Zero Zone Theory Expressing Everything via One Parameter and Its Application to Find New Equations

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1. Introduction

How many fundamental physical constants are there in nature? And what are they? Despite continuous efforts to resolve such questions, we haven't reached a clear and consistent answer to explain our physical world. The number of such fundamental physical constants may depend on the theoretical model of nature and the current perspectives of physics. Weinberg [S. Weinberg] defines constants to be fundamental if we can not calculate their values in terms of more fundamental constants, not just because calculation is too difficult, but because we do not know anything more fundamental than they already are.

The International System of Units (SI) defines seven dimensionally independent SI base units [BIPM]: second, meter, kilogram, Ampere, Kelvin, candela and mole. Note that all the physical quantities can be expressed by these base units and hence nature can be considered to consist of seven fundamental physical constants in SI units.

The centimetre-gram-second system (abbreviated CGS or cgs) is a metric system of physical units based on centimeter, gram, and second. CGS system takes a direct approach in the definition of electromagnetic units, which is different from SI units. It does not introduce new base units and derives all electric and magnetic units from centimeter, gram, and second. It refers to physics laws, Coulomb's law or Ampere's force law, which relate electromagnetic phenomena to mechanics [N. Feather].

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On the other hand, three dimensioned constants like the maximum velocity in special relativity given by the speed of light *c*, the minimum quantum of action in quantum mechanics *h*, and the Newton gravitational coupling constant in classical gravity *G* are often considered as fundamental. The dimensions of above three constants are again presented in terms of three basic units of length, mass and time.

In natural system of units, all physical quantities and variables become dimensionless or pure numbers, which is realized in all physical equations by setting the properly selected physical constants in a consistent manner.

Stoney (1826-1911) from England was thinking about a system of units based on observable constants in nature, rather than something for human convenience such as standard mass of a kilogram or a length of a meter. He proposed a system of units in 1881 based on the physical constants, assuming they were the same everywhere in universe [G. Stoney]. The constants that Stoney adopted were speed of light(*c*), universal gravitation constant (*G*), and basic electron charge (*e*). It is notable that he considered the speed of light was constant well before Einstein proposed the constancy of light velocity. He showed that these constants could be combined so that a unit of mass, a unit of length and a unit of time could be derived from them.

Later in 1899, Planck (1858-1947) proposed a unit system which was independent of special bodies or substances. He adopted natural units of mass, length and time which were defined by the most fundamental constants of Nature such as the gravitation constant *G*, the speed of light *c*, and the constant of action *h*, which is now called as Planck constant [M. Planck]. In addition, by adopting the Boltzmann's constant, *k*, natural temperature was defined. When these four constants are properly combined, Planck's unit with the dimensions of mass, length, time and temperature are derived such as Planck mass, Planck length, Planck time and Planck temperature, respectively. Nowadays, Planck units of measurement are defined exclusively in terms of the five fundamental constants including Coulomb force constant, in such a way that all of these constants take on the numerical value of 1 [J. Barrow] .

Natural units including Planck units may be useful in the limited fields of science as their units can be replaced with the corresponding numbers, which are derived from physical constants. Despite that, natural units are considered practically inappropriate to be widely applied to all scientific fields since only five out of seven SI base units can be replaced with numbers and mostly show unacceptably high uncertainties.

According to the values of the fundamental physical constants recommended by CODATA in 2006, the relative standard uncertainty of Planck mass, Planck temperature, Planck length and Planck time is 5.0×10^{-5} which is very high compared with the relative standard uncertainty of the same kind of physical quantities appeared in 2006 CODATA values [Peter J. Mohr & Barry N. Taylor]. The large uncertainties in Planck units are mainly due to the large uncertainty of Newtonian constant of gravitation, *G*, of 1.0×10^{-4}.

In this paper, a new system of units is proposed in which all 7 SI base units and consequently all physical quantities are converted into dimensionless numbers by one parameter. And the uncertainties of the converted numbers are within the experimentally acceptable range, which is one of the basic requirements for deployment in all scientific areas

It is remarkable that the proposed system of units does not have any dimension at all. This is why the numeric values of all physical quantities including those of unlike-dimensioned quantities like mass and length can be converted and hence added, subtracted and compared with each other in a consistent manner.

