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How could Einstein empty vacuum become stable quantum liquid with the common Einstein-Lorentz invariance and other standard model features?

Abstract. The global Einstein-Lorentz and gauge invariance arise in our hypersymmetric, double-waveguide space structure, filled by dynamical C-photowaves – locally massless quasiparticles, carrying +/-mass. This structure allows building yet unknown massless „bare" atoms – coupled e-/e+ electron/positron pairs – building blocks of the non-gravitating, equilibrium quantum vacuum with *zero energy density*, which allows the geometrical unification of basic physical forces, realizing the famous Unification Program of A. Einstein. The appropriative „large-scale" cosmological verification of this +/-M-symmetry is proposed.

Introduction

Planck started 1900 epoch of quantum physics, but till now it remains a kind of *empirical* theory, Feynman even mentioned that nobody understands quantum mechanics. Einstein noted, „alone corpuscular-wave dualism requires something unheard of before" (Einstein 1942). It is not surprising that modern physics accumulated many yet unsolvable *fundamental problems* as the *classical and quantum singularities, unification charge with gravity, origin of zero mass, no gravitation and zero vacuum energy, space flatness, accelerating universe expansion, etc.*

Where is the origin of zero mass from? Why not a string theory? M. Veltman assumes, that „the miraculous thing with the Standard Model (SM) is that originally ALL the particles in the SM have some zero mass..." (Hargittai 2004, p. 101). He asks, „is there a deeper layer to understanding the balancing of forces?" and notes, „we don't know why, but it gives you the suspicion that in the Higgs system there is probably another layer where the idea of mass gets another interpretation" (Id. p.101). He makes a penetrating remark here,

„the breaking of symmetry is not in the theory, not in the balancing of forces, it's in the way we look at it“ (Id., p. 107). M. Veltman joins that the very big hopes for modern string theory did not prove true, and the „strings and supersymmetry...explain nothing from things what we don't understand today” (Id., p. 107). G. ‘t Hooft says, „I think now that there must be some fundamental theory of Nature that we don't know about at all yet, where quantum mechanics does not enter any of the equations. The theory is totally deterministic, causal, coherent and consistent – having nothing to do with quantum mechanics” (Id., p. 125). Hoft's prophesying, correlating with Einsteinian vision, will be exactly realized below. V. L. Fritch makes very important note, „…the CP violation observer in the weak interactions is not nearly large enough to account for the matter-antimatter asymmetry in the Universe” (Id., p. 205). „Obviously, physicists have overlooked something fundamental in this universe, kind of mechanism, which care that all different components of cosmological constant are exactly zero” (S. Coleman 1993, p. 280). Thus, we propose below the simplest – the matter-antimatter symmetry!

Are there some unknown hidden symmetries? G. ‘t Hooft asks, „Why the cosmological constant is so small? One possible reason could be that there is symmetry” (Hargittai 2004, p. 127). „There is no theory for such a cosmological constant at present. It's a great mystery“ (Id. p. 128). L. M. Lederman notes, „There is a deep symmetry, which enables us to understand the EH force, the weak force, and the strong force. Gravity is stile a mystery” (Id., p. 152). He asks, „Is there any evidence for the Higgs fields? NO” (Id. p. 153) .A. Zee notes, „The most unsatisfying…is the present formulation of gauge theories. Gauge ‚symmetry’ does not relate two different physical states, but two descriptions of the same physical state”… Historically a very big surprise was to discover two fundamental hidden symmetries, *Lorentz invariance* and *gauge invariance*: two symmetries that „hold the key to the secrets of the universe. Might not our present day theory also contain some unknown hidden symmetries?”... „In dimensional destruction a D-dimensional theory may look (D+1)-dimensional in some range of energy scale: the field theory can literally create a spatial dimension”… this suggests „that quantum field theories contain considerable hidden structures waiting to be uncovered” (Zee 2003, p. 456–457). „One of the disappointments of *string theory* is its inability to resolve the cosmological constant problem. But the brane world scenario offers a glimmer of hope” (Id., p. 436). S. Weinberg recalls the „idea of „ether“, and that „Einstein solved the problem by IGNORING it.”… (Hargittai 2004, p. 27).

The comeback of the quantum ether. Later A. Einstein totally reconsider his „anti-ether“ conclusion and explained that „according to the general theory of relativity space without ether is unthinkable; for in such space there not only would be no propagation of light, but also no possibility of existence for standards of space and time”. He clamed some essential physical properties for this hypothetical ether: (a) it must be a non-pondermotor, non-gravitating media; (b) the corresponding sound-light waves in this media must be transverse (as the transverse light waves) and, thus „must be of the nature of a solid body“ (Einstein 1920). In these times he could not take in consideration the new promising ether analogy with quantum liquids where the „transverse light waves” are natural (Volovik 2003).

The forces unification problem. „We have working theories of particular systems…, but none of the whole, nor even a plausible concept of what a whole theory of nature might be like”…, „the central problem of physics today is to reconcile the concepts of quanta and gravity”, writes D.R. Finkelstein (1996, pp. 34, 166). „The general relativity has unavoidable space-time singularities”. „The deep incompatibility between the basic structures of general relativity and of quantum theory of quantum gravity requires a profound revision of the most fundamental ideas of modern physics.” (Isham 1993**,** p. 4–5). E. Witten concludes, „In the String Theory (ST) we do not have the analogue of the Einstein-Hilbert action” (Witten 2003, p. 458).

