

Rethinking the Formal Methodology (I): Wave-Vortex Essence of the Substance

George Kirakosyan ^[6]

Physics Department, State Engineering University,
Yerevan, Armenia E- mail: gevorge@inbox.ru
(P.O. Box 42, Dubai, UAE)

Abstract

An approach/methodology proposed to basic problems, alternative to standard formalism. Elm particles' physical essence and types of interactions interpreted within wave-field peculiarities. The problems with de Broglie wave and particles' double slit interference discussed. The possibility to a causal representation of quantum phenomena is shown. Physical models of basic hadrons, their internal structure and static fields' configurations proposed. The values of mass, spin, magnetic moments of n , p hadrons defined within modeling. Causal interpretation to β decay presented. The tremendous penetrating peculiarity of neutrino discussed. Structural schemas to ${}^4_2\text{He}$, ${}^{12}_6\text{C}$ nucleons are proposed.

Keywords: Standard Model, Proton, Neutron, Nuclear Structure

1. Introduction

1. Critical Remarks

*Blind sages touching the elephant, have concluded, "The trees are here!"
(From Indian parable)*

*Author tries to show that we have been engaged with the "forest's
theory" for a long time, whereas there is an elephant only...*

Ancient philosophers have put forward the "Main Issue" with comprehensive formulation, "From what kinds of primordial substances and by which principles exists the material world?" The statement of the problem has essentially changed by time; in the language of contemporary physics it sounds as follows: "By which minimal quantity of natural constants and on the basis of what equations is it possible to describe all kinds of physical phenomena?" There are no principal contradictions between two statements. Meanwhile, these are significantly different by meaning and in content that we shall examine in attempts to comprehend where from arises present unprecedented complexities in disputable sections of physics. Author is inclined to see the explanation of current difficulties within previous serious misconceptions at the basic level. He proposes some retreat and rethinking of a traversed path, by simplest reasoning: such audit may give a chance only, and no harm, as it is impossible to lose what is known. We cannot exclude possible mistakes of deserved pioneers and ignore the necessity of revising the past way sometimes, which is natural at any research. We start with some remarks concerning to known "**Copenhagen's Interpretation**", introduced at the beginning of past century as a revolutionary approach, in context of comparison. We shall look at some points only since the issue was widely discussed among prominent luminaries long ago. To judge the significance of introduced methodology let us begin with known facts:

1. A key postulate of quantum mechanics (QM), a probable/statistical interpretation of Schrödinger's equation (SE), was accepted with majority of opinions (i.e. politically and not on the objective arguments!)

Hence, it is right to look at the mentioned interpretation as situational, "ad-hoc" approach only, i.e. as a subject, which needs further clarification, and not as a doubtless "basic principle". The mentioned interpretation is mainly justified with its certain productivity. With careful observation, we

can guess that it is an obvious misunderstanding to attribute results of any theory to a conditional name, or to its declarative interpretation. Nevertheless, ***the productivity of QM may evidence its quantitative accordance to reality only, and not its intuitive/verbal interpretation, which can be any!*** The issue gets trivial solution with logical viewpoint. Taking into consideration that SE is based on the Hamilton/Laplace operators that are generalized, causally defined relations (differential, in math meaning), we can assert; ***corresponding causal interpretation of SE and quantum phenomena should exist*** (the possibility of imaginary representation of quantum phenomena as cause-effect, consecutive chains). This type of description totally differs from nowadays-accepted formal methodology based on the abstract, math reasoning. It corresponds to human's natural ability of thinking, by means of images and actions that can make physics a comprehensive-realistic science. Here we need to remember that: ***the SE is deduced with generalization of de Broglie wave-particle dual properties and optics' geometry, by cause-effect, quantitative reasoning. Hence, it is right to look at the "workability" of SE as an evidence of correctness of the way and principles of its deduction*** (and not to its arbitrary interpretation!) In Schrödinger's deep confidence, SE should have corresponding causal representation that he resolutely attempted to bring to colleagues' awareness. However, majority decided how to interpret it and the author was accused for "naive-realistic" ideas (!) [1]. ***SE definitely means to look at the localized elm particle as a standing wave packet, by logic of its deduction.*** Therefore, realistic thinkers have tried to prove the concept. The approach has been recognized as "wrong" due to not being successful to prove it mathematically. The statistical/probable interpretation of QM has been introduced then, with the formal recipes and instructions of new methodology. We shall emphasize following obvious-subjective action in this crucial event: ***defining something as "impossible/unacceptable" since we did not manage to do it (!)*** Such unprecedented decision has met a deep protest of known coryphées, who continued their efforts of building a realistic science, remaining in dramatic minority. With Einstein's confidence, ***the division of mater and el. charge from field as different kinds of realities, after establishment of $W=mc^2$ seems unnatural*** [2].

He has insistently attempted to complete his *Unified Field's Theory* working in full isolation from the community (for the last 30 yrs of his life!) Meantime, de Broglie has managed to explain one key quantum phenomenon within cause-effect principle: a two-slight interference of particles (*de Broglie-Bohm theory*). Mentioned solution proved the rightness of Schrödinger's viewpoint. *De Broglie-Bohm theory shows the principal possibility of cause-effect interpretation of the quantum phenomena*. Nevertheless, such important result remains yet "invisible" in community. A new ideology was accepted there, as having no alternative, since certain results had been achieved already and it gave a wide opportunity for math manipulations, in author's view. Meantime, *The cause-effect interpretation of quantum phenomena may open an opportunity to build physics on general principles and to complete it on unique conceptual basis. The formal methodology ignores/excludes the mentioned opportunity.*

2. QM methodology is not enough adequate quantitatively

Let us demonstrate first the subjective/uncritical character of applying operations in below example. The wave function in stationary SE for freely moving particle (external field's potential $U=0$, a particle moves along x , with speed and energy; $v=const$, $w=mv^2/2$) given as:

$$\psi = A \exp\left[-\frac{i}{\hbar} \sqrt{2mW} x\right] + B \exp\left[\frac{i}{\hbar} \sqrt{2mW} x\right] \quad (1.1)$$

Here A, B are certain constants, remaining in QM as obscure. The complex conjugate function is introduced in next step:

$$\psi\psi^* = |\psi^2| = |A^2| \quad (1.2)$$

However, QM *doesn't give an answer/argument; where from and why ψ^* appears there?* It means an unjustified operation takes place here (even, from formal viewpoint) which just looks as necessary (?) to link the solution (1.1) with the eq. (1.2). Moreover, a new concept is introduced and a new supposition is accepted then:

$$|A^2| = \frac{dw}{dv} = \rho \quad (1.3)$$

Where: ρ is declared as the "density of probability" (the probability of finding the particle in the elementary volume). Below expression is accepted then as the measureless "unit of probability":

$$\int_{\nu} |\psi|^2 d\nu = \int_{\nu} |A|^2 d\nu \equiv 1 \quad (1.4)$$

We would notice that measureless numbers arise in descriptions of real phenomena as ratios of physical values to basic ones, having the same kinds. Passage from real/physical to relative values assumes initial definition of their kinds and basic measures, which is possible if we are clearly aware of the nature of studied objects and physical essence of phenomena. The introduced relative unit (1.4) “suspends in the air”; it stays as cognitively dark category, since QM initially speaks nothing about physical nature of wave function. Therefore, the necessity of “choosing” its interpretation/affiliation, as well as for definition of basic measures and borders of its existence/action arises further (which was done in QM by votes, arbitrary actions and unexplainable instructions, as we saw above).

3. A QM methodology has internal inconsistencies

Let us examine following example. The quantum objects may be presented as “particles” or “waves”, and not as “waves and particles” at the same time, with interpretation of de Broglie’s duality principle (DP), accepted in QM. The freely moving particle is described there with wave function (1.1) in accordance to it. In fact, we deal with a “particle” that generates a “wave” at its movement, which are indivisible from each other. The QM recognizes the mentioned indivisibility as well. However, it becomes verbal/psychological declaration only, since the QM allows presenting/describing one kind of object, and not two types together (“wave” and “particle”) as it is in reality. I.e. **the QM accepts two kinds of objects, existing together at the same time, and it allows describing one of them only** (?) Reader will see further that the mentioned arbitrary rule causes serious misconceptions and confusions. We would bring to readers’ attention also that, in fact, DP becomes disturbed in quantum el. dynamics (QED). The moving particle is presented there as in permanent interaction with the virtual photon, as the process of alternating radiation/absorption of it by particle. Thus, the described objects become two kinds, vs. QM’ rule. We will show further that success and productivity of QED are particularly related to its silent departure from mentioned unexplainable recipe.

4. The “Point-like” representation of objects contradicts to reality

The mentioned point is important to comprehend as one of the main problems of formal methodology, as well as the priority of suggested

approach. The QM has developed in analogy to Newtonian physics; therefore, some of idealized concepts have uncritically passed into it. The issue is about the concept of “material point” that is principally not compatible to reality. However, it’s used in classical physics with strong restriction: the own sizes of moving objects should be insignificant compared to distances in studied phenomena. We deal with restricted distances in microcosm not having enough criteria that objects of study are too small in relation to these. Therefore, initial acceptance of objects as “insignificantly small” is unjustified (we do not have enough experimental knowledge of them as in classical physics). The second point is more important. We lose any opportunity to comprehend the physical essence of quantum objects by declaring them as “point-like”. We just have closed for ourselves the way to their realistic description, initially accepting them as “something that is not subject to representation with sizes, images and actions”; by the same, the abstract math reasoning only remains as the single tool of analysis.

5. The statistical interpretation of phenomena contradicts to facts

We will look at one obvious example only, from many similar. The statistical distribution of atomic electrons is accepted in QM as “clouds of probability” within above interpretation of wave function (1.1.2.) The emission of photons is interpreted as consequence of electrons’ passage from one probable/average parameter into the other. It follows; the emitted single photon should have certain deviation in parameters, which means a spectral line of single photon will have no exact place on the screen but an average. Hence, a spectral picture should lose sharpness with decreasing intensity close to fluctuation level. As known however, a spectral picture does not depend on intensity, which shows that emitted photons have strongly determined parameters. An obvious question comes out then: how does exact/determined photon arise from “cloud of probability” (?) However, reader should know that natural questions are not subject of QM, by definition. Therefore, the answer to such questions remains only one, “our formulas show it”. It actually means, “God has made our world as it is” because our formulas are constructed as artificial models of reality, and not as natural derivatives from basic concepts, with accepted methodology. Thus, we have the right to assert; the probable/statistical interpretation of phenomena and rejection of cause-effect principles actually prohibit the cognitive study of the subjects.

