A 34 m_e NEUTRAL BOSON, PREDICTED BY A PARTICLES COLD GENESIS THEORY AND EXPERIMENTALLY EVIDENCED, AS ARGUMENT FOR A PREONIC QUARK MODEL

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Abstract: The new neutral boson of 34 m_e, experimentally evidenced and supposed to be an X-boson of a fifth basic force, was predicted as being a basic z^0 preon of cold formed quarks by a pre-quantum model of elementary particle resulted from an etherono-quantonic theory of the author, and can be a strong argument for a Bose-Einstein condensate model of particle, resulted by magnetically confined gammons formed as pairs of quasielectrons. A strong argument in the favour of the preonic structure of quarks and for the Cold Genesis of the elementary particles is proposed a new, pre-quantum model of quark resulted in theory with quasi-crystallin preonic structure, given by a quasi-crystallin form of the basic preon z^0, resulted as cluster of quasi-electrons. The brought arguments sustain also the conclusion that the z^0 boson can be a „dark matter" constituent.

Key words: pre-quantum model, neutral boson, preon, quark model, B-E condensate, dark matter, X boson.

1. Introduction

In a relative recent paper, [1], a research team of Science's Institute for Nuclear Research in Debrecen, Hungary, after some experiments for the detection of dark photons, announced that significant deviation from the internal pair creation during the (e^+ -e^-) transition to the ground state of an excited Be8* nucleus was observed at large angles, which indicates that, in an intermediate step, was formed a neutral super-light particle with a mass of ~17 MeV/c^2, (~34 m_e), the excited Be8* state being obtained by proton interaction with a target of Li7, i.e. by a reaction of type:

$$\mathrm{Li7} + p^+ \rightarrow \mathrm{Be}^* \rightarrow \mathrm{Be8} + b^0\ ; \quad b^0 \rightarrow e^+ + e^- \quad , \tag{1}$$

In another paper, [2], a team of american physicists from California concluded that the evidenced new boson is not a dark photon and this experimental result could be the evidence for a fifth fundamental force mediated by the predicted X-boson, coupling quarks with leptons, which decay by a reaction of type:

$$X \rightarrow e^+ + e^- \ \text{or}\ X \rightarrow \nu + \bar{\nu}(\text{neglijible}), \quad \text{instead: } X \rightarrow u + u\ ; \quad X \rightarrow e+ + \bar{d}.$$

Later, the considered X boson was theoretically identified as k = 113 light pion, by the p-Adic thermodynamics, [3].

But a particle with the same mass: 34 m_e, was considered by a cold genesis quark model as being the basic preon by which is composed the effective quark mass, according to a cold genesis pre-quantum theory of particles and fields of the author, (CGT), [4-6].

According to this theory, based on the galileian relativity, the magnetic field is generated by an etherono-quantonic vortex $\Gamma_M = \Gamma_A + \Gamma_\mu$ of s-etherons (sinergons-with mass $m_s \approx 10^{-60} kg$)- giving the magnetic potential **A** by an impulse density: $p_s(r)=(\rho_s \cdot c)_r$ and of quantons (h-quanta, with mass: $m_h = h/c^2 \approx 7.37x10^{-51} kg$), giving the magnetic moment and the magnetic induction **B** by an impulse density: $p_c(r)= (\rho_c v_c)_r$, generated by a magnetic moment of an atomic particle but also by a magnet or an electromagnet.

The theory deduces also a variation of the Compton radius and of the fermion's magnetic moment, inverse proportional with the density in which is placed the particle's super-dense kernel, (the particle's centroid) and sustains the possibility of a cold genesis of particles, which results theoretically in a chiral soliton model as Bose-Einstein condensate of photons- in the electron's case and of "gammons": $\gamma_c = (e^+\!-\!e^-)$ - considered as pairs of degenerate electrons, i.e- of quasielectrons- in the case of mesons and of baryons, with the inertial mass m_e^*, formed by a superdense centrod and a quantum volume of vexons (vectorial photons composed by vortexed vectons), the particle's magnetic moment radius being given by its Compton radius, $r_\lambda = \lambda/2\pi = \hbar/m_p c$.

-The virtual radius: r_μ^n of the proton's magnetic moment, μ_p , results –in the theory, by a degenerate Compton radius of the attached positron, which decreased when the protonic positron was included in the N^p cluster volume, from the value: $r_\mu^e = 3.86x10^{-13}m$, to the value: $r_i = r_\mu^p = 0,59fm$, as a consequence of the increasing of the impenetrable quantum volume mean density in which is included the protonic positron centrol: m_0, from the value: $\overline{\rho}_e$ to the value: $\overline{\rho}_n \cong f_d \cdot N^p \cdot \overline{\rho}_e$, conformed with the equations:

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

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

The relation (2b) also gives: $r_e^+ = 0.96\ fm$ for the protonic positron axial position inside the protonic quantum volume, the theory giving for the electron a radius: a = 1.41 fm and a quanta density variation inside the electron's quantum volume: $\rho_e = \rho_e^0 \cdot e^{-r/\eta}$; with: $\rho_e^0 = 22.24\ kg/m^3$ and: $\eta = 0.965\ fm$ for the electron mass quanta density variation, [4-6].