The waveguide model of physical space

Attempts at building the general theory of electricity and gravity. T. Kaluza (1921) introduced the 5^{th} dimension into the 4–dimensional physical space (x,y,z,t) of the gravity theory of Einstein. O. Klein (1926) and V. Fock (1926) discovered that trajectories of the charged particle correspond to geodesic lines with the 0-length (geometrical beam). They showed that the classical *physics of relativity* is equivalent to the *geometrical optics* on a beams transmission in the 5D-space and the *quantum mechanical* movement of the charged particle is equivalent the *wave optics* on the transmission of scalar waves in 5D-space, if the wave function ψ has *cyclical condition*: $\psi(x^1,x^2,x^3,t,x^5) = u(x^1,x^2,x^3,t) \exp[2\pi i(MC/h)x^5]$. In this case will arise the well-known equation for waves of matter (the 3D+1-wave of de Broglie). A. Einstein and P. Bergmann (1938) proposed the periodical condition for metric potentials in the 5^{th} coordinate (i.e. they unrolled the cylindrical surface onto a „plate” in the 5^{th} dimension, and conserved the periodicity, connecting with the cylindrical Kaluza model of the 5^{th} dimension. J. B. Rumer (1956) also introduced the 5^{th} coordinate, but in these x^5-theories there is not clear is the generic physical nature of the necessary, basic *cyclical condition* $\exp[2\pi i(MC/h)x^5]$.

The waveguide hyperspace structure. We have (Gribov 1999, 2003) the simplest proposal – instead of the cylindrical-like 5^{th}-dimension (x^5) it introduces the linear additional dimension as the „substantial" *super-thin, elastic flat waveguide* with the constant thickness $\Delta X^5 = \Delta L = L_o$ and endless in our physical macro-space ($x,y,z,0<L<L_o$). We proposed also that mass-particle is the light-speed „photowave" quanta with $E=h\nu=MC^2$ in this waveguide (having phase speed $\mathbf{C} = (V_x,V_y,V_z,C_l \neq 0)$; C^2 = const for all inertial systems of coordinates.). The „resting" energy $M_oC^2 = h\nu_o$ is *dynamically* installed in the substantial layer $\Delta L = L_o$ as a *resonance* photowave-quanta ($\gamma = 2L_o$, $\nu_o = C/2L_o$). This photowave has $V_{mech.} = V_x \equiv C_x$ and moves with the light speed along the *quasi-polygonal trajectory*, $\sin\alpha=C_x/C$, $\cos\alpha=\sqrt{(C^2-V^2)}/C=\sqrt{(1-V^2/C^2)}$, (Fig. 1.1).

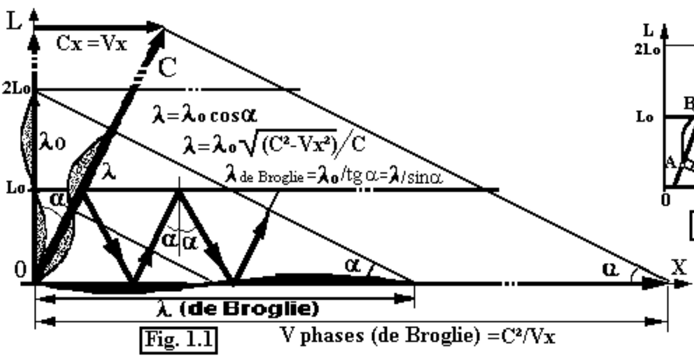


Fig. 1.1

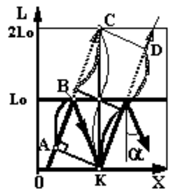


Fig. 1.2

Notably, the Einstein relativistic mass equation $M = M_o/\sqrt{(1-V^2/C^2)}$ arises here *as a pure wave-effect* – as the *„self-interference*" – between parallel segmented wave elements (Fig.1.2), quite similar to the thin oilskin model of the wave optics: $E(V_x) = E(\alpha) = h\nu = h\nu_o/\cos\alpha$ with its corresponding relativistic mass $M = M_o/\sqrt{(1-V_x^2/C^2)}$. The wave energy $E = h\nu = h/(C/\lambda)$ could pass along the waveguide L_o if two parallel wave-trains AC and OD have the same wave phase on the line $AK\perp AC$. Here the wave path difference ΔS is $\Delta S=AB+BK$ (Fig. 1.2). Our wave is additionally reflected two times (in the points B and K, that adds $\pi+\pi = 2\pi$ phase. The ΔS-interval must contain one integer wavelength λ and is equal to the cathetus AC = AB+BC = AB+BK =

λ in the square triangle KAC where ∠KAC = 90°, with its hypotenuse KC = λ_o. Thus, we obtain $\lambda = \lambda_o\cos\alpha$, $\nu = \nu_o/\cos\alpha$, $h\nu = h\nu_o/\cos\alpha$ and $M = M_o/\sqrt{(1-V_x^2/C^2)}$. The Kaluza's *cyclical condition,* mentioned above, very naturally arises here as a *result* of the *„photowave's" dynamics* in the waveguide, where our physical quantum mass-particle (electron) is the dynamical resonance photowave $\psi(x,y,z,0<L<L_o)$, $\psi = \psi_o\cdot\exp[-2\pi i\,(nt-K_xX-K_yY-K_zZ-K_l L)]$ or $\psi = \psi_o\pi\exp[(-2\pi i/h)(Et-P_xX-P_yY-P_zZ-P_lL\,)]$, where $\mathbf{K} = (K_x, K_y, K_z, K_l)$ is the wave vector **K,** with $|\mathbf{K}| = 1/l$ performing here the x^5 „wave function" of quantum mechanics, repeating the relativistic x^5-Klein-Gordon equation, transforming into the common Schrödinger equation if V<<C. The $P_l = M_{oe}C$ = const, (see below), gives now physically transparent cyclical x^5-condition (1). The wave of de Broglie arises here naturally as the spatial crossection $\psi(x,y,z,L = 0)$. Formally, the Klein-Gordon wave corresponds to bosonic field or bosonic particle (spin $S = h/2\pi$), but this photowave has now its P_l photopressure, deforming our waveguide $0<L<L_o$, and building the self-focused, spatially localized *cylindrical quantum loop-attractor,* arising in the elastic waveguide (see below). The second *very distinguishing and basic aspect* of our waveguide space structure is its ±M-mass symmetry for particles and antiparticles: we proposed for this purpose the double-waveguide│e–│e+│, like $\pm L_o$ sandwich, symmetrically divided into two identical flat layers – for *particles* $(x,y,z,0<L<L_o)$ and for *antiparticles* $(x,y,z,-L_o<L<0)$ (Gribov 1999, 2003). P. Dirac initially proposed this in his great 1928 work, which predicted positrons, but later this was roughly criticized and even forbidden.

