The inherent derivations derived theoretically from one-dimensional Maxwell equations on the basis of exact differential equation

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The second in the sequel

Abstract

This second paper of sequels submitted by Ohki in viXra, under a postulate that there an exact differentiable linear continuous self-medium with vacuum permeability and permittivity, subject to a discrete and coherent frequency given from the source, proposes solutions to free most people from well-known spells that must be: massless of light for violation the Lorentz transformations, existence of external field for light to travel in vacuum space, regardless of impossibility for light to travel in free space with no external media denied by Michelson-Morley, derived only transverse wave from the equations of Maxwell. The others are showed maladaptation for the conservation law at any given point in time for electromagnetic wave function like mechanical system with total energy summed kinetic plus potential energy, and substantial distinction between Electromagnetic Corpuscular System (ECS) and Mechanical Particle System (MPS).

To free from those spells, this paper leads to its solutions: (1) inherent derivations theoretically from one-dimensional complex equations of Maxwell on theorem of the Noether, (2) the derivations of electromagnetic attitude of radiant octad beam carriers: electric momentum, magnetic momentum, mass, momentum, energy, force, power, and electromagnetic indeterminacy described as the wave form. (3) the self-medium in a continuity entity helps the radiant octad carriers travel on an axis in free vacuum space as longitudinal wave and transverse wave duality, (4) which the self-medium helps the carrier travel in free space as the longitudinal wave moving in the same direction of travel on an axis through the movements backwards and forwards in the continuity, we can observe electromagnetic waves which electromagnetic distortion due to the movement generates for the continuity neutralized

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i) Self-funding electric engineer researching novel ways to study specific derivations theoretically from Maxwell's complex equations on the basis of the Noether's theorem with a complex symmetry, which is constituted due to the imaginary part and the real part rotating out of phase by $j\pi/2$, under an orthogonal respective relationship between complex time axes and complex space axes in absolute complex spacetime with attributes of homogeneity, isotropy, linearity, differential continuity and electromagnetic invariant product of permittivity and permeability.

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(D-1) https://www.researchgate.net/profile/Ohki/research

(D-2)https://www.academia.edu/s/b01cc1dfdc/version1-22-nov-2019-substructure-and-configuration-of-an-electron-on-the-orbit-in-hydrogen.

electromagnetically. (5) the indeterminacy carrier of the radiant octad carriers has a space interval or a time interval disappeared only in observing, some of the others are observable and calculatable through invariant the speed of light. (6) maladaptation of time reversal symmetry in the ECS.

Besides, the self-medium with octad complex coordinates has an electromagnetic complex wave in the ECS to interchange the real manifest regimen into the imaginary potential regimen each other to-and-fro for each carrier, and to be described as complex wave function. Therefore, there are complex conservation laws able to apply respectively to the radiant octad carriers at any one point in time like total energy plus kinetic energy and potential energy in the MPS. In short word, the ECS has potential imaginary regimen like the MPS's potential energy. The indeterminacy constitutes of indeterminate space interval or time interval that disappears in observing. However, if the time interval equal to time of observation regards as normal probability distribution through the observation, it will lead us to quantum mechanics world. Moreover, relationship between the beam energy and the beam indeterminacy is described as b(w) Δ t = Δ equation stands on the ECS side, when the Δ t defined as the measurement time interval product of space interval Δ z and the speed of light is assumed as a property of a probability distribution in the self-medium.

Keyword: exact differentiable linear continuous self-medium, Maxwell's complex equations, the Noether's theorem, time reversal symmetry, the indeterminacy principle, radiant octad carriers, longitudinal and transverse wave duality, electromagnetic mechanical substructure

Precaution statement specified in advance, disobedient to conventional sign and description, non-use of the Greek alphabet in this abstract.

Apart from well-known notation convention, to simplify and never to use superscript notation and subscript notation under no specifications to need to describe, to simplify, so this paper is described as below:

<Abbreviations>

(Ab-1) ECS: Electromagnetic corpuscular System

(Ab-2) MPS: Mechanical particle system

<Terms>

(a) Scalar notation for all terms under no need to specify.

(b) If need, using bold sign as respective unit vector: **i** on an axis of x, **j** on an axis of y, **k** on an axis of z

We can use them as scalar notation as example: radiant electric flux density D, radiant magnetic flux density B and electromagnetic velocity dz/dt are, respectively, function with independent variables z, t, just on x axis, just on y axis and just on z axis in this paper discussed only in free space.

(c) To avoid using superscript notation and subscript notation and to simplify their notations, both permittivity ε and permeability μ have no suffix naught in this paper discussed only in free space.

(d) End notes are square brackets: [].

(e) For the same reason, Cub(x) means the third power of x, Sq(x) means x squared and Sqrt(x) means the square root of x.

(f) Specified unit: Frequency [Nos/s], electric charge [As], magnetic charge [Vs], permittivity [As/Vm], permeability [Vs/Am], radiant electric flux density [As/Sq(m)], radiant magnetic flux density [Vs/Sq(m)], wavenumber [Nos/m], the others accord with SI base units [1].

(g) Radiant octad carriers:

(g-1) radiant electric momentum,

(g-2) radiant magnetic momentum,

(g-3) radiant electromagnetic momentum,

(g-4) radiant electromagnetic mass,

(g-5) radiant electromagnetic energy,

(g-6) radiant electromagnetic force,

(g-7) radiant electromagnetic power,

(g-8) radiant electromagnetic indeterminacy.

All of them are able to travel concurrently at the speed of light, using the self-medium for the light to generate with discrete phase from a source under no annihilation into any sink.

(h) In general, media falls into two types:

(h-1) External medium is medium in space with relative permittivity and relative permeability over than 1.

(h-2) Self-medium is an independent medium having permittivity and permeability together from the external medium in vacuum space, playing a role of action through medium and pushing continuously out from the source with push-out mechanism per discrete frequency.

The above-mentioned each radiant octad carrier having invariant permittivity and permeability together can travel concurrently at the speed of light in vacuum space. So this paper postulates the self-medium with itself orthogonal complex coordinates independent from geometric coordinates, which has an property of invariant permittivity and permeability with isotropy, homogeneity, linearity, exact differentiable continuity, making up a single string with a discrete and coherent frequency or a bunch of the strings respectively. In addition, the self-medium helps radiant octad carriers travel at the speed of light, keeping a coherent and discrete frequency product of wave number times the speed of the light in radiating from the source.

(i) Radiant electric momentum density defined as $\mu D = \mu D(x)$: $\partial(\partial\mu D/\partial z)/\partial t$ means the second partial derivative of μD with respect to independent variable x, z in free space with the self-medium and t in time, second partial D by second partial z. This definition of μD is because electric momentum density can harness the self-medium.

