

New four-dimensional model

And its application for interpreting fundamentals of Modern Physics

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Abstract

Important features of our new four-dimensional model are -

1. Four-dimensional cosmology and physics go together. **2.** This new model asserts that our universe is four dimensional filled with two kinds of four dimensional (4D) hyper spherical particles. **3.** Fundamental particles are created from these 4D particles when four-dimensional space deforms locally. **4.** Every object in universe moves as wave due to local transverse motion of these 4D particles. **5.** Fundamental particles have special 4D structures with infinite extent which justifies electromagnetic and gravitational influence of one fundamental particle on another at very large distance from it (there is no such device in our 3D model to justify mechanism of action at a distance) . **6.** Schrödinger equation is related to the 4D structure of fundamental particle which justifies its successful applications in physics. **7.** The 4D wave pulse of a fundamental particle is more appropriate to resolve wave-particle duality of matter than that done by a wave packet of 3D model. **8.** The equation of 4D wave pulse is used for a short derivation of de Broglie hypothesis (our traditional physics does not derive this). **9.** The net energy of the 4D structure of a fundamental particle that is formed satisfying some equilibrium conditions determines its mass (explanation of origin of mass by Higgs mechanism is not free from criticism). **10.** The model also describes a four-dimensional classical technique (named as **spiral transformation**) for conversion of radiation into matter and vice versa. Standard model does not give us a classical picture of this phenomenon. **11.** Addition and removal of matter-energy along a 4D spiral path ensures reversibility of spiral transformation process which explains reversible nature of emission with absorption and pair production with annihilation. **12.** The model also gives an expression for unified Coulomb and strong force. It explains why electron-positron pair annihilates but electron-proton pair forms a stable combination and why n-n or p-p combination is unstable in spite of strong attractive force but n-p combination (deuteron) is stable. **13.** As per our new model charge is not a quantity that can be distributed over a fundamental particle. Concept of charge arises from the Coulomb force on the fundamental particle which is found to be independent of its size and dependent on its shape. This new concept is responsible for equal magnitude of charges ($\pm e$) of fundamental particles of different masses shape being similar for all. **14.** New model resolves the puzzle behind dual nature of radiation by assuming photon as a 4D hyper surface wave of finite length(There is no single classical picture in traditional physics to describe nature of light, we have to accept both photon model and wave model).**15.** Existence of spin quantum number is consistent with extra space dimension. **16** New model also hints how neutron is created from electron and proton.

1. Introduction

Along with the development of research on standard model (which includes 12 leptons, 36 quarks, 12 mediators and one Higg's boson as elementary particles) the branch of theoretical physics has become more complex. Presence of large number of arbitrary elements and fractional unsymmetrical distribution of charge in quarks are two main demerits of standard model. Standard model accepts the hypothesis of expanding universe with big bang origin where all the mass of our universe was compressed at the beginning of its creation. Many cosmologists do not accept big bang model because of singularity at origin and uneasy impracticable time scale of the order 10^{-43} at initial phase. These models may explain many experiments and observations (like epicycle theory of geocentric model) but it is possible that better simple models may replace them. We know how complex geocentric (false) theory of Ptolemy was replaced after more than thousand years by simpler heliocentric (true) theory of Copernicus. Also many physicists believe that truth of nature will ultimately be described by simple ideas. Simplicity of Einstein's mass-energy relation and de Broglie's hypothesis indicate that there might be simple clues hidden somewhere to explain the wonderful nature of our universe. So physicists are in search of an alternate simple model free from singularity with minimum number of arbitrary elements. The new four dimensional (4D) model described by this article may fulfill these requirements. Even at the beginning stage this new 4D model is able to explain or interpret successfully a good number of fundamental laws, puzzles or phenomena of modern physics. . A lot more outcomes will emerge when more people take interest in developing or modifying this baby model. Future research on this model may justify its validity. Before describing the model, it will be better to state following assumptions on which the model stands and brief about them.

(i) *Our universe is four dimensional filled with two kinds of four dimensional hyper spherical * particles.*

The idea of fourth space dimension is an old one, but the idea of four dimensional (4D) space built up by 4D hyper spherical particles may be a new idea.

