Genesis of super-dense centroids and kerneloids of photons and of 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 brownian component and a wind-like component of an etherono-quantonic medium, containing also heavy (sinergonic) etherons and quantons with mass $m_h = h\cdot 1/c^2$, by two equation of dynamic equilibrium and by a ‚sinergonic' force of Magnus-type. It was deduced that in the actual cosmic era, for the cold forming of these leptons would be necessary a critical density of sinergons: $\rho_s^0 + \rho_{sv}^0 \approx 7.2\text{x}10^{18}$ kg/m^3 and a critical induction associated to the formed vortex-tubes: $B^0(r_v^k) = 3.37\text{x}10^{17}$ T , respective $-B^0(r_0) = 0.79\text{x}10^{16}$ T, for the forming of light vector photons with mass $m_v \approx 2.3\text{x}10^{-40}$ kg and of electronic centroids, but in the begining 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 $k_c = \upsilon_h \rho^c{}_s/\sqrt{2}\cdot m_h$, corresponding to a critical B_c-field associated to the etherono-quantonic vortex: $B_c = k_1 \rho_{sv}{}^c(r_v)w = k_1 \rho_s{}^c(r_v)k_c c$.

Keywords: vortical electron; cold genesis; photon model; Protouniverse period; Copenhagen vacuum.

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 jn case of a superfluids, 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 super-fluid, (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, and 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 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:

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

where $\hbar = h/2\pi$, h is the Planck constant , m is the mass of the superfluid particle, and $\Delta\phi_v$ 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 $\Delta\phi_v = 2\pi n$, where *n* is an integer. Thus, the circulation is quantized.

So, in a superfluid, a quantum vortex „carries" quantized orbital angular momentum, bu in a superconductor, the vortex also carries a quantized magnetic flux, over some enclosed area S:

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

where **A** is the vector potential of the magnetic induction **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]), based on Galileian relativity, the sub-quantum medium –considered by the Bohm-Vigier's theory, is composed by two 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 **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 un-compensated component of the etheronic, sub-quantum medium, [8]-[10].

In CGT it vas 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',

$$F_{gm}(r) = -\nabla V_{gm}(r)\,; \qquad V_{gm}(r) = \tfrac{1}{2}\upsilon_h \rho_\varphi(r) w^2\,; \quad (w \approx \sqrt{2}c) \tag{3}$$

with: $\upsilon_h(r_h)$ –the quanton's volume and: $p_\varphi = \rho_\varphi w$ – the impulse density of the vortexed sinergons, and by a ‚sinergonic' force of Magnus-type given by a magneto-gravitic potential, $V_{mg}(r)$:

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

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_f, 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 :

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

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

with: ρ_s^0- the density of ‚sinergons' at the surface of the vecton's centroid, by considering the quanton as cylindrical, of lenght $l_h = 2r_h$ and density ρ_h , [9], [10].

As argument for the vortical nature of the magnetic moment can be mentioned also the fact that at neutron's transforming, the beta-electron is expelled with relativist speed, $v_e \rightarrow c$, (~0.92c).

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

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

2. The forming of the centroids and kerneloids of vectons and of electrons

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 = 1.41 fm) and its photons' density at its surface: $\rho_a(a) = \mu_0/k_1^2 = 5.16 \times 10^{13}$ kg/m^3, ($k_1 = 4\pi a^2/e = 1.56 \times 10^{-10}$ m^2/C), was obtained. from relation [8], [9]:

$$\epsilon_E^o = \int_a^\infty 4\pi \cdot r^2 \Phi(r) dr = \frac{e^2}{8\pi\varepsilon_0 a} = m_e c^2; \qquad \Phi(r) = \varepsilon_0 \frac{E^2(r)}{2} = \frac{\varepsilon_0}{2}\left(\frac{e}{4\pi\varepsilon_0 r^2}\right)^2 \tag{6}$$

Because in CGT the electron' mass is given by a quantity of photons confined by the etherono-quantonic vortex $\Gamma_\mu(r) = 2\pi rc$ 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]:

$$B(r) = k_1\rho_c v_c = k_1\rho_f c, \qquad (r \le r_\mu, \Rightarrow v_c = c;\ \rho_f(r) = \rho_c(r)) \qquad (7)$$

($\rho_c v_c$ –the impulse density of the quantonic vortex $\Gamma_\mu(r)$), it results that the density ρ^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 $r \le r_\mu = \lambda/2\pi$, ($\lambda = h/m_e c$), and which gives: $\varepsilon_0 E^2 = B^2/\mu_0, \Rightarrow \epsilon_E^0 = \epsilon_B^0$, i.e.:

$$m_e = 2\pi a^3\cdot\rho_f(a) = 2\pi a^3\cdot E_a/k_1c^2 = 2\pi a^3\cdot B_a/k_1c = 2\pi a^3\cdot\rho_c(a) \qquad (8)$$

From Eq. (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:

$$m_k = 2\pi r_k^3\cdot\rho_k\ ; \qquad \rho_k = B_k/k_1c\ , \quad \Rightarrow \quad m_k = 2\pi r_k^3\cdot B_k/k_1c \qquad (9)$$

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 considerd as stably formed when its density exceed a critical density, higher than that corresponding to an electronic centroid, respective –kerneloid, i.e.:

$$\rho_k \approx m_k / 2\pi r_k^3 = B_k/k_1c > \rho_k(e) \qquad (10)$$

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/c^2), according to older experiments [11] , so – with a mass: $m_0 = 4.5\text{x}10^{-35}$ kg, and it was identified with the scattering centers considered as nucleonic current quarks, in the Standard Model, so- with a radius: $r_0 = 0.43\text{x}10^{-18}$ 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: $\rho_0 \approx m_0/2\pi r_0^3 = 9\text{x}10^{19}\ kg/m^3$.

