

# The informational model – Nuclear Force

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**Abstract** In this paper the universal model of fundamental interactions (fundamental Nature forces), which was developed in 2007-2023 in framework of the whole informational physical model that is based on the main postulate that everything in Matter exists, happens, interacts, and moves as some specific disturbances in Matter's ultimate base – the [4+4+1]4D dense lattice of the [4+4+1]4D binary reversible fundamental logical elements [FLE]; including particles are specific disturbances – close-loop algorithms that cyclically run basing on the FLE “hardware”, which was applied at developing of the 2007 initial models of Gravity and Electric forces, is applied here at developing of the initial model of Nuclear Force. It is shown, that in the case, when the particles, including the nucleons in nuclei, interact on some distances, the action of Nuclear Force is seems practically complete analog of action of Gravity and Electric forces, i.e. the Nuclear Force mediators, “circular mesons”, are in the main traits analogs of Gravity and Electric forces mediators “circular gravitons/photons”, also are propagating in the lattice as specific disturbances that are initiated by specific parts of particles' algorithms' FLEs “Forces charges”, and which, in contrast to particles, at propagating in the lattice, don't carry energy, while carry the standard and universal for all Forces elementary momentums  $p=\hbar/r$ ,  $r$  is distance between particles, which is transmitted to other particles, where, in contrast to the mediation of Forces in standard physical theories, all mediators are completely real, and by no means “virtual”, structures in Matter. The developed model is in accordance with existent nuclear physics experimental data.

**Key words:** informational physics; fundamental Nature forces; fundamental forces mediators; Standard particle Model ; nuclei,  $\pi$ -mesons, Nuclear force

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## 1. Introduction

In the 2007 “The Information as Absolute” concept [1 - 3], the recent version of the concept [3a], it was rigorously proven that Matter in our Universe – and Universe as a whole - are some informational systems (structures), which exist as uninterruptedly transforming [practically] infinitesimal sub-sets of the absolutely infinite and fundamental “Information” Set. This informational concept has enabled to propose the informational physical model (more see [4],

[5]), which, basing, first of all, on the really outstanding C. F. von Weizsäcker's 1950-54 years "UR" hypothesis [7, 8] and Fredkin-Toffoli finding [9], adequately to the reality and in complete accordance with all existent reliable experimental data depicts the motion and interactions of particles in spacetime. In the model the ultimate of Matter's base is the Matter's "ether" – the dense lattice of at least [5]4D elementary logical gates – "fundamental logical elements" (FLE), which are some (essentially distinct, though) analogs of C. F. von Weizsäcker's 1950-54 years "Urs". The FLE's sizes in the spacetime in both – in the space and in the ("coordinate,"  $c\tau$ , and "true",  $ct$ ) times dimensions – are equal to Planck length,  $l_p$ ,  $l_p = (\frac{\hbar G}{c^3})^{1/2}$ ,  $\hbar$  is the reduced Planck constant – the elementary physical action,  $G$  – gravitational constant,  $c$  – the speed of light in the vacuum; the time interval of the FLE's state change – "FLE's binary flip" is equal to Planck time,  $t_p, t_p = \frac{l_p}{c}$ . The lattice is placed in the corresponding Matter's utmost fundamental and universal fundamentally absolute, fundamentally flat, and at least utmost universal [5]4D, Cartesian spacetime with the metrics  $(c\tau, X, Y, Z, ct)$ , where the dimensions correspond to the main FLE degrees of freedom at changing of its state – "binary flip", and everything in Matter is/are some specific disturbances in the ether.

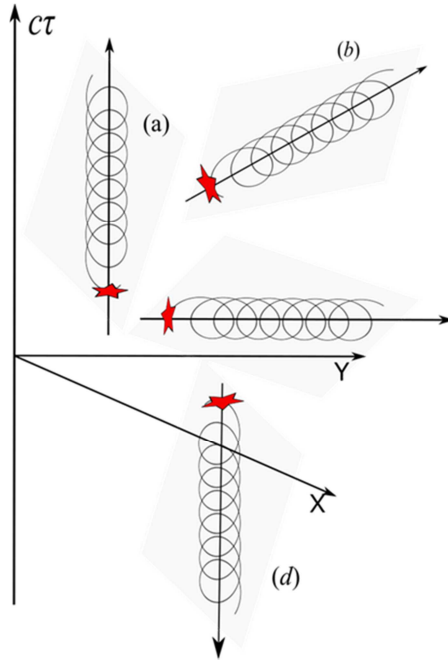
The model yet now solves and makes clearer more 30 fundamental problems in physics, see [4], [5]; including, enabled to put forward rather reasonable 2007 initial models of the fundamental Nature Gravity and Electric forces in statics [1]. where the Forces mediators are real – i.e. by no means virtual - disturbances in the Matter's ether. In [6] more detailed and corrected version of the model, including description of free fall motion of gravitational test mass in Gravity field and of motion of electric charges, was presented, where it is shown that at the motion in any field no singularities are created, and so rather probably it is possible to obtain at least first approximation description of motion of masses in extreme gravity fields, including below event horizon in SMBH, etc. As well as it is rigorously shown that both – Gravity and Electric Forces fields have no energy and energy density, don't interact specifically independently on charges with anything in Matter, so there is no "electromagnetic" masses, etc.; besides the models explain why the inertial and gravitational masses are equivalent, the fundamental puzzle why  $\alpha\hbar c = e^2 / 4\pi\epsilon_0$ , etc. In this paper we consider the fundamental Nuclear Force.

## 1.1. Particles

Particles (more see [4]) are specific disturbances in the [5]4D ether, which are created when some ether's FLE is impacted by some 4D momentum,  $\vec{P}$ .