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* A circle of area πr^2 is enclosed by a line of length $2\pi r$. A sphere of volume $\frac{4}{3}\pi r^3$ is enclosed by a spherical surface of area $4\pi r^2$. Similarly a 4D hyper sphere of hyper volume $\frac{1}{2}\pi^2 r^4$ is enclosed by a 3D hyper spherical surface of volume $2\pi^2 r^3$.

(ii) *Every 4D particle exerts two kinds of forces on every other 4D particle simultaneously, one is long range and other is short range in nature.*

The long range force is called hyper gravitational force because it is similar in nature to gravitational force of our conventional 3D universe. This force determines the structure of our universe by creating two 4D universe on two sides of our 3D universe. The short range forces among 4D particles are similar to cohesive and adhesive forces. They are responsible for hyper surface tension phenomena on 3D hyper surface (our universe).

(iii) *Fundamental particle with negative charge (or positive charge) is created when our flat three dimensional universe is deformed locally into upper side (or lower side) forming a 4D structure given by the equation, $w = \pm a \exp[-b(x^2 + y^2 + z^2)]$ where w is the displacement along fourth dimension perpendicular to x , y and z directions.*

The article describes how this structure of fundamental particle is responsible for the origin of strong force and how this structure is related to Schrödinger equation and de Broglie hypothesis supporting quantum mechanics and resolving wave particle duality of matter.

(iv) *At every stage during the process of transformation of radiation energy into matter and vice versa, radiation energy utilized by photon is equal to magnitude of both hyper gravitational energy and hyper surface energy of the 4D structure of fundamental particle.*

The article describes how this assumption is responsible for stability of fundamental particles.

2. Structure of our universe as per the new model

In order to give a concrete shape to our new model, it is assumed that our universe is four dimensional and is built up by two kinds of four dimensional **hyper spherical particles**. The long range attractive force between any two particles of these two kinds is just like the gravitational attraction between two particles of our conventional 3D universe. We may call this force as **hyper gravitational force**. The first kind of 4D particles are heavier, so due to central attractive forces among them they form a grand four dimensional hyper sphere around the center of our 4D universe. Let these particles be named as **inons** because they form the inner hyper sphere of the 4D universe. The second kind of 4D particles are lighter than the first kind and let them be named as **outons** because they form the outer hyper sphere of our 4D universe surrounding the inner 4D hyper sphere. Our new model asserts that our conventional 3D universe is nothing but the 3D hyper surface of separation lying in

between the inner 4D hyper sphere and outer 4D hyper sphere. Just like a two dimensional spherical surface separates an inner solid sphere and a concentric hollow outer sphere, our conventional 3D universe separates an inner solid 4D hyper sphere and a concentric outer hollow 4D hyper sphere. So our universe is a grand three dimensional hyper surface sandwiched between two concentric four dimensional hyper spheres. Our universe is finite and unbounded with no beginning and no end. It is partly similar to Einstein's model of universe [1]

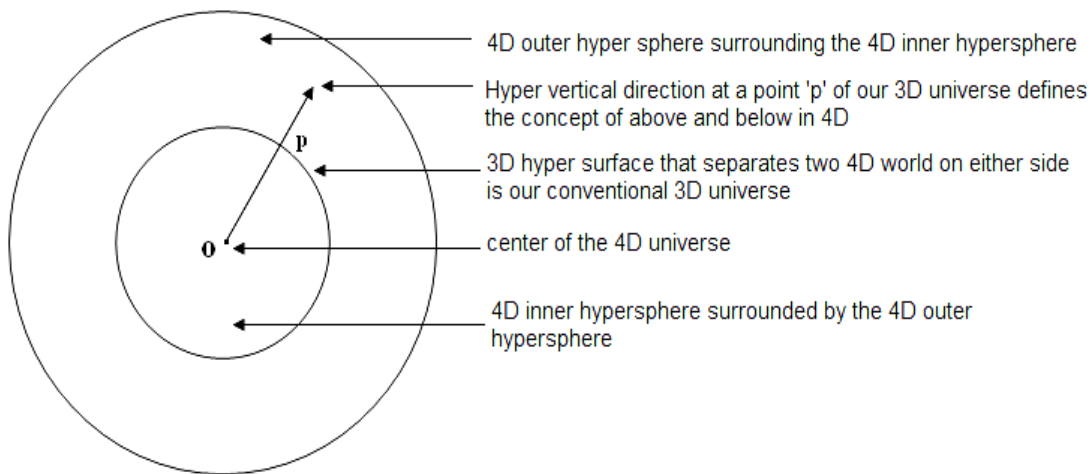


Fig.1 shows the structure of our 4D universe.