Optical mechanism of photoacceleration. The photowave has an orthogonal momentum $MC_l \neq 0$, this creates pressure inside the elastic guide layer and *deforms* it. The optical acceleration g_x was shown for the small opening of the angle $\beta \approx 0$ between two side-plates of the above-mentioned waveguide (Fig. 2.1).

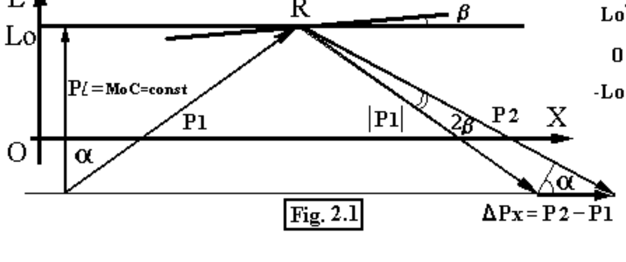


Fig. 2.1

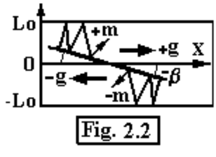


Fig. 2.2

The local accelerating force is on average $f_x = \Delta P_x/\Delta t$, ($\Delta P_x = 2\beta|P1|/\cos\alpha = 2\beta MC/\cos\alpha$ and $\Delta t = (2L_o/\cos\alpha)/C$), i.e., $f_x = Mg_x = \beta MC^2/L_o$. Thus, the photoacceleration $g_x = \beta C^2/L_o$ does not depend of the M, so the local unparalleled deformation can be strictly considered as the potential $U(x) \sim L(x)C^2/L_o$ of the classical gravitation field $F_x = -\partial U(x)/\partial x$, where $\mathrm{tg}\beta(x) = \partial L(x)\partial x \approx \beta(x)$ for very small $\beta(x) \approx 0$, $\mathbf{g} = (\beta_x,\beta_y,\beta_z)C^2/L_o$, $g^2 = (\beta^2{}_x+\beta^2{}_y+\beta^2{}_z)C^4/L^2{}_o$. It is easy to show that the „resting" resonance photowave $E_o = h\nu_o$, ($T_o = 2L_o/C$) vibrates slower in the thicker substantial layer $L = L_o+\delta L>L_o$, (where $T = T_o+2\delta L/C$), and the corresponding substantial micro-times-slowing δT is the same as in the gravity field of Einstein. The one-signed mass particles *attract each other***,** but the oppositely signed masses particles (+M, –M) *repulse* each *other*, because the $+\beta \Rightarrow -\beta$ and we have ±opening for the same photogravity field $\mathbf{g}_x$ (Fig. 2.2).

On the spatial structure of the photoparticle

It is easy to show that the photowave's orthogonal momentum $P_\perp = P_l = MC_l = M_{oe}C$ = const will be the constant of motion, while $M = M_{oe}/\sqrt{(1-V^2/C^2)}$ and $C_l \equiv \sqrt{(C^2-V^2)}$, if we postulate that our photowave has the same phase velocity C = const for all possible directions in the layer – that the L_o-layer medium is homogeny and isotropic and our photowave quanta has energy $E = h\nu_e = M_eC^2$. The invariance of the $P_{\perp e} = M_{oe}C$ causes the *invariance of electron charge*, created by its orthogonal photopressure $F_{le} = F_{\perp e}$ = const (see below). The total force $f_{\perp e}$, orthogonal to this „substantive membrane" is surprisingly huge for very tiny, resting electron or positron quanta, $f_{\perp e} = f_{le} = 2\Delta P_{le}/\Delta T$, thus, $f_{\perp e} = \pm 2M_oC/(2L_o/C) = \pm M_oC^2/L_o$ and finally $f_{\perp e} \approx \pm 6{,}7$kg!

The (D+1) nature of the Higgs mechanism. Note, that the $L^5{}_o$-layer is the literal waveguide analog of the famous Einstein mirror clock (where $|C|$ = const) and automatically contains special relativity and very simple (3+1D)-mass M_{oe} and charge Q_e appearance (caused by the $P_{le} \neq 0$) as universal physical sense of the Higgs mechanism!