6. The conceptual-cognitive representation of phenomena is absent in formal methodology. The “composition/construction” of the quantitative descriptions are accepted as the final task of the theory

R. Feynman has truly formulated the mentioned point [3] that we have seen in previous content as well. Depicted reality means “to harness a cart ahead the horse”, from logical viewpoint. It explains why realistic thinkers could not accept the new approach, and how they appeared to be in deeper opposition. Einstein demanded at his time, *to build physical theories on conceptual basis*, and, *to use concepts connected to reality* [2, 4]. It simply means to grasp the essence of studied phenomena initially and not to input hypothetical objects at each difficult case (see: “*Occam’s Razor*”). However, majority has seen unlawfulness of these demands, and Einstein got the “corresponding” stamp as well (see: *Einstein’s operationalism*). Modern theories have been developed then as a specific genre of creation, having no borderlines between reality and fiction. It has brought to a loss of objective criteria as well (estimation of work’s significance on the “indisputable” opinions, quantity of citations, by “brand” etc, and not on the workable results corresponding to reality, i.e. politically and not essentially). It has caused hard polarization between main types of scientists: “thinkers by own brains”- “intransigent rebels” as a rule, and respectable scientists, “followers of holy instructions” in majority, as natural. Professor **R. Santilli** impressively depicts nowadays reality [5]. Numerous unclear approaches and unsubstantiated doctrines have been introduced into disputable sections as consequence. Described way of building “Basic Science” is unable to withstand elementary logical criteria. It has been decided then to look at the logical requirements as a kind of philosophical category that are “unseemly and trivial” for the leading science (which can be even “harmful”!)¹ Most scientists, trained in such spirit, already seriously believe in the possibility to explain at last, “How God created the world” within symbols and math formulas only, excluding natural language and thought. The abstract mathematics (i.e. our “work-tool”!) has become priority in result, which may even “show us”

¹ There is no exaggeration here. The physical theory accepts the “math modeling of reality” without any conceptual paradigm, within present ideology (see, for example, **Kuhn, T.S.**, “*The Structure of Scientific Revolutions*”, University of Chicago Press, 1962. ISBN 13: 9780226458083)

the necessary direction of research. It is difficult therefore to imagine how the desired “Final Theory” will look. Judging from dominating **Standard Model** it will be a big collection of sophisticated equations completed with numerous “calibrating”, “normalizing” functions and factors, experimentally and empirically introduced. A limited quantity of individuals will be able “to understand” it (mastering the tremendous volumes!) We also cannot guess what purpose such theory may serve to (other than demonstrating the “merits” of scientists). It will be just craftiness to talk about “cognitive significance”, since similar categories are accepted as “unscientific” at the beginning. Reader can judge that “Final Theory” will be useless also from technological viewpoint, by simplest reasons. ***The absence of common view and actual inability of researchers to formulate the purpose of their job are the obvious/alarming symptoms of deep confusion of modern physics***, in author’s opinion. The formal methodology actually has brought to certain impressing results at the beginning (QED etc.) Nevertheless, huge technical problems and gnoseological fog quickly have arisen against physicists. Several speculative-formal theories and accompanying tremendous experiments, with unclear goals, periodically have been developed afterwards (as ongoing LHC project² etc). Thus, modern physics actually has gone in trivial way of “test-error” for unlimited math exercises, and not in any consistent direction. Much of objective criticism and unanswered questions permanently proceed from large group of realistic thinkers, reflecting the present crisis. Numerous “reviewers” and “moderators” are engaged on “neutralizing” these at different levels, applying ready stamps, under noble purpose of “protecting the truth from heresy!” As we see, ***the formal methodology actually welcomes uncritical compositions and it resolutely prohibits natural way of thinking*** (!) It corresponds to “amputation of brains”, by Einstein’s definition, which may reliably stop any progress of science. Is the depicted reality a result of simple misunderstanding, manifestation of group’s ambition in a worse scenario, or more serious circumstances are covered here? We do not undertake to speculate on this direction, recalling just that similar situations have taken place in science history enough often, by

² The opening of “Higgs Boson” has been announced at present. Reader can judge the significance of the event with mastering the article.

explainable reasons. In author's view, the current reality of modern physics is far incompatible with scientific spirit and undeclared honesty. It may call only a regret of true thinkers who can hope on future in such case. ***The present crisis of physics requires general revision of methodology, the statements of problems and accepted criteria of significance on disputable subjects.*** We attempt to do it in the scope of this work, particularly.

2. Compatibility of the approach to existing theories

The proposed approach is an attempt to present the picture of reality of disputable subjects in possible-complete form, in author's view and in his ability. There is no initial intent to prove or reject any existing approach concerning the issue. It is right to look at this work in context of critical overview of several existing theories based on different methodological principles. ***The main criterion of selection was the compliance of results to established facts*** (leaving aside various interpretations and large terminology accompanying these). The approach demands revision and rejection of misinterpretations, unreasonable instructions, intuitively accepted beliefs/doctrines, and not the existing facts, actual results. We can assert therefore that it satisfies to "***Correspondence Principle***" in the extent by which comparable works conform to established facts. Proposed changes mainly have cognitive-psychological character that always has played painful and huge-resistive role. The problem aggravates more as the proposed approach has already been examined. It has got a final verdict "wrong" and main ideologists have decided, "The page is closed!" (1.1.1.) However, similar situations also happened in science history. We hope therefore, that presented work may be perceived in right meaning and significance with time. ***Disputable areas of physics may get the unique conceptual basis, which gives real opportunity to separate valuable approaches and results from existing plenty of unnecessary,*** in author's confidence.

3. Basic principles

We present key points of the approach with some substantiation:

1. Quant of Electromagnetic Field (QEF) is a unique base of substance a). Representations of the photon and localized particle (electron) with their known properties as kinds of QEF manifestations presented in [6]

We present some additional arguments confirming the concept.

b). The existence of unique couple of universal constants c, h confirms the concept. There are no experimental evidences to existence of other constants with similar significance (let's say $c_1, c_2...c_n, h_1, h_2....h_n$). There are no principal arguments excluding their existence as well. Hence, their uniqueness in fact points at the unique nature of the basic substance.

c). Similar physical characters and properties of different elm particles and their equality (such as existence and equality of spin, el. charge) obviously evidence the unique nature of all known kinds of particles. Otherwise, the mentioned similarity/equality becomes unclaimed, unexplainable coincidence (that actually seems in the Standard Model!)

d). Known possibility of mutual transformations of all kinds of elm particles (by accepted terminology) into each other (within conservation laws) directly confirms their unique essence (independent from our ability to prove it theoretically; as mentioned, the math proofs may look more significant than existing facts in formal methodology!)

e). The electromagnetic, wave-field nature of basic substance derives from Einstein's $W=mc^2, W=hv$ equations (to be discussed). Many of researchers have been working on this direction (as example: [7, 8].) We will refer to Feynman's phenomenal intuition as well on the issue. He has seen identical results in different kinds of formal theories as weighty evidence to uniqueness of basic laws and principles of the nature [3, 9]

We present a brief description of QEF as a candidate of basic substance:

2. The QEF has a wave-vortex, dynamic nature, presenting itself a circularly polarized, restricted wave flow (quantum wave packet)

The existence of spin for known kinds of elm particles, without exception, evidences the vortex-dynamical nature of QEF. The interpretations of spin for the electron and photon within named concept is presented in [6]

3. The QEF manifests in two possible physical forms:

a). As propagating stable quantum wave packet (photon, γ - quanta)

b). As localized/standing wave-vortex, unstable mainly, and stable in few special cases, showing general and individual peculiarities (kinds of localized elm particles/antiparticles, stable/unstable)

4. The Mass and pseudo static fields ("charges") arise in localized QEF aftermaths of interferential redistribution of wave energy

Origins of mass, spin, static electric/magnetic fields ("charges") for the electron are interpreted within the concept in [6]

5. All kinds of QEF interactions have electromagnetic nature

We represent their possible kinds of manifestations as below:

- a). Mutual interactions of none localized QEFs (photons)**
- b). Interactions of none localized QEFs with pseudo static fields of localized QEFs** (It causes absorption/emission of photons etc)
- c). Interaction of localized QEFs within their pseudo static fields** (These are analogues of Coulomb and Lorentz's forces defining atomic orbital structures, binding energy in atomic nucleons, nuclear structures, etc)
- d). Interaction of localized QEFs in the range of their mutual coverage** (mostly corresponding to accepted "weak interaction")
- e). Internal interactions in QEF** (causes propagation of photon, origin of mass, "charges", mag. momentum of localized particles, stability and decay of particles, phenomenon of gravity, breaking of symmetry (?) These are subjects of modern formal theories, such as QED, Standard Model etc.)
- f). Simultaneous actions of above-mentioned kinds of interactions mostly take place with QEFs.** The unique, electromagnetic nature of forces and interactions in microcosm (excluding gravity) is shown within formal-quantitative reasoning (*Glashow, Weinberg, Salaam, Swinger* and others). Numerous theorists recognize it, having different views at the other problems. The attempts to create a unified theory continue.

4. Methodology

Applied methodology significantly differs from formal, accepted at disputable sections. The hypertrophied role and some mystification of the mathematics in the research have been shown in previous content. We will present a brief explanatory to definitions of "realistic methodology" vs. "formal", for perception of work by readers having standard education.

We understand the "math reasoning" as quantitative logic tool, which is based on abstract conservation laws. We consider it as an important component of realistic methodology that includes other inevitable/necessary tools as well, such as the "induction", "deduction", "supposition", "syllogistic compositions/conclusions", etc. **As a "tool" and "component", the math reasoning cannot have priority and guide us solely** (as any other tool!) As known, the quantitative analysis often yields to variety of results that incompatible with the physical reality (as any "tool" it may have unclaimed applications!) Hence, **in "realistic methodology" the "math reasoning" must work within comparison to**

other “tools” of study, under mutual control and restrictions (it means, we should comprehend the subjects of study and counting in principle).

We present key points of approach as below:

- 1. We have looked at the established facts as indisputable basic arguments** (we are forced to emphasize it, vs. formal methodology!)
- 2. We have accepted cause-effect relations as the basic laws of nature, describing QEF** (Maxwell’s quantized wave equations) [6]
- 3. The basic natural constants are considered two: c , h , reflecting dynamical and quantitative characteristics of QEF, experimentally established. Measureless constants π , $a \approx 1/137$, appearing in descriptions of QEF, are conditioned by its wave-vortex, dynamic nature; these are possible to deduce at the conceptual basis** (π known from geometry, a deduced as wavy peculiarity [6])
- 4. All kinds of properties and peculiarities of quantum objects are conditioned and are possible to represent with four basic constants, mentioned in previous point** (such particles’ mass, sizes, kinds’ of energy, its “charge”, spin, mag. momentum etc)
- 5. We combine the causal/quantitative reasoning with imaginary representation of objects/actions in analyzing process**
- 6. We exclude operations/reference with supposed objects that are not confirmed experimentally as kinds of realities** (the “ether”, “physical vacuum”, “quarks”, “gluons”, “graviton”, “dark energy/mater” etc)
- 7. We looked at the possibility of representing numerous established facts in the frame of common concept and methodology as the main evidence of reliability/significance of the presented approach**

2. Results³

1. Quantized Wave Equations (QWE) as basic laws

We show below the possibility of causal interpretation of known key phenomena, relations and principles at the base of QWE

1. A causal representation of the Heisenberg’s Uncertainties (HU)

The physical essence of HU is represented in [6] (chap. 2) as the consequence of “wave beating”, causing **the deviation of parameters, peculiar to a quantum wave packet**. The origin of uncertainties in the parameters of QEF and its equivalence with the HU are interpreted there.