At any point in our 3D universe it is possible to construct three mutually perpendicular axes. But we can imagine an extra normal at every point. This extra normal, if produced along inward direction, will pass through the centre of our 4D universe. The outward direction of this extra normal is the hyper-vertical direction of our 4D universe at the point. This hyper vertical direction gives us the concept of 'above and below' in four dimensions. Our 3D universe is curved, but it is flat locally because of grand size of the universe. Any straight line path in our 3D universe is the part of a great circle whose centre coincides with the centre of the 4D universe.

We further assume that in addition to the long range hyper gravitational force there are also local attractive cohesive and adhesive forces between any two 4D particles. The cohesive force between any two outons is assumed to be more than the adhesive force between an inon and an outon. For this reason the 3D hyper surface

layer just above our 3D universe will exhibit *hyper surface tension* phenomena with positive hyper surface energy. This is because the outons lying within this 3D hyper-surface layer experience a net upward force and thus work must be done against this upward force to bring more outons to this hyper surface layer i.e. to increase the hyper volume of the hyper surface layer. Similarly we may assume that the cohesive force between any two inons is less than the adhesive force between an inon and an outon. This results in giving a negative hyper surface energy to the 3D hyper surface layer lying just below our conventional universe.

The net hyper surface energy of our 3D universe is the sum of the positive hyper surface energy of the 3D hyper surface layer lying just above our 3D universe and negative hyper surface energy of the 3D hyper surface layer lying just below our 3D universe. The net hyper surface energy per unit space should have such a value that particle formation in our universe will be smooth. If net hyper surface energy per unit space has large positive value, then formation of particles in our universe will be difficult. On the other hand if net hyper surface energy has a negative value, then our universe will be unstable because there will be a tendency of increase of volume at every place in the universe. Due to hyper surface tension phenomena our 3D universe behaves like an elastic 3D membrane of special kind with similar conditions on both sides so that a fundamental particle and its anti particle can be created on opposite sides.

3. Structure of fundamental particles as per our new model

Fundamental particle- antiparticle pair are created when our flat* three dimensional space is deformed locally into two sides forming two 4D structures given by the equation

$$w = \pm a \exp[-b(x^2 + y^2 + z^2)] \quad \dots\dots (1)$$

This is the equation of the curved 3D hyper surface the 4D structure of a fundamental particle (formed at origin of our 4D co-ordinate system) whose base is flat 3D hyper surface containing 3D space axes. Here w is the distance of any point (x, y, z, w) on the curved 3D hyper surface from its flat 3D base.

* Straight line, plane surface and flat space (volume) have analogous meanings in one, two and three dimensions respectively.

The 4D structure of a fundamental particle as defined above is named as **4D Gaussian structure** because the edge of the cross section of its 3D hyper surface by any hyper vertical plane containing w -axis is a Gaussian curve. Putting $x = y = z = 0$ in equation (1), we get $w = \pm a$ which shows that position of vertex of the 4D Gaussian structure is at a distance of $\pm a$ from its flat base. Here ' a ' is called height of the 4D structure and is different for particles of different masses. As per third assumption ' a ' is positive for a particle with negative charge and is negative for a particle with positive charge. Again ' b ' in the equation (1) is regarded as constant. So shape will be similar for all particles because for any two different particles the ratio $w/w' = a/a' = \text{constant}$ if $x = x'$, $y = y'$ and $z = z'$. Fig. 2 shows the 4D Gaussian structure of an electron which is formed on the upper side (' a ' is positive) of our 3D universe.