By Eq. (10) this corresponds to a value of B-induction of the confining magnetic field, of value: $42.18\text{x}10^{17}$ 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: $\rho_i < \rho_k = 9x10^{19}$ kg/m^3, 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. <u>The forming of centroids and kerneloids of photons and of electrons from a vortex of quantons having the mean speed $v_c = c$</u>:

a1) <u>The B^0-field values of the forming of photonic and electronic centroids and kerneloids</u>
-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 Eq. (5) it results that the dynamic equilibrium which maintains the quantonic vortex around the electon's centroid m_0 is realized by the resulting condition: $4\pi r_h^2 k_v \rho_s^0 \cdot r_0 = m_h = h/c^2$, i.e. –by the condition: $\rho_s^0 k_v r_0 = m_h/4\pi r_h^2 = ½\rho_h \cdot r_h$ = constant.
With the value resulting from Ref. [9] for the ratio: $k_h = 2\pi r_h^2/m_h = 27.4$, (giving $r_h = 1.79x10^{-25}$ m –the gauge radius of the quanton), it results [10]:

$$\rho_s(r)k_v \cdot r = \rho_s^0 k_v r_0 = m_h/4\pi r_h^2 = 1/2k_h = 1.825x10^{-2} \text{ [kg/m}^2\text{]}. \qquad (11)$$

The quanton's c-speed can be maintained by a dynamic equilibrium of etheronic pressure forces F^t on the tangent direction, considered of Stokes type ($F^t \sim v$), specific to a laminary flowing of the sinergonic fluid in report to the quantons, and given by the $\mathbf{\Gamma}_a$ –vortex having a density $\rho_{sv}(r)$ and by the density $\rho_s(r)$ which generates a drag force: $F_r^t = F_a^t(r)$. At dynamic equilibrium we have [10]:

$$F^t = F_r, \Rightarrow k_v\rho_{sv}(r)\cdot(w - c) = k_v\rho_s(r)\cdot c; \quad (w = \gamma\sqrt{2}c), \quad \Rightarrow \rho_{sv}(r) = \rho_s(r)/(\gamma\sqrt{2}-1), \qquad (12)$$

($\gamma \approx 1$ and $k_v << 1$ –coefficient which take into account the particle's radius and the super-fluidity of the etherono-quantonic medium, i.e. the d'Alembert paradoxe, [16]).

The speed: $w \approx \sqrt{2}\cdot c$ is –in CGT, the local mean speed (considered as invariable, as the c-speed in Einsteinian relativity) of the wind-like sinergonic component of the etheronic winds, (whose component given by pseudo-gravitons is probably characterized by $\gamma > 1$).

Particularizing for the case of the electron's magnetic moment vortex, Γ_μ^e, for which Refs. [8],[9] gives a density:

$\rho_c(a) = \rho_\mu(a) = \rho_e(a) = \mu_0/k_1^2 = 5.16x10^{13}kg$, (a = 1.41 fm),

and by using the formula: $B = k_1\rho_c v_v$ for the electron's B-field [8],[9], with $v_v = c$ for $r \leq r_\lambda^c$, using Eq. (7) for the magnetic induction, it results that the magnetic potential is :

$$A(r) = ½B\cdot r = ½\, k_1\rho_c c\cdot r = ½\, k_1\rho_{sv} w\cdot r; \qquad \Rightarrow \qquad (13)$$

$$\rho_s(a) = \rho_{sv}(a)\cdot(\gamma\sqrt{2}-1) = \rho_c(a)(1-1/\gamma\sqrt{2}); \Rightarrow \rho_{sv}(a) = \rho_c(a)/\gamma\sqrt{2} \qquad (14)$$

By taking $\gamma = 1$, ($w = \sqrt{2}c$, [9],[10]), it results: $\rho_s(a) = 0.29\, \rho_c(a) \approx 1.49x10^{13}$ kg/m^3;

(a = 1.41fm).

From Eq. (11) we also have: $\rho_s(a) = 1.825x10^{-2}/a\cdot k_v$, resulting that: $k_v \approx 0.87$, [10], ($v_h \approx 0.87c$), so- for $r_0^e \approx 0.43x10^{-18}$ m, (electron centroid's radius, in CGT[10]), by Eq. (11) we obtain:

$\rho_s^0(r_0^e) \approx a\cdot\rho_s(a)/r_0^e \approx 0.49x10^{17}$ kg/m^3, for the electron' centroid.

