

Quantum Physics as Dynamic Space-Time Differential Calculus

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Abstract

For the first time, a unified quantum metric system has been developed analytically without any artifacts, such as m , s , and kg without measurements at all. Energy diagrams of Feynman are replaced by calculations of relative space-time differentials. The main constants of quantum physics are, in fact, the dynamic gradients of the normal, half-normal, log-normal and truncated normal distribution of the inverse radius of the pulsating spiral. Quantum physics as a whole is a logarithmically compressed two-dimensional image of the three-dimensional motion of wave fronts.

Spatio-Temporal Geometry

The first attempt to develop an absolute metric system was made by Gauss in the early nineteenth century. The attempt was unsuccessful due to the noncommutativity of parabolic, elliptical and hyperbolic geometry. Using the inverse logarithmic relationships of the transcendental numbers π and e allows to overcome this problem and create an absolute metric without any artifacts, such as m , s , and kg without any measurements at all.

It suffices to postulate the number π as an absolute unit of space and the number e as an absolute unit of time. Then the first derivative of π by e is the unit of absolute velocity, and the second derivative is the unit of absolute acceleration. Geometrically, π is an absolute perimeter, e is an absolute diameter of the absolute space-time sphere. $e/2$ is the absolute radius, $4\pi*(e/2)^2$ is the absolute surface, $4/3\pi*(e/2)^3$ - the absolute volume of the sphere, $\pi*(e/2)^2$ is the surface of absolute circle and $N*(\pi*e^2)/4$ is a discrete set of volumes of absolute cylinders.

Functional relations between these absolute space-time geometrical parameters and the infinite set of integers N form the basis of polar calculus of three-dimensional wave motion [1].

Spatio-Temporal Arithmetics

The two-dimensional image of three-dimensional motion of harmonic waves can be described by the equation of a pulsating and simultaneously rotating spiral with the dynamic eccentricity about $A = 137 = [\sqrt{(\pi^2 + e^2)/2} + (\pi + e)/2 + \sqrt{\pi * e} + 2\pi * e / (\pi + e)]^2$ (squared sum of four mean values: the root mean, the arithmetical, geometrical and harmonic mean).

The unique ratio $A1 = 1/A = 1/137 = 0.007299270072992700729927...$ is the center of periodic mirror symmetry of the inverse natural set. The number 1 can be interpreted as a quantum of progressive natural set, and the number $1/137 = \text{Sum} \{729927/10^{(8*N)}\}$ as a harmonic quantum of reciprocal natural set.

The number 1 can be rewritten as $[0.999999] >$, and all the numbers 10^N can be rewritten as $[999999] > = [9*111111] >$. The unique integer $B = 602214183$ (Avogadro's integer) and the dynamic integral $BS = \text{Sum} \{B/10^{(3*N+11)}\} = 0.006028169999 > = 0.00602817$ generate an infinite set of digits 9 and reflect the absolute bond of binary (0...1) and decimal (0...9) positional calculation systems.

The prime $A = 137$ and the inverse dynamic integral $AS = 1/100 / \text{Sum} \{[137 + (137 - 100)]/10^{(3*N+2)}\} = 1/100 / (1.11111 >)^3 = 1/100 / (1 + 1/10 + 1/100 + 1/1000 + ...) ^3 = 3^6/2^5/5^5 = 0.00729$ connects binary, decimal and alpha (0...137) positional calculation systems [2].

The integer $R = 105456978 = \text{Integer} \{10^8 * (C/10^7)^{(1/64)}\}$ and the corresponding dynamic integral $C = (R/10^8 + 4\pi * C/10^18)^{64} * 10^{(-1...+7)} = 2.9979245786759104(30) * 10^8$ complete the base of absolute spatio-temporal dynamic integro-differential calculation system [2].

Quantum Thermodynamics

Quantum thermodynamics is based on the unit of absolute temperature kelvin K .

$K = E + AS + BS = 2.7315999984590452$ where

$E = (1 + 1/N)^N = 2.7182818284590452$,

$AS = 1/100 / \text{Sum} \{[137 + (137 - 100)*N]/10^{(3*N+2)}\} = 0.00729$,

$BS = \text{Sum} [602214183/10^{(3*N + 8)}] = 0.00602817$.

The number K is an upper limit of inverse temperature (used in SI for calibration of the triple point of water as $100 * K = 273.16$). The number e is the base of natural logarithm in mathematics but in physics it is a lower limit of inverse temperature. The word "temperature" means literally "rating of tempo" or, in other words, rating of a speed of vibrations.