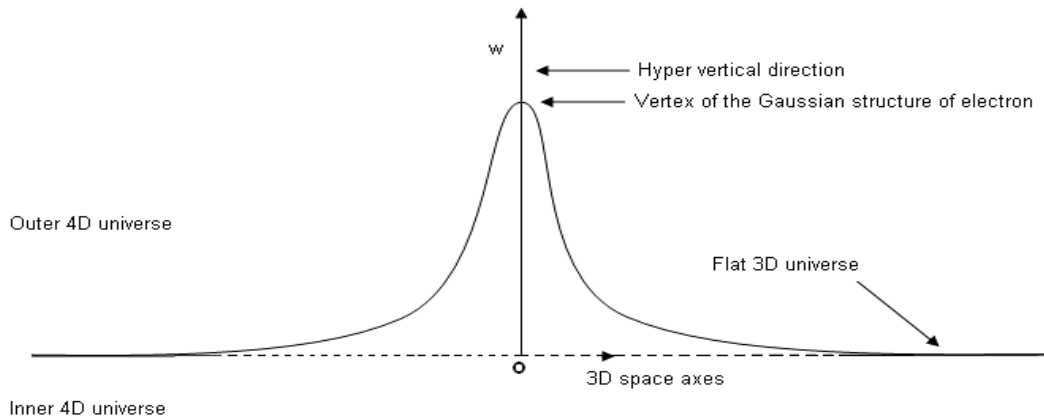


Fig.2 shows 4D Gaussian structure of electron.

How can infinitely extended 4D Gaussian structure be localized?

The structure of fundamental particles as described by equation (1) extends from minus infinity to plus infinity along x , y and z axes. This justifies electromagnetic and gravitational influence of a fundamental particle on another fundamental particle at very large distance from it. There is no such device in our 3D models to justify mechanism of action at a distance.

Although theoretically the 4D Gaussian structure has infinite extent, but practically it represents a particle localized at the origin provided the value of ' b ' in equation (1) is very large. To justify the range of strong

nuclear force (in section 8) the value of 'b' has been taken as order of 10^{30} in S.I. units. Let us verify how far this value of 'b' satisfies localized condition of the 4D Gaussian structure. Putting $x=10^{-12}$, $y=0$, $z=0$ and $b=10^{30}$ in equation (1) we find that $w = a \exp(-10^6)$. So the value of 'w' (whose value at origin is a) is very negligible at a very small distance (10^{-12} m) from the center of the base of the 4D Gaussian structure. So 4D Gaussian structure is very much localized for this value of $b=10^{30}$.

Calculation of volume of 3D hyper surface and hyper volume of the 4D Gaussian structure:

Suppose the 4D Gaussian structure of a fundamental particle satisfy the equation $w = ae^{-b(x^2+y^2+z^2)}$. The cross-section of this structure by $x-w$ plane is a two dimensional Gaussian curve that satisfy the equation, $w = ae^{-bx^2}$.

The slope of this curve at the point $(x, 0, 0, w)$ is given by

$$\frac{dw}{dx} = -2abxe^{-bx^2}.$$

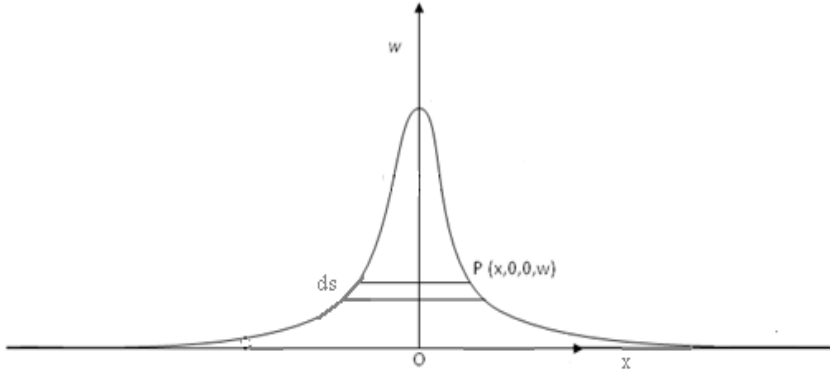


Fig. 3 showing cross section of 4D Gaussian structure by $x-w$ plane

From elementary calculus we know that

$$ds = \left\{ 1 + \left(\frac{dw}{dx} \right)^2 \right\}^{\frac{1}{2}} dx = \left\{ 1 + 4a^2 b^2 x^2 e^{-2bx^2} \right\}^{\frac{1}{2}} dx = (1 + 2a^2 b^2 x^2 e^{-2bx^2}) dx$$

