Photon as a Basic Unit

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Abstract   Since photon is the most common and abundant particle in our universe and a lot of its properties are under study, this research has done to investigate some of its properties by comparing the properties of the starting and final products in some annihilation processes; as a result some fundamental properties like structure, mass, length, velocity and motion path radius for photon have been deduced, and by relating these properties with the properties of other subatomic particles like proton, electron and positron; it was suggested that photon may be the origin of these subatomic particles, then the method of how these properties can be used for atomic radii calculation, explaining photoelectric effect, Compton effect and deriving some nature's constants has been illustrated.

Keywords   Photon structure, Proton and electron structures, Photon length, Photon mass, Photon velocity, Charge origin, Positron source, Atomic radii, Nature's constants, Spin, Photoelectric effect, Compton effect

1. Introduction

Light was described by Huygens in 1679 as a wave, his theory was approved by the discovery of Young and Fresnel for interference and diffraction, Plank ensured this idea by his formula for the black body radiation and by introducing the new constant h which has called quantum of action [1], in 1902 Lenard showed that the energy of the electrons in the photoelectric effect does not depend on the intensity of the incident light but depends on its wavelength [2], Einstein illustrated Lenard's discovery by suggesting that light energy is distributed in space in the form of localized light quanta [3]. With this suggestion Einstein renewed Newton's point of view for the corpuscular nature of light, in 1923 Compton confirmed the corpuscular nature by scattering of X-rays on electrons [4]. Annihilation of subatomic particles versus their own antiparticles according to energy-mass equivalence principle [5] produce other subatomic particles and photons e.g. electron and positron annihilation and creation process [6], proton and antiproton annihilation into electron-positron pairs and gamma ray pairs [7]. Since many photon's properties are under study; this study has done in a try to understand the nature of the photon, derive its fundamental properties like structure, mass, velocity and length, and to show how photons interact with each other and with other particles, then to reveal how these properties are useful in describing other subatomic particles and atom structures, calculating atomic radii and deriving some nature's constants.

2. Structure and Nature of Photon

Constant velocity of light which does not depend on the nature of the source or on the frequency, its dual nature and spin [8] are among the properties of light which lead us to postulate a structure for photon as a sperm "see Figure. 1" consisting of three parts: head, spiral tail, and a separator which is the point at which head and tail can be connected or separated, From this point of view photon can act as a particle by the head part and as a wave by the spiral tail which gives it the spin and momentum by continues motion clockwise or anticlockwise.

The following criteria for photons have to be postulated with respect to photon's suggested structure to reveal some properties for photons, subatomic particles and atom in the following sections;

1. Head to head Interaction: collision between photons' heads is elastic, constructive or destructive according to interaction energy level.
2. Head to tail interaction: head of one photon can penetrate tail of another one in the same motion phase clockwise or anticlockwise till the head meets the separator forming a unified one tail and branches of heads (tree form).
3. Tail to tail interaction: tails in an opposite motion phases can penetrate each other forming a unified one tail.
4. Head like the separator has 1/6 photon's length and mass while tail has 2/3 of its length and mass.
5. Head can be separated or connected to the tail as a separate particle.
6. Wavelength concept is the linear distance between 2 successive photons.

7. Frequency is number of photons pass a definite point per second.
8. Parallel tails in the same phase can be unified and become longer.

3. Charge Origin

Coulomb (c) is the measurement unit of charge; which means the charge transported by a constant current of one ampere in one second, hence coulomb unit is defined by number of charge carriers and time; which gives us the concept of frequency so it can be deduce that charge is the time which one particle takes to pass a definite point.

4. Mass of Photon

In electron-positron annihilation and creation process; electron and positron turn into 2γ rays with equal wavelengths and vice versa, also γ rays were produced from proton and antiproton annihilation process; it can be postulated that photons are in the interior structure of electron, positron and proton and they are the main units in these particles.

Photon's rest mass can be derived from the rest mass of the annihilated particle as in electron-positron annihilation and creation process by making comparison between masses and charges (times) of the electron or positron and the photon produced from the annihilation process; the time for one electron with a mass $9.1094 \, x \, 10^{-31} kg$ is $1.6 \times 10^{-19} s$ -as postulated in section 3- while the time for the photon γ_e produced from electron-positron annihilation process with energy $0.511 \, mev$ and frequency $\upsilon = 1.24 x 10^{20} Hz$ is $1/\upsilon = 8.06 \, x \, 10^{-21} s$ so photon mass from electron can be calculated as

Electron mass → *photon mass* ?