³Author recommends to read [6] previously

2. Representation $W=hf$ as wave-field' energy

The QWE is presented by (37) in [6], as particular solution of Maxwell's equations, corresponding to vector representation (Figure 1.)

$$\mathbf{E}_V \approx \frac{\omega}{2\pi} \sqrt{\frac{h}{2c\sigma n}} \left[\mathbf{i} \sin \omega \left(t - \frac{x}{c} \right) + \mathbf{k} \cos \omega \left(t - \frac{x}{c} \right) \right] \quad (2.1)$$

$$\mathbf{E}_H \approx \frac{\omega}{2\pi} \sqrt{\frac{h}{2c\sigma n}} \left[\mathbf{i} \sin \omega \left(t - \frac{x}{c} - \frac{1}{\omega} \right) + \mathbf{j} \cos \omega \left(t - \frac{x}{c} - \frac{1}{\omega} \right) \right]$$

Where: $\mathbf{E}_V, \mathbf{E}_H$ vectors of field's tension in mutually perpendicular planes (Fig.1), $\sigma \approx \Delta\lambda^2$ section of "ring-strings" for the energy' concentration, $\omega = 2\pi c/\lambda$ cyclic frequency, $\Delta\lambda$ is the HU for wavelength: $\Delta\lambda \approx \alpha\lambda$, $n \approx 1/(\eta\alpha)^3$ number of pairs of whole waves composing wave packet, $\eta = m/p$, (m, p whole positive numbers), α Fine Structure Constant. Its value deduced as *interference redistribution constant* (new introduction) $IRC \cong e_* \equiv a^{0.5}$

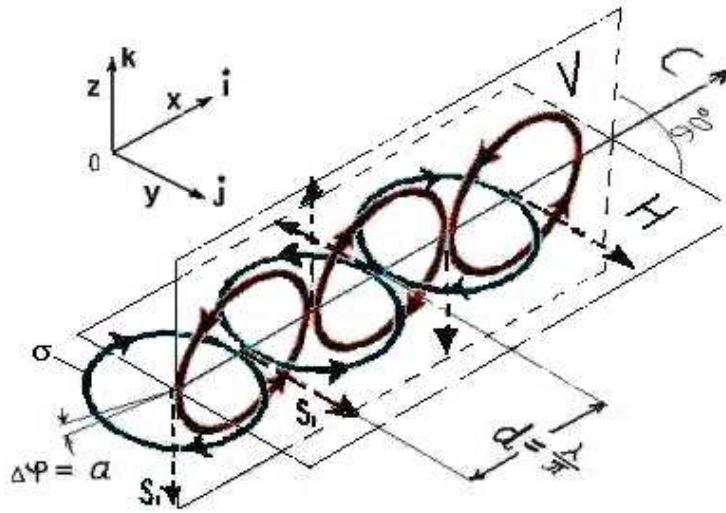


Figure 1. The Scheme of Quantum Wave-Packet

IRC defined as $a^{0.5} \cong \sin \Delta\varphi \cong 0.0854245\dots \cong e_*$ (e_* elementary charge in natural units' system $\hbar = c = 1$), $\Delta\varphi$ defined in [6] from below equation:

$$\sum_{m=1}^{n \rightarrow \infty} \left\{ \frac{1 + \cos[\Delta\varphi m - \delta_\theta / (1 - \delta_\theta / \Delta\varphi m)]}{(2m+1)[1 - (\delta_\theta / \Delta\varphi m)^2]} \right\}^2 \approx \pi^2 \tan \Delta\varphi \quad (2.2)^4$$

Where: $\delta_\theta \approx \Delta\varphi(1 - \cos \Delta\varphi m) / \pi(2m+1)$

We shall define energies' density in "ring-strings" (Fig. 1) as scalar square of \mathbf{E}_V , \mathbf{E}_H vectors. Considering equality of their modules, using Kronecer's symbol $\delta_{ij} = \{ 1(i=j), 0(i \neq j) \}$, and $\sin^2 A + \cos^2 A = 1$ from (2.1) we get:

$\rho \approx \langle \mathbf{E} \rangle^2 \approx \omega^2 \hbar / 8\pi^2 c \sigma n$. Total energy for the packet defined as:

$$W = W_V + W_H \approx 2\rho V n \approx 2\rho \sigma \lambda n \approx 2(\omega^2 \hbar / 8\pi^2 c \sigma n) \sigma \lambda n = h\nu \quad (2.3)$$

Where: $V = \sigma \lambda$ is the volume of one "ring". The symbol (\approx) replaced with ($=$) due approximation in eq. (2.1) is conditioned with σ , n [6] that become cut. Thus, the initial key assumption/postulate of QM, *eq. $W = h\nu$ gets a causal explanation as energy of quantum wave packet, derived from classical wave' peculiarities.* These results with (2.1.1) show artificial separation of QM from classical/causal principles that are seen repeatedly.

3. Representation $W = mc^2$ as a wave-vortex' energy

We will show first that the seeming difference between classical expressions of energy/impulse ($W = mV^2/2$, $P = mV$) and equations ($W = mc^2$, $P = mc$) gets simple explanation with the "ring-strings" distribution of field's energy, peculiar to elm particles. Let's remind first that equality of kinetic and potential energies $W_k = mv^2/2 = W_p$ derives from balance centrifugal and potential forces for the movement by circle, in the central potential field. The total energy of balanced system becomes $W = W_k + W_p = mV^2$ that corresponds by form to $W = mc^2$. Thus, In view of form we can conclude that *eq. $W = mc^2$ it evidences the vortex-dynamic nature of the basic substance.* Presented interpretation well corresponds to the fact of existence of particles' spin $S = (\hbar, \hbar/2)$ [6]. We will show the wave-field origin of mass with the Bohr's hydrogen atom model, as the simplest

⁴ It is important to remark that eq. (2.2) is deduced on the pure cognitive basis, i.e. **on the conceptual principle** exclusively, vs. numerous representations of α by different combinations with known basic constants.

way. The balance condition of electron on the first orbit with radius a_0 is the equality of centrifugal and Coulomb's forces:

$$m_e V^2 / a_0 = e^2 / 4\pi\epsilon_0 a_0^2 \quad (2.4)$$

We write from (2.4):

$$m_e V^2 / 2 = e^2 / 8\pi\epsilon_0 a_0 = W_E \quad (2.5)$$

W_E is potential energy of a system. Eq. (2.5) confirms the equality of kinetic and potential energies. We present as $a_0 = \lambda_e / 2\pi\alpha$, orbital speed as $V = \alpha c$, elementary charge as $e = (2\epsilon_0 \alpha h c)^{0.5}$ where λ_e is the Compton wavelength of the electron, ϵ_0 electrical constant. Substituting the values into (2.5), we get⁵: $m_e c^2 = hc / \lambda_e = h \nu_e = W$ (2.6)

Eq. (2.6) shows equivalence of electron's rest mass to quant of energy with Compton wavelength. It shows a wave-field nature of the particle.

4. Causal interpretation of de Broglie's wave: Physical meaning of "Feynman's arrows": Explanatory to particles' double slit interference
a). The electron's model and de Broglie wave

The electron's model is presented in [6] as circularly polarized Compton's standing wave-vortex/interference (Fig. 2). Its experimentally known peculiarities and parameters are interpreted there within modeling (chap. 3), [6]. De Broglie's wave is interpreted as Doppler Effect ("wave' beating") conditioned with movement of localized particle $\lambda_D = \lambda_c (c/V)$. We present additional clarifications to de Broglie wave essence using graphic images (Figure 3). The origin of "ring-strings" of de Broglie wave becomes simply explainable from Maxwell's equations as field's induction, in consequence of movement of the Compton's standing wave-vortex. The amplitude of tension of induced field (in the "ring-strings" of de Broglie wave) is simply defined as $E_D = E_0 dx / c dt = E_0 (V / c)$ where E_0 is the amplitude of tension in Compton wave circulation (2.1). We define the energy for de Broglie's wave packet corresponding to whole wavelength λ_D [Fig. 3. a)], [6] using the same reasoning (2.1.2.)

$$W_D = 0.5 h \nu_c (V^2 / c^2) \quad (2.7)$$

⁵ We have accepted non-applicability of SR and Lorentz's coordinates' transformation at the subject; shown in several works (as in [8]).

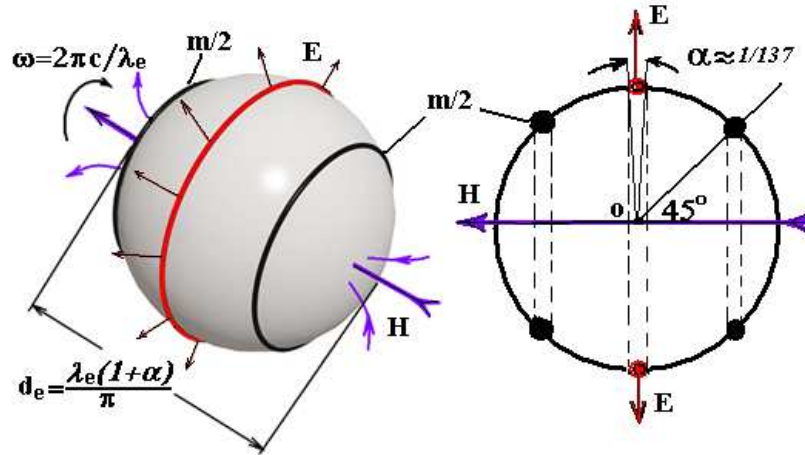


Figure 2. Schematic Model of the Electron

Explanatory to Figure 2

Known peculiarities and parameters of electron deduced by modeling it as Compton's standing wave-vortex/interference [6]. $m_e = W_0/c^2 = h/c\lambda_e$, $W_0 = hc/\lambda_e$, $W_E = W_\mu = 0.5aW_0$, $s = h/4\pi = \hbar/2$, $\mu_e / \mu_B \approx 1,00115965$, Where: W_0 energy of main pick of interference that manifests as rest mass of the particle, W_E , W_μ are energies of electrical and magnetic pseudo static fields conditioned with secondary picks of interference, a fine structure constant. μ_e , μ_B electron's mag. moment and Bohr magneton.

Where: ν_c is the Compton wave frequency for a moving particle. Numeric coefficient 0.5 in (2.7) it expresses the important peculiarity of de Broglie wave, the alternating radiation/absorption character of wave-field, taking place at the way of particle's movement. It is explained within graphics [Fig. 3. *b*), *c*.)] The tension of field increases with the origin of new standing "rings" from moving particle at the interval 1-2. It reaches to a maximum at the point 2. The tension decreases with further movement of the particle, in consequence of new rings neutralizing the previous ones because of inverse directions of circulations (at the interval 2-3). The field's tension becomes 0 at the point 3. Described process quantitatively corresponds to radiation of photon and its further back-absorption by freely moving particle in the alternating intervals accordingly. The acting/average value of de Broglie's wave energy becomes half of its maximum that explains the coefficient 0.5 in eq. (2.7). Presented model causally interprets how moving particle "interacts with himself" [Fig. 3. *c*), *d*)] that looks as "mystery" in QED (see *exchange character of*

interaction, Feynman's arrows). The presented interpretation clarifies productivity of QED as conditioned with its correct cause-effect base (which remains unformulated because of formal methodology!)

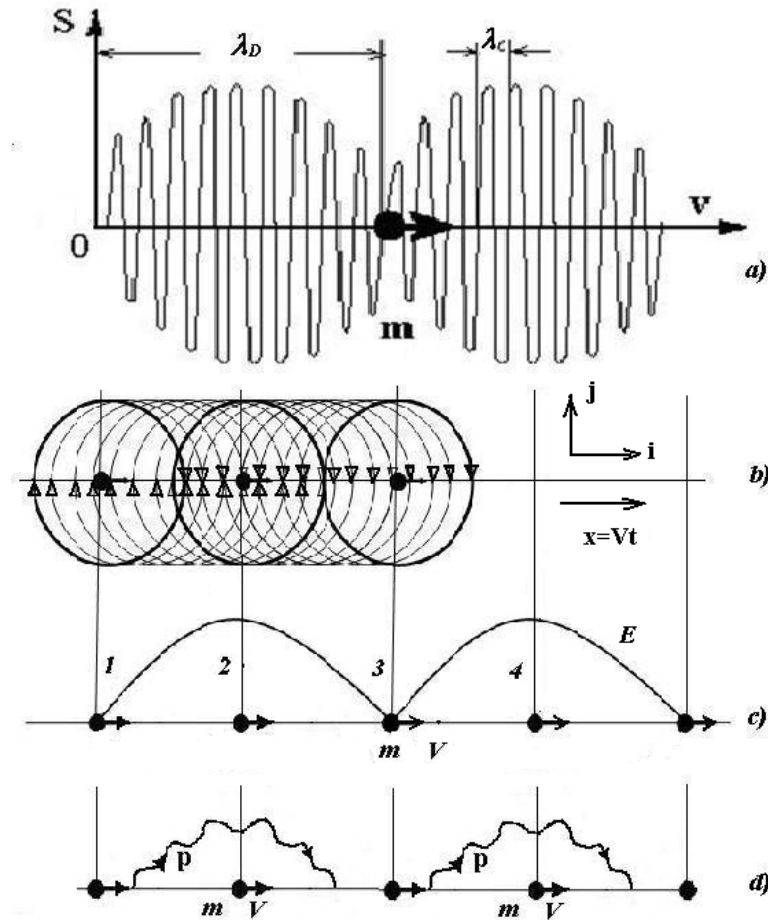


Fig. 3. De Broglie's wave illustration

Explanatory to figure 3

a) The graphic of “wave beating”. **b)** The origin of standing “ring-strings” of de Broglie’s wave from moving particle at the interval 1-2, and their mutual annihilation at the interval 2-3 (the annihilation’ process took place in range of middle solid circle where direction of circulations become contrary). **c)** The acting value of field’ tension of “wave beating”. **d)** Representation of a process as the alternate radiation/absorption of virtual photon **P** at the way of movement; it clarifies the physical meaning of **Feynman’s arrows** in QED. (The “Ring-strings”, perpendicular to drawing plane, not shown)

b). Particles' double slight interference

Presented interpretation of de Broglie wave gives opportunity of causal explanation of particles' double slight interference as well which was one of the intriguing problems prior to QM. As we mark, De Broglie-Bohm theory quantitatively describes the phenomenon (1.1.1.) We present descriptive-imaginary representation of that within (Fig. 4.) Let us remember first that the main question, exciting the minds, was "how the single particle passes troughs two slights at the same time?"

