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Relativistic Quantum Equation For Electromagnetic Field And Bio Photons

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Abstract:

Using special relativistic energy momentum relation beside plank and De Brogglie quantum hypothesis, the light and electromagnetic field equations of motion was derived. This equation conforms with observations. This is since it shows that for macro objects light and electromagnetic fields behaves like waves. But for micro particles on the nano and angstrom scales and all smaller scales they behave as highly localized photons. This shows clearly that this equation really represents the photon equation. The experimental observations of the biophotons concerning the quantum incoherence behavior of bio photons and their spatial decay far from the source, beside the static nature of the biophotons, which can be explained by this model confirm the ability of this model.

1. Introduction:

Light and electromagnetic waves plays an important role in our day life. Light stimulate the vision sense which enables us to see and communicate with the surrounding. Electromagnetic waves (EMW) are widely used in telecommunication, television and mobile phones. The nature of light and electromagnetic waves was tackled by newton which propose that EMW behave like particles. Unfortunately this model fail in explaining interference phenomenon. This encourages huygen to assume that EMW behave like waves. The wave model succeeded in explaining reflection, refraction, interference and diffraction [1,2].

The wave model fail in explaining black body radiation phenomenon. This forces max plank to propose his quantum model. In his model light and all EMW behave as discrete quanta having energy proportional to its frequency. This means that light and electromagnetic waves have dual nature [3]. They behave some times as waves, and can behave also as particles. The light and electromagnetic quanta is called a photon. This dual nature of EMW encourages De Brogglie to propose that particles like electrons can behave also as waves. This hypothesis was confirmed experimentally by the electron diffraction experiment. This dual nature of the atomic world led to the born of quantum physicsquantum laws succeeded fortunately in explaining a wide variety of atomic and elementary particle phenomena [4].

In spite of these successes this quantum the any fails in unifying all forces and solving some problems associated with the nature of photons .Till now no quantum photon equation which explain all photon phenomena exist. Recently the nature of so called bio photons cannot fully explained theoretically, the existence of bio photons was experimentally verified using many devices like photon multiplier tubes (PMT) or single photon emission detection unit (SPE) [5].

Many researches wave made concerning the existence of bio photons and their theoretical models beside their applications in medicine and biology [6].

In the work done by Maurizio Ben fatto in collaboration with others, he study bio photons and emergence of quantum coherence from germinating seeds using diffusion entropy analysis (DEA)O techniques. This technique can determine whether the signal complexity is generated either by non-ergodic crucial events with non – stationary correlation function or by infinite memory of a stationary but non-integrable correlation function or by a mixture of both processes was observed. However with the progress of germination the non- ergodic component tends to vanish and complexity becomes dominated by the stationary infinite memory [7]. This work shows possibility of detecting bio photons using DEA.

Roel and van Wijk and Eduard RA van Wijk review the main developments made in the field of bio photon emission. The study shows that photon emission recording techniques can allow resolution of the signal and time, where spatial intensity resolution is possible. This resolution is related to the bio photon heath and disease intensity and resolution aspects. Only few studies allow first conclusion about the implications and significance of bio photons in relation to health and disease [8]. This means that the developed technique can utilize time and spatial resolution to promote bio photon application in medical diagnosis to differentiate between normal and infected tissue.

The behavior of bio photons in the visual perception of a single object image was studied by I.Bokkon and other researchers. They show that the bio photons are not by-products of cellular metabolism but originating from regulated cellular radical/radox processes. They also show that the bio photon intensity can be considerably higher inside cells than outside. Their calculations suggest that the real bio photon intensity in retinotopic neurons many be sufficient for creating intrinsic bio physical picture representation of a single – object during visual perception [9]. This paper thuo suggests radical / redox process as another mechanism for bio photon generation beside metabolism.

To quantify the therapeutic effect, Jeremy B. Kent and other researchers study the effect of two bioactive compounds. These compounds are Reiki and sham. The study measure the effects of Reiki an mice intervertebral disc (IVD) cells compared with sham and to quantify Reiki by measuring photon emission. Mice IVD cells were treated with ten-minute session of either Reiki or sham on three successive days. The bio photons detection was made using photon multiplier (PMT) tube, where cells were placed in a specific box with installed PMT. The study shows that Reiki significantly increased the photon emission of the cells post-treatment comported with Reiki treatment and sham (PC0.05). Real time PCR (RTPCR) showed an increase in collagen 11 and agree can (PC 0.05) [10]. Therefore bio photons can detected using PMT detector and can be increased using some chemical compounds which can activate cells.