The relativistic nature of the fermionic spin h/4π. The orthogonal pressure $\pm f_\perp$ inside the $\pm L_o$-layers creates a local non-parallelism between outside framing membranes (x,y,z,$\pm L_o$) and the middle one (x,y,z, L = 0), (we have $-\delta L_o$ for particle and $+\delta L_o$ for antiparticle and assume that only the middle membrane is deforming. Such inevitable, naturally local swellings will further concentrate the photowave energy by the mentioned above mechanism of photoacceleration $g = \beta C^2/L_o$, directed towards the swelling elevation! This creates the crucially important phenomenon – the self-organizing *self-focusing dynamics, -self-localizing the photowave energy* in the form of the tiny quantum attractor – „quantum topological defect" – the spinning, non-dissipative quantum vortex – building the almost *point-like particle*, but now with the definite-finite quantum loop radius $R = h/4M_{oe}C$, expresses the *generic spatial structure of the elementary photoparticle*. If the photowave is self-focused and stabilized in the plate ($x \approx 0, y \approx 0, z, 0<L<L_o$) into a quantum attractor, and moves along OZ, the full photowave vector remains $|C|$ = const; but it will have symmetric rotational components $C_y(t)$ and $C_x(t)$. This will provide the same spin directed along the axes OZ. In the non-relativistic frames the minimal resonance loop $2\pi R_o$ must contain *only one length* of $\lambda_{deBroglie}$: $2\pi R_o = \lambda_{deBroglie} = \lambda/\sin\alpha$, where $\sin\alpha = \sqrt{}(C^2_x+C^2_y)/C$. But for very small loop (and very small $\lambda_{deBroglie}$) we will reach relativistic rotating speed $\sqrt{}(C^2_x+C^2_y) = C_{|\,|}$ comparable with C and we must take in account relativistic loop length shortening $2\pi R_o\sqrt{}(1+C^2_{|\,|}/C^2)$! Now the same $\lambda_{deBroglie}$ will cover longer interval $l_{rel}>2\pi R_o$, where the $l_{rel} = 2\pi R_o\sqrt{}(1-C^2_{|\,|}/C^2)+\Delta l=\lambda_{deBroglie}$. Obviously, that the search relativistic length l_{rel} will be derived at $\sqrt{}(1+C^2_{|\,|}/C^2) = 1/2$, giving corresponding resonance condition $l_{rel} = 2\pi R_o/2+2\pi R_o/2$, where $R_{o/rel} = R_o/2$. Now we derive $4\pi R_{o/rel} = \lambda_{deBroglie}$. This means that the $C_l = C/2$, $C_{|\,|} = C\sqrt{}3/2$ and $\alpha = 60°$ in the *relativistic* electron attractor. The searched spin $S_{ez} = M_e(\pm C_{|\,|})R_{o/rel} = \pm M_e C\sin\alpha R_{o/rel}$ and then $S_{ez} = \pm M_e C\sin\alpha\lambda_{deBroglie}/4\pi$. We recall that the $\lambda_{deBroglie} = \lambda/\sin\alpha$ and $M_eC^2 = h\nu=hC/\lambda$, thus the $S_{ez} = \pm h/4\pi$ and $R_{o/rel} = h/4\pi M_{oe}C$. This radius corresponds to the magnetic moment $\mu_{oe} = eh/4\pi M_{oe}C$ for electron.

The nature of the photon and neutrino spin. The resonance $\lambda_{deBroglie}$ wave is twisted *two times* around the cylindrical electron attractor. This relativistic coaxial double-loop could be formally considered as consisting of two half-spinors $S_e = h/8\pi+h/8\pi$. Thus, e-/e+ coupled pair has zero spin $S_{coupl} = h/8\pi+h/8\pi-h/8\pi-h/8\pi = 0$, which could be disturbed as $S_{dist} = S_{photon} = h/8\pi+h/8\pi+h/8\pi+h/8\pi = h/2\pi$, or as $S_{neutrino} = h/8\pi+h/8\pi-h/8\pi+h/8\pi = h/4\pi$.

The fractal-like multilevel leptonic quantum vacuum paradigm. Fundamental ideas of D. R. Finkelstein that „physical space-time is a locally finite assemblage of discrete finite quantum elements" and that „spacetime structure is already quantized" (Finkelstein 1996, pp. 478, 482) are realized in our conception of the fractal-like quantum vacuum microstructure:

$V^4 = V^3+1$ (e-/e+) is our global $\pm M_{oe}$-hypersymmetric e-/e+ quantum liquid level, filled by it's the biggest „V^4-atoms"- the e-/e+ coupled pairs, providing

the common global Einstein-Lorentz invariant and the global QED-gauge invariance for photons and electron neutrino. This global nongravitating vacuum must have its locally massless mother-vacuum, consisting of the more fine-grained „atoms" filling its $\pm L_{oe}$ waveguids – building bricks for e-/e+ attractors.

$V^5 = V^4+1$ (mu-/mu+). We connect this mother-vacuum with leptonic muon/antimuon composites – building mu-/mu+ locally massless quantum liquid, where our electron C-photowave has the same maximal velocity C. The μ-/μ+ Cooper-like coupled muonic attractors have much more thin muonic waveguids with $\pm 2L_{o\mu}=\lambda_{\mu o Compt}$

$V^6 = V^5+1$ (tau-/tau+). We could extend this principle to ever deeper leptonic generations and propose that the local grandmother of the e-/e+ vacuum is the $\pm M_{o\tau}$ quantum liquid and so on.