If the momentum is practically infinitesimal, than in the lattice some straight line of sequentially "this-next" flipping ether FLEs appear, when the "flipping point" moves in the ether [and so in the 4D space with metrics  $(c\tau, X, Y, Z)$ ] with 4D speed of light, and corresponding "particle" has zero inertial mass and zero momentum – as for the case when FLE doesn't flip at all. But after some impact with non-zero momentum  $\vec{P}$  in its direction, since the flipping cannot be with a speed that is larger than  $c$ , that results in precessing of the flipping FLEs, the flipping trajectory transforms into some 4D "helix"; and so the flipping transforms in some close-loop algorithm – which is just a created particle, which moves in the 4D space with the 4D speed of light, having momentum  $\vec{P} = m\vec{c}$ , energy  $E = Pc$ , inertial mass,  $m$ , and the "radius" of the "helix"

$\lambda = \frac{\hbar}{mc}$ , which is the particle's Compton length. The frequency the algorithm ticks with which is  $\omega = \frac{E}{\hbar}$  (see Figure 1)



**Figure 1.** A few examples of particles creation (a) – a T-particle at 3D absolute rest moves along  $c\tau$ -axis; (b) – a T-particle moves also in 3D space; (c) – a photon moves only in 3D space; (d) – a T-antiparticle moves along  $c\tau$ -axis in negative direction. Stars point events when an ether FLE is impacted. Note that that is only some illustrative picture, in 4D space a 4D “helices” on Figure don’t exist, so that can be quite equally painted relatively to  $(X,Z)$  and  $(Y,Z)$  planes as well. From this it follows, including, that neutrinos for sure have non-zero rest masses; and – when a T-particle moves in 3D space, its “helix” is the sum of two “helices” – along  $c\tau$ -axis and along the spatial direction.

Really there exist two main types of particles: – “T-particles” that are created by momentums that are directed along the  $c\tau$ -axis, which, if are at absolute rest in the 3D XYZ space, move only in the  $c\tau$ -dimension with the speed of light, and so have “rest masses”, that are most of particles; and “S-particles” that are created by momentums that are directed along some 3D space line, and so always move only in 3D space with the speed of light, having no “rest masses”, now that are for sure photons.

That above is a first approximation scheme, more see [4], [5], however in this case, i.e. when we consider what are the fundamental Nature forces, that is enough.

## 2 Mediation of the Forces in complex systems

### 2.1. Fundamental Nature forces and charges

Now four “fundamental” kinds of the fundamental interactions (four “fundamental Nature forces”) are known – Gravity, Weak, Electric (EM), Strong; which differ by the strength, e.g., for the proton as (approximately)  $10^{-36}:10^{-11}:1:10^2$ . In recent physics

mediating of Forces proceeds as exchange by Forces' mediators, which are "virtual" particles, in quantum electrodynamics that are virtual photons, Strong Force in QCD is mediated by virtual gluons inside hadrons, including nucleons, and outside, i.e. in systems of nucleons – atomic nuclei, as the nuclear Force – by virtual  $\pi$ -mesons.

Nonetheless it looks as completely rational to suggest that in Matter there are no "virtual" particles and interactions, and the "virtual particles" really is a mathematical trick, which, for unknown now reason though, is – in QED extremely – effective at elaboration of some physical tasks.

Correspondingly real interactions in Matter are caused and happen as real interactions of real material objects, and the mediators of the Forces really are not "virtual".

Besides in SM it is postulated that the virtual mediators, if are "free" become to be real particles, and can be detected, so in SM corresponding real particles are indicated as the Forces' mediators (forces carriers), see Figure 1

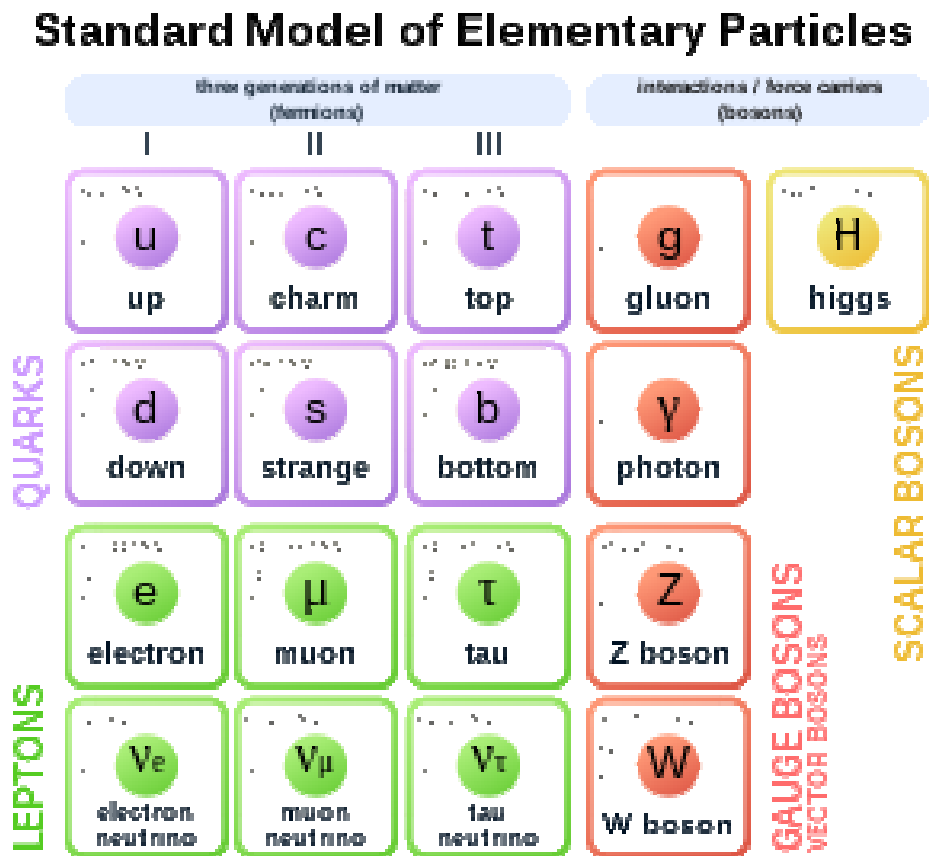


Figure 2. Elementary particles in Standard Model [10]