Quantum Electrodynamics

Electrodynamics is based on the Absolute Speed Unit (speed of light) C:

$$C = (R + 4\pi C / 10^{18})^{64} \cdot 10^7 = 299792457.867591338433684$$

where

$$R = \text{Integer} [10^8 \cdot (C / 10^7)^{1/64}] / 10^8 = 1.05456978.$$

The number C is the value of three-dimensional rotational speed of radius-vector. The number R is the harmonic value of the inverse squared radius. The value 4π is solid angle in radians. The value $4\pi \cdot 10^{-7}$ is the Magnetic constant. The value $4\pi C \cdot 10^{-7}$ is the Impedance of free space. The value $1 / (4\pi \cdot 10^{-7}) / C^2$ is the Electric constant. The number C is the Speed of light in physics, but arithmetically it is simply the number of turns around a ball with radius $4\pi / 10^{18}$ per unit of time. The value $1 / 10^{18}$ is a natural limit of accuracy of calculations of an inverse squared radius.

Invariant Units of Quantum Arithmetics

Thirteen invariant units of quantum arithmetics are the "consonants" of "quantum alphabet" [3-5]:

Avogadro's matrix of entropy of inverse eccentricity:

$$0.0073189621138002 = A4 = A0 + 4 \cdot (A1 - A0) \text{ is upper parabolic limit of relative inverse eccentricity.}$$

$$0.0073187289405399 = AH = 1 / (16 \cdot \pi \cdot E) \text{ is an upper hyperbolic limit of inverse eccentricity.}$$

$$0.0060221410732354 = NB = B / (1 + 4 \cdot \pi / 10^8) / 10^{11} \text{ is PI-reference point of entropy.}$$

$$0.0073071361524362 = AL = 1 / (\ln(E) + 59 \cdot \ln(10)) \text{ is an upper logarithmic limit of inverse eccentricity.}$$

[G]	[G] = $\{2\pi \cdot (1 + 2/100 \cdot (E + [A] \cdot (1 + \sqrt{2\pi \cdot E/100}))) \cdot (1 + [A])\}$ (Newton)
[NA]---[R]---[P]---[G]	[NA] = $\{(\sqrt{8\pi \cdot E} / (8\pi \cdot E + 137^2)) / (1 + 2 \cdot [A] / 1000 - 5/10^8) / 10\}$ (Avogadro)
[TBG]--[T]--[V]---[C]	[TBG] = $[E \dots E + AS \dots E + AS + BS]$, [V] = $\{R\}^{64} \cdot 10^{(-1 \dots +7)}$ (Kelvin-Maxwell)
[KB]--[DA]	[KB] = $\text{Cos}(12 - [A] / 10) - \text{Sin}(12 - [A] / 10)$, [DA] = $\{(12 - [A] / 10) / 1000\}$ (Boltzmann-Dalton)
[AX]	[AX] = $5 / \text{Root}\{X \cdot E^X / (E^X - 1) = 5\}$ (Wien)

Matrix of Newton [G] = $[P] \cdot (1 + [A])$ coordinates the relative inverse perimeters and eccentricities.

Matrix of Planck [P] = $2\pi \cdot [R]$ coordinates relative inverse radii and relative inverse perimeters.

Matrices of Kelvin-Maxwell coordinates relative inverse radii and corresponding rotating radius-vectors.

Dalton's matrix [DA] coordinates reciprocal ($0 \dots 1/10^N$) and progressive ($0 \dots 10^N$) decimal calculations with floating point.

Boltzmann's matrix [KB] describes the phase entropy of translational velocity of waves.

Avogadro's matrix [NA] describes the amplitude entropy of translational velocity of waves.

Wien's matrix [AX] shows the lower limit of relative inverse eccentricity.

Planck-Sommerfeld matrix of inverse eccentricity:

$0.0072992700729927 = A1 = 1/A$ is a center of hyperbolic symmetry of eccentricity distribution.

$0.0072973525205056 = AF = 1000 / \text{Integer}\{1000 \cdot \sqrt{137^2 + \pi^2}\}$ is 'fine structure' point of eccentricity.

$0.0072927060593902 = A0 = (\pi \cdot E)^2 / 10000$ is a center of parabolic symmetry of eccentricity distribution.

$0.0072900000000000 = AS = 3^6 / 10^5$ is a center of quantum bit symmetry of eccentricity distribution.

Kelvin-Maxwell matrix of inverse radius:

$1.0545697837673031 = RC = R + 4\pi C / 10^{18}$ is upper limit of rotational radius.

$1.0545697836787944 = RE = R + 1/E / 10^8$ is upper limit of vibrational radius.

$1.0545697836689549 = RA = R + 1/(E + AS) / 10^8$ is reference point of quantum bit.

$1.0545697836608581 = RK = R + 1/K / 10^8$ is lower limit of vibrational radius.

Wien's "blackbody" point of eccentricity.

$0.0070261763632109 = AX = 5 / \text{Root}\{X \cdot E^X / (E^X - 1) = 5\} - 1$ is median point of inverse eccentricity distribution.