The work done by Majid Rahnama and others was devoted to study the interaction of mitochondrial bio photons with micro tubules from a quantum mechanical point of view. The theoretical analysis shows that the interaction of bio photons and microtubules causes transition or fluctuation of microtubules between coherent and incoherent states. This transition has been confirmed experimentally using alpha electro encephalogram (EEG) diagrams which are related to the fluctuation function of microtubules [11]. As a result EEG can be also utilized to detect bio photons beside PTM.

The paper published by Jason Cohen and other colleges study the effect of irradiating human cells with low dose gamma radiation. This is motivated by the fact that bio photon emission leading to by stander effects (BES) was shown in beta – irradiated cells. In this study photon emission was measured in HCTII6 $P^{53+/+}$ cells irradiated with a total dose of 22mgy from cesium – 137 source at a dose rate of 45 mGy/min. A single photon emission detection unit was used and shielded with lead. Higher quantities of photon emission were observed when the cells in a tissue culture vessel were captured at 340nm and 610nm. HCTII6 $P^{53+/+}$ cells emitted 205 times more 340nm UVA bio photons than 610nm bio photons. Thus gamma radiation was shown to induce bio photon emission from biological cells [12]. Hence a third detector, which is a single photon emission (SPE) detection unit, can also be utilized in bio photon diction beside PMT and EEG. The gamma photons activate cells to increase bio photon emission in the UV region.

Billy C.S yearning ton with other researchers. In their work, cultures of Bl6 – BL6 cells were exposed to weak electromagnetic field (EMF) for one hour. The EMF generator has been used to purify water of toxins. A significant decrease in mean photon counts was observed from BI6 – Bly cells exposed at a distance im compared to those exposed at om. The spectral power density change was also observed in 8 – 10 Hz range [13]. These results show that bio photons intensity decreases with distance and changes when the EMF frequency changes. Therefore the change of frequency of the externally applied field affect cell activity.

A review on bio photon research and its applications was made by Amir Hamouda and two other researchers. Their work indicates that bio photons obey poison distribution law. Bio photons are characterized by high degree of coherence, for normal people. Cancer patients lost this coherence. Their frequencies ranges from UV through the near IR. They can be detected by photomultiplier tubes (PMT) [14].

Although bio photons are classified in the literature as electromagnetic fields, but some researchers think that they are different from electromagnetic fields in many respects. One of them is Siva Poobal asingam, M.D., who propose that bio energy are in the form of static energy in the form of circles. This biological field cause living cells to be unclamped thus improve blood circulation, lymphatic circulation and reduce tissue compression, swelling and pain there by promote healing [15]. This new version of static nature of bio photons conforms with the experimental foundations of magnetic therapy. All these researches and applications of bio photons motivates to do this work. Section 2 is devoted for the theretical model and discussion. Conclusion is in section 3.

2. The Bio photon and photon equation of motion.

The photon obeys mainly plank hypothesis, i.e its energy E, is given in terms of its frequency f, and plank constant h, in the form

$$E = hf = \hbar w \quad (1)$$

$\hbar = h/2\pi w = w\pi f =$angular frequency since its speed is very high it must also obeys energy-momentum relativistic relation

$$E^2 = C^2P^2 + mo^2C^4 \quad (2)$$

A summing the photon to be mass less

$$E^2 = C^2P^2$$
$$E = C\,P \quad (3)$$

Using the well-known frequency wave lengthλ, relation

$$c = \lambda\, f \quad (4)$$

$$E = hf = \frac{hc}{\lambda} = \frac{h}{2\pi}\frac{2\pi}{\lambda}c = \hbar kc \quad (5)$$

Where the wave number is defined to be

$$k = \frac{2\pi}{\lambda} \quad (6)$$

Comparing equations (5) and (3), the momentum of the photon is given by

$$p = \hbar k \quad (7)$$

The photon can be assumed to be in the form

$$\Psi = A\int_k^{k+\Delta k} e^{i(kx-wt)}\,dk = Ae^{-iwt}\int_k^{k+\Delta k} e^{ikx}\,dk \quad (8)$$

$$\Psi = \frac{A}{ix}e^{-iwt}\left[e^{iwt}\right]_k^{k+\Delta k} = \frac{A}{ix}\left[e^{i(k+\Delta k)} - e^{iwt}\right]$$
$$= \frac{A}{ix}e^{i(kx-wt)}\left[e^{i\Delta kx} - 1\right] \quad (9)$$

This represent a wave packet highly localized at or near $(x = 0)x \to 0$.