Also, for the electron's kerneloid, of radius: $r_k^e \approx 10^{-17}$ m, in CGT [10], (corresponding to the experimentally determined electron's radius reported by Milloni [17]), we obtain:

$\rho_s^0(r_k^e) \approx a\cdot\rho_s(a)/r_k^e \approx 0{,}21x10^{16}$ 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 and of its 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 having approximately the same density: $\rho_v^0 \approx \rho^0 = 9x10^{19}$ kg/m^3, is possible to estimate the radius: r_{vo} of the vecton's centroid by Eq. (5) in which we replace r_h with r_{vo} and m_h with $m_v^0 \approx 2.3x10^{-40}$ kg, i.e. by the resulting relation:

$$F_{sl} = F_{cf}, \Rightarrow 4\pi\cdot r_{vo}^2 k_v\cdot c^2\cdot\rho_s^0(r_0)r_0 = m_v^0 c^2; \Rightarrow r_{vo} = 2\, k_v\cdot\rho_s^0(r_0)r_0/\rho_0 \qquad (15)$$

which gives: $r_{vo} \approx 4x10^{-22}$ m; $\rho_s^0(r_{vo}) \approx 5.24x10^{19}$ kg/m^3 , (the density of sinergons which maintains vortexed quantons at the vecton centroid's surface) and : $m_v^0 = 3.6x10^{-44}$ kg.

-With these values of ρ_s^0 it results by Eq. (14) with $\gamma = 1$, that:

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

-Eq.(16), for the electron' centroid, give: $\rho_{sv}^0(r_0) = 1.2x10^{17}$ kg/m^3, which by Eq.(7) for B^0 corresponds to : $\rho_c^0(r_0) = \sqrt{2}\rho_{sv}^0 = 1.69x10^{17}$ kg/m^3, and to a magnetic induction:
$B^0(r_0) = 0.79x10^{16}$ T at $r = r_0$ from the center of the vortex-tube ξ^0_B which can form the electron's centroid, considering a vectonic kerneloid as pre-kerneloid, (with $r_v^k \approx 10^{-20}$ m).

- Similarly, for the forming of electron's kerneloid, it results: $\rho_{sv}^0(r_k) = 0.51x10^{16}$ kg/m^3 and: $\rho_c^0(r_k) = \sqrt{2}\rho_{sv}^0 = 0.73x10^{16}$ kg/m^3 , corresponding by Eq. (7), to: $B^0(r_k) = 0.34x10^{15}$ T.

-For the forming of the vecton's centroid, we obtain by Eqs. (15) and (16):
$\rho_{sv}^0(r_v^0) = 1.28x10^{20}$ kg/m^3, which by Eq. (13) corresponds to: $\rho_c^0 = \sqrt{2}\rho_{sv}^0 = 1.8x10^{20}$ kg/m^3 and to a magnetic induction: $B^0(r_v^0) = 8.42x10^{18}$ T of the vortex-tube ξ^0_B which can form the vecton's centroid.

Also, considering a vecton's kerneloid of radius $(r_v^k) \approx 10^{-20}$ m, containing its inertial mass, (value corresponding to a density $\rho_v^0 \approx 3.6x10^{19}$ kg/m^3 of its inertial mass: $m_v \approx 2.3x10^{-40}$ kg [8],[9]), similarly are obtained the values: $\rho_s^0(r_v) \approx 2.1x10^{18}$ kg/m^3; $\rho_{sv}^0(r_v) \approx 5.12x10^{18}$ kg/m^3 $B^0(r_v^k) = 3.37x10^{17}$ T, for the vecton's kerneloid forming.

Because the increasing of the ratio ρ_s/ρ_{sv} (at $\rho_s' > \rho_s^0(r_v)$) lowers the quantons' speed, v_c , conform to Eq. (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.

-The obtained values for $\rho_s^0(r_v)$, $\rho_{sv}^0(r_v)$ and $B^0(r_v^k) = 3.37x10^{17}$ T can be considered as critical values specific to the actual cosmic era, 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, because we observe - by Eq. (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 the cluster of vortexed quantons or of quantons and light protons vortically attracted by the etherono-quantonic vortex of a pre-centroid approximated as being a vecton's centroid, could generate centroids and kerneloids of heavier vector photons and of electrons, also by auto-confining, by the vortex-tubes ξ_B of the B-field formed around its pre-centroids, of mass given by the confination of slowed quantons, (i.e. by the force $F_{gm}(r)$), at intensities of the B- field lower than that given by Eq. (10), with:

$9x10^{19}$ $kg/m^3 \geq \rho_k > \rho_c^0(r_v^k) \approx 7.2x10^{18}$ kg/m^3,

i.e. lower than $42x10^{17}$ T but higher than $3.37x10^{17}$ T – for the vecton's forming and thereafter– for the electron' centroid's forming.

-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 Eq.(13):

$$A^0(r) = A^0(r_v^0) = ½B^0(r_v^k)\cdot r_v^k = \quad ½(3.37x10^{17}Tx10^{-20}\ m) = 1.685x10^{-3}\ T\cdot m$$

a2) <u>The explaining of the vortical model of vector photon and of electron with $v_c = c$ for $r \leq r_\lambda$</u>

-From Eq. (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 neglijible value compared to the etheronic of magnus type, $F_{mg}(r) = F_{sl}(r)$, given by Eq. (12).

