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 [3]

IV. Characteristics in an electromagnetic corpuscular system different from a mechanical particle system
IV. I. Two lights traveling parallel to each other out of phase by p/2 in both real and imaginary frames
IV. II. Maladaptation to time reversal symmetry
IV. III. One-dimensional complex Maxwell's complex equations on Noether's theorem
IV. IV. Radiant octad radiant carriers of mass, momentum, energy, force, power, and electromagnetic constant with unite of Js
IV. V. The conservation law for the radiant octad carriers at any one given point in time like mechanical total energy system
IV. VI. The carriers via action through the beam's self-medium in free orthogonal space only with the self-medium
IV. VII. The indeterminacy principle with space interval, volume element and time interval made disappearance in observing
V. Light's substructures to carry the radiant octad carriers
VI. Self-medium constituted by the beam continuity with permittivity and permeability in free space
VII. Longitudinal and transverse wave duality
(to be continued to the third of sequels)

Abstract

This second paper of sequels submitted by Ohki, proposes solutions to free most people from well-known spells: massless of light for violation the Lorentz transformations, regarding it impossible to travel in free space with no media, unable to derive the so-called longitudinal wave from Maxwell's equation. The others are 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).

These solutions: (1) inherent derivations from one-dimensional Maxwell's complex equations on the basis of Noether's theorem, (2) the derivations: light's attitude of radiant octuplet carriers of mass, momentum, energy, force, power, and electromagnetic constant described as the wave form with mass. Besides, (3) a postulate that well-organized longitudinal and transverse wave duality help the radiant octuplet carriers travel on an axis in free vacuum space only with the self-medium, (4) electromagnetic constant derived from

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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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<Preprint> (P-1) https://fs23.formsite.com/viXra/form2/index.html

<Draft preprint>

(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.

Footnotes: A particular way to avoid Greek alphabet; epsilon: q, delta: Δ, theta: a, pi: p only in phase, rho: r, phi: F, mu: u, epsilon times mu: Sq(1/c), the others: c: the speed of light, mass: m, momentum: p, energy: w, power: P, force: N, h: term with unit of Newton times second.

a momentum linear density and the indeterminacy principle of the radiant octuplet carriers respectively with space observable interval or time observable interval disappeared only in observing. (5) maladaptation to apply the well-known time reversal symmetry to the ECS. Furthermore, (6) given self-medium contained permittivity and permeability duality in fee space as the carrier, it 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 of continuous entity of light, we can observe electromagnetic waves which electromagnetic distortion due to the movement generates. Moreover, the self-medium helps both electromagnetic longitudinal and transverse waves able to travel in vacuum space.

The above-mentioned context is derived theoretically from one-dimensional Maxwell's equations on the basis of exact differential equation in free orthogonal space only with the self-medium under conditions postulated that the space has an attribute electromagnetic invariant product of permittivity and permeability, so the electromagnetic wave in the ECS interchanges the real manifest frame into the imaginary potential frame each other to-and-fro. Therefore, (8) there exists of complex conservation laws able to apply respectively to the radiant octuplet 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 frame like the potential energy in the MPS, (9) a fundamental difference between the ECS and the EPS is that the ECS has an attribute of absolute spacetime, absolute frame and EPS has a property of a relative spacetime, in consequence, the EPS is unable to use the speed of light derived from the ECS, (10) In the indeterminacy principle with indeterminate volumetric factor, either time or length in the ECS is different from the uncertainty principle with the determinate factor of either time or length in the EPS, in either case, all of respective indeterminate factor disappear in observing, (11) Einstein energy equation, that is, b(E) = Sq(c)b(m) equation stands only on the ECS side.

