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## **SPEED OF LIGHT CONSTANT AND QUANTUM MATRIX OF RELATIVE SPACE-TIME**

### **INTRODUCTION**

The main logical error of symbolic functional analysis is the conclusion that irrational and transcendental numbers can be considered as mathematical or physical constants. Only integer and rational numbers are really constants, but irrational numbers are always variables - endless digital waves that can never be completely written into the finite memory of any computing device.

At the end of the 19th century, G. Cantor founded the theory of sets and introduced the concept of transfinite numbers, infinitely large, but different from each other. G. Peano showed that the addition of natural numbers can be recursively determined, and, in the first third of the 20th century. K. Godel proved that a set of theorems of mathematics can be recursively enumerated. All primitive functions can be calculated with a pencil and paper, or, even more primitively, by moving pebbles from one place to another using some finite set of instructions, which is now called a program. Conversely, only recursive functions can be calculated using the theoretical machine proposed by A. Turing, or a modern computer. The Church-Turing thesis states that the informal concept of computability is completely covered by the formal concept of recursive functions and, therefore, is theoretically reproducible by a machine. Godel's incompleteness theorem proved that any useful formal mathematical system would contain unsolvable propositions - propositions that could neither be proved nor disproved. Church and Turing, trying to find an algorithmic (mechanical) test to define a theorem, independently proved that such an algorithmic method was not possible for first-order predicate logic (Britannica.com. Recursive definitions).

But on the other hand, quantum physics as a natural synthesis of quantum metrics and quantum calculus can become an alternative concept based on abduction (combined induction and deduction) second-order logic.

The seven basic units of quantum metric, first introduced in [1], are calculated below with final possible accuracy and identified by the names of the first investigators:

Speed unit of Maxwell

$$C = [\text{Integer}\{10^8 \cdot (C/10^7)^{(1/64)}\} / 10^{8+4 \cdot \pi \cdot C / 10^{18}}]^{64 \cdot 10^7}$$

$$C = [299792457.86759133843368398914990500927337258665405914040533114633]$$

Temperature unit of Kelvin  $K = [E+AS+BS]$

$$K = [2.7315999984590452353602874713526624977572470936999595749669676277]$$

$A = 1/\text{Lim}\{\text{Sum}\{729927/10^{(8 \cdot N)}\}\} = 137$  – integer of Sommerfeld-Schrödinger

$AS = \text{Lim}\{\text{Sum}\{[A+(A-100) \cdot N]/10^{(3 \cdot N+2)}\}\} = 729/10^5$  – ratio of

Schrödinger-Sommerfeld

$B = 602214183$  – integer of Avogadro-Dalton

$BS = \text{Lim}\{\text{Sum}\{B/10^{(3 \cdot N+8)}\}\} = 602817/10^8$  – ratio of Dalton-Avogadro

$R = \text{Integer}\{10^8 \cdot (C/10^7)^{(1/64)}\} = 105456978$  – integer of Dirac-Maxwell

Quantum unit  $C$  is the stroboscopic limit of the translation velocity of a harmonic circular motion of pulsating helix. In a decimal positional system, unit  $C$  cannot be calculated with an accuracy better than  $1/10^{64}$ . Quantum unit  $K$  is the stroboscopic limit of the progressive velocity of harmonic radial motion of core of pulsating helix and should also be estimated with an accuracy of  $10^{(-64)}$ . With the same accuracy, we must cut off the numbers  $\pi$  and  $e$  when estimating separately the parameters of a harmonic circular and harmonic radial motion of pulsating spherical spiral:

Decimally normalized spatial unit of Pythagoras  $PI = [\text{Integer}\{\pi \cdot 10^{64}\} / 10^{64}]$

$$PI = [3.1415926535897932384626433832795028841971693993751058209749445923]$$

Decimally normalized temporal unit of Euler  $E = [\text{Integer}\{e \cdot 10^{64}\} / 10^{64}]$

$$E = [2.7182818284590452353602874713526624977572470936999595749669676277]$$

From the other side the carefully measured and recommended by CODATA SI metric constants  $C$  and  $K$  are many years ago established by convention as 299792458 and 2.7316, respectively. The last digits are not exact absolutely due to the measurement errors. It is obvious that a nine-digit decimal length of number  $C$  limits the accuracy of the inverse speed computations to  $10^{(-8)}$ . A five-digit decimal length of  $K$  limits the accuracy of the temperature metric and computations to  $10^{(-4)}$ . At the same time, modern quantum physics is successful working with quantum units at the Boltzmann level of  $10^{(-23)}$ , at the Dalton level  $10^{(-27)}$ , at the Planck level  $10^{(-34)}$  and at the Avogadro level  $10^{(+23)}$ .