For example, for the electron's vortex of quantons, with the values obtained in CGT:
$r_h = 1.79x10^{-25}$ m, $r_0 = 0.43x10^{-18}$ m , $\rho_{sv}^0(r_0) = 1.2x10^{17}$ kg/m^3 , it results by Eq. (3) that: $F_{gm}(r_0) = 0.6x10^{-21}$ N, which can confine only quantons having the speed: $v_h(r_0) = \sqrt{[(r_0/m_h)F_{gm}(r_0)]} < 1.87x10^5$ m/s, while for $F_{mg}(r) = F_{sl}(r)$, with the corresponding value:
$\rho_s^0(r_0) \approx 0.49x10^{17}$ kg/m^3, obtained by (11), by Eq. (4) it results a value: $F_{sl}(r_0) = 1.54x10^{-15}$ N –with five size order higher, (which can confine and quantons with $v_c \to c$).

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 $\rho_s^0(r_v) \to 2.1x10^{18}$ 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, conform CGT, characterizing its chirality, $\varsigma_e = \pm 1$, and this Γ_μ^e - vortex explains the volume of confined heavy photons, of classic radius a = 1.41 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 $\rho_s^0(r_0^e) \approx 0.49\text{x}10^{17}$ *kg/m³* and $\rho_{sv}^0(r_0^e) \approx 1.195\text{x}10^{17}$ *kg/m³,* 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, 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 two components: brownian and wind-like components.

So, for an super-fluid etherono-quantonic medium it results that the value:
$\rho_s^* \approx \rho_s^0(r_0^e) + \rho_{sv}^0(r_0^e) = 1.685\text{x}10^{17}$ *kg/m³* corresponds also, 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: $\rho_{es} + \rho_{ev} = \rho_{et} =$ constant, having a etheron's mass-depending kinematic viscosity, $\nu(m_g)$. This determines a much lower resistance force to the advancing with relativist speed $v \to c$ of quantons is a medium of pseudo-gravitonic etherons than that of the advancing in a medium of sinergonic etherons.

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

But relating to Eq.(11), the density of the gravitonic medium, ρ_g^*, 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 $F_{sl}(r)$. 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).

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 $r_\lambda = \lambda/2\pi = h/2\pi m_f c$, even if these quantons have the c -speed up to $r = r_\lambda$.

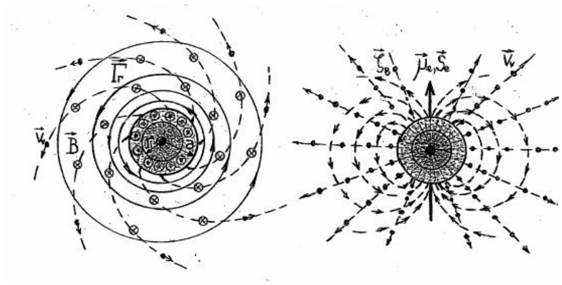

Fig. 1. *Model of Vortical Electron [8],[9]*

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 Eq. (12) by a variation of ρ_{sv}: $\rho_{sv}(r) \sim r^{-2}$, for $r > r_\lambda$, i.e.:

$$v_c/(w - v_c) = \left(\rho_{sv}(r_\lambda)/\rho_s(r_\lambda)\right)(r_\lambda/r)^2(r/r_\lambda) = \left[c/(w - c)\right](r_\lambda/r) \qquad (17)$$

which gives $v_c(r_\lambda) = c$ for $r = r_\lambda$, the variation: $v_c \approx c(r_\lambda/r)$ 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 sinergoic 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 Eqs. (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 Eqs. (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:

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

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 Eq. (13), ($B = k_1\rho_{sv}(r)w$).

The question is: if the formed centroids, could be stable at $v_c << c$.

-Supposing that the density $\rho_s(r_0)$ is lower than the critical value $\rho_s^0(r_0)$, and in this case the Magnus- type sinergonic force $F_{sl}(r)$ cannot confine vortexed quantons. But we can deduce the quantons' speed v_c^l 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 $v_c^l << c$. In this case we have:

$$F_{gm}(r) = -\nabla V_{gm}(r) = \tfrac{1}{2}\upsilon_h\nabla\rho_{sv}(r)(w - v_c)^2 \approx \tfrac{1}{2}\upsilon_h\rho^c_{sv}r_0w^2/r^2 = m_hv_c^2/r\,; \qquad (19)$$

$$(w \approx \sqrt{2}c;\ v_c = k_c c)$$

At $r = r_0$, using also Eq. (18), it results that:

$$\upsilon_h\rho^c_{sv}c^2 \approx \upsilon_h\rho^c_s k_c c^2/\sqrt{2} = m_h k_c^2 c^2 \Rightarrow k_c \approx \upsilon_h\rho^c_s/\sqrt{2}\cdot m_h \qquad (20)$$

Taking a value: $\rho_s^c(r_0) < 0.49\text{x}10^{17}$ *kg/m³*, for example: 10^{16} *kg/m³*, it results:
$k_c \approx 2.3\text{x}10^{-8}$, giving: $v_c^l \approx 6.9$ m/s and: $\rho_{sv}^c(r_0) \approx \rho_s^c(r_0)k_c/\sqrt{2} = 1.63\text{x}10^8$ kg/m³, corresponding to a critical value: $B_c(r_0) = k_1\rho_{sv}^c(r_0)w \approx k_1\rho_s^c(r_0)k_c c \approx 5.27\text{x}10^7$ 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 the B-field corresponding to the formed etherono-quantonic vortex-tubes ξ_B, ($B = B^0(r_v^k)$) and to a sinergonic density higher than the critical value $\rho_s^0(r_v^k)$ previously obtained (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 ξ_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 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: $L_h = m_h \cdot r \cdot v_c(r)$, 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 variant c) is more explanatory.

