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Analyses of the Light Quantum Field Theory to the Electromagnetic Field Tense

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Abstract: In this article with the strict mathematics derivation, it is proved that the electromagnetism appearance is a mechanics course of the light quantum system. The vector potential is a vibrating velocity vector. The magnetic field intensity is the rotation of vibrating velocity vector. Einstein's electromagnetism tensor matrix can be derived from the vibrating momentum, angular momentum, energy etc. of the light quantum system.

Keywords: light quantum system, electromagnetism tensor matrix, vector potential, vibrating state function.

The electromagnetic effect is being applied so extensively in modern times, in the science and technology. However, how it is so advanced, the essential forms on electromagnetism appearance, have not been gotten definite answer up actually yet, so that some men still think the "magnetic charge" exists. In this article with the strict mathematics derivation from the distribution, vibration, momentum, angular momentum, energy etc. of the light quantum system, it has been proved that the electromagnetism appearance is a mechanics course of the light quantum system. That is the first time in history. What is the vector potential? What is the magnetic field intensity? What Einstein's electromagnetism tensor matrix is, that all can find genuine answer from this article.

The light quantum system of particle can be regarded as continuous medium that is in moving and vibrating formed with the light quantum. Make a relatively static coordinate system O with the particle center as origin. Inside the arbitrary small region of coordinate system O, can get the system of equation:

$$\frac{\partial \rho}{\partial t} + \frac{\partial \rho V_i}{\partial x_i} = 0$$

(the law of conservation of matter)

$$\frac{\partial \rho V_i}{\partial t} = \frac{\partial \sigma_{ij}}{\partial x_i} + g_i$$

(Newton's law).

In order to describe vector of matter field that must spread $\varphi(\vec{r})$ into $\varphi_\mu(\vec{r})$. $\mu = 1,2,3$, $\varphi_i(\vec{r})$ as the vibrational momentum $\rho\vec{U}(r)$. $\mu = 0$, $\varphi_0(\vec{r})$ corresponding matter field in place $\vec{r}$ as the probability density of matter wave ρ, V_i is the vibration speed of light quantum for three dimension. The vibration speed of the light quantum system is three dimensions. σ_{ij} is the stress field, g_i is external force, that effect to the light quantum system in the space around them.

$\sigma_{ij} = \rho\,\delta_{ij} + P_{ij}$. From these you can get:

$$\begin{pmatrix} P_{XX} & P_{XY} & P_{XZ} & ic\rho U_X \\ P_{YX} & P_{YY} & P_{YZ} & ic\rho U_Y \\ P_{XZ} & P_{ZY} & P_{ZZ} & ic\rho U_Z \\ -ic\rho U_X & -ic\rho U_Y & -ic\rho U_Z & -ic\rho ic \end{pmatrix} \begin{pmatrix} \frac{\partial}{\partial x} \\ \frac{\partial}{\partial y} \\ \frac{\partial}{\partial z} \\ \frac{\partial}{\partial ict} \end{pmatrix} = \begin{pmatrix} -g_X \\ -g_Y \\ -g_Z \\ -g_0 \end{pmatrix}, \quad P_{ij} = P_{ji}.$$

Chooses the principal axis serve as the coordinate axis, as $i \neq j$ then $P_{ij} = P_{ji}$,and it is equal to 0. Because of it is symmetry and isotropy, as i=j $P_{ij} = P$, supposes that P is direct ratio to ρ, and supposes that proportionality coefficient is C^2 as a normalization condition, thus can get:

$$\begin{pmatrix} P & 0 & 0 & ic\rho U_X \\ 0 & P & 0 & ic\rho U_Y \\ 0 & 0 & P & ic\rho U_Z \\ -ic\rho U_X & -ic\rho U_Y & -ic\rho U_Z & -ic\rho ic \end{pmatrix} \begin{pmatrix} \frac{\partial}{\partial x} \\ \frac{\partial}{\partial y} \\ \frac{\partial}{\partial z} \\ \frac{\partial}{\partial ict} \end{pmatrix} = \begin{pmatrix} -g_X \\ -g_Y \\ -g_Z \\ -g_0 \end{pmatrix}, \qquad (A)$$

$$\begin{pmatrix} \frac{\partial P}{\partial x} + \frac{\partial \rho U_X}{\partial t} \\ \frac{\partial P}{\partial y} + \frac{\partial \rho U_Y}{\partial t} \\ \frac{\partial P}{\partial z} + \frac{\partial \rho U_Z}{\partial t} \\ -ic\frac{\partial \rho U_X}{\partial x} - ic\frac{\partial \rho U_Y}{\partial y} - ic\frac{\partial \rho U_Z}{\partial z} - ic\frac{\partial \rho}{\partial t} \end{pmatrix} = \begin{pmatrix} -g_X \\ -g_Y \\ -g_Z \\ -g_0 \end{pmatrix}, \qquad (A)$$