Where

$$|\Psi|^2 \to \text{Large} \qquad x \to 0$$
$$|\Psi|^2 \to 0 \qquad x \to \infty \quad (10)$$

This can be represented schematically as in figure (1)

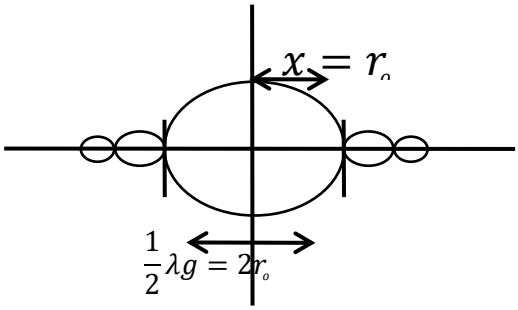

Fig (1) the photon as highly localized wave packet.

Since the photon exists near $(x = 0)$ thus $(x \to 0)$, therefore

$$i(\Delta k)x \to 0$$

Hence one can expand the exponential function to be

$$e^{i\Delta kx} = 1 + i\Delta kx = 1 + ikgx$$

(11)

Where kg is the wave number of the wave packet satisfying (see figure (1)).

$$Kg = \frac{2\pi}{\lambda g} = \frac{2\pi}{4r_o} = \frac{\pi}{2r_o} = \frac{\pi}{2x}$$

(12)

Inserting (10) and (11) in (8) gives

$$\Psi = \frac{A}{ix}[ikgx]e^{i(kx-wt)} = Akge^{i(kx-wt)} = \frac{A\pi}{2r_0}e^{i(kx-wt)}$$

(13)

$$\Psi = A_0 e^{i(kx-wt)}$$

(14)

Where

$$A_0 = \frac{\pi A}{2r_0}$$

(15)

With the aid of equation (1) and (7)

$$\Psi = A_0 e^{\frac{i}{\hbar}(px-Et)}$$

(16)

Equations (14) and (15) shows that for the frame at the Centre of the photon it is highly localized.

However for any other frame $(x = s + r_0)$ it is not. Differentiating (15) w.r.t time and space gives:

$$\frac{\partial^2\Psi}{\partial t^2} = -\frac{E^2}{\hbar}\Psi \qquad \nabla^2\Psi = -\frac{P^2}{\hbar^2}\Psi$$

$$E^2\Psi = -\hbar^2\frac{\partial^2\Psi}{\partial t^2}\, P^2\Psi = -\hbar^2\nabla^2\Psi$$

(17)

A direct substitution of equation (16) in (2) gives the photon and bio photon equations in the form

$$E^2\Psi = c^2P^2\Psi + mo^2c^4\Psi$$

$$-\hbar^2\frac{\partial^2\Psi}{\partial t^2} = -\hbar^2c^2\nabla^2\Psi + mo^2c^4\Psi$$

(18)

When the photon has very small rest mass which can be neglected to satisfy the relations (3) and (17)

$$-\hbar^2\frac{\partial^2\Psi}{\partial t^2} = -c^2\hbar^2\nabla^2\Psi$$

3. General solution of the electromagnetic field equation

Equation (18) can be solved by suggesting spatially separable wave function, with time oscillation in the form

$$\Psi = e^{-\gamma x}Y(y)Z(z)e^{-iwt}$$

(20)

A direct differentiation w.r.t to space and time gives

$$\nabla^2\Psi = yz\frac{\partial^2 e^{-\gamma x}}{\partial x^2} + ze^{-\gamma x}\frac{\partial^2 y}{\partial y^2} + xe^{-\gamma x}\frac{\partial^2 z}{\partial z^2}$$

$$\nabla^2\Psi = \left[\gamma^2 yz + z\frac{\partial^2 y}{\partial y^2} + y\frac{\partial^2 z}{\partial z^2}\right]e^{-\gamma x}$$