The superposition of the (N^p+1) quantonic vortices: Γ_μ^* of the protonic quasielectrons, generates inside a volume with the radius: r_μ^a = 2.35fm, a total dynamic pressure: $P_n = (1/2)\rho_n(r) \cdot c^2$ which gives a nuclear potential: $V_n(r)$, in an eulerian form, having a variation according to eq. (2b), with: $\eta^* = 0.755fm$, that is: $V_n(r) = \upsilon_i P_n = V_n^0 \cdot e^{-r/\eta^*}$; $V_n(r) = \upsilon_i P_n^0$; ($\upsilon_i$(0.6fm) ≈ 0.9fm³- the impenetrable quantum volume).

-In a previous book, [4], the preon of 34 m_e was considered formed as cluster of 34 quasielectrons, e^*, with degenerate magnetic moment and electric charge corresponding to the value : $\pm^2/_3$e, (specific to u-quark/antiquark), coupled in gammonic pairs: $(e^{+*}\text{-}e^{-*})$, but with un-degenerate mass.

-In the next variant, in english, [5, 6], the preon of 34 m_e was considered „quarcin", with a charge $e^* = \pm^2/_3e$, because that it was considered as formed by an odd number of 39 quasielectrons with degenerate mass: $m_e^* \cong 0.872m_e$. This m_e^*- value was approximated considering that the confination of vortexial (vectorial) photons inside the electron's quantum volume and of gammonic pairs: $\gamma^* = (e^{+*}\text{-}e^{-*})$ inside the particles quantum volume, complies with the chiral sub-solitons forming condition, [7], which specifies that the energy density $\in_r = \rho_r c^2$ of the mass-generating vortexial field should be double, at least, comparing to the mass energy density: $\in_w = \rho_w c^2$ of the generated sub-solitons, $(\in(m_e^*) = 2\in(\Gamma_M))$, and considering a degeneration of Γ_μ corresponding to the charge $e^* = \pm^2/_3e$, (the decreasing of the mean radius of Γ_μ from: $\eta_e = 0.965\ fm$ to $\eta_\mu = 0.755\ fm$) and an un-degenerate Γ_A vortex.

The necessity of the preon with ~34 m_e resulted in CGT by the conclusion that –in a cold genesis scenario, the elementary particles could be formed in a magnetaric super-strong magnetic field, with $B_T \to 10^{13}$ T, in a cascade particles forming process, by masses given according to the sum rule and equal or very close to a value given as integer number of basic preons, c_0 . As helpful theory for this issue was used a theoretical result of Olavi Hellman which deduces the value of elementary particles mass, by a simplified relation:

$$M_p = \frac{K_m}{2\alpha} m_e; \quad \alpha = \frac{e^2}{hc} = \frac{1}{137}; \quad m_e = 9.1x10^{-31}kg \qquad (3)$$

with a tolerance under 1%, neglecting the electromagnetic field contribution, by integer values of K_m, as a multiple of the mass: $M_0 = 68.5m_e$; (K_m = 3; 4; 14 for the mesons μ, π, K).

2. Theoretical arguments for a preonic structure of quarks

It may be observed that- for nucleons, the theory of O. Hellman gives- by $K_m = 27m_n$: p/n =1849,5 m_e instead ~1836m_e , i.e. – a difference which indicated that the M_0 = 68.5m_e value is not enough plausible. Also, we may observe that the value M_0'= 68m_e gives a very good correspondence with the nucleon mass but not gives a good correspondence with the mass of Σ -particle; (m_Σ = 2312 m_e or 2380 m_e instead (2327; 2333 ; 2342) m_e) . This fact indicated in CGT as the most plausible value for the mass of the basic preon which may explain the mass of the elementary particles by quark masses obtained according to the sum rule (i.e-effective mass), the value: z^0 = 68/2 =34 m_e. If we consider as real the value: $z^{0'}$ = 68.5/2 =34.25 m_e , the difference: $\Delta z^0 = (z^{0'} - z^0)$ =0.25 m_e may be considered as a cold genesis binding energy per z^0 –preon, which is released at the cold genesis of quarks.
The obtained effective masses of the resulted quarks and their preonic sub-structure was presented in the book: „The Cold Genesis of Matter and Fields”, [5, 6] and in the previous book, [4].