(j) Radiant magnetic flux density defined as $\varepsilon B = \varepsilon B(y)$: $\partial(\partial\varepsilon B/\partial z)/\partial z$ means the second partial derivative of εB with respect to independent variable y, z in free space with the self-medium and t in time, second partial εB by second partial z. This definition of εB is because electric momentum density can have use of the self-medium

(k) Integral constant is able to be zero through choosing judiciously the point, so constant through the result of integrating will not be described for all terms integrating under no need to specify.

(l) All wave forms stand for root mean square (afterward, if need, uses r.m.s) for getting mechanical energy equivalent to electromagnetic energy on common criterion respectively, so the ECS keeps equivalent to the MPS on the basis of energy.

(m) Δt: observable time interval with nonzero, which is on a time axis for the light to travel, which has a unit of [s],

(n) Δz: observable space interval with nonzero, space interval on a space axis for the light to travel, which has a unit of [m], those observables disappear when we observe them.

(o) Δf: observable frequency interval with nonzero for reciprocal time with nonzero, time number per unit time on a time axis for the light to travel, which has a unit of [Nos/s]

(p) Δk: observable wave number interval with nonzero, wave number per unit length on a space axis for the light to travel, which has a unit of [Nos/m].

(q) Longitudinal and traverse wave duality:
The self-medium help those carriers travel in the space as the longitudinal wave moving in the same direction of travel on an axis through the movements backwards and forwards in the continuity entity, we can observe electromagnetic waves made electromagnetic distortion generating in compressing and expanding the movement through the continuity neutralized electromagnetically. However, our observation of the longitudinal wave will be extremely difficult to observe the longitudinal momentum. So, the self-medium can help both electromagnetic longitudinal and transverse waves able to travel in vacuum space only with the self-medium without external media.

(r) Light in this paper is electromagnetic entity defined as having radiant octad carriers per a discrete and coherent frequency in pushing out from the light source on the differentiable continuous self-medium field with invariant permittivity and permeability in free (vacuum) orthogonal complex space. Besides, the light has a property of integrating over all ranges from the least upper bound frequency to the least upper bound frequency and can travel at the speed of light. However, the light has no divisible infinitescimal element for perfect continuity entity unable to cut up.

1. Introduction

This paper proposes lots of solutions freed most people from well-known spells: light's massless for violation the Lorentz transformations [2] regarded as defective equation without the validity at the speed of light, impossibility to travel in free space with no field in no media, longitudinal wave [3] unable to derive easily from Maxwell's equation like the well-known transverse wave, no existence of the conservation law at any given point in time and any time in every point in electromagnetic wave function like mechanical system with total energy summed kinetic plus potential energy.

We will be freed from those spells:

(A) The concept is taken root that there exists of field, regardless of no existence of external medium in free space under facts that Michelson-Morley experiments denied existence of the medium in space.

(B) Root taken only transverse wave able to derive from Maxwell's equations, regardless of some submissions with respect to longitudinal wave.

(C) The light has no mass able only to fit in the Lorentz transformations.

(D) A belief in getting an isolated fundamental element in observing the continuity entity, though a perfect continuity entity cannot cut an infinitescimal element up, in general, we.

To return to this paper's subject, according to the paper [4] submitted by Ohki Yasutsugu, many derivations is showed theoretically from Maxwell's equations [5], [6] on the basis of exact differential equation in an orthogonal relationship between time axis and each axis of free space with attributes of homogeneity, isotropy, linearity, differential continuity and invariant electromagnetic invariant product of constant permittivity and constant permeability in the space with the light's generation from any source and annihilation into the sink. Using the above-mentioned derivations and new derivation in this paper in detail, those spells are freed below.

2. Characteristics in the ECS different from mechanical system

In the MPS, we know that wave is quite different from particle with mass [7], so it is well-known they are different concept unacceptable each other. The MPS never allows the duality to be acceptable, on the other hand, this paper will help the ECS take acceptable positions in future. However, in the ECS, most peoples have discussed with wave-particle duality [8] for a long time, irrespective of taking root of concept of light 's massless denied under the Lorentz transformations, and according to Ohki's paper [9], the duality is derived easily from Maxwell's equations.

Besides, a fundamental difference between the ECS and the MPS, which has an attribute of the self-medium independent from orthogonal coordinates in the ECS, in contrast, the MPS has a property of a relative spacetime in geometric coordinates. In consequence, the MPS will be able easily to use the speed of light derived from the ECS only when they stand on a proper criterion.

2.1 Wave function in the ECS

2.1.1 Phase function in the ECS

Phase function in the ECS different from the MPS is described in detail below.

In general, using Euler formula in regard to complex exponential function [10], [11], in one-dimensional wave function, the phase function θ is able to be described below.

$$\theta = ft\text{-}kz \quad (2.1.1\text{-}1)$$

where

- z is space variable [m], means the direction for the wave to travel on an axis, and either derivative of a point function in differentiable continuous function or a space interval as finite different value in finite difference function on the axis.
- t is time variable [s], and means either derivative of a time function in differentiable continuous function or a time interval as finite different value in finite difference function on the axis.
- f is time number per unit time in wave function in detail later, in the continuity entity with a discrete and coherent frequency and the self-medium with permittivity and permeability in free space: the so-called frequency in wave function [Nos/s]
- k: observable wave number with nonzero, wave number per unit length on a space axis for the light to travel, which has a unit of [Nos/m].

1/2 means root mean square (hereafter, abbreviated as r.m.s.), is factor equivalent to energy in the mechanical particle system

2.1.2 Time reversal symmetry in the phase function

A context that time reversal symmetry in the MPS cannot apply to the ECS is described in detail below.

As to the time reversal symmetry for the ECS, we discuss with the difference between the MPS and the ECS below. Under the conditions that each time and space interval means, respectively, an interval never to be negative, positive with non-zero, time reversal, we can discuss with mathematical operation of replacing the expression for time with its negative in the wave function expressed above so that they describe an event in which time runs backward or all the motions are reversed below. When each time t and space z is interchangeable to plus or minus, excluded phase equation (2.1.1-1), we can fall the phase function into three cases:

Case 1: only time change; $t \rightarrow -t, z \rightarrow z$:

$$\theta = -(ft + kz) \quad (2.1.2\text{-}2)$$

Under conditions that only time changes negative in phase equation as mathematical operation, so that phase equation changes $\theta = -(ft + kz)$, that is, the wave function changes wave inversion form out of phase by p rad., so that the inversion does never occur under invariant boundary condition allowed the light to travel in free space with homogeneity and isotropy. Besides, this case has no existence to violate the condition of (c) in section 2.1

Case 2: only space change $t \rightarrow t, z \rightarrow -z$:

$$\theta = kz + ft \quad (2.1.2\text{-}3)$$

This case has no existence to violate the condition of (c) in section 2.1

Case 3: both change; $t \rightarrow -t, z \rightarrow -z$:

$$\theta = kz - ft \quad (2.1.2\text{-}4)$$

Under conditions that both space and time are negative, so that in wave function, observer's eye moving with wave changes observer's eye at rest position.