MA = 3.1415926535897932384626433832795028841971693993751058209732535377  
Med = 3.1415926535897932384626433832795028841971693993751058209732535377  
MG = 3.1415926535897932384626433832795028841971693993751058209732535376  
MH = 3.1415926535897932384626433832795028841971693993751058209732535379

MR = 3.141592653589793  
MA = 3.1415926535897932384626433832795  
Med = 3.141592653589793178846982537459625  
MG = 3.1415926535897932384626433832795  
MH = 3.1415926535897932384626433832795

MR = 3.141592653589793  
MA = 3.1415926535897932  
Med = 3.14159265358979315  
MG = 3.1415926535897932  
MH = 3.1415926535897932

The finite difference  $[PI - PI(C)]$  has a decimal order of 57, and we can consider this value as the computational horizon for the informational entropy of natural quantum metric. In the standard physical model decimal order of 57 is the sum of the Boltzmann and Planck orders and, therefore, the energy entropy in quantum metric can be considered as the equivalent of information entropy in quantum calculus. Moreover, with this conception we can consider sub-molecular (atoms) and subatomic particles (proton, neutrons, electron, neutrinos, photons and quarks) as the condensed states (or standing waves, equivalently) of harmonically moving particles, that naturally combine analytical chemistry and material science with quantum mechanics at the infinitesimal scales.

The basic equations of classical and quantum physics can be combined in the framework of the normalized recursive metric of relative space-time and relative speed-temperature [2], where parameters of equations are functions of the argument of informational entropy  $\text{Sqrt}(2*\pi*e)$  of the Gaussian normal distribution. Despite its amazing simplicity, the equations completely coordinate the various sections of mathematics (arithmetic, geometry, algebra, logarithms and big data statistics) into a universal information system, drawing a wave interference pattern, which from a geometric point of view can be considered as a two-dimensional matrix hologram of the parameters of the three-dimensional motion of the observable quantum particles and waves in compressed space below and above the unity point  $AI = 1/137$ :

Radius-eccentricity recursion of Dirac-Sommerfeld-Gauss

$[Ri] = 1 + 2/100 * (e + [Ai] * (1 + \sqrt{2 * \pi * e / 100}))$  – distribution of the inverse radius of pulsating sphere.

$[Ai] = (100 * ([Ri] - 1) / 2 - e) / (1 + \sqrt{2 * \pi * e / 100})$  – distribution of the inverse eccentricity of pulsating sphere.

Perimeter-radius recursion of Planck-Dirac-Heisenberg

$[Pi] = 2 * \pi * [Ri]$  – distribution of the inverse perimeter of pulsating sphere.

$[Ri] = [Pi] / (2 * \pi)$  – distribution of the inverse radius of pulsating sphere.

Perimeter-eccentricity recursion of Newton-Planck-Sommerfeld

$[Gi] = [Pi] * (1 + [Ai])$  – distribution of density of inverse perimeters.

$[Pi] = [Gi] / ([Ai] + 1)$  – distribution of the inverse perimeter.

Velocity-radius recursion of Maxwell-Kelvin-Dirac

$[Vi] = [Ri]^{64} * 10^7$  – distribution of the translational speed.

$[Ri] = \{ [Vi] / (10^7) \}^{1/64}$  – distribution of the inverse radius.

Amplitude-phase recursion of Boltzmann-Amagat-Sommerfeld

$[Mi] = 12 - [Ai] / 10$  – distribution of relative amplitude of pulsations.

$[Ki] = \text{Cos}[Mi] - \text{Sin}[Mi]$  – distribution of relative phase of pulsations.

Entropy-eccentricity recursion of Avogadro-Dalton-Sommerfeld

$[Ni] = 100 * (\sqrt{8 * \pi * e / (8 * \pi * e + 137^2)}) / (1 + 2 * [Ai] / 1000) - 5 / 10^8$  – distribution of entropy of eccentricity.

$[Di] = 10 / [Ni]$  – inverse entropy of eccentricity.

$[Ai] = 1000 * (100 * \sqrt{8 * \pi * e / (8 * \pi * e + 137^2)}) / ([Ni] + 5 / 10^6) - 1 / 2$  – distribution of the inverse eccentricity.

The presented set of parametric equations was firstly obtained intuitively based on the optically observed stereo-metric shadow image of a pulsating spherical spiral (as a pulsating ball of many twisted threads) and after that was derived by means of standard functional analysis and hyperbolic differential geometry.