The experimentally evidenced particle with 34m_e as neutral boson which decay into a (e^+-e^-) pair suggests that- in accordance with CGT, in the decay of Be8* to its ground state, the excess energy was emitted in the form of a neutral preon, formed as cluster of an even number of quasielectrons (by an integer number of degenerate gammons), of n = 40 or n'= 42 quasielectrons with: 34/42 = 0.8095 m_e given by the sub-solitons forming condition [7], by a degeneration of Γ_μ corresponding to the charge $e^* = \pm{}^2/_3 e$, (the decreasing of the mean radius of Γ_μ from: η_e= *0.965 fm* to: η_μ= *0.755 fm)* and a degeneration of Γ_A –vortex corresponding to a decreasing of the mean radius of Γ_A from: η_e= *0.965fm* to: η_A= *0.839 fm,* (approximate- a half of the Γ_μ-vortex decreasing).

The case: n = 40m_e* may be explained by the predicted quarcin: $c_0^\pm$ =39 m_e*, (m_e*≅ 0.872 m_e), considering that the expelled quarcin has left the nucleon with the un-paired quasielectron of the adjacent quarcin of the basic „zeron” $z^* = (c_0 + \overline{c}_0)$, forming a neutral boson which decayed in the form:

$$b^0(c_0^0 + e^{+*} + e^{+*}) \rightarrow \gamma + e^+ + e^+ \quad , \tag{4}$$

by the transforming of quasielectron into electron, in a free state, [5, 6].

The case: n = 42m_e* may be explained considering a quarcin $c^{*\pm}$ = 21 m_e*, (m_e* ≅ 0.8095 m_e) and considering that the expelled boson b^0 is a basic preon: $z^0 = (c_0^* + \overline{c}_0^*)$ = 34m_e , which decayed in the form:

$$z^0(c_0^* + \overline{c}_0^*) \rightarrow c_0^+ + c_0^- \rightarrow e^+ + e^- \quad ; \tag{5}$$

by the transforming of the quarcin into a heavier electron, in the free state, by the transfer of the un-paired quasielectron (which gives the quarcin's charge) in the external part of its impenetrable quantum volume,[5, 6].

In this last case, the nucleon results as formed by $N^p \approx 54x42 = 2268$ quasi-electrons which gives- by the superposed vortexes of their magnetic moments, $\Gamma_\mu^*(e^*)$, a nuclear potential at d ≈ 2fm:

$$V_s^n(r) = -\upsilon_i \cdot P_d(r) = -\frac{\upsilon_i}{2}\rho_n(r)\cdot v_c^2 = V_s^0 \cdot e^{-\frac{r}{\eta^*}};\quad V_s^0 = -\frac{\upsilon_i}{2}\rho_n^0 \cdot c^2;\ r \le r_\mu^a = 2.35\text{fm} \tag{6}$$

in which the proton density in its centre has the value: $\rho_n^o \approx N^p \cdot \rho_e^o = 5.04x10^{17} kg/m^3$, $(\rho_e^0 = 22.24\ x10^{13}\ kg/m^3)$, giving- with $\upsilon_i(a_i) = 0.9\ fm^3$, $V_s^0 = 127.5\ MeV$; $V_s(d=2fm) \approx 9MeV$ – value specific to the mean binding energy per nucleon in the nuclei with the mosts trongly bound nucleons: 9.14 ÷9.15 MeV/nucleon for ^{56}Fe, ^{58}Fe, ^{60}Ni, ^{62}Ni ; (i.e- it results a better fit with the experimental data).

In the same time, taking into account the experimental value for the mean radius of the nucleon density variation: η_n^e =0.841fm, the proton mass and the m_e*- mass of the specific bound quasi-electron, results for an effective radius: a_n ≈ 1.363 fm, (closer to the value: ~1.25fm used by the equation of empirical nuclear radius: $R_n \approx r_0 \cdot A^{1/3}$, ($r_0 \approx 1.25$ fm).

By the basic z*-zeron it is possible to deduce a quark model of cold formed particles with effective mass of quarks, which gives the particle mass by the sum rule, considering as stable solitonic constituent of mesons and baryons, the basic preon $z^0 = 42 \cdot m_e^* \cong 34\ m_e$, which can form derived “zerons”.

The resulted structure of the fundamental elementary particles, considered as formed "at cold" by quarks with current mass and fractional electric charge $q^* = (+{}^2/_3e;\ -{}^1/_3e)$, formed as preonic clusters, is given by the following sub-structures, [4]:

> Conform acestui rezultat, într-un model de formare "la rece" a particulelor elementare, prin vortex cuantic Γ_A de forţă supertare (generată de potenţial cuantic de Broglie-Bohm), particulele elementare rezultă formate din quarci cu mase curente rezultate în model tip cluster de electroni degeneraţi, prin considerarea drept unitate constitutivă fundamentală a particulelor elementare compuse, a unui cluster neutru pe care îl denumim "zerol" $Z^0 = Z^*/2 = 34\ m_e$, format din electroni degeneraţi dispuşi în perechi: negatron-pozitron, de spin şi moment magnetic nul şi cu volumul cuantic de rază $r_q < a$, comun.

