{ kg/m}^3$, the etherono-quantonic vortex of the electronic kerneloid's magnetic moment is auto-sustained by a possible spiral form of the electron's centroid, (of twisted yarn bundle type)—in CGT, characterizing its chirality, $\zeta_e = \pm 1$, and this Γ_μ^e -vortex explains the volume of confined 'heavy' photons, ('naked' photons, virtually reduced to their inertial mass m), of classic radius: $a = 1.41 \text{ fm}$, conform to CGT [8] [9].

- The actual density of the etheronic medium, given by pseudo-gravitonic and sinergonic etherons: $\rho_{et}^* = \rho_g^* + \rho_s^*$ can be approximated by the conclusion that the maintaining of the electron's etherono-quantonic vortex $\Gamma_\mu^e(r)$ with an impulse density $p_{sv} = \rho_{sv}w$ specific to the value of its magnetic moment μ_e corresponds to the obtained critical values $\rho_s^0(r_0^e) \approx 0.49 \times 10^{17} \text{ kg/m}^3$ and $\rho_{sv}^0(r_0^e) \approx 1.195 \times 10^{17} \text{ kg/m}^3$, because the fact that the mass of electron's centroid is not increased indicates that the quantons having the light speed c are expelled from the surface of its centroid of r_0^e -radius.

However, for explain the stability of the formed fermions, it is necessary to consider that the density $\rho_s(r)$ corresponds to sinergonic etherons vortically accumulated by the sinergonic vortex $\Gamma_{sv}(r)$ of lighter sinergons, from an initially homogenous medium of mixed etherons: pseudo-gravitonic and sinergonic etherons, with a continuous speeds' distribution but theoretically reduced to two components: a brownian one (giving static pressure $P_s = \rho_s c^2$) and a wind-like component of mean speed w , resulting from components reduced theoretically to a mean component with dynamic pressure: $P_d = \frac{1}{2} \rho_d w^2$, (c —the light's speed).

So, for a super-fluid etherono-quantonic medium it results that the value:

$\rho_s^* \approx \rho_s^0(r_0^e) + \rho_{sv}^0(r_0^e) = 1.685 \times 10^{17} \text{ kg/m}^3$ also corresponds, approximately, to the density of the etheronic medium ρ_{et}^* of pseudo-gravitonic and sinergonic etherons, which is characterized by the applicability of the Bernoulli's law in its

simplest form: $\rho_{es} + \rho_{ev} = \rho_{et} = \text{constant}$, having a etheron's mass-depending kinematic viscosity, $v(m_g)$.

This determines a much lower resistance force to the advancing with relativist speed $v \rightarrow c$ of quantons in a medium of pseudo-gravitonic etherons than that of the advancing in a medium of sinergonic etherons, (because $v(m_g) \ll v(m_s)$).

In consequence, we can approximate that the value of the ρ_g^* -component, of pseudogravitons, ($\rho_g^* = \rho_{et}^* - \rho_s^*$), will not change significantly Equation (12) of dynamic equilibrium, (generated by the sinergonic component), which explains the maintaining of the fermion's vortex: $\Gamma_\mu(r) = 2\pi r c$ of its magnetic moment, *i.e.* with $v_c = c$ up to $r = r_\lambda = \lambda/2\pi$.

But relating to Equation(11), the density ρ_g^* of this medium of pseudo-gravitons, will influence the interaction of the etheronic brownian component with the quanton's sinergonic vortex by an increased total density of the brownian component of etheronic medium, $\rho_{re}(r)$, which also increases the magneto-gravitic (etheronic) force $F_{sl}(r)$, as consequence to the fact that the acting of ρ_g^* in report to the sinergons of the quanton's vortex Γ_h is significant.

In this case, this $F_{sl}(r)$ -force has a much slower decreasing with the distance r , determining the vortically attraction toward the fermion's center of quantons and vector photons which at the surface of the fermion's centroid are expelled with c -speed by the centrifugal force $F_{cf}(r)$ from the fermion's proximity, on a pseudo-radial trajectory, conform to the resulting model (**Figure 1**).

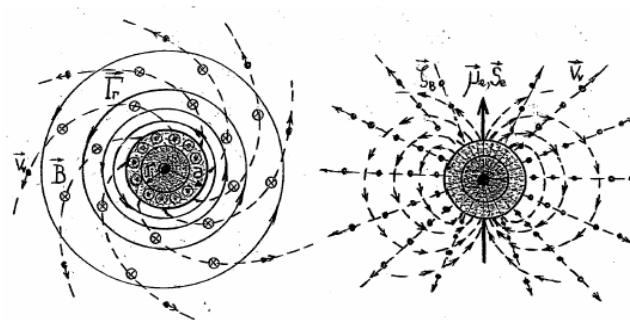


Figure 1. Model of Vortical Electron [8] [9].

It is explained in tis case the fact that—in the vecton's case, even if its magnetic moment μ_v is much smaller than the electron's magnetic moment ($\mu_v < \mu_e$), corresponding to a lower density of accumulated sinergons, $\rho_s(r)$, the magneto-gravitic (etheronic) force $F_{sl}(r)$ can exceed the centrifugal force, for $r > r_0^e$, determining the forming of the vecton's quantonic vortex, of radius $r_\lambda = \lambda/2\pi = h/2\pi m_e c$, even if these quantons have the c -speed up to $r = r_\lambda$.

The variation: $v_c \approx c(r_\lambda/r)$ of the quantons' speed for $r > r_\lambda = \lambda/2\pi$, in the Γ_μ -vortex can be explained in accordance with Equation (12) by a density' variation: $\rho_{sv}(r) \sim r^{-2}$, for $r > r_\lambda$:

$$\frac{v_c}{w-v_c} = \frac{\rho_{sv}(r_\lambda)}{\rho_s(r_\lambda)} \left(\frac{r_\lambda}{r} \right)^2 \frac{r}{r_\lambda} = \frac{c}{w-c} \frac{r_\lambda}{r} \quad (17)$$

which gives $v_c(r_\lambda) = c$ for $r = r_\lambda$, the variation of v_c being conform to the vortex' law.

The increasing of the ratio: $(w-v_c)/(w-c)$ with r , corresponds to the conclusions that the quantonic vortex is formed by gradually attraction and acceleration of quantons, by the sinergonic vortex formed around the fermion's centroid up to the reaching of the c -speed at $r = r_\lambda$, being thereafter expelled at the kerneloid's surface.

B. The forming of centroids and kerneloids of photons and of electrons from a vortex of quantons having the mean speed $v_c < c$

We observe from Equations (4), (5), (11) and (12), that for the same ratio: $k_v = v_h/v_c$, if the mean speed of the vortexed quantons is lower than the light speed, ($v_c < c$), the critical value ρ_s^0 resulting from Equations (5), (11), remains the same as in case ($v_c = c$) but the ratio: $\rho_{sv}(r)/\rho_s(r) = v_c/(w-v_c)$ decreases. If $v_c = k_c c$, ($k_c < 1$), with $w \approx \sqrt{2}c$, it results that:

$$\rho_{sv}(r)/\rho_s(r) = \rho_{sv}^0(r_0)/\rho_s^0(r_0) = k_c / (\sqrt{2} - k_c) < 1 / (\sqrt{2} - 1) \quad (18)$$

This means that the pre-centroid of vector photons and of electrons could be formed also by slowed quantons, ($v_c < c$), by a lower value of the confining B -field, given by Equation (13), ($B = k_1 \rho_{sv}(r) w$).

- The question is: if the formed centroids could be stable at $v_c \ll c$.