COMPUTATIONAL ENTROPY OF RECURSIVE ARITHMETIC

We can immediately demonstrate the informational entropy of calculations of harmonic mean in different, but mathematically equivalent, notations  $MH1 = 2/(1/\pi + 1/e)$  and  $MH2 = 2*\pi*e/(\pi + e)$  changing the length N of digital records of  $\pi$  and  $e$ :

Mean harmonic MH1	Decimal order N
2.4000000000000000	01
2.8862068965517241	02
2.9091965811965812	03
2.9142304147465438	04
2.9145605747734526	05
2.9146452959536645	06
2.9146467315424754	07
2.9146474496431801	08
2.9146474826586594	09
2.9146474885485554	10
2.9146474889936798	11
2.9146474890568518	12
2.9146474890658988	13
2.9146474890662000	14
2.91464748906626178	15
2.914647489066265942	16
2.9146474890662661432	17
2.91464748906626617338	18

Unexpected fact is observed: always  $2/(1/\pi + 1/e)$  is not equal to  $2*\pi*e/(\pi + e)$  when  $N > 1$

Mean harmonic	MH2N
2.9146474890662661733836877634297139370899665719276731004859726984	18
2.9146474890662661432271340487896641497502285350809052429652886066	17
2.9146474890662659421834426178559988188888904480263412523209212224	16
2.9146474890662617768318350202910202020875281750671576926127529108	15
2.9146474890662000495765944390045076482272134233627659307058572759	14
2.9146474890658987903392328767740518340192743930461333095041856566	13
2.9146474890568518242248408701108514245299963504003429453470654923	12
2.9146474889936797911944367103116806437819478305300319541986058526	11
2.9146474885485553744235567014357692007362298994608789129795696728	10
2.9146474826586594098149682718373999571359418557647020721930242987	09
2.9146474496431800654293887254648324885598230569583539000000000000	08
2.9146467315424754085967392126075087292847472974243600000000000000	07
2.9146452959536645010896146160239049671750397193111792600000000000	06

2.914560574773452565831015239688038636790279365837842000000000000	05
2.9142304147465437788018433179723502304147465437788018000000000000	04
2.9091965811965811965811965811965811965811965811965812000000000000	03
2.8862068965517241379310344827586206896551724137931030000000000000	02
2.4000	01

### SPEED OF LIGHT IN QUANTUM MULTIVERSE

Multiverse, a hypothetical collection of potentially diverse observable universes, each of which would comprise everything that is experimentally accessible by a connected community of observers. The observable known universe, which is accessible to telescopes, is about 90 billion light-years across. However, this universe would constitute just a small or even infinitesimal subset of the multiverse. The multiverse idea has arisen in many versions, primarily in cosmology, quantum mechanics, philosophy, and often asserts the actual physical existence of different potential configurations or histories of the known observable universe (Britannica.com). Let's define mathematically multiverse as a set of partial functions  $[Ci] = C(N*\pi)$ :

$$C = \{[R/(10^8)+(N*\pi)*C/(10^18)]^{64}\}*(10^7) = (10^8)*\{[R/(10^8)+(N*\pi)*C/(10^18)]^{64}\}/10$$

$N*\pi$	$[Ci]$
+4*pi	299792457.86759133843368398914990500927337258665405914040533114633
+2*pi	299792423.59665663248376226231081777919356930996545001005836181873
+1*pi	299792406.46119366396584077309834867624656763543007780021999152550
+0*pi	299792389.32573361841809854874363142602544838624276139015179771702
+0	299792389.3257336184181
Zero	299792389.32573362 > $[C(+0)] = [C(-0)]$
-0	299792389.3257336184181
-0*pi	299792389.325733618418098548743631426025448386242761390 15179771702
-1*pi	299792372.190276495839650351277089019610066040283656596 18783613189
-2*pi	299792355.0548222962296109431216612570508993053407603761 6922998012
-4*pi	299792320.7839226659112175463984915230831583330308417247 2274810799

The main characteristic feature of the presented  $[Ci]$ -matrix is the fact that no scientific or engineering calculator working in the discrete digital field of standard functional analysis can feel the logic of equality  $[+0*\pi] = [+0] = \text{Zero} = [-0] = [-0*\pi]$  and, therefore, gives different results for different designations of absolute zero. This is the so-called "machine zero problem" caused by the inability to write fully the endless irrational numbers to the finite computer

memory. In quantum physics, this logically corresponds to the problems of black energy, black matter and black-body irradiation. Another feature of the [Ci]-matrix is the fact  $[\text{Integer}\{C(+4*\pi)\} - \text{Integer}\{C(-4*\pi)\}] = 137 = A$ . This was first observed by A.Sommerfeld, and after that A.Eddington, M.Born, R.Feynman and many others deeply discussed this as the so-called «mystery of prime 137».