Figure 1: the prediction for z^0-preon ; ([4], 2006, p. 58)

a) –basic zerons (preons) : $z^0 = 34m_e$; $z^* = 2z^0 = 68\ m_e$; $Z_1 = 3Z^0 = 102\ m_e$;
$Z_2 = 4Z^0 = 136\ m_e$;
b) -derived zerons: $Z_3 = 2(Z_1 + Z_2) = 476\ m_e$; $Z_4 = 3(Z_1 + Z_2) = 714\ m_e$.

c) basic quarks: $m_1^+ = (Z_2 - m_e^*) = 135{,}2\ m_e$, ($mark_1$, $+2e/3$); $m_e^*(e^*) \approx 0.8\ m_e$;

d) derived quarks, (effective mass):
$m_2^- = m_1 + e^- + \sigma = 137{,}8\ m_e$; ($mark_2$ - $q^* = +2e/3$); ($\sigma = e^{*+}e^{*-} = 2\ m_e^*$ – gluol)
$p^+ = m_1 + Z_3 = 611{,}2\ m_e$, (park, $+2e/3$); $n^- = m_2 + Z_3 = 613{,}8 m_e$, (nark, $-e/3$);
$\lambda^- = m_2 + Z_4 = 851{,}8\ m_e$, (lark, $-e/3$); $s^- = \lambda + Z_2 = 987{,}8\ m_e$, (sark, $-e/3$);
$v^- = s + Z_2 = 1123{,}8\ m_e$, (vark, $-e/3$); $m_2 \to m_1 + e^- + \bar{\nu}_e$; $n \to p^+ + e^- + \bar{\nu}_e$

d)Elementary particles:
Mesons : (theoretic mass) / (experimentally determined mass)
$\mu^- = 2Z_1 + \bar{e}^- = 205\ m_e$; / $\mu^+ = 206{,}7\ m_e$
$\pi^o = m_1 + \bar{m}_1 = 270{,}4\ m_e$; / $\pi^0 = 264{,}2\ m_e$
$\pi^+ = m_1 + \bar{m}_2 = 273\ m_e$; / $\pi^+ = 273{,}2\ m_e$
$K^+ = m_1 + \bar{\lambda} = 987\ m_e$; / $K^+ = 966{,}3\ m_e$
$K^o = m_2 + \bar{\lambda} = 989{,}6\ m_e$; / $K^o = 974{,}5\ m_e$
$\eta^o = m_2 + \bar{s} = 1125{,}6\ m_e$; / $\eta^0 = 1073\ m_e$; ($\bar{s}$ = s-antiquark)
Baryons:
$p_r = 2p + n = 1836.2\ m_e$; $n_e = 2n + p = 1838{,}8\ m_e$; / $p_r^+ = 1836{,}1\ m_e$; $n_e = 1838{,}7\ m_e$
$\Lambda^o = s + n + p = 2212.8\ m_e$; / $\Lambda^0 = 2182{,}7\ m_e$
$\Sigma^+ = v + 2p = 2346.2\ m_e$; $\Sigma^- = v + 2n = 2351.4 m_e$; / $\Sigma^+ = 2327\ m_e$; $\Sigma^- = 2342{,}6\ m_e$;
$\Sigma^o = v + n + p = 2348.8\ m_e$; / $\Sigma^0 = 2333\ m_e$;
$\Xi^o = 2s + p = 2586.8\ m_e$; $\Xi^- = 2s + n = 2589.4\ m_e$; / $\Xi^0 = 2572\ m_e$; $\Xi^- = 2587{,}7\ m_e$
$\Omega^- = 3v = 3371.4\ m_e$; / $\Omega^- = 3278\ m_e$.

Some "resonance" particles may be formed also "at cold", in:
$\Delta^o = 2v + p = 2858.8\ m_e$; $\Delta^- = 2v + n = 2861.4\ m_e$; (known mass: 2850 m_e), and:
$\Xi^{-*} = 3s^- = 2963.4\ m_e$; (known mass: 3004 m_e).

The differences between the theoretic mass and the experimental mass may constitute a photonic energy of quarks, ('gluonic' –in QM), which is released in the cold genesis process of particles .

The theory predicts also the existence of the next particles:

$\Phi^- = 2v + \lambda = 3099.4 m_e$; $\Phi^{-*} = 2v + s = 3235.4\ m_e$; $2s + \lambda = 2827.4$; $3s = 2963.4\ m_e$

$\Lambda^+ = s + 2p = 2210.2\ m_e$; $\Lambda^- = s + 2n = 2215.4\ m_e$; $Z_5 = (Z_1 + Z_2) = 238\ m_e$;