This makes it easy to analyze the relationship among physical quantities and to validate even a complex scientific equation promptly and precisely by using their converted values. Furthermore, it is possible to forecast an innovative physical equation with unlike-dimensioned quantities on both sides, which has been extremely difficult or impossible in the established SI units.

The proposed system of units seems to fit the 'other worlds' George Gamow depicted [G. Gamow] earlier.

> *If, however, we imagine other worlds, with the same physical laws as those of our own world, but with different numerical values for the physical constants determining the limits of applicability of the old concepts, the new and correct concept of space, time and motion, at which modern science arrives only after very long and elaborate investigations, would become a matter of common knowledge (pp.381-391).*

2. Zero Zone Theory

2.1 Nondimensionalization

Nondimensionalization is usually the partial or full elimination of units from a mathematical equation via a suitable substitution of variables, which can simplify and parameterize problems when measured units are involved. Although nondimensionalization is well adopted for simplifying differential equations, it is not restricted to them.

Natural system of units shows another example of nondimensionalization. Natural units are physical units of measurement defined in such way that some chosen physical constants are normalized to have numerical values set in a consistent manner

In cases of the natural systems of units including Planck units and Stoney units, five physical quantities such as length, mass, time, temperature, and electric charge are adopted to define the base units. Since only five physical constants mentioned above are selected to express the physical quantities by dimensionless values in existing natural units, the two SI base units, cd and mol, are not considered for nondimensionalization. Besides how to optimize the uncertainties of the dimensionless values in the natural units is not considered.

The so-called 'Zero Zone theory' has been developed and introduced [Dong Bong Yang, Gun Woong Bahang & Sang Zee Lee] as a generalized method of nondimensionalization of all physical quantities with acceptable uncertainties in line with the experimental data. It is intended to define a new system of units where all seven SI base units are converted into the pure numerical values by selecting and setting some appropriate physical quantities with lower uncertainties as 1. Since all other units can be derived by seven SI base units, all physical quantities can obviously be converted into dimensionless values.

The term 'qunit' was coined to describe the converted dimensionless number of a physical quantity in the Zero Zone system of units. 'Qunit' stands for 'physical quantity embedding units in numbers'

If a dimensionful physical quantity (x) composed of nondimensional numeric variable (x*) and unit (x_u) is defined as $x = x^* x_u$, it can easily be converted into dimensionless numerical value by substituting the unit, x_u, with the corresponding value. This process can be achieved by using a simple operator Q[x], named 'Q-transform', on a physical quantity x that converts it into a qunit value. By using the denoted operator, the dimensionless numerical value of a physical quantity x can be expressed simply as $Q[x] = Q[x^* x_u] = x^* Q[x_u]$ where $Q[x_u]$ is the qunit value of a unit x_u.

2.2 Conversion of all 7 SI base units into numerical values

The so-called Zero Zone theory can be applied to convert all seven SI base units into the dimensionless values by normalizing the properly selected seven physical quantities in a consistent manner. It is worth noting that the time duration of one second is selected and set to unity (1) to determine the qunit value of the SI base unit of time, s, independently while the qunit values of other units are derived dependently. The speed of light c, Planck constant h, Boltzmann constant k, electron charge to mass quotient e/m_e, and Avogadro constant N_A are also selected and set to unity (1) for normalization. The last constant for normalization mentioned above is newly defined one related to the luminous intensity as b = B/sr where B is the spectral luminous efficacy for monochromatic radiation of frequency of 540 x 10^{12} hertz as exactly 683 lumens per watt and sr stands for steradian.

In summary, six physical constants and one SI base unit are selected and normalized in a consistent manner as shown in Equation (1)

$$Q[s] = Q[c] = Q[h] = Q[e/m_e] = Q[k] = Q[N_A] = Q[b] = 1 \quad (1)$$

First of all, the qunit value of the SI base unit of time, s, is given by Q[s] = 1 independently as an exact value by definition in Equation (1).

Q-transform of the light speed, c = 299 792 458 m/s, results in Q[c] = 299 792 458 Q[m]/Q[s]. By substituting Q[c] = Q[s] = 1, the qunit value of the SI base unit of length, m, can easily be obtained as Q[m] = 1/299 792 458 which is also an exact value.