where we have neglected the higher order terms of binomial expansion as value of $4a^2 b^2 x^2 / e^{2bx^2}$ is very small (for value of $b = 10^{30}$).

If our Gaussian structure were three dimensional instead of four, then area of its curved surface would have been $\int_0^\infty 2\pi x ds$ (Fig.3), but for 4D Gaussian structure, volume of its 3D curved hyper surface is $\int_0^\infty 4\pi x^2 ds$. This volume is infinite giving infinite hyper surface energy to the 4D Gaussian structure. This seems uncomfortable. But 4D Gaussian structure has finite hyper surface energy, because before its formation its curved 3D hyper surface coincides with the volume $\int_0^\infty 4\pi x^2 dx$ of its 3D flat base which is also infinite and the net increase of volume is not infinite. The net increase of this volume is given as

$$V = \int_0^\infty 4\pi x^2 (ds - dx) + V' = \int_0^\infty 8\pi a^2 b^2 x^4 e^{-2bx^2} dx + V' = 8\pi a^2 b^2 \frac{3}{8} \sqrt{\frac{\pi}{(2b)^5}} + V'.$$

$$\text{So we get} \quad V = k_1 b^{-\frac{1}{2}} a^2 + V'. \quad \dots (2)$$

The additional term V' enter into above equation because at a point very near to the axis of Gaussian structure where x^{-2} is of same order of magnitude as 'b', the higher order terms of the above binomial expansion cannot be neglected.

If our Gaussian structure were three dimensional instead of four, then its volume would have been $\int_0^\infty 2\pi x w dx$ (Fig. 3), but for 4D Gaussian structure its hyper volume is given as

$$V_{hyper} = \int_0^\infty 4\pi x^2 w dx = \int_0^\infty 4\pi a x^2 e^{-bx^2} dx = 4\pi a \cdot \frac{1}{4} \sqrt{\frac{\pi}{(2b)^3}} = k_2 b^{-\frac{3}{2}} a. \quad \dots (3)$$

Equation (2) and (3) show a special property of a 4D Gaussian structure by which the enclosed hyper volume is proportional to 'a' where as enclosing hyper surface is proportional to higher degree of 'a' (in contrast to hyper spherical or spherical structure).

4. Origin of mass of electron, proton and their anti-particles

Mass of a fundamental particle depends upon the size of its 4D Gaussian structure. Out of infinite possible 4D Gaussian structures Nature will select that equilibrium 4D Gaussian structure of a particular size for which hyper gravitational energy of its mass is equal (in magnitude) to its hyper surface energy. This equilibrium size fixes the mass of a fundamental particle. For electron hyper gravitational energy is positive because it is formed by inons of inner 4D world when flat 3D hyper surface of separation (our universe) is deformed into upper side where potential energy of all 4D particles is positive with respect to the surface of separation. For electron hyper surface energy is negative, because it is formed by inon layer lying just below our universe. Positron which is formed below the surface of separation has an inverted shape with negative hyper gravitational energy and positive hyper surface energy.

