The Fundamental Particle of Matter
- Let's call it Photon

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Abstract:
The Standard Model visualizes seventeen fundamental particles and nineteen independent parameters to explain the physical world, but still it is incomplete. An alternate model based on a single particle and just three independent parameters is proposed in this paper. The details of the particle including its proposed physical constants are also given. The new model has the least arbitrariness possible, and so may be closer to the real truth.

Key words: Fundamental particle, photon, three-dimensional motion, fundamental constants

1. Introduction:

The classical Newtonian concept is that everything is made up of matter, and that space and time remain as the arena in which things exist. It was thought that matter is made up of some basic constituents, which are indivisible and have identical properties. The efforts to identify this basic constituent led to the discovery of atoms, electrons, protons and neutrons. However, further efforts led to the Standard Model, which visualizes some seventeen or so fundamental particles. Thus, instead of a single basic constituent, we have a set of fundamental particles, some of which are not matter in the normal sense; and the search for a unique fundamental particle is no more a topic of serious discussion in mainstream physics.

However, in this paper, the classical concept that matter has a fundamental particle having finite properties is proposed as an alternate to the Standard Model. The properties of the particle are explained and the probable values of its physical constants are given. These constants were derived on the basis of the probable structures of electron and neutron, and so the derivation is not included in this paper.

The term photon was originally used by Gilbert N Lewis [1] to represent '*a carrier of radiant energy*' and was later adopted by Einstein for representing a '*quantum*' of radiation. The proposed fundamental particle resembles the 'photon' of G N Lewis, and so the term '*photon*' is used here to represent the fundamental particle of matter.

2. Photon, the fundamental particle:

Photon can be defined as the smallest possible particle of matter. It is the only fundamental particle in the universe. Mass is its unique property. It is three-dimensional, and remains moving at the speed of light; so it requires a space-frame and a time-frame to exist. No two photons can remain at the same position at the same time. Photon has no internal energy or

internal structure. It can neither acquire excess energy nor give out energy. The reaction to its motion creates the forces of nature [2], and so energy and force of a photon are equal to $mc^2/2$ (in energy units).

3. Motion of a photon:

The motion of a photon can be explained based on Newton's third law. When a photon tries to move forward, it gets subjected to an equal and opposite force of reaction. This prevents it from moving straight; so it changes the direction and follows a curved path that the direction of motion and hence the direction of reaction change continuously. As change in direction is uniform, the curve is a circle. In the three-dimensional space, this circular motion cannot be confined to a particular plane, and so the circular motion becomes a helical motion and the photon moves forward in space. In such a motion, the speed along the helix and the speed of forward motion can be different. As there cannot any preference between these two, the two speeds should be equal. So the helix elongates, the radius becoming very small, and its axis bends, the axis ultimately becoming circular. The photon thus spirals around a circular axis and eventually returns to the original place; here, the speeds measured along the helix and along the outermost points of the helical path become equal.

The above motion can be regarded as a uniform '*three-dimensional motion'*. The mathematical relation for such a motion can be given as $R = a^2r/2$, where R is the radius of the circular axis, 'r' the radius of the helix, and 'a' the number of spiraling motions during one revolution along the circular path. The derivation of the relation is given below:

During one spiraling motion, the distance moved along the outermost points of the helical path is $2\pi(R+r)/a$; and the distance moved along the helix is equal to the diagonal of a rectangle with sides $2\pi R/a$ and $2\pi r$. These distances should be equal.

Therefore,

$$2\pi(R+r)/a = \sqrt{[(2\pi R/a)^2 + (2\pi r)^2]}$$
$$(R+r)^2 = R^2 + a^2r^2$$
$$2Rr = (a^2 - 1)\, r^2$$
$$R = a^2r/2 \text{ (nearly)}$$

The wavelength of photon is the distance moved during one spiraling motion. As 'r' is negligible small compared to R, the wavelength can be given as, $\lambda = 2\pi R/a = \pi ra$, and the time required to complete one revolution can be given as, $t = 2\pi R/c$.

4. Fields of a photon:

Translational motion creates gravity [2]. In the case of photon, it moves at the speed 'c', and so the force created is mainly gravity. But its motion is not exactly uniform in very short intervals of time. The axis of the helix being circular, its turns are closer in the inner side. So the photon moves faster when it remains on the outer side of the helix and slower when in the

inner side. During one spiraling motion, the speed varies from c+Δc to c-Δc such that the average speed is a constant 'c'. The changes in the natural speed create potential states, and these in turn create electrostatic force, and the motion of the potential state creates magnetic force. However, the electrostatic and magnetic forces thus created are negligible compared to gravity, because the variation in speed is negligible.