It can be observed also that- excepting the particles Σ and Ξ, the masses of the principal elementary particles can be found as cluster of zerons: $z^* = 2z^0 = \nu_\mu^* = 68 m_e$, having the form:

a) $2^n z^*$, (n=1...5); b): $(3 \times 2^n + n) \cdot z^*$, (n =1...3); c): $3 \times 2^n z^*$, (n = 4) (7)

which indicates the tendency of clusters forming, in the a)-form:

a): $n = 1 \to (m_{1,2})$; $n = 2 \to (\pi^{0,\pm})$; $n = 4 \to (\eta^0)$; $n = 5 \to (\Lambda^0)$;

(specific specially to the mesons), or triplets (specific to baryons), in a b)- or c)-form:

b): n= 0 → ($\mu^{\pm}$); n=1→ (z_3); n= 2→ ($K^{0,-}$); n= 3→ (p_r, n_e);

c): $3x2^n z^*$; n= 4→ (Ω^-); d): $[(4x2^n+n)z^* - z^0]$; n = 3→ ($\Sigma^{0,\pm}$);

e) $[(3x2)^n + n]z^*$; n =2→ $\Xi^{0,-}$

i.e.-a tendency specific also to the quarks theory of the particle standard model.

The obtaining of the particle's charge as sum of the internal quarks charge is equivalent- according to CGT, with an attached positron, negatron or a negatron- positron pair, giving the same charge, to a neutral N^p cluster .

3. A possible explanation for the proton's stability

According to the theory, the possibility of a z^0-preon decaying into component quarcins $c^{*\pm}$ may results- by the interaction energy of (Li7, p^+) couple, by a resulted resonant state of the (2p+n) quarks system of the captured proton.

In this sense, it may be observed the fact that- even if the proton is formed by three quarks like other baryons, it is a very stable particle until a critical temperature, $T_c \approx 2x10^{12}$ K, of quarks deconfination, compared to other baryons, for which may be considered a semi-empiric relation for the particle's lifetime resulted dependent of the total intrinsic vibration energy of the internal quarks, ε_v , in the form:

$$\tau_k = \frac{\tau^0}{k_v \cdot 10^{2n}}; \quad \tau^0 \cong 10^{-13}\,\text{sec.}; \quad k_v = \frac{\Delta m_p}{m_p} = \frac{n \cdot \varepsilon_v}{\varepsilon_v^o} = \frac{n \cdot T}{T_d}; \quad T_d \cong 2x10^{12}\,\text{K} \tag{8}$$

in which: $\varepsilon_c^0 = k_B T_d \cong h\nu_c^0$ represent the critical phononic energy of the particle vibration which determines the quark deconfination, at: $T_d \cong 2x10^{12}$K, (Arghirescu, 2006, 2012, 1015).

This fact was explained by the pre-quantum model of nucleon derived from CGT, by a new proposed Bag Model for the nucleon's stability, [8], of type with repulsive shell of the impenetrable quantum volume given by a static pressure of kinetized quanta, with a Gaussian variation and maximum value corresponding to the constant B of model "bag" of MIT, without intermediaries gluons hypothesis.

In the mentioned paper was hypothesized also- by eq. (8), that the higher stability of the proton indicates an axially magnetic coupling of the proton's quarks along its magnetic moment vector, μ_p , favored by the quasi-equality between the effective mass of n- and p- quark deduced in CGT, this arrangement reducing the total intrinsic vibration energy of quarks inside the impenetrable quantum volume. An argument for this conclusion may be the result of some high energy p-p elastic scattering experiments in the TeV region, based on an effective field theory model of the proton [9], which deduced - from the hard collision of a valence quark of one proton with that of the other, the existence of a core region of size ~ 0.2 fm, where the current mass of the valence quarks are confined and of a layer of scalar particles that envelops the baryonic charge shell of the proton, which originates from a scalar field, (i.e- similar to the repulsive shell of the impenetrable quantum volume considered in the Bag model of CGT), resulting that the proton is a "condensate enclosed Chiral Bag".

But according to other experiments, [10], the value of ~ 0.2 fm corresponds to the current mass quark radius, so the mentioned result of p-p elastic scattering indicates an alignement of current masses of the protonic quarks along the proton's magnetic moment, in our oppinion.

A less stable state of proton is obtained when the current masses of quarks- totally included into the impenetrable quantum volume of nucleon considered with a radius of ~ 0.6 fm [8], are aligned perpendicular to the proton's magnetic moment, position in which the u-quarks (the p-quarks –in the CGT model), are rotated around the d-quark (the n-quark –in the CGT model). According to this conclusion, it results that – before the quarks deconfining at $T_c \approx 2x10^{12}$ K, it is possible to exist another critical thermic point, T_m , of proton's transition into a meta-stable state with current mass quarks aligned perpendicular to the proton's magnetic moment, (figure 2, a).

The experimentally evidenced boson of ~ 34 m_e in p-Li7 interaction at low energy, identified as the predicted preon z_0 in CGT, indicates- according to the previous conclusions, the possibility of z_0 preon(s) emission at the considered T_m transition temperature and by nuclei with giant resonance.