Electron time → *photon time*

$$photon \; mass \; = \frac{Electron \; mass \; x \; photon \; time}{electron \; time}$$

$$= \; 4.59 x \, 10^{-32} kg \simeq 4.6 x \, 10^{-32} kg$$

The ratio n of particle mass M to photon mass m_o can be considered as number of photons in a particle

e.g. $n_e = \dfrac{electron \; mass}{photon \; mass} = 19.8$

5. Velocity and Motion Path Radius of Photon

Einstein's energy-mass equivalence formula $E = mc^2$ plus Plank's black body radiation formula $E = h\upsilon$ resulted in quantum of action constant $h = mc\lambda$. By introducing photon's mass m_o in this formula

$$\frac{h}{m_o} = c\lambda = 1.44 \times 10^{-2}$$

In this equation c is inversely proportional to λ, but c is the universal light constant, so it has to be exchanged by the tangential velocity V.

$$\frac{h}{m_o} = V\lambda = 1.44 \times 10^{-2} \qquad (1)$$

Photon's motion path radius r can be calculated by calculating its tangential V and angular ω velocities where

$$V = \omega r = 2\pi \upsilon r$$

e.g. γ_e with a frequency $1.24 x 10^{20} Hz$ and $V = 5.95 \times 10^9 m/s$ has $r = 7.6 \, x \, 10^{-12} m$, the same with all frequencies; the same radius has obtained.

6. Length of Photon

Photon's length L_o is the distance passed by the photon in time $(t = 1/\upsilon)$ with tangential velocity V hence $L_o = V \times t$ e.g. length of γ_e with $V = 5.95 \times 10^9 m/s$ and $t = 8.06 \, x \, 10^{-21} s$ is $L_o = 4.8 \times 10^{-11} m$; the same with all frequencies the same photon's length has obtained. In annihilation processes within mass-energy equivalence level the ratio of the produced photon's length to its wavelength (L_o / λ) equals the ratio of particle's mass to photon mass.

$$\frac{L_o}{\lambda} = \frac{M}{m_o} = n \qquad (2)$$

$$m_o \times L_o = M \times \lambda \qquad (3)$$

7. Electron Mass

In section 4 the ratio of electron mass to photon mass is not integer number, if $(1/6) m_o$ which represents photon's head mass is added to electron mass

$$9.1094 \times 10^{-31} + \frac{1}{6} \left(4.59 \times 10^{-32} \right) = 9.1859 \times 10^{-31} Kg$$

In this case the ratio $n_e = 20$ is an integer number; this means that there are 2 masses for the electron which can be described as the free electron with mass $9.1094 \times 10^{-31} Kg$ and the bounded electron with mass $9.1859 \times 10^{-31} Kg$.

This suggested difference in electron mass can be explained by describing electron-positron creation process under the control of the suggested criteria for photon in section (1);

1. Two γ rays with energy 0.551mev in an opposite direction to each other make collision in a definite

point.

2. Head to head interaction: Destructive interaction between the first photons' heads in each series and the 2 heads will be separated as separate particles with masses $(1/6)m_o$.

3. Head to tail interaction: the second photon in each ray penetrates the first one in its series and makes a branch and so on with a definite number of photons (20 photons).

4. Two particles are formed in a tree form structure with one condensed tail and branches of heads "see Figure. 1" with the same mass but opposite in direction motion (clockwise and anticlockwise) which can be interpreted as charge sign: positive or negative.

Electron-positron creation process has done by losing the first photon's head in each series which resulted in the formation of free electron or positron which can be converted into bounded electron by receiving one photon's heads.
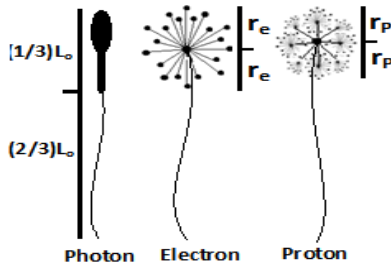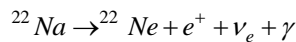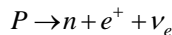

Figure 1. An approximation for Photon, electron and proton structures with an indication for their lengths L_o and radii

8. Positron Origin and Proton Structure

Since electron-positron pairs and γ rays were produced from proton-antiproton annihilation process [7], also proton-antiproton pairs were produced by electron positron beams collision [9], and some radioactive isotopes decay by emitting positrons, e.g. ^{22}Na [10] according to the decay reaction

$$^{22}Na \rightarrow ^{22}Ne + e^+ + \nu_e + \gamma$$

which occurs by electron capture as first suggested by Yukawa [11]

$$P \rightarrow n + e^+ + \nu_e$$

So it can be postulated that proton is formed from positrons in a tree form structure with one condensed tail and branches of positrons' heads as in section (7), "see Figure. 1", and vice versa antiproton is formed from electrons.

If 1/6 positron's mass is added to proton mass

$$m_p = 1.67261898 \times 10^{-27} + \frac{1}{6}\left(9.1859 \times 10^{-31}\right)$$

$$= 1.672772078 \times 10^{-27} \, Kg$$

The ratio of proton mass to positron mass gives an integer number

$$\frac{1.672772078 \times 10^{-27}}{9.1859 \times 10^{-31}} = 1821 \, positrons$$

As described in section (7); proton has 2 masses: free proton with mass $1.67261898 \times 10^{-27} \, Kg$ and bounded proton with mass $1.672772078 \times 10^{-27} \, Kg$.

9. Atomic Radii

On the basis of the suggested structures for photon, proton and electron; models for hydrogen and helium atoms can be suggested, then other atoms can be expressed in the same way to derive a general formula for atomic radii calculation.