At equilibrium size, the sum of hyper gravitational energy and hyper surface energy of electron or positron is zero. Then how does the particle get its rest mass energy? The photon involved in the pair production process gives a part of its energy ($h\nu_0$) to electron or positron to account for its rest mass energy (m_0c^2). It is assumed that at equilibrium size

$$h\nu_0 = m_0c^2 = \text{magnitude of hyper surface energy} = \text{magnitude of hyper gravitational energy} \quad \dots (4)$$

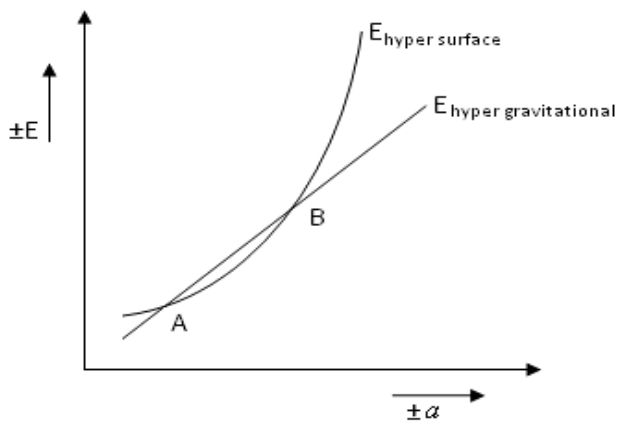


Fig. 4 shows equilibrium points where hyper surface energy and hyper gravitational energy of fundamental particles are equal.

Now we shall show that equilibrium 4D Gaussian structures exist due to a special property of Gaussian structure. In third section it has been shown that hyper volume of 4D Gaussian structure is proportional to its height 'a' but its hyper surface area minus base area is proportional to 'a²'. So for this reason rate of increase of hyper surface energy will be more than that of hyper gravitational energy for large value of 'a'. The exact nature of variation of these two energies with 'a' is not important for us now, but investigation will reveal the fact that the graph has two points of intersection where hyper surface energy is equal to hyper gravitational energy. The point of intersection at A (fig.3) with small value of 'a' corresponds to equilibrium Gaussian structure of electron and positron. Similarly the point B with large value of 'a' corresponds to equilibrium Gaussian structure of proton and anti-proton. These two points are unstable equilibrium positions because a slight decrease in the value of 'a' (for electron and proton) and slight increase in the value of 'a' (for positron and anti proton) result in decrease of net energy (magnitude of $E_{\text{hyper gravitational}} - E_{\text{hyper surface}}$) of the system. The K.E. received by these four Gaussian structures from photons make them stable in spite of their unstable equilibrium conditions (like a wheel that continues to remain in its vertical unstable equilibrium position when it is in motion).

A 4D classical technique of converting energy into matter and vice versa

Fundamental particle and anti particle pair[2] such as electron and positron are created when a high frequency photon, under certain condition, deform our flat 3D space creating two 4D Gaussian structures on either side carrying with them three different energies- (a) photon energy converted into rotational kinetic form (b) hyper gravitational energy of the 4D particles lying inside the hyper volume of the Gaussian structure (c) hyper surface tension energy of the 3D hyper surface of the Gaussian structure. Out of infinite possible 4D Gaussian structures, only that equilibrium structure of a particular size and shape is created which satisfies the conditions given in eqn. (4).

In the above mentioned process radiation energy is transformed into matter energy of fundamental particle. We shall call this transformation process as *spiral transformation* because 4D masses are added spirally to the 4D Gaussian structure when it is under rotation (clay-pot making on a rotating pad is a 3D spiral process). Here addition of 4D mass occurs along a 4D spiral path to ensure the reversibility of the process. For electron the beginning of this transformation process is associated with the formation of vertex of the 4D Gaussian structure

at a point on the flat 3D universe. Then hyper-volume of the Gaussian structure increases as vertex rises gradually when inons of the hyper-surface layer lying just below our 3D universe are added spirally to the hyper surface of the Gaussian structure which is rotated as more and more of the energy of photon takes part in the transformation process. It is to be noted that the condition of equation (4) is satisfied at every stage of the transformation process (assumption iv). Similarly an inverted 4D Gaussian structure for positron is formed below the flat 3D hyper surface of our universe. If the energy of photon is sufficiently high then complete structures for electron and positron are formed. If the energy of the photon is more than the threshold energy required for pair production, then after the formation of two complete 4D Gaussian structures for electron and positron, both of them become free acquiring some K.E. in expense of this extra energy of photon. However if the energy of the photon is less than the threshold energy required for pair production, then after the formation of two incomplete Gaussian structures spiral transformation proceeds in reverse direction, gradually decreasing the size of the Gaussian structures of electron and positron till complete annihilation at a point on the 3D universe where vertexes of both vanish along with the emission of two photons in opposite directions. During the process of spiral transformation the electron-positron pair forms an unstable composite system to which we call positronium.