3. The correspondence with the Copenhagen-type quantum vacuum

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, conform to CGT, [9],[18], which determines the quasi-radial emission of sinergons and quantons from the kerneloid' surface and which transform a quasi-cylindrical (barrel-like) electron into a quasi-sperical one, ($\rho_c \sim r^{-2}$) with specific variation of its field, ($B(r) \sim E(r) \sim r^{-2}$, for $r \leq r_\lambda$), this spin precession movement determining an exponential variation of the densities ρ_s and ρ_{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:

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

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

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

the value: $\kappa = 1/\sqrt{c_2}$ representing the distance until the $|\phi|$ -field reaches its vacuum value ϕ_0, but with the difference that the variation: $|A| \sim 1/r$ corresponds – by Eq. (13), to a variation: $B(r) \sim r^{-2}$, ($r \leq r_\lambda$), characteristic to an e-charge with precession movement, whose magnetic moment μ_e is similar to a magnetic vortex-tube ξ_B but with $B(r) \sim r^{-2}$ for $a < r \leq r_\lambda$. 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.:

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

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

$$V_H(r) = \frac{m_i m_j}{m_H^2}\frac{1}{4\pi r}e^{-m_H c\cdot r/\hbar}$$

with a Higgs mass of 125.18 GeV/c^2, resulting in a range of this potential of the order of the reduced Compton wavelength of the Higgs boson: 1.576×10^{-18} m, (between two electrons, this being about 10^{18} times weaker than the weak interaction), and decreasing exponentially.

In CGT, this explanation of the formation of rest mass of elementary particles results as speculative and unnecessary.

4. The explaining of the atomic electrons' rotation without radiation emission

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 **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 the $v_e(r)$- speed variation of the atomic electrons: $v_e(r) = c\sqrt{(2a/r)}$, (a = 1.41 fm), by the conclusion that these electrons are revolved by the action of an accelerating force: $F_A(r)$, which can be of Stokes type for $r \leq 2a$, (specific to a laminary flowing), given by the sinergonic impulse density $p_{sv} = \rho_{sv}(r)w$ of the Γ_A^p- vortex having a density $\rho_{sv}(r)$, against a drag force $F_R(r)$ specific to a laminary flowing, given by the density $\rho_r(r)$ which – for $r \leq 2a$, is identified with $\rho_s(r)$ from Eqs (5), being applied Eq.(12) of dynamic equilibrium, resulting that for $r \leq 2a$, $\Rightarrow \rho_r(r) = \rho_{sv}\cdot(\gamma\sqrt{2} -1) = \rho_s(r)$, ($\gamma = e^{r_o/r} \rightarrow 1$ for $r\rightarrow 2a$).

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 an energetic layer considered as having quasi-cylinder (barrel-like) form, of l_σ -heigh and quantified r_e-radius.

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

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

resulting that:

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

which for r = 2a, ($\gamma \approx 1$), k = 1, gives: $\rho_R(2a) = \rho_{sv}\cdot(\sqrt{2} -1) = \rho_s(2a)$, i.e. conform to Eq. (12).

-For $r \le r_\mu^a = 2.35$ fm, because $v_e \approx c$ (as $v_c = c$ in the quantonic vortex) and $\rho_R(r)$ not vanish when $r \to r_0$, it results that in Eq. (24b), we must take: $\gamma\sqrt{(r/a)} \approx \sqrt{2}$, (for $r \le r_\mu^a$), conform to: $\rho_R \approx \rho_s$ (Eq.(12)), so the value r_o can be approximated by Eq.(24) written for $r = r_\mu^a = 2.35$ fm, (for which we have still $v_c = c$, [9]), resulting that:

$$v_c = c,\ r = r_\mu^a,\ \Rightarrow\ \gamma\sqrt{(r_\mu^a/a)} \approx \sqrt{2},\ \Rightarrow\ \gamma = e^{r_o/r} = 1.095;\ \Rightarrow r_o = 0.213 \text{ fm}; \qquad (24c)$$

-For $r >> 2a$, 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: $L_e = m_e v_e r_e = n.h/2\pi$, ($v = v_0/n$; $r = n^2 r_0$), 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: $F(r,v) \propto k_t\rho(r)v^2$, ($k_t$ –coefficient which take into account the particle's surface and the super-fluidity of the etherono-quantonic medium, i.e. the d'Alembert paradoxe, [16]), resulting the equation:

$$F_R(r) = F_A(r),\ r>>2a \Rightarrow \rho_{sv}(r)\cdot(w-v_e)^2 = \rho_R(r)\cdot v_e^2\ ;\ \ (w \approx \sqrt{2}\cdot c;\ v_e(r>>2a) \approx c\sqrt{(2a/r)}) \qquad (25)$$

With the approximation: $r>>2a \Rightarrow w-v_e \approx w \approx c\sqrt{2}$, from Eq. (25) it results that:

$$r >> a,\ \Rightarrow \rho_R(r) \approx \rho_{sv}\cdot(w/v_e) \approx \rho_{sv}\cdot(r/a) \qquad (26)$$