Q-transform of Planck constant, h = 6.626 068 96 x 10^{-34} Js, becomes Q[h] = 6.626 068 96 x 10^{-34} Q[J] Q[s]. From the relationship of J = m^2 kg s^{-2}, we can get its Q-transform as Q[J] = $Q[m]^2$ Q[kg] $Q[s]^{-2}$ and substitute it into the above equation, producing Q[h] = 6.626 068 96 x 10^{-34} $Q[m]^2$ Q[kg] $Q[s]^{-1}$. By applying Q[h] = Q[s] = 1 given in Equation (1) and the qunit value of Q[m] obtained above, we can get the qunit value of kg as Q[kg] = 1.356 392 733 x 10^{50}.

It is worthwhile to note that Q[kg] is not an exact value and has a certain relative uncertainty, mainly due to the uncertainty of the experimentally determined coefficient of Planck constant, i.e., 5.0x10^{-8}.

Undoubtedly, the uncertainty of the qunit value of a unit depends on the physical quantities applied and the procedures of derivation. And it is necessary to minimize the uncertainties of the qunit values of SI base units within the acceptable range in order to establish the compatibility between Zero Zone system and SI units.

Rydberg constant, R_∞, and the fine structure constant, α, with relatively lower uncertainties of 6.6 x 10^{-12} and 6.8 x 10^{-10} respectively, are used to derive the qunit values of the elementary charge, *e*, and the electron mass, m_e, with optimized uncertainties.

Q-transform can be applied to Rydberg constant, $R_\infty = \alpha^2 m_e c/2h$ = 10 973 731.568 527 m^{-1}, which results in $Q[R_\infty] = \alpha^2 Q[m_e]Q[c]/2Q[h]$ = 10 973 731.568 527 $Q[m]^{-1}$. By adopting Q[*c*] = Q[*h*] = 1 as given in Eq. (1), the dimensionless value of Q[m] obtained above and fine structure constant α = 7.297 352 5376 x 10^{-3}, the qunit value of electron mass, $Q[m_e]$, can be calculated. And since Q[*e*] equals $Q[m_e]$ by defining $Q[e/m_e]$ =1 in Equation (1), we get Q[*e*] = $Q[m_e]$ = 1.235 589 9746 x 10^{20}. The calculated relative standard uncertainty here is 1.4 x 10^{-9} and is better than 2.5 x 10^{-8} and 5.0 x 10^{-8}, i.e., the relative standard uncertainties of *e* and m_e, respectively, announced by CODATA in 2006.

If we apply Q-transform to elementary charge, *e* = 1.602 176 487 x 10^{-19} C, we can get Q[*e*] = 1.602 176 487 x 10^{-19} Q[C] and Q[C] can be easily calculated by adopting the qunit value of Q[*e*]. From the definition of A = C/s and the Q-transform as Q[A] = Q[C]/Q[s] with Q[s] = 1, we obtain Q[A] = Q[C] = 7.711 946 75 x 10^{38}. The relative standard uncertainty here is about 2.9 x 10^{-8} by using that of Q[*e*], 1.4 x 10^{-9}, as explained above and that of coefficient of elementary charge, 2.5 x 10^{-8}, according to CODATA.

The qunit values and their uncertainties of the rest of SI base units can also be derived in similar procedures, and the reaults for all seven SI base units are summarized in Table (1).

Table 1

Summary of zero zone dimensionless values for the seven SI base units

Quantity	Unit	Dimensionless value in qunit	Calculated relative standard uncertainty
Time	s	Q[s] = 1	Exact value
Length	m	Q[m] = 1/299 792 458	Exact value
Mass	kg	Q[kg] = 1.356 392 733(68)x10^{50}	5 x10^{-8}
Electric current	A	Q[A] = 7.711 946 75(23)x10^{38}	2.9 x10^{-8}
Thermodynamic Temperature	K	Q[K] = 2.083 6644(36)x10^{10}	1.7 x10^{-6}
Amount of Substance	mol	Q[mol] = 6.022 141 79(30)x10^{23}	5.0 x10^{-8}
Luminous Intensity	cd	Q[cd] = 2.209 649 27(11)x10^{30}	5.0 x10^{-8}

According to Table 1, all seven SI base units have their unique dimensionless values and any kinds of physical quantities as well as the derived units can be converted into their corresponding qunit values with the calculated uncertainties. Just as the qunit values given in Table 1 are substituted for units in a physical equation, the equation can be validated simply by comparing the qunit values on both sides of equal sign.