Another possibility for experimentally verifying of the preonic nature of the 34 m_e boson is to determine the mass of the Be8 nucleus resulted after the reaction: *(p; Li7)* $\rightarrow$ *(Be8; z_0)*, which must be:

$$M(Be8) \approx M(Li7) + m_p - m(z_0) = [(7{,}016u + 1)x1836 - 34]/1836 = 7.997u \qquad (9)$$

The stability of z^0 preon may results as consequence of a quasi-cristalline form of the component quarcins:
$c^{\pm} = 7x3 = 21m_e^* = 17\ m_e$, (i.e.-hexagonal)–considered by CGT, (figure 1, b), given by the specific interaction and arrangement between the component quasi-electrons with superdense centroids of $\sim 10^{-18}$m radius.

The quark structure resulted from CGT is shown in figure 2, c), in which r_q is the radius of quark's current mass, given by its impenetrable quantum volume and the maximal density of the particle's kernel, [8], $\upsilon_q(r_p)$ is the quantum volume of its effective mass (which gives the particle's mass according to the sum rule), which is composed by confined vectorial photons (vexons), which forms- in CGT, the vortexial equivalent of the gluonic shell considered in Quantum Chromodymamics, ‚Ss' being a scalar shell of ~0.1fm thickness, which envelops the current mass of quark and which may explain- according to CGT, the value of ~0.3 fm for the quark radius determined by some scattering experiments as those made at Fermilab , [10]. This scalar shell, evidenced for proton by p-p scattering at few TeV, [9] , may be considered also for the quark because that the same cause which forms the repulsive, scalar shell of the protonic impenetrable quantum volume, according to CGT, i.e : the attraction of kinetized quantonic clusters (vectonic inertial masses) by the vortexial field: $\Gamma_v = \Sigma(\Gamma_\mu^*)$, may generate a small scalar shell of scalar field quanta also around the current mass of an individual quark, according to the model.

According to the theory, the 34 m_e boson may be also a „dark matter" particle which may form- in the quantum vaquum, bigger bosons and quark-antiquark pairs.

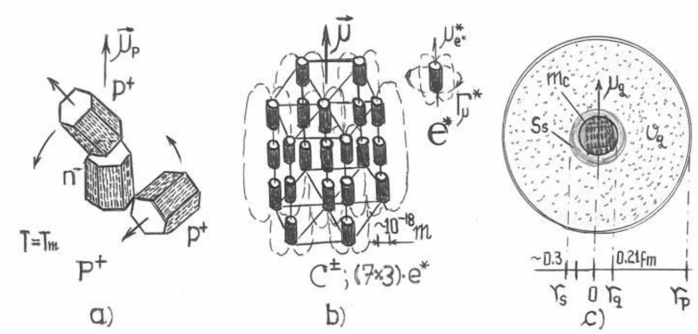

Figure 2. a) proton's transition to metastable state; b) quasi-crystalline structure of $c^{\pm}$-quarcin; c) model of quark with scalar shell, (CGT)

In the sametime, considering –according to the model, also the existence of the zeron:
$z_\pi = (z_1 + z_2) = 7z^0$, the deduced quasicrystalline structure of the z^0 preon explain the value of the rezulted quark masses by a quasicrystalline model of quark and by a quark equation:

$$q = m + k\cdot z_\pi + n\cdot(k-2)\cdot z_2\ ; \quad k = 0 \div 3\ ;\ n = 0 \div 2;\ n < k\ ;\ (m = (m_1^+ , m_2^-))\ , \qquad (10)$$

with: $m = (m_1^+ , m_2^-)$, the quasicrystallin form of quarks resulting from the quasicrystallin form with hexagonal simmetry of the considered z^0 and $z_\pi = 7z^0$ zerons, like in figure 3, i.e.:
-(k, n = 0) $\Rightarrow q = m_{1,2}$; (k= 1, n = 0) $\Rightarrow q = r^{\pm}$, (rark- un-stable quark); (k = 2) $\Rightarrow q = p^+ , n^-$;
- (k = 3, n = 0) $\Rightarrow q = \lambda^-$; (k = 3, n = 1) $\Rightarrow q = s^-$; (k = 3, n = 2) $\Rightarrow q = v^-$.
The mesons results by eq. (10) with: $m = (m_i + m_k)$, i, k = 1, 2 , like in the old theory of quark, as combinations: $(q_1 - \overline{q}_2)$ and the baryons results as combinations (q-q-q) but not only, by the equation:

$$b = \mathrm{M} + \mathrm{k}\cdot \mathrm{z}_\pi + \mathrm{n}\cdot(\mathrm{k}-6)\cdot \mathrm{z}_2\,;\qquad \mathrm{M}=\sum_{i=1}^{3}\mathrm{m}_i\ ;\ \ \mathrm{m}_i=(\mathrm{m}_1^+;\mathrm{m}_2^-);\ \ \mathrm{k}=6\div 9;\ \ \mathrm{n}\le 2 \qquad (11)$$