Under conditions that both time and space are negative as mathematical operation, the thought experiment will allow.

In consequence, there is no existence of the time reversal symmetry in the ECS, however, the MPS will be able to have mathematical operations.

2.1.3 Wave function expressed with root mean square form in complex exponential function of Euler formula

Wave function in the MPS is different from the function in the ECS to be described due to root mean square form on the basis of energy.

Using the phase θ in phase equation (2.1.1-1), we can get wave function with r.m.s. factor of 1/2 and amplitude of Exp (j 0 π/2) below.

$$\mathrm{Exp}(4j\pi\theta)/2 \quad (2.1.3\text{-}1)$$

where

j is Exp(jπ/2)

1 denotes Exp (j 0 π/2)

1/2 means root mean square (hereafter, abbreviated as r.m.s.), is factor equivalent to energy in the MPS

Exp(ja) is a complex exponential function of Euler formula with phase a below.

Using the phase function and the Euler formula, most terms in the ECS is expressed as a wave function form in simple case of amplitude equal to Exp (j 0 π/2) below.

2.2 Two lights traveling parallel to each other out of phase by π/2 in both real and imaginary regimens

2.2.1 The speed of light in real regimen

Velocity of particle in the MPS is unattainable to the speed of light in free space only with the self-medium due to the Lorentz transformations, however, all the time, the speed is invariant. Note, however, it is well-known that Cherenkov radiation [12] is when a particle moves through a medium at a speed faster than the speed of light for that medium.

In other word, a big different point is that any particle with mass in the MPS is unattainable to the speed of light for the particle subject to the Lorentz transformations, whereas, according to Ohki's paper [13], regardless of light with massless, the paper shows a linear continuous beam mass b(m) that travels at the speed of light in free orthogonal space with homogeneity and isotropy attributes in the ECS, with no generation and annihilation.

To return to this subject in this section, and to lead to the speed of light in an imaginary regimen in after sections, breaking free the spell of light's zero mass, well-known the speed of light is specified below.

Ohki' s the paper is derived from one-dimensional Maxwell's equations on basis of exact differential equation under invariant permittivity and permeability in the space, using exact differential equation with respect to the phase equation (2.1.1-1) under invariant frequency and wave number respectively, in the ECS, we can get the speed of light described below.

$$c = dz/dt = \Delta z/\Delta t > 0 \quad (2.2.1\text{-}1)$$

where

Δ means a finite difference that each space and time interval is, respectively, a finite difference in the first divided differences [14], so that we can regard the speed of light as the ratio of the interval to time interval for each term never to be zero.

The derivative of the space interval with respect to time in the phase equation (2.2.1-1) or the positive ratio infers below.

So, this equation falls into three cases below.

(a) When either is positive, the other is positive

(b) When either is negative, the other is negative

(c) When either is positive/negative, in reverse, the other will never be negative /positive.

Furthermore, given a condition that the direction for the light to travel on an axis is on z axis with unit vector **k**, the speed of light c is on the z axis, so that space variable with vector sign for the direction for the light to travel in the phase equation (2.2.1-1) shows below.

$$dz\,\mathbf{k} = c\,\mathbf{k}\,dt \quad (2.2.1\text{-}2)$$

In consequence, we can postulate that time has a scalar function for the speed of light is a vector function with direction of unit vector **k**.

2.2.2 The speed of light in imaginary regimen

The MPS will be supposed to have no attribute of traveling independent parallel to each other in respective real and imaginary regimens with the speed of light like the ECS.

In section 2.1, we discuss with the speed of light, and this section shows the speed of light in imaginary regimen.

Given each space and time interval, respectively, multiplied by a factor of exp(jπ/2), under condition that the speed of light is invariant as the real regimen, assumed a derivative space variable with respect to time variable or a ratio of imaginary space interval to imaginary time interval, so new postulate is that there exist of an imaginary ratio equation below.

$$c = j\,dz/j\,dt = j\,\Delta z/j\,\Delta t > 0 \quad (2.2.2\text{-}1)$$

This equation above (2.2.2-1) means electromagnetic carriers can travel at the speed of light in an imaginary spacetime, and the above-mentioned discussion, so that we assume the absolute complex spacetime do never allow time reversal symmetry [15], in mathematical operation in details below.

2.2.3 No rest point in the ECS

There is rest condition for particle with mass in the MPS, whereas, there is no rest condition in the ECS.

In addition, the MPS has a rest point and interval with respect to time and space, however, the ECS has no point of time and space but independent variable intervals with respect to time and space on an axis for the light to travel under a postulate that the speed of light does never stop.

Whereas, in mechanical inertia system, there exists the particle in rest condition, however, in the ECS, there do not exist the beam in rest condition in any regimen.

3. Wave function derived from one-dimensional Maxwell's Complex equations on basis of the Noether's theorem

In one-dimensional wave equation, stretched string movable longitudinally [16] in the MPS and a linear electromagnetic wave to travel on an axis in the ECS have the same wave form with unit of velocity squared, so the string wave in the MPS interchanges the manifest energy into the potential energy in the

stretched wire as the strain energy each other to-and-fro, whereas, the electromagnetic wave in the ECS interchanges the real manifest regimen into the imaginary potential regimen each other to-and-fro in a self-complex medium.
In consequence, the MPS with velocity less than the speed of light is quite different from the ECS with the speed of light under the conditions according to conservation law with respect to the energy at any one point in time.

3.1 Rederivations from one-dimensional Maxwell's equations on the basis of exact differential equation[1]

Using examples from well-known that one-dimensional Maxwell's equations [17], under conditions that permittivity and permeability are invariant respectively, one-dimensional Maxwell's equations in the ECS is expressed below.

$$\partial D/\partial z = -\varepsilon \partial B/\partial t \quad (3.1\text{-}1)$$

$$\partial B/\partial z = -\mu \partial D/\partial t \quad (3.1\text{-}2)$$

μD defined as electric momentum density and εB defined as electric momentum density can, respectively, harnessing the self-medium jointly with invariant permeability μ and permittivity ε.
So, multiplying both right side hands in equation (3.1-1) by invariant μ, inserting ε into derivative position of left hand in equation (3.1-1), we can get equation below.

$$\partial \mu D/\partial z = -\mu \partial \varepsilon B/\partial t \quad (3.1\text{-}3)$$

So, multiplying both hands in equation (3.1-1) by invariant ε, through the same above-mentioned process,

$$\partial \varepsilon B/\partial z = -\varepsilon \partial \mu D/\partial t \quad (3.1\text{-}4)$$

Next, according to exact differential equation text [18], given the total differential of function of g (z, t) with respect to each of independent variable, z, t, we can get the function described as follows.

$$dg(z,t) = (\partial g(z,t)/\partial t)\, dt + (\partial g(z,t)/\partial z)\, dz = 0 \quad (3.1\text{-}5)$$

$$\partial(\partial g(z,t)/\partial z)/\partial t = \partial(\partial g(z,t)/\partial t)/\partial z \quad (3.1\text{-}6)$$