9.1. Electron and Proton Radii

Photon's head plus the separator have been postulated in section (2) to represent 1/3 of its length and as postulated in section (7) they are the basic unit of electron's head, so photon's head plus the separator length $(1/3)L_o$ in the electron is supposed to represent electron radius r_e "see Figure. 1" which has to be decreased with respect to electron mass to be balanced with photon's head length and mass

$$\frac{1}{3}m_o \times \frac{1}{3}L_o = \frac{1}{3}m_e \times \frac{1}{3}L_e$$

$$r_e = \frac{1}{3}L_e = 8.06 \times 10^{-13} \, m$$

Also as postulated in section (8) that proton's head is formed from positrons' heads (the same radius as electron) and its radius r_e in the proton represents half proton radius r_p "see Figure. 1" which has to be decreased with respect to its mass m_p to be balanced with positron mass m_e and radius r_e

$$\frac{1}{3}m_e \times 2r_e = \frac{1}{3}m_p \times \frac{1}{3}L_p$$

$$r_p = \frac{1}{3}L_p = 0.8779 \times 10^{-15} \, m$$

9.2. Hydrogen Atom

In hydrogen atom proton is connected to electron by an attractive force; which can be expressed with respect to the suggested structures for electron and proton by the interaction and complete unification between their 2 tails (opposite phases). As postulated in section (7); tail motion direction is responsible for charge sign, so as the 2 tails of electron and proton unify they cancel the charge of each other and the resulted atom become neutral with straight total length L_H "see Figure. 2"

$$L_H = L_o + \frac{1}{3}L_o = 6.4 \times 10^{-11} \, m$$

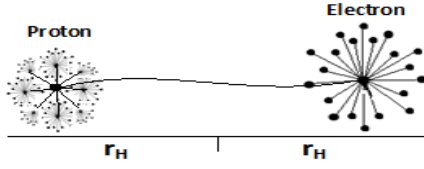Hydrogen atom radius $r_H = L_H / 2 = 3.2 \times 10^{-11} m$, and hydrogen's electron occupies 1s orbital.

Figure 2.   An approximation for Hydrogen atom structure with its radius r_H

9.3. Helium Atom

Helium atom is formed from 2 protons and 2 electrons, hence from 2 hydrogen atoms, if the 2 protons completely interfered by heads in the nucleus, the total straight length L_{He} will be decreased by $(1/3)L_o$

$$L_{He} = 2L_H - \frac{1}{3}L_o = 11.2 \times 10^{-11} m$$

For the stability of helium atom; it is postulated to be bended like water molecule with an angle ϕ between the 2 electrons "see Figure.3".

The length from electrons' heads to nucleus equals $L_{He} / 2 = 5.6 \times 10^{-11} m$, if it divided by 2 the result is the radius of helium atom $r_{He} = 2.8 \times 10^{-11} m$. The angle θ in helium atom can be estimated in structure (1) in case if the 2 electrons' heads touched each other but did not interfere

$$\theta = tan^{-1} \frac{8.06 \times 10^{-13}}{5.6 \times 10^{-11}} = 0.8246°$$

$$\phi = 2\theta = 1.649°$$

In structure (2), in case if the 2 electrons' heads interfered to touch the centre of each other, the angle

$$\theta = tan^{-1} \frac{4.03 \times 10^{-13}}{5.6 \times 10^{-11}} = 0.4123°$$

$$\phi = 2\theta = 0.8246°$$

The 2 electrons of helium atom make coupling in 1S orbital.

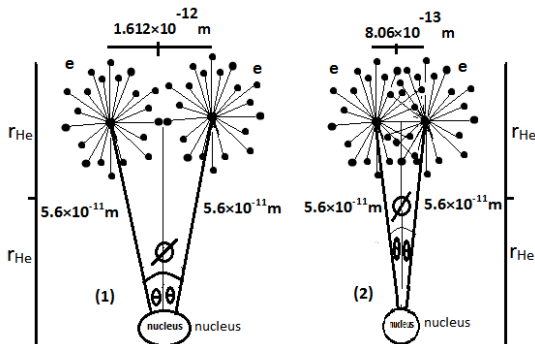**Figure 3.**   An approximation for Helium atom structure with its radius r_{He} and the angle between the 2 electrons ϕ

9.4. Lithium Atom

Lithium atom is suggested to be formed by adding third hydrogen atom to helium atom by inserting its proton into the nucleus in a new level "see Figure. 4", the new electron will occupy 2s orbital. The mass of the added electron and its length have to be balanced with the masses and lengths of the 2 electrons in 1s orbital.

$$m_e r_1 + m_e r_2 = m_e r_3$$

$$r_1 + r_2 = r_3$$

$$r_3 = 11.2 \times 10^{-11} m = 2r_H + L_o$$

As a postulation; $(1/3)L_o$ will be added to this length for the formation of new level in the nucleus and the radius become

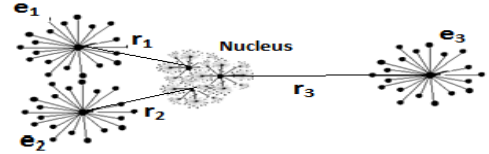$$r_{li} = 2r_H + L_o + \frac{1}{3}L_o = 12.8 \times 10^{-11} m$$

