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Classical Electromagnetic Dynamic System Based on a System of Three Electromagnetic Waves

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This paper [1] proposes a classical electromagnetic mechanic system due to three waves constituted transverse waves and a longitudinal momentum wave perpendicular to each other, which are derived from one-dimensional Maxwell's equation based on exact differential equation in the rectangular coordinate system (the Cartesian coordinate system), so that most concepts and equations in the existing quantum mechanics will be replaced with new concepts and equations of the classical mechanics detailed, hereafter.

- First postulate is that there exists a mobile-self-medium whose property of physical homogeneity, isotropy, non-dispersibility, mathematical differentiability, radiates electric and magnetic flux density with together from an electromagnetic source, travel with each other at the speed of light. So that, the medium provides electric and magnetic flux density to an electromagnetic field with permeability μ and permittivity ε in empty space, their flux density can travel at the speed of light in empty space. In addition, fundamental functions in Maxwell's equations are electric flux density and magnetic flux density.
- Second postulate is that each one-dimensional density function g (t, z) in the medium obeys the exact differential equation with respect to variable time {t}, space variable {z} for the wave to travel on the z-axis:

Electric flux density	Magnetic flux density
dD = 0 dD = dD (t, z) = (∂D/∂t) dt + (∂D/∂z)dz = 0, ∂D/∂t = - (dz/dt) (∂D/∂z), ∂(∂D/∂t)/∂z = ∂(∂D/∂z)/∂t, ∂(∂D/∂t)/∂t = Sq((dz/dt))∂(∂D/∂z)/∂z, D =A(D)Exp(2πj(ft-kz)) / Sqrt(2) A(D): Amplitude of D flux wave	dB = 0 dB = (∂B/∂t) dt + (∂B/∂z) ds = 0, ∂B/∂t = - (dz/dt) (∂B/∂z), ∂(∂B/∂t)/∂z = ∂(∂B/∂z)/∂t, ∂(∂B/∂t)/∂t = Sq((dz/dt))∂(∂B/∂z)/∂z, B =A(B)Exp(2πj(ft-kz))/ Sqrt(2) A(B): Amplitude of B flux wave
dz/dt = ±f/k where, f is the frequency [1/s], k is the wave number [1/m], Sqrt (2) is root-mean-squared factor, we can observe the progressive wave with dz/dt = - f/k, but we cannot the retrogressive wave with dz/dt = f/k, so that the retrogressive wave rules out in this paper. In addition, each phase constant in the wave is zero so that each the density function synchronizes.	

- Third postulate is that there is constancy of the permittivity ε and the permeability μ, and of the speed of light.

<table>
<tr><th>Maxwell's equations for the electric flux density</th><th>Maxwell's equations for magnetic flux density</th></tr>
<tr><td>$\partial D/\partial z = -\varepsilon(\partial B/\partial t)$, On the other hand, $\partial B/\partial t = -(dz/dt)(\partial B/\partial z)$,

$\partial D/\partial z = \varepsilon(dz/dt)(\partial B/\partial z)$, $d\varepsilon = 0$. $d((dz/dt))=0$

$\partial D/\partial z = \partial(\varepsilon(dz/dt)B)/\partial z$</td><td>$\partial B/\partial z = -\mu(\partial D/\partial t)$, On the other hand, $\partial D/\partial t = -(dz/dt)(\partial D/\partial z)$,

$\partial B/\partial z = \mu(dz/dt)(\partial D/\partial z)$, $d\mu = 0$. $d((dz/dt))=0$

$\partial B/\partial z = \partial(\mu(dz/dt)B)/\partial z$</td></tr>
<tr><td colspan="2">where the speed of the flux density is b, in other word, the speed of light, $b = dz/dt$, $b = D/\varepsilon B = B/\mu D$ [m/s] where permittivity is defined as $\varepsilon \equiv D/B/b$, permeability is defined as $\mu \equiv B/D/b$, and $\varepsilon\mu \equiv 1/\mathrm{Sq}(b)$.

Arranging the equation above of the speed of light, we can mass density equation below.

