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Equations of Physical Laws and Physical Constants Affected by Gravitational Field and Aging of the Universe

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[Abstract]
Physical constants and their arithmetic operations are defined, and commutativity, associativity and distributivity of the operations are derived. Equations of physical laws are interpreted by the equality between two associated quantities of induced properties of the same interactive object or event caused by two objects or events. Compared to mathematical constants which contain only real numbers and remain always unchanged, physical constants however contain additional unit quantities with arithmetic operations and they are dependent on gravitational field and aging of the universe.

[Keywords]
Arithmetic Operations, Commutativity, Associativity, Distributivity, Physical Laws, Physical Constants, Yangton and Yington Theory, Wu's Pairs, Wu's Spacetime Shringkage Theory, Principle of Parallelism, Thermal Equilibrium, Subatomic Eqilibrium.

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I. Introduction

There are some fundamental questions in physics that have always bothered scientists such as: Why equations of physical laws in general are always true? What are the meanings of arithmetic operations such as multiplication and division between physical quantities and units? How to derive physical equations by mathematics? And what are the meanings of physical constants? It is the purpose of this paper trying to give a sound answer to all these questions.

II. Arithmetic Operations and Physical Quantities

A physical quantity is the quantity of a property (such as dimension and duration) of an object or event in the universe. In mathematics, a physical quantity is a value (quantity) corresponds to a function (property) of an element (object or event) in a domain (a group of substance).

"Nature Quantities" such as a piece of space and time, don't change with anything at all, no matter of any object or event. However, "Associated Quantities" such as the dimension and duration, are properties of an object or event. Also, "Measured Quantities" are composed of two components "Amount" and "Unit Quantity" of the same property. Where amount is a real number and unit quantity is a specific associated quantity of a standard object or event. Both associated quantities and unit quantities are dependent on local gravitational field and aging of the universe according to Wu's Spacetime Shrinkage Theory [1].

In physics, arithmetic operations including Addition, Subtraction, Multiplication and Division are the products of the interactions between two properties of the objects or events [2]. In Addition and Subtraction operations, the product of the operation is the associated quantity of the same property of the combined object or event [2]. However, in Multiplication and Division operations, the product of the operation is the associated quantities of the induced property of the interactive object or event generated from the interaction between the two objects or events [2].

The definitions and some basic theories of arithmetic operations on associated quantities can be represented as follows [2]:

A. Addition

1. Definition of Addition

Q(A) and Q(B) are two associated quantities of the same property Q of two objects or events (A and B). Because of the intrinsic structures, associated quantity is proportional to the amount of object or event.

$$Q(mA) = mQ(A)$$

Accordingly, Addition is defined as follows:

$$Q(A) + Q(B) \equiv Q(A\psi B)$$

Where AψB is the combined object or event of A and B.

2. Commutativity

$$Q(A) + Q(B) = Q(B) + Q(A)$$

3. Associativity

$$(Q(A) + Q(B)) + Q(C) = Q(A) + (Q(B) + Q(C))$$

4. Distributivity

$$m(Q(A) + Q(B)) = mQ(A) + mQ(B)$$

B. Subtraction

1. Definition of Subtraction

Q(A) and Q(B) are two associated quantities of the same property Q of two objects or events (A and B).
If an associated quantity Q (M) of the same property Q of an object or event M can satisfy the following:

$$Q(M) + Q(B) = Q(M\psi B) = Q(A)$$

Then Subtraction is defined as:

$$Q(A) - Q(B) \equiv Q(M\psi B) - Q(B) \equiv Q(M)$$

2. Definition of Negative Physical Quantity

If there is an object or event N can satisfy:

$$Q(A) + Q(N) = 0$$

Then the "Negative Physical Quantity" -Q(A) is defined as:

$$-Q(A) \equiv Q(N)$$

Also,

$$Q(A) + (-Q(A)) = 0$$

3. Theory

$$Q(A) - Q(B) = Q(A) + (-Q(B))$$

C. Multiplication

1. Definition of Multiplication

Q(A) is the associated quantity of property Q of an object or event A; P(B) is the associated quantity of property P of an object or event B; and $\underline{Q\Phi P}(A\Phi B)$ is the associated quantity of the induced property $\underline{Q\Phi P}$ generated from the two properties Q and P, caused by the interactive object or event AΦB produced from the interaction between the two object or event A and B (Q and P can be the same property, but A and B must be considered as two objects or events even they are the same object or event).
Because of the intrinsic structures, associated quantity of the induced property is proportional to the amounts of both objects or events.