Figure 4.   An approximation for lithium atom structure

9.5. Beryllium Atom

As in section (9.4) the electron of the fourth hydrogen atom will occupy 2s orbital and make balance with the third one to be degenerate in the same orbital and the radius become

$$r_{Be} = (r_{li} + 2r_H)/2 = \left(2r_H + 2L_o + \frac{2}{3}L_o\right)/2 = 9.6 \times 10^{-11} m$$

9.6. Boron Atom

The 5th hydrogen atom will occupy $2p^1$ orbital and force the 2 electrons in 2s orbital to bend forming helium atom with a length

$$\left(2r_{Be} - \frac{1}{3}L_o\right)/2 = 8.8 \times 10^{-11} m$$

The new electron will make balance with the 2S electrons; $(1/3)L_o$ will be added for the new subshell occupation, and the radius become

$$r_B = \left(2 \times (8.8 \times 10^{-11}) + 2r_H + \frac{1}{3}L_o\right)/3$$

$$= (2r_H + 4L_o)/3 = 8.53 \times 10^{-11} m$$

9.7. Carbon Atom

The 6th electron will occupy $2P^2$ orbital and make balance with $2P^1$ electron to be degenerate

$$r_C = (r_B + 2r_H)/2 = (2r_H + 8L_o)/6 = 7.466 \times 10^{-11} m$$

9.8. Nitrogen Atom

The 7th electron will occupy $2P^3$ orbital and make balance with 2P1 and 2P2 electrons to be degenerate and the radius become

$$r_N = (2r_C + 2r_H)/3 = (2r_H + 12L_o)/9 = 7.1 \times 10^{-11} m$$

9.9. Oxygen Atom

The 8th electron will be coupled with one of P orbital electrons to form helium atom with length

$$\left(r_N + 2r_H - \frac{1}{3}L_o \right)/2 = (r_N + L_o)/2$$

The formed helium atom will be balanced with the other 2 electrons to give Oxygen atom with radius

$$r_O = \left(2\left(\frac{r_N + L_o}{2} \right) + 2r_N \right)/4$$
$$= (2r_H + 15L_o)/12 = 6.5 \times 10^{-11} m$$

9.10. Fluorine Atom

The 9th electron will be coupled with one of the 2 odd electrons forming helium atom with length

$$\frac{r_O + 2r_H - \frac{1}{3}L_o}{2} = \frac{r_O + L_o}{2}$$

The formed helium atom will be balanced with the other 3 electrons to give Fluorine atom with radius

$$r_F = \left(2\left(\frac{r_O + L_o}{2} \right) + 3r_O \right)/5$$
$$= (2r_H + 18L_o)/15 = 6.1 \times 10^{-11} m$$

9.11. Neon Atom

The 10th electron will be coupled with the only odd P orbital electron forming helium atom with length

$$\frac{r_F + 2r_H - \frac{1}{3}L_o}{2} = \frac{r_F + L_o}{2}$$

The formed helium atom will be balanced with the other 4 electrons to give Neon atom with radius

$$r_{Ne} = \frac{2\left(\frac{r_F + L_o}{2} \right) + 4r_F}{6} = \frac{2r_H + 21L_o}{18} = 5.9 \times 10^{-11} m$$

9.12. General Formula for Atomic Radii Calculation

By applying the same steps with the next elements in the periodic table, the next general formula can be derived for atomic radii r calculation.

$$r = \frac{nr_H + YL_o}{XM} \tag{4}$$

Where (n, r_H and M) are period number, hydrogen atom radius and number of electrons in the external orbital respectively.

$X = 1$ for s block elements and $X = 3$ for p, d and f blocks elements. Y: Specific constant for each group of atoms according to its position in the periodic table "see Figure. 5"

Figure 5. Gives the (Y) constant value for each element according to its position in the periodic table, and (A) is number of paired orbitals

Table 1. Gives the element symbol (N) and the calculated atomic radii (r) in Pico meter unit according to equation (4)

N	r [pm]	N	r [pm]	N	r [pm]	N	r [pm]	N	r [pm]
H	32	Ti	165.3	Tc	164.2	Dy	203.2	Fr	288
He	28	V	163.5	Ru	160.8	Ho	202.1	Ra	274
Li	128	Cr	162.6	Rh	158.4	Er	201.3	Ac	218.6
Be	96	Mn	162.1	Pd	156.6	Tm	200	Th	213.3
B	85	Fe	159.1	Ag	155.2	Yb	200	Pa	211.5
C	75	Co	156.9	Cd	154.1	Lu	192	U	210.6
N	71	Ni	155.3	In	165.3	Hf	176	Np	210.1
O	65.3	Cu	154	Sn	138.6	Ta	170.6	Pu	209.7
F	61	Zn	153	Sb	129.7	W	168	Am	209.5
Ne	59	Ga	154.6	Te	121.3	Re	166	Cm	207.3
Na	160	Ge	133.3	I	116.2	Os	162	Bk	205.6
Al	128	Se	118.6	La	208	Pt	158	Es	203.1
Si	120	Br	114.1	Ce	208	Au	156.4	Fm	202.2
P	117	Kr	111.1	Pr	208	Hg	155.2	Md	201.4
S	112	Rb	224	Nd	208	Tl	176	No	200.7
Cl	108.8	Sr	192	Pm	208	Pb	144	Lr	202.6
Ar	106.6	Y	181.3	Sm	208	Bi	133.3	Rf	181.3
K	192	Zr	170.6	Eu	208	Po	124		
Ca	176	Nb	167.1	Gd	206	At	118.4		
Sc	170	Mo	165.3	Tb	204	Rn	114.6		