However, from experimental data it rather convincingly follows at least for Electric force, that the real interactions, at least in statics, are not caused by real "ordinary" photons – just which in QED are introduced as "virtual photons", but which in Standard Particle Model are indicated as real mediators. In this case there is no any experiment, where an exchange by ordinary photon was observed in a static system of charged

bodies, nonetheless the charges at statics really do interact; and it looks as quite rational to assume that the same is in every other Force case.

In this informational model the Forces are some logical marks, that can be, and are in Matter, assigned to, or, more correctly activated in, any FLE. So really FLE has more degrees of freedom at changing its state, and Matter' spacetime so has other than the ultimately common and universal "kinematical" [5]4D dimensions above, i.e. at least that relates to considered in [6] Gravity and Electric Forces, and considered below nuclear Force. Thus the real Matter's spacetime is fundamentally absolute, fundamentally flat, and at least [4+3+1]4D Cartesian spacetime with the metrics ( $c\tau$ ,  $X$ ,  $Y$ ,  $Z$ ,  $g$ ,  $e$ ,  $sn$ ,  $ct$ ), " $g$ " and " $e$ " are Gravity and Electric Forces dimensions, " $sn$ " is the nuclear force dimension. Rather probably there exist the " $s$ " dimension that relates to just Strong Force, however, since Strong Force seems essentially differs from the 3 Forces above (more see below), this model isn't applicable directly in this case now.

Now conjecture that if some FLE in the algorithm's FLE sequence of some particle has some Force's logical mark, then at constant cyclic running of the algorithm, it precesses in the Force's dimension with some precession angle relating to axis additionally to the 4D universal "kinematical" ( $c\tau$ ,  $X$ ,  $Y$ ,  $Z$ ) precession of particles algorithms' FLE (see section 1.1) above, and when this FLE flips, it causes flipping of neighbor ether FLE, at that:

- (i) - in these ether FLEs corresponding Force mark becomes be activated,
- (ii) – this ether FLE becomes to flip with (4+1)D space, i.e. in "kinematical" 4D and the Force dimension, precession as well, causing sequential flipping – and also "marked by Force" next ether FLEs., and,
- (iii) - at every flip the flipping FLE causes not only a next ether FLE flip – as that happens at articles' running, but so, that the flipping FLEs always compose in 3D space a dense circle "FLE rim".

However, the flipping and preceding FLEs in a rim differ from the flipping and precessing only in the 4D space particles algorithms FLEs, which compose close loop logical sequence and helix trajectory of their flips, the rim's FLEs don't compose close loop logical sequences and propagate always directly - along the rim radiuses orthogonally to the rim's circle; and, as that was pointed above relating to "kinematical" flipping of the ether FLEs along a straight line, when the Compton length of corresponding "particle" is infinite, and this "particle" contains zero energy, *the rims also don't contain energy.*

*Or, by another words, the rims aren't particles.* However the FLEs in the rims have specific momentums, so, when such FLE fits on an FLE of "irradiated" particle that has the same Force mark, *this particle obtains a "kinematical" 3D space momentum and, if is free, its kinetic energy increases. However, that happens in specific way – the impacted this particle's FLE precession decreases (if the Force acts as attractive force), and further the particle's algorithm ticks slower, and its own intrinsic energy and mass decrease.* Just by this way the negative defect mass arises in coupled by attractive Forces systems of particles, bodies, etc. – a particle moves in Forces' fields spending own energy, and so the energy conservation law acts, sum of energies in coupled by a Force closed system, if the energy isn't dissipated outside the system is always at any

interactions inside is equal to sum of energies that particles had when were completely free, i.e. at rest in 3D absolute space on infinite distances, i.e.  $E = \sum_i m_{0i} c^2$

That solves one of the main problems in mainstream Forces physics – where in the classical and quantum electrodynamicses the particles constantly radiate either EM field strength and at that the EM filed contains energy, or “virtual photons”, while, despite the constant radiating in outer space the strengths and virtual photons, the stable particles are stable billions of years.

Such marked flipping propagates in the FLE-ether as the Force mediator and when some this mediator’s rim’s FLE meets another particle algorithm’s flipping FLE that has this Force mark, the some momentum,  $\vec{p}$ , is transmitted to the other – “irradiated” – particle.

Note also a couple of important points else. First of all the Forces’ mediators propagate only in the 3D (XYZ) space - and so everything interact practically only in 3D space independently on – where a particle is in the  $c\tau$ -dimension; photons that are radiated by extremely distant cosmological objects interacts with anything on Earth without problems despite that are distant on  $c\tau$ -axis in billions of light years, and

- it looks as rather scientifically rational to conjecture, that if a Force rim is impacted by some way with transmission to the a rim’s FLE a non-zero “kinematical” 4D momentum, it transforms into some close-loop algorithm, what in the Electric Force case ordinary photons are, practically for .sure that is in the Gravity Force case, and so the “ordinary gravitons” exist; and, at that these rims transformations move, nonetheless in the 3D space also. In the Electric and Gravity Forces cases the transformations have zero rest masses and move in 3D space with the speed of light.