Supposing that the density $\rho_s(r_0)$ is lower than the critical value $\rho_s^0(r_0)$, in this case the Magnus-type sinergonic force $F_{sl}(r)$ cannot confine vortexed quantons.

But we can deduce the quantons' speed v_c^1 for which the gravito-magnetic force: $F_{gm}(r) = -\nabla V_{gm}(r)$ still can confine vortexed quantons.

Because this F_{gm} -force is much weaker than the magneto-gravitic force F_{sl} , it is logical that $v_c^1 \ll c$. In this case we have:

$$F_{gm}(r) = -\nabla V_{gm}(r) = -\frac{1}{2} \mathcal{G}_h \nabla \rho_{sv} (w-v_c)^2 \approx -\frac{1}{2} \mathcal{G}_h \rho_{sv}^c \frac{r_0}{r^2} w^2 = -m_h \cdot v_c^2 / r \quad (19)$$

($w \approx \sqrt{2}c$; $v_c = k_c \cdot c$). At $r = r_0$, using also Equation (18), it results that:

$$\mathcal{G}_h \rho_{sv}^c c^2 \approx \mathcal{G}_h \rho_s^c k_c^2 / \sqrt{2} = m_h k_c^2 c^2 \Rightarrow k_c \approx v_h \rho_s^c / \sqrt{2} \cdot m_h \quad (20)$$

Taking a value: $\rho_s^c(r_0) < 0.49 \times 10^{17} \text{ kg/m}^3$, for example: $\rho_s^c(r_0) = 10^{16} \text{ kg/m}^3$, it results: $k_c \approx 2.3 \times 10^{-8}$, giving: $v_c^1 \approx 6.9 \text{ m/s}$ and:

$\rho_{sv}^c(r_0) \approx \rho_s^c(r_0) k_c / \sqrt{2} = 1.63 \times 10^8 \text{ kg/m}^3$ corresponding to a critical value:

$B_c(r_0) = k_1 \rho_{sv}^c(r_0) w \approx k_1 \rho_s^c(r_0) k_c c \approx 5.27 \times 10^7 \text{ T}$.

- It results in consequence the next scenarios of the cold forming of centroids and kerneloids of vector photons and of electrons in the Proto-Universe's forming period:

a) either from confined quantons of relativist mean speed: $v_c \approx c$, at high intensities of B -field corresponding to the formed etherono-quantonic vortex-tubes

$\xi_B, (B = B^0(r_v^k))$ and to a sinergonic density higher than the critical value $\rho_s^0(r_0^k)$ of case A;

b) or at densities of the sinergonic medium lower than the critical value $\rho_s^0(r_0)$ and at lower intensities of the B -field corresponding to the formed etherono-quantonic vortex-tubes $\xi_B, (B < B^0(r_v^k))$, but from slowed vortexed quantons, having $v_c < c$;

c) or the cold genesis of centroids and kerneloids of vector photons and of electrons at densities of the sinergonic medium higher than the critical value $\rho_s^0(r_v)$ and at lower intensities of the B -field corresponding to the formed etherono-quantonic vortex-tubes $\xi_B, (B < B^0(r_v^k))$, from initially slowed vortexed quantons, having $v_c < c$, which finally, at: $\rho_s(r_v) = \rho_s^0(r_v^k)$ and $B = B^0(r_v)$, were vortexed with mean speed $v_c \approx c$, this evolution being specific to a high mass of vortexed sinergons and quantons with constant impulse moment: $L_h = m_h \cdot r \cdot v_c(r)$, which has a density of the sinergonic medium initially lower than the critical value $\rho_s^0(r_v)$, and a high radius which is gradually decreased with the increasing of the ρ_s^0 -density until the actual critical value $\rho_s^0(r_v)$.

In our opinion, this c)-variant is more explanatory.

3. The Correspondence with the Copenhagen-Type Quantum Vacuum

Conform to the model, the further increasing of the fermion's centroid or of its kerneloid is impeded by a repulsive field/potential $V_r(r) \sim \rho_s^0(r)$ of short range, given by the kerneloid's zeroth vibrations of spin precession [9] [18], which determine the quasi-radial emission of sinergons and quantons from the kerneloid' surface and which transform a quasi-cylindrical (barrel-like) electron into a quasi-spherical one, ($\rho_s \sim r^{-2}$) with specific variation of its field: ($B(r) = E(r)/c \sim r^{-2}$, for $r \leq r_\lambda$, this spin precession movement determining an exponential variation of the densities $\rho_s; \rho_{sv}^0$, at least inside the fermion's kerneloid.

This conclusion corresponds to the Copenhagen-like conclusion [1] [2] which considers a vortex-tube of magnetic H-field in the quantum vacuum as a fluctuation ρ_f of the vacuum value of the flux ϕ resulting from a Higgs-like potential: $V(\phi) = -c_2|\phi|^2 + c_4|\phi|^4$ whose minimal value: $|\phi| = \phi_0 = \sqrt{c_2/2c_4}$ characterizes the vacuum-value of the field $|\phi|$ and gives an equation of motion:

$$(\partial_\mu + ieA_\mu)^2 \phi = -2c_2\phi + 4c_4\phi^2\phi^*; \phi(r) = \phi_0 + \rho_f(r) = |\phi| \cdot e^{ix} = 2\pi r \cdot |A(r)| \quad (21)$$

(e —the electron' charge, A_μ —the magnetic potential), resulting that:

$$|A| = 1/er + K(r) \cdot e^{-e|\phi|r}, \left(K(r) \sim \sqrt{(e|\phi|r)^{-1}} \right); \rho_f(r) \sim e^{-\sqrt{c_2} \cdot r} \quad (22)$$

the value: $\kappa = 1/\sqrt{2}$ representing the distance until the $|\phi|$ -field reaches its vacuum value ϕ_0 , but with the difference that the variation: $|A| \sim r^{-1}$ corresponds—by (13), to a variation: $B(r) \sim r^{-2}$, characteristic to $a < r < r_\lambda$ and to a

e-charge with precession movement, whose μ_e -magnetic moment is similar to a magnetic vortex-tube ξ_B but with: $B(r) \sim r^{-2}$ for $r \leq r_\lambda$.

Also, the first and the second terms of the Higgs—like potential corresponds in CGT to the gravito-magnetic potential $V_{gm}(r)$ and to the mentioned repulsive potential $V_r(r)$, *i.e.*:

$$V_{gm}(r) \sim |\phi|^2 \sim \rho_{sv}(r) \sim B_e(r) \sim r^{-2}; V_r(r) \sim |\phi|^4 \sim \rho_c^2(r) \sim B_e^2(r) \sim r^{-4} \quad (23)$$

But unlike CGT, the Standard Model considers that the formation of rest mass of elementary particles implies an exchange of a virtual Higgs boson between coupled particles, resulting in classical potentials of the form:

$$V_H(r) = \frac{m_i m_j}{m_H^2} \frac{1}{4\pi r} e^{-m_H c r / \hbar} \quad \text{with a Higgs mass: } m_H = 125.18 \text{ GeV}/c^2, \text{ which gives}$$

an action range equal to the reduced Compton wavelength of m_H : 1.576×10^{-18} m, (of about 10^{18} times weaker than the weak interaction between two electrons).

In CGT, this explanation of the formation of particle's rest mass results as speculative and unnecessary, as in the case of the Einsteinian relation of mass increasing by the particle's speed contrary to the law of substance-energy conservation.

Also, the 'vacuum catastrophe' theoretic problem of the Standard Model, (a very high density of the quantum vacuum, which can impede even the atomic electrons' rotation) is avoided by the previous model of the cold genesis of photons and electrons.