Unification gravitational and electrostatics forces

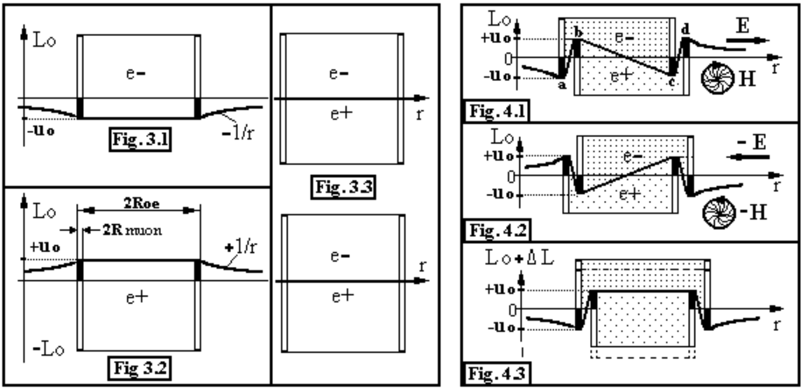
The ±Q-electromechanical-membrane analogy. R. Feynman showed that a thin, elastic two-dimensional flat membrane (x,y), having very strong surface tension τ = const, is the full analogy to electrostatic potential – with a static membrane deviation from its flat state (Feynman et al. 1966, v. 2/5 p. 243–246). The orthogonal mechanical force $f_\perp$ is here the full analog of „electrical charge" (imagine cylindrical pencil with radius R_o, pressing the membrane surface with the force $\pm f_\perp$). The ±Q charges (and ±potentials) are realized here by the opposite ±f pressure – from two different sides of this membrane! (Id. p. 243). If deviation is $\delta L(x,y) \approx 0$, the membrane tension $\tau(x,y) \approx$ const and we have $\nabla^2 \delta L(r) = -f_\perp/\tau$. It is the exact analog of electrostatic potential U(r) for charge ρ/εo in the equation $\nabla^2 U = -\rho/\varepsilon_o$, (Id. p. 245). This deviation corresponds to the electrostatic potential of the regularly charged endless cylinder with the radius R_o. Feynman notes, that the equation $\nabla^2 \delta L(r) = -f_\perp/\tau$ will be the same also in the case of the 3D-membrane, realizing now the deformation of the 3D-elastic body. Thus, we obtain now the very important 3-dimensional membrane analog $\delta L(x,y,z) = \delta L(r) \approx \pm 1/r$, strictly corresponding to the 3D-potential of a regularly charged sphere with radius R_o. We have no singularities $U(r = 0) = \pm\infty$ here, $U(r \sim 0) = \pm 1/R_o = \delta L(0<r<R_o)$ = const!

The ±M-gravitomechanical-membrane analogy. If the middle membrane (x,y,z,L = 0), strictly dividing e- and e+ wave-guides in our vacuum space, has very small deviations $\pm\delta L(x,yz) \approx 0$, we would have gravity potential

$U_{gr}(x,y,z) \approx \pm\delta L(x,y,z)C^2/L_o$, mentioned earlier (Gribov 1999, 2003). Thus, we identify both electrostatic and gravity potentials with the same middle 3D-membrane deviations $\pm\delta L(x,y,z)=\pm\delta L(r)\sim\pm 1/r$! Thus, the Newton (gravity) and Coulomb (electrostatic) laws could have the same 1/r character!

The „hidden" reciprocal ±M symmetry creates the relation $F_{el}/F_{gr} \approx 4\times 10^{42}$.

We can estimate some geometrical characteristics of the 1/r attractors form (Fig. 3.1; 3.2), if we compare our „photogravity" potential $\delta L(r)C^2/L_{oe}$ with the common gravity potential for an electron $U_{gr}(r) = GM_{eo}/r = \delta L_{gr}(r)C^2/L_{oe}$, where G is the gravitational constant.



Thus, now the membrane deviation $\delta L_{gr}(r) \equiv u_{gr}(r) = -(GM_{oe}L_o/C^2)/r$. Within the interval $R_{oe} \geq r \geq 0$, ($R_{eo} = 2\pi L_o$) we have now $u_{gr}(R_{oe}) = u_{max} \equiv u_{ogr} = -2\pi GM_{oe}/C^2$, where $u_{ogr} \approx -4{,}2\times 10^{-55}$cm. The relation $\delta L_{gr}(r)/L_{oe} \approx 10^{-55}/10^{-10} \approx 10^{-45}$, that keeps $\nu_{oe} = C/2L_o = \text{const}$.

Now we will combine the very smooth gravity deviation $U\sim -1/r$ potential (Fig, 3.1; 3.2), described above, with the (e-/e+) quantum vacuum polarization under this oppositely acting gravitational force **F**, ($\mathbf{F}_{e-} = +\mathbf{g}_{gr}M_{oe-}$) for electron, and the opposite $\mathbf{F}_{e+} = -\mathbf{g}_{gr}M_{oe+}$ for positron respectively). Here will be derived the geometrical sense of the electrostatic tension energy, deeply hidden from common physics. The enormous density of electrostatic energy arises here as the unexpectedly very strong reciprocal ↓↑ membrane deformation __/‾‾ or ‾‾__ caused by the axially shifted cylindrical attractors in the coupled e-/e+ pairs under the smooth 1/r membrane deviance! We associate the smooth 1/r membrane tensions __/ and /‾‾\ with the gravity energy E_{gr} and the accompanying reciprocal polarizing membrane tension __/‾‾ with the electrostatic vacuum energy E_{el} related to our free electron or positron attractors. Earlier we described this very simple geometric picture of the basic classical forces similarly but only qualitatively (Gribov 1999, 2003), without evaluation of the above mentioned __/‾‾ deformation energy.

The local membrane straining $\delta r(r)$, connected with its full deviations $\delta L(r)$, could be consider independently for the smooth membrane deviation $u_{gr}(r) = -(GM_{oe}L_o/C^2)/r$ – for the straining δr_{gr}, and for the reciprocal __/‾‾ deviation – the straining δr_{el} . Now we can acquire the enormous relation E_{el}/E_{gr} between these two membrane strainings, if we assume that:

(1) The local smooth membrane straining $\delta r_{gr}(r)$ is connected with the very small deviation from the parallelism on an angle $\beta_{gr}(r) \approx \partial u_{gr}(r)/\partial r \approx 0$ and is approximately $\delta r_{gr} \approx \beta^2{}_{gr}(r)dr$ (Fig. 5.1). We recall that the photoacceleration $g_{gr}(r)=\beta_{gr}(r)C^2/L_{oe}=GM_{oe}/r^2$, thus the $\beta_{gr}(r) = (GM_{eo}L_{oe}/C^2)/r^2$, or $\beta_{gr}(r) = u_{ogr}R_{oe}/r^2$. Here $dE_{gr} = \sigma\delta r_{gr}4\pi r^2 = \sigma\beta^2{}_{gr}(r)4\pi r^2dr$; $dE_{gr} = \sigma u^2{}_{ogr}R^2{}_{oe}4\pi r^2dr/r^4 = \sigma u^2{}_{ogr}R^2{}_{oe}4\pi dr/r^2$, where $\sigma(r) = \sigma = const$ is a very strong constant bulk tension of our 3D-membrane. The full tension energy $E_{gr} = \int^{\infty}{}_{Roe}dE_{gr}$, $= 4\pi\sigma u^2{}_{ogr}R_{oe}$, (where $u_{ogr} = 2\pi GM_{oe}/C^2$ and $R_{oe} = L_o/2\pi$): $E_{gr} = 4\pi\sigma u^2{}_{ogr}R_{oe}$,

(2) This smooth gravitational potential $u_{gr}(x)\sim 1/r$ will provide polarization of e-/e+ vacuum pairs around of the free electron attractor R_o, that will create reciprocal *radial* __/‾‾ membrane strainings in the each e-/e+ pair of vacuum (Fig. 4,1;4,2;5,3). This reciprocal local __/‾‾ membrane straining δr_{el} must be also distantly reduced as $1/r^2$, as is reduced the polarizing reciprocal gravitational force $g(r) = \pm\partial u_{gr}(r)/\partial r\sim\pm 1/r^2$, (see Fig. 2,2). The δr_{el} consists approximately of 2 identical quasi-orthogonal intervals **ab** $\approx 2u_{ogr}$ and **cd** $\approx 2u_{ogr}$ for each single e-/e+ pair (see Fig. 4.1; 4.2). But we must take in account additional straining interval **da** $\approx 2u_{ogr}$, arising between two neighboring e-/e+ pairs, placing along radius r. (Fig. 5.3).

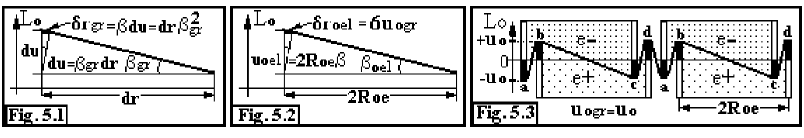


Fig. 5.1 Fig. 5.2 Fig. 5.3

We could imaginary unfold these *radial* __/\\/‾‾ membrane $(2u_{ogr}+2u_{ogr}+2u_{ogr})$-strainings, related to each e-/e+ pair, into the smooth elements, building now imaginary smoothed function $U_{el}\sim k_{el}/r$ (see Fig. 5,2). This imaginary smooth function U_{el} has its local very small angle $\beta(r)_{el} = \partial U_{el}(r)/\partial r \approx 0$, and it is changed as $\beta(r)_{el}\sim 1/r^2$. We have $\beta_{max}(r = R_{oe}) \equiv \beta_o$

and thus, $\beta(r)_{el} = \beta_o R^2_{oe}/r^2$, with very small angle $\beta_o = \sqrt{}(6u_{ogr}/2R_{oe}) \approx 0$, (see Fig. 5,2). Thus, $\beta(r)_{el} = \sqrt{}(6u_{ogr}/2R_{oe})R^2_{oe}/r^2$ and electrostatic straining $\delta r_{el}(r) \approx \beta^2(r)_{el}dr = [(6u_{ogr}/2R_{oe})R^4_{oe}/r^4]dr$. Walls of our e- and e+ cylinders R_{oe} have a small thickness, they cannot be thinner as the $2R_{omu}$, while these walls are built from the corresponding muonic vacuum „atoms" (see our fractal vacuum concept above). It is proposed that this thickness $d_{ewall} = d_{min}$ and is exactly the $d_{ewall} = 2R_{omu}$. Thus, the electron/positron orthogonal reciprocal straining is distributed in each polarized e-/e+ pair along two thin ring-strip areas $2\Delta S_o = 2(2\pi R_{oe} 2R_{mu})$. In the further integral account we must use these strainings, averaging on the full approximately quadratic e-/e+ micro-space-cell $\Delta S_{sq} \approx 2R_{oe} \times 2R_{oe}$, containing these straining ring-strips, i.e. we must use averaging multiplicand $2\Delta S_o/\Delta S_{sq} = 2\pi R_{omu}/R_{oe}$ for each e-/e+ ring-straining, thus, the local straining $\delta r_{el}(r) \approx [(6u_{ogr}/2R_{oe})R^4_{oe}/r^4]dr$ will be written as the $\delta r_{el}(r) \approx (2\pi R_{omu}/R_{oe})[(6u_{ogr}/2R_{oe})R^4_{oe}/r^4]dr$, Now we form the $4\pi r^2$ spherical layer with $dE_{el} = \sigma \delta r_{el}(r) 4\pi r^2$ and then write the final integral form $E_{el} \approx \int^{\infty}_{Roe} \sigma(2\pi R_{omu}/R_{oe})(6u_{ogr}/2R_{oe})R^4_{oe} 4\pi r^2 dr/r^4$. Thus, we derive: $E_{el} = 24\pi^2 \sigma R_{mu} R_{oe} u_{ogr}$ .The search relation $E_{el}/E_{gr} = 24\pi^2 \sigma R_{omu} R_{oe} u_{ogr}/ 4\pi\sigma u^2_{ogr} R_{oe}$, and finally $E_{el}/E_{gr} = 6\pi R_{omu}/u_o$ where $R_{omu} = h/4\pi M_{omu} C = 0{,}934 \times 10^{-13}$cm, $u_{ogr} = 2\pi G M_{oe}/C^2 = 4{,}235 \times 10^{-55}$cm. The numerical computation gives $(E_{el}/E_{gr})_{EMMA} = F_{el}/F_{gr} \approx 4{,}145 \times 10^{42}$. This means that we derive almost the same (with only 0.5% difference) value as the empirical value $(E_{el}/E_{gr}) \approx 4{,}169 \times 10^{42}$! We recall that $F_{el}/F_{gr} = (e^2/r^2 4\pi\varepsilon_o)/(Gm^2_e/r^2) = U_{el}/U_{gr}$ and is compared with the $(E_{el}/E_{gr})_{EMMA}$. The electron charge comes from the last equation as $e^2/\varepsilon_o = 3hCM_{oe}/M_{omu}$. If $E_{el} = 24\pi^2 \sigma R_{omu} R_{oe} u_{ogr} \approx M_{oe} C^2$ we have $\sigma \approx 9{,}45 \times 10^{72}$ [gcm/sec²cm²]!