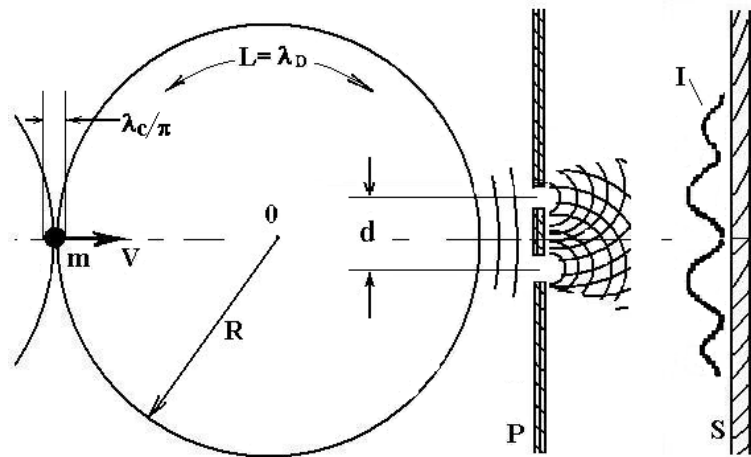


Fig. 4. Illustration to double-slit interference of particle

Explanatory to Figure 4

P partition with two slights, *S* screen, *I* a curve of interferential distribution on the screen, $L=\lambda_D$ one of "ring-strings" of de Broglie's wave, *m*, *V* mass and velocity of particle, λ_c Compton's wavelength of the particle. *d* distance between slights.

The front of de Broglie's wave reaches to slights before of particle. It causes the interference behind the partition and the distribution field on the screen. Considering $V \ll c$, $\lambda_D \gg \lambda_c$ and $R \gg d$ we can accept wave front as "parallel" to partition plane. I.e. the deviation of particle's trace in range of *d* will not influence the interferential picture. I.e., single particle can pass by any of the slights that doesn't change distribution picture on the screen. Interferential picture becomes disturbed with closing any of slights.

The problem looks as follows; if we assume that the single particle passes through one slit only the difficult question arises then: "why interferential

picture from single particle is disturbed when we close the “unnecessary” second slit?” We get the simplest answer if we ignore DP instruction and look at particle together with de Broglie wave (as it is actually!) Having in view the “interference of de Broglie wave” instead of “interference of the particles”, we get easy explanation of the problem. Thus, we should just take care, that there are two participants in phenomenon and not only one. We can find clear causal interpretation of this intriguing issue as; **de Broglie wave causes the interferential distribution that directs the particles within configuration of standing waves field**

With the same, one of the main difficulties, that force the introduction of “new laws of nature” (probable/statistically), goes out from the agenda.

5. The causal interpretation of wave function and SE

a). Let’s assume that electron moves by circle equal by length to de Broglie’s wavelength. For the electron $v_c=v_e$, on a first Bohr’s orbit $V/c=\alpha$ we get from eq. (2.7):

$$W_D = 0.5a^2 h v_e = 0.5a^2 hc / \lambda_e = h v_R = h R_y \quad (2.8)$$

Where $v_R \approx 3.28 \cdot 10^{15} \text{s}^{-1} \approx R_y$ is the Rydberg’s constant. We represent a density of energy for de Broglie’s wave accordingly to (2.1.2.), (2.1.4.) as:

$$\rho = \langle \mathbf{E}_D \rangle^2 = \langle \mathbf{E}_0 \frac{V}{c} \rangle^2 \approx \frac{h \omega_e^2 V^2}{8\pi^2 c^3 \sigma n} \cdot \langle \mathbf{i} \sin \omega_e t + \mathbf{k} \cos \omega_e t \rangle^2 \quad (2.9)$$

From eq. (2.8), we write:

$$W_D \approx \int_v \rho dv = \int_v \langle \mathbf{E}_D \rangle^2 dv = h R_y \quad (2.10)$$

We replace the vector’ square in eq. (2.9) as:

$$\langle \mathbf{i} \sin \omega_e t + \mathbf{k} \cos \omega_e t \rangle^2 = \exp(-i\varphi) \exp(i\varphi) \quad (2.11)$$

Using eq. (2.8), (2.10), we can represent W_D in form:

$$W_D \approx \int_v \Psi \Psi^* dv = \int_v \langle \mathbf{E}_D \rangle^2 dv = h R_y \quad (2.12)$$

Where $\Psi = A \exp(-i\varphi) + B \exp(i\varphi)$ is a complex function required to find.

Comparing (2.11), (2.12) with (1.1), (1.4), using $(-i\varphi) = (-\frac{i}{\hbar} \sqrt{2m_e W} x)$,

$W = m_e V^2 / 2$, $x = Vt$, $m_e = h v_e / c^2 = \hbar \omega_e / c^2$ (2.6) we get $\varphi = \omega_e t (V/c)^2$. We define required complex function as:

$$\Psi = E_0(V/c)\exp[-i\omega_e t(V/c)^2] = E_D \exp[-i\omega_e t(V/c)] \quad (2.13)^6$$

Accepting the energy of de Broglie's wave (2.12) as measureless unit $hR \equiv 1$, using eq. (2.13) we can write:

$$\frac{W_D}{hR} \approx \frac{1}{hR} \int \Psi \Psi^* dv = \frac{1}{hR} \int \langle \mathbf{E}_D \rangle^2 dv = \int |A|^2 dv \equiv \int |\psi|^2 dv = 1 \quad (2.14)$$

Where: $|A|^2 = \langle \mathbf{E}_D \rangle^2 / hR_y$. Thus, we come to eq. (1.4)

This representation clarifies the meaning of eq. (1.1), (1.4) and SE. In QM $|A|^2$ considered as “a probability to find the particle in elm volume” (1.1.2.) and the “normalization” is applied there that expressed in eq. (1.4). We can see from (2.14) that named operation actually reduces to acceptance of $W_D = hR \equiv 1$. I.e., **“normalization” actually means consideration** (declaration) **of the energy of de Broglie's wave as the “unit of probability”** (or, “a full probability”) **for particle's location**. From eq. (2.13), we can see that **the amplitude of wave function** (“amplitude of probability”) **actually corresponds to the module of field's tension in de Broglie's wave**. It means; the measureless value of “probability of the particle's location” coincides with the density of de Broglie's wave energy in relative units. The distribution of de Broglie's wave energy has a form of “ring-string” [2.1.4.a).], [2.1.5.a).] It coincides with the orbit of particle's movement. Thus, the presented interpretation clarifies the compliance of QM results with the reality and its productivity. **De Broglie wave and the particle are indivisible; hence, the distribution of de Broglie wave energy defines the location of the particle simultaneously** **b)**. Coming to the question of **unjustified entrance of conjugate function ψ^* in eq. (1.2)**, we can see that mentioned operation actually serves to “organize” the desirable result (1.4). Meanwhile, similar solution (2.10) in real values derives naturally based on QWE as definition of energy's density (without unexplainable suppositions and arbitrary operations!) Thus, we can assert; **Schrödinger's equation derives from Maxwell's quantized wave equations**. We would mark that QWE actually contains fine structure constant and HU as well, since the parameters σ , $\Delta\lambda$, n are

⁶ We accept $B=0$ as it has no further application in the subject

defined with α (2.1.2.) Moreover, α also derives from wave peculiarities; it is represented as the **wave constant** in [6]. We shall refer to [10] where the connection of α with HU and to wave interference is shown that independently confirms presented approach. The common roots of SE and **Dirac', Pauli', Cline-Cordon' equations** and **Heisenberg's matrix mechanic** are known from numerous works as [8].

c). We have seen above that **de Broglie wave is a secondary phenomenon rising as consequence of particle's movement** (we image it "as a tail of particle" for logical comfort, if it is permissible!) The cognitive mistake of intention "to build a localized particle from de Broglie wave" becomes obvious. The impossibility of solution has become clear for theorists by formal-quantitative reasoning. By presenting the standing wave-packet (particle) as series of Fourier' harmonics $U=\sum f_n(\lambda_{Dn})$ depending on velocity $\lambda_D=F(V)$, it becomes clear: **the construction demands existence of numerous components, moving with different speeds, in the same place!** Thus, impossibility of intention is obvious (the particle immediately decays). However, the wave-field concept of localized particle has been rejected totally, which has been crucial in physics! (1.1.1)

We get solution of the problem if **we "build" the localized particle from Compton standing wave**. Considering that **Compton wave and its harmonics do not depend on velocity**, considering as well **the equivalence of Compton wave energy with eigenenergy of particle** ($m_0c^2=h\nu_c$) we get direct clue to the essence of localized particle [6].

d). Coming to the issue of SE **significance**, we would emphasize first that QM expresses the "external behavior" of the particle and does not reflect its full essence. Why is it so? SE actually describes the secondary phenomenon (de Broglie wave) arising from particle's movement (i.e. the behavior of "tail" only!), and the "owner" is actually not presented there. For example, considering $V=0$ for freely moving particle, we get $\lambda_D=\infty$; by the same we lose any data concerning to particle, i.e. our particle just disappears! However, within realistic description **we should have the particle in rest condition**. It shows that SE **is a part of some realistic description** (as it expresses a part of real phenomenon only!) We shall present a complete equation, satisfying the mentioned requirement, for energy of the electron in first Bohr orbit in hydrogen atom, including fine structure level (i.e. for $n=1, l=m=0, m_s=\pm 1/2$). We shall represent full energy of electron as: $W = w_R + w_o$ where: w_R, w_o are the eigenenergy and

orbital energy, accordingly. We shall present energies of mass, electrical and mag. static fields of electron, using transformations (2.5), (2.6), considering equality of electrical and mag. static fields' eigenenergy [6]. Expressing these by Compton wave frequency ν_e and α , we write full eigenenergy as:

$$w_R = w_m + w_e + w_\mu = h\nu_e + 0.5\alpha h\nu_e + 0.5\alpha h\nu_e = h\nu_e(1 + \alpha) \quad (2.15)$$

Where: w_m , w_e , w_μ are energies of mass, el. static ("charge") and mag. static fields accordingly. We shall present orbital energy using (2.5), (2.8), expressing fine structure energy w_f in same units:

$$w_o \cong w_k \pm w_f = \alpha^2 h\nu_e / 2 \pm \alpha^4 h\nu_e / 8 \quad (2.16)$$

The sign (\pm) for fine structure energy considers spin-orbital orientations (m_s). We get below expression of full energy:

$$W \cong h\nu_e[1 + \alpha + (\alpha^2 / 2) \pm \alpha^4 / 8] \quad (2.17)$$

A 3-rd member in eq. (2.17) is the kinetic energy $w_k = m_e V^2 / 2 = \alpha^2 h\nu_e / 2 = hR_y$ that is equal to de Broglie wave energy (or, Rydberg energy). It defines energetic terms of electron. Using n , $m_s = \pm 1/2$, we can write (2.17) as:

$$W \cong h\nu_e[1 + \alpha + \alpha^2 / 2n^2 \pm (\alpha^4 / 2n^2)(3/4n - 1/2n)] \quad (2.18)$$

The eq. (2.18) differs from accepted standard description of spectral terms by presence of first two members. These present the mass' and static fields' energy of the electron. Next members depend on speed. Considering $V=0$ these become 0 and eq. (2.18) turns to eq. (2.15) presenting eigenenergy of electron. Thus, eq. (2.18) reflects the complete phenomenon as it takes place in reality. The components of orbital energy (without additional small corrections) we can present as:

$$W_k = h\nu_e(\alpha^2 / 2n^2) = (hc / \lambda_e)(V / c)^2(1 / 2n^2) = hR_y / n^2 \quad (2.19)$$

$$W_f = \pm(hR_y / n^2)(\alpha^2 / 4n) \quad (2.20)$$

These correspond to QM results as shown above. The spectral energetic terms can be presented as:

$$W_o \cong h\nu_e(\alpha^2 / 2n^2)(1 \pm \alpha^2 / 4n) \quad (2.21)$$

Analogical representations are possible for orbital radiuses and speeds:

$$R_n \cong R_0 n^2(1 \pm \alpha^2 / 4n), V_n \cong V_0 / n, \text{ where } R_0 \cong \lambda_e / 2\pi\alpha, V_0 \cong \alpha c \quad (2.22)$$

Equations (2.18), (2.21), (2.22) present the energetic, geometrical and dynamical peculiarities (behavior) of the orbital electron as functions of

its single eigen parameter (Compton wave). The opportunity of adequate description of electron's behavior on causal basis is shown above content. Thus, the quantitative consequences of QM and causal representations coincide if we replace the relative values ("probable-average") with the real physical. The realistic form and "workability" of eq. (2.18) clarifies significance of SE. We can define the cognitive essence of SE as, ***Schrödinger's eq. is a partial description of real phenomena in relative units*** (by the same, it leaves place to arbitrary interpretations!)