### INTERFERENCE PATTERN OF HARMONIC WAVE MOTION

The four trident matrices presented below combine standard (pi...e) and non-standard (C...V...T...K) functional analysis with the main branches of physics (gravodynamics, thermodynamics, electrodynamics, chromodynamics) within the framework of the relative space-time metric (average velocity) and of their natural derivative - speed-temperature metric (instantaneous velocity):

Two-dimensional distribution of the inverse eccentricity of the pulsating sphere (where  $A = 137$ ;  $B = 602214183$ ) gives a partial set of Avogadro units [Ni] and describes the computation entropy boundaries for the ideal crystalline state of matter (interference pattern of a rotating polyhedrons):

$$A4 = 4/A-3*A0$$

$$\text{Median}\{AH...A4\} = AH4$$

$$AH = 1/16/\pi/e \quad \text{Median}\{AHL...AH4\} = AE \ggg NE...NA...NB \lll$$

$$B/(1+4*\pi/10^8)/10^8$$

$$\text{Median}\{AH...AL\} = AHL$$

$$AL = 1/(1+59*\text{Ln}(10))$$

Two-dimensional distribution of the inverse perimeter of the pulsating sphere gives a partial set of Planck units [Pi] and describes the boundaries of the computation entropy for the ideal liquid state of matter (interference pattern of a rotating polygons):

$$A1 = 1/A$$

$$\text{Median}\{A0...A1\} = A01$$

$$A0 = (\pi*e/100)^2 \quad \text{Median}\{A0S...A01\} = AP \ggg PP...PQ...PF \lll \quad AF = 1/(A+36/1000)$$

$$\text{Median}\{A0...AS\} = A0S$$

$$AS = 1/100/(10/(10-1))^3$$

Two-dimensional distribution of the inverse radius of the pulsating spiral (where  $BS=\{B/10^{(3*N+8)}\}$ );

$K = [e + AS + BS]$  gives a partial set of Dirac  $[R_i]$  and Maxwell-Kelvin units  $C, V, T$  and describes the boundaries of the entropy of the ideal gas state of matter (a wave interference pattern of a rotating helix)

$$RE = (R+1/e)/10^8$$

$$\text{Median}\{RA\dots RE\} = RAE$$

$$RA = (R+1/(e + AS))/10^8$$

$$\text{Median}\{RAK\dots RAE\} = RT \gg \gg VT\dots V\dots VC \ll \ll$$

$$RC = (C/10^7)^{(1/64)}$$

$$\text{Median}\{RA\dots RK\} = RAK$$

$$RK = (R+1/K)/10^8$$

Two-dimensional distribution of the density of perimeter of the core of the pulsating helix (where  $\text{Root}\{X^*e^{-X}/(e^{-X}-1)\} = X$  is a Wien's factor of the wavelength displacement) gives a partial set of Newtonian units  $[G_i]$  for the idealized solid state GN, for the liquid crystal state GQN, for the idealized liquid state GQ, for the liquid gas state GQV, for the idealized gas state GV, for the gas-vacuum (vapor) state GVX, for the vapor-vacuum state GX, and for the average gravitation G (a wave interference pattern of a rotating core of pulsating helix)

$$GN = PN*(1+AN)$$

$$\text{Median}\{GQ\dots GN\} = GQN$$

$$GQ = PQ*(1+AQ)$$

$$\text{Median}\{GQV\dots GQN\} = GVN\dots G\dots GX \ll \ll AX = 5/X - 1$$

$$\text{Median}\{GQ\dots GV\} = GQV$$

$$GV = PV*(1+AV)$$

For the first time analytically determined and then calculated partial decimally normalized gauge sets of the relative entropy units of Avogadro  $[N_i]$ , the relative atomic mass units of Dalton  $[D_i]$ , the relative eccentricity units of Sommerfeld  $[A_i]$ , the perimeter units of Planck  $[P_i]$ , the translation velocity units of Maxwell-Kelvin  $[V_i]$ , the radial amplitude-phase entropy units of Boltzmann-Kelvin  $[K_i]$ , the relative mass-gravity units of Newton-Wien  $[G_i]$  are presented below:

Entropy units of Avogadro

$$N4 = 602214100258192265954542.790639264054910632971429625386573637623000$$

$$NH = 602214100539028838674670.359666642830819375385139115731597073948000$$

$$NB = 602214107323543381768832.372080781545789391818054856435188473944780$$

$$NL = 602214114501517301123100.966725291786865948242313092851729415813000$$



GL = 0.00000000066744900157701819328593528677963771946315335088156190  
 GI = 0.00000000066744364873680224292185910483000481884177319277195916  
 GF = 0.00000000066744234384921214159611943953611634645758144315309572  
 GO = 0.00000000066743918194962957193271732313472748453752700748755735  
 GS = 0.0000000006674373404865887625028165458105518473146722545554924  
 GC = 0.00000000066739140452062992860293936167978444193636663660125695  
 GE = 0.00000000066739140238977399203350181712938924917247912961769965  
 GA = 0.00000000066739140215288578693056001955271762539009208673810927  
 GK = 0.00000000066739140195795574401178024788041027602493412757457591  
 GX = 0.00000000066725781076198223768643093336888740997069675170845242

In engineering practice, never before have the complete spectrum of distribution of basic quantum units been coordinated analytically without previous accurate measurements. The physical and mathematical coincidence of the results presented here cannot be considered random, since all estimates lie at the center of the confidence interval of the normal distribution. Analytically defined sets of quantum constants allow us to exclude all artifacts from the metric system and avoid measurements at all by replacing the Feynman's energy diagrams with diagrams of information entropy of inverse functional analysis in a gauge fields of relative space and time and of their natural derivatives - relative speed and temperature.

Quantum matrices with great confidence reflect the hidden mathematical structure of subatomic and hyper-atomic space. We cannot derive and explain the presented computational algorithms from any partial theory of matter, but we can show that all existing quantum theories, such as super-symmetry, loop gravity, strings, multiverse, correspond to the presented matrices. This is the only reason for the lack of mention of modern authors here. All of them are partly right, but the presented information-entropy-energy paradigm really needs a primary base of mathematical and physical logic, which begins with the simplest measurement and calculations of intervals and gradients of relative space and time, but also ends with the same calculations.

## DISCUSSION

Quantum physics combines manifold quantum metrics with recursive quantum calculus through the harmonic values of the instantaneous mass  $m$ , velocity  $v$ , phase  $k$ , temperature  $t$ , electric charge  $q$ , electric voltage  $u$ , instantaneous action  $h$  and frequency  $f$ :

Gravidynamics quanta  $QG = (m * (v^2)/2) * [1 + (v/C)^2]$  – from Newton to Einstein  
 Thermodynamics quanta  $QT = (k * t) / [1 + (v/C)^2]$  – from Boltzmann to Shannon

Electrodynamics quanta  $QE = (q * u) / [1 + (v/C)^A2]$  - from Dirac to Kaufman  
Chromodynamics quanta  $QC = (h * f) * [1 + (v/C)^A2]$  - from Planck to Kotel'nikov

he presented equations reflect the mathematical structure of sub-molecular space and directly connect classical physics with quantum mechanics, thermo-, chromo-, and electrodynamics. Moreover, replacing the number 2 with any integer N or reciprocal number 1/N in the expression  $(v/C)^A2$  fully coordinates the special and general theory of relativity. This is simply a translation of the multi-parabolic ratio of speeds into exponential one without changing the initial and final results. From the point of view of mathematical logic, all this can be considered as a natural parametric synthesis of standard functional analysis, non-standard functional analysis, quantum metrics and quantum calculus.

The ultimate matrix [Ai] and the finite value of C mutually coordinate the super-symmetry (combined mirror and central symmetry) arithmetic with the dynamic «ring-string-spring» geometry of the quantum universe, since the recursive calculation of the constant C not depend on the initial approximation for C, but depends only on the products  $N*pi*C$ , which can be treated as the high-order hoops in spaces of arbitrary order. And last three remarks:

Standard functional analysis  $e^{A(j*pi)} + 1 = 0$  - continuous (symbolic) Euler mathematics  
Non-standard analysis  $E^{A(j*PI)} = 1/(10^A64) > 0$  - discrete (digital) Gauss mathematics  
Quantum physics  $E^{A(j*PI)} = [Ai]/(10^A57) > 0$  - manifold matrix meta-mathematics

## CONCLUSION

The discussion of partial features of presented here information-entropy-energy paradigm of quantum physics can be endless as the history of science, but now the presented here materials can be regarded as a quantum renaissance of classic physics.

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