10. Photoelectric Effect

According to Newton's third law; the minimum photon's force $F\gamma$ required for the photoelectric effect and attraction

force Fa between nucleus and electron within an atom are equal in magnitude but opposite in direction of action

$$F\gamma = -Fa$$

Since force is energy E divided by distance d

$$F\gamma = \frac{E}{d} = \frac{h\upsilon}{d} \quad (5)$$

$$Fa = k\frac{q_1 q_2}{r^2} \quad (6)$$

Where $q_1 = q_2 = 1.6 \times 10^{-19} c$ and r is the distance from nucleus to electron which in our case represents the calculated atomic radius, by equating equations (5) and (6)

$$\frac{h\upsilon}{d} = k\frac{q_1 q_2}{r^2}$$

$$\upsilon = \frac{3.48 \times 10^5 d}{r^2}$$

In this case $d = (1/3) \times L_o \times period\ number(n)$

$$\upsilon = \frac{5.568 \times 10^{-6} n}{r^2} \quad (7)$$

Work function ϕ is the minimum energy required to extract an electron from an element, which equals photon's energy $E = h\nu$ required for the photoelectric effect, it can be calculated via equation (7).

Table 2. Gives the element symbol (N), the frequency required for the photoelectric effect and the corresponding work function for some element

N	$\upsilon \times 10^{15}$	ϕ ev	N	$\upsilon \times 10^{15}$	ϕ ev	N	$\upsilon \times 10^{15}$	ϕ ev
Li	0.679	2.819	Zn	0.951	3.934	Pd	1.13	4.675
Be	1.208	4.998	Se	1.58	6.537	Ag	1.15	4.758
Na	0.6525	2.699	Rb	0.555	2.295	Tb	0.803	3.321
Mg	0.903	3.736	Y	0.847	3.504	Ir	1.305	5.399
Al	1.019	4.216	Zr	0.956	3.955	Pt	1.33	5.502
K	0.604	2.499	Mo	1.01	4.215	Au	1.365	5.647
Ca	0.719	2.974	Ru	1.076	4.452	Hg	1.387	5.739
Sc	0.771	3.188	Rh	1.109	4.588	U	0.878	3.632

11. Compton Effect

Compton formula states that $\lambda_s = \lambda_I + \lambda_c(1 - cos\theta)$ where

λ_s, λ_I are the scattered and the incident photon's wave lengths and $\lambda_c = h/m_e c$ is Compton wave length which according to mass-energy equivalence principle equals the wavelengths of the electron λ_e and the produced photons from electron-positron annihilation process hence each photon within the electron has a wave length λ_e. It was postulated in section (7) that electron contains 20 photons in a shape of tree with one condensed tail and branches of heads distributed in the form of sphere "see Figure. 6".
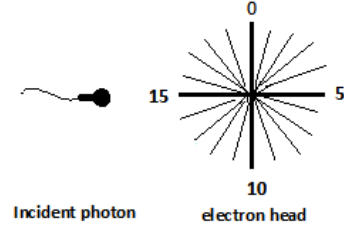

Figure 6. An approximation for the distribution of photons' heads in electron head

If a high frequency photon makes collision with an electron, three things are expected to occur:
1-insertion: the incident photon will insert itself into the electron and number of photons in this electron will be increased by one. 2-Photoelectric effect: the electron will be emitted from the atom with an energy E_e equivalent to its mass and with wave length λ_e. 3-Releasing: the emitted electron will restore its original number of photons by releasing one photon with energy E_s and wave length λ_s according to its position in the electron with respect to the position of the incident photon. These 3 processes can be explained via the following examples with respect to figure (7); 1. Photon in position (5): is on the same axis of the incident one, it will be released with wave length λ_e, according to the third law for newton it will counter the energy of the incident one with the same amount of energy but in different direction so its wave length will be increased by λ_I, the released photon is in the same direction of the emitted electron so the electron will give the photon its energy E_e so the wave length of the released one will be decreased by λ_e hence the total released photon's wave length λ_s become $\lambda_s = \lambda_e + \lambda_I - \lambda_e = \lambda_I$. 2. photon in position (0): is perpendicular to the incident one, it will be released with a wave length λ_e and will counter the incident one so its wave length will be increased by λ_I but it is not in the direction motion of the emitted electron so it will not transfer any of its energy to the released photon and the total released photon's wave length become $\lambda_s = \lambda_e + \lambda_I$. 3. Photon in position (15): will be released with wave length λ_e and will counter the incident one so its wavelength will be increased by λ_I also it will lose an energy E_e to counter the motion effect of the emitted electron in an opposite direction to its motion so its wave length will be increased by λ_e again and the total wave length become $\lambda_s = \lambda_e + \lambda_I + \lambda_e = \lambda_I + 2\lambda_e$. In general the released photon which can be called the scattered one will have the wave length of the electron plus the wave length of the incident one to counter its effect plus or minus all or part of the emitted electron wave length according to the released photon's position with respect to the direction motion of the electron.