6. The possibility of minimizing used concepts/system factors

a). We start with brief retreat. In accepted courses and academic publications we often come across some ordinary sub explanatory as, "here c is a speed of light", and " h constant of Plank" (!) Such presentation reflects cognitive confusion in modern methodology as the subject of study initially becomes unclear (with what we deal?) It changes nothing if we use other accepted expression: " h is the World Universal Constant" as the issue remains open (a constant of what?) The matter is the problem has a cognitive character, which requires logical solution and it is banned by accepted rules! The initial approach to the problem is presented in [1.3.1. b)], (1.4.3.) Our next example relates to fundamental concept of "elm charge". It is possible to comprehend from logical viewpoint that this concept actually reduces "the drop of weightless el liquid" that never has existed! We "saw" in fact, the particle as the source of electric (magnetic) static fields only, and nothing else! We never "saw" the independently existing kinds of realities as "pure" el (or, mag.) static fields, separate from mass, spin and other properties of particle. Hence, we should accept the static fields as the indivisible peculiarity of particle and do not to input other hypothetical things ("charge" that have the "especial duty" only of creating static fields!) I.e., the "elm charge" actually belongs to large family of hypothetic realities such as the unobservable "ethers", "kinds of liquids", "phlogiston" etc that have brought confusions and have only aggravated the problems. Thus, we can just remove the concept and term of "elm charges" from our lexicon generally, if we wish to express the facts as they are! Opponents will point on the existence of constant $\pm e$ as "indisputable evidence" to reality of "elm charge". Such argumentation is simply a consequence of initial confusion in methodology as an aftermath of mixing the real physical objects with mathematical (we can compose different kinds of quantitative invariants, with combination of

corresponding variables and announce “new kinds of realities”!) Actually, we already have got rid of the concept of “el charge” in above content as in eq. (2.21), (2.22). We shall bring one important remark on that. With application of “el charge” as “source of static field”, the necessity of applying “special settling coefficient” (system constant) arises there that gives opportunity to link the real-physical value with the hypothetical (i.e. a field, with “charge”). The electrical constant ϵ_0 serves for it, the existence of which remains completely unclear in contemporary physics! As we saw above, with representation of static fields’ energy as part of localized QEF’s energy, the concepts of “el. charge” as well as the system constant ϵ_0 automatically go out from our formulas [6]. Thus, we can comprehend that these concepts generally were unnecessary; that much simplifies our formulas and the picture of the subject area. We can comprehend that there is nothing strange from cognitive point. The necessity of changing used concepts and their quantities arises with the passage from macro to microcosm (such as the concepts of “temperature”, “color”, “pressure”, etc become unclaimed and others appear there). Thus, we should be ready to “sacrifice” our usual concepts under dictation of facts and logic. The same reasoning is applicable to “mag. charge” (or, “Dirac Monopole”)⁷. As example, we shall present Coulomb force in rational form, for two elm particles, acting on a distance $R \gg \lambda_e$

$$F_C = \pm e^2 / 4\pi\epsilon_0 R^2 = \pm \alpha \hbar c / R^2 \quad (2.23)$$

Presented expression shows needlessness of concept “elm charge” as well as the “electrical constant”. We can judge with this example that kinds of similar “system constants” just serve to link false realities with the actual. Meantime, two basic natural constants h , c and geometrical/dynamical constants π , α (dimensionless) become enough for rational descriptions of phenomena in microcosm, in case of correct conceptual interpretation of reality, excluding kinds of “system constants”. Presented formulas satisfy to this criterion (the same in [6])

b). We can comprehend *actual meaning of Plank’s constant* if we simply represent QEF as one single contour of field’s circulation. We can judge from (2.1.2) and [6] that its energy’s value and spin will be the same for

⁷ There is no argumentation, why “Dirac Monopole does not exist” yet and the “elm charge exists”, since these concepts are fully equivalent.

the photon. For the electron (2.1.1), the distribution factors of energy and impulse moment arise (that cause a “charge”, mag. moment and reduces spin on half), that we shall not examine, as these are not essential in our cognitive conclusions. In conformity to Maxwell’s first law, we write:

$$u_\lambda = \oint_\lambda \mathbf{E}_M \cdot d\mathbf{l} \quad (2.26)$$

Where: u_λ , \mathbf{E}_M the full potential of the contour and tension’s amplitude vector accordingly, corresponding to above representation of QEF. To define quantized value of u_λ we see first that $(hc)^{0.5}$ has a dimension $[L^{1.5}M^{0.5}T^{-1}]$ that corresponds to measure of (potential) x (length). We accept:

$$\sqrt{hc} = \text{const} = u_h \quad (2.27)$$

We call $u_h = \sqrt{hc} \approx 4.457 \cdot 10^{-13} [V \cdot m]$ **Quant of Potential** (QP)

Using concept of QP we can represent QEF’s energy as:

$$w = u_h^2 / \lambda = hc / \lambda = h\nu \quad (2.28)$$

It follows from (2.26), (2.27)

$$u_\lambda \lambda = E_M \lambda^2 = u_h, \text{ and } E = u_h / \lambda^2 \propto \lambda^{-2} \quad (2.29)$$

We get to most important conclusion, causally clarifying how the QEF “works”. Eq. (2.29) shows: **the wavelength and all parameters of QEF are defined with amplitude of wave tension**. We shall emphasize the causal/classical character of established relation. Eq. (2.29) shows that QEF’s oscillation frequency (wavelength) depends exclusively on field’s tension. By the same, we can comprehend that “quantum laws” actually are manifestations of the cause-effect classical laws (that seems repeatedly). We shall mark next cognitively important conclusion from this representation: **the linear dimension of elm particle is inversely proportional to eigenenergy**. Thus, we come to comprehension that the main principles of elm particles’ physical essence are:

The elm particles are wave-vortexes of QEF. Their eigenenergies depend on field's tension: the higher the field's concentration, the smaller particles' dimensions and the bigger their eigenenergies. The photon corresponds to this principle on large experimental basis. The wavelength and interaction time (wave packet length) of photon decrease with rising of energy. By dominating opinions however, the localized light particles are considered to have "small sizes", compared to heavy ones, vs. to photon. We see such belief as intuitive-esthetical only, as there are no facts directly proving such imagination, while the arguments on inverse direction are much (if considered!) We will examine the issue further. We shall emphasize one remarkable detail as well. As we see, $QP=(hc)^{0.5}$ has "electrical dimension" (numerically equal to the potential of field's contour with unit length.) Such fact additionally confirms the wave-field nature of substance. Above representation shows: ***c and h are the invariant eigen parameters (dynamic and quantitative) that define peculiarities of QEF within combination of a single free parameter*** (as such the wave tension, wavelength, frequency etc. can be accepted). Using (2.29), we can simply estimate, for example, wave tension amplitude in QEF in its different manifestations. The field's tension amplitude in "ring-strings" of the electron (that forms a rest mass) will be about: $E_e \approx u_h / \lambda_e^2 \approx 7.5 \cdot 10^{10} [V/m]$. We estimate the field's tension amplitude for photons as $E_p \approx u_h / 2n\lambda^2$, where $n \approx (1/\eta\alpha)^3$ [6] number of pairs of whole wavelength in propagating wave packet. Accepting $\nu \approx R_y$, $\lambda \approx 10^{-6} m$ and $\eta \approx 1$, $n \approx 10^6$ (as atomic photons) we get: $E_p \approx 10^{-7} [V/m]$. Thus, we can talk about a single kind of physical reality only forming the material world, which is the ***energy*** of QEF. We have seen above, other kinds of physical values are possible to represent as QEF's parameters, properties, peculiarities etc. (1.4.3), (1.4.4), and these is possible to measure with "electrical" units only. It means the possibility of removing the concepts of "mass", kinds of "charges" etc, as well as numerous "calibrating", "setting" factors and functions from our descriptions of microcosm, becomes real, which much simplifies the subject.

7. Causal representation of QEF's interactions

a). The contour imagination of QEF opens an opportunity to causal representation of its kinds interactions⁸ (1.3.5). The interactions between QEFs with the same/close parameters (and their low harmonics) present actual interest to us, due to its wave essence (analogical to theoretical electrotechnique). We shall start with imaginary representation of atomic photons absorption/radiation that is important to comprehension of particles interaction in general. We shall mention first that QEFs' interactions will differ from classical: 1) with restricted (quantized) character of actions, that turns the process to a transitional. The exact description of interaction becomes complicated due to appearance of non-periodical components and kinds of Fourier harmonics. 2) The eigen parameters of QEF are simply interconnected by means of natural constants, which make results trivial, from cognitive viewpoint. We shall use mainly the second aspect; it yields approximate solutions/estimations in most cases. We present the description of photon's absorption/radiation process with hydrogen's atom within scheme (Figure 5.) We suppose the electron to be on the first Bohr orbit and frequency of incident photon equal to R_y to simplify the reasoning. The speed of electron $V_0 = \alpha c$ and photon's frequency coincide with angular circulation in this case, i.e. $\omega_0/2\pi = R_y = v_p$ that presents classical resonance condition. The energy of photon transforms to electron with the parameter $\Delta w/w \approx 1/n$ per one cycle. The number of whole waves in the wave packet is $n \approx 1/\alpha^3$ ($\eta=1$), [(35), [6]] and we get $\Delta w/w \approx 1/n \approx \alpha^3$ that defines intensity of process⁹. We define the time of process (Fig. 5. a), 1-2) as $\tau \approx 2nT = 2n/v_p \approx 2/R_y \alpha^3 \approx 1.6 \cdot 10^{-9} s$. We define orbital parameters in the end of absorption considering orbital energy $w_e = w_0 + hR_y = 2w_0$ that yields $R_e = 0.5R_0$, $V_e = \sqrt{2}V_0 = \sqrt{2} \cdot \alpha c$ (the centrifugal and electrical forces balance preserves; their values increase four times). The single factor that

⁸ That seems natural in context of unique base of substance.

⁹ It is important to mark that α^3 plays in QED important role characterizing intensity of el.mag interchange.

qualitatively distinguishes excited condition of electron vs. former stable, it is the difference between de Broglie wave and orbital length.