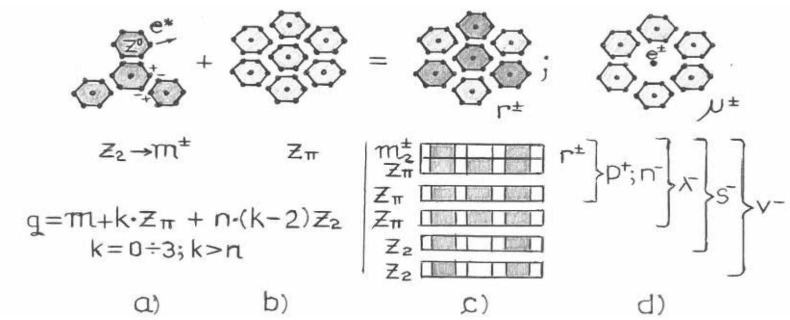

Figure 3. a) m- basic quark; b) quasi-crystallin form of z_π ; c) quasi-crystallin structure of quarks, (CGT) d) quasi-crystallin ring form of $\mu^\pm$

4. Conclusions

According to the etherono-quantonic theory resulted in CGT, based on the galileian relativity, which sustains the possibility of particles cold genesis by a vortexial nature of the magnetic field-given by an etherono-quantonic vortex: $\boldsymbol{\Gamma_M} = \boldsymbol{\Gamma_A} + \boldsymbol{\Gamma_\mu}$ of sinergons and of quantons , the new experimentally evidenced neutral boson of 34 m_e , supposed to be an X- boson of a fifth basic force but predicted in CGT as being a basic z^0 preon of cold formed quarks, may constitute a strong argument for the pre-quantum Bose-Einstein condensate Model of elementary particle, resulted in CGT, and it may be also a bosonic component of the „dark" matter. The principal argument for this conclusion is the possibility to explain the sub-structure of the elementary particles and their weak and strong interactions, in accordance with their known mass, by a preonic structure of quarks , based on the z^0 preon, resulted as cluster of quasi-electrons, in a quasi-crystallin quark model, (figure 3).

According to CGT, the mentioned z^0 boson can be also –by the vortexial field of its quasi-electrons, an intermediary gluon between a quark and a lepton, i.e- an X-boson, but as component of quarks, i.e.- as constituent of the current mass of quarks, and not as boson with null rest mass.

A quasi-unitary image over the basic fields conformed to the particle and field models specific to CGT , [4-6], may be mathematically synthesized by an semi-empiric equation similar to the telegraphist equation which may be generalized also for the case of the fundamental fields [11] if we use a field rank coefficient, u, and a specific field source term, in the form specific for a source Q* placed in the center of the coordinate system:

$$\nabla^2\Psi - u\frac{1}{c^2}\frac{\partial^2\Psi}{\partial t^2} - \frac{2\sigma}{c}\frac{\partial\Psi}{\partial t} - u\cdot k^2\Psi - (1-u)\frac{2m}{\hbar^2}V^0|\Psi|^2\cdot\Psi = -u\cdot\sum\frac{(Q^*\cdot q^*)}{\varepsilon_0 m_q}\delta(\vec{r},t);\qquad \Psi=\Psi(\vec{r},t)\ ;\ \mathrm{u}=0,1;\ \sigma_\mathrm{n}=-\mathrm{i}\cdot \mathrm{mc}/\hbar \qquad (12)$$

in which we have: u = 0 and $\sigma = \sigma_n$ = -i·mc/ħ for the short-range field (of nuclear type) and u = 1 for the long-range field, (of gravitic and electro-magnetic type field), and:

$$\mathrm{k}=\frac{\mathrm{m_c}c}{\hbar};\quad V^0|\Psi^2|=\mathrm{V(r,t)}\ ;\quad q^*=(q_e^*;q_G^*);\quad Q^*=(Q_e^*;Q_G^*);\quad q_e^*(m_q)=n_1\cdot e;\ \ Q_e^*(M)=n_2\cdot e;\ \ q_G^*=\frac{\mathrm{m_G}}{\beta_c}\frac{\mathrm{e}}{\mathrm{m_e}}; \qquad (13)$$

$$(\beta_c=1-\frac{v^2}{2c^2})\ ;\ \ \hat{Q}_G=-4\pi G\varepsilon_0 M\frac{m_e}{e}(1+\frac{v_e}{c});\ (v_e=v_p\sin(\vec{v}_p,\vec{r})\ ;\ v_e\perp r);\ \ |\Psi|^2=R^2;\ \ \Psi=R\cdot e^{i\frac{S_\mu}{\hbar}};$$

with: q*, Q*- generalized charges (of electric, q_e or electro-gravitic, q_G type); v_p –the speed of the electro-gravitic charge q_G* ; k –wave number associated to the field quantum: m_c .