Considering Q-transform to convert a certain physical quantity in SI units into its qunit value, we can also define inverse Q-transform, vice versa. In order to convert some qunit value into its corresponding physical quantity with SI units, the desired units should be designated.

The simplest case of inverse Q-transform is to convert a certain qunit value into the physical quantity with single SI unit. It is established in such a way that a certain qunit value is divided by the designated unit's qunit value as given in Table (1) and the quotient here is the denominate number of the designated unit. Such a calculation method can simplify the conversion process between the physical quantities via dimensionless qunit values in the transformed domain.

Let's consider a certain qunit value N = Q[f] where its corresponding dimensionful physical quantity is given by $f = f^*f_u$ where f* is coefficient and f_u means unit. Here inverse Q-transform can be defined by $f = Q_{fu}^{-1}[N]$. By way of example, inverse Q-transform of a qunit value N into the quantity f with the unit of mass, f_u = kg, can be represented as $f = Q_{kg}^{-1}[N]$.

In general, inverse Q-transform of a qunit value N can be represented as $f = Q_{fu}^{-1}[N] = NQ_{fu}^{-1}[1]$ where $Q_{fu}^{-1}[1]$ means inverse Q-transform of unity (1) into its corresponding physical quantity with a desired unit f_u. It is worthwhile to note that, if we get physical quantities of inverse Q-transform of unity (1) for all seven SI base units, an arbitrary qunit value can be transformed into the dimensionful quantity with any desired unit. Physical quantities in seven SI base units corresponding to inverse Q-transform of unity (1) are easily derived from Table (1) and given in Table (2).

Table 2

Qunit value of '1' and the equivalent physical quantity in SI unit

Quantity	Value in qunit	Equivalent physical quantity in SI unit
Zero Zone Time	1	$Q_s^{-1}[1] = 1$ s
Zero Zone Length	1	$Q_m^{-1}[1] = 2.997\ 924\ 58 \times 10^8$ m
Zero Zone Mass	1	$Q_{kg}^{-1}[1] = 7.372\ 495\ 99[37] \times 10^{-51}$ kg
Zero Zone Electric Current	1	$Q_A^{-1}[1] = 1.269\ 689\ 452[38] \times 10^{-39}$ A
Zero Zone Thermodynamic Temperature	1	$Q_K^{-1}[1] = 4.799\ 2374[82] \times 10^{-11}$ K
Zero Zone Amount of Substance	1	$Q_{mol}^{-1}[1] = 1.660\ 538\ 782[83] \times 10^{-24}$ mol
Zero Zone Luminous Intensity	1	$Q_{cd}^{-1}[1] = 4.525\ 605\ 10[23] \times 10^{-31}$ cd

Since Q[s] = 1 as shown in Table 1, inverse Q-transform of unity (1) into SI base unit of time s is obtained by f = Q_s^{-1}[1] = Q_s^{-1}[Q[s]] = 1s

For SI base unit of length m, we can get as f = Q_m^{-1}[1] = 2.997 924 58 x 10^8 Q_m^{-1}[Q[m]] = 2.997 924 58 x 10^8 m since Q[m] = 1/299 792 458 from Table (1) or 1 = 2.997 924 58 x 10^8 Q[m]

For all other SI base units, inverse Q-transform can be obtained similarly. Table (2) provides physical quantities corresponding to inverse Q-transform of unity (1) for all seven SI base units.

2.3 Paradigm shift in physics

In Zero Zone theory, it is possible to express all physical quantities via the number one (1), the single parameter, by transforming them into dimensionless numbers, that is qunit values. As the transformed qunit values are all dimensionless, they can be converted with each other by using the designated conversion factors among them. It means that they can be added, subtracted or compared with each other without any physical contradiction.