New paradigm of liquid quantum ether supports our concept

Hu 1996; Padmanabhan 1999; Laughlin and Pines 2000; Volovik 2003 showed that „properties of our world such as gravitation, gauge fields, elementary chiral fermions, etc., all arise in the low energy corner as low energy soft modes of die underlying Planck condensed matter" (Volovik 2003, p. 7). „It is assumed that the quantum vacuum of the Standard Model is also a fermionic system, while the bosonic modes are the secondary quantities, which are the collective modes of this vacuum". „Its physical structure on a ‚microscopic' trans-Planckian scale remain unknown, but from topological properties of elementary particles of the Standard Model one might suspect that the quantum vacuum belongs to the same universality class as 3He-A. More exactly, to reproduce *all the bosons and fermions of the Standard Model*", „but the effective gravity still remains a caricature of the Einstein theory. (Id., p. 5, p. 8). Two mentioned above condensation concepts totally support our vacuum architecture, consisting of the hypersymmetric-condensed ±electrons vortexes – Fermi quantum liquid, keeping the Standard Model complex with its U(I)×SU(2)×SU(3) symmetry, really consisting „of some discrete elements – bare particles – whose number is conserved” (Volovik 2003, p. 18). This vacuum keeps global Lorentz and U(I) gauge invariance at the low T for its quasiparticles!

The paradigm of the non-gravitating equilibrium vacuum is exactly „at home”, it is the straight result of the underlying ±space-geometry, but with the immediately arising anti-gravity with its symmetrical „anti-Minkowski space”. This paradigm „cannot be derived within the effective theory. *It can follow only from the still unknown fundamental level.***”** */I.G./* (Id., p. 8). We need a *‚perfect’ quantum liquid*, „where in the low-energy corner the symmetries become exact to a very high precision as we observe today in our Universe.” (Id., p. 463).

Why the most profound physical idea of ±M-symmetry of P. Dirac was lost? If we change simultaneously the sign of mass and charge, our now fully „hypersymmetric” positron will fly in the same direction as the electron! But this is common nonsense while they are revolved in the opposite directions. But in the frames of our space-anti-space symmetry it is easy to show that not only the signs of mass and charge are switching, *the sign of the acting field **H**, **E** and **g*** for our positron is *switching simultaneously as –**H**, –**E**, –**g*** (see Fig. 1.2 and Fig. 4.1; 4.2). The positron „senses” all these fields as the opposite! This *essential „field signs” correction* fully rehabilitates the unjustly „forbidden” and forgotten Diracian ±M-symmetry. Now we have two absolutely correct equations:

For magnet field ± H: a_{e-} = –QVH/M, a_{e+} = +QV(–H)/(–M) = +QVH/M. (Fig. 4.1 and Fig. 4.2). *For electrostatic field ± E:* a_{e-} = – QE/M; a_{e+} = +Q(–E)/(–M) = +QEM. (Fig. 4.1 and Fig. 4.2).

For gravity field ± g: a_{e-} = (M/M)g, or a_{e-} = +g ; a_+ = (–M/–M) (–g) = –g. (Fig. 1.2);

The waveguide nature of the Yukawa potential. The Yukawa’s exponential suppressing factor e^{-mr} has the straight analog with our wave-guided vacuum: there is the same exponential suppressing factor e^{-kr} for the electromagnetic (EH) wave propagation in the rectangular waveguide for the EH waves E_y = $E_o \sin K_x x\ e^{i\omega t} e^{-kz}$ (Feynman et al. 1966 v. 2/6, p. 228).

The universal sense of the fundamental Planck constant h. All possible bosonic Cooper-like-composites of our physical quantum vacuum (e-/e+, mu-/mu+, tau-/tau+, …, (x-/x+)…attractors) have the same quantum bosonic spin structure $S_o = h/4\pi h/4\pi = 0$ or, after the perturbation $S_1 = h/4\pi + h/4\pi = h/2\pi$ that explains the universality of the minimal action h.

The geometrical sense of unified fields. After annihilation – then the photoparticles e- and e+ are coupled in our sense – their summary membrane straining energy $2E_{membr} = |2M_oC^2| = |2E_{gr}| + |2E_{el}|$ is liberated and is *fully conversed into radiation*, but both generic quanta $h\nu_{oe-}$ $h\nu_{oe+}$ do not disappear. They realize „the ghosts of the theory of gauge fields", they „are scalars (spin 0) and yet obey odd statistics" (Finkelstein 1996, p. 436).

The self – renormalizability. The common theoretical estimate $\rho_{theor} / \rho_{experim} = 10^{123}$ for vacuum energy density! But in our ±M-vacuum – it is now $\rho_{vacuum} \approx 0$, as it is for quantum liquids.