Fractal Tree of Quantum Arithmetics

Matrix equation $[Gi] = 2\pi \cdot [Ri] \cdot (1 + [Ai])$ where Ai , Ri and Gi are the partial inverse eccentricity, radius and relative radial density correspondingly, completely describe geometry of three-dimensional wave motion. Radii and eccentricities are bonded by the Gaussian argument of information entropy $\sqrt{2\pi \cdot E}$ of the function of normal distribution $Ri = 1 + 2/100 \cdot (E + Ai \cdot (1 + \sqrt{2\pi \cdot E/100}))$.

Inverse eccentricities	Inverse relative radii	Planck's perimeters
0.0073189621138002	1.0545725104198716	6.6260745028256285
0.0073187289405399	1.0545725038291215	6.6260744614147243
0.0073131309589000	1.0545723455995802	6.6260734672291954
0.0073071361524362	1.0545721761536017	6.6260724025687129
0.0072992700729927	1.0545719538152265	6.6260710055755006
0.0072973525205056	1.0545718996147182	6.6260706650236632
0.0072927060593902	1.0545717682803448	6.6260698398254579
0.0072900000000000	1.0545716917923240	6.6260693592370495
0.0072224962396475	1.0545697837673031	6.6260573707622726
0.0072224931083101	1.0545697836787944	6.6260573702061559
0.0072224927601997	1.0545697836689549	6.6260573701443325
0.0072224924737441	1.0545697836608581	6.6260573700934588
0.0070261763632109	1.0545642346951568	6.6260225049136943

Boltzmann's phase	Newton's density	Avogadro's entropy
1.3806514048140000	6.6745704910750269	0.0060221410025819
1.3806513976730000	6.6745689043376527	0.0060221410053903
1.3806512262230000	6.6745308102383351	0.0060221410732354
1.3806510426190000	6.6744900157701825	0.0060221411450152
1.3806508017020000	6.6744364873680225	0.0060221412397551
1.3806507429730000	6.6744238427142733	0.0060221412628504
1.3806506006630000	6.6743918194962957	0.0060221413188129
1.3806505177840000	6.6743734048658876	0.0060221413514050
1.3806484502840000	6.6739140452062915	0.0060221421644283
1.3806484501880000	6.6739140238977372	0.0060221421644660
1.3806484501770000	6.6739140215288678	0.0060221421644702
1.3806484501680000	6.6739140195795554	0.0060221421644737
1.3806424370550000	6.6725781076198224	0.0060221445289294

Dynamic Units of Quantum Arithmetics

Dynamic units are the "vowels" of quantum "alphabet".

Harmonized rotational celerity C:

$$(R/10^8 + 4 * \pi * C / 10^{18})^{64} * 10^7 = 2.9979245786759134 * 10^8 = CU \text{ is upper limit of C.}$$

Median {CL...CU} = 299792457.86759104(30) = C is harmonized speed of light.

RC^{64}/10 = 2.9979245786759074 * 10^8 = CL is lower limit of C.

Upper limit of vibrational tempo TU:

$$RE^{64} * 10^7 = 299792456.25727419 = TE$$

$$\text{Median}\{TA...TE\} = 299792456.16776435$$

$$RA^{64} * 10^7 = 299792456.07825451 \text{ Median of medians}$$

$$299792456.08618160 = TU$$

$$\text{Median}\{TA...TK\} = 299792456.00459885$$

$$RK^{64} * 10^7 = 299792455.93094320 = TK$$

Harmonized background temperature TBG:

$$E+AS+BS = 2.7315999984590452 = K$$

$$\text{Median}\{EA...K\} = 2.7285850810946404 = EAK$$

$$E+AS = 2.7255718284590452 = EA \text{ Median of medians TBG} =$$

$$2.7252543275634558$$

$$\text{Median}\{EA...E\} = 2.7219256081809304 = EA0$$

$$E+0 = 2.7182818284590452 = E$$

Lower limit of vibrational tempo TL:

$$(R/10^8 + 1/TBG/10^8)^{64} * 10^7 = 299792456.08603140 = TL.$$

Harmonized vibrational tempo T:

$$TU = 299792456.08618160$$

Median {TL...TU} = 299792456.08610650(751) = T is

harmonized vibrational tempo of light.

$$TL = 299792456.08603140$$

Harmonized translational velocity V:

$$C = 2.9979245786759104 * 10^8$$

Median {T...C} = 299792456.97684877(89074227) = V is

harmonized translational velocity of light.

$$T = 2.99792456.08610650 * 10^8$$

Eccentricity of harmonized rotational celerity AC =

$$0.0072224962396481$$

Eccentricity of harmonized vibrational tempo AT =

$$0.0072224927753208$$

Denormalized Dalton units (relative molar mass reference units):
 $MC = 1000*(12-AC/10)/1000 = 11.9992777503760352$
 $MT = 1000*(12-AT/10)/1000 = 11.9992777507224679$

Polarization vector phase entropy KB:
 $\text{Cos}(MT)-\text{Sin}(MT) = 1.3806484502840 = \text{KBU}$ - upper limit.
 $RS = 1.0545716917923240$
 $\text{Median}\{\text{KBL}...\text{KBU}\} = 1.3806484502305(535) = \text{KB}$ is phase entropy unit of Boltzmann.
 $\text{Cos}(MC)-\text{Sin}(MC) = 1.3806484501770 = \text{KBL}$ - lower limit.