For $r \ge a$, conform to the specific variation of the proton's B-field at $r \ge a$, we have $B \sim r^{-3}$, variation which can be explained by Eq. (7) with: $v_c(r) = c(r_\lambda/r)$ and $\rho_c(r) = \rho_c^a\cdot(a/r)^2$, ($\rho_c^a = \mu_0/k_1^2$):

$$B(r) = k_1\rho_c v_c = k_1(\mu_0/k_1^2)(a/r)^2 c(r_\lambda/r) = \mu_0(ecr_\lambda/4\pi r^3) = (\mu_0/2\pi)(\mu_p/r^3) \qquad (27)$$

($\mu_p = ½\,(ecr_\lambda^p)$ –the proton's magnetic moment) which verify the relation: $E = cB$ for $r = r_\lambda$ and the relations: $\mathbf{A}(r) = ½\,\mathbf{B}(r)\mathrm{x}\mathbf{r} = (\mu_0/4\pi)(\boldsymbol{\mu}_p\mathrm{x}\mathbf{r}/r^3)$, for a uniform magnetic B- field to a circle around the $\boldsymbol{\mu}_p$ –magnetic moment.

Because we have by CGT: $c\cdot\rho_c(r) = w\cdot\rho_{sv}(r)$, it results that we have: $\rho_{sv}(r) = \rho_{sv}^a\cdot(a/r)^2$, and for $r >>2a$, it results from Eq. (25) that:

$$\rho_{sv}(r) = \rho_{sv}^a\cdot(a/r)^2 \ \Rightarrow\ \ \rho_R(r) = \rho_{sv}^a\cdot(a/r) \qquad (28)$$

This variation of $\rho_R(r)$, for $r >> 2a$, corresponds to the variation of $\rho_s(r)$ specific to Eqs.(5), (12), i.e. is specific to a sinergonic vortex' cylindrical distribution, which –by Eqs. (17) and (27) explains the variation: $v_c \propto r^{-1}$ of the vortexed quantons of the sinergono-quantonic vortex Γ_μ which gives the proton's magnetic moment, (generally- of the nucleus' magnetic moment), μ_p, and which is maintained in laminary flowing conditions, conform to the model.
It also results that the supposition: $k = 1$ in Eq. (24) is justified only if $\rho_{sv}(r) \sim r^{-1}$, for $r \to 2a$, so –only for a quasi-cylidrical proton, but for a proton (or another nucleus) with precession rotation, the variation with r^{-2} of the B-field for $r > a$, indicates the variation: $\rho_c = \sqrt{2}\rho_{sv} \sim r^{-2}$, for $r > a$, which explains the atomic electrons' rotation speed by $k = 2$, the case: $k = 1$; $\rho_{sv}(r) \sim r^{-1}$, being valid up to $r = a$, for an electron released in a beta-disintegration.

However, in the same time, the choice k = 1 can explain –by Eq. (17), 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: $r_\lambda^p = 0{,}59$ fm of the proton' μ_p- magnetic moment, may be explained in the model 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' surface, giving its e^+-charge and having a confined vortical energy: $w_w = ½m_h(\omega_h r)^2 = ½m_w c^2$ contained by a chiral soliton with radius: $r_w^n \rightarrow 1.4$fm which extends the limit up to which we still have $v_c = c$ for the vortexed quantons around the proton, to the value: $r_\mu^a = a + r_w^n \approx 2.35$ fm, ($r_w^n \cong (r_\mu^e/1836)\cdot e^{1.4/0.93} = 0.946$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: $\gamma = e^{ro/r} \rightarrow 1$, for $r \rightarrow 2a$, ($r_0 \approx 0.21$ fm), in the value of the vortexed sinergons' speed: $w \approx \gamma\cdot c\sqrt{2}$, given by the density of the superposed $\boldsymbol{\Gamma}_w$-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 Eqs. (17) and (27), by the form [8],[9]:

$$v_c(r) = \begin{cases} c, & for: r < r_\mu^a = a + r_w^n \cong 2.35 fm; \qquad (a = 1.41\text{fm}) \\ c\left(\dfrac{r_\lambda^p}{r}\right)^{\left(1-\frac{r_\mu^a}{r}\right)}, & for: r \geq r_\mu^a \cong 2.35 fm; \qquad r_\lambda^p = r_i = 0{,}59 fm \end{cases} \tag{29}$$

An argument for Eq. (24) 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 Eq. (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 vortex can explain the speed of the released electronic neutrino, ν_e .

Also, by Eq. (24c), ($w = \gamma\cdot c\sqrt{2}$; $\gamma\sqrt{(r/a)} \approx \sqrt{2}$; $\gamma = e^{ro/r}$), it results also- 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).
For example, for r = a = 1.41 fm, we have by Eq. (24): $k_\nu \approx \gamma = 1.16$, ($v_\nu = 1.16\cdot c$).

The force $F_A(r) = k_t\rho_{sv}(r)\cdot(w-v_e)^2$ 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:

$$F_A(ne)/m_q = F_A(e)/m_e).$$

5. The explaining of Compton radius' variation with the mass of charged particle

It is known that the magnetic moment generated by an e-charge of a m-particle rotated to an orbital of r-radius is: $\mu_q = i\cdot S = (ev/2\pi r)\pi r^2 = ½(evr) = ½(e/m)L$, (L –the kinetic moment).