It is noted that convertibility among physical quantities reveals that all the physical quantities of the same qunit value are equal, rather than equivalent. Let's take the units of mass, kg and g for example. It is well-known that kg and g can be substituted mutually in a physical equation with no contradiction such that unit of kg is substituted directly with 1000g, vice versa, for calculation purposes. Therefore, the physical quantities of 1kg and 1000g are equal, rather than equivalent.

According to $E = mc^2$, Einstein's mass-energy equivalence, it is indicated that the energy of E = 8.987 551 787... x 10^{16} J can be derived from the mass of m = 1 kg. The above two physical quantities, energy and mass, do have equivalent relationship since the unit of mass, kg, and the unit of energy, J, have different dimensions in SI units, thereby being treated as different physical quantities. In any equations represented by SI units, there is no way to directly substitute kg and J with each other without any contradiction.

When the same equation $E = mc^2$ is transformed into dimensionless numbers and Q[c] = 1 is substituted, then Q[E] = Q[m]. The energy of E = 8.987 551 787... x 10^{16} J and its equivalent mass of m = 1 kg can be transformed into dimensionless numbers and they become Q[E] = 8.987 551 787... x 10^{16} Q[J] and Q[m] = 1 Q[kg], respectively. It can easily be verified that Q[E] = Q[m] if the qunit value of J, Q[J], and the qunit value of kg, Q[kg], are substituted. Since Q[E] and Q[m] are equal as mentioned above, rather than equivalent, they produce the relationship of 8.987 551 787... x 10^{16} Q[J] = Q[kg]. In addition, Q[J] and Q[kg] are dimensionless numeric values of the same dimension and they are also interchangeable between one another. Their conversion factor is equal to Q[kg] / Q[J] = 8.987 551 787...K x 10^{16}.

It is worthwhile to note that, even though the unit of mass, kg, and the unit of energy, J, are the unlike-dimensioned units conventionally in SI, their dimensionless numeric values, Q[kg] and Q[J], transformed by Zero Zone theory are like-dimensioned and convertible with one another.

As shown in Tables 1 and 2, all SI base units can be transformed into the corresponding qunit value and a given qunit value can be transformed back to any desired unit. The dimensional barriers among all physical quantities with unlike-dimensioned units in SI are dismantled in the transformed domain by the Zero Zone theory. Therefore, we can add, subtract and compare even among the unlike-dimensioned physical quantities in SI without any contradiction by using the dimensionless numerical values in the transformed domain. It is expected to take a paradigm shift in science.

Accordingly, it is now possible to discover a new physical equation via the proposed mechanism of Zero Zone theory, which has been considered theoretically to be almost impossible due to the barrier between the unlike-dimensioned units in SI.

2.4 Database of qunit values(QDB) for inverse Q-transform

Q-transform is designed to transform a variety of physical quantities and physical equations into dimensionless numbers in such way that the base units or derived units expressed as symbols are substituted simply by the corresponding dimensionless numbers or qunit values.

In addition, inverse Q-transform is designed to convert any given qunit value back into physical quantities with the specifically designated units in SI. The direct conversion process via qunit value as mentioned above can easily resolve the problem that some physical quantity is to be converted to another one with a designated unit.

However, when we are trying to discover a new physically meaningful equation which contains multiple units or physical constants in the complicated form, inverse Q-transform requires an even more delicate, complex and time-consuming calculation process.

Let's consider that two terms of the physical equation in question are defined as f_1 and f_2, respectively, and we want to identify a new equation f_2 for a given equation f_1 so that they have the same qunit value within the required range of uncertainty while satisfying $Q[f_1] = Q[f_2]$.

In order to solve the foregoing problem, the qunit value of the given equation f_1, $Q[f_1]$, is easily calculated via Q-transform. Then, the desired target equation f_2 which is different from f_1, yet with the dimensionless number equal to $Q[f_1]$, shall be obtained via inverse Q-transform. This process is given by Equation (2)

$$f_2 = Qf_2^{-1}[Q[f_1]] \qquad (2)$$

As an exemplary case, let's consider f_1 is the SI base unit of thermodynamic temperature, that is, f_1 = K and we get $Q[f_1] = Q[K] = 2.083\ 6644(36) \times 10^{10}$ from Table 1. If the last 2 digits of the significant number (36) of the given uncertainty are considered, the permissible range of $Q[f_1]$ is between min. $2.083\ 6608(36) \times 10^{10}$ and max. $2.083\ 6680(36) \times 10^{10}$.

