Genesis of super-dense centroids and kerneloids of photons and of electrons from quantum vacuum

Author: Arghirescu Marius
*GCI-DLMFS, Romanian Academy; Email: maris3a@yahoo.com

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: $\rho_s^0 + \rho_{sv}^0 \approx 7.2 \times 10^{18}$ kg/m^3 and a critical induction associated to the fomed vortex-tube: $B^0(r_v^k) = 3.37 \times 10^{17}$ 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 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:

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

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:

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

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]) it vas argued that the lightest photonic quanta, named ‚quantons', of mass $m_h = h/c^2 = 7.37\times10^{-51}$ kg, can be attracted toward the kernel of a vector photons m_v (particularly –‚vectons', of mass $m_v \approx 2.3\times10^{-40}$ 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', (sinergonic etherons, with mass $m_s \approx 10^{-60}$ kg, which give phenomenologically the magnetic potential **A**, in CGT [8]):

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

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 :

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

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

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 wit 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 –‚vectons' [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: $\rho_a(a) = \mu_0/k_1^2 = 5.16\text{x}10^{13}$ kg/m^3, ($k_1 = 4\pi a^2/e = 1.56\text{x}10^{-10}$ m^2/C), was obtained from relation [8], [9]:

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

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]:

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

($\rho_c v_c$ –the impulse density of the quantonic vortex $\Gamma_\mu(r)$), 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.:

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

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:

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

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

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

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/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: $\rho_i < \rho_k = 9\text{x}10^{19}$ 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>

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: $\rho_s^0 k_v r_0 = m_h/4\pi r_h^2 = \frac{1}{2}\rho_h \cdot r_h$ = constant.

With the value resulting from Ref. [9] for the ratio: $k_h = 2\pi r_h^2/m_h = 27.4$, (giving $r_h = 1.79\times10^{-25}$ m –the gauge radius of the quanton), it results:

$$\rho_s(r)k_v\cdot r = \rho_s^0 k_v r_0 = m_h/4\pi r_h^2 = 1/2k_h = 1.825\times10^{-2}\ [\mathrm{kg/m^2}]. \quad (11)$$

The quanton's c-speed can be maintained by a dynamic equilibrium of etheronic pressure forces F^t on the tangent direction, of Stokes type ($F^t \sim v$), 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:

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

($k_v \ll 1$ –coefficient which take into account also the super-fluidity of the etherono-quantonic medium, i.e. the d'Alembert paradoxe, [15]).

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

$$\rho_c(a) = \rho_\mu(a) = \rho_e(a) = \mu_0/k_1^2 = 5.16\times10^{13} kg, \qquad (a = 1.41\ \mathrm{fm}),$$

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 $r \le r_\lambda^c$, using Eq. (7) for the magnetic induction, it results that the magnetic potential is :

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

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

By taking $\gamma = 1$, ($w = \sqrt{2}c$, [9],[10]), it results: $\rho_s(a) = 0.29\,\rho_c(a) \approx 1.49\times10^{13}\ kg/m^3$; ($a = 1.41$fm).

From Eq. (11) we also have: $\rho_s(a) = 1.825\times10^{-2}/a\cdot k_v$, resulting that: $k_v \approx 0.87$, [10], ($v_h \approx 0.87c$), so- for $r_0^e \approx 0.43\times10^{-18}$ m (electron centroid's radius, in CGT[xx]), by Eq. (11) we obtain:

$$\rho_s^0(r_0^e) \approx a\cdot\rho_s(a)/r_0^e \approx 0.49\times10^{17}\ kg/m^3, \text{ for the electron' centroid.}$$

Also, for the electron's kerneloid, of radius: $r_k^e \approx 10^{-17}$ m, in CGT [10], we obtain:

$$\rho_s^0(r_k^e) \approx a\cdot\rho_s(a)/r_k^e \approx 0{,}21\times10^{16}\ kg/m^3,$$

-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: $\rho_v^0 \approx \rho^0 = 9\times10^{19}$ 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 $m_v^0 \approx 2.3\times10^{-40}$ kg, i.e. by the resulting relation:

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

which gives: $r_{vo} \approx 4\times10^{-22}$ m; $\rho_s^0(r_{vo}) \approx 5.24\times10^{19}$ kg/m^3 , (the density of sinergons which maintains vortexed quantons at the vecton centroid's surface) and : $m_v^0 = 3.6\times10^{-44}$ kg.

-With these values of ρ_s^0 it results by Eq. (14) that:

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

-Eq.(16), for the electron' centroid, give: $\rho_{sv}^0(r_0) = 1.2\times10^{17}\ kg/m^3$, which by Eq.(7) for B^0

corresponds to : $\rho_c^0(r_0) = \sqrt{2}\rho_{sv}^0 = 1.69x10^{17}$ *kg/m³*, 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 vecton's centroid as pre-kerneloid, (with $r_v^0 \approx 10^{-20}$ m).