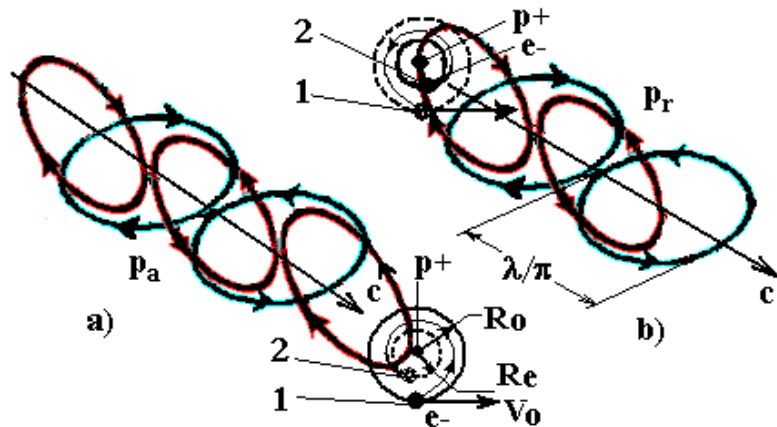


Figure 5. Illustration to absorption/radiation process of the photon

Explanatory to Fig. 5

a) Scheme of photon's absorption process, and b) The radiation process, P_a the absorbing photon, P_r the radiating photon, R_0 electron's orbital radius before absorption process, R_e orbital radius in the end of absorption, p^+ proton, e^- the electron, λ wavelength of photon, V_0 orbital speed in unexcited condition.

The "ring-strings" of photon's wave packet reach to atom and pass through electron's orbit R_0 . It induces additional component of tension in the contour of de Broglie standing wave (that coincides with the orbit) by the same frequency of electron's circulation. The increased tension of field accelerates the electron and "presses" it to center. The electron moves spirally and in the end of process reaches to radius $R_e < R_0$, its speed becomes $V > V_0$. The process corresponds to pumping energy and transition of electron to excited condition. b) Radiation of photon takes place with orbit's extension, and decreasing speed of the electron to the former.

Its relation becomes now $\lambda_{De} / 2\pi R_e = \sqrt{2} > 1$. It means standing condition of wave becomes disturbed on the new orbit that "inhibits" movement of the electron. The radiation process starts, corresponding to movement of the electron with extending spiral trajectory (Fig. 5. b), 2-1). We shall estimate tangential force and corresponding wave field's tension component, acting on the electron at the transition process as:

$$\langle F_a \rangle = dP / dt \approx m_e \frac{V_e - V_0}{\tau} \approx m_e \frac{ac(\sqrt{2}-1)}{1.6 \cdot 10^{-9} s} \approx 0.56 \cdot 10^{-15} N \quad (2.30)$$

It corresponds to field's average tension $\langle E_a \rangle = \langle F_a \rangle / e \approx 3.5 \cdot 10^3 V / m$.

We can estimate length of spiral way as: $L \approx \tau(V_0 + V_e) / 2 \approx 4 \cdot 10^{-3} m$.

We shall define the change of potential for de Broglie wave contour as: $\Delta u_D \approx \langle E_a \rangle L \approx 14 V$. It corresponds to electron's energy change at $14 eV$ that is close to R_y ($13.53 eV$). We shall link accelerating tension to absorbing/radiating photons wave tension E_p as:

$$\langle E_a \rangle \approx 2nE_p (\lambda_p / \lambda_D)^2 \quad (2.31)$$

Eq. (2.31) gets easy explanation with imaginary representations of QEF and photon-electron interaction (Fig. 1, Fig. 5.) The wave packet' contours become "pressed and wrapped" (trapped) on the electron's orbit at the end of absorption. It means the superposition of $2n$ numbers of contour λ_p on de Broglie wavelength λ_D takes place. Considering $\lambda_p / \lambda_D = 1/\alpha$ in first orbit and eq. (2.29) we get (2.31). Using values for E_p , n [2.1.6. b)], we get from (2.31) $\langle E_a \rangle \approx (2 \cdot 10^6 \cdot 10^{-7} / \alpha^2) V / m \approx 3.75 \cdot 10^3 V / m$ that confirms first estimation ($(3.5 \cdot 10^3 V / m)$) and presented causal model of interaction by the same. The mutual correspondences and straight links between orbit's radius, speed, orbital impulse, etc with the spectral energetic terms are obvious in presented model. As example, we can write **Balmer-Rydberg formula** as:

$$\nu_p = R_y (1/n^2 - 1/n_1^2) = R_y a_0 (1/R_e - 1/R) \quad (2.32)$$

Where a_0 first Bohr radius, R_e , R the radiuses in excited and stable orbits accordingly. Accepting $R_e = a_0$ (i.e. $L_{orb} = \lambda_D$) and $R = 4a_0$ ($L_{orb} = 2\lambda_D$), we get $\nu_p = R_y(3/4)$ that presents the first line in **Lyman series** [2.1.5.d)]. The same reasoning is possible for other frequencies/orbits as well. The opportunity of similar interpretations of phenomena conditioned with mutual influences of atomic electrons has to be clear for the reader. Descriptions of spatial orientations, precessions etc become technically difficult, due to number of participants. Different approximation methods are used in QM on the problem (see: **quasi-classical approximation, perturbation theory**), which principally are similar to causal-classical [11]. We find interesting to mark the opportunity of pumping energy by low frequency photons to generate a high one (for example, the pumping the

environment with the red light to radiate green, used in some lasers), it becomes simply explainable within modeling. The contour's resonance to harmonics well confirms this case. In favor of presented model, we shall mark also that the retention ("trapping") of the electron in photon's interferential field has been studied theoretically and experimentally in numerous works [12, 13]. This indirectly confirms the lawfulness of presented model in simplest logic. Since the photon's interferential field catches the electron, the opportunity of inverse phenomenon has to be, as any influence is mutual. The absorption of photon with atomic electron is possible to consider from this viewpoint. We shall mark also that **photon's propagation process** well fits to above interpretation. To preserve propagation speed equal to c , energy transfer in the photon's wave packet has to be with parameter $\Delta w/w \approx T/\tau \approx 1/n \approx (\eta\alpha)^3$ (35), [6] (i.e. with the energy, corresponding to single contour, per cycle). The process of propagation corresponds to induction of new contour "ahead" of wave packet with simultaneous annihilation of the last in the "end", per period of oscillation. The time of absorption/radiation process of photon corresponds to its propagation in presented model. The eq. (2.32) shows direct connection of spectral terms & orbits' radiuses. The speculative essence of "probable distribution" of atomic electrons becomes obvious by the same. As it seems, QM **accepts the exact distribution of spectral lines on the screen, as visible** (i.e. as fact) **and rejects the same for the electrons in the atoms, since it is not subject to direct observation!**

The actually coincidences of "probable redistributions" (1.1.5) with experimental dates, concerning to single, double and N -slits interferences are shown in [10]. The essence of QM equations becomes evident once more by the same, as **causally determined**, since the wave interference is a classical phenomenon, described within causal relations. The common principle of wave phenomena and electrons' behavior in atom becomes obvious, upon multiple judgments and results. The "probability" becomes then as an unjustified introduction, that causes confusion only. The contour representation of QEF appears productive to understand the interactions of localized particles also. The electron's model (Fig. 2) corresponds to contour representation. The representation of electron's interaction with γ quanta (**Compton Effect**) becomes simply possible by the same causal principle, as the photon with de Broglie standing wave.

Thus, ***the principal combination of energetic, kinematic and geometric properties of QEF in the common causal frame of electrodynamics is possible.*** The opportunity to reduce all kinds of phenomena to the electromagnetic becomes evident by the same (1.3.5)

8. Causality & uncertainty: Stability of elementary particles

The uncertainties of quantum objects are presented in official physics as “indisputable prerogative” of QM, which are “not subject to causal interpretations”. The HU interpreted in [6] as deviation of QEF parameters in consequence to wave packet restriction. The direct communication of HU with the fine structure constant is shown. It has been shown in [10] also. However, we need to emphasize that ***the process of deviation of QEF parameters is not subject to direct experimental confirmation due to general quantum limitations*** (it is explainable by simplest logic; this circumstance, itself, leaves place to cognitive speculations to justify the formal methodology!) Mentioned view corresponds to conclusions of deserved theorists [14] (doomed to oblivion!) We shall divide first the QEF uncertainties by the obvious criterion. We call ***eigen uncertainties*** the consequences of above-mentioned wave beating process which is a causal/regular deviation of QEF parameters. We accept as ***external uncertainties*** those, which are conditioned by movement of QEF relative to observer. These are the uncertainties of coordinate-impulse and derived relations, connected to the process of measurement. We just note that their causal representations also become possible considering the wave nature of quantum objects, their actual sizes, time of measuring process, etc. We will study the first type only as necessary for future issues. The SUD (symmetry of uncertainties distribution) serves as stability condition of photon, expressed as $(\Delta\lambda/\lambda)^3 \approx (\eta\alpha)^3 \approx 1/n$ [6]. In geometrical-imaginary representation it corresponds to the symmetrically/homogenous volume distribution of wave-beating deviations on the full length of wave packet, with the parameter α (we find useful to image a chain having the same thickness and form of rings). It is taken in SUD $\eta = 2\pi$ (that yields $n \approx (2\pi/\alpha)^3$, $\nu \approx \nu_e$) as special (additional) condition necessary for stable localization of QEF. We imagine above condition as a possibility of homogenous chain to wrap on a wavelength with creation of a volume, symmetrical in respect to Cartesian coordinate axes. It corresponds to symmetric form, from geometrical

viewpoint, and with well-balanced (in relation to 3-axes) rotating flywheel in mechanical analogy. Presented model of localized QEF corresponds also to **phases and spatial angles equality condition** of wave interference, from wave-dynamic point of view. It yields electron's parameters, corresponding to actual (Fig. 2), [6]. From previous narration, we can formulate stability condition for kinds of QEF manifestation as below: **a). The stability condition of none localized** QEF (photon) **corresponds to SUD by one dimension** (the homogenous distribution of uncertainties by the length of wave packet). **b). The SUD for the plan localized QEF is two-dimensional** (for photon "trapped" in atomic orbit). **c). The SUD for stable localized QEF is tree-dimensional** (the localized stable elm particles). The large spectra of freely propagating QEFs (photons, γ quanta), the limited quantity of atomic orbits and the existence of few stable localized QEFs only (known localized fundamental particles) become causally comprehensive in context of above presented common principle of SUD. We see one more time the whole importance of understanding the true meaning of α [15, 16].

9. Wave-vortex representation of the basic hadrons & neutrino:

a). Physical/geometrical models of proton/neutron

The presented stability condition of electron $\eta = 2\pi$ corresponds to "wrap" of uncertainties by diametric length of localization $\pi d = \lambda$. We can understand it as a special case only, since SUD preserves also in cases $\pi D = k\lambda$, $\pi d = \lambda / m$, where: $k=1, 2, 3, \dots, n$ whole positive numbers, and $m=2, 4, 6, \dots(?)$ the even numbers (that can be a few only!) Mentioned conditions simply correspond to **many-wave** and **half-wave** (quarter etc) **standing waves** (interference). Possible kinds of QEF localizations are illustrated graphically. Electron corresponds to **One-wave** localization of QEF within illustration [Fig. 6. **a)**] studied in [6]. We begin with study of the many-wave localization. As we see in graphic, the k number of whole waves becomes necessary to cover diametric length of localization πD in the many-wave localization; the cellular structure arises in result [Fig. 6. **b).**] We can represent each cell of localization in analogy to electron and describe as it is.