For an e-charge having a spin: $s = \hbar/2$, ($\hbar = h/2\pi$), we replace L with S by a gyromagnetic correcting g-factor, which for electron is: $g_e = 2$, i.e.: $\mu_e^s = ½(ecr_\lambda) = ½g_e(e/m_e)s = e\hbar/2\pi m_e$.

The question is: which can be the physical meaning of the Compton radius, $r_\lambda = \hbar/mc$, of a charged particle ? A electron model that explains the electron's magnetic moments and its r_λ-radius considers a ring model of electron, 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 , and it depends on the particle's mean density: $\bar{\rho}_m = m/\upsilon_a$, by a g-factor.

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

If in the previous case, of the atomic electrons' rotation around a proton, we use the obtained conclusions for a proton (or another nucleus) with precession rotation, ($k = 1$; $\rho_{sv}(r) \sim r^{-1}$, for $r \leq a$; $\rho_{sv}(r) = \rho_c/\sqrt{2} \sim r^{-2}$, for $r > a$ and $\rho_s(r) \sim r^{-1}$), relating to the rotation of quantons in the Γ_μ -vortex of proton's magnetic moment, μ_p , Eq. (12) of equilibrium is written similarly to Eq. (17) but with $r_l = a$ instead of $r_l = r_\lambda$, and with $v_c = c\cdot(r_\lambda/r)$, $\gamma = 1$, i.e.:

$$\rho_s(a)\cdot c(r_\lambda/r)(a/r) = \rho_{sv}(a)(\sqrt{2} - r_\lambda/r)c(a/r)^2 \qquad (30)$$

which for $r = r_\lambda$ gives:

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

For $r_\lambda = a$, Eq. (31) corresponds to Eq. (14) specific to $\rho_{sv}(r) \sim \rho_s(r) \sim r^{-1}$ in the case of the cold forming of a static electron, (electron without precession movement) and to the proton's case, being an intermediary value between $r_\lambda = r_\lambda^p = 0.59$ fm (the real value of r_λ^p, specific to an exponential variation of $\rho_{sv}(r)$ inside proton) and $r_\lambda = r_\mu^a = 2.35$ fm –specific to the taking into account the contribution of vector photons of the proton's surface.

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

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 $\upsilon_a(a)$ (of a-radius, for mesons and for nucleons) Eq. (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 $V_{gm}(a) = \Sigma\, V^e_{gm}(r)$ given by the sinergonic part Γ_A^e, which attracts heavier sinergons with a force proportional to the number of particle's quasielectrons.

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 υ_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 degenerate magnetic moment, in concordance to Eq. (31), the value $\rho_s^a = \rho_s(a)$ being proportional to the particle's mean density: $\bar{\rho}_m = m/\upsilon_a(a)$ for electrons, mesons, nucleons and other baryons:

$$\rho_s^a \sim \bar{\rho}_m\ ;\quad \rho_s^a(p^+) = \rho_s^a(e^+)\cdot(m_p/m_e)k_g, \qquad (k_g = g_e/g_p = 1/2.79) \qquad (32)$$

g_e , g_p - gyromagnetic factor of electron and of proton).

Also, it results by Eq. (31) that the densities ratio: ρ_s^0/ρ_{sv}^0 decreased from the Proto-Universe' period of electrons cold genesis until the actual period.

Also, if we use the result of Eq. (28) specific to the proton's case: $\rho_s^a = \rho_{sv}^a$, for r < a, from Eq.(31) it results that: $r_\lambda^p = a\left(\sqrt{2}-1\right)$ = 0.584 fm –value very close to the value: $r_\mu^p = 2\mu_p/ec = (g_p/g_e)(r_\mu^e m_e/m_p) \approx 0.58684$ fm, of the proton's effective magnetic radius –obtained by the gyromagnetic ratio: $r_g = (g_p/g_e) = (5.5857/2) \approx 2.7928$, experimentally verified, corresponding to a proton with spin precession movement, i.e. to $(\rho_c , \rho_{sv}) \sim r^{-2}$.

At $r >> r_\mu^p$ from Eq. (31) for the proton's case it results: $v_c \approx (a\sqrt{2}/r)c \neq c(r_\mu^p/r)$, so the value $c(r_\mu/r)$ corresponds in Eq. (25) to : $k_h' > k_h$, and to a ratio:

$$r > r_\mu^p, \Rightarrow (v_c/c) = k_v = (a/r)(k_h/k_h')(\sqrt{2}-k_v) = (r_\mu^p/r), \qquad (33a)$$

$$r >> r_\mu^p, \Rightarrow (k_h/k_h') = r_\mu^p/a(\sqrt{2} - r_\mu^p/r) \approx r_\mu^p/a\sqrt{2} = 0{,}29. \qquad (33b)$$

The variation (33a) can be explained by the resistance of the part composed of pseudo-gravitonic etherons, of sub-quantum medium, which is neglijible only for electrons, but having influence for quantons (which have much smaller centroids).

6. 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 having 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, $V_{mg}(r)$, 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 wind-like sinergonic components of the sub-quantum medium –corresponding to a critical value of the intensity of magnetic B^0 -field of a (quasi)stable specific vortex-tube 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 considered by the Bohm-Vigier's theory [21].