Keyword: Maxwell's complex equations, Noether's theorem, time reversal symmetry, the indeterminacy principle, radiant octuplet carriers, longitudinal and transverse wave duality, light's substructure, self-medium

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

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

(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

In case not to leading to misunderstand, 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 q and permeability u have no suffix zero 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) For the same reason, radiant electric flux density D = D(x): ∂(∂D/∂z)/∂t means the second partial derivative of D with respect to independent variable x, z in space and t in time, second partial D by second partial z.

(g) For the same reason, radiant magnetic flux density B=B(y): ∂(∂B/∂z)/∂z means the second partial derivative of B with respect to independent variable y, z in space and t in time, second partial B by second partial z.

(h) 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.

(i) All wave form stands for root mean square (afterward, if need, uses r.m.s) for getting mechanical energy

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equivalent to electromagnetic energy on common criterion, so electromagnetic corpuscular system keeps equivalent to the MPS on the basis of energy.

(j) 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].

(k) Electromagnetic constant product of electric charge and magnetic charge, which has a unit product of Joule and second, [Js].

(l) Radiant octuplet carriers: (1) mass, (2) momentum, (3) energy, (4) force, (5) power, (6) electromagnetic constant, (7) radiant electric flux density, (8) radiant magnetic flux density, which are, respectively, able to travel concurrently at the speed of light invariable in free orthogonal space with the self-medium.

(m) Δt: observable time with nonzero, time interval on a time axis for light to travel, Δz: observable length with nonzero, space interval on a space axis for light to travel, which has a unit [s].

(n) Δf: observable frequency with nonzero for reciprocal time with nonzero, time number per unit time on a time axis for light to travel, which has a unit [Nos/s], Δk: observable wave number with nonzero, wave number per unit length on a space axis for light to travel, which has a unit [Nos/m].

(o) Electromagnetic invariant is one product of permittivity and permeability, which has a unit divided the second squared by the meter squared. [Sq(s/m)].

(p) Self-medium contained permittivity and permeability duality in fee space as the carrier

(q) Longitudinal and traverse wave duality:

Self-medium help 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 of continuous entity of light, we can observe electromagnetic waves made electromagnetic distortion generated due to compressing and expanding the movement, however, our observation of the longitudinal wave is very difficult to observe the longitudinal momentum. However, the self-medium can help both electromagnetic longitudinal and transverse waves able to travel in vacuum space with no media.

<Abbreviations>

(z) ECS: Electromagnetic corpuscular System

(y) MPS: Mechanical particle system

1. Introduction

This paper proposes solutions freed most people from well-known spells: massless of light for violation the Lorentz transformations [2], impossibility to travel in free space with no media, never derivation longitudinal wave from Maxwell's equation, maladaptation for the conservation law at any given point in time and any time in every point for electromagnetic wave function like mechanical system with total energy summed kinetic plus potential energy.

Those spells will be freed from when most of peoples reach acceptance on the new thoughts and concepts at the times:

(a) When self-media concept takes root under Michelson-Morley experiments denied existence of media in space.

(b) When going through a renaissance of longitudinal wave denied due to take root of the concept of transverse wave to prevail through Maxwell's equations.

(c) When light with mass come to increase the stakes, irrespective of taking root of concept of light with massless which has been superseded due to violate the Lorentz transformations.

(d) When, in observing a continuity entity, we know it be natural that attribute of the indeterminate length or time disappears.

To return to this paper's subject, according to the paper [3] submitted by Ohki Yasutsugu, many derivations is showed theoretically from Maxwell's equations [4] 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 light's generation from any source and annihilation into the sink.

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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

The so-called MPS seems to be comprehensible to the ECS [3] on the surface, however, there is primordial difference between the ECS and the MPS, the difference details below.

In the MPS, we know that wave is quite different from particle with mass [5], so it is well-known they are different concept unacceptable each other.

However, in the ECS, most peoples have discussed with wave-particle duality [6] 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 [3], the duality is derived easily from Maxwell's equations.

The MPS never allows the duality to be acceptable, on the other hand, this paper will help the ECS take acceptable positions in future.