Take $\left(\frac{\partial}{\partial x}, \frac{\partial}{\partial y}, \frac{\partial}{\partial z}, \frac{\partial}{\partial ict}\right)$ multiply at left both sides of (A), gets:

$$\frac{\partial^2 P}{\partial x^2} + \frac{\partial^2 \rho U_x}{\partial x \partial t} + \frac{\partial^2 P}{\partial y^2} + \frac{\partial^2 \rho U_Y}{\partial y \partial t} + \frac{\partial^2 P}{\partial z^2} + \frac{\partial^2 \rho U_Z}{\partial z \partial t} - \frac{\partial^2 \rho U_X}{\partial x \partial t} - \frac{\partial^2 \rho U_Y}{\partial y \partial t} - \frac{\partial^2 \rho U_Z}{\partial z \partial t} - \frac{\partial^2 \rho}{\partial t^2}$$

$$= -\frac{\partial g_X}{\partial x} - \frac{\partial g_Y}{\partial y} - \frac{\partial g_Z}{\partial z} - \frac{\partial g_0}{\partial ict},$$

and take $\frac{\partial P}{\partial \rho} = C^2$ substitute in it, namely

$$\frac{\partial^2 \rho}{\partial x^2} + \frac{\partial^2 \rho}{\partial y^2} + \frac{\partial^2 \rho}{\partial z^2} - \frac{1}{c^2}\frac{\partial^2 \rho}{\partial t^2} = -\frac{1}{c^2}\left(\frac{\partial g_x}{\partial x} + \frac{\partial g_y}{\partial y} + \frac{\partial g_z}{\partial z} + \frac{\partial g_0}{\partial ict}\right).$$

$\because$ ψ and ρ all correspond to the density of light quantum, $\because \psi = A\exp\left(\frac{i}{\hbar}(\vec{r}\vec{P} - \hbar\omega t)\right)$,

take ψ substitutes for ρ, after differential can get $\nabla^2\psi - \frac{1}{c^2}\frac{\partial^2 \psi}{\partial t^2} = -\frac{1}{c^2}\left(\frac{\partial g_x}{\partial x} + \frac{\partial g_y}{\partial y} + \frac{\partial g_z}{\partial z} + \frac{\partial g_0}{\partial ict}\right)$.

According to the analyze of light quantum field (http://lqfp.nease.net) for the vibrating state function, the equation (a) is existent:

$$\nabla^2\psi_\mu - \frac{1}{C^2}\frac{\partial^2 \psi_\mu}{\partial t^2} = -a\frac{m}{r^2}\psi_\mu \quad ......(a) \quad l = 0, 1, ...n$$

$$m = -l, -l+1, ...0, ...l-1, l$$

"m" is the proper value of $\hat{L}_z$ the third component of $\hat{L}$.

This equation (a) compare with upper equation, can get:

$$-\frac{\partial g_x}{\partial x} - \frac{\partial g_y}{\partial y} - \frac{\partial g_z}{\partial z} - \frac{\partial g_0}{\partial ict} = -c^2 g\psi_0 \qquad g = a\frac{m}{r^2}.$$

Take $\left(\frac{\partial}{\partial ict}, 0, 0, -\frac{\partial}{\partial x}\right)$ multiply at left both sides of (A), gets:

$$\frac{\partial^2 P}{\partial x \partial ict} + \frac{\partial^2 \rho U_x}{\partial x \partial ict} + ic\frac{\partial^2 \rho U_x}{\partial x^2} + ic\frac{\partial^2 \rho U_y}{\partial x \partial y} + ic\frac{\partial^2 \rho U_z}{\partial x \partial z} + ic\frac{\partial^2 \rho}{\partial x \partial t} = -\frac{\partial g_x}{\partial ict} + \frac{\partial g_0}{\partial x}$$. Definite $rot\,\rho\vec{U} = \vec{b}$,