From the above exact differential equation (3.1-3), divided both hands in the equation by dt, arranging them, using the speed of light c defined as dz/dt, we can get equation below.

$$(\partial g(z,t)/\partial t) = -c\,(\partial g(z,t)/\partial z) \quad (3.1\text{-}7)$$

where
dz/dt defined as derivative of space z with respect to time is, respectively, common speed, that is, the speed of light c in equation (3.1-14) for the radiant octad carriers.
Substituting radiant electric momentum density defined as μD for g (z, t) and radiant magnetic momentum density defined as εB for g (z, t) respectively, we can get respective equation below.

$$(\partial \mu D/\partial z) = -(1/c)(\partial \mu D/\partial t) \quad (3.1\text{-}8)$$

$$(\partial \varepsilon B/\partial z) = -(1/c)(\partial \varepsilon B/\partial t) \quad (3.1\text{-}9)$$

Comparing respective left hands in equation (3.1-6) and (3.1-7), and respective left hands in equation (3.1-6) and (3.17), each hand equal each other, arranging them respectively, we can get equation below.

$$(\partial \mu D/\partial z) = -(1/c)(\partial \mu D/\partial t) = -Sq(1/c)\,\partial \varepsilon B/\partial t \quad (3.1\text{-}10)$$

$$(\partial \varepsilon B/\partial z) = -(1/c)(\partial \varepsilon B/\partial t) = -Sq(1/c)\,\partial \mu D/\partial t \quad (3.1\text{-}11)$$

Integral constant is able to be zero through choosing judiciously the point, we can get equations below.

$$D = \varepsilon c B \quad (3.1\text{-}12)$$

$$B = \mu c D \quad (3.1\text{-}13)$$

Multiplying respective left hands in the equation (3.1-12) and (3.1-13) and right hands, both hands equal them, we can get equation below.

$$Sq(1/c) = \varepsilon\mu \quad (3.1\text{-}14)$$

Substituting the radiant electric momentum density μD and the radiant magnetic momentum density εB for g(z, t) in the equation (3.1- 6) respectively, using the equation (3.1-3) and (3.1-4), arranging them, we can get respective one-dimensional wave equation below.

$$\partial(\partial \mu D/\partial z)/\partial z = Sq(1/c)\,\partial(\partial \mu D/\partial t)/\partial t \quad (3.1\text{-}15)$$

$$\partial(\partial \varepsilon B/\partial z)/\partial z = Sq(1/c)\,\partial(\partial \varepsilon B/\partial t)/\partial t \quad (3.1\text{-}16)$$

3.2 Maxwell's complex equations on Noether's theorem in Cartesian complex coordinate system with octad axes

3.2.1 Maxwell's complex equations

Given one function of the octad carriers as g (z, t), we can describe below.

$$\partial(\partial g(z,t)/\partial z)/\partial z = Sq(1/c)\,\partial(\partial g(z,t)/\partial t)/\partial t \quad (3.2.1\text{-}1)$$

When substituting complex jz and jt for z and t in the equation above, each equation keeps the same form through dividing both hands in each equation by imaginary operator Exp(jπ/2), Exp(jπ), respectively.
Therefore, we can define Maxwell's complex equation in an imaginary regimen, representative function g(z, t) are able to replace any one carrier, respectively, so we can be described as the same wave function in both real and imaginary regimens below.
Therefore, we can sum up each wave function in a real regimen and in an imaginary regimen respectively, so the total complex wave function g (T: z, t) is described as below.

$$g(T{:}\, z,t) = g(R{:}\, z,t) + jg(I{:}\, z,t) \quad (3.2.1\text{-}2)$$

where
g (R: z, t) denotes wave function in a real regimen

$$g(R{:}\, z,t) = A(g)\,Exp(4j\pi\theta) \quad (3.2.1\text{-}3)$$

g (I: z, t) denotes wave function in an imaginary regimen

$$g(I{:}\, z,t) = A(g)\,Exp(4j\pi\theta + j\pi/2) \quad (3.2.1\text{-}4)$$

Furthermore, using equation (3.2.1-4) above, we can get total complex wave function g (T: z, t) below.

$$g(T{:}\, z,t) = g(R{:}\, z,t) + j\,g(I{:}\, z,t) = g(R{:}\, z,t)(1 + Exp(j\pi)) = 0 \quad (3.2.1\text{-}5)$$

From the equation above, total complex wave function g (T: z, t) is zero at any point in time and at any time in point, so we can get equation below.

$$g(R: z, t) = g(I: z, t)\,Exp(-j\pi/2) \quad (3.2.1\text{-}6)$$

3.2.2 Conservation law in the ECS

The equation (3.2.1-5) implies that all of terms are preserved at any one given point in time and at any time in point, coming and go to the real regimen and the imaginary regimen, in short word, those terms have complex regimen.

In consequence, we are able to be postulated that complete conservation law for those terms come into effect in the ECS, comparable to the conservation law in the MPS.

3.2.3 Noether's theorem

Reviewing equation (3.2.1-6), we can know that any carrier function in the real regimen is equivalent to any carrier function in the imaginary regimen under conditions of rotating angle of Exp(- jπ/2), respectively, their relationships are symmetric each other, so we will be able to see fitting the Maxwell's complex equations into Noether's theorem.

Therefore, we can postulate that the ECS has an inherent complex coordinate with orthogonal octad axes: both real axes with space three dimensions and time which coexists alongside imaginary axes with the same dimensions.

In consequence, the ECS is essentially different from the MPS.

In addition, through the equation above, given space and time defined as complex term like the four quadrants of a Cartesian coordinate system [19] with totally real and imaginary regimens, so that there exists of one-dimensional real system with the four quadrants in real regimen parallel to one-dimensional imaginary system with the four quadrants in imaginary regimen. To simplify, when we focus only directional axes for the light to travel in real and imaginary regimens, the double two quadrants constitute of time axis, imaginary time axis out of phase by π/2 on a circle rotating in anticlockwise of time, space axis and imaginary space axis out of phase by π/2 on a circle rotating in anticlockwise of space, each time and space is independent variable each other.

Moreover, the absolute spacetime [20] proposed by Newton is applied absolutely to the MPS, however, the Newtonian's spacetime is quite different from the absolute spacetime in the ECS, which the absolute complex spacetime with each real and imaginary regimen have a respective attribute of the speed of light parallel to each other. For the speed of light in both regimens is positive in the phase equation (2.2.1-1) and (2.2.2-1), besides, the speed of light in real regimen is equivalent to the speed of light in imaginary under condition rotating out of phase by jπ/2, so they are symmetric to each other.

3.2.4 Cartesian complex coordinate system

In consequence, in the ECS, Cartesian complex coordinate system has eight dimensions: a time dimension, a time imaginary dimension, three spatial dimensions, and three spatial imaginary dimensions.