Besides, a fundamental difference between the ECS and the EPS is that ECS has an attribute of absolute spacetime, absolute frame and EPS has a property of a relative spacetime, in consequence, the EPS is unable to use the speed of light derived from the ECS.

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 [7, 8], in one-dimensional wave function, the phase function is able to be described below.

a = ft -kz (2-1)

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, 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]:

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), we can fall the phase function into three cases:

Case 1: only time change; t → - t, z → z: a = - (ft +kz) (2-2)

Under conditions that only time changes negative in phase equation as mathematical operation, so that phase equation changes a = - (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 → t, z → - z: a = kz + ft (2-3)

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

Case 3: both change; t → - t, z → - z: a = kz – ft (2-4)

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, but THE MPS will be able to have mathematical operations.

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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 a in phase equation (2-1), we can get wave function with rms factor of 1/2 and amplitude of Exp(j 0 p/2) below.

Exp(4pja)/2 (2-5)

where

j is Exp(jp/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 p/2) below.

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

2.2.1 The speed of light in real frame

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 [9] is when a particle moves through a medium at a speed faster than 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 [10], 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 frame in after sections, breaking free the spell of light's zero mass, well-known the speed of light is specified below.

According to Ohki' s paper [1] derived from one-dimensional Maxwell's equations on basis of exact differential equation under invariant permittivity and permeability in the space, using the phase equation (2-3), the speed of light in the ECS is described below.

$c = dz/dt = \Delta z/\Delta t > 0$ (2-6)

where

Δ means a finite difference that each space and time interval is, respectively, a finite difference in the first divided differences [11], 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 (2-1) 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 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 light to travel in the phase equation (2-1) shows below.

$dz\,\mathbf{k} = c\,\mathbf{k}\,dt$ (2-7)

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 frame

The MPS will be supposed to have no attribute of traveling independent parallel to each other in respective real and imaginary frames 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 frame.

Given each space and time interval, respectively, multiplied by a factor of exp(jp/2), under condition that the speed of light is invariant as the real frame, assumed a derivative space variable with respect to time variable or a ratio of imaginary

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space interval to imaginary time interval, so new postulate is that there exist of an imaginary ratio equation below.

$$c = j\,dz/j\,dt = j\Delta z/j\Delta t > 0 \quad (2\text{-}8)$$

This equation above (2-8) 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[12], in mathematical operation in details below.

2.2.3 Relationship between the speed of light and phase function

Velocity in mechanical phase function is unattainable to the speed of light in the ECS.

The phase a in the phase equation (2-1) is a differentiable function on the basis of exact differential equation, the derivative of phase a with respect to independent variable, space z and time t, is described as follows.

$$da = f dt - k dz = 0 \quad (2\text{-}9)$$

$$c = dz/dt = f/k = \Delta f/\Delta k \quad (2\text{-}10)$$

where

dz/dt in this speed equation (2-10) is defined as phase velocity equal to the ratio of frequency to wave number, Δf/Δk, in wave function.

f: wave cycle number per unit time on a time axis for light to travel.

Δf: discrete frequency with nonzero for reciprocal number of time interval with nonzero, wave cycle number per unit time on a time axis for light to travel,

k is wave number form per unit length [Nos/m].

Δk: observable wave number with nonzero, wave number per unit length on a space axis for light to travel.

Each the speed equation (2-6), (2-8) and (2-10) is the ratio of space interval to time interval, in other word, the ratio of one finite difference variable to the other variable. We can postulate that each finite difference never becomes be zero, so that each space interval and time interval have, respectively, none zero value.

2.2.4 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 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 frame.