4. Theoretical Implications

4.1. The Explaining of the Perpetual Rotation of the Atomic Electrons

In CGT, the atom results as system with electrons vortically circulated with a rotation speed v_e under the action of impulse density $p_{sv} = \rho_{sv} w$ of the sinergonic vortex $\Gamma_{A^p} = 2\pi r \cdot w$ of the nuclear magnetic moment, μ_N , which explains the physical nature of the magnetic potential \mathcal{A} and which in the particular case of the hydrogen atom, is given by an incorporated positron with degenerate magnetic moment, according to CGT [8] [9].

This sinergonic Γ_{A^p} -vortex of the atomic nucleus explains in CGT the v_e —speed variation of the atomic electrons: $v_e(r) = c\sqrt{2a/r}$, ($a \approx 1.41$ fm), by the conclusion that these electrons are revolved by the action of an accelerating force: $F_A(r)$, given by the sinergonic impulse density $p_{sv} = \rho_{sv}(r)w$ of the Γ_{A^p} -vortex with $\rho_{sv}(r)$ -density, which acts against a drag force $F_R(r)$ given by a density $\rho_r(r)$ of brownian sinergons which—for $r \leq 2a$, could be identified with $\rho_s(r)$ from Equation (5), if it is applied Equation (12) of dynamic equilibrium, giving: $\rho_r(r) = \rho_{sv} \cdot (\gamma\sqrt{2} - 1) = \rho_s(r)$, ($\gamma = e^{\frac{v_e}{c}} \rightarrow 1$ for $r \rightarrow 2a$), *i.e.* if we suppose a laminary flowing specific to: $(F_A, F_R) \sim v_e$, but only for a proton without precession movement, (approximately of cylindrical form). But in atoms the nucleus has spin precession.

- The quantification of the electron number of an atomic energy level: $N(n)$, can be explained [8] as corresponding to a superficial charge density σ_e of constant value for a energetic layer considered as having quasi-cylinder (barrel-like) form, of l_σ -height and quantified r_e -radius: $N(n) = Q(n)/e = (\sigma_e \cdot 2\pi r_e l_\sigma)/e = 2n^2$; $r_o = e/(\sigma_e \cdot \pi \cdot l_\sigma)$; $r_e = n^2 \cdot r_o$ (these electronic shells being transformed into quasi-spherical (barrel-like) shells, of higher homogeneity).

For $q = e, \Rightarrow n = 1/2$, (transition on sub-fundamental level, corresponding to the forming of ‘mascons’, *i.e.* solid structures with concentrated mass).

- For $r > 2a, r \rightarrow 2a$, supposing a variation: $[F_r(r); F_A(r)] \sim v_e^k, (k = 1..2)$, from Equation (12), with: $v_e(r) = c\sqrt{2a/r}$ instead of $v_c = c$, (*i.e.* $v_e(n) = v_0/n$), it results the next equation:

$$F_A(r) = F_r(r) \Rightarrow k_\rho \rho_{sv}(r)(w - v_e)^k = k'_\rho \rho_R(r)v_e^k; \left(w = \gamma \cdot c\sqrt{2} \right), \quad (24a)$$

By the approximation: $k_\rho \approx k'_\rho$ (for sinergonic quanta with close masses), it results that:

$$w = \gamma \cdot c\sqrt{2}, v_e(r) = c\sqrt{2a/r} \Rightarrow \rho_R(r) \approx \rho_{sv}(r) \cdot (\gamma\sqrt{r/a} - 1)^k \quad (24b)$$

which for $r = 2a, (\gamma \approx 1), k = 1$, gives: $\rho_R(2a) = \rho_{sv} \cdot (\sqrt{2} - 1) = \rho_s(2a)$, so conform to Equation (12), but with the observation that Equation (24b) is not valid for $r < 2a$.

- For $r \gg 2a$, the electron’s $v_e(r)$ -speed variation in the hydrogen atom, which results from the quantification law of the orbital kinetic moment of electron: $L_e = m_e v_e r_e = n \cdot h/2\pi, (v = v_0/n; r = n^2 r_0)$, can be explained by the hypothesis that the dynamic equilibrium between the drag force $F_R(r)$ and the accelerating force $F_A(r)$ is realised in conditions of turbulent flowing of the sinergono-quantonic medium in report to the rotated electron, as consequence of its, zeroth’ vibrations of precession movement. In this case, the drag force $F_R(r)$ and the accelerating force $F_A(r)$ have the specific dependency: $F(r, v) \propto k_\rho \rho(r)v^2, (k_\rho(v; S_i))$ —coefficient which take into account the particle’s interaction surface S_i and the d’Alembert paradoxe [16], *i.e.* the kinematic viscosity ν characterizing the super-fluidity of the etherono-quantonic medium), resulting—by the approximation $k_\rho \approx k'_\rho$, the equation:

$$F_A(r) = F_r(r); r \gg 2a \Rightarrow k_\rho \rho_{sv}(r)(w - v_e)^2 = k'_\rho \rho_R(r) \cdot v_e^2; \left(w = \gamma c\sqrt{2} \right) \quad (25)$$

With the approximation: $r \gg 2a \Rightarrow w - v_e \approx w \approx c\sqrt{2}$, by Equation (25) it results that:

$$r \gg a; v_e(r) \approx c\sqrt{2a/r} \Rightarrow \rho_R(r) \approx \rho_{sv}(r) \cdot (w/v_e)^2 = \rho_{sv}(r) \cdot (r/a) \quad (26)$$

For $r \geq a$, conform to the specific variation of the proton’s B -field at $r \geq a$, we have $B \sim r^{-3}$, variation which can be explained by Equation (7) with:

$v_c(r) = c(r_\lambda/r)$ and: $\rho_c(r) = \rho_c^a \cdot (a/r)^2$, (specific to a proton with spin precession), with $\rho_c^a = \mu_0/k_1^2$ resulting:

$$B(r) = k_1 \rho_c v_c = k_1 \left(\frac{\mu_0}{k_1^2} \right) \left(\frac{a}{r} \right)^2 c \left(\frac{r_\lambda}{r} \right) = \mu_0 \left(\frac{ecr_\lambda}{4\pi r^3} \right) = \left(\frac{\mu_0}{2\pi} \right) \left(\mu_p / r^3 \right) \quad (27)$$

($\mu_p = 1/2(ecr_{\lambda p})$ —the proton's magnetic moment), Equation (27) verifying the relation: $E = cB$ for $r = r_\lambda$ and the relations:

$$A(r) = \frac{1}{2} B(r) \times r = (\mu_0/4\pi) (\mu_p \times r/r^3), \text{ for a uniform magnetic } B\text{-field to a circle around the } \mu_p \text{—magnetic moment, giving: } A(r_\mu) = \frac{1}{2} k_1 \rho_{sv} \cdot w \cdot r_\mu.$$

Because—conform to Equation(13), we have by CGT: $c \cdot \rho_c(r) = w \cdot \rho_{sv}(r)$, it results by (27) that we also have: $\rho_{sv}(r) = \rho_{sv}^a \cdot (a/r)^2$, and for $r \gg 2a$, it results from Equation (26) that:

$$w \approx c\sqrt{2}; \rho_{sv}(r) = \rho_{sv}^a \left(\frac{a}{r} \right)^2 \Rightarrow \rho_R(r) = \rho_{sv}(r) \left(\frac{r}{a} \right) = \rho_{sv}^a \left(\frac{a}{r} \right) = \rho_s^a \left(\frac{a}{r} \right) \quad (28)$$

This variation of $\rho_R(r)$, for $r \gg 2a$, corresponds to the variation of $\rho_s(r)$ —density (of accumulated sinergons) specific to Equations (5), (12), *i.e.* is specific to a sinergonic vortex' cylindrical distribution: $\rho_R(r) \approx \rho_s(r)$, (even if it has precession rotation), which—by Equations (17) and (27) also explains the variation: $v_c \propto r^{-1}$ of the quantons of the Γ_μ -vortex of the proton's magnetic moment, μ_p , (generally—of the nucleus' magnetic moment), and which is maintained in laminary flowing conditions reported to quantons, conform to the model.