$\frac{\partial \rho U_x}{\partial z} - \frac{\partial \rho U_z}{\partial x} = b_y$, $\frac{\partial \rho U_y}{\partial x} - \frac{\partial \rho U_x}{\partial z} = b_z$, take $\frac{\partial P}{\partial \rho} = c^2$ substitute in it,

$$ic\frac{\partial^2 \rho U_x}{\partial x^2} + ic\frac{\partial^2 \rho U_y}{\partial y^2} - ic\frac{\partial b_z}{\partial y} + ic\frac{\partial^2 \rho U_x}{\partial z^2} + ic\frac{\partial b_y}{\partial z} - ic\frac{\partial^2 \rho U_z}{\partial t^2} = -\frac{\partial g_x}{\partial ict} + \frac{\partial g_0}{\partial x}$$, namely

$$\frac{\partial^2 \rho U_x}{\partial x^2} + \frac{\partial^2 \rho U_x}{\partial y^2} + \frac{\partial^2 \rho U_x}{\partial z^2} - \frac{1}{c^2}\frac{\partial^2 \rho U_x}{\partial t^2} = \frac{1}{c^2}\frac{\partial g_x}{\partial t} + \frac{\partial g_0}{ic\partial x} + \frac{\partial b_z}{\partial y} - \frac{\partial b_y}{\partial z}.$$

Take ψ_1 substitutes for ρU_x, namely:

$$\frac{h^2}{2\mu}\nabla^2\psi_1 - \frac{h^2}{2\mu}\frac{1}{c^2}\frac{\partial^2\psi_1}{\partial t^2} = \frac{1}{c^2}\frac{\partial g_x}{\partial t} + \frac{\partial g_0}{ic\partial x} + \frac{\partial b_z}{\partial y} - \frac{\partial b_y}{\partial z}.$$

This equation compare with upper equation (a) , can get:

$$\frac{1}{c^2}\frac{\partial g_x}{\partial t} + \frac{\partial g_0}{ic\partial x} = -g\psi_1 - \frac{\partial b_z}{\partial y} + \frac{\partial b_y}{\partial z} \;\cdots\cdots\cdots\; (1)$$

, alike

$$\frac{1}{c^2}\frac{\partial g_y}{\partial t} + \frac{\partial g_0}{ic\partial y} = -g\psi_2 - \frac{\partial b_z}{\partial x} + \frac{\partial b_x}{\partial z} \;\cdots\cdots\cdots (2)$$

$$\frac{1}{c^2}\frac{\partial g_z}{\partial t} + \frac{\partial g_0}{ic\partial z} = -g\psi_3 - \frac{\partial b_y}{\partial x} + \frac{\partial b_x}{\partial y} \;\cdots\cdots\cdots (3)$$

, add

$$\frac{1}{c^2}\frac{\partial g_x}{\partial x} + \frac{1}{c^2}\frac{\partial g_y}{\partial y} + \frac{1}{c^2}\frac{\partial g_z}{\partial z} + \frac{\partial g_0}{\partial ict} = g\psi_0 \;\cdots\cdots\cdots\; (4)$$

$$\frac{\partial}{\partial x}(1) + \frac{\partial}{\partial y}(2) + \frac{\partial}{\partial z}(3) - \frac{1}{ic}\frac{\partial}{\partial ict}(4)$$

$$\frac{1}{ic}\frac{\partial^2 g_0}{\partial x^2} + \frac{1}{ic}\frac{\partial^2 g_0}{\partial y^2} + \frac{1}{ic}\frac{\partial^2 g_0}{\partial z^2} + \frac{1}{ic}\frac{\partial^2 g_0}{\partial (ict)^2} = -\frac{\partial g\psi_1}{\partial x} - \frac{\partial g\psi_2}{\partial y} - \frac{\partial g\psi_3}{\partial z} + \frac{1}{ic}\frac{\partial c^2 g\psi_0}{\partial ict}$$

$$-\frac{\partial^2 b_x}{\partial x\partial y} + \frac{\partial^2 b_y}{\partial x\partial z} - \frac{\partial^2 b_z}{\partial x\partial y} + \frac{\partial^2 b_x}{\partial z\partial y} - \frac{\partial^2 b_y}{\partial x\partial y} + \frac{\partial^2 b_z}{\partial y\partial z}.$$