$\rho(m) \equiv \mu \mathrm{Sq}(D) = \varepsilon \mathrm{Sq}(B)$[kg/Cub(m)] where Cub(x) is x to third power.</td></tr>
<tr><th>Electromagnetic mass density wave equation</th><th>Electromagnetic energy density wave equation</th></tr>
<tr><td>Electromagnetic mass density:

$\rho(m) \equiv 0.5(\mu \mathrm{Sq}(D) + \varepsilon \mathrm{Sq}(B))$[kg/Cub(m)]

$d\rho(m) = \mu D\, dD + \varepsilon B\, dB = 0$

$\partial(\partial\rho(m)/\partial t)/\partial z = \partial(\partial\rho(m)/\partial z)/\partial t$,

$\partial(\partial\rho(m)/\partial z)/\partial z = (\varepsilon\mu)\partial(\partial\rho(m)/\partial t)/\partial t$,

The mass wave function:

$\rho(m) = (A(m)/2)\mathrm{Exp}(4\pi j(ft-kz))$ where, A(m): Amplitude of the mass density wave</td><td>Electromagnetic energy density:

$\rho(E) \equiv \varepsilon\mu\rho(m) = 0.5(\mathrm{Sq}(D)/\varepsilon + \mathrm{Sq}(B)/\mu)$[J/Cub(m)]

$d\rho(E) = (D/\varepsilon)dD + (B/\mu)dB = 0$

$\partial(\partial\rho(E)/\partial t)/\partial z = \partial(\partial\rho(E)/\partial z)/\partial t$,

$\partial(\partial\rho(E)/\partial z)/\partial z = (\varepsilon\mu)\partial(\partial\rho(E)/\partial t)/\partial t$,

The energy wave function:

$\rho(E) = (A(E)/2)\mathrm{Exp}(4\pi j(ft-kz))$ where, A(E): Amplitude of the energy density wave</td></tr>
</table>

- Forth postulate is that Planck momentum quad(h) **K** [Js/Quad(m)] equals electromagnetic momentum ρ(M) **K** [Ns/Cub(m)] cross product of the electric flux density D **I** and magnetic flux density B **J** according to the dimensional analysis, where bold sign I, J, K the unit vector on the x-axis, the y-axis, the z-axis, respectively.

Two momentum equations	Electromagnetic momentum density wave equation
Planck momentum quadplex density: quad(h) [Js/Quad(m)] ≡ DB [Js/Quad(m)] ≡ [Ns/Cub(m)] Electromagnetic momentum density: $\rho(M) \equiv DB$[Ns/Cub(m)] $d\rho(M) \equiv D\, dD + B\, dB = 0$	Using $\rho(E) = 0.5(\mathrm{Sq}(D)/\varepsilon + \mathrm{Sq}(B)/\mu)$, $\rho(m) = 0.5(\mu \mathrm{Sq}(D) + \mathrm{Sq}(B)/\mu)\mathrm{Sq}(B)/)$ $d\rho(M) = (1/b)\ (\partial\rho(E)/\partial t)dt + b\ (\partial\rho(m)/\partial z)dz = 0$ on the other hand, $d\rho(M) \equiv (\partial\rho(M)/\partial t)dt + (\partial\rho(M)/\partial z)dz = 0$ Referring two equations, we can get two equations below. $\rho(E) = b\ \rho(M)$, $\rho(M) = b\ \rho(m)$ Moreover, the wave equation of ρ(M) is $\partial(\partial\rho(M)/\partial z)/\partial z = (\varepsilon\mu)\partial(\partial\rho(M)/\partial t)/\partial t$, we can obtain the wave function below, $\rho(M) = (A(M)/2)\mathrm{Exp}(4\pi j(ft-kz))$ A(M) is Amplitude of energy density wave

- Fifth postulate is that a constancy keeps of a front wave cross-section of cylindrical electromagnetic momentum density, and of length from zero crossing point to the next point under the constancy of the speed of light, we can observe the momentum truncated for we cannot observe the momentum cut off just at the zero-crossing point.