$$\underline{Q\Phi P}\ (mA\Phi B) = m\ \underline{Q\Phi P}(A\Phi B)$$
$$\underline{Q\Phi P}\ (A\Phi nB) = n\ \underline{Q\Phi P}(A\Phi B)$$

Accordingly, Q(A) x P(B) is defined as follows:

$$Q(A) \times P(B) \equiv \underline{Q\Phi P}(A\Phi B)$$

2. Commutativity

$$Q(A) \times P(B) = P(B) \times Q(A)$$

3. Associativity

$$(Q(A) \times P(B)) \times R(C) = Q(A) \times (P(B) \times R(C))$$

D. Division

1. Definition of Division

Q(A) is the associated quantity of property Q (such as Duration) of an object or event A. R(M) is the associated quantity of property R (such as Distance) of an object or event M.
If an associated quantity P(B) of property P (such as Speed) of an object or event B can satisfy the following:

$$Q(A) \times P(B) = \underline{Q\Phi P}(A\Phi B) = R(M)$$

Then Division is defined as:

$$R(M)/Q(A) \equiv \underline{Q\Phi P}(A\Phi B)/Q(A) \equiv P(B)$$

2. Definition of Inverse Physical Quantity

If there is an object or event B can satisfy:

$$Q(A) \times P(B) = 1$$

Then the "Inverse Physical Quantity" 1/Q(A) is defined as:

$$1/Q(A) \equiv P(B)$$

Also,

$$Q(A) \times 1/Q(A) = 1$$

3. Theory

$$R(M)/Q(A) = R(M) \times 1/Q(A)$$

In fact, all physical laws, theories and equations are represented by arithmetic operations on associated quantities either with or without physical constants, such as $F = ma$, $E = MC^2$, $PV = nRT$ and $F = GM_1M_2/R^2$.

III. Arithmetic Operations and Unit Quantities

"Measured Quantities" mU(S) are composed of two components, m is a real number and U(S) is a unit quantity. "Unit Quantity" is an associated quantity of a specific property of a standard object or event. For examples, "meter" (m) – the quantity of dimension (property U_1) of a standard ruler (object S_1) can be represented as $U_1(S_1)$, "Kilogram" (Kg) – the quantity of mass (property U_2) of a standard weight (object S_2) can be represented as $U_2(S_2)$ and "second"(s) – the quantity of duration (property U_3) of a standard atomic clock (event S_3) can be represented as $U_3(S_3)$.

Some basic theories of arithmetic operations on measured quantities can be represented as follows [2]:

1. Addition

$$mU(S) + nU(S) = (m+n)U(S)$$

2. Subtraction

$$mU(S) - nU(S) = (m-n)U(S)$$

3. Multiplication

$$mU_1(S_1) \times nU_2(S_2) = mn\ U_1(S_1) \times U_2(S_2)$$

4. Division

$$mU_1(S_1)/nU_2(S_2) = (m/n)\ (U_1(S_1)/U_2(S_2))$$

As a result, all measurements and calculations in physics are carried out by arithmetic operations on measured quantities. For examples,

3 meter + 5 meter = (3+5) meter = 8 meter,

10 Kg -3 Kg = (10-3) Kg = 7 Kg,

2m/s x 4s =(2x4) (m/s x s) = 8 ((vxs/s) x s) = 8 m.

IV. Equations of Physical Laws

An equation of physical law contains four components: Variables, Arithmetic Operations, Physical Constant and Equality.

Variables are used to represent the associated quantities of the properties of the same or different objects or events. For examples, L represents the associated quantity of dimension (a property) of an object or event; S represents the associated quantity of duration (a property) of an object or event; and V represents the associated quantity of velocity (an induced property) of a moving object (interactive object or event).