This scheme works in the similar Gravity and Electric Forces, however can, though non-principally, but essentially, differ in other Forces cases – in nuclear physics nuclear force acts, as that is postulated in physics now, as an exchange by virtual particles (mesons), while “ordinary” mesons are particles that have rest masses, whereas however that is not essentially principal and the scheme above seems rather effectively applicable in this case as well, more see below.

So the charge of a Force is, first of all, a set – a part – of Force-marked FLEs in the particle’s algorithm. However, that is not complete, the Force strength – and so “charge” also depends on the frequency at which this algorithm runs.

In the Gravity and Electric Forces’ models [1], [4], [6] some non-existent in physics now as real Electric force mediators “circular gravitons” and “circular photons”, are proposed, in this nuclear Force model we introduce analogously “circular mesons”

Remaining in this informational concept it is possible to put forward [1] rather reasonable conjecture: that particles interact exchanging by mediators that the strength of interactions is proportional to the *accidental coincidence rate* of random hits of the mediators’ FLEs on the other particle flipping FLE, which has corresponding Force mark . Such coincidences always exist since the FLE’s flip-time [Planck time] is not equal zero, and that happens in the 3D (XYZ) space, by three conditions:

(i) - the frequency at which a particle's algorithm runs if particle is at rest (in statics), is  $\omega = E / \hbar = m_0 c^2 / \hbar$ , where  $m_0$  is the inertial rest mass,  $c$  is the speed of light,  $\hbar$  is the Planck's elementary physical action;

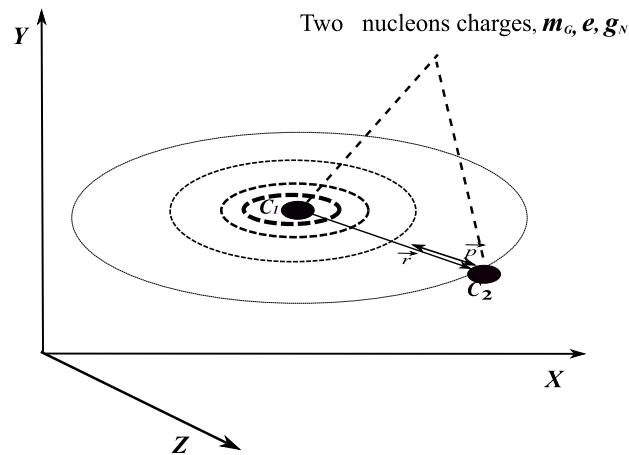
(ii) - in the model every particle's algorithm has different numbers of the marked by Forces FLEs

(iii) at every of a particle algorithm cycle, the flipping Forces-marked FLE initiate in the 3D space radial propagating of 2D rims – G-marked “circular gravitons”, E-marked “circular photons” and SN-marked “circular mesons” of flipping the FLE-lattice FLEs, which are a Force-marked also, and at hitting in flipping the same Force-marked FLE of other particle, that transmits to this particle the elementary momentum.

Since the Forces-marked FLEs flip independently in both particles, and particles practically are not oriented specifically in the space [what happens at Gravity and Electric Forces at least on macro scale], or that is at nuclear Force interactions, though since in this case this Force acts fundamentally only on the QM scale, that is true only in first approximation, the elementary interactions above are random.

As that was assumed above, the FLE's sizes are equal to Planck's length,  $l_p$ . Besides, as that is pointed above, assume that:

(i)- because of that all Forces above have potentials that are proportional  $1 / r$ , at every “tick” of a particle's algorithm “rim” of a Force-marked FLEs flips starts to expand in the lattice *in the space* with radial speed that is equal to the speed of light,  $c$ , so the rim's area is equal  $2\pi r l_p$ , see Figure 3,



**Figure 3.** A sketch of a spreading in 3D space of a Force-marked FLEs flips rims (of Forces mediators) in the space between two nucleons.  $C_1$  and  $C_2$  are Forces charges:  $m_G$  is Gravity Force charge (“gravitational mass”),  $e$  is Electric Force charge (elementary charge),  $g_N$  is Nuclear Force charge.

(ii) – the time intervals of the “radiating” particle's Force-marked FLEs, of the corresponding rim's the lattice Force-marked FLE, and other particle's Force-marked FLE, flips are the same and are equal to Planck time; and

(iii) – at the interaction of a rim’s flipping Force-marked FLE and a particle’s flipping Force-marked FLE, the “irradiated” particle is impacted with the specific transmission to it . the elementary momentum  $p = \pm \frac{\hbar \vec{r}}{r^2}$ , “+” if the Force is repulsive, “-” if the Force is attractive;  $r$  is the radius-vector from the radiating to the impacted particle.