Planck momentum h defined as cross product of electric flux density and magnetic flux density
quad(h)i = D×j = DB = k ρ(M) k h ≡ ∫quad(h) dV dz [Js] ≡ ∫ρ(M)dVdz = M∫dz, ∵ M ≡ ∫ρ(M)dV, dh = (∂h/∂t)dt + (∂h/∂z)dz = E dt +M k dz k = E dt +M dz = 0: dh = scalar item + vector item d(dh/dt) = d(E + b M) = (∂E/∂t)dt + b(∂M/∂t)dt +(∂E/∂z)dz + (∂M/∂z)dz = P dt + b Fdt +F dz + (∂M/∂z)dz d(dh/dt)/dt = P + bk Fk + Fk bk+ b(∂M/∂z) = P + 2bF+ b(∂M/∂z), where P ≡ (∂E/∂t), F ≡ (∂E/∂z) ≡ ∂M/∂t

Electromagnetic indeterminacy	**The uncertainty principle under an observable truncated length Δz**
h ≡ ∫quad(h) dV dz = ∫ρ(M) dV dz = M ∫dz = M Δz = E Δt	The momentum density is separated into momentum flux ϕ(M) [Ns/Sq(m)] and linear momentum [Ns/m], the truncated momentum in observing at an observable interval Δz, is defined as Δ M below. $\Delta\mathrm{M} = \int_0^{\Delta z} \rho(M)\,\mathrm{d}z,$ using equation Δz = b Δt, E = b M $\mathrm{h} \int_0^{\Delta z} \rho(M) dVdz = \Delta\mathrm{M}\,\Delta\mathrm{z} = \left(\frac{\Delta\mathrm{E}}{\mathrm{b}}\right)\Delta\mathrm{z} = \Delta\mathrm{E}\Delta\mathrm{t}$

- Sixth postulate is that a length of the speed of light per second is the wave length λ times n(λ), reciprocal of the wave length equals the wave number times n(k), = n(λ) λ = 1/ (n(k) k)= 1/n(f)f, the truncated length =Δ b =n(λ)λ = 1/(n(k)k), and the truncated time interval Δ t =1/(n(f)f)

Electromagnetic energy and mass equation	**Electromagnetic wave energy and momentum truncated in observing the continuous beam wave**
m = ∫ρ(m)dV = εμ ∫ρ(E)dV = εμ E [kg] where E=∫ρ(E)dV ≡ ∫(1/εμ)ρ(m) dV= m/εμ, E= m Sq(b) [J]	M = n k h, ΔM = h /Δz =n (k) k h E= n f h, Δ E = h /Δt = n (f) f h Δ means truncated momentum and energy, respectively, period The wave number is n (k) per length truncated and The frequency number is n (f) per time interval truncated.
Δ E = h /Δt = n (f) f h = Δ m Sq(b) in the electromagnetic energy equation truncated Δ M = h /Δz = n (k) k h = Δ m b in the electromagnetic momentum equation truncated	

- Seventh postulate is that there exists a dynamic system of electromagnetic sextuplet wave equations without rotational equations: i. Electromagnetic mass {m}, ii. Momentum {M}, iii. Energy {E}, iv. Force{F}, v. Power {P}, vi. Planck momentum {h}.

Electromagnetic dynamic wave six functions:

Electromagnetic momentum wave function: M (t, z)= (A(M)/2)Exp(4πj(ft-kz)) [Ns]

Electromagnetic energy wave function: E (t, z)= b M = (b A(M)/2)Exp(4πj(ft-kz)) [J]

Electromagnetic mass wave function: m (t, z)= (M/b) = (A(M)/2 b)Exp(4πj(ft-kz)) [kg] Force

wave function: F (t, z) = ∂E/∂z = (2πf A(M))Exp(4πj(ft-kz) -jπ/2) [N]

Power wave function: P (t, z) = b F = (2πfb A(M))Exp(4πj(ft-kz) -jπ/2) [W]

Planck momentum wave function: h (t, z) = M Δz =(A(M) Δz /2)Exp(4πj(ft-kz)) [Js]

As Evidence, Application of the Equations Above for Experiments

(a) Each Wave in the Three Waves System Works Against the Double Slit Experiment

Light separated two waves via the first slit, each wave passing through at the second two slits, makes diffraction per each slit as the transverse waves, on the other hand, makes interference each other and cross product of the transverse wave vectors makes a linear longitudinal momentum wave vector for the wave to travel along on the z- axis, so that the linear momentum wave makes a dot on a screen as the collision.