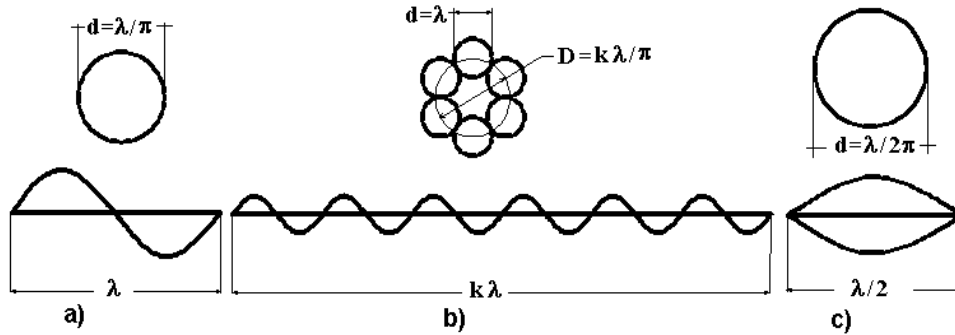


Figure 6. Possible kinds of QEF localisations

a) One-Wave, b) Many-Wave, c) Half-Wave standing waves

We shall emphasize first one important detail: as seen, the diameter of cells becomes $d=\lambda$ whereas for the electron it is $d=\lambda/\pi$. It yields $\eta_c=\pi\eta=2\pi^2$. The number of whole waves in each cell will be defined as $n=(1/2\pi^2)^3=\pi^3n_e$ to preserve SUD (see previous point) where: n_e is the number of whole waves composing electron's wave packet. Meantime, the reduction of wavelength by $1/\pi$ yields increase of energy on π^2 for the one single whole wave, in conformity to Maxwell's equations. Thus, the eigenenergy of the particle becomes $k\pi^5$ times more than electron's. It's easy to see that at $k=6$ we get known relation $6\pi^5 \cong 1836.118 \cong m_p / m_e$ close ($\delta \approx 0.016\%$) to actual ratio of proton/electron mass [17]. The presented coincidence is not unique. Described model opens simplest opportunity to interpret large kinds of properties/peculiarities of basic hadrons (proton, neutron) that we shall examine with the scheme of 6-th cellular particle (Figure 7). We do not have an accomplished answer to intriguing question, why the number of cells is six? Below judgment deserves attention. The 6-cellular construction shows a specific (magical) peculiarity, from geometric viewpoint, which does not repeat with any other number of cells. An identical cell is possible to place inside the structure that touches all externals [Figure 7, a)].

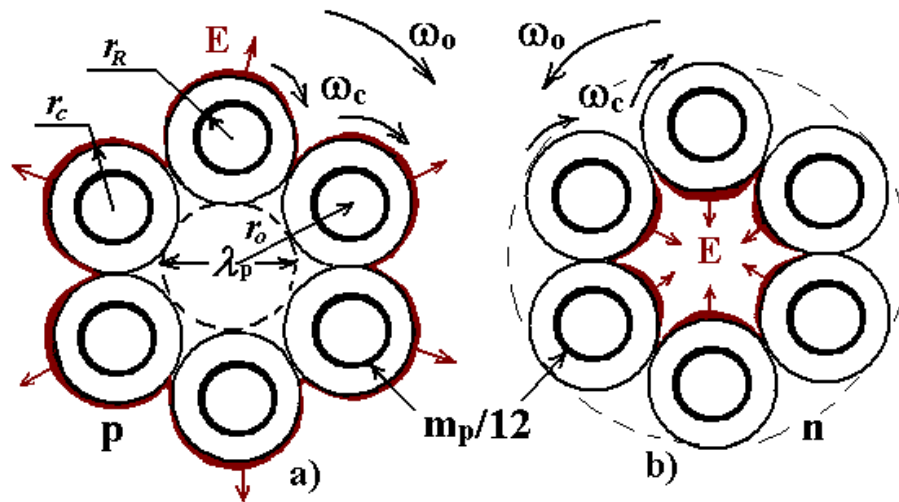


Figure 7. Scheme of the proton a), neutron b)

$m/12$ - the "ring-string" of the mass, \mathbf{E} - the el static field
 ω_o - orbital speed, ω_c - cellular circulation speed

Mentioned peculiarity looks important from wave-dynamical point of view, as mandatory to stability of the many-wave standing condition.

Next conclusion concerns to dimensional appraisalment of the particle. The particle "thickness" is equal to Compton wavelength: $\lambda_p \approx 1.3 \cdot 10^{-15} m$ as seen in graphics. It confirms experimental estimations of **nuclear radiuses** $[(1.3 \div 1.7) \cdot 10^{-15} m / per nuke]$ ¹⁰. Meantime, we get an important clue concerning to linking of hadrons in the nucleus structure and to its possible forms (to be discussed).

The multi-cellular structure yields new peculiarities of particle. It may have the **orbital momentum** in two possible directions relative to circulation of cells, as seen in graphics. We can imagine two ball bearings as: **a)** rotating with the imaginary external corps, relative to unmoving central shaft, and **b)** rotating with the shaft, relative to unmoving external corps.

¹⁰ The coincidence of nucleons "thickness" with Compton wavelength looks in modern physics as coincidental/unclaimed

We link the existence of basic hadrons p, n to the presented models; their different dates are interpreted as consequence of described two combinations of cellular/orbital momentums. We define summary spin of particles taking in consideration that angular speed of circulation in the cells decreases as the waves become “wrapped” by π times shorter vs. to electron scheme (Fig. 6). Considering above we get:

$\omega_c = c / \pi r_c$, $r_c = \lambda_p / 2 = h / 2m_p c$ where: ω_c, r_c are the angular speed and radius of cells accordingly. We define spin, using dates and graphic, as:

$$S = 12 \frac{m_p}{12} \omega_c r_c \sin \frac{\pi}{4} r_c \sin \frac{\pi}{4} = \frac{h}{4\pi} = \frac{\hbar}{2} \quad (2.33)$$

The particle’s spin does not change, since the transformation of impulse/energy from “balls” to “corps”/“shaft” does not take place in both models. We present summary spin of particle as:

$$m_p (\omega_o r_o^2 + \omega_c r_R^2) = \hbar / 2 \quad (2.34)$$

Where: ω_o, r_o are the orbital angular speed and radius accordingly, and r_R is the radius of “ring-string” in the cells. In the first model: $\omega_o = \omega_c = \omega$ We find from graphic: $r_R = \lambda_p \sqrt{2} / 4$, $r_o = \lambda_p$ and from (2.34) we get:

$S = 1.125 \omega \lambda_p^2 m_p = \hbar / 2$. Considering: $m_p = h / c \lambda_p$ we define angular speed:

$$\omega = c / 4.5 \pi \lambda_p \quad (2.35)$$

The magnetic momentum of the particle is defined in analogy to electron [6] within below judgment: if we assume the particle does not have orbital momentum then its magnetic momentum has to be defined as: $\mu = (6 / \pi) \mu_N$, since the contour of circulation of “elm charge” increases 6-times and their angular speed becomes π times less, compared to single-cell particle (electron). ($\mu_N = e \hbar / 2 m_p$ is accepted as *nuclear unit magneton* in analogy to *Bohr magneton*). This simplest judgment yields the value definitely close to neutron’s magnetic momentum:

$$\mu / \mu_N = (6 / \pi) (e \hbar / 2 m_p) / \mu_N \approx 1.910 \approx \mu_n / \mu_N \approx 1.9130 \quad (2.36)$$

Considering (2.35), we count the orbital factor of mag. momentum as:

$$\mu_o = e V r_o / 2 = e c \lambda_p / 2 \cdot 4.5 \pi = e h / 9 \pi m_p \approx 0.44 \mu_N \quad (2.37)$$

We have accepted $r_o = \lambda_p$ in above judgment. By representing the “el charge” (the pseudo static field) as manifestation of secondary

interferential maximums [6], considering also the *phase/angular correspondence principle for the interference*, we make following conclusion: the secondary interferential maximums have to be located on the moving sides of contours of circulation. The instantaneous speed becomes maximal on the external side of cells, and zero on the internal in first model and inverse for the second. The “el charge” has to be distributed on the external/internal sides of cells in the models accordingly (“charge” shown in red color). The factor of “charge” redistribution appears equal to the orbital. Meantime, for two models it gets inverse signs. We define the mag. momentum of two particles considering above judgment and results (2.36), (2.37) as:

$$\mu_p \approx \mu_N(1.91 + 0.44 + 0.44) \approx 2.79\mu_N \quad (2.38)$$

$$\mu_n \approx \mu_N(-1.91 + 0.44 - 0.44) \approx -1.91\mu_N \quad (2.39)$$

Where: the signs of mag. Momentums are taken relative to spin¹¹ [18]

The presented modeling demands *presence of “charge”, inside neutron, which is a new property* that may be subject of an experiment.

b). Mass differences of n, p hadrons. The p, n masses’ difference is linked to presence/absence of “elm charges” of particles within accepted interpretations [18]. Considering the previous content, we need to add only some details. Proton looks like “charged sphere” and neutron as “charged capacitor” in the models (Fig. 7). Hence, the difference of “electrical mass” will be defined with hidden electrical energy in the neutron (“capacitor”). The particles have difference in mag. fields’ energy, due to difference of mag. momentums, which we also must take into consideration. We have defined Δm_{np} , considering models and above remarks by below formula:

$$\Delta m_{np} \approx \frac{e^2 / 8\pi\epsilon_0 \cdot 0.6\lambda_p}{c^2} \left(1 + \frac{\mu_p - \mu_n}{\mu_n}\right) \approx \frac{\alpha h}{4\pi \cdot 0.6\lambda_p} \left(1 + \frac{\mu_p - \mu_n}{\mu_n}\right) \approx 2.3 \cdot 10^{-30} \text{ kg} \quad (2.40)$$

Where, we have accepted approximate radius of “charge” distribution inside neutron $\approx 0.6\lambda_p$ from graphics [Fig. 7. **b).**] We have used also the

¹¹ The *isospin* of inverse directions attributed to hadrons in particle physics, with the corresponding quantum number.

equality principle of electrical and magnetic components of pseudo static fields' energy ("charges") [6] and the known relation $e^2=2\epsilon_0ahc$.

c). Differences of stability of n, p hadrons and possibility of their links

The dependence of magnetic force on distance is $1/R^3$ vs. electrical $1/R^2$. The magnetic-attractive and electric-repulsive forces between two electrons become equal on the distance of their centers $2R=\lambda/\pi$ (in touch state) with their axial orientation (Fig. 2). It shows that two electrons cannot be in linked state without external pressure. The Coulomb repulsive force exceeds the attractive magnetic if distance of two protons is bigger $l \geq (1.5 \div 2)\lambda_p$. In simple estimation, electrical force becomes smaller than magnetic, in the fusion of two protons (with "flat" sides). Their binding energy becomes comparable to the characteristic binding energy of nucleons¹². Thus, the short-acting force between nucleons becomes possible to interpret as Ampere/Lorentz interaction of wave-circulation contours. It is possible to appraise from particles' schemes that the form of n, p hadrons and their mag. fields' configuration allow their different fusions. The preferable fusion of n, p hadrons, due to difference of "charges" distribution becomes comprehensive. We can conclude from models that stability condition of n, p cannot be the same. The electrical energy, concentrated inside, will be destructive for the neutron (in simple analogy to Coulomb repulsive force). The Proton's electrical energy is distributed in the space, starting from its surface hence is not destructive. Moreover, the Lorentz force, pressing the cells to center, increases stability of the proton. We estimate it as enough to keep the neighboring neutrons in stable condition as well, in the nuclear structure (Fig. 8). An intriguing question arises from presented nucleus model concerning to presence/absence of friction between linked particles. We suggest below interpretation, which simply follows from previous content and models. As it follows from HU representation, the dimension of particle also has the deviation (beating) as eigen uncertainties of parameters. It yields some enlargement in effective sizes of particle (it causes anomaly of mag. momentum of the electron) [6]. Meantime, it forms "boiling zone" on the surfaces and causes some bounce of particles within short distance, relative to their sizes. The particles become as free from friction due to

¹² It varies in range about $1 \div 9$ MeV per particle, for different nukes

described process. Thus, we can imagine the localized particles as “in vibrating and rotating state same time”. We can see that combination of these properties with static Coulomb/Lorentz, central/axial forces opens an opportunity to causal comprehension of the formation of structure and behavior of atomic nucleuses. For example, it is easy to conclude that nucleons may have kinds of elastic deformations and, corresponding to these, the internal oscillations, axial and angular.