It was deduced that in the actual cosmic era, would be necessary a critical density of brownian sinergons: $\rho_s^0(r_v) \approx 2.1x10^{18}$ kg/m^3 and a critical density of wind-like sinergons: $\rho_{sv}^0(r_v) \approx 5.12x10^{18}$ kg/m^3 corresponding to a critical induction: $B^0(r_v^k) = 3.37x10^{17}$ T associated to the fomed vortex-tube, for the forming of light vector (vectons) with mass $m_v \approx 2.3x10^{-40}$ kg, and a critical value: $B^0(r_0) = 0.79x10^{16}$ T for the forming of electronic centroids from vectonic centroids, but in the begining 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 Eq. (3) , if the rotation speed of vortexed quantons not exceed a critical value $v_c^c = k_c c$, with $k_c = \upsilon_h \rho^c_s/\sqrt{2}\cdot m_h$, corresponding to a critical B_c-field associated to the etherono-quantonic vortex: $B_c = k_1 \rho_{sv}^c(r_v) w = k_1 \rho_s^c(r_v) k_c c$.

- It results as more explanatory scenario for the cold genesis of centroids and kerneloids of vector photons and of electrons 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: $L_h = m_h v_c(r) r)$, which initially 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 which gives its magnetic moment, having the mean speed c of its quantonic component up to $r = r_\lambda$ is also explained by the kinetics of the sub-quantum (etheronic) medium.

The previous arguments for the particle' cold genesis indicates that the hypothesis of the formation of rest mass of elementary particles by Higgs' bosons of mass 125 GeV/c^2 results as speculative and unnecessary.

-It also results that some hipothetical particles considered as ‚dark matter' leptons, such as the theorized ‚axions', with rest mass considered in the range: 10^{-7} to 1 eV/c^2 or even up to 14.4 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 convesion into pseudo-scalar photons (formed by two paired vector photons with opposed magnetic moments), respective –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 $v_k^c \approx c\cdot\upsilon_k \rho^c_s/\sqrt{2}\cdot m_k$. 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 $\rho_e^a(a) = 5.16x10^{13}$ kg/m^3 of the electron's surface (in CGT's model) must have the total value given by Eq. (7): $B(r) = k_1 \rho_c v_c = k_1 \rho_f c = 2.4x10^{12}$ 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 argued also 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 tinteraction 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).

The previous conclusions sustains also 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 $\boldsymbol{\xi}_\mathbf{B}$ of the magnetic field, which increased the particles magnetic moment : $\mu_p \sim \Gamma_T(r) = \Gamma_r(r) + \Gamma_\mu(r)$ and the magneto-gravitic potential V_{MG} (r) generated by $\Gamma_T(r)$, but until a limited value depending on the magnetic B-field's value.

-As argument for the Proto-Universe's cold forming, the vortical model of vector photon and of electron sustains the Rees's hypothesis of Multiverse, [25].

-It results also as possible the forming of very high radius etherono-quantonic vortices, initiated by a stellary, which can be 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.

An argument for the mentioned possibility can be considered and the fact that strophysical 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 have been measuring 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 gravistars [9] having a central quark star, an intense magnetic field and a rotated shell of quantons and photons, amd from the collapsing of a number of gravistars was generated a huge central black hole which determined the gaseous matter' rotation and –after a first intense confining, the matter's expansion with rotation in the same sense around the expelled gravistars which thereafter becomed central black holes of galaxies rotated in the same sense.

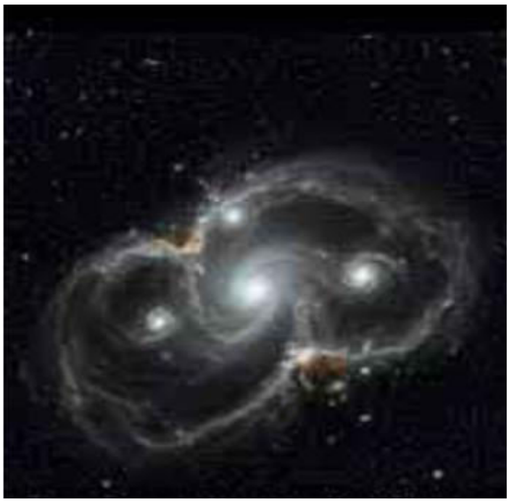

Fig. 2, vortices formed in a cloud of water vapor floating around a black hole, [27].

Also, it was observed that the region known as Sagittarius B2, (26,000 light-years from Earth), located near the center of ou 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 vertical 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 $v_\omega \approx$ constant), specific to the proportionality: $B(r) \sim \rho_{sv}(r) \sim \rho_s(r) \sim r^{-2}$.

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, propostional 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 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.:

$$\left[\rho_{ec};\,\rho_m\right]_r \approx \left[\rho_{ec}^0;\,\rho_m^0\right]_r \left(\frac{R_0}{R}\right)^k \cdot e^{-\beta\cdot\left(\frac{t}{t_0}-1\right)^2}; \quad (k = 1 \div 2) \tag{33}$$

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

There are also 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, [33];

-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 process, 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 [34].

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:
$m_q \approx 8.5$ 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 and to obtain X17-bosons from muonic μ^+ -μ^- or pionic π^+ -π^- high energy interacting jets.

Also, the possibility to obtain ‚super-photon' as Bose-Einstein condensate of laser radiation' photons, experimentally evidenced [35] sustains the CGT's model of kerneloids' cold genesis, the model of composite photon and the Lorentzian model of electron with photonic shell, (considered in a Galileian relativity).

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