An endless three waves passing the second slits continuously make the interference waves and the longitudinal wave, so that lots of the dots make the distribution of the interference fringes on the screen.

(a-2) The beam wave radiated from the sun, separated the beam reflected from the Mercury and the beam directly radiated from the sun, when the radiation beam collides with the side of the reflected beam, as the collision momentum effect, the reflected beam pushes away from the sun because the force due to the effect is much more than the attraction gravitational force: m means electromagnetic mass in the wave beam mb □ mg(sun). Whereas, light bends, a ratio of the bending fits the well- known observable facts.

(b) Next evidence, in case of a classical collision, we know classical conservation equations in the scalar energy and momentum vector before and after.

(b-1) In microscopic world, the momentum before and after is unable to observe, when the momentum appears in the macroscopic world, we can observe the momentum when an incident momentum exceeds over the momentum function Φ(work)/b, divided the work function Φ(work) by the speed of light {b}.Given the speed of light{b}, and the energy and momentum vector before and after, that the electromagnetic energy E(b) before is described as E(b) = hf(b) = Sq(b) m(b), the electromagnetic energy E(a) after is described as E(a) = hf(a) = Sq(b) m(a), on the other hand, the momentum M(b) before is as M(b) K = hk(b) K = bm(b) K, and the momentum M(a) vector after is M(a) k = hk(a) k = bm(a) k, where k in bold expression is the unit vector on the z- axis.

In the momentum, Δ M = M(a) -M(b) = h(k(b)-k(a)) = b(m(b)-m(a)), in the energy, Δ E = E(a)-E(b) = h(f(b)-f(a)) = Sq(b) (m(b)-m(a)), h is a linear proportionality to the momentum variable and to the energy variable.

(c-1) Photoelectric effect: when the momentum excess Δ M excess over the momentum work function, that is, $\Delta\Delta$M = ΔM - Φ(work)/b > 0, we can observe lots of electron emitted from the metal.

(c-2) Compton effect: the beam momentum after lesser than the incident beam momentum before in the collision between an electron and the beam wave with the momentum, in other word, when the incident momentum loss in colliding with an electron, so that the momentum after make smaller naturally.

Postulate for an electron	An electron substructure
(a) An electron has an elementary charge. (b) The electron constitutes three beam waves with wavefront charged by one-sixth elementary charge. (c) The mass density of the beam is ρ(m), ρ(m) = μSq(D), so that an electron density ρ(e) is described as ρ(e) = 3 ρ(m) = 3 μ Sq(D) [kg/Cub(m)] (d) Perfect sphere with radius R(e), so that the volume is 4πCub(R(e))/3 [Cub(m)]. (e) Electric flux density D diverged from the sphere is: D = e/(4πSq(R(e)) [As/Sq(m)] (f) The wave with a frequency is immanent and stable in the electron so that a zero-cross-point of the half frequency meets a center of the sphere. (g) The electron constituted the waves behaves as an electron wave when the electron gets high energy.	A. Classical relationship of the electron's substructure ρ(e) = 3 ρ(m) = 3 μ Sq(D) m(e) = ρ(e) V = 3 μ Sq(D)V = μSq(e)/(4πR(e)) We can get classical relationship between the electron mass, the radius, permeability and elementary charge. B. The wave with half frequency f(1/2) is immanent in the electron. When the inherent wave is freed from the electron, according to the electromagnetic energy equation, E(e) = 0.5 h f (1/2) = m(e) Sq(b), the gamma ray with the frequency, 2.471 E (20) [1/s], is radiated from the electron, where E (20) means 20th power of 10. This frequency in radiating meets the experiment data in annihilating.
Perspective in the future	
Derivation of the Schrödinger equation, mobile-self-medium's substructure for the retrogressive wave, quark with the fractional elementary charge freed from the electron, light's substructure, and so on [1].	

1. Yasutsugu O (2024) A Longitudinal Electromagnetic Beam Wave with Mechanical Sextuplet Property and An Electron Substructure Derived from The Wave, Journal of Physics and Chemistry Research 6.