An argument for Equation (24a) is the fact that—at β disintegration of the neutron, the released electron has an energy corresponding to a speed close to the light speed, ($v_\beta = k \cdot c \cong 0.92c$) explained with Equation (24) by the conclusion that this speed is given to the β^- -electron by the Γ_{μ^p} —vortex of the remained proton.

Also, the same sinergono-quantonic Γ_{μ^p} -vortex can explain the speed of the released electronic neutrino, ν_e , and the photons' absorption or emission at the electron's transition from an electronic orbital to another.

It also results that the supposition: $k = 1$ in Equation (24) is justified only if $\rho_{sv}(r) \sim r^{-1}$, for $r \rightarrow 2a$, so—only for a quasi-cylindrical proton without precession, but for a proton or heavier nucleus with spin precession, the variation with r^{-2} of the B -field indicates that:

$$\rho_c = \sqrt{2} \rho_{sv} \sim r^{-2} \text{ at least for } r > a = 1.41 \text{ fm, but logically—also for: } \Delta r = (a \div r_{\lambda^p}), \text{ (with } r_{\lambda^p} = 0.587 \text{ fm} \approx 0.59 \text{ fm), which explains the atomic electrons' rotation speed by } k = 2 \text{ in (24).}$$

It can be argued that the model can be generalized for heavier atoms.

However, in the same time, by (17) the choice $k = 1$ (laminary flow) can be applied to quantons' rotation and can explain the variation of the quantons' speed, $v_c = c(r_\mu/r)$.

- The apparent contradiction between the value $r_{\mu^a} \rightarrow 2a$ and the radius: $r_{\lambda^p} \approx 0.59$ fm of the proton' μ_p -magnetic moment (and of its impenetrable volume [9]) may be explained by the fact that the protonic Γ_{μ^p} -vortex, given

by its positron, generates also the Γ_{w^-} vortices of parallel polarized heavy vector photons (m_w) of proton's surface, giving its e^+ -charge and having a confined vortical energy: $w_w = \frac{1}{2} m_h (\omega_h r)^2 = \frac{1}{2} m_w c^2$ contained by a chiral soliton with radius: $r_{w^n} \rightarrow 1$ fm which extends the limit up to which we still have $v_c = c$ for the vortexed quantons around the proton, to the value:

$r_{\mu^a} = a + r_{w^n} \approx 2.4$ fm, ($r_{w^n} \cong (r_{\mu^e} / 1836) \cdot e^{1.4/0.88} \approx 1$ fm [9]), with an exponentially decreasing density $\rho_{sv}(r) \sim \rho_r(r)$ of accumulated sinergons and quantons inside the volume of r_{μ^a} -radius, variation which introduces a correction factor: $\gamma = e^{r_0/r} \rightarrow 1$, for $r \rightarrow 2a$, ($r_0 < r_\lambda^p$), in the value of the vortexed sinergons' speed: $w \approx \gamma \cdot c\sqrt{2}$, (mean speed $w > c\sqrt{2}$, for $r < 2a$), given by the density of the superposed Γ_{w^-} vortices in the volume of radius: $a < r \leq 2a$.

It results—in this case, a semiempiric relation for the variation of quantons v_c -speed in the proton's Γ_{μ^p} -vortex, which corresponds to Equations (17) and (27), by the form [8] [9]:

$$v_c(r) = \begin{cases} c, & \text{for } r < r_{\mu^a} = a + r_{w^n} \approx 2.4 \text{ fm, } (a \approx 1.41 \text{ fm}) \\ c \left(\frac{r_\lambda^p}{r} \right)^{1 - \frac{r_{\mu^a}}{r}}, & \text{for } r \geq r_{\mu^a} \approx 2.4 \text{ fm; } (r_\lambda^p = 0.587 \text{ fm}) \end{cases} \quad (29)$$

- For $r \leq r_{\mu^a} = 2.4$ fm, because $v_e \approx c$ (as $v_c = c$ in the quantonic vortex) and $\rho_R(r)$ not vanish when $r \rightarrow r_0$, it results that in Equation (24b), we must take: $\gamma\sqrt{r/a} \approx \sqrt{2}$, (for $r \leq r_{\mu^a}$), conform to: $\rho_R \approx \rho_s$ (Equation(12)), so the value r_0 can be approximated by Equation (24) written for $r = r_{\mu^a} = 2.4$ fm, (for which we have still $v_c = c$ [9]), resulting that:

$$(v_c = c; r = r_{\mu^a}) \Rightarrow \gamma\sqrt{r_{\mu^a}/a} \approx \sqrt{2} \Rightarrow \gamma = e^{r_0/r} = 1.084 \Rightarrow r_0 = 0.193 \text{ fm}$$

The value: $r_{w^n} \cong (r_{\mu^e} / 1836) \cdot e^{1.4/0.88} \approx 1$ fm represents the modified Compton radius of the heavy photons of protonic positron, decreased by the value of total photons density at the proton's surface. Applied to the proton's quasidelectrons, the same formula gives the modified Compton radius of a compressed electron, having a smaller volume inside a proton, corresponding to $r_c^e \approx 0.41$ fm for a marginal position $r^* = 0.58$ fm of its centroid, *i.e.* to a proton's mass radius: $r_p \approx r_c^e + r^* \approx 1$ fm, while its known radius $r_i^p \approx 0.6$ fm $\approx r_\lambda^p$, of its mass, corresponds in CGT to a volume containig the kerneloids of its quasi-electrons, the value $\Delta a = a \div r_p$ corresponding to a shell of vector photons which gives (by their lighter vortexed vectons) the Lorentz force (acting on a moving proton) and the proton's 'bag' pressure, conform to CGT.

The force $F_A(r) = k_\rho \rho_{sv}(r) \cdot (w - v_e)^2$ corresponds to the force which generates also the Aharonov-Bohm effect, *i.e.* the part: $p_e = q \cdot A$ of the canonic impulse, by the proportionalities: $A \sim \rho_{sv} \cdot w$ and $q \sim S_i \sim k_v$, the ratio: F_A/m_q remaining the same: $F_A(ne)/m_q = F_A(e)/m_e$.

Also, by Equation (24b), ($w = \gamma \cdot c \sqrt{2}$; $\gamma = e^{r_0/r}$, $r_0 \approx 0.2$ fm), it results—for $r \rightarrow a$, that a nuclear particle such as an emitted neutrino in a β -transformation or in a mesonic transformation ($\pi^\pm \rightarrow \mu^\pm + \nu_\mu$), may be accelerated by the protonic Γ_A -vortex in a time of $\sim 10^{-23}$ s, to a speed $v_\nu = k_\nu \cdot c$ with $k_\nu > 1$, (exceeding the light speed, c).

But returning to Equation (24b), it is raised the question: ‘it is valid this variation of $\rho_R(r)$ also for $r < 2a \approx 2.818$ fm?’. We can answer to this question in connexion to the explaining of the effective radius of proton’s magnetic moment.