- Similarly, for the forming of electron's kerneloid, it results: $\rho_{sv}^0(r_k) = 0.51x10^{16}$ *kg/m³* and: $\rho_c^0(r_k) = \sqrt{2}\rho_{sv}^0 = 0.73x10^{16}$ *kg/m³* , 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/m³*, which by Eq. (13) corresponds to: $\rho_c^0 = \sqrt{2}\rho_{sv}^0 =$ 1.8x10^{20} *kg/m³* 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) ≈ 10^{-20} m, containing its inertial mass, (value corresponding to a density $\rho_v^0 \approx 3.6x10^{19}$ kg/m³ 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/m³; $\rho_{sv}^0(r_v) \approx 5.12x10^{18}$ kg/m³ $B^0(r_v^k)$ = 3.37x10^{17} T. 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.

-It also results that if the k_v –value decreases or/and the variation of $\rho_s(r)$ is faster than that specific to a vortex-tube, ($\rho_s \sim r^{-1}$), 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 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 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:

$r_h = 1.79 \times 10^{-25}$ m, $r_0 = 0.43 \times 10^{-18}$ m , $\rho_{sv}^0(r_0) = 1.2 \times 10^{17}$ *kg/m³* , it results by Eq. (3) that: $F_{gm}(r_0) = 0.6 \times 10^{-21}$ N, which can confine only quantons having the speed: $v_h(r_0) = \sqrt{[(r_0/m_h)F_{gm}(r_0)]} < 1.87 \times 10^5$ m/s, while for $F_{mg}(r) = F_{sl}(r)$, with the corresponding value: $\rho_s^0(r_0) \approx 0.49 \times 10^{17}$ *kg/m³*, obtained by (11), by Eq. (4) it results a value: $F_{sl}(r_0) = 1.54 \times 10^{-15}$ 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 $\rho_s > \rho_s^0(r_0)$.

-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):

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

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 $\rho_s^0(r_v) \to 2.1 \times 10^{18}$ *kg/m³*, 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].

B. <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>

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:

$$\rho_{sv}(r)/\rho_s(r) = \rho_{sv}^0(r_0)/\rho_s^0(r_0) = k_c/(\sqrt{2} - k_c) < 1/(\sqrt{2} - 1) \quad (17)$$

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 $v_c \ll c$.

-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 $v_c^l \ll c$. In this case we have:

$$F_{gm}(r) = -\nabla V_{gm}(r) = \tfrac{1}{2}\upsilon_h \nabla\rho_{sv}(r)(w - v_c)^2 \approx \tfrac{1}{2}\upsilon_h \rho^c_{sv} r_0 w^2/r^2 = m_h v_c^2/r\ ; \quad (18)$$

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

At $r = r_0$, using also Eq. (17), it results that:

$$\upsilon_h \rho^c_{sv} c^2 \approx \upsilon_h \rho^c_s k_c c^2/\sqrt{2} = m_h k_c^2 c^2 \Rightarrow k_c \approx \upsilon_h \rho^c_s/\sqrt{2} \cdot m_h \quad (19)$$

Taking a value: $\rho_s^c(r_0) < 0.49\times10^{17}$ *kg/m³*, for example: 10^{16} *kg/m³*, it results:
$k_c \approx 2.3\times10^{-8}$, giving: $v_c^1 \approx 6.9$ m/s and: $\rho_{sv}^c(r_0) \approx \rho_s^c(r_0)k_c/\sqrt{2} = 1.63\times10^8$ kg/m³, corresponding to a critical value: $B_c(r_0) = k_1\rho_{sv}^c(r_0)w \approx k_1\rho_s^c(r_0)k_c c \approx 5.27\times10^7$ 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: $L_h = m_h v_c(r)r$), 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 $\rho_s^0(r_v)$.