The nature of the Einstein Equivalence Principle. The gravity has *always-dynamical (equal) sense* in our waveguide system. *Dynamical* quanta pressure $f_\perp = M_oC^2/L_o = h\nu_o/L_o$ causes (1) the 1/r gravity potential $\delta L(r) \sim U(r) = -GM/r$ (as the 3D-membrane deviation $\delta L(r)$ and (2) this very smooth β_{gr}-deformation provides *dynamical* photoacceleration $F_{gr} \approx \beta_{gr} MC^2/L_o = \beta_{gr} h\nu/L_o$ of this quanta under an outside gravity field.

Where is the Goldstone boson from? If we look attentively into the structure of the coupled e-/e+ quantum attractor (Fig. 3.3), we note that its strictly reciprocal coaxial state looses its confining frames (Fig. 3.1; 3.2) – the middle membrane becomes flat. Thus, a potential energy $U(\Delta r)$, coupling these interacting e-/e+ attractors, has its unstable equilibrium state at $\Delta r = 0$ and looks exactly like common „hat-like" potential for the Goldstone boson ⌣∩⌣. It means that the two coupled coaxial e-/e+ attractors could jump off into a kind of stable equilibrium asymmetric (degenerate) state, $U(\Delta r_o \neq 0) = U_{min}$. This hidden radius is approximately the $\Delta r_o = 2R_{omu}$ (Fig. 4,1; 4,2). This asymmetry allows all possible $\Delta \mathbf{r_o}$ orientations of this slightly quasi-polarizating coupled pair. This degree of freedom has common QED-association with the massless Goldstone boson and the Goldstone mode. This spatial asymmetry $\Delta \mathbf{r_o}$ will have random distribution in the flat e-/e+ quantum vacuum, filled by the coupled e-/e+ pairs. If a free electron and deviation $u(r) \sim k/r$ arise, the previous zero random vacuum polarization $\Delta \mathbf{r_o}$ will get corresponding radial order proportional to the $\mathbf{g}(r)$, i. e, $\Delta \mathbf{r_o} \sim k/r^2$ and we derive the same E_{el}/E_{gr} calculation, $E_{el}/E_{gr} \approx 4 \times 10^{42}$, see above. If this Goldstone boson arises in the muonic vacuum with $C_\perp \neq 0$, it will become mass, – the Goldstone's potential „hat" will be turned!

The further direct examination of the above proposed ±M-symmetry. Only now *the first direct experimental examination of presented physical concept arises*, connected with the *neutral anti-hydrogen* atoms studies, provided recently in *CERN* (*ATHENA*-research group of *R. Landua*), where enough cold *neutral antimatter* is created.

Cosmology with the ±M baryonic symmetry

The Global ±M-Neutral Cosmological Symmetry Paradigm. This paradigm (Gribov 1999, 2003; Ripalda 2001) provides a solution for the most fundamental cosmological problems (the *Horizon Problem*, the *Flatness Problem*, the *Repulsive Dark Energy Problem*, the *Accelerating Expansion Problem*; the large-scale *Foam-like Structure Problem*). We suppose the large-scale baryon-antibaryons matter *symmetry*, i.e. $\sum(+M_{bar.}-M_{antibar.}) = \sum M_{Universe} = 0$. These fundamental symmetry is crucial not only for the elementary particle physics, including the Standard Model, they become crucial for understanding the ±M-neutral (on the large-scale) universe.

The Horizon Problem. The mixture of the ±M baryonic matter creates the large-scale *repulsive potential*, common, e.g., in the electrically neutral liquids with positive and negative ions (see Ripalda 2001). This negative pressure was much higher in the early more dense earlier universe, providing a very high expansion rate $R(t) \rightarrow t^n$ $(n>1)$.

The Accelerating Expansion Problem. The repulsive +/-M gravity potential – the negative pressure – explains the resent observations data of the accelerating universe expansion. But this acceleration is impossible from the point of view of the common asymmetrical +M physics, if not proposed some unknown repulsive material agent (Caldwell et al. 1998).

The Flatness Problems is easy explained by the zero baryonic mass $\sum M_{Universe} = 0$ of the universe. The –M baryonic matter must build exactly the 1/2 of all visible galaxies clusters, distributed in the universe but we cannot distinguish the +M or -M galaxy clusters, using observational radiation, while photons and are the same for the +M and -M radiating matter!

The „Bubbles Structure" Problem. For recent observations of the very large-scale universe structure consisting of giant and surprisingly empty „foam bubbles" „no exhaustive and fully consistent theory has been found". (Capozziello et al. 2004). But the +/-M repulsive expansion (Ripalda 2001) will create plenty of „local" empty bubbles. It is simply energetically profitable to devastate local cosmic areas being initially homogenously filled by the ±M matter.

Parallel Universes – Hyperinternet. Thus, it is quite possible that we live on the „single 3D-page of a giant hypersymmetric hyper-book", live between parallel ±universes, physically similar to each other, glued together and pakked very densely with density $N_L = 1/L_o \approx 10^{10}$ universes/cm) (Gribov 1999, 2003). We could have very near (e.g., around $R = x^2+y^2+z^2+L^2 < 3\times10^{10}$cm, $\Delta T_{comm} = 1$sec) intelligent „brothers" somewhere within neighboring $N = 10^{20}$(!) similar parallel universes and can possibly become members of their hyperinternet system.

Cosmological résumé. Our concept finds the cosmological confirmation in the *large-scale phenomenology* – the ±M-neutral cosmic matter providing the „impossible" Accelerating Repulsive Energy, Flatness and Bubble universe Structure.

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