Harmonized inverse radius RP and perimeter PP:
 $R1 = 1.0545719538152265$
 $\text{Median}\{R0...R1\} = 1.0545718610477836$
 $R0 = 1.0545717682803448$ Median of medians
 $1.0545717955420578 = \text{RP}$,
 $\text{Median}\{R0...RS\} = 1.0545717300363340$
 $RS = 1.0545716917923240$

$2*\text{PI}*RP = 6.6260700111158525 = \text{PP}$ is harmonized perimetral unit of Planck.

Denormalized fine structure unit AFN:
 $1000*1000/(\text{Integer}\{1000*\text{Sqrt}(A^2+\text{PI}^2)\}) = 7.2973525205055606 = \text{AFN}$

Elementary charge unit Q:
 $\text{Sqrt}(\text{AFN}*RP/T/10^7) = 1.6021766174051646 = \text{QU}$
 $\text{Median}\{\text{QL}...\text{QU}\} = 1.6021766150249739(23801907) = \text{Q}$ is charge of electron.
 $\text{Sqrt}(\text{AFN}*RP/C/10^7) = 1.6021766126447832 = \text{QL}$.

Harmonized charge density radius RQ:
 $R(\text{AF}) = 1.0545718996147182 = \text{RQU}$ is upper limit of RQ.
 $\text{Median}\{\text{RQL}...\text{RQU}\} = 1.0545718475783874 = \text{RQ}$ is harmonized orbital density radius.
 $RP = 1.0545717955420578 = \text{RQL}$ is lower limit of RQ.

Harmonized mass density radius RM:
 $RS = 1.0545716917923240$
 $\text{Median}\{\text{RC}...\text{RS}\} = 1.0545707377795978 = \text{RCS}$
 $\text{Median}\{\text{RTX}...\text{RCS}\} = 1.0545688734791973 = \text{RM}$ is harmonized nuclear density radius.
 $\text{Median}\{\text{RT}...\text{RX}\} = 1.0545670091804446 = \text{RTX}$
 $RX = 1.0545642346951568$

Eccentricity of orbital density $AQ = 0.0072955115341644$
 Eccentricity of nuclear density $AM = 0.0071902912792972$

Harmonized gravity unit G:
 $2*\text{PI}*RQ*(1+AQ) = 6.6744109106473266 = \text{GQ}$ is orbital (charge) density harmonized level.
 $\text{Median}\{\text{GM}...\text{GQ}\} = 6.6740528968513915 = \text{G}$ is Newtonian gravitational unit.
 $2*\text{PI}*RM*(1+AM) = 6.6736948926576010 = \text{GM}$ is nuclear (mass) density harmonized level.

Harmonized orbital eccentricity entropy NA:
 $\text{NA}(\text{Median}\{\text{AH}...\text{A4}\}) = \text{N4}$
 $\text{Median}\{\text{NL}...\text{N4}\} = \text{NE}$ $\text{Median}\{\text{NE}...\text{NB}\} =$

$6.0221410564201849/1000 = \text{NA}$ is quantum entropy unit of Avogadro.
 $\text{NA}(\text{Median}\{\text{AH}...\text{AL}\}) = \text{NL}$

Decimal orders of fundamental quantum constants are determined from the gauge expression $E^{137} = 100*\text{PI}*10^{57}$.

New SI measurement system will be introduced at the end of the year 2018 and will be based on constants derived from nature only. So far, the main problem with regards to defining constants is finding the coordinated values of basic quantum units we showed that this problem has been successfully solved.

Comparison of analytically obtained units with their recommended by CODATA conventional values is presented below:

Unit	Measured	Analytical
Speed of light	299792458	299792457.8676
Background temperature	2.725 (unvalued)	2.725254327563
Relative molar mass	0.012 (carbon-12)	0.011999277750
Kelvin	2.7316	2.731599998459
Fine structure	0.00729735256	0.007297352520
Avogadro	6.022140857	6.022141056420
Boltzmann	1.38064857	1.380648450231
Planck	6.626070040	6.626070011116
Elementary charge	1.6021766208	1.602176615020
Newtonian gravitational	6.67408	6.674052896851

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