It is evident, that interactions of the mediators and particles’ Force-marked FLEs are accidental events – coincidences of independent processes of “radiation” and spreading of the mediators of “radiating” particle and of the Force-marked FLE flipping of other one. Both – the rate  $n_1$  of mediators FLE in a point, where a particle’s Force-marked FLE flips, and the rate  $n_2$  of these Force-marked FLE flips, are random; and, if both [average] rates of coincidences inside Plank time interval,  $\tau$ , (note that isn’t, of course, “ $\tau$ ” in the spacetime metrics above) aren’t too large, then it is well known that the coincidence rate is equal

$$N_c \approx 2n_1n_2\tau \quad (1)$$

- and the momentum that is transmitted to “irradiated” particle in one second,  $\frac{d\vec{P}}{dt}$  is the force that acts on the particle

$$\vec{F} = \frac{d\vec{P}}{dT} = \pm N_c \frac{\hbar \vec{r}}{r^2} \quad (2)$$

The rate of a Force mediators’ hits,  $n_1$ , and the rate of the Force-marked FLE flips  $n_2$ , depend on both particles two parameters – the rate of the particles algorithms ticks, i.e.  $\omega$ , and on the number of the Force-marked FLEs in the whole logical algorithm’s length,  $n_F$ ,  $n_F = k \frac{\lambda}{l_p} = k \frac{\hbar}{mcl_p}$ ,  $k$  is some specific Force coefficient and, if we consider interactions between particles, then at given distance between particles so the force  $F$  is proportional to both these parameters,  $\vec{F} \sim \omega n_{F1} \omega_2 n_{F2}$  and the value  $\omega n_F$  is the component of a “Force charge”.

Gravity Force has extremely small charge, since in this case all particles have only one G-marked FLE and so  $n_F = 1$ ; in any particle; and so different particles, algorithms of which tick with different rates  $\omega$  in both cases, if a particle radiates the Gravity marked rims “circular gravitons”, or is irradiated with larger rate, it impacts / is impacted by larger force than a particle with lesser  $\omega$ . An example – gravitational force of proton is larger than gravitational force of electron in  $\approx 1835$  times.

Electric Force number of E-marked FLEs is relative,  $n_F = \alpha^{1/2} \frac{\hbar}{mcl_p}$ ,  $\alpha$  is the fine structure constant, and so the value  $\omega n_F = \frac{mc^2}{\hbar} \alpha^{1/2} \frac{\hbar}{mcl_p} = \frac{\alpha^{1/2} c}{l_p}$  is the same for all particles (we don’t say here about quarks) and so electron and proton interact equally..



Thus the ratio of the Forces charges values,  $R_{cF}$ , for equal masses, for identical particles, or practically equal in this cases proton and neutron, is determined only by  $n_F$ . Gravity and Electric charges ratio for electron  $R_{cF}(G : E) = \alpha^{-1/2} \frac{mcl_p}{\hbar} \approx 4.9 \times 10^{-22}$ ; and the forces' strengths between two electrons so differ in  $R_{cF}^2 \approx 2.4 \times 10^{-43}$ .

In reality the interactions of rims' and irradiated particles algorithms' FLEs happen in any time moment when the both Plank times intervals overlap (Figure 4).

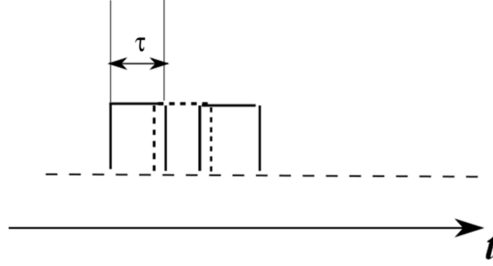


Figure 4. Overlapping of a Force's rim's the Force-marked the lattice FLE and the Force-marked FLE in the algorithm of the "irradiated" particle.

The forces, the particles interact with which, besides the values of  $\omega$  and  $n_F$ , depends also on two other factors – the coincidence resolution time interval,  $\tau$ , in Eq.(1), and on the "geometrical" probability of interactions that is equal at a given radius,  $r$ , to the ratio of the rims' widths,  $W$ , to the corresponding sphere surface  $\frac{2\pi rW}{4\pi r^2}$ ,  $W_G = l_p$  for Gravity Force,  $W_E = \alpha^{1/2} \frac{\hbar}{mc}$  for Electric Force, the coincidence resolution time interval is equal  $\tau_E = \frac{W_E}{c}$ ,

Thus the coincidence rate in a electrically charged particle is

$$N_{cE} = \frac{mc^2 \cdot 2\pi rW_E}{\hbar 4\pi r^2} P_E \frac{mc^2}{\hbar} 2\tau_E, \quad (3)$$

where  $P_E$  – the probability of the elementary momentum transmission at a coincidence. If  $P_E = 1$  the force that acts on the is

$$F_E = \vec{p} \cdot N_{cE} = \pm \frac{\alpha \hbar c \vec{r}}{r^3} = \pm \frac{e^2 \vec{r}}{4\pi \epsilon_0 r^3} \quad (4)$$

## 2.2. Initial model of Nuclear Force

As that is assumed in this model, all Forces at interactions of different particles act in accordance with the same scheme: exchange by mediators, mediators act only in 3D space as propagating 2D rims of flipping a Force-marked the FLE-lattice FLEs, and so the Forces' potentials are  $\sim 1/r$  potentials; and the relative strengths of a Forces really depends practically only on what fraction of the whole logical length of a particle's

algorithm a concrete Force-marked FLEs occupy. Correspondingly that should be true in the case of nuclear Force, which acts between different nucleons in atomic nuclei.

The potential for this Force was suggested by Yukawa yet in 1935 [11], when he suggested that nuclear Force is the action of some scalar field  $U$  that has the potential  $\sim 1/r$  - as that is in the Gravity and Electric Forces cases, however, unlike the Electric Force, it acts as exchange by some  $U$  quanta of energy, that are equivalent  $\approx 200$  electron's rest mass. Besides, using also the Heisenberg finding that the solution of Klein-Gordon equation for a field with additional term is that the field's potential exponentially decreases, he obtained the equation for nuclear potential

$$\varphi = -g_N \frac{\exp(-r/\lambda)}{r} \quad (5)$$

- where  $\lambda \approx 2\pi\lambda_p$ ,  $\lambda_p$  is proton's Compton  $\approx$ length,  $g_N$  is the nuclear force charge, nucleons in nuclei interact exchanging by these quanta. In physics there was known in 1930s no any rational mechanism how that can happen, including, e.g., the physics had (and has till now) no any understanding – how nucleons extremely intensively radiate energy quanta  $\approx 15\%$  of nucleon mass without any changes in their masses, why these quanta's impact decreases exponentially, etc., however after at high enough energy accelerators experiments  $\pi$ -mesons were detected, these particles were, and are till now, adopted in physics as real nuclear Force mediators.