Furthermore, we will be able to define complex Maxwell's equations on Noether's theorem on Cartesian complex coordinate system.

In consequence, under an orthogonal respective relationship between complex time axes and complex space axes in absolute complex spacetime with attributes of homogeneity, isotropy, linearity, differential continuity and electromagnetic invariant product of permittivity and permeability, we can use the Maxwell's complex equation on the Noether's theorem.

3.3. Octad carriers

3.3.1 Wave functions for octad density carriers

It is well-known that electromagnetic energy density ρ(w) is described below.

$$\rho(w) = 0.5(Sq(D)/\varepsilon + Sq(B)/\mu)\ [J/Cub(m)] \quad (3.3.1\text{-}1)$$

where to simplify, suffix naught is left out as:

ε is invariant permittivity in free space

μ is invariant permeability in free space

product of ε and μ is defined as Sq(1/c)

c is the speed of light

D: electric flux density

B: magnetic flux density

Sq (): squared function

Cub (); cubed function

m: meter

Besides, the energy density expressed with wave function form is described below.

$$\partial(\partial\rho(w)/\partial z)/\partial z = \varepsilon\mu\partial(\rho(w)/\partial t)/\partial t \quad (3.3.1\text{-}2)$$

Multiplying the both hands in the equation above by εμ, under conditions that εμ is invariant, we can insert εμ into both hands in the partial differential equation, so the wave equation is below.

$$\partial(\partial\varepsilon\mu\rho(w)/\partial z)/\partial z = \varepsilon\mu\partial(\varepsilon\mu\rho(w)/\partial t)/\partial t \quad (3.3.1\text{-}3)$$

So that, ρ(m) is defined as εμρ(E), we can get equation below.

$$\rho(m) = \varepsilon\mu\rho(w)[kg/Cub(m)] \quad (3.3.1\text{-}4)$$

This ρ(m) means electromagnetic mass density.

$$\partial(\partial(\rho(m)/\partial t)/\partial t = Sq(c)\partial(\partial\rho(m)/\partial z)/\partial z \quad (3.3.1\text{-}5)$$

Multiplying the equation above by the speed of light c invariant, electromagnetic momentum is defined as below.

$$\rho(p) = c\rho(m)\ [kgm/s/Cub(m)] \quad (3.3.1\text{-}6)$$

Besides, inserting ρ(p) into the wave function, arranging them, we ca get equations below.

$$\partial(\partial(c\rho(m)/\partial t)/\partial t = Sq(c)\partial(\partial c\rho(m)/\partial z)/\partial z \quad (3.3.1\text{-}7)$$

$$\partial(\partial(\rho(p)/\partial t)/\partial t = Sq(c)\partial(\partial\rho(p)/\partial z)/\partial z \quad (3.3.1\text{-}8)$$

In consequence, using relationships: the indeterminacy and the energy, or, the momentum, $\rho(h)=\delta t\rho(w)$, or $\rho(h)=c\rho(m)\delta z$, force and invariant discrete and coherent frequency times momentum $f\rho(p)=\rho(N)$, force times the speed of light and power $\rho(P)=c\rho(N)$, so we can get each octad carrier defined in electromagnetic wave function form below.

(1) electric momentum carrier: $\partial(\partial(\rho(\varepsilon D)/\partial t)/\partial t$

$$=Sq(c)\partial(\partial\rho(\varepsilon D)/\partial z)/\partial z \quad (3.3.1\text{-}9)$$

(2) magnetic momentum carrier: $\partial(\partial(\rho(\mu B)/\partial t)/\partial t$

$$=Sq(c)\partial(\partial\rho(\mu B)/\partial z)/\partial z \quad (3.3.1\text{-}10)$$

(3) momentum carrier: $\partial(\partial(\rho(p)/\partial t)/\partial t$

$$=Sq(c)\partial(\partial\rho(p)/\partial z)/\partial z \quad (3.3.1\text{-}11)$$

(4) mass carrier: $\partial(\partial(\rho(m)/\partial t)/\partial t$

$$=Sq(c)\partial(\partial\rho(m)/\partial z)/\partial z \quad (3.3.1\text{-}12)$$

(5) energy carrier: $\partial(\partial(\rho(w)/\partial t)/\partial t$

$$=Sq(c)\partial(\partial\rho(E)/\partial z)/\partial z \quad (3.3.1\text{-}13)$$

(6) force carrier: $\partial(\partial(\rho(N)/\partial t)/\partial t$

$$=Sq(c)\partial(\partial\rho(N)/\partial z)/\partial z \quad (3.3.1\text{-}14)$$

(7) power carrier: $\partial(\partial(\rho(P)/\partial t)/\partial t$

$$=Sq(c)\partial(\partial\rho(P)/\partial z)/\partial z \quad (3.3.1\text{-}15)$$

(8) indeterminacy carrier: $\partial(\partial(\rho(h)/\partial t)/\partial t$

$$=Sq(c)\partial(\partial\rho(h)/\partial z)/\partial z \quad (3.3.1\text{-}16)$$

3.3.2 Wave functions for octad carriers

3.3.2.1 Wave function form

According to wave function from equation (3.3.1-9) to equation (3.3.1-16), the electromagnetic energy density $\rho(E)$, momentum $\rho(p)$ and mass $\rho(m)$ are, respectively, included electric flux density squared and magnetic flux density squared, able to be described with 4π factor in the phase on the r.m.s. base as follows.

$$\rho(p)=A(p)\,Exp(j4\pi\theta)/2 \quad (3.3.2.1\text{-}1)$$

$$\rho(m)=A(m)\,Exp(j4\pi\theta)/2 \quad (3.3.2.1\text{-}2)$$

$$\rho(w)=A(w)\,Exp(j4\pi\theta)/2 \quad (3.3.2.1\text{-}3)$$

where

A(w): Amplitude in electromagnetic energy density wave [J/Cub(m)]

A(p): Amplitude in electromagnetic momentum density wave [kgm/s/Cub(m)]

A(m): Amplitude in electromagnetic mass density wave [kg /Cub(m)]

j is $Exp(j\pi/2)$

θ: electromagnetic wave phase reintroduced equation (2.1.1-1)

$$\theta=ft-kz \quad (3.3.2.1\text{-}4)$$

z is space variable [m], means the direction for the wave to travel on an axis, and either derivative of a point function in differentiable continuous function or a space interval as finite different value in finite difference function on the axis, which is positive with non-zero.

t is time variable [s], and means either derivative of a time function in differentiable continuous function or a time interval as finite different value in finite difference function on the axis, which is positive with non-zero.

f is time number per unit time in wave function in detail later: the so-called frequency in wave function [Nos/s]

Furthermore, inserting equation (3.3.2.1-1), equation (3.3.2.1-2), equation (3.3.2.1-3) into equation (3.3.1-11), equation (3.3.1-12), equation (3.3.1-13) respectively, arranging them, we get common equation below.

$$Sq(f)=Sq(c)Sq(k) \quad (3.3.2.1\text{-}5)$$

Under conditions that the speed of light is positive and the others are, respectively, positive, so we can get equation below.

$$f=ck \quad (3.3.2.1\text{-}6)$$

Given the entity with self-medium and a discrete and coherent frequency f, we can know that if frequency f is invariant, so when the speed of light varies, wave number k must change.