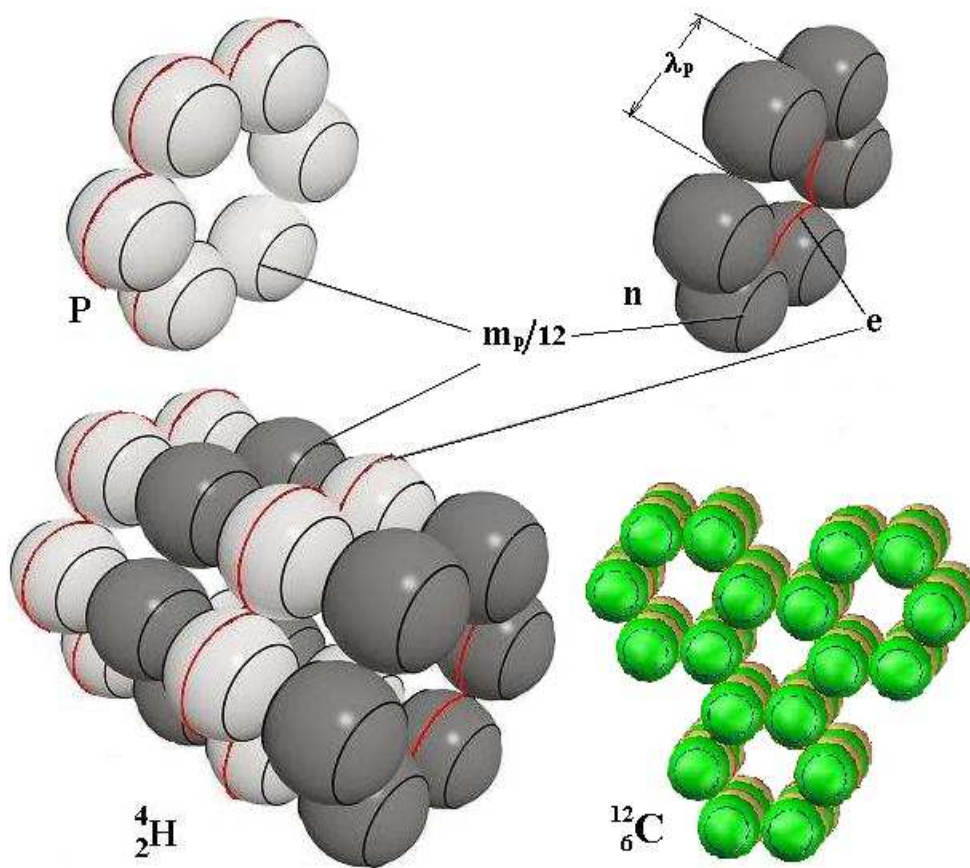


Figure 8
The schemas of proton, neutron, helium and carbon nucleuses

The described nucleus model does not contradict to empirical models, used in practice of study of nuclear transformations (“drop” model, etc). The known common and individual properties of nucleus mostly correspond to the presented model that we shall mark briefly. As it seems, the $2p+2n$ combination of hadrons has to be in high stability, due to symmetry of form and full balance of magnetic fields. It explains the high stability of ${}^4_2\text{He}$, ${}^{12}_6\text{C}$, ${}^{16}_8\text{O}$ nucleons, etc (Figures 8, 9). A few strong deviations of binding energy in the beginning of curve (light isotopes) and their gradual extinction on right become simply explainable.

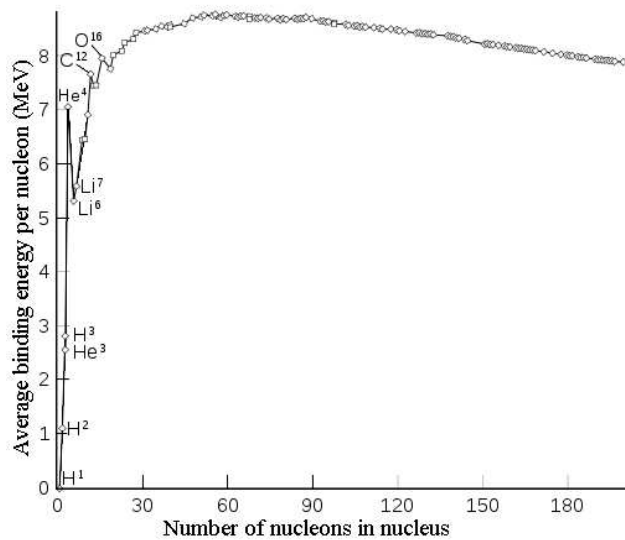


Figure 9. The curve of binding energy

The **form factors** and existence of **magic numbers** for nucleons, forming the stable isotopes [18] confirm modeling. As it seems, the nucleus model corresponds to **hexagon-crystal structure**, formed by principle of fusion of the completed + uncompleted “tubes” of H^4 nucleons. The fusion of next nucleons may be from “side” (as in ${}^{12}_6\text{C}$) as well as from “front”. The cells’ mag. field plays “gluing” role in this case. We shall mark that presented **nucleus model corresponds to quantum condensate** as well, since “absence of friction” and presence of the static, polarized forces between

nucleons. The model may help to explain the *Bose-Einstein* and *Fermi-Dirac condensate* properties as we hope.

d). Neutron's β decay. We can imagine the neutron as inverted (or excited) proton that aggravates its stability condition. It will be natural to look at the transition $n \rightarrow p + e + \tilde{\nu}$ as return of particle into stable condition from excited. We can imagine the process as reversal of the particle's orbital momentum into direction of cells circulation (Fig. 7). To describe it, we use analogy of photon's radiation. The angular speed of circulation and "charge" distribution (from internal to external) is changing in the process, similar to the first. The change causes induction of new contours of circulation, forming two new localized wave-vortexes (particles) within conservation laws. The process quantitatively corresponds to photon's radiation/localization, i.e. it has a universal, **exchange character**. We use reasoning from energetic point of view (kinematical description of process looks somewhat difficult due to composite structure of particle). Assuming that process corresponds to photon's radiation, conditioned by α^3 factor [2.1.7. a.)], we define the energy transformation parameter as:

$$k \approx \alpha^3 [1 + (\mu_p - \mu_n) / \mu_n] \quad (2.41)$$

In the formula we have considered a share of magnetic component (2.40) as well (vs. atomic photon's, where mentioned factor is ignored as insignificant, due $V \ll c$). We define the average power of energy change as: $d\mathcal{E} / dt \approx \Delta w / \tau \approx k w_n / T$, where $T = 1s$ is unit time, τ relaxation time, w_n neutron's eigenenergy. Considering $\Delta w = w_e$ (ignoring the share of neutrino in reaction), we get:

$$\tau \approx \frac{w_e}{w_n \alpha^3 [1 + (\mu_p - \mu_n) / \mu_n]} \cdot s \quad (2.42)$$

It yields $\tau \approx 16 \text{ min}$ (vs. $\approx 15 \text{ min}$ experimentally established)

The correspondence of results (2.40), (2.42) to actual, deduced within general concept, evidences the reliability of interpretation and modeling.

We can imagine the process as "slow" creation of the standing wave-vortexes around the neutron, forming the electron and neutrino, in consequence of static fields' change, during orbit's reversal.

e). The essence of neutrino. We concluded from graphics [Fig. 6. c)] that the 3-th type of localized QEF has a new kind of peculiarity vs. examined e , n , p particles. The secondary interferential peaks will be distributed with inverse-symmetrical angular directions, since the localization takes place as $1/2$ ($1/4$, etc) wavelength of standing waves. It will cause mutual annihilation of secondary peaks and pseudo static fields in localization. It means, this kind of particles have no electric/magnetic “charge”. We call these “truly neutral particles” vs. neutron which has a hidden electrical “charge” (and partially, magnetic). The stability of particles will be much easier vs. “charged”, since these become free of corresponding interaction. We will estimate eigenenergy of particles in general principle. We define the number of whole waves in a wave packet and energy using the same formula as for electron [6], $n \approx (2\pi/ma)^3$ accepting $m = 2, 4...$ etc (for the electron: $m = 1$, $n_e \approx (2\pi/a)^3$). We define $n_1 \approx n_e/8$, $n_2 \approx n_e/64$ etc. These correspond to energies:

$$w_1 \approx w_e/8^2 (\approx 8 \text{ keV}), \quad w_2 \approx w_e/64^2 (\approx 124 \text{ eV}),$$

Where: $w_e \approx 511 \text{ keV}$ is the electron’s eigenenergy. The estimations of energy and absence of el. static fields (“charges”) allow identifying described particles with the neutrinos. We cannot to assert it confidently due to absence of mag. momentum and the non-established values of masses (their presence?) for the neutrino. This kind of particles must have a mass, in general context of approach. It is interesting to mark that the radius of the first particle is about half of the first Bohr radius. Thus, the neutrinos become incomparable with other localized particles with their huge sizes and insignificant densities of energy, relative to n , p , e . Mentioned circumstance and absence of “charge” allow neutrino to let other particles pass through it, “not feeling” their presence. Thus, the change of intuitive-ethical perception (“a light particle should be smaller than the heavy one!”) allows simple solution of this old, intriguing problem - to explain huge penetration ability of neutrino.

f). Unstable particles & significance of their study

The presence of numerous kinds of localized unstable particles becomes explainable within previous content, as localized QEFs that not satisfy the SUD conditions [(2.1.8. c).] The purposefulness of their further study also becomes easily understandable if guided by their common essence. The

lifetimes of free γ , e , p basic particles, that practically may be considered as infinite even in cosmic scale (!), are incomparable with the unstable particles, which live for insignificant time, even in human scale (!) The natural question immediately rises for realistic researcher - why the lifetimes are so different for two objects, which are so similar by all other aspects? Mentioned huge difference and such inevitable question required an answer in same significance, before of detailed study numerous kinds of unstable particles. Their short lifetime and tremendous quantity may point on some construction defect or, unbalance etc vs. stable particles. ***Stable particles are incomparably important as objects of study vs. unstable, by the same criterion of their stability as completed constructions, which build our material world.*** Meantime, the possibility of mutual transformation of all particles, that yield few stable particles only in the end of any reaction, evidences the intermediate-transition essence of unstable particles. Thus, the situation becomes analogical to below, from cognitive viewpoint. << We initially know that water transforms into steam in result of boiling, and we do a detailed study of the process hoping to open water's chemical formula in such way (since we don't know other!) We become happy with every detection of new forms of bubbles or streams, imagining that we came close to the desired target having no doubt that a new kind of concepts and science required to this purpose>>. The story gives an idea what is going on in advanced line of science and on what we can reckon in future on the subject, in author's view. Thus, we can assert. ***The numerous unstable particles do not deserve special attention due to their common physical essence, as kinds of transient states of the same substance.*** We can estimate the tremendous efforts for their production, systematization and description as a mostly useless occupation, upon above content.

3. Resume

- The opportunity of representation of the quantum phenomena in causality principle, on the wave-field common nature of the substance is shown, with numerous solutions of disputable problems.
- The interpretation of quantum objects' behavior as manifestation of "new kind" of nature laws ("probable/statistical") was an arbitrary-unscientific decision. The Schrödinger's equations and quantum laws are causal laws by their essence, related to electromagnetic field's

description. These are derivatives from Maxwell's equations, with consideration of natural invariant parameters of field (c, h).

- Mentioned misinterpretation has brought to an artificial-speculative methodology (formal-mathematical) with rejection of natural way of research in subject area. The significance and productivity of returning to the causality principle and natural thinking is possible to judge by numerous results and self-consistency of the presented picture.
- The known viewpoint of Einstein on the essence of substance and his phenomenal prediction of the future way of physics, Schrödinger's and de Broglie's deep convictions in the wave-field nature of the particles, the efforts of many realistic thinkers on the same direction mostly become confirmed in presented work, in author's viewpoint.
- The cause-conceptual interpretation of substance may provide new aspects/opportunities to solution of basic problems, related to gravity, cosmology, symmetry breaking etc.

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