However that, first of all the radiating energy problem, isn't unique problem, and in only this case. That eventually happens at consideration of many postulates in every, classical and quantum, physical theories, so in physics such considerations are practically tabooed; while in quantum field theories it is solved by rather evidently strange way: the Forces mediators are "virtual" particles, which in some points have properties and parameters of real particles – see Figure 2, however, if some properties and parameters of real particles evidently aren't applicable at descriptions and analysis of what really is observed at experiments, the virtual particles by some mystic ways lose these properties and parameters, etc.

An example of recent analog of Yukawa derivation of the nuclear Force potential equation is given, e.g., in [12]:

- squared energy equation of a free particle that has a rest mass,  $m$ , and moves in 3D space with 3D momentum  $p$  is

$$E^2 = m^2 c^4 + p^2 c^2, \quad (6)$$

- the corresponding Klein-Gordon equation for the potential of the meson field,  $\varphi$ , is

$$\nabla^2 \varphi - \frac{1}{c^2} \frac{\partial^2 \varphi}{\partial t^2} - \frac{m^2 c^2}{\hbar^2} \varphi = 4\pi g_N, \quad (7)$$

- where  $g_N$  is the density of the meson charge. The solution of Eq.(7) in statics case ( $\frac{\partial \varphi}{\partial t} = 0$ ) is

$$\varphi = -g_N \frac{\exp(-r/\lambda_m)}{r}, \quad (8)$$

- where  $\lambda_m = \frac{\hbar}{mc}$  is the Compton length of the meson.

It is evident that all in the QM approach above really can be correct only if in Eq. (6) – (8) the mass  $m$  really exists, i.e. really in this case again really rather strange process of intensively and constantly escaping from parental nucleons mesons is supposed; and, besides, if, as that is postulated in mainstream nuclear physics, the mesons are the  $\pi$ -mesons, which are unstable particles and decay with creation  $e^\pm$ ,  $\mu^\pm$ , gammas, neutrinos, and, since, even the mesons would move with the speed of light – really, since have rest masses, with lesser speed – and even in this case the mesons are free in average  $\approx \sim 10^{-23}$ s, they, nonetheless should decay; and so, since the mesons are radiated extremely intensively, any macro quantity of matter should radiate well observed decays products above. What isn't observed, while, besides at the decays observed stable particles must lose their mass rather quickly as well, however are stable billions of years. That looks as rather strange, however, again, that is typical situation if some virtual, but really existing and interacting particles, first of all the Forces mediators are introduced in standard physics at description and analysis of what exists and happens in Matter, and that is, say, in QED, the unique difference is in that in QED photons are stable and the “observable decay products” problem above in QED doesn't exist.

Nonetheless the following from the equations above the  $g_N$  value is consistent with experiments, including from the experiments at  $N$ - $N$  interactions it follows that the Nuclear Force strength in  $\approx 10$  times larger than Electric Force strength on equal distances, or, by another words,  $g_N \approx 10e$  in the CGS system.

This initial Forces model, which looks as quite applicable in the Gravity and Electric Forces cases, where different distant gravitational and electric charges interact, since in nuclei different particles interact on rather large distances as well, allows to describe what happens at nuclear Force interactions as well, using practically only two rational conjectures, that are used already in the Gravity and Electric Forces models:

- (i) - Nuclear Force differs, in that is essentially stronger comparing with other Forces, only because of that the number of Nuclear-marked FLEs in the nucleons' algorithms logical lengths is larger than that is in other Forces cases; and
- (ii) the Force mediators – “circular mesons”, unlike circular gravitons and circular photons, are unstable, and decay with decay constant  $\lambda_{cm}, \lambda_{cm} = \frac{r_0}{c}$ , while the rest is the same – circular mesons rims propagate in the 3D space only, only with the speed of light, and every flipping the ether N-marked FLE carries the momentum  $\vec{p} = -\frac{\hbar\vec{r}}{r^2}$

In proton's logical length Gravity- and Electric-marked FLEs occupy (one Gravity-marked FLE part of the algorithm is quite negligible)  $\sqrt{\alpha}$  part of whole length  $N_0$ . The

remained part is so  $\Delta N_N = \frac{1-\sqrt{\alpha}}{\sqrt{\alpha}} N_0 \approx 10.7 \Delta N_E$ , i.e. is as that is the experimental ratio of nuclear and electric charges  $g_N / e \approx 10$  above.