12. The Relation between Photon's Constants and Some Nature's Constants

The suggested concepts and constants for photons as mass, length, and velocity can enable us to explain the origin of some other constants and phenomena in nature.

12.1. Plank Constant

According to Plank's formula $E = h\upsilon$, if E is the total energy in one second, υ is number of photons in one second; h is the energy of one photon and it can be expressed as:

$$h = m_o \times L_o \times c \qquad (8)$$

12.2. Light Velocity

According to equation (1)

$$V = \frac{h}{m_o \lambda} \qquad (9)$$

By using equations (3) and (8) and compensating in eq. (9)

$$\lambda = \frac{m_o L_o}{M} \text{ and } h = m_o L_o c$$

$$V = \left(\frac{M}{m_o}\right) c = nc = \left(\frac{L_o}{\lambda}\right) c$$

$$c = \frac{V\lambda}{L_o} \qquad (10)$$

This equation indicates that as V changes with respect to λ the final linear velocity c is constant because L_o and $V\lambda$ are constants.

12.3. Spin of Proton and Electron

Since rotational kinetic energy $K_E = (1/2)I\omega^2$ where moment of inertia $I = mr^2$

$$K_E = \frac{1}{2}mr^2\omega^2 = \frac{1}{2}mr^2\left(\frac{V}{r}\right)^2 = \frac{1}{2}mV^2$$

According to equation (10)

$$V = \frac{cL_o}{\lambda}$$

$$K_E = \frac{1}{2}m\left(\frac{cL_o}{\lambda}\right)^2$$

Multiply both sides by time (t)

$$K_E \times t = \frac{1}{2}m\left(\frac{cL_o}{\lambda}\right)^2 \times t$$

For proton and electron $q = t = 1.6 \times 10^{-19} = L_o / c$

$$K_E \times t = \frac{1}{2}m\left(\frac{cL_o}{\lambda}\right)^2 \times \frac{L_o}{c}$$

According to equation (10) at $V = c$; $\lambda = L_o$

$$K_E \times t = (1/2)mc\lambda = (1/2)h \qquad (11)$$

By dividing by 2π

$$\frac{K_E \times t}{2\pi} = \frac{1}{2}\hbar \qquad (12)$$

Where $\left(\dfrac{K_E \times t}{2\pi}\right)$ formula can be considered as a description for spin property and $\hbar$ is the reduced Plank's constant.

12.4. Temperature and Boltzmann Constant

Boltzmann constant k_b can be obtained by dividing plank's constant h by photon's length L_o

$$k_b = h / L_o = m_o L_o c / L_o = m_o c$$

$$E = K_b T = (h / L_o)T = h(T / L_o) = h\upsilon$$

$$\upsilon = T / L_o$$

$$T = L_o \upsilon = L_o / t = V(velocity) \qquad (13)$$

In this formula temperature can be described as the tangential velocity of the released photons from a body. Boltzmann unit can be expressed as:

$$k_b = \frac{m^2 kg}{s^2 k} = \frac{m^2 kgs}{s^2 m} = Kgms^{-1}$$

12.5. Magnetic Permeability Constant for Free Space

Since magnetic flux density formula

$$B = \frac{\mu_o}{4\pi}\frac{qv}{r^2} = \frac{f}{qv} \qquad (14)$$

where B, q, f, v and μ_o are magnetic flux density, charge, force, velocity and the magnetic permeability constant for free space respectively.

$$f = \frac{\mu_o}{4\pi}\frac{q^2 v^2}{r^2} \qquad (15)$$

As postulated in section (3) that charge q is the time taken by a particle to pass a definite point so the length of the charged particle $L = qv$

$$f = \frac{\mu_o}{4\pi}\frac{L^2}{r^2}$$

If $r^2 = L^2$ $f = \frac{\mu_o}{4\pi} = 1 \times 10^{-7}$

The constant $\mu_o / 4\pi$ can be deduced to be the least force which a charged particle can effect on another point or particle.