For: u = 0 and σ = - imc/ħ , is obtained the Schrödinger equation, particularly- with soliton-type solutions, with : V(r) = $V^0\cdot|\psi^2|$, in which, according to eq. (5), we have:

$$V^0=V_n^0=\frac{\upsilon_i}{2}\rho_n^0 c^2\ ;\ \ |\Psi|^2=\Psi\cdot\Psi^*=R_n^2;\ \ \Psi=R_n\cdot e^{i\frac{S_\mu}{\hbar}};\ S_\mu=(\delta m_i)_r c\cdot l_r\ ;\ \ R_n^2=\cdot e^{-\frac{r}{\eta^*}} \qquad (14)$$

with: $(\delta m_i)_r = \upsilon_i\cdot\rho_n(r)$; $l_r \perp r$; η* = 0.755 fm, for the inter-nucleons scalar nuclear field, and:

$$V^0 = V_n^0 = \frac{\upsilon_i}{2}\rho_n^0 c^2; \quad |\Psi|^2 = R_{nv}^2 = e^{-\frac{r}{\eta^*}} \cdot e^{-\frac{l_v^*}{\eta^*}}; \qquad l_v^* = l_v^0 \cdot (\frac{3}{2} - \frac{1}{2}\vec{\tau}_p \cdot \vec{\tau}_n); \quad \vec{\tau} = \frac{\vec{s}}{s}; \tag{15}$$

for the tensorial interaction between two nucleons, with: $\eta^* = 0.755$ fm, l_v^*-the vibration liberty, $l_v^0 \approx 1$fm – for deuteron and $l_v(E_v=0) = 0$; ($\bar{s}$- the nucleon spin ; E_v –the vibration energy).

For the inter-quarks strong field, according to CGT, [8], we have:

$$V^0 = V_q^0 = \frac{\upsilon_q}{2}\rho_n^i(a_i) \cdot c^2 \; ; \quad |\Psi|^2 = R_q^2; \quad \Psi = R_q \cdot e^{i\frac{S_\mu}{\hbar}}; \quad S_\mu = (\delta m_e)_r c \cdot l_r \; ; \quad R_q^2 = e^{-\frac{(r-a_i)^2}{\delta}} \tag{16}$$

with: $\upsilon_q = \upsilon_q(r_q \approx 0.21\text{fm})$; $\delta = 0.28 \div 0.24$ and $a_i \approx 0.6$ fm , (force of static quantum pressure gradient in the field of a repulsive shell of the nucleon's impenetrable quantum volume $\upsilon_i(a_i)$ acting over the υ_q volume of the current mass of quark).

For: u = 1 and σ- the medium conductivity, from eq. (12) is obtained a generalized form of the telegraphist equation, which for $\sigma = 0$, gives an equation of Proca-Maxwell type specific to a field of electro-magnetic type, with mediating quanta with rest mass: m_c and confined field source, (generalized charge, Q^*), in which- for an unitary form, we must choose: $m_c \approx m_g \approx 10^{-69}$kg:

$$\nabla^2\Psi - \frac{1}{c^2}\frac{\partial^2\Psi}{\partial t^2} - \frac{2\sigma}{c}\frac{\partial\Psi}{\partial t} - k^2\Psi = -\sum\frac{(Q^* \cdot q^*)}{\varepsilon_0 m_q}\delta(\vec{r}); \qquad \Psi(r,\sigma=0) = \sum\frac{(Q^* \cdot q^*)}{4\pi\varepsilon_0 m_q \cdot r} \cdot e^{-k \cdot r} \; ; \quad a(r) = \frac{dv}{dt} = \frac{\partial\Psi}{\partial x} \tag{17}$$

The eq. (17) may be transformed into a generalized wave equation of Klein type, for the case of a source field with spatial-extended density, $g = \rho/\varepsilon_0$ and into a Maxwell type equation, for $m_c = 0$.
The "splitting of eqn. (12) into two derived equations by the field rank coefficient, u, may be written also in a matricial form:

$$\begin{vmatrix} \left(\nabla^2 + i\frac{2m}{\hbar}\frac{\partial}{\partial t}\right) ; & -\frac{2m}{\hbar^2}V^0|\Psi|^2 \\ \left(\nabla^2 - \frac{1}{c^2}\frac{\partial^2}{\partial t^2} - \frac{2\sigma}{c}\frac{\partial}{\partial t}\right) ; & \frac{m_c^2 c^2}{\hbar^2} \end{vmatrix} \bullet \begin{vmatrix} \Psi \\ \Psi \end{vmatrix} = \begin{vmatrix} 0 \\ -\sum\frac{(Q^* \cdot q^*)}{\varepsilon_0 m_q}\delta(\vec{r},t) \end{vmatrix}; \qquad \Psi = \Psi(\vec{r},t) \; ; \tag{18}$$

The weak interaction may be partially described mathematically by equation (7), in CGT.

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