Namely,

$$\frac{\partial^2 g_0}{\partial x^2} + \frac{\partial^2 g_0}{\partial y^2} + \frac{\partial^2 g_0}{\partial z^2} - \frac{1}{c^2}\frac{\partial^2 g_0}{\partial t^2} = -ic\frac{\partial g\psi_1}{\partial x} - ic\frac{\partial g\psi_2}{\partial y} - ic\frac{\partial g\psi_3}{\partial z} - ic\frac{\partial g\psi_0}{\partial t}$$

The vector $\vec{g}$ is got from matrix differential equation (A), to calculate easily, gets: $rot\,\vec{g} = \frac{\partial\vec{b}}{\partial t}$, namely $\frac{\partial g_y}{\partial x} - \frac{\partial g_x}{\partial y} = \frac{\partial b_z}{\partial t}$, $\frac{\partial g_x}{\partial z} - \frac{\partial g_z}{\partial x} = \frac{\partial b_y}{\partial t}$.

$$\frac{\partial}{\partial t}(1):\quad \frac{1}{c^2}\frac{\partial^2 g_x}{\partial t^2} + \frac{1}{ic}\frac{\partial^2 g_0}{\partial x\partial t} = -\frac{\partial g\psi_1}{\partial t} - \frac{\partial^2 b_z}{\partial y\partial t} + \frac{\partial^2 b_y}{\partial z\partial t} \;\cdots\cdots\cdots\; (1^*)$$

,

$$-\frac{\partial}{\partial xt}(4):\quad \frac{\partial^2 g_x}{\partial x^2} + \frac{\partial^2 g_y}{\partial x\partial y} + \frac{\partial^2 g_z}{\partial x\partial z} + \frac{1}{ic}\frac{\partial^2 g_y}{\partial x\partial ict} = C^2\frac{\partial g\psi_0}{\partial x} \;\cdots\cdots\cdots (2^*)$$

, $-(1^*)+(2^*)$ $\because rot\,\vec{g} = \frac{\partial\vec{b}}{\partial t}$

$$\frac{\partial^2 g_x}{\partial x^2}+\frac{\partial^2 g_x}{\partial y^2}+\frac{\partial^2 g_x}{\partial z^2}-\frac{1}{c^2}\frac{\partial^2 g_x}{\partial t^2}+\frac{\partial^2 b_z}{\partial y\partial z}-\frac{\partial^2 b_y}{\partial z\partial t}=\frac{\partial g\psi_1}{\partial t}+c^2\frac{\partial g\psi_0}{\partial x}+\frac{\partial^2 b_z}{\partial y\partial t}-\frac{\partial^2 b_y}{\partial z\partial t}$$

namely,

$$\frac{\partial^2 g_x}{\partial x^2}+\frac{\partial^2 g_x}{\partial y^2}+\frac{\partial^2 g_x}{\partial z^2}-\frac{1}{c^2}\frac{\partial^2 g_x}{\partial t^2}=\frac{\partial g\psi_1}{\partial t}+c^2\frac{\partial g\psi_0}{\partial x}.$$

Alike,

$$\frac{\partial^2 g_y}{\partial x^2}+\frac{\partial^2 g_y}{\partial y^2}+\frac{\partial^2 g_y}{\partial z^2}-\frac{1}{c^2}\frac{\partial^2 g_y}{\partial t^2}=\frac{\partial g\psi_2}{\partial t}+c^2\frac{\partial g\psi_0}{\partial y},$$

$$\frac{\partial^2 g_z}{\partial x^2}+\frac{\partial^2 g_z}{\partial y^2}+\frac{\partial^2 g_z}{\partial z^2}-\frac{1}{c^2}\frac{\partial^2 g_z}{\partial t^2}=\frac{\partial g\psi_3}{\partial t}+c^2\frac{\partial g\psi_0}{\partial z},$$

add:

$$\frac{\partial^2 g_0}{\partial x^2}+\frac{\partial^2 g_0}{\partial y^2}+\frac{\partial^2 g_0}{\partial z^2}-\frac{1}{c^2}\frac{\partial^2 g_0}{\partial t^2}=-ic\frac{\partial g\psi_1}{\partial x}-ic\frac{\partial g\psi_2}{\partial y}-ic\frac{\partial g\psi_3}{\partial z}-ic\frac{\partial g\psi_0}{\partial t}.$$