(21)

A direct substitution of (20) in (18) gives

$$-E^2\Psi = -\hbar^2 w^2\Psi = \hbar^2 c^2\nabla^2\Psi$$

(22)

Hence the action of the energy operator in eqn (20) confirms the fact that photon energy is $(E = \hbar w)$. Thus

$$-E^2\Psi = \hbar^2 c^2\nabla^2\Psi$$

$$\nabla^2\Psi = -\frac{E^2}{\hbar^2 c^2}\Psi = -\frac{\hbar^2 w^2}{\hbar^2 c^2}\Psi = -k^2\Psi$$

(23)

Again the action of momentum operator in (22) shows that for the photon. Hence eqn (20) gives

$$\left[\gamma^2 y\, z + z\frac{\partial^2 y}{\partial y^2} + y\frac{\partial^2 z}{\partial z^2}\right]e^{-\gamma x} = -k^2 y\, ze^{-\gamma x}$$

(24)

Can celling the exponential term and dividing all sides by yz yields

$$\gamma^2 + \frac{1}{y}\frac{\partial^2 y}{\partial y^2} + \frac{1}{z}\frac{\partial^2 z}{\partial z^2} = -k^2$$

(25)

Consider now a photon within a rectangular wave guide in the region $(y = 0,\ y = a\ , z = 0,\ z = b)$. Thus one can suggest

$$\frac{1}{y}\frac{\partial^2 y}{\partial y^2} = -N^2$$

(26)

$$\frac{1}{Z}\frac{\partial^2 Z}{\partial Z^2} = -M^2$$

(27)

y = sin ∝ y

$$\frac{\partial^2 y}{\partial y^2} = -\propto^2 y$$

(28)

$$-\propto^2 y = -N^2$$

$$\propto = N$$

(29)

Considering photons inside a wave guide with confined in a region$(y = 0,\ y = b)$. Thus

$$y = 0 \qquad y = 0$$

(30)

$$\sin \quad 0 = 0$$

(31)

And

$$y = a \qquad y = 0$$

(32)

$$y(a) = \sin \propto a = 0$$

(33)

$$\propto a = 2\,n\,\pi \qquad n = 0,1,2,3 \ldots \ldots$$

(34)

$$N = \propto = \frac{2\,n\,\pi}{a}$$

(35)

Similarly for a wave guide in the region $(z = 0\,,\ z = b)$

$$Z = \sin \beta Z$$

$$\frac{\partial^2 Z}{\partial Z^2} = -\beta^2 Z$$

(36)

$$-\beta^2 Z = -M^2 Z$$

$$\beta = M$$

(37)

$$Z = 0 \qquad Z = 0$$

(38)

$$0 \ = \ \sin \ 0$$

(39)

$$Z = b \qquad Z = 0$$

(40)

$$\sin \beta b = \ 0$$

(41)

$$\beta b = 2\,\pi\,m$$

$$m = 0\,,1\,,2\,,3\,, \ldots \ldots$$

(42)

$$M = \beta = \frac{2\pi m}{b}$$

(43)

A direct insertion of equations (25) and (26) in (24) gives

$$\gamma^2 - N^2 - M^2 = -K^2$$

$$\gamma = \pm\sqrt{-K^2 + N^2 + M^2}$$

(44)

$$\gamma = \sqrt{-K^2 + \left(\frac{2\pi n}{a}\right)^2 + \left(\frac{2\pi m}{b}\right)^2}$$

(45)

4. Behavior as an electromagnetic wave for bulk matter

For bulk matter, the dimensions are relatively large

$$a \to \infty \qquad\qquad b \to \infty$$

(46)

Compared to the ordinary light wave number

$$K \sim \frac{2\pi}{\lambda} \sim 10^{14}$$

(47)

For one millimeter

$$a \gtrsim 10^{-2}\frac{1}{a^2} \sim 10^{4}$$

(48)

Thus

$$\gamma = \sqrt{-1}\sqrt{k^2} = i(IK)$$

(49)