However here is a nuance, real electric charge in proton, which, as that seems rather rationally is postulated in the Standard Model, is a composition of charged  $u$  that has electric charge  $+2/3e$ , and  $d$  that has electric charge  $-1/3e$ , quarks ( $\bar{u}$  and  $\bar{d}$  are antiquarks),  $p = uud$ , and so its “whole” charge is  $5/3e$ , and so real ratio of the

$$\text{Electric and Nuclear charges parts of } N_0 \text{ is } \frac{\Delta N_N}{\Delta N_E} = \frac{1 - \frac{5}{3}\sqrt{\alpha}}{\frac{5}{3}\sqrt{\alpha}} \approx 6.04.$$

Nonetheless, since the positive and negative charges compensate action of each other, and so only 1e interaction is really experimentally observed, thus the ratio of the

$$\text{real strengths of these Forces is } \frac{\Delta N_N}{\Delta N_{Ereal}} = \frac{1 - \frac{5}{3}\sqrt{\alpha}}{\sqrt{\alpha}} \approx 10.03, \text{ i.e. in accordance with the}$$

experiment. Neutron is the quarks composition  $n = udd$ , and, though so has zero “active” charge, nonetheless while proton’s experimentally measured electric charge .radius is equal to 0,871fm, the neutron’s measured one, 0,751fm, i.e. differs only in  $\approx 16\%$ , Thus the neutron Nuclear Force part in  $N_0$  isn’t equal to the proton’s part, but

$$\Delta N_{Nn} = 1 - \frac{4}{3}\sqrt{\alpha}, \text{ i.e. neutron’s nuclear Force charge can be, in principle, slightly}$$

larger than the proton’s charge. However in the neutron’s algorithm there exist also at least some non-zero FLE-part that acts as the Weak Force algorithm’s defect, which causes the decay of neutron, so the proton and neutron N-charges can be identical; however that should be studied additionally.

Correspondingly Eq. 3 for Electric Force for Nuclear force is as

$$N_{cN} = \frac{mc^2 \cdot 2\pi r W_N}{\hbar 4\pi r^2} P_N \frac{mc^2}{\hbar} 2\tau_N \quad (9)$$

- where  $W_N$  and  $\tau_N$  are circular meson rims’ width,  $W_N = \left(1 - \frac{5}{3}\sqrt{\alpha}\right) \frac{\hbar}{mc}$ , and the

coincidence resolution time interval is equal  $\tau_N = \frac{W_N}{c}$ ;  $m$  is the mass of nucleon, and

the equation (4) for the forces that act between nucleons is

$$F_N = \vec{p} \cdot N_{cN} = - \left(1 - \frac{5}{3}\sqrt{\alpha}\right)^2 \frac{\hbar c \vec{r}}{r^3} = - \frac{g_N^2 \vec{r}}{r^3} \quad (10)$$

-where

$$g_N = \left(1 - \frac{5}{3}\sqrt{\alpha}\right) (\hbar c)^{1/2} = \left(1 - \frac{5}{3}\sqrt{\alpha}\right) \left(\hbar \frac{l_p}{t_p}\right)^{1/2} \quad (10a)$$

- is the Nuclear Force charge of nucleon (“meson charge” in [12]) /Nuclear Force interaction constant.

The **circular mesons since are a Force mediators, aren’t particles and don’t carry energy**, but, since all Forces in systems of interacting distant charges act by the same way, at impact on a circular meson that is radiated by some nucleon by some external particle some “ordinary” particle can be created – as that happens, say, when a circular photon that is radiated by some nucleus is impacted by an photon with energy more 1.022 MeV, and this circular photon transforms into the  $e^\pm$  pair, which, since both, ordinary and circular photons have only 3D space momentums, despite that electron and positron have rest masses, since they move in the opposite  $c\tau$ -dimension, has whole momentum zero  $c\tau$ -component,

- it looks as rather natural to suggest that analogously an impact on a circular meson transforms it into observed at N-N interactions  $\pi^\pm$  mesons,  $\pi^+ = u\bar{d}$ ,  $\pi^- = \bar{u}d$ , pairs, the pairs whole momentums’ have zero  $c\tau$ -component, and  $\pi^0$  mesons,  $\pi^0 = \frac{u\bar{u} - d\bar{d}}{\sqrt{2}}$ , where the quarks and the antiquarks also have identical opposite momentums in  $c\tau$ -dimension, and so  $\pi^0$  mesons have zero  $c\tau$ -components; moreover,  $\pi^0$  mesons don’t move in  $c\tau$ -dimension at all. . Correspondingly all these “ordinary” mesons decay so that the sum of their decays products, i.e.  $e^\pm$ ,  $\mu^\pm$ , gammas, neutrinos and antineutrinos, have also the all particles zero whole momentum  $c\tau$ -component.

Note, also, that nuclei are principally only QM systems, and so in nuclei the other universal Forces act – “spin”, “spin-orbital” and “exchange” Forces, so, e.g. in the system  ${}^2H = n + p$  the binding energy of the proton and neutron is rather small – 2.22 MeV, i.e. the  $p$  and  $n$  are on distance  $\approx 20.06$  the nucleons’ Compton lengths, and on  $\approx 3$  mesons’ Compton lengths/3 the circular mesons’ average decay lengths.

When number of nucleons in nuclei increases, the binding energy sharply increases as well, and yet in  ${}^4He$  it is equal  $E=7.18$  MeV, and further is near this value – in nuclei the “binding energy saturation” effect is observed, what looks as can have rather interesting application at considering of extremely large Gravity and Electric charges interactions problems [5], [6]

### 3. Conclusion

This initial Nuclear Force model is in accordance with existent experimental data, and so looks as completely scientific model. From the consideration above it follows that at least 3 fundamental Nature Gravity, Electric, and Nuclear, forces at interactions in systems of distant enough particles (macro bodies and charges in Gravity and Electric Forces cases), i.e. when the distances are larger than the particles’ Compton lengths, act by the same one scheme:

- the Forces charges are Forces-specific sequences of Forces-marked FLEs in the particles’ algorithms, the strengths of the interactions is determined, besides, by the frequency the algorithms tick with,

