On the Supersymmetry Realization of Involving β^+-Orthopositronium. Phenomenology

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The absence of a Coulomb barrier in the interaction of the Vacuum-Like State of Matter with normal matter is the basis of the phenomenology of the Project of the New (Additional) $G\hbar/ck$-Physics "Outside" the Light Cone.

"*Of course, the most intriguing question is whether NEC-violation fields exist in Nature. Needless to say, no such fields have been discovered. The situation is not entirely hopeless, however: we may learn at some point in future that Universe went through the bounce or Genesis epoch, and that will be an indication that NEC-violation indeed took place in the past*" [1].

Closely adjoins this problem the phenomenology of the extension of the Standard Model/SM (as the possibility of two-valued/± vacuum states), the formulation of which is stimulated by observations (1956/USA, 1965/USA, 1967/Russia, 1975/USA, 1975/England, 1975/Canada, 1987/Russia, 1982–1990/USA, 2003/USA) anomalies of annihilation of β^+-decay positrons (β^+-orthopositronium) in the system

$$^{22}\mathrm{Na}\,(3^+) \xrightarrow{e^+_\beta+\nu} {}^{22*}\mathrm{Ne}\,(2^+) \xrightarrow{\gamma_n\simeq 1.274\ \mathrm{MeV}} {}^{22}\mathrm{Ne}\,(0^+) - \text{gaseous neon (8.86\% } {}^{22}\mathrm{Ne}).$$

The necessary definiteness in the construction of the model to explain the anomalies in neon is the result of our critical experiment [2] (the hypothesis about paradoxical realization of the Mossbauer effect/EM): at the indicated "*resonance conditions*" there is doubling 1.85 ± 0.1 of the contribution of the orthopositronium component $\boldsymbol{I}_2$ of the lifetime spectra of the β^+-positrons e^+_β at decrease in the fraction of the isotope ^{22}Ne in the natural isotope composition — from 8.86% to 4.91% — in the sample for comparison. From the SM position, the possible change in $\boldsymbol{I}_2$ is vanishingly small: $10^{-7} - 10^{-6}$.

Self consistent phenomenology in the proposed model is formulated with reference to the results and conclusions of a number of creative searches for theorists (1962–2012) — by including in the final state of the β^+-decay of nuclei ^{22}Na, ^{64}Cu, ^{68}Ga and the like ($\Delta J^\pi = 1^\pi$) of the bounded 4-volume of space-time "outside" the Light Cone, instead of counterproductive phenomenology "*tachyon*, as a particle" [3].

Otherwise, it is impossible to explain the "isotope anomaly".

It is necessary to return to this fact ignored by the scientific community: among the known and presumed vacuum effects — from the Lamb shift of atomic levels and Casimir effect to the birth of the universe "in the Laboratory" [1, 4] — there is no discussion of a paradoxical realization of EM in the "resonance conditions".

The effect can be represented as the result of a *Topological Quantum Transition/TQT* of a bounded 4-volume of space-time in the final state of β^+-decay into a two-valued/± *Vacuum-Like State of Matter/VSM*$^{\text{"}+''}$ "*Through the Looking Glass*"/*TLG*$^{\text{"}-''}$ — *Long-Range Atom/LRA* with a *LRA Core*. In phenomenology, this is a kind of realization of a string (the Hamiltonian chain), at the nodes of which there are quasiparticles of all the ingredients of stable matter – quasiprotons ($\bar{p}$), quasielectron ($\bar{e}$), quasineutrino ($\bar{\nu}$) [2, 3].

According to the SM, negative masses are not physically realized, since otherwise such physical states would be unstable with respect to the catastrophic generation of an unlimited number "particle-antiparticle" pairs (disintegration of the vacuum). The prohibition of such "pathological states" underlies the Weak Energy Condition/WEC (NEC) of the General Relativity.

The model proposed in [3] of the LRA of the two-valued/± Planck mass

$$\pm M_{\mathrm{Pl}} = \pm\sqrt{\frac{(\pm\hbar)\cdot(\pm c)}{G}}\,, \quad G > 0,$$

with the total number of cells/nodes

$$\pm N^{(3)} = \frac{\pm M_{\mathrm{Pl}}}{\pm m_{\bar{p}} \pm m_{\bar{e}} \pm m_{\bar{\nu}}} \simeq 1.3\cdot 10^{19}$$

and a LRA Core [5]

$$\pm n \simeq 5.3\cdot 10^4,$$

in the final state of the β^+-decay type $\Delta J^\pi = 1^\pi$ stops the disintegration of the vacuum and substantiated the EM in "resonance conditions".

The main thing is that presented model is based on the assumption of a fundamental difference between the QED-orthopositronium formed in the substance as result of the production of the $e^+ - e^-$ pair from the β^+-orthopositronium/β^+-o-Ps, since it is possible to justify [3] that in the process of

formation and lifetime β^+-o-Ps in the substance a supersymmetry is realized [6]. The process is limited by the lifetime of β^+-o-Ps, which, being formed "inside" the Light Cone — oscillates due to single-quantum (virtual) annihilation.

So β^+-o-Ps objectively formalized the status of the physical observer.

In this case, the causality principle (global) is realized as a local causality principle due to the presence of β^+-o-Ps.