After its formation, the 4D Gaussian structure of electron is separated from the rest of the universe and acquires particle status because it can easily move as a 4D Gaussian shape wave pulse satisfying the equation

$$w = a \exp[-b(x - vt)^2] \quad \dots (5)$$

where we have suppressed 'y' and 'z' coordinates as motion is assumed to be along x-axis. Actually there will be no transfer of particles of the medium (inons and outons) along the direction of motion; rather a disturbance in the form of a wave is transmitted when 4D particles execute transverse local displacements along hyper vertical direction. Just like the apparent motion of wave on the surface of water (the real motion being the transverse vibrations of particles of the medium), the motion of every object in our universe is apparent, the real motion being the local transverse displacements of inons and outons which constitute the fundamental particles of the object.

Classical picture of emission and absorption in atoms:

Spiral transformation process can also explain the emission and its reverse process of absorption in atoms, although it will be a very complex process in a multi-particle system. It is a rapid process which may account for

the instantaneous emission of photoelectron from atoms. Standard model does not give us a classical picture of internal mechanism to show how emission and its reverse process of absorption occur in atoms. Spiral transformation process of the new model gives a clear classical picture of these phenomena. Let us consider the simplest example of hydrogen atom. Electron and proton of the atom are two 4D Gaussian structures lying on opposite sides of our universe with their 3D bases coinciding with a part of our 3D universe. A photon is a progressive hyper surface wave of finite length (described below) with amplitude small in comparison to height of Gaussian structures. Obviously the photon moving along the 3D hyper surface (our universe) will enter the atom along the intersecting 3D bases of electron and proton. The photon will transfer its energy to electron and proton and in the process of spiral transformation the radius of their 3D base increases. This increases the separation between electron and proton. In this manner a sufficiently high energetic photon may ionize the atom. Reversibility of the process is maintained because energy transformation takes place along a spiral path.

6. Wave particle duality of radiation and matter

Due to hyper surface tension phenomena our universe behaves like an elastic 3D membrane of special kind and thus allows creation of mechanical wave when 4D particles execute to and fro vibrations along the 4th dimension (w - axis). We assume that light and other electromagnetic waves are nothing but mechanical waves of this kind when 4D particles lying in a straight narrow path execute transverse vibrations in sequence. Thus a photon is a sinusoidal progressive 4D wave of finite length travelling along a straight line path. This assumption is more appropriate because of the following reasons. (a) It directly retains the transverse nature of light. (b) A photon of finite length is to be serially absorbed by particle-antiparticle pair during spiral transformation process. (c) Energy of a photon is proportional to number of waves it contains and a photon of certain length contains more number of waves if its wave length is less. (d) It satisfies particle nature of light in interaction experiments in which a photon (a wave of finite length) is absorbed serially, but instantly because the time interval between beginning and end of spiral transformation process is very short. Photons, which are discrete waves of a beam of light, will produce separate clicks in a photo multiplier tube and will be distinguished clearly when intensity of light is very weak. (e) The progressive transverse wave nature of light can explain double slit experiment and all optical phenomena in usual manner.

We know that the localized particle wave packet is not stable as it spreads [3] with the passage of time, so it may not represent a stable particle. But our 4D Gaussian wave pulse represented by the equation (5) is both localized

and stable, so it truly represents a particle. In equation (5) 'v' is the velocity with which a point of constant phase moves along x-axis and energy of the particle is also transmitted with the same velocity 'v'.