We can postulate that a discrete and coherent frequency f or product of wave number and the speed of light is invariant under the entity with the frequency is invariant below.

$$df=0 \quad (3.3.2.1\text{-}7)$$

If c varies, wave number k must vary for the discrete and coherent frequency conserves in a continuous self-medium as below.

$$d(kc)=cdk=0 \quad (3.3.2.1\text{-}8)$$

Furthermore, under the discrete and coherent frequency f, we can postulate that equation (3.3.2.1-6) is described in the finite difference form [21],

$$\Delta f=c\Delta k \quad (3.3.2.1\text{-}9)$$

3.3.2.2 A momentum carrier

According to Ohki's paper, relationship between electric flux density and magnetic flux density is described as vector firm and scalar form

$$D\mathbf{i}=B\mathbf{j}\times\varepsilon c\mathbf{k} \quad (3.3.2.2\text{-}1)$$

$$B\mathbf{j}=\mu c\mathbf{k}\times D\mathbf{i} \quad (3.3.2.2\text{-}2)$$

$$D=\varepsilon cB \quad (3.3.2.2\text{-}3)$$

$$B=\mu cD \quad (3.3.2.2\text{-}4)$$

Multiplying both hands in equation (3.3.2.2-3) and equation (3.3.2.2-4), dividing them by DB, we can get equation below.

$$\mu\varepsilon\,Sq(c)=1 \quad (3.3.2.2\text{-}5)$$

$$\mu\varepsilon=Sq(1/c) \quad (3.3.2.2\text{-}6)$$

In addition, electromagnetic volumetric momentum density $\rho(p)$ in the ECS is defined as follows.

$$\rho(p)\mathbf{k}=D\mathbf{i}\times B\mathbf{j}=DB\mathbf{k} \quad (3.3.2.2\text{-}7)$$

$$\rho(p)=DB\ [kgm/s/Cub(m)=Ns/Cub(m)] \quad (3.3.2.2\text{-}8)$$

where

$\rho(p)$ is a scalar of momentum density in the ECS

D is radiant electric flux density on an axis of x with **i** unit vector.

B is radiant magnetic flux density on an axis of y with **j** unit vector.
k is unit vector on an axis of z for radiant momentum density.
× means vector product.
Electromagnetic momentum string density in the ECS is defined as below.
The derivative of string flux s(p) with respect to z is defined below.

$$ds(p)/dz = \rho(p) \quad (3.3.2.2\text{-}9)$$

Integrating antiderivative of ρ(p) with respect to variable space z,
∫ρ(p) dz (from zero to Δz)

$$= \int ds(p) \text{ (from zero to } \Delta z) = s(p)\,\Delta z \quad (3.3.2.210)$$

ΔA is cross-section area element product of an infinitesimal length dx on an axis of x and an infinitesimal length dy on an axis of dy,

$$\Delta A = \Delta x \Delta y \quad (3.3.2.2\text{-}11)$$

The derivative of b(p) with respect to variable area element A product of infinitesimal variable dx and dy is defined below.

$$db(p)/dA = s(p) \quad (3.3.2.2\text{-}12)$$

Integrating antiderivative of s(p) with respect to variable space infinitescimal area A=dxdy,
∫s(p) dA (from zero to ΔA=ΔxΔy)

$$= \int db(p) \text{ (from zero to } \Delta A) = b(p)\,\Delta x \Delta y \quad (3.3.2.2\text{-}13)$$

Furthermore, given double integrating ρ(p) with respect to variable z and variable cross-section area A, we can get equation defined as electromagnetic beam indeterminacy b(h) defined as below.

$$b(h) = \iiint \rho(p)\, dA\, dz\, dz/(\Delta x \Delta y \Delta z)$$

$$= b(p)\,\Delta z \text{ [Js]} \quad (3.3.2.2\text{-}14)$$

Using Δz = cΔt in equation (2.2.1-1), the beam indeterminacy b(h) is below.

$$b(h) = c\, b(p)\, \Delta t \quad (3.3.2.2\text{-}15)$$

This equation (3.3.2.2-14) and (3.3.2.2-15) mean the indeterminacy principle in the ECS like the uncertainty principle in the MPS.

3.3.3 Octad carriers

The same process above, we can get the other carriers below.
For the speed of light is invariant, using electromagnetic octad carriers defined below, respectively.
Beam energy defined as below.

$$b(w) = \Delta f\, b(h) = c\Delta k\, b(h) = cb(p) = Sq(c)b(m) \text{ [J]} \quad (3.3.3\text{-}1)$$

Beam momentum defined as below.

$$b(p) = cb(m) = kb(h) \text{ [kgm/s]} \quad (3.3.3\text{-}2)$$

Beam mass defined as below.

$$b(m) \text{ [kg]} \quad (3.3.3\text{-}3)$$

Under conditions of invariant frequency f and invariant wave number k in equation (3.3.2.1-9), we can get equation of beam force through k times b(w) and f times b(p), respectively, so beam force is defined below.
Beam force defined as below.

$$b(N) = k\, b(w) = f\, b(p) \text{ [kgm/Sq(s)]} \quad (3.3.3\text{-}4)$$

Using the above equation (3.3.3-4) multiplying the speed of light c, we can get equation of power below.
Beam power defined as below.

$$b(P) = cb(N) = ckb(w) \text{ [Nm/s]} \quad (3.3.3\text{-}5)$$

Beam indeterminacy b(h) in equation (3.3.2.2-14) and (3.3.2.2-15) is expressed below.

$$b(h) = \Delta z\, b(p) = \Delta t\, b(w) \text{ [Js]} \quad (3.3.3\text{-}6)$$

where
Δz is indeterminate space interval in finite difference.
Δt is indeterminate time interval in finite difference.
Δ means difference sign in finite difference
Beam electric momentum defined as below.

$$b(\varepsilon B) \text{ [kgm/s]} \quad (3.3.3\text{-}7)$$

Beam magnetic momentum defined as below.

$$b(\mu D) \text{ [kgm/s]} \quad (3.3.3\text{-}8)$$

Moreover, we know that electric flux density is described as wave function form in electromagnetic text [22].

$$\partial(\partial(D/\partial t)/\partial t = Sq(c)\partial(\partial D/\partial z)/\partial z \text{ [As/Cub(m)]} \quad (3.3.3\text{-}9)$$

Multiplying the equation above by invariant μ, we can get equation below.