4.2. The Explaining of the Compton Radius’ Variation with Particle’s Mass

It is known that the magnetic moment generated by an e-charge of a m-particle rotated to an orbital of r-radius is:

$$\mu_q = i \cdot S = (ev/2\pi r) \pi r^2 = \frac{1}{2}(evr) = \frac{1}{2}(e/m)L, \quad (L \text{ —the kinetic moment}).$$

For an e-charge having a spin: $s = \hbar/2$, ($\hbar = h/2\pi$), if we replace L by the particle’s spin s by a gyromagnetic correcting g-factor which for electron is $g_e = 2$ giving $r_\lambda^e = r_\mu^e$, (electron’ magnetic radius), we obtain:

$$\mu_p^s = \frac{1}{2}(ecr_\lambda) = \frac{1}{2}g_p(e/m_p)s = \frac{1}{2}e \cdot g_p \hbar/2m_p.$$

The question is: which can be the physical meaning of the Compton radius, $r_\lambda = \hbar/mc$, of an electron, and the value of effective radius of proton’s magnetic momen?

A electron model that explains the electron’s magnetic moments and its r_λ -radius considers a ring model, with the e-charge contained by its m_e -mass forming a ring of r_λ -radius, but the experiments contradict this model. The modern Quantum electrodynamics (QED) considers that virtual processes in the Compton region determine the spin of electron and renormalization of its charge and mass, and this region of the electron should be considered as a coherent whole with its pointlike core, forming a physical (“dressed”) electron; but it still not explains phenomenologically the dependence: $r_\lambda \sim 1/m_e$.

- In CGT, r_λ represents the radius up to which quantons have the c-speed in the magnetic moment vortex Γ_μ . This interpretation is conform to:

$$E(r_\lambda) = B_{r_\lambda} \cdot c \quad \text{and to the next reason:}$$

- Supposing (as in the Sidarth’s electron model) that a photonic shell giving the electron’s spinorial mass m_e^s is extended up to its Compton radius, r_λ^e , for a rotation angular speed: $\omega = E/\hbar$ and for $v_\lambda = \omega \cdot r_\lambda = c$, the electron’ kinetic moment must be equal to its spin, *i.e.*:

$$L = I \cdot \omega = \left(m_e^s \cdot \frac{r_\lambda^2}{2} \right) \omega = \frac{1}{2} m_e^s \cdot r_\lambda \cdot c = \frac{1}{2} \hbar \Rightarrow r_\lambda = \frac{\hbar}{m_e^s c}; \quad (m_e^s \approx m_e)$$

Also, in CGT, r_λ depends on the particle’s mean density: $\bar{\rho}_m = m/v_a$, by a g-factor.

We can explain this dependence by Equations (12) and (17).

If in the previous case, of the atomic electrons' rotation around a proton, we use the conclusions of Equation (28) for a proton (or another nucleus) with precession rotation, ($\rho_{sv}(r) = \rho_c / \sqrt{2} \sim r^{-2}$ and $\rho_s(r) \sim r^{-1}$), instead of that specific to Equation (24b), but with $k = 1$, *i.e.* relating to the rotation of quantons in the Γ_μ -vortex of proton's μ_p -magnetic moment, Equation (12) of equilibrium is written similarly to Equation (17), with a variation of $\rho_s(r)$, $\rho_{sv}(r)$, conform to Equation (28) and with: $v_c = c \cdot (r_{\lambda'} / r)$, specific to Equation (27) of the B -field's expression,

in which $r_{\lambda'} = r_\mu^p$ is the effective radius of proton' magnetic moment, *i.e.*:

$$k'_\rho \cdot \rho_s(a) \cdot c \frac{r_{\lambda'}}{r} \frac{a}{r} = k_\rho \cdot \rho_{sv}(a) \left(\gamma \sqrt{2} - \frac{r_{\lambda'}}{r} \right) c \left(\frac{a}{r} \right)^2 \tag{30}$$

which for $r = r_{\lambda'}$, (*i.e.* $v_c = c$), with $k_\rho \approx k'_\rho$, (ρ given by quanta with close masses), gives:

$$r_{\lambda'} = \rho_{sv}^a \cdot a \left(\gamma \sqrt{2} - 1 \right) / \rho_s^a; \left(\rho^a = \rho(a); \gamma \approx 1 \right) \tag{31}$$

For $r_{\lambda'} = a$, Equation (31) corresponds to Equation (14) specific to $\rho_{sv}(r) \sim \rho_s(r) \sim r^{-1}$, for a static electron, without precession movement, but for a proton with precession rotation, it is logical that Equation (30) is applicable also to the interval $\Delta r = (a \div r_\mu^p)$ by Equation (28).

So, because Equations (30), (31) were obtained for a charged fermion with charge $q = e$ and with precession movement, having $\rho_{sv}(r) \sim r^{-2}$ and the same value of $\rho_{sv}^a = \rho_{sv}(a)$, it results that the value $r_\lambda = \lambda / 2\pi$, ($\lambda = h / m \cdot c$), representing the Compton radius and the radius r_λ of particle's magnetic moment (for $r_\lambda > a$), decreases proportional to $\rho_s^a = \rho_s(a)$.

For the particle model of CGT, that considers the mesons and the baryons of m -mass as cluster of gammonic pairs of degenerate electrons (quasi-electrons) with opposed charges: $\gamma^* = (e^{*-} e^{*+})$ confined in the same volume $v_a(a)$ (of a-radius, for mesons and for nucleons), Equation (31) explains the decreasing of r_λ -radius with the particle's mass m by the conclusion that the density ρ_s^a of sinergons accumulated by the particle's vortical field given by superposed etherono-quantonic vortices Γ_μ^e increases at the particle's surface proportional to its number of gammonic pairs, *i.e.* proportional to the sum of superposed Γ_μ^e -vortices and to its mass, because the increasing of the gravito-magnetic potential $V_{gm}(a) = \sum V_{gm}^e(r)$ given by the sinergonic part Γ_A^e , which attracts heavier sinergons with a force proportional to the number of particle's quasidelectrons.

This theoretical result is important because it argues the CGT's conclusion that the proton's e -charge is given as in the Anderson's model [19], by a positron polarly positioned, close to the proton's surface and with degenerate magnetic moment, the neutron being explained similarly in CGT, as having a negatron incorporated in the v_p —volume of a proton, rotated around the proton's center—for the free neutron, as in the Lenard-Radulescu neutron model [20], and with degen-

erate magnetic moment, in concordance to Equation (31), the value $\rho_s^a = \rho_s(a)$ being proportional to the particle's mean density: $\bar{\rho}_m = m/v_a(a)$, for electrons, mesons, nucleons and other baryons, *i.e.*—proportional to the mass density in which the e-charge's centroid is positioned:

$$\rho_s^a \sim \bar{\rho}_m; \rho_s^a(p^+) = \rho_s^a(e^+)(m_p/m_e)k_g [\text{kg}]; (k_g = g_e/g_p) \quad (32)$$

(g_e, g_p —gyromagnetic factor of electron and of proton).

For a proton, if we use the result of Equation (28) specific to the proton's case:

$\rho_s^a = \rho_{sv}^a$, also for $r < a$, from Equation(31) it results that:

$r_\lambda^p = a(\sqrt{2} - 1) \approx 0.584 \text{ fm}$ —*i.e.* a value very close to the known value:

$r_\mu^p = 2\mu_p/ec \approx 0.587 \text{ fm}$, obtained classically by: $r_\mu^p = (g_p/g_e)(r_\lambda^e \cdot m_e/m_p)$, of

the proton's effective magnetic radius—obtained by the gyromagnetic ratio:

$r_g = (g_p/g_e) = (5.5857/2) \approx 2.793$, experimentally verified, corresponding to a

proton with spin precession movement, *i.e.* to $(\rho_c, \rho_{sv}) \sim r^{-2}$.