Field indicates that force is available [2]. When the speed of photon is equal to 'c', there is no electrostatic field; when the speed increases from 'c' to c+Δc and decreases back to 'c', there is a negative field, and when the speed changes from 'c' to c-Δc and back, there is a positive field. Thus during each spiraling motion, positive and negative fields are created alternately, and the strengths of the fields change from zero to the maximum and then to zero again. The photon thus behaves like a particle having a variable charge, and so its motion creates a varying magnetic field. Thus a photon has all the three fields.

5. Photon-pairs, photon-rings and photon-shells:

Because of the small variations in the speed, photons cannot remain independent; they exist in pairs in which the two photons occupy diametrically opposite positions in the helix so that when one has excess energy, the other has shortage of energy, and thus the pair has always the same energy. Each photon in the pair moves in its own helical path, and thus the pair as a whole has rotating motion as it moves forward. The wavelength of the pair is half that of photon and so, from the relations obtained above, the time it takes to complete one revolution is one-fourth of that of a photon. The photon-pairs act as the fundamental units for further integration. The emission, absorption and transfer of photons take place in pairs.

The pair formation is linear integration. The next step is planar integration in which the photons form a ring having a radius equal to that of the helix; and the natural next step is spatial integration in which the photons form a spherical shell having the same radius. Electromagnetic radiations are streams of photon-pairs, the energy depending on the number of photon-pairs in a quantum [3]. Neutrino radiations are streams of photon-rings, the energy depending on the number of rings in a quantum. All heavier particles are formed from photon-shells. Electrons and positrons contain photon-shells, and a neutron contains electron-positron pairs [4]. A proton contains a lone positron surrounded by electron-positron pairs.

6. Quantization:

Matter is a quantized entity. The basic unit of matter, photon, has finite properties. So any system made up of photons is finite, and the physical constants of that system can be deduced from that of the photon. But the space and time frames in which the photon exists are infinite. The only possible way in which a finite entity can exist in an infinite frame is to settle in an infinite-loop [5]. Here, the photon completes its revolution in a finite interval of time, and the process is repeated again and again infinitely. The space-frame allows reversal of direction, and so the infinite loop confines the photon in a closed path in space. The time-frame does not allow reversal of direction, and so the loop moves forward in time.

7. Physical constants of photon:

Once we know the internal structures of a quantum (of radiation) [3], electron and neutron[4], the physical constants of a photon can be deduced using the known values of mass of neutron, speed of light and plank's constant. The speed of light and plank's constant represent the 'space- time' and 'space- mass' relations of matter respectively, and so are crucial in deducing the constants of photon. The deduced values are furnished herewith. The actual derivation will be dealt with in a separate paper later.

Mass of a photon	=	1.1042×10^{-47} kg.
Radius of a photon	=	3.1740×10^{-23} m.
Wavelength of a photon	=	8.0064×10^{5} m.
G of a photon	=	5.1669×10^{41} m^3/kgs^2
Mass of a photon ring	=	4.5907×10^{-40} kg.
Radius of helix	=	4.2004×10^{-16} m.
Radius of circular path	=	8.18 billion light years
Period of revolution:		
Photon	=	51.40 billion years.
Photon-pair	=	12.85 billion years

8. Fundamental constants:

Mass, radius and speed of a photon are the only '*fundamental constants*' in the physical world. All other constants can be deduced from these three. The alternate model thus visualizes just one fundamental particle and three independent parameters (representing mass, space and time) for explaining the physical world, and thus it has the least arbitrariness possible. Comparing this with the Standard Model with 17 particles and 19 independent parameters, it can be argued that the new model is closer to the real truth.

9. Conclusion:

Thus in this paper, the properties of the proposed fundamental particle has been explained. If the step by step integration of such particles into a system we call the universe can be explained mathematically, then the proposal will be logical – my claim is that such an explanation is really possible. In that case, the model of the universe that we arrive at will be the one with least arbitrariness and one that agrees with our commonsense based reality.

Reference:

[1]. Lewis G. N. (1926). "*The conservation of photons*", Nature 118 (2981):874-875.

[2]. Jose P Koshy, *The inherent relation between motion and force (Motion creates the Forces of Nature)*, **viXra: 1312.0176** (thermodynamics and energy)

[3]. A paper proposing '*the internal structure of a quantum of radiation*' will be posted subsequently in **viXra.**

[4]. A paper proposing '*the internal structures of electron and neutron*' will be posted subsequently in **viXra.**

[5]. Jose P Koshy, *Quantization and Infinity as intrinsic properties: Entities are either quantized or infinite*, **viXra: 1312.0245 (**history and philosophy of physics)