It is the next step to find the target equation, f_2, whose qunit value is same as $Q[f_1]$ obtained above. Since there may be numberless equations whose qunit values are equal to $Q[f_1]$, we have to limit the condition more severely to solve the problem. Now we assume that the target equation should be composed of the unit of the electrical charge C, the unit of voltage V, the unit of length m and some coefficients.

Furthermore, we focus on equations in the format of $Q[f_2] = \{ a\ Q[C]^p\ Q[V]^q\ Q[m]^r \}^s$ for simplicity. Here, a is a coefficient of a pure number and the exponents p, q, r and s can be real numbers, yet it is more desirable when they are defined as integers or relatively simple fractions. Even if the format of $Q[f_2]$ is restricted as above, the huge amount of highly repeated and monotonous processing may be required to identify the most optimized target equation with the simplest exponent as well as coefficient among all varieties of available equations.

Therefore, in order to automate efficiently to get the desired value of the coefficient and exponents in the target equation through the process of inverse Q-transform via a computer program, it is more effective to establish a database for qunit values of base units, derived units, physical constants and physical equations. The database here is referred to as 'Qunit Database' or simply QDB.

To explain the process in more detail, let's take $Q[C]^p$ as an example where the permissible cases of p includes reasonable integer number between -10 and +10, simple positive or negative fractions such as 1/2, 1/3, 2/3, 1/4, 2/4, 3/4 1/5, 2/5, 3/5, 4/5, etc. and p can be further extended to include the specific values that are proved to be physically significant and meaningful. Even though the qunit value of $Q[C]^p$ can be calculated for each value of p during the iterative calculation, it seems to be more efficient to store the calculated qunit value of $Q[C]^p$ for all desired values of p at QDB for repeated use.

As for other physical quantities, the combination of the qunit value similar to $Q[C]^p$ as mentioned above are additionally stored in QDB. Whenever a certain equation is discovered newly and proved to be physically meaningful, it is also stored at the QDB for upgrading QDB gradually to be used for finding the better equations.

As is presented earlier, the most optimized equation to express K, the SI base unit of Kelvin, as the combination of C, V and m could be identified by using QDB upgraded recently and to the utmost. The exemplary result is shown in Equation (3). All physical quantities expressed as symbols in this Equation (3) represent the qunit values transformed by Zero Zone theory instead of the quantities in SI units. Thus, operator Q[ ] indicating Q-transform is omitted, just for convenience sake. As can be seen in Equation (3), the selected values of a, p, q, r and s are set to be relatively simpler and more optimized and the qunit value of the newly established equation lies within Q[K]'s tolerable range of uncertainty.

$$\begin{aligned} K &= \left(\frac{2693 \times 1.5\,CV^2}{9294 \times 2\pi^5\, m^2} \right)^{1/4} \\ &= \left(\frac{1.193\,030\,886\,724\,917... \times 10^{31}}{6.329\,080\,527\,562\,127... \times 10^{-11}} \right)^{1/4} \\ &= (1.884\,998\,747\,494\,931... \times 10^{41})^{1/4} \\ &= 2.083\,664\,374\,795\,356... \times 10^{10} \end{aligned} \tag{3}$$

2.5 Other newly discovered physical equations

QDB is to contain qunit values of a variety of physical quantities that are broadly used in areas of physics including quantum mechanics and relativity theory. In addition, the considerable amount of qunit values concerning a variety of the newly discovered equations has been added for upgrading QDB by investigating and analyzing the conventionally established physical data to develop Zero Zone theory for a period of time longer than a decade.