Arithmetic operation between two variables represents the associated quantity of the induced property of the interactive object or event resulted from the interaction between two (same or different) objects or events. (In Addition and Subtraction operations, induced property is the same property of the two objects or events and interaction is the combination of the two objects or events).

An equation of physical law with a physical constant (fixed-ratio correlation factor) can be established and derived through logical analysis, physical simulation and experimental proof between the associated quantities of two fixed-ratio correlated induced properties of the same interactive object or event generated from the interaction between two objects or events in a specific domain. This is named "Equation of Physical Law" which can be represented as follows:

$$Q(A) = K\ P(A)$$

Where A is an interactive object or event generated from the interaction of two objects or events in a specific domain. Q(A) is the associated quantity of induced property Q of the interactive object or event A. P(A) is the associated quantity of induced property P of the same interactive object or event A. Also Q and P are correlated by a fixed-ratio correlation factor, and K is a physical constant.

For example, the Ideal Gas Law $PV = nRT$, where PV (as Q(A)) and nT (as P(A)) are the associated quantities of the induced properties PV and nT respectively of the same interactive ideal elastic gas (as A) in a group of ideal elastic gases (as domain) with a fixed-ratio correlation R (as K) between PV and nT induced properties. Also, Ideal Gas Law can be derived by Kinetic Theory of Gases with logical analysis, physical simulation and proved by experiments.

V. Physical Constants

The equations of physical laws such as Newton's Law of Gravitation $F = GMm/R^2$, Photon's Energy $E = h\nu$ and Ideal Gas Law $PV = nRT$ are derived from logical analysis and physical simulation and then proved by experiments. In the equations, the associated quantities of different induced properties of the same interactive object or event on both sides of the equation are proportional to each other by a fixed-ratio correlation factor named "Physical Constant". A physical constant contains two components: a real number and a group of physical units with arithmetic operations which is used for the transformation between the associated quantities

of the induced properties on both sides of the equation. Physical constants are different from the mathematical constants (real numbers) such as $\pi = 3.1416$. It is also different from the conversion factors between unit quantities of the same properties of two different objects or events based on Principle of Parallelism [3] such as 1 inch = 2.2 cm.

Physical constant multiplied to one side of the equation should make it completely equal (identical) to the other side of the equation with the same amount (real number) and unit quantities (units). For examples, in Newton's Law of Universal Gravitation $F = GMm/R^2$, Gravitational Constant G (6.674×10^{11} N m^2 kg^{-2}) multiplies Mm/R^2 is equal to F; in Photon's Energy $E = h\nu$, Planck's Constant h (6.626×10^{-34} m^2 kg/s) multiplies ν is equal to E; and in Ideal Gas Law PV = nRT, Ideal Gas Constant R (8.314 J/K) mol multiplies nT is equal to PV.

VI. Thermal Equilibrium and Subatomic Equilibrium

Equations of Physical Laws can be attained only under both thermal equilibrium and subatomic equilibrium [4] at the same time (co-thermal and subatomic equilibriums). It is because that all associated quantities of the properties of an object or event including associated quantities of induced properties of an interactive object or event are dependent on both the macrostructure and microstructure of the object or event. At "Thermal Equilibrium", all macrostructures including atoms and subatomic particles are settled at a constant temperature and pressure. Furthermore, at "Subatomic Equilibrium" all Wu's Pairs (the building blocks of the universe) in the subatomic particles are stabilized at a constant gravitational field due to the bombardment of gravitons based on Gravity Affected Wu's Spacetime Shrinkage Theory [1] in compliance with Graviton Radiation and Contact Interaction [5]; also at a constant aging of the universe due to built-in attractive Force of Creation in Wu's Pairs [6] based on Aging Affected Wu's Spacetime Shrinkage Theory [1] in according to CMB radiation [7].

VII. Wu's Pairs

"Yangton and Yington Theory" [6] is a hypothetical theory based on a pair of super fine antimatter circulating Yangton and Yington particles with an inter-attractive Force of Creation forming a permanent circulating particle pair named "Wu's Pair" proposed as the fundamental building blocks of the universe. It explains the formation of all the subatomic particles and unified field theory in the universe as well as the correlations between space, time, energy and matter.