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 [13] in the MPS and a linear electromagnetic wave to travel on an axis in the ECS in detail later have the same form with velocity squared, so the string wave in the MPS interchanges the manifest energy into the potential energy in the stretched wire as strain energy each other to-and-fro, whereas, the electromagnetic wave in the ECS interchanges the real manifest frame into the imaginary potential frame each other to-and-fro. 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 [14], one-dimensional Maxwell's equations in the ECS is expressed below.

$$\partial D/\partial z = -u\,\partial B/\partial t \quad (3\text{-}1)$$

$$\partial B/\partial z = -q\,\partial D/\partial t \quad (3\text{-}2)$$

According to exact differential equation text [15], 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.

$$dg(z,t) = (\partial g(z,t)/\partial t)\,dt + (\partial g(z,t)/\partial z)\,dz = 0 \quad (3\text{-}3)$$

$$\partial(\partial g(z,t)/\partial z)/\partial t = \partial(\partial g(z,t)/\partial t)/\partial z \quad (3\text{-}4)$$

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From exact differential equation (3-3), divided both hands in the equation by dt, arranging them, we can get equation below.

$$(\partial g(z,t)/\partial t) = -c(\partial g(z,t)/\partial z) \quad (3\text{-}5)$$

where

(dz/dt) is the speed of light c

Substituting radiant electric flux density D for g(z,t) and radiant magnetic flux density B in equation (3-5), we can get respective equation below.

$$(\partial D/\partial z) = -(1/c)(\partial D/\partial t) \quad (3\text{-}6)$$

$$(\partial B/\partial z) = -(1/c)(\partial B/\partial t) \quad (3\text{-}7)$$

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

$$(\partial D/\partial z) = -(1/c)(\partial D/\partial t) = -u\,\partial B/\partial t \quad (3\text{-}8)$$

$$(\partial B/\partial z) = -(1/c)(\partial B/\partial t) = -q\,\partial D/\partial t \quad (3\text{-}9)$$

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

$$D = u\,c\,B \quad (3\text{-}10)$$

$$B = q\,c\,D \quad (3\text{-}11)$$

Multiplying respective left hands in the equation (3-10) and (3-11) and right hands , both hands equal them, we can get equation below.

$$Sq(1/c) = uq \quad (3\text{-}12)$$

Furthermore,

Substituting radiant electric flux density D and radiant magnetic flux density B for g(z,t) in the equation (3-4) respectively, using the equation (3-1) and (3-2), arranging them, we can get respective one-dimensional wave equation below.

$$\partial(\partial D/\partial z)/\partial z = Sq(1/c)\,\partial(\partial D/\partial t)/\partial t \quad (3\text{-}13)$$

$$\partial(\partial B/\partial z)/\partial z = Sq(1/c)\,\partial(\partial B/\partial t)/\partial t \quad (3\text{-}14)$$

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

The ECS has an inherent complex coordinates with orthogonal octad axes, that is, both real axes with space three dimensions and time coexists alongside imaginary axes with the same dimensions, so is essentially different from the MPS.

In respective equation in the section above, 2.3.1 section. substituting complex jz and jt for z and t, each equation keeps the same form through dividing both hands in each equation by imaginary operator Exp(jp/2), Exp(jp).

In consequence, we can get the speed of light in imaginary frame in section 2.2.2, and Maxwell's complex equations can be defined through the above-mentioned statements.

In addition, through the equation above, given space and time defined as complex term like the four quadrants of a Cartesian coordinate system [16] with totally real and imaginary frames, so that there exists of one-dimensional real system with the four quadrants in real frame parallel to one-dimensional imaginary system with the four quadrants in imaginary frame. To simplify, when we focus only directional axes for light to travel in real and imaginary frames, the double two quadrants constitute of time axis, imaginary time axis out of phase by p/2 on a circle rotating in anticlockwise of time, space axis and imaginary space axis out of phase by p/2 on a circle rotating in anticlockwise of space, each time and space is independent variable each other.

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 can define complex Maxwell's equations on exact differential equation.