$$\partial(\partial(\mu D/\partial t))/\partial t = Sq(c)\partial(\partial\mu D/\partial z)/\partial z \text{ [J]} \quad (3.3.3\text{-}10)$$

So, we know that magnetic flux density is described as wave function form in electromagnetic text [23].

$$\partial(\partial(B/\partial t)/\partial t = Sq(c)\partial(\partial B/\partial z)/\partial z \text{ [Vs/Cub(m)]} \quad (3.3.3\text{-}11)$$

Multiplying the equation above by invariant ε, we can get equation below.

$$\partial(\partial(\varepsilon B)/\partial t)/\partial t = Sq(c)\partial(\partial b(w)/\partial z)/\partial z \text{ [J]} \quad (3.3.3\text{-}12)$$

In consequence, we can get each electromagnetic wave function with respect to all of the octad carriers below.
(1) electric beam momentum

$$\partial(\partial(\mu D/\partial t)/\partial t = Sq(c)\partial(\partial\mu D/\partial z)/\partial z \text{ [kgm/s]} \quad (3.3.3\text{-}\mu D)$$

And the electric momentum carrier is expressed as wave form below.

$$b(\mu D) = A(\mu D)\, Exp(2\pi j\theta)/2 \quad (3.3.3\text{-}\mu D\text{-}2)$$

where A(μD) denotes amplitude of b(μD) wave function.
(2) magnetic beam momentum

$$\partial(\partial(\varepsilon B/\partial t)/\partial t = Sq(c)\partial(\partial\varepsilon B/\partial z)/\partial z \text{ [kgm/s]} \quad (3.3.3\text{-}\varepsilon B)$$

And the magnetic momentum carrier is expressed as wave form below.

$$b(\varepsilon B) = A(\varepsilon B)\, Exp(2\pi j\theta)/2 \quad (3.3.3\text{-}\varepsilon B\text{-}2)$$

where A(εB) denotes amplitude of b(εB) wave function.
(3) electromagnetic beam energy

$$\partial(\partial(b(w)/\partial t)/\partial t = Sq(c)\partial(\partial b(w)/\partial z)/\partial z \text{ [J]} \quad (3.3.3\text{-}w)$$

$$b(w) = A(w)Exp(2\pi j\theta)/2 \quad (3.3.3\text{-}w\text{-}2)$$

where A(w) denotes amplitude of b(w) wave function.

(4) electromagnetic beam momentum

$$\partial(\partial(b(p)/\partial t)/\partial t = Sq(c)\partial(\partial b(p)/\partial z)/\partial z \text{ [kgm/s]} \quad (3.3.3\text{-p})$$

$$b(p) = A(p)Exp(4\pi j\theta)/2 \quad (3.3.3\text{-p-2})$$

where A(p) denotes amplitude of b(p) wave function.

(5) electromagnetic beam mass

$$\partial(\partial(b(m)/\partial t)/\partial t = Sq(c)\partial(\partial b(m)/\partial z)/\partial z \text{[kg]} \quad (3.3.3\text{-m})$$

$$b(m) = A(p)Exp(4\pi j\theta)/2 \quad (3.3.3\text{-m-2})$$

where A(m) denotes amplitude of b(m) wave function.

(6) electromagnetic beam power

$$\partial(\partial(b(P)/\partial t)/\partial t = Sq(c)\partial(\partial b(P)/\partial z)/\partial z\text{[Nm/s]} \quad (3.3.3\text{-P})$$

$$b(P) = A(P)Exp(4\pi j\theta)/2 \quad (3.3.3\text{-P-2})$$

where A(P) denotes amplitude of b(P) wave function.

(7) electromagnetic beam force

$$\partial(\partial(b(N)/\partial t)/\partial t = Sq(c)\partial(\partial b(N)/\partial z)/\partial z \text{ [N]} \quad (3.3.3\text{-N})$$

$$b(N) = A(N)Exp(4\pi j\theta)/2 \quad (3.3.3\text{-N-2})$$

where A(N) denotes amplitude of b(N) wave function.

(8) electromagnetic beam indeterminacy

$$\partial(\partial(b(h)/\partial t)/\partial t = Sq(c)\partial(\partial b(h)/\partial z)/\partial z \text{ [Js]} \quad (3.3.3\text{-h})$$

$$b(h) = A(h)Exp(4\pi j\theta)/2 \quad (3.3.3\text{-h-2})$$

where A(h) denotes amplitude of b(h) wave function.

b(h) is the indeterminacy carrier, using equation (3.3.3-h-2), (3.3.3-6) and (3.3.2.2-15), per A(h), so we can describe each wave form function with the amplitude's three types:

Indeterminate amplitude on the basis of energy beam,

$$A(h) = A(h\text{-}w)\,\Delta t \quad (3.3.3\text{-h-2-1})$$

Indeterminate amplitude on the basis of momentum beam,

$$A(h) = A(p)\,c\,\Delta z \quad (3.3.3\text{-h-2-2})$$

Indeterminate amplitude on the basis of mass beam,

$$A(h) = A(m)\,Sq(c)\,\Delta z \quad (3.3.3\text{-h-2-3})$$

The above-mentioned amplitudes will be, respectively, called probability amplitude, that is, special indeterminate amplitude different from the definite amplitude in the other electromagnetic wave functions, respectively.

Besides, given the well-known normal probability distribution as observation time interval, from the equation of A(h) = A(h-w)Δt (3.3.3-h-2-1), that is, regarded duration of observable time interval Δt as normal probability distribution as the observed probabilistic effect, we can get energy beam distribution below. The general form of energy beam continuous probability density function [24] is below.

$$\rho(\Delta t) = (1/(\sigma\, Sqrt(2\pi)))\, Exp(-Sq((x-u)/\sigma)/2) \quad (3.3.3\text{-}13)$$

where, ρ(Δt) denotes energy beam continuous probability density function, the parameter u is the mean or expectation of the distribution (and also its median and mode); and σ is its standard deviation and the variance of the distribution is Sq(σ).

All of octad carriers can travel concurrently at the speed of light in the continuity entity with self-beam-media played as the localized beam in free space like a flow of bullet discharged continuously.

Besides, the self-beam-medium constitutes of permittivity and permeability in the continuity entity with a discrete and coherent frequency, so there is absolute need of both electric flux density and magnetic flux density as fundamental term in the ECS.

4. Conclusions

Conclusions fall into three parts:

(A) Indispensable postulates

(B) Equations derived from Maxwell's equations on Noether's theorem

(C) Each interpretation for those equations

If one of the above-mentioned postulates breaks, the postulate will need to be remedied and equations concerning the postulates will need change, so derivative of the postulate draw a wrong conclusion.

However, I hope that some conclusions carry through under boiling reviews to free from the great spells.