In our opinion, the 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],[16], 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:

$$(\partial_\mu + ieA_\mu)^2\phi = -2c_2\phi + 4c_4\phi^2\phi^* ; \quad \phi(r) = \phi_0 + \rho_f(r) = |\phi|\cdot e^{i\chi} = 2\pi r\cdot|A(r)| \qquad (20)$$

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

$$|A| = 1/er + K(r)\cdot e^{-e|\phi|r}, \quad (K(r) \sim \sqrt{(e|\phi|r)^{-1}}) ; \quad \rho_f(r) \sim e^{-\sqrt{c_2}\cdot r} \qquad (21)$$

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.:

$$V_{gm}(r) \sim |\phi|^2 \sim \rho_{sv}(r) \sim B_e(r) \sim r^{-2} ; \qquad V_r(r) \sim |\phi|^4 \sim \rho_c^2(r) \sim B_e^2(r) \sim r^{-4} \qquad (22)$$

4. 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 (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 equation 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 a specific critical density ρ_s^0 , ρ_{sv}^0, of the brownian and wind-like sinergonic component of the sub-quantum medium –corresponding to a critical value of the intensity of magnetic B^0 -field corresponding to a (quasi)stable specific vortex-tube ξ_B characterizing the lepton's magnetic moment.

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 $\rho_s^0(r_v)$.

-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 [17] 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).
-It results also as possible the forming of very high radius etherono-quantonic vortices, initiated by a stellary or planetary magnetic field, which can be partial cause of the forming of cosmic gas vortices of high radius (figure 1, [18]) or of cosmic dust rings.

Fig. 1, cloud of water vapor floating around a black hole (Quasar APM 08279+5255) that is 12 billion light-years away [18].

References

[1] Nielsen, H.B., Olesen, P., , A quantum liquid model for the QCD vacuum: Gauge and rotational invariance of domained and quantized homogeneous color fields**'**, Nucl. Phys. B **160**: 2, 3 (1979) 380-396.

[2] Nielsen, H.B., Olesen, P., ‚Vortex-line Models for Dual Strings', Nucl. Phys. B **61** (1973) 45-61.

[3] Barenghi, C. F., Skrbek, L., Sreenivasan, K. R., (2023). ‚*Quantum Turbulence'*. Cambridge Univ. Press.

[4] Falconer I. (2019), ‚Vortices and atoms in the Maxwellian era'. Phil. Trans. R. Soc. A 377: 20180451.

[5] Shanquan Lan , Hong Liu, Yu Tian, Hongbao Zhang, (2025), ‚Landau instability and soliton formations', Phys. Rev. Lett. D **112**, L021901

[6] Abrikosov, A. A. (1957). "The magnetic properties of superconducting alloys". *Journal of Physics and Chemistry of Solids*. **2** (3): *199*–208.

[7] Sitenko, Y. A., Gorkavenko, V. M., (2019, ‚Induced vacuum magnetic flux in quantum spinor matter in the background of a topological defect in two-dimensional space', Phys. Rev. D **100**, 085011. arXiv:1908.02058v2 [hep-th] 30 Oct 2019

[8] Arghirescu, M. (2006), ‚The Genesis of Material Structures and Field Effects'. Matrix-Rom (Ed.) Bucharest.

[9] Arghirescu, M. (2015), ‚A Quasi-Unitary Pre-Quantum Theory of Particles and Fields and Some Theoretical Implications'. Int. J. of High En. Phys. 2(4-1) 80-103; viXra:1104.0043.

[10] Arghirescu, M. (2013), The Nature of the 1 MeV-Gamma quantum in a Classic Interpretation of the Quantum Potential', Theor. Phys. Lett. (PTL) 18(06) 0631-3657

[11] Bergkvist, K.E. (1972) Nucl. Phys. B, 39, 317.

[12] ZEUS Collaboration (2016) Limits on the Effective Quark Radius from Inclusive e-p Scattering at HERA. Physics Letters B, 757, 468-472.

[13] Chipman, D.R. and Jennings, L.D. (1963) Measurement of the Atomic Scattering Factor of Ne, Ar, Kr, and Xe. Physical Review, 132, 728-734. https://doi.org/10.1103/physrev.132.728

[14] Kaspi, V. M.; Beloborodov, A. M. (2017), "Magnetars". *Annual Review of Astronomy and Astrophysics*. **55** (1): 261–301. arXiv:1703.00068.

[15] Saint-Venant, A.: Memoire sur la theorie de la resistance des fluides. Solution du paradoxe propose a ce sujet par d'Alembert aux geometres. Comparaison de la theorie aux experiences. Comptes Rendus des Seances de l'Acad. des Sciences, 24 (1847) 243–246.

[16] Arghirescu, M., (2021), "An Explanatory Model of Heavy Quarks and Particles Generating resulted by a Cold Genesis Theory" Theor. Phys. Lett. (PTL), **9** (11) 190- 217

[17] S Andriamonje, S Aune, D Autiero, et al., ‚Search for 14.4 keV solar axions emitted in the M1-transition of 57Fe nuclei with CAST', arXiv:0906.4488v2 [hep-ex] 4 Dec (2009)

[18] ‚Yes, massive water 'cloud' in space holds 140 trillion times all the water in Earth's oceans', Africa Check, 25 March 2022