Moreover, the absolute spacetime [17] 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 frame have a respective attribute of the speed of light parallel to each other. For the speed of light in both frames is positive in the phase equation (2-1) and (2-3), besides, the speed of light in real frame is equivalent to the speed of light in imaginary under condition rotating out of phase by jp/2, so they are symmetric to each other.

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

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apply exact differential equation to the Noether's theorem in the complex Maxwell's equation.

In consequence, using Maxwell's complex equation, the main terms are able to replace by a representative function g(z,t) respectively, so we can be described as the same wave function in both real and imaginary frames below.

$$\partial(\partial g(z,t)/\partial z)/\partial z = Sq(1/c)\, \partial(\partial g(z,t)/\partial t)/\partial t \quad (3\text{-}15)$$

Therefore, we can sum up each wave function in a real frame and in an imaginary frame respectively, so the total complex wave function g(T: z,t) is described as below.

$$g(T: z,t) = g(R: z,t) + jg(I: z,t) \quad (3\text{-}16)$$

where

g(R: z,t) denotes wave function in real frame

$$g(R: z,t) = A(g)\, Exp(4pja) \quad (3\text{-}17)$$

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

$$g(I: z,t) = A(g)\, Exp(4pja + jp/2) \quad (3\text{-}18)$$

Furthermore, using equation (3-18) above, we can get total complex wave function g(T: z,t) below.

$$g(T: z,t) = g(R: z,t) + j\, g(I: z,t) = g(R: z,t)\,(1 + Exp(jp)) = 0 \quad (3\text{-}19)$$

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

$$g(R: z,t) = g(I: z,t)\, Exp(-jp/2) \quad (3\text{-}20)$$

3.3 Conservation law in the ECS

The equation (3-19) 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 frame and the imaginary frame, in short word, those terms have complex frame.

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.

3.4 Radiant octuplet carriers derived from a one-dimensional momentum linear density on an axis for light to travel

3.4.1 Radiant electromagnetic volumetric momentum density in the ECS

Electromagnetic volumetric momentum density r(p) in the ECS is defined as follows.

$$r(p)\mathbf{k} = D\mathbf{i} \times B\mathbf{j} = DB\mathbf{k} \quad (3\text{-}21)$$

$$r(p) = DB\ [kgm/s/Cub(m) = Ns/Cub(m)] \quad (3\text{-}22)$$

where

r(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.

$$ds(p)/dz = r(p) \quad (3\text{-}23)$$

Integrating antiderivative of r(p),

$$\int r(p)\, dz \text{ (from zero to } \Delta z) = \int ds(p) \text{ (from zero to } \Delta z) = s(p)\, \Delta z \quad (3\text{-}24)$$

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,

$$\Delta A = \Delta x \Delta y \quad (3\text{-}30)$$

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

$$db(p)/dA = s(p) \quad (3\text{-}25)$$

Integrating antiderivative of s(p),

$$\int s(p)\, dz \text{ (from zero to } \Delta A = \Delta x\Delta y) = \int db(p) \text{ (from zero to } \Delta A) = b(p)\, \Delta x \Delta y \quad (3\text{-}26)$$

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

$$h(p) = \iiint r(p)\, dA\, dz\, dz/(\Delta x \Delta y \Delta z) = b(p)\, \Delta z\ [Js] \quad (3\text{-}27)$$

Using Δz = cΔt in equation (2-6),

$$h(p) = c\, b(p)\, \Delta t \quad (3\text{-}28)$$

The equation (3-27) and (3-28) means the indeterminacy equation, so the equation means to be able to obtain the momentum beam only when gauge of ΔxΔy and size of Δz, and observed space interval or observed time interval in observing disappears.

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3.4.2 Relationship between beam mass, beam momentum and beam energy

Multiplying equation (3-10) by D/q and equation (3-11) by B/u respectively, adding them, next, dividing them 1/2c, we can get equation below.

DB = (1/2c)(Sq(D)/q + Sq(B)/u) (3-28)

Moreover, multiplying equation (3-10) by uD and equation (3-11) by qB respectively, adding them, next, dividing them c/2, we can get equation below.