Eq. (4) presents another exemplary case of the newly discovered physical equation by using the QDB, which is related to cosmic background radiation temperature (CBR). In this Equation (4), CBR* means CBR's coefficient and its qunit value is expressed as the combination of Rydberg (R_∞) and fine structure constants (α), the SI base unit of length, m, and several coefficients. For reference, the number 9192631770 among coefficients in Eq. (4) is included in the definition of one second (s), SI base unit of time, in the 13th CGPM, 1967. In other words, this is the duration of 9192631770 period of electromagnetic wave that corresponds to the potential of two hyperfine levels at the ground state of Cesium atom (^{133}Cs).

$$\begin{aligned}\mathrm{CBR}^* &= \left(\frac{9\times 9192631770\times 469\alpha}{32.5792458\times 792\times R_\infty\ \mathrm{m}}\right)^S \\ &= \left(\frac{2.831525934213500...\times 10^{11}}{2.831525913064944...\times 10^{11}}\right)^S \\ &= 2.724996006023...\end{aligned} \tag{4}$$

Another example of a newly discovered physical equation through inverse Q-transform with QDB is given in Equation (5).

$$\mu^{10/9} = \frac{2(1+\mathrm{C}/e^2)(np)^{2/3}\beta}{3p^{1/3}(n-p)^{4/3}} \tag{5}$$

where

$$\beta = \left(\frac{\mu^{14/3}(n-p)^2}{np}\right)^{2/3}\left(\frac{2}{3}\cdot\frac{\mu^2}{p^{1/3}} + \mathrm{C}/e^2\cdot\frac{2\mu^2}{3p^{1/3}}\right)^{-1} \tag{6}$$

In Equations (5) and (6), μ, n and p stand for muon-electron mass ratio, m_μ/m_e, neutron-electron mass ratio, m_n/m_e, and proton-electron mass ration, m_p/m_e, respectively and they are originally pure numeric values without units. According to CODATA, their values are 206.768 2823(52), 1838.683 6605(11) and 1836.152 67247(80) with the respective relative standard uncertainty of 2.5×10^{-8}, 6.0×10^{-10} and 4.3×10^{-10}. And C in Equation (5) and (6) represents qunit value, Q[C], of Coulomb, the SI unit of electric charge while e represents Q[e], the qunit value of elementary charge

It should be noted that the newly discovered physical equations presented here have not been established before mainly due to the barriers of the conventional units like SI. Even though the physical meaning of those new equations derived by Zero Zone theory was not shown clearly in this paper, they do have mathematical integrity and consistency via the dimensionless values of all physical quantities without any contradiction. A further study about one more step to convert the newly discovered equations by using the qunit values into the equivalent equations with SI units will be helpful for better understanding by the conventional dimensional analysis.

As a new mathematical method is presented in this paper for the pursuit of new physical equations via QDB by Zero Zone theory, the existing paradigm of physics will be revolutionized.

3. Conclusion

This paper introduces Zero Zone theory, which presents a new mathematical approach of expressing all measurable physical quantities in dimensionless qunit values, while retaining the compatibility with the established SI units. Additionally, the process of Q-transform and inverse Q-transform are introduced.

All physical quantities that are converted into dimensionless qunit values under Zero Zone theory can be expressed by unity (1), the single parameter, and they can be interchangeable among each other based on the designated conversion factors. It is worth noting that there is no barrier of dimensions among the qunit values of physical quantities. Furthermore, it is possible to add, subtract and compare even among unlike-dimensioned physical quantities, without any contradiction. This is denoted as a shift in paradigm of physics.

Zero Zone theory explains Q-transform of converting units, physical constants and physical equations in SI units into dimensionless numbers and inverse Q-transform of converting dimensionless numbers back into units. In order to produce some new physical equations by using inverse Q-transform process, the database of the qunit values, QDB, upgraded gradually and recently is proved to be useful to the utmost to identify the desired target equation. And the efficacy of the new approach of Zero Zone theory is proven based on the exemplary equations that are newly discovered through QDB.

In summary, Zero Zone theory presents a revolutionary mathematical means without not theoretical contradiction to discover new equations by using the dimensionless qunit values in the transformed domain, which has been highly difficult or theoretically almost impossible in the conventional systems of units like SI due to the dimensional barriers of units. Ideally, Zero Zone theory is expected to contribute to show a way to 'Theory of Everything', if the proposed theory is adopted to discover some new meaningful equations concerning both Newtonian constant of gravitation (*G*) and elementary particles in the standard model such as Neutrino, Quark, etc.

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