So, we can interpret the known value of the effective radius r_μ^p of proton's magnetic moment in concordance with Equation (29), as the maximal radius characterized by $v_c(r) = c$, in the hypothesis that the quantonic vortex $\Gamma_\mu^p(r_\lambda^p)$ of the proton's magnetic moment would be given only by its impenetrable quantum volume, by a variation of $\rho_s(r)$ and $\rho_{sv}(r)$ conform to Equation (28), (*i.e.* 'saw' from a distance $r \gg 2a$).

One can also observe that a variation of $\rho_s(r)$ conform to Equation (28) would generate a sinergonic drag force higher than that specific to the dynamic equilibrium (24a), which would reduce the speed of quantons and of rotated electrons, for $r \rightarrow 2a$. This could explain the possibility of the K-capture, which transforms a proton into a neutron ($p^+ + e^- \rightarrow n_e + \nu_e$) but in this case is difficult to explain the relativist speed ($\sim 0.92c$) of beta-electrons, which is well explained by a variation of $\rho_s(r)$ conform to Equation (24b), as obtained by the effect of $\Gamma_\mu^p = \text{vortex}$, at $2a \leq r < a$. So, it results that Equation (24) is explanatory at $r \rightarrow 2a$ and Equation (28) for the variation of $\rho_s(r)$ in explanatory at $r \gg 2a$, both being linked by Equation (29).

Another explanatory possibility for the variation of ρ_s is to consider a variation of k_ρ/k'_ρ :

At $r \gg r_\mu^p$, from Equation (30) for the proton's case it results:

$$v_c \approx (k_\rho/k'_\rho)(a\sqrt{2}/r)c = c(r_\mu^p/r) = c \cdot k_{cv} \Rightarrow (k_\rho/k'_\rho) = r_\mu^p/a\sqrt{2} = 0.294$$

So, the value r_μ^p at $r \gg r_\mu^p$ corresponds to: $k'_\rho > k_\rho$. From Equations (24a) and (28) it results:

$$r_\lambda^p/r = (k_\rho/k'_\rho)(a/r)(\sqrt{2} - k_{cv}) = a(\sqrt{2} - 1)/r; \quad (33a)$$

$$\Rightarrow K_\rho = (k_\rho/k'_\rho) = (\sqrt{2} - 1)/(\sqrt{2} - k_{cv}) \quad (33b)$$

For $r = r_\mu^p$, it results: $k_v = 1$ and $k_\rho \approx k'_\rho$ —conform to the initial hypothesis.

The decreasing of K_ρ with r can be explained by the more rapid decreasing

of $\rho_{sv}(r)$ than $\rho_s(r)$, or also to a relative decreasing of the mass of corresponding sinergons, as consequence to the resistance of the part composed of pseudo-gravitonic etherons, of the sub-quantum medium, which is negligible only for electrons, but has influence for quantons (which have much smaller centroids).

It also results—according to Equation (31), that:

$$\mu_p/\mu_e = r_\mu^p/r_\mu^e = \rho_{s^e}(a)/\rho_{s^p}(a) = 1.51 \times 10^{-3}, \text{ and by the value:}$$

$$\rho_{s^p}(a) = \rho_{sv^a} = \rho_{c^a}/\sqrt{2} \approx 3.66 \times 10^{13}, (\rho_{s^a} = 5.16 \times 10^{13} \text{ kg/m}^3), \text{ it results that:}$$

$\rho_{s^e}(a) \approx 5.53 \times 10^{10} \text{ kg/m}^3$, resulting that the density of pseudo-stationary sinergons is much lower at the electron's surface than that corresponding to the proton's surface.

5. Conclusions

It results from the previous analysis that the genesis of electron and of vector photon considered in a vortical model, from a primordial dark energy theoretically reduced to a brownian component and a wind-like component of an etherono-quantonic medium, containing light (pseudo-gravitonic) etherons, heavy (sinergonic) etherons and quantons having a mass $m_h = h \cdot 1/c^2$ can be classically explained in CGT by two equations of dynamic equilibrium: on tangent direction and on radial direction—by a “sinergonic” force of Magnus-type, given by a magneto-gravitic potential, $V_{gm}(r)$, which can maintain the formed quantonic vortex of the magnetic moment of fermionic lepton, at specific critical densities ρ_s^0 , ρ_{sv}^0 , of the brownian and of wind-like sinergonic components of the sub-quantum medium—corresponding to a critical value of the intensity of magnetic B^0 -field of (quasi)stable vortex-tubes ξ_B characterizing the lepton's magnetic moment.

This can also be considered an argument for the existence of the subquantum medium, (etheronic—in CGT), previously reconsidered by the Bohm-Vigier's theory [21].

- It was also deduced that in the actual cosmic era, would be necessary a critical density of brownian sinergons: $\rho_s^0(r_v) \approx 2.1 \times 10^{18} \text{ kg/m}^3$ and a critical density of wind-like sinergons: $\rho_{sv}^0(r_v) \approx 5.12 \times 10^{18} \text{ kg/m}^3$ corresponding to a critical induction: $B^0(r_v^k) = 3.37 \times 10^{17} \text{ T}$ associated to the formed vortex-tubes, for the forming of light vector photons (vectons) with mass $m_v \approx 2.3 \times 10^{-40} \text{ kg}$, and a critical value: $B^0(r_0) = 0.79 \times 10^{16} \text{ T}$ for the forming of electronic centroids from vectonic centroids, but in the beginning of the Proto-Universe era these particles could have been formed from slowed quantons, confined by a less intense sinergonic vortex $\Gamma_{sv}(r)$, either with a density $\rho_s > \rho_s^0(r_v)$ at an associated vortex-field intensity: $B < B^0$, or at $\rho_s < \rho_s^0(r_v)$ by a gravito-magnetic potential $V_{gm}(r)$ given by Equation (3), if the rotation speed of vortexed quantons not exceed a critical value $v_c^c = k_c c$, with $k_c = v_h \rho_s^c / \sqrt{2} \cdot m_h \ll 1$, corresponding to a critical B_c -field associated to the etherono-quantonic vortex: $B_c = k_1 \rho_{sv}^c(r_v) w = k_1 \rho_s^c(r_v) k_c c$.
- Conform to the CGT's model, it results as more explanatory scenario for the

cold genesis of centroids and kerneloids of vector photons and of electrons the scenario of their forming at densities of the sinergonic medium higher than the critical value $\rho_s^0(r_v)$ and at lower intensities of the B -field corresponding to the formed etherono-quantonic vortex-tubes ξ_B , ($B < B^0(r_v^k)$), from initially slowed vortexed quantons, having $v_c < c$, which finally, at $\rho_s(r_v) = \rho_s^0(r_v^k)$ and $B = B^0(r_v^k)$, were vortexed with mean speed $v_c \approx c$, this evolution being specific to a high mass of vortexed sinergons and quantons with constant impulse moment: $L_h = m_h v_c(r) \cdot r$, which has a density of the sinergonic medium initially lower than the critical value $\rho_s^0(r_v)$ and a high radius which is gradually decreased with the increasing of the ρ_s^0 -density until the actual critical value $\rho_s^0(r_v)$.

- The CGT's models of electron and of vector photon, with etherono-quantonic vortex giving the lepton's magnetic moment and having the mean c -speed of its quanta up to $r = r_\mu$, are also explained by the kinetics of the sub-quantum (etheronic) medium, in accordance to the possibility to explain the electron's e -charge by vector photons contained in its surface, maintained and oriented by the Γ_μ -vortex of the electron's magnetic moment.