DB = (c/2)(uSq(D) + q Sq(B)) (3-29)

Using equation (3-22), arranging them, we can get equations below.

r(p) = r(E)/c (3-30)

r(p) = c r(m) (3-31)

r(E) = Sq(c) r(m) (3-32)

where

electromagnetic mass density is defined below,

r(m) = (uSq(D) + qSq(B))/2 (3-33)

electromagnetic energy density is defined below,

r(E) = (Sq(D)/q + Sq(B)/u)/2 (3-34)

Furthermore, postulated that there exists of a divisible infinitescimal light element under conditions that characteristics of light do never lose at all even when sliced infinitely up a linear continuous entity on an axis, so that the element sliced is able to regard as a mass element.

Given electromagnetic volumetric mass density r(m), linear string mass density s(m), linear beam mass b(m) in a linear entity, we can get derivative equations and integrating equations, respectively.

ds(m)/dz = r(m) (3-35)

∫r(m) dz (from zero to Δ z) =

∫ds(m) (from zero to Δ z) = s(m) Δ z (3-36)

Next,

db(m)/dA = s(m) (3-37)

where dA means infinitescimal cross-section area element on direction of z, dA=dxdy

∫s(m) dA (from zero to Δ A) =

∫db(m) (from zero to Δ A) = b(m) Δ A (3-38)

where ΔA means infinite area element ΔxΔy,

Double integrating r(m), electromagnetic constant h(p) is defined below.

∬r(m) dAdz/ ΔxΔyΔz = b(m) (3-39)

and using equation, we can get equation below.

h(m) = ∭r(m) dxdydz dz = b(m) Δ z (3-40)

Using the speed equation (2-6), we can get equation below.

h(m) = c b(m) Δ t (3-41)

Using equation (3-31) and (3-32), Multiplying equation (3-39) by the speed of light and the speed of light squared, we can get equations defined as beam energy b(E), b(p) respectively.

b(p) = b(m) c (3-42)

b(E) = b(m) Sq(c) (3-43)

Process from equation (3-39) to (3-43) can apply to the other radiant carries, so that we can discuss with the octad carriers as the same equations.

3.4.4 Substructures of electromagnetic beam mass in the MCS

Reviewing equation from equation (3-31) to equation (3-43), we will be able to postulate that electromagnetic beam mass in the MCS constitutes of a string lined lots of beads with mass element, a beam bunched the string to a cross-section gauge in continuity entity and a group bunched the beam up.

3.4.5 Longitudinal wave and transverse wave

According to physical text, a transverse wave and longitudinal wave is expressed below:

In a transverse wave, the particles of the medium move perpendicular to the wave's direction of travel.

In a longitudinal wave, the particles of the medium move parallel to the wave's direction of travel.

Analogy to the motion of particles, a linear continuity entity in MCS will be able to postulate that a linear electromagnetic longitudinal mass constitutes of a bead mass per unit element length, the string mass per unit area, the beam mass per unit length, which is packed into a bundle, the bundle mass gathered together the beam mass, which is proportional to intensity of light.

In consequence, we can postulate that light substructure constitutes of a string in-lined bead element, a beam bundled together the string, and a group tied the beam together.

3.4.6Radiant octuplet carriers in the ECS

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Both electric flux density in the equation (3-10) and magnetic flux density in the equation (3-11) show wave function respectively in equation (3-13) and (3-14).

Following that, substituting the other radiant carrier for g(z,t) in the equation (3-4), we can know that all of octad radiant carries are described as wave function respectively in the wave function equation (3-15).