12.6. Coulomb Constant

In equation (15); If $v = c$

$$f = \frac{\mu_o c^2}{4\pi} \frac{q^2}{r^2}$$

Where $\mu_o c^2 / 4\pi = k \,(coulomb\ constant)$

If $q = t = 1.6\ x\ 10^{-19}$ so $q \times c = L_o$ and Coulomb's law can be written as

$$f = \frac{\mu_o}{4\pi} \frac{L_o^2}{r^2}$$

12.7. Universal Constant for Gravitation (G)

Newton's law for gravitation

$$f = G\, \frac{m_1 \times m_2}{r^2}$$

This law is a problem between 2 forces affecting 2 masses, in a try to originate the value of G constant; the 2 forces can be expressed as a one reduced force (F)

$$F = \frac{f_1 \times f_2}{f_1 + f_2}$$

$$f_1 \times f_2 = G^2 \frac{m_1^2 \times m_2^2}{r^4} \quad \text{and} \quad f_1 + f_2 = 2\,G\, \frac{m_1 \times m_2}{r^2}$$

$$F = \left(\frac{G}{2}\right) \frac{m_1 \times m_2}{r^2}$$

It was postulated previously that each mass is formed from definite number of photons with masses m_o and lengths L_o, the attraction between the 2 masses was postulated to be done by the interaction between the tails of each mass; hence (G) constant can be replaced in the previous equation by photon's constants (m_o, L_o)

$$F = \left(\frac{X^2 L_o^2}{2m_o^2}\right) \frac{m_1 \times m_2}{r^2}$$

Where (X) is unknown constant, by taking the square root for $\left(\dfrac{X^2 L_o^2}{2m_o^2}\right)$ and comparing (G) value with $\left(\dfrac{X L_o}{\sqrt{2} m_o}\right)$, the (X) value can be calculated to be $9.045 \times 10^{-32} \simeq 2m_o$

$$G = \frac{2m_o L_o}{\sqrt{2} m_o} = \sqrt{2} L_o$$

So Newton's law for gravitation can be written as

$$F = \frac{2m_o L_o}{\sqrt{2} m_o} \frac{m_1 \times m_2}{r^2} = \frac{\sqrt{2} m_o L_o}{r^2} \frac{m_1 \times m_2}{m_o}$$

If $\dfrac{m_1 \times m_2}{m_o} = n$ so $F = \sqrt{2} m_o \dfrac{n L_o}{r^2}$ (16)

According to this equation by increasing the distance between the 2 masses till $r^2 = n L_o$, force between them decreases to be $\sqrt{2} m_o$ which is the least force could be available between 2 masses.

12.8. Acceleration (a)

Acceleration is the change in velocity of an object with respect to time, according to Newton's Second Law

$$F = ma \qquad (17)$$

Where (F) is the net force acting on a body, (m) is the mass of the body and (a) is its acceleration, by equating equations (16) and (17)

$$a = \frac{\sqrt{2} L_o m}{r^2} \qquad (18)$$

Where (m) is the mass of the body with gravitational field and (r) is distance between its centre and the accelerated body, hence acceleration is formulated using photon's length.

13. Gravity and Acceleration

It can be noticed that Newton's law for gravitation, Coulomb law and acceleration are expressed in terms of photon's constants; which strengthen the suggested postulation for photon as a basic unit in building the matter and indicate that magnetic and gravitational fields for an object depend on the properties of the spiral tails it contain.

e.g. according to the suggested models for proton and atom; ionized atom contains at least one proton -not connected to an electron- with free spiral tail characterized by continuous motion (spin) directed towards proton's head; in this case the atom is considered to be charged; due to the free spiral tail which is free to make interaction with other particle or atom (bond formation).

When number of ionized atoms within a body increase number of free protons' spiral tails also increase, groups of these free spiral tails aggregate and unify to be longer and be balanced with each other to surround the body and make a field, which can be interpreted as magnetic or gravitational field.

With this suggestion; gravity can be described to be the interaction and interference of the gravitational field's spiral tails with the connecting spiral tails within the atoms of the attracted body according to the criteria postulated in section (2), so gravity is only a matter of interaction between spiral tails.

According to equation (18) and the suggested description for gravity; acceleration does not depend on the mass of the falling body, but depends on the mass of the body with gravitational field, which gives an indication for the nature of free spiral tails surrounding it.

There will be no difference in the velocities of the falling heavy and light bodies; because the amount of connecting tails within a falling body will interact with an equivalent amount of the spiral tails of the gravitational field.

There are constant properties for the spiral tails of the gravitational field which makes a falling body is always directed with acceleration towards the centre; this can be illustrated by imagining the motion of a nut and bolt "see Figure. 7"; when the bolt is rotated clockwise the nut is directed to bolt's head.

In our case the bolt is the spiral tails of gravity which are characterised by its continuous motion towards the centre, and the nut is the object in contact with the spiral tails (spring form "see Figure. 7") which follows the path motion of the spiral tail toward the centre.

Due to the continuous motion of the spiral tail; each roll within it has the ability to supply the falling object with a constant amount of kinetic energy to make it move with a definite velocity and when the body reach the next roll; the same amount of kinetic energy is supplied to it hence the object's velocity is increased by the same amount and so on, the result is increasing object's velocity with the same amount with respect to time; and this is the definition of acceleration (a).
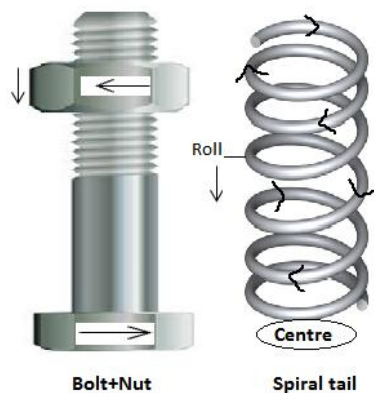

Figure 7. On left the arrows indicate to the direction motion of a nut on a bolt while on right it indicate to the spiral tail's direction motion and the path which a falling body will take to the centre

Another consequence for the continuous motion of the spiral tails for an object towards its centre is applying a force on it making it rotates and spins in the absence of external resistance.