Is also argued by the CGT's model, that the hypothesis of the formation of rest mass of elementary particles by Higgs' bosons of mass $125 \text{ GeV}/c^2$ results as unnecessary.

It can be also observed that the electron mass m_e cannot be contained entirely in its kerneloid ($r_k^e \approx 10^{-17} \text{ m}$) because its mean density would be in this case: $\rho_e' = 1.45 \times 10^{20} \text{ kg/m}^3$ —higher than that of its superdense centroid ($\sim 10^{20} \text{ kg/m}^3$) and because this kerneloid is penetrable to X-rays photonic centroids action (conform to made experiments [13]), so, the electron must have a penetrable photonic shell, with 'naked' photons having rest mass.

- It also results that some hypothetical particles considered as "dark matter" leptons, such as the theorized "axions", with rest mass considered in the range: 10^{-7} to $1 \text{ eV}/c^2$ or even up to $14.4 \text{ keV}/c^2$ [22], can exists in the form of paired centroids of photons and of electrons (*i.e.* electronic neutrinos—in CGT [8] [9]), coupled with opposed chiralities, (with null or quasi-null magnetic moment, *i.e.* without etherono-quantonic vortex).

In this case, it results the possibility of paired centroids/kerneloids conversion into pseudo-scalar photons (formed by two paired vector photons with opposed magnetic moments), respectively—into electronic pairs ($e^- - e^+$), at interaction energies $E \rightarrow m_k c^2$, (m_k —kerneloid's mass) by acquiring a mass of thermalised photons by the gravito-magnetic potential V_{gm} given by the kerneloid's magnetic moment vortex $\Gamma_\mu^k(r)$, if there are enough photons with the speed lower than the critical value $v_k^c \approx c \cdot v_k \rho_s^c / \sqrt{2} \cdot m_k$.

In the contrary case, ($v_k > v_k^c$), it is necessary a supplementary magnetic B -field, for photons' confining into an electronic volume of a -radius, which—for attaining the density: $\rho_e^a(a) = 5.16 \times 10^{13} \text{ kg/m}^3$ of the electron's surface (in CGT's model) must have the total value given by Equation (7):

$B(r) = k_1 \rho_c v_c = k_1 \rho_f c = 2.4 \times 10^{12} \text{ T}$, conform to CGT [8] [9].

According to CGT, it results in consequence that the vacuum fluctuations, supposed initially by P.I.Fomin (1970) and E.P.Tyron (1973 [23]) as possible mechanism of particle-antiparticle pairs production (but without sustainable explanations), may explain the Universe matter's cold genesis but only as chiral, vortical fluctuations which are the real equivalent of the used concept of "virtual particles" and which can generate centroids and kerneloids from primordial dark energy by quantons confining, with the generation of stable leptonic fermions and thereafter—of bosonic quanta of light and 1 MeV-gamma radiation and elementary particles (mesons and baryons).

This theoretically obtained conclusion is in accordance to subsequent conclusions of the quantum fluctuations theory which considers that in the quantum vacuum, at specific energies of excitation, particle-like states can be generated as chiral (spinorial) excitations, individually or in pairs. It was also argued that the vortices play a crucial role in the confinement process, and that condensation of such vortices may be the long-sought confinement mechanism: in the confinement phase, vortices percolate and fill the spacetime volume, in the deconfinement phase they being much suppressed [24].

Also, it results that the mechanism of mass acquiring by interaction with the Higgs' field, considered in the Standard Model, can have as correspondent in CGT, for the electron's case, the mechanism of photons confining (from the quantum vacuum) by the interaction of a centroid or of a kerneloid with magnetic moment (*i.e.* fermionic) with the vacuum's quantum component, in specific conditions (either by a high density of thermalised photons or by the aid of a high intensity magnetic field).

- As argument for the Proto-Universe's cold forming, the vortical model of vector photon and of electron sustains also the Rees's hypothesis of Multiverse [25].
- The previous conclusions sustain and the possibility of a real increase of the particle's mass, charge and magnetic moment, in a strong magnetic field, by an supplementary etherono-quantonic vortex $\Gamma_r(r)$ which is added to the similar vortex $\Gamma_\mu(r)$ of the particle's magnetic moment by the vortex-tubes ξ_B of the magnetic field, increasing the particles magnetic moment:

$$\mu_p \sim \Gamma_r(r) = \Gamma_r(r) + \Gamma_\mu(r)$$
and the magneto-gravitic potential $V_{MG}(r)$ generated by the $\Gamma_r(r)$ -vortex, but until a limited value depending on the magnetic B -field's value.
- It also results as possible the forming of etherono-quantonic vortices with very high radius, initiated by a dense star, which can be the partial cause of the forming of cosmic gas vortices of high radius or even in a cloud of water vapor floating around a black hole like the one observed around the Quasar APM 08279 + 5255, 12 billion light-years distance [26]. The formed vortices will have the same sense, as those presented in **Figure 2** [27], (as formed by parallel sinergono-quantonic vortex-tubes of the same magnetic B -field).

Also, a planetary magnetic field could contribute similarly to the forming of cosmic dust rings, in our opinion.



Figure 2. Vortices formed in a cloud of water vapor floating around a black hole [27].

An argument for the mentioned possibility can be considered and the fact that astrophysical observations made with the James Webb Telescope have shown that most galaxies rotate in the same direction, which is unexpected [28], being considered that either our universe exists in a black hole, or astronomers measured the Universe's expansion incorrectly.

Another possibility is that the structures of the Proto-Universe, considered as in CGT, after the cold genesis of a high quantity of photons, electrons and nucleons, contained and cold formed micro-black holes and gravistars [9] having a central quark star, an intense magnetic field and a rotated shell of quantons and (vector)photons, from the collapsing of a number of gravistars being generated a huge central black hole which determined the gaseous matter's rotation and—after a first intense confining, the matter's expansion with rotation in the same sense around the expelled gravistars which thereafter became central black holes of galaxies rotated in the same sense.

Also, it was observed that the region known as Sagittarius B2, (26,000 light-years from Earth), located near the center of our galaxy, although it contains only about ten percent of the molecular gas in the area, it produces nearly half of the stars forming there. Scientists say that such a level of efficiency contradicts current models of star formation and they believe that turbulence, magnetic fields, and temperature differences could accelerate the gravitational collapse. However, no single theory fully explains the region's extraordinary productivity, the observed data suggesting that multiple generations of stars can form simultaneously in the same cloud [29] [30].

Also, astrophysical observations of early huge galaxies, sometimes as massive as the Milky Way, show that rapid, efficient star formation happened much sooner and more intensely than previous theories predicted [31].

Conform to the previously presented conclusions of CGT, the strong magnetic

field of the Sagittarius A, (the black hole found in our galaxy' center), can induce in time, by its vortical nature, the confining of bosons, fermions and of light nuclei and atoms, forming initially cold clusters (particularly—Bose-Einstein condensates) with paralelly oriented magnetic moments which gradually accelerate the matter's collapse not only by the static gravitational field but also by a gravito-magnetic field—phenomenon in concordance with the previous astrophysical observations.

Also, the vortical nature of this strong magnetic field (of its magnetic potential A) could explain—at least partially, the quasi-constancy of the stars' speed in a disk-like galaxy (the law $v_\omega \approx \text{constant}$), specific to the proportionality: $B(r) \sim \rho_{sv}(r) \sim \rho_s(r) \sim r^{-2}$, an argument being the fact that the galaxy rotation curve either remains flat or even increases as distance from the center increases, for some galaxies.