Selecting the minus sign in (48) equation (19) becomes

$$\Psi = yze^{i(kx-wt)}$$

(50)

With the aid of eqns (45), (34) and (42) beside (25) and (26)

$$N = 0 \qquad\qquad M = 0$$

(51)

And thus equations (25) and (26) can be solved y by suggesting

$$y = A_1 = \text{constant} \qquad Z = A_2 = \text{constant}$$

(52)

To make eqn (49) to be

$$\Psi = A_1A_2e^{i(kx-wt)} = A\, e^{i(kx-wt)}$$

(53)

This means that when the light or electromagnetic wave interact with large macro bulk matter it behave as a pure wave. This agrees with observations.

5. Behavior as a photon for micro particles

Consider now the case when they interact with micro nano or move smaller systems such that: Solutionsolution

$$a \sim 10^{-9}m$$

$$\left(\frac{2\pi n}{a}\right)^2 \sim 10^{18}$$

(54)

On the atomic scale $(10^{-10}m \sim 1A)$

$$a \sim 10^{-10}$$

$$\left(\frac{2\pi n}{a}\right)^2 \sim 10^{20}$$

Thus in view of equations (44), (44) and (53)

$$\gamma = \sqrt{\left(\frac{2\pi n}{a}\right)^2 + \left(\frac{2\pi m}{a}\right)^2} \sim 10^9$$

(55)

Thus equation (19) gives

$$\Psi = e^{-\gamma x} yz e^{-iwt} = e^{10x} yz\, e^{iwt}$$

(56)

This represent a highly localized wave. Confining ourselves to the y direction only, using equations (27) and (28), equation (54) reads

$$\Psi = e^{10x} e^{-iwt} \sin \propto y$$

(57)

Which represent highly localized oscillating gravelling photon in the y direction, localized near $(x = 0)$.

This may explain why on the atomic scale electromagnetic waves behave as highly localized isolated particles. Equation (55) can also explain the decay of bio photons away from the source as pointed out by Billy C.S [14].

6. Bio photons behavior and quantum entalgenment

Let us look, how bio photons looks like, to do this, one have to bear in mind that low electromagnetic frequencies, in the range

$$f \sim w \sim 20 - 100\ \text{Hz}$$

(58)

Interact with human body and cause sometimes healing or get rid of pain. Thus one expect the bio photons to be of the same frequency range. Thus the wave length, should be in the range.

$$\lambda = \frac{c}{f} \sim 10^6 - 10^7 m$$

(59)

Thus the wave number is the range

$$\lambda = \frac{2\pi}{\lambda} \sim \frac{1}{\lambda} \sim 10^{-7} - 10^{-6} m^{-1}$$

(60)

Thus for bio photons, equations (52) and (57) gives

$$k \sim 0$$
$$\Psi = A\, e^{-iwt}$$

(61)

Thus bio photons are not travelling waves, but standing waves which almost distribute it self instantaneously in the space, where its speed v is given by

$$v = \lambda f = \frac{w}{k} \to \infty$$

As

$$k \to 0 \qquad\qquad k \to 0$$

(62)

Thus any standing non travelling wave, have zero wave number and very large wave length, i.e

$$\lambda \to \infty \qquad\qquad k \to 0$$

(63)

Thus

$$v = \frac{w}{k} \to 0$$

This any bio photon or quantum entanglement process is associated with almost instantaneous distribution with non-travelling standing vibrating waves which vibrate with time.

6. Conclusions

We formulated equation of motion of the photon which shows very interesting properties that agree with experimental observations thus confirms its viability. For bulk matter on the macroscopic scale the electromagnetic field behaves as a wave. But for elementary particles and atoms on a micro scale it behave as a localized pho Solution solution ton (particle). Moreover the energy and momentum operators gives the correct expressions for the photon energy and momentum. These results conforms with experimental observations completely. It also confirms the fact that Schrodinger and relativistic quantum equations can describe the photon behavior, since the wave function expression was derived using plank hypo this and it represent integration of spatial waves over the momentum k space which represent highly localized wave packthus The work also predicts also the attenuation, incoherence, and static behavior of biophotons $\left[\Psi(x) = \int_0^\infty \Psi_P \, e^{ikx} dk\right]$

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