Moreover, in each equation above, we can substitute the momentum for the left radiant carriers of mass, energy, force, power, electromagnetic constant, they are, respectively, defined in volumetric density, string, beam form like r(m), s(m) and b(m) in case of mass in the ECS, following that work density r(w), string work s(w) and beam work b(w) in case of energy, power density r(P), power string s(P) and power beam b(P) in case of power, force density r(N), force string s(N) and force beam b(N) in case of force, electromagnetic constant density r(h), electromagnetic constant string s(h) and electromagnetic constant beam b(h) in case of electromagnetic constant.

4. Conclusions

Conclusions fall into three parts:

(A) Indispensable premises as each postulate

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

(C) Respective interpretation for those equations

If one of the postulate breaks, the postulate will need to be remedied and equations concerning the postulates will need change.

However, I hope that some conclusions carry through under boiling reviews.

(A) Indispensable postulates

(a-1) There coexist of absolute orthogonal real coordinates and imaginary coordinates in complex free spacetime

(a-2) In the spacetime, there exist of Maxwell's complex equation on Noether's theorem

(a-3) There exist of the space with self-media constituted invariant permeability and permeability and without outside media

(B) Assumptions derived from the above-mentioned equations

(b-1) Self-media in free space

In wave function form, all of radiant octad carriers have both permittivity and permeability terms which travels concurrently at the speed of light in a free orthogonal space.

We can postulate that there is continuous self-media for light to travel in vacuum space.

Electromagnetic role is played as sequent for a rear bead to push out front bead in front of the rear and for the front bead to attract the rear bead as a linear self-media distributed on an axis for sequential beam linking lots of continuous strings beaded(b-2) Substructure of light

Given divisible infinitescimal light element under conditions that characteristics of light do never lose at all even when sliced infinitely up a linear continuous entity on an axis, the element allows a bean mass element with its center to be treated as a mass element sliced infinitely up a linear continuous entity of light.

(b-3) Longitudinal and transverse wave duality

Using the above-mentioned knowledge of the substructure of light with the bead element, analogy to mechanical longitudinal wave mechanism [18] with moving particle with mass in-lined in a string stretched, when regarding particle as the bead element on self-medium, we able to postulate that electromagnetic wave is assumed as the longitudinal wave more than the well-known transverse wave [19], so that in free space without outside media, octad carriers in electromagnetic wave form can travel concurrently at the speed of light so that the well-known transverse wave requires space with media in traveling.

A group of light made up continuous bundles of light constitutes of a group of string, held together by the self-internal-directional-force, which is fastened bead element by self-longitudinal-back-forth-force as action through self-medium.

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

We should observe both the waves, however, it is exceedingly difficult for us to observe its wave so that we have to observe the longitudinal momentum. In consequence, we

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have come to believe only the transverse wave to easily observe it.

(b-4) Radiant octad carriers

Analogy to the MPS, with carriers of mass, momentum, energy and force over remote locations, regardless of whether the carrying is action through the self-medium, when this analogy applies to the ECS, in Ohki's paper [20], radiant octad carriers are, respectively, able to be defined as beam mass, beam momentum, beam energy, beam force and electromagnetic constant so that any one of the octad carrier is able to describe as wave function on the basis of wave equation.

(b-5) The indeterminacy principle

Light has indeterminacy of bead element size in observing time interval, string gauge for light is a linear continuity, only in observing, the indeterminacy disappears, we can get some observed values in octad carriers.

(b-6) Relationship between beam mass and beam energy

we get equation below.

$$b(p) = b(m)\, c \quad (3\text{-}42)$$

$$b(E) = b(m)\, Sq(c) \quad (3\text{-}43)$$

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 [21] is energy E equal to mass times the speed of light squared, this equation seem to be able to apply to either ECS or MPS, however, so it is difficult for us to take the mass–energy relationship in the MPS from the relationship inn the equation (3-43) in the ECS.

(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 space with attribute of invariant permittivity and permeability in free geometric orthogonal space 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.

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

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

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

So we can get equation defined as beam mass.

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

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.

Not to use the Greek alphabet generates disruption, make an author confused, so please refer to a footnote in every page.

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