14. Dark Matter and Dark Energy

According to the previous explanation for gravity; stars within a galaxy are expected to have nearly similar velocities; because they are floating on the gravitational field's spiral tails for the object in the centre of the galaxy, and their velocities are governed by the movement of the gravitational field's spiral tails during the spiral rotation of the galaxy.

In the 1920s Fritz Zwicky had postulated the presence of dark matter; which in our case can be interpreted to be the distribution of the gravitational field's spiral tails within the galaxy.

As it was postulated that photon is the basic unit in building the matter so it was supposed to contain both observable and dark matters; 33.3% of its mass is in the head part which represents the observable matter while tail and separator represent 66.6% of the total photon's mass which gives it the momentum and interaction properties; in our case this percentage represent the dark matter.

In 1929 Edwin Hubble introduced the evidence for the expansion of the universe and acceleration of galaxies apart from each other, the reason for these phenomena was explained by the presence of repulsive power in the space which has been called dark energy.

From the previous definition for acceleration in section (13), and to illustrate the expansion and acceleration of galaxies; it has to be postulated that there is another great object with gravitational field's spiral tails which fill all space of the universe, and all universe contents are in contact with this spiral tails and directed towards it with acceleration due to the continuous motion of its spiral tails as explained in section (13).

Dark energy can be interpreted to be the effect of gravity of the great object due to the continuous motion of its spiral tails towards its centre and the acceleration is due to the continuous kinetic energy supplied from each roll within it.

15. Conclusions

In this study a point of view about photon's intrinsic fundamental properties like structure, mass, length, velocity and motion path radius has been introduced; Photon was suggested to has a structure like a sperm, also it was postulated to be the basic unit in the structure of electron, positron and proton, hence its rest mass was derived from the rest mass of electron to be $4.6 x\, 10^{-32}\, kg$. Photon's tangential velocity was found to be inversely proportional to its wavelength and its motion path radius was deduced to be constant for all wavelengths and equals $7.6\, x\, 10^{-12}\, m$. By suggesting that charge is the time taken by a particle to pass a definite point photon's length was calculated to be $4.8 \times 10^{-11} m$, By relating these properties to other subatomic particles like electron, positron and proton; their structures have been suggested to be in the form of a tree structure consisting from one condensed tail with 2 directions of motion clockwise or anticlockwise which was interpreted as charge sign and a group of photon's heads in electron and positron, a group of electrons heads in antiproton and a group of positron heads in proton. Depending on the previous suggestions models for Hydrogen and Helium atoms were postulated then a general formula was derived for atomic radii calculation, which was useful in deriving general formula for calculating the frequency required for the photoelectric effect, and on the bases of the suggested structures for photon and electron the difference in wavelength between the incident photon and the scattered one in Compton effect was illustrated. By exploring some other constants and phenomena in nature; it was suggested that photon's constants are the main components for them.

REFERENCES

[1] M. Plank, "On the Law of the Energy Distribution in the Normal Spectrum," Ann. Phys. 4 (1901) 561.

[2] P. Lenard, Ueber die lichtelektrische Wirkung, Ann. Phys. 8 (1902) 169.

[3] A. Einstein, "On an Heuristic Point of View Concerning the Production and Transformation of Light," Ann. Phys. 17 (1905) 132.

[4] A.H. Compton, "A Quantum Theory of the Scattering of X-rays by Light Elements," Phys.Rev. 22 (1923) 409.

[5] Einstein, "Does the inertia of a body depend on its energy content?," Ann. Phys. 18 (1905) 639-641.

[6] C.S. Wu and I. Shaknov, "The Angular Correlation of Scattered Annihilation Radiation," Phys. Rev. 77 (1950) 136.

[7] D. L. Hartill, B. C. Barish, D. G. Fong, R. Gomez, J. Pine and A. V. Tollestrup, "Antiproton-Proton annihilation into Electron-positron pairs and Gamma-ray," Phys.Rev. 184 (1969) 5.

[8] C V RAMAN and S BHAGAVANTAM "Experimental proof of the spin of the photon". Indian J. Phys. 6 353-366 (1931).

[9] F. S. Sadykhov, I. G. Dzhafarov, and R. Sh. Yakh'yaev, "Production of Proton-Antiproton Pairs in Colliding Electron-Positron Beams," J. Exptl. Theoret. Phys. (U.S.S.R.) 47, 1463-1467 (October, 1964).

[10] Günther and Paneth, Zeits. f. physik. Chemie 173, 401 (1935).

[11] Yukawa and Sakata, Proc. Phys. Math. Soc. Japan 17, 467 (1935); 18, 128 (1936).