At the cosmic scale, a similar variation of $\rho_{sv}(r) \sim \rho_s(r) \sim r^{-2}$ can be justified by the hypothesis of a quasi-homogenous tridimensional spreading, proportional to the matter's density variation, resulting that in the Proto-universe's period existed conditions for the genesis of photons, of electrons and of cold quarks that formed nucleons and meta-stable baryons, with a rate of the particles' production which can be approximated as exponentially but different of that considered in Ref. [32], resulting from the hypothesis that a huge quantity of primordial etherono-quantonic dark energy was initially vortexed with a gradually increasing of the tangent speed and of its density, generating conditions for photons and electrons genesis with an increasing rate, by high density vortices, and thereafter—of nucleons and atomic nuclei which—by the forming of micro-black holes and of gravistars, produced a macro-quasar which generated cosmic expansion, (big “bang”), the local density $\rho_{ec}(r)$ —of primordial dark energy and $\rho_{ec}(r)$ —of formed particles decreasing approximatively exponentially, *i.e.*:

$$[\rho_{ec}; \rho_m]_r \approx [\rho_{ec}^0; \rho_m^0]_r \left(\frac{R_0}{R} \right)^k \cdot e^{-\beta \left(\frac{t}{t_0} - 1 \right)^2}; \quad (k = 1 \div 2) \quad (34)$$

the value t_0 corresponding to the big-bang's moment, the value of β depending on $\rho(t=0)$.

Also, as in CGT, the possibility of a Lorentz-like force generating in an Aharonov-Bohm effect with photons was considered and in Ref. [33], but without demonstration.

Relating to the nature of the dark matter, the lack of its interaction with the electromagnetic radiation indicates—according to CGT, a high density and a quasi-null magnetic moment, suggesting as possible candidates neutrinic clusters formed as compact sum of paired electronic centroids (with opposed chiralities), corresponding to a density: $9 \times 10^{19} \text{ kg/m}^3$, and of vector photons centroids, the weak interaction with photons being explained by the fact that by pairing, the centroids' vortices are mutually annihilated, the “naked” photons of their ker-

neloids being lost.

So, much higher densities of dark matter particles, as that supposed by Ref. [34] (primordial black hole (PBH) with mass 5 - 15 M_{\oplus} (Earth masses), about the diameter of a tennis ball, corresponding to $\rho \approx 5 \times 10^{28} \text{ kg/m}^3$, existing in the extended Kuiper Belt), or by Ref. [35] (Jupiter-mass black hole with a diameter of 5.6 m, corresponding to $\rho \approx 2 \times 10^{25} \text{ kg/m}^3$) results as speculative in CGT which deduced as maximal density that of the quanton: $\rho_h = h/c^2 \nu_h \approx 2 \times 10^{23} \text{ kg/m}^3$ [8] [9]).

However, recent research [36] based on analytical calculations and numerical simulations of rotating ultralight dark matter halos in a Thomas-Fermi regime, where the halo size is much larger than the typical de Broglie wavelength of dark matter particles, suggested that rather than being structureless, dark matter might actually behave like a cosmic superfluid, forming vortex lines and stable rotating nuclei (solitons) within galaxies, argues the CGT's model of photonic and electronic centroids and kerneloids forming in the Protouniverse's era.

A correspondence of the CGT's model of magnetic field with the possibility to obtain free energy from quantum vacuum is given by its correspondence with the Sachs theory of electrodynamics [37] which states that exists a vacuum energy in form of vacuum' current which gives the magnetic energy density: $\epsilon_B = \frac{1}{2} B_v^2 / \mu_0$ contained by a space volume which contains magnetic field lines, and which explains the functioning of some free energy devices which can convert this energy into electric energy [38], such as the "motionless generator" (patent US6362718B).

The vortical model of electron can be verified by an experiment of relativist electron passing through two magnetic fields: a B1-field parallel with its impulse and a weaker B2-field rectangular to its impulse. If the B2-field is enough weak for re-orientate the electron's spin, previously oriented by B1, the electron's deviation by the Lorentz force in B2 must be negligible if the Lorentz force is of Magnus type, conform to CGT.

Also, the vortical model of electron and of vector photon, having not only super-dense centroid but also a dense kerneloid, can explain and the good pseudo-scalar photons reflection on a metallic surface (whose electrons act as a "cloud" of electric charge).

There are some experiments which sustains the presented conclusions of CGT, such as:

- In accordance to the CGT's model of proton with included positron, physicists at the Lawrence Livermore Laboratory (California), by ultra-intense laser, used to irradiate a millimeter-thick gold target, produced more than 100 billion positrons [39];
- In accordance to the CGT' conclusion that "gammonic" negatron-positron pairs can exist in the quantum vacuum as real bosons named "gammons", it was possible the experimentally obtaining of electron-positron pairs from intense high-energy gamma rays, in a lead converter via the Bethe-Heitler pro-

cess, using a multi-PW laser for generate hot electrons (above 1 MeV) which produced γ -rays when they collide with the atomic nuclei in the converter [40]; Conform to GGT, similarly, it is possible to split 17 MeV-gamma rays (emitted at de-excitation of Be nuclei) into so-named “quarcins” with opposed charges and mass: $m_q \approx 8.5 \text{ MeV}/c^2$, by two-photon interaction, *i.e.* by the Breit-Wheeler-type process, $\gamma + \gamma' \rightarrow q^+ + q^-$, in a strong magnetic field.

- The radius of $0.43 \times 10^{-18} \text{ m}$ considered in CGT for the electron’s centroid corresponds to the value of $4.42 \times 10^{-19} \text{ m}$ calculated by Rosen [41] and to the upper limit of $5 \times 10^{-18} \text{ m}$ [42] experimentally derived;
- The theoretically obtained value: $r_{\lambda'}^p = a(\sqrt{2} - 1) \approx 0.584 \text{ fm}$ of the proton’s effective magnetic radius is very close to the experimentally obtained value: $r_{\mu}^p \approx 0.587 \text{ fm}$, and corresponds to the volume with quarcic/electronic kerneloids, the known proton’s charge/mass radius: 0.84 fm being obtained by CGT of value $\sim(0.88 \div 1) \text{ fm}$, the value $\Delta a = a \div r_p$ corresponding to a shell of vector photons which gives—by their lighter vortexed vectons, the Lorentz force acting on a moving proton and the proton’s ‘bag’ pressure, in CGT, this conclusion being in accordance to the fact that experiments of J/Ψ -meson photo-production [43] [44] have revealed (by theoretic interpretation of experimental data with the lattice model and the holographic model) a “cloud” of gluons of higher radius than that of the electric charge (0.84 fm), up to a scalar radius of $1.15 \div 1.3 \text{ fm}$ (the considered limit to which gluons act to “capture” and confine quarks within the proton);
- Also, the possibility to obtain “super-photon” as Bose-Einstein condensate of laser radiation’ photons, experimentally evidenced [45] sustains the CGT’s model of kerneloids’ cold genesis, the model of composite photon and the Lorentzian model of electron with photonic shell, and justify the use of the Galilean relativity, which admits the hypothesis of a photon’s rest mass comparable with its usual mass given by: $h\nu = m_{\text{r}}c^2$ —conclusion which also explains the fact that the experimental evidence of the X17—boson [46] corresponds to a de-excitation of highly excited nuclei of ^8Be , ^4He , ^{12}C [47], nuclei known as emitters of γ -quanta with an energy around of 17 MeV, (resulting that the emission of the X17 boson is also specific to some giant-resonant nuclei, which emit gamma quanta of energy close to, as ^{90}Zr).

Conflicts of Interest

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

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