Because of the fundamental difference in the radii of interactions — infinite radius for electromagnetic and gravitational interactions and submicroscopic radii of "nuclear" interactions (weak ones, $r_w \sim 10^{-16}$ cm and $r_{str} \sim 10^{-13}$ cm) — there is no Coulomb barrier at interaction the LRA Core with ordinary substance.

In the gravitational field of the ground laboratory, the two-valued/± components of the LRA Core ($\text{VSM}^{\text{“}+''}/\text{TLG}^{\text{“}-''}$) diverge vertically by a distance h_G in the vertical during the lifetime of β^+-o-Ps ($\tau_{\text{o–Ps}} \leqslant 1.42 \cdot 10^{-7}$ s)

$$h_G = 2 \cdot \frac{g\,\tau^2_{\text{o–Ps}}}{2} \leqslant 10^{-11}\ \text{cm}.$$

Since $h_G \gg r_w$ and r_{str}, in the final start of the β^+-decay of ^{22}Na, ^{64}Cu, ^{68}Ga nuclei (TQT in the presence of β^+-o-Ps) at the nodes of the LRA Core, the quasiprotons of the $\text{VSM}^{\text{“}+''}$ ($\bar{p}$) are released (decompensation of the baryon charge) but the electric charges of the quasiprotons and the charges of the quasi-electrons of the $\text{VSM}^{\text{“}+''}$ ($\bar{p}^+$, $\bar{e}^-$) are compensated by the $\text{TLG}^{\text{“}-''}$ ($\bar{p}^-$, $\bar{e}^+$).

This means that there is no Coulomb barrier in the interaction of the LRA Core with the nuclei of the substance atoms. As a result, a Rigid Body/RB is formed (^{22}Ne) in the system

$$^{22}\text{Na}\,(3^+) \longrightarrow {}^{22*}\text{Ne}\,(2^+) \longrightarrow {}^{22}\text{Ne}\,(0^+) - \text{gaseous neon (8.86\% } {}^{22}\text{Ne).}$$

by way exchange interaction of the quasiprotons of the ^{22}Na nuclei from gas with the quasiprotons of the LRA Core at nodes ($\bar{n}$) during the lifetime of the β^+-o-Ps ($\tau_{\beta^+-o-Ps} \leqslant 1.42 \cdot 10^{-7}$)-collectivization of the γ_n-quantum ("resonance conditions" — the Mössbauer effect)

$$^{*22}\text{Ne}\,(2^+) \xrightarrow{\gamma_n \simeq 1.274\ \text{MeV}} {}^{22}\text{Ne}\,(0^+).$$

It is interesting that the ratio of the macroscopic dimensions of the LRA to the size of the LRA Core on the order of magnitude is equal to this ratio for atoms of the ordinary substance

$$\sqrt[3]{\frac{N^{(3)}}{\bar{n}}} \simeq \frac{r_H}{r_p} \simeq 10^5,$$

where r_H and r_p, respectively, are the radii of the hydrogen atom and the proton.

Conceptually, the stated phenomenology seems to have for a long time been foreseen:

"*A week energy conditions is not satisfied for the 'C-field' proposed by Hoyle and Narlikar* ⟨[7]⟩*, which is also a scalar field* $m = 0$*; only this time the energy-momentum tensor has the opposite sign and, consequently, the energy density is negative. In view of this, simultaneous production of quanta of fields with positive energy and C-field with negative energy is possible. This process take place in a stationary universe proposed by Hoyle and Narlikar, in which, as the particles increase, a new substance is continuously created as a result of the general expansion of the universe, so that a constant average density is maintained. However, such a process causes difficulties in terms of quantum mechanics. Even if the cross section of such process is very small, the presence of an infinite phase volume for quanta of positive and negative energy would lead to the production of an infinite number of pairs in a finite region of space-time*" [8].

With the adoption of the considered model, the process of real one-quantum annihilation of the β^+-o-Ps is

$$\beta^+\text{–o–Ps/p-Ps}' \longrightarrow \gamma\, U^{\pm}(\gamma^{\circ}/2\gamma'),$$

where γ° is a notoph [9], p-Ps′ is a parapositronium in the TLG, γ' is a photon/notoph in TLG and β^+-decay of nuclei of the type $\Delta J^{\pi} = 1^{\pi}$ with "resonance conditions" (EM) in the final state of the TQT [2, 3]

$$^{22}\text{Na}\,(3^+) \xrightarrow{e^+_{\beta} + \nu + U^{\pm}} {}^{22*}\text{Ne}\,(2^+) \xrightarrow{\gamma_n \simeq 1.274\ \text{MeV}} {}^{22}\text{Ne}\,(0^+) - \text{gaseous neon (8.86\% } {}^{22}\text{Ne).}$$

At the same due to the interaction of the neon atoms from the gas (90.88% ^{20}Ne, 0.26% ^{21}Ne) with the lattice nodes of the LRA Core, a quasi-nucleus [^{22}Ne–$\bar{p}$] ⇔ ^{22}Na is formed, since the nuclear-mass defect ^{23}Na (−9.5296) is maximal in comparison with ^{22}Na (−5.1840) and ^{21}Na (−2.1858).

The model realizes the thought first expressed in the report of M. Faraday to the Royal Society "*On the possible connection of gravity to electricity*" (November 28, 1850) — "*A long and unchanging conviction that all the forces of Nature are in mutual communication, having a common or rather, representing different manifestations of the single basic force…*" — the connection of physical interactions, including strong and weak (electroweak) interaction [10], open in the twentieth century.

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