These four equations is the equation group(b).
Build the matrix differential equation (B),

$$\begin{pmatrix} \frac{i}{c}H & c^2 b_z & -c^2 b_y & -ic\, g_x \\ -c^2 b_z & \frac{i}{c}H & c^2 b_x & -ic\, g_y \\ c^2 b_y & -c^2 b_x & \frac{i}{c}H & -ic\, g_z \\ ic\, g_x & ic\, g_y & ic\, g_z & g_0 ic \end{pmatrix}\begin{pmatrix} \frac{\partial}{\partial x} \\ \frac{\partial}{\partial y} \\ \frac{\partial}{\partial z} \\ \frac{\partial}{\partial ict} \end{pmatrix}=\begin{pmatrix} c^2 g\psi_1 \\ c^2 g\psi_2 \\ c^2 g\psi_3 \\ icc^2 g\psi_0 \end{pmatrix},$$

To postulate $\frac{\partial H}{\partial g_0}=c^2$, can prove that the equation group (b) are equivalent with the matrix(B).
According to the law of conservation of matter, to the stable system

$$\frac{\partial(g\psi_1)}{\partial x}-\frac{\partial(g\psi_2)}{\partial y}-\frac{\partial(g\psi_3)}{\partial z}-\frac{\partial(g\psi_0)}{\partial t}=0, \quad \frac{\partial^2 g_0}{\partial x^2}+\frac{\partial^2 g_0}{\partial y^2}+\frac{\partial^2 g_0}{\partial z^2}-\frac{1}{c^2}\frac{\partial^2 g_0}{\partial t^2}=0$$

is homogeneous partial differential equation, but three other equations are inhomogeneous partial differential equation.

Only adopting the particular solution, namely the matrix differential equation (C) become the matrix differential equation:

$$\begin{pmatrix} 0 & c^2 b_Z & -c^2 b_Y & -ic\, g_X \\ -c^2 b_Z & 0 & c^2 b_X & -ic\, g_Y \\ c^2 b_Y & -c^2 b_X & 0 & -ic\, g_Z \\ ic\, g_X & ic\, g_Y & ic\, g_Z & 0 \end{pmatrix} \begin{pmatrix} \frac{\partial}{\partial x} \\ \frac{\partial}{\partial y} \\ \frac{\partial}{\partial z} \\ \frac{\partial}{\partial ict} \end{pmatrix} = \begin{pmatrix} c^2 g\, \psi_1 \\ c^2 g\, \psi_2 \\ c^2 g\, \psi_3 \\ icc^2 g\, \psi_0 \end{pmatrix}.$$

g_X, g_Y, g_Z are the external force which the light quantum of the particle suffered from surrounding space at point A (x,y,z), that also is the force to the external space at point A (x,y,z) surrounding the particle. b_X, b_Y, b_Z are the stress to the external space at A (x,y,z).

But, according to the tradition, so-called the external field of particle at A (x,y,z) is regard as the particle is a bulk particle entire acting outward to the another bulk particle. The another particle is on the point A. Think that the density of another particle is concentrated in A (x,y,z)again. ∴ The external field strength of particle at A (x,y,z) is $\vec{E}(A) = \int_0^\infty \delta(A)\vec{g}(r)d\tau$, and the stress field strength of particle at A (x,y,z) is $\vec{B}(A) = \int_0^\infty \delta(A)\vec{b}(r)d\tau$. Take $\delta(A)$ multiply at left, both sides of the matrix differential equation (C), and volume integral the result in region $0 \rightarrow \infty$, gets:

$$\begin{pmatrix} 0 & c^2 B_Z & -c^2 B_Y & -ic\, E_X \\ -c^2 B_Z & 0 & c^2 B_X & -ic\, E_Y \\ c^2 B_Y & -c^2 B_X & 0 & -ic\, E_X \\ ic\, E_X & ic\, E_Y & ic\, E_Z & 0 \end{pmatrix} \begin{pmatrix} \frac{\partial}{\partial x} \\ \frac{\partial}{\partial y} \\ \frac{\partial}{\partial z} \\ \frac{\partial}{\partial ict} \end{pmatrix} = \begin{pmatrix} c^2 \int_0^\infty \delta(A) g\, \psi_1 d\tau \\ c^2 \int_0^\infty \delta(A) g\, \psi_2 d\tau \\ c^2 \int_0^\infty \delta(A) g\, \psi_3 d\tau \\ icc^2 \int_0^\infty \delta(A) g\, \psi_0 d\tau \end{pmatrix},$$

$\int_0^\infty \delta(A) g \psi_\mu d\tau = \int_0^\infty \frac{am}{r^2}\delta(A)\, \psi_\mu(r)\, r^2 dr = am\psi_\mu(A)$, $\psi_\mu = \rho(A) U_\mu(A)$, $\rho(A) = \delta(A)$.

$U_i(A)$ is shown as the velocity of moving particle $\vec{u}$, take these substitutes to above matrix differential equation,

Thus gets matrix differential equation (D):

$$\begin{pmatrix} 0 & B_z & -B_y & -\frac{i}{c}E_x \\ -B_z & 0 & B_x & -\frac{i}{c}E_y \\ B_y & -B_x & 0 & -\frac{i}{c}E_z \\ \frac{i}{c}E_x & \frac{i}{c}E_y & \frac{i}{c}E_z & 0 \end{pmatrix} \begin{pmatrix} \frac{\partial}{\partial x} \\ \frac{\partial}{\partial y} \\ \frac{\partial}{\partial z} \\ \frac{\partial}{\partial ict} \end{pmatrix} = \begin{pmatrix} am\delta(A)u_1 \\ am\delta(A)u_2 \\ am\delta(A)u_3 \\ am\delta(A) \end{pmatrix}.$$

Since the existence of $\hbar\omega$, the particle has been produced the outward field which rise to the direct ratio in m the proper value of $\hat{L}_z$ the third component of $\hat{L}$. As if quantum number m is given a definition as q the electric charge quantity (q=am, 'a' serve as a constant), this is identical with tradition. Then matrix differential equation (D) just is Einstein' electromagnetism tensor matrix. $\hat{L}$ is spinor since existence of $\hbar\omega$ in the wave equation, it also is angular momentum formed since elastic collision of light quantum system revolving to wind the particle center O . Its proper value 'l'definited as isospin,

$\vec{B}(A) = \int_0^\infty \delta(A)\vec{b}(r)d\tau = \int_0^\infty \delta(A)\, rot\, \rho(x_\mu)\vec{U}(x_\mu)d\tau = rot\, \rho(A)\vec{U}(A)$, and definite $\vec{A}(A) = \rho(A)\vec{U}(A)$ as vector potential, thus $\vec{B} = rot\,\vec{A}$, so the equation group (b) can all identify with Maxwell electromagnetic field equation and Einstein' electromagnetism tensor matrix unexpectedly. How wonderful it is!

It must be explanation (1) The result of volume integral in region $0 \to \infty$ is regard as the particle is a bulk particle entirely acting outward to another bulk particle. (2) The first $\delta(A)$, $\vec{E}(A) = \int_0^\infty \delta(A)\vec{g}(r)d\tau$ is shows that the density of another particle is concentrated in A (x,y,z) again, but the second $\delta(A)$ shows $\psi_\mu = \rho(A)U_\mu(A)$, $\rho(A) = \delta(A)$ that the density of particle is concentrated in A, two "A" are unlike.

According to the vibration energy and momentum of the light quantum system and the mechanics principle completely from the above discussion, has been established the new concept of the electric charge, with the isospin, and the vector potential, electromagnetism tensor and electromagnetic field theory. Those are unanimously complete with the Maxwell electromagnetic field equation and Einstein' electromagnetism tensor matrix of tradition. What a surprise they are. These derivation courses with the establishment of electromagnetic field theory of new concept is not supported from the Coulomb's law, the ampere ring road law etc. a bit, but has been established completely by energy conservation and the mechanics principle of light quantum system. This result has fully proved the mechanics course of the light quantum system that the electromagnetism effect is.

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