(A) Indispensable postulates

(a-1) There coexists of absolute orthogonal real coordinates and imaginary coordinates in free complex spacetime only in the ECS

(a-2) In the complex spacetime, there exist of one-dimensional Maxwell's complex equation applicable to the Noether's theorem

(a-3) There exists of an independent space from geometric coordinates in the MPS, with a complex self-media in a linear continuity entity with a discrete and coherent frequency and with invariant permeability and permeability applicable to both the real and the imaginary regimen.

(B) Assumptions derived from the above-mentioned postulates

(b-1) Self-media allowed self-complex field in the continuity entity

In wave function form, all of radiant octad carriers with each discrete and coherent frequency can travel concurrently at the speed of light in a free orthogonal space, using the self-media allowed self-field in the continuity entity with permittivity and permeability terms.

(b-2) Mechanical substructure of the light

In thought experiments, if given divisible infinitescimal light element under conditions that characteristics of the light do never lose at all even when sliced up the continuity entity on an axis, if the element allows a bean mass element with its center to be treated as a mass element sliced ultimately up the entity of the light, we will be able to define the beam mass element with length and gauge, however, when we observe the beam mass, the length and the gauge will disappear and we can get only value of energy, so we can get the beam mass divided the beam energy by Sq(c), the beam momentum divided the beam energy by c, the force multiplying the beam energy by the discrete and coherent frequency, etc.

In consequence, we will be supposed the substructure of the light less value so that the substructure depends on the interaction to observe it.

(b-3) Longitudinal and transverse wave duality

The self-medium plays a role of making every carrier smaller electromagnetically for multiplying either the invariant permeability μ or permittivity ε, so they are in almost undetected under weak detection sensitivity for every carrier's substructure neutralized electromagnetically in later sequel detailed.

Some relevant precedents for longitudinal and transverse wave duality have already been made public [25], [26], [27], [28], however, every one of them never discussed with the self-medium able to travel at the speed of light.

Besides, in spite of the less value, from equation (3.3.2.2-9) to equation (3.3.2.2-15) and from equation (3.3.3-1) to equation (3.3.3-12), we are able to suppose the substructure of the light has an infinitescimal bead element, an string connected lots of beads and a group beam bundled lots of the strings. Given the substructure and regarding particle as the bead element on self-medium, through an analogy to mechanical longitudinal wave mechanism [29] with moving particle with mass in-lined in a string stretched, we able to postulate that electromagnetic wave is the longitudinal wave more than the well-known transverse wave [30]. The group of the light holds together by the self-internal-directional-force between beads, which is fastened bead element by self-longitudinal-back-forth-force as action through the self-medium.

So that in free space, radiant octad carriers in electromagnetic wave form can travel concurrently at the speed of light via the self-medium.

Moreover, our observation of the electromagnetic wave will be assumed to cause electromagnetically due to continuous distortions generated inside the continuity neutralized electromagnetically in making progressive process in the longitudinal wave.

In consequence, we will be able to observe both the waves. However, it is exceedingly difficult for us to observe its wave so that we have to observe the longitudinal momentum. So that, we have come to believe only the transverse wave to easily observe it. On the other hand, external media field provide us an easy opportunity to observe the characteristics.

(b-4) The indeterminacy principle and respective observation value in the octad

Reviewing both equation (3.3.3-5) and equation (3.3.3-6), the light has the beam indeterminacy with size interval or time interval, we can it natural that, when observing the continuity entity, the indeterminacy disappears, after we can observe one value in octad carriers, we can calculate each value through multiplying frequency, the speed of light or the squared.

(b-5) Relationship between beam mass and beam energy, relationship between beam energy and beam indeterminacy

The Planck-Einstein-Schrodinger formula [31] is equivalent to equation (3.3.3-1) on the basis of energy below

Nb(w) = NΔf b(h) = NcΔk b(h) = Ncb(p) = NSq(c)b(m) (4-1)

where N denotes product of number of beam bunched lots of beaded strings with a discrete and coherent frequency and number of grouping lots of the frequencies distributed over the entire region.

This equation stands only on the ECS side, shows an equivalent equation between the beam energy and the beam mass.

Therefore, Albert Einstein's famous formula [32] is electromagnetic energy equal to mass times the speed of light squared, so this equation will be able to apply only to ECS for all of terms in E = b(m)Sq(c) equation belong to the MCS.

(b-6) Observable duration

Given the energy beam continuous probability density function as observable duration, this probability density function will be called as a piece of Quantum Physics [33] different from classical electromagnetic theory in this paper.

(C) Interpretations

(c-1) An absolute spacetime applied only in ECS contradistinguished from theory of relativity in MPS

If anyone deals with the speed of light as the highest priority in solving relative motions for objects, most of the people will need to the theory of relativity. However, if we believe that there exist of an absolute spacetime, we will not need the theory of relativity for point of viewing via observer's eyes on board traveling at the speed of light.

In this paper, we know the chicken-or-the-egg problem, this paper builds it on a foundation that there exists of the self-medium space with attribute of invariant permittivity and permeability in free orthogonal space independent from a geometric coordinates as the highest priority, on the other hand, most people believe that there exists of the speed of light as the highest priority and need to the theory of relativity in the geometric coordinates.

(c-2) Reduction proportional to distance for all the octad carriers

In case of beam energy b(w), substituting b(w) for g (z, t) in the equation (3-5),

$$(\partial b(w)/\partial t) = -c(\partial b(w)/\partial z) \quad \text{(c-2-1)}$$

So, we can get equation defined as beam mass.

$$b(m) = Sq(1/c)(\partial b(w)/\partial t) = -(1/c)(\partial b(w)/\partial z) \quad \text{(c-2-2)}$$

The equation above implies that the farther, the less beam energy per unit length and the less beam mass per unit length, all carriers reduces being proportional to distance.

(c-3) Energy beam continuous probability density function and the Copenhagen interpretation [34]

Equation (3.3.3-13) will lead to a solution of the Copenhagen interpretation, which physical systems generally do not have definite properties prior to being measured, and this equation (3.3.3-13) will be able to only predict the probability distribution of a given measurement's possible results for a time of observation has some distribution as a necessary consequence like God's dice [35].

In short word, using $\Delta z = c\Delta t$ in equation (2.2.1-1) and observation time Δt in equation (3.3.3-13), we can get equation with respect to slice thickness Δz when cutting up the continuity entity of the light in an observation time interval under the speed of light invariant c.

$$\rho(\Delta z) = c\rho(\Delta t) = (c/(\sigma \,\mathrm{Sqrt}(2\pi)))\,\mathrm{Exp}(-\mathrm{Sq}((x-u)/\sigma)/2) \quad \text{(c-2-3)}$$

where

$\rho(\Delta z)$ denotes the energy beam continuous probability density function with respect to space interval variable Δz on an axis of direction for the light to travel below.

$$\rho(\Delta z) = c\rho(\Delta t) \quad \text{(c-2-4)}$$

Equation (c-2-3) and (3.3.3-13) will represent to quantum physics [36].

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