- these FLE-sequences cause the propagating in the Matter's ultimate base – “everyferous aether” – the (at least) [4+3+1]D dense FLE lattice that is placed in the corresponding Matter's fundamentally absolute, fundamentally flat, and at least [4+3+1]4D Cartesian spacetime with the metrics  $(c\tau, X, Y, Z, g, e, sn, ct)$ , “g” and “e” are Gravity and Electric Forces dimensions, “sn” is the nuclear force dimension, of rims of flipping Forces-marked the lattice's FLEs, which, at interactions with particles' flipping marked by the same Force precessing FLE, cause change the precession angle, at that the article “works out” for itself the fundamentally universal for all Forces elementary 4D “kinematical” momentum  $p = \pm \frac{\hbar \vec{r}}{r^2}$  so, that if the particle is essentially at rest in the 3D X,Y,Z space, this momentum is directed to the “radiating Force rims” particle. If the “irradiated” particle is free, it starts to move/accelerates in direction to the radiating particle.

At that the Forces mediators don't carry some energy, and so the radiating particles don't lose their energy, if are free; but if is irradiated and move, the moving particles kinetic energy is provided by spending this particle's intrinsic energy  $E$ , if a particle is free and at rest  $E_0 = m_0 c^2$ , if it interacts with other particles composing a coupled by a Force system, including the system of nucleons “a nucleus”, the particles' intrinsic energies are lesser than  $E_0$  on the binding energy/particle's mass defect.

The flows of the mediators are observed in physics as the Forces' fields, in mainstream physics some really strange properties for which are postulated, first of all that the fields contain energy, in QFT, besides, it is postulated that all fields of all possible Forces always constantly exists in some “virtual” state, composing rather so strange “physical vacuum”, where always and constantly all particles in virtual states are creating/annihilating as “excitations of the fields”, while real particles are excitations of real fields as well. Really indeed everything in Matter, including particles and fields, really always exists potentially, since any specific impact on any/every FLE in the lattice can result in creation of any particle, however only after this in 3D space corresponding fields, which are radiated by the particle appears.

All Forces' mediators are fundamentally real, and by no means “virtual”, disturbances in the FLE lattice, and, at that, the real Forces' mediators can be impacted by some ways, so some specific for every Force real particles are created, i.e. in this case gravitons, photons and  $\pi$ -mesons, but these real particles have no relations to the Forces mediations in coupled systems, they haven't the Forces' charges and so don't create fields [at least that is true relating to photons and gravitons, and so rather probably is true for the mesons as well], however, since their algorithms contain the Forces-marked FLEs, which in this case, though don't radiate the Forces mediators, nonetheless interact with other correspondingly charged particles.

## References

- [1] S.V. Shevchenko, V.V Tokarevsky, “The Information and the Matter.” e-print [arXiv: physics/0703043v5](https://arxiv.org/abs/physics/0703043v5) (2007-2008)
- [2] S.V. Shevchenko, V.V Tokarevsky, “Inform Physics do is possible?” Poster report on the conference XIXèmes Rencontres de Blois Matter and Energy in the Universe. Blois, Loire Valley, France May 20th – May 26th, (2007) <http://confs.obspm.fr/Blois2007/AllAbstracts.html>

[3] S.V. Shevchenko, V.V Tokarevsky, “The information as Absolute” e-prints [arXiv:1004.3712v2](https://arxiv.org/abs/1004.3712v2) , <http://vixra.org/abs/1402.0173> , [https://www.researchgate.net/publication/260930711\\_the\\_Information\\_as\\_Absolute](https://www.researchgate.net/publication/260930711_the_Information_as_Absolute) <http://dx.doi.org/10.5281/zenodo.268904> (2010-2017)

[3a] S.V. Shevchenko, V.V Tokarevsky, “The Information as Absolute” - 2022 ed.” e-print <https://hal.archives-ouvertes.fr/hal-03812066> DOI <http://dx.doi.org/10.13140/RG.2.2.10868.63365> (2022)

[4] S.V. Shevchenko, V.V Tokarevsky, “The Informational Conception and Basic Physics” e-print [arXiv:0707.4657v5](https://arxiv.org/abs/0707.4657v5) (2021)

[5] S.V. Shevchenko, V.V Tokarevsky, “The Informational Physical Model and Fundamental Problems in Physics”. Preprints 2021, 2021100453 (doi: 10.20944/preprints202110.0453.v4) <https://www.preprints.org/manuscript/202110.0453/v4> (2023)

[6] S.V. Shevchenko, V.V Tokarevsky, “The informational model -Gravity and Electric Forces” (Version v2), GPA22-07 conference paper, Cairo, 4-9 of December , <https://indico.cern.ch/event/1109513/>

[7] C .F. von Weizsäcker, “Eine Frage Über die Rolle der quadratischen Metrik in der Physik Zeitschrift für Naturforschung”, 7 a: 141, (1952).

[8] C.F. von Weizsäcker, “Komplementarität und Logik. Die Naturwissenschaften”, 42: 521–529, 545–555, (1955.)

[9] E. Fredkin, “Digital Philosophy”, [http://www.digitalphilosophy.org/digital\\_philosophy/toc.htm](http://www.digitalphilosophy.org/digital_philosophy/toc.htm) (2000)

[10] [https://en.wikipedia.org/wiki/Elementary\\_particles](https://en.wikipedia.org/wiki/Elementary_particles)

[11] H. Yukawa. “On the Interaction of Elementary Particles” Proc. Phys-Math Soc. Jpn (PTP), 17, p 48 (1935)

[12] К. Н Мухин “Экспериментальная ядерная физика” Книга 2 “Физика элементарных частиц” (in Russian) М. Энергоиздат (1993)