VIII. Wu's Spacetime Shrinkage Theory

When the universe becomes older, according to Cosmic Microwave Background Radiation (CMB) [7] and Five Principles of The Universe [8], Wu's Unit Length l_{yy} (the diameter of Wu's Pair) is getting smaller through aging of the universe, and eventually Yangton will recombine with Yington to destroy each other such that everything will go back to Nothing. This phenomenon is named "Aging Affected Wu's Spacetime Shrinkage Theory" [4]. Furthermore, in compliance with Principle of Parallelism, wavelength should decrease with aging of the universe ($\lambda \propto l_{yy}$), such that Cosmological Redshift can be observed [9].

On the other hand, because of the heavy graviton bombardment under large gravitational field, the speed of Yangton and Yington circulation is getting slower and Wu's Unit Length is getting bigger. This phenomenon is named "Gravity Affected Wu's Spacetime Shrinkage Theory" [4]. Furthermore, in compliance with Principle of Parallelism [3], wavelength should increase at massive gravitational field ($\lambda \propto l_{yy}$), such that Gravitational Redshift can be observed [10].

According to Aging Affected Wu's Spacetime Shrinkage Theory, the diameter of Wu's Pairs l_{yy} (Wu's Unit Length) and the period of the Wu's Pairs t_{yy} (Wu's Unit Time) on the present earth are smaller than that of the stars 5 billion years ago. Based on Principle of Parallelism, normal unit length (meter) and normal unit time (second) also become smaller on the present earth. However, on the contrary, the universe becomes bigger (reverse expansion) as measured by the shrinking normal unit length on the present earth. This is named "Wu's Spacetime Reverse Expansion Theory" [11]. In addition, the photon emitted from a star a few billion light years away, has a lower light speed (Absolute Light Speed) and lower frequency but longer wavelength than that of the present earth. These preserved ancient properties (longer wavelength means redder spectrum) can be observed as the photon quenches onto the present earth. This phenomenon is called Cosmological Redshift [10].

IX. Effects of Gravitational Field and Aging of the Universe on Physical Constants

For the same reason that associated quantities in equation of physical law have fixed values at co-thermal and subatomic equilibriums, physical constants should also be stabilized at fixed values under co-thermal and subatomic equilibriums. In other words, the components of unit quantities with arithmetic operations in physical constants are also dependent on gravitational field and aging of the universe. Besides, unit quantities as the associated quantities of the specific property of a standard object or event, they should also

have fixed values at co-thermal and subatomic equilibriums, which means that they are also dependent on gravitational field and aging of the universe.

For examples, Gravitational Constant 6.674 x 10^{11} N m^2 Kg^{-2} contains a real number component 6.674 x 10^{11} and a unit quantities with arithmetic operations component N m^2 Kg^{-2} which is dependent on gravitational field and aging of the universe. Also, Planck's Constant 6.626 x 10^{-34} m^2 Kg/s contains a real number component 6.626 x 10^{-34} and a unit quantities with arithmetic operations component m^2 Kg/s which is dependent on gravitational field and aging of the universe.

X. Physical Constants versus Mathematical Constants

The major difference between physical constants and mathematical constants is that physical constants have unit quantities with arithmetic operations which are dependent on gravitational field and aging of the universe, but not the mathematical constants which have only the real number constants. In Principle of Parallelism, the ratios between the same properties of two different objects or events are mathematical constants. They remain unchanged no matter gravitational field and aging of the universe. For examples, 1 Kg = 2.2 lb and 1 inch = 2.54 cm are always true even at moon and Saturn.

XI. Conclusions

Physical constants and their arithmetic operations are defined, and commutativity, associativity and distributivity of the operations are derived. Equations of physical laws are interpreted by the equality between two associated quantities of induced properties of the same interactive object or event caused by two objects or events. Compared to mathematical constants which contain only real numbers and remain always unchanged, physical constants however contain additional unit quantities with arithmetic operations and they are dependent on gravitational field and aging of the universe.

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