So, velocity of mass-energy = phase velocity

$$\text{or } v = v\lambda \quad \dots\dots (6)$$

If $h\nu$ is the energy excess over the threshold energy required for pair production, then half of this energy gives kinetic energy to electron where as other half gives kinetic energy to positron. Then we have

$$\frac{1}{2} h\nu = \frac{1}{2} mv^2$$

$$\text{or } h\nu = mv^2 \quad \dots\dots (7)$$

$$\text{Equations (6) and (7) give } \lambda = \frac{h}{mv} \quad \dots\dots (8)$$

This is de Broglie hypothesis. Our traditional physics, instead of deriving it in this manner, accepted it as a hypothesis because this relation is valid for radiation. Again a hypothetical phase velocity c^2/v [2] was attributed to the particle using the relation $h\nu = mc^2$. But this point of view is questionable because $v = mc^2/h$ is constant but in equation (6) it varies with phase velocity.

7. Schrödinger equation from new model

Let us write equation (5) again for sake of convenience

$$w = a \exp[-b(x - vt)^2] \quad \dots\dots (5)$$

Equations (4) and (6) can be used to modify equation (3) which becomes

$$w = a \exp [zi(kx - \omega t)], \text{ where } k=2\pi/\lambda, \omega = 2\pi\nu \text{ and } z = \frac{ibh^2}{4\pi^2 m^2 v^2} (kx - \omega t).$$

So we get

$$w = a \exp[i(kx - \omega t) + i(kx - \omega t) + \dots \text{summed for } z \text{ times}]$$

$$\text{or } w = a' \exp[i(kx - \omega t)] \times a' \exp[i(kx - \omega t)] \dots \dots \dots \text{multiplied for } z \text{ times,}$$

where $a' \times a' \dots \dots$ multiplied z times = a

If we take $\Psi = a' \exp[i(kx - \omega t)]$ (9)

Then equation (5) becomes,

$w = \Psi \times \Psi \times \dots$ multiplied for z times (10)

Thus we see that the displacement 'w' in equation (5) can be expressed as the product of z number of equal displacement Ψ of a plane progressive wave represented by equation (9). So if 'w' of equation (5) describes the behavior of a fundamental particle, then we assume that Ψ of equation (9) will also describes the behavior of the same particle. We know how equation (9) can be used to derive [4] Schrödinger equation. In this way Schrödinger equation is related to structure of fundamental particle because equation (5) is obtained from equation (1). Perhaps this is the reason behind successful applications of Schrödinger equation in physics.

8. Origin of strong force

At this point let us refresh our minds about some properties of two dimensional Gaussian curve satisfying the equation

$$w = a \exp(-bx^2) \quad \dots (11)$$

then,

$$dw/dx = -2abx \exp(-bx^2) \quad \dots(12)$$

and

$$d^2w/dx^2 = 2ab \exp(-bx^2) (2bx^2 - 1) \quad \dots(13)$$

The slope of the Gaussian curve at any point is found from equation (12). The slope of the curve is zero at $x=0$. The slope decreases as x increases and becomes maximum negative at $x = 1/(2b)^{1/2}$, which is the point of inflexion satisfying the condition $d^2w/dx^2=0$. There after the slope increases and reaches the value zero again at $x = \infty$. So the point of inflexion is the turning point from where the slope increases in one direction and decreases in other direction i.e. on one side of the point of inflexion d^2w/dx^2 is +ve and on the other side it is negative. Then it is logical to assume that at this point of inflexion the repulsive Coulomb force between two protons is converted into attractive strong nuclear force. The change of direction of force is consistent with mathematics as w is differentiable at the point of inflexion. In this way our new model will be able to unite

strong nuclear force and electromagnetic force in a simple way. If the value of 'b' in equation (11) is taken as the order of 10^{30} in S.I. units then point of inflexion will be at a distance of $1/(2b)^{1/2} \approx 10^{-15}$ m from the center of the Gaussian structure. This is the range of strong nuclear force.

The above point of inflexion theory is supported by the fact that it can easily explain why electron-positron pair annihilates but electron-proton pair forms a stable combination and why n-n or p-p combination is unstable [5] in spite of strong attractive force but n-p combination (deuteron) is stable. As equal size electron and positron approach each other, points of inflexion of both come to point of contact simultaneously (during spiral transformation process) and so attraction is continued further as direction force changes sign twice. However when electron and proton approaches each other, the point of inflexion of electron comes to point of contact earlier and thus changing the attraction to repulsion and this prevents electron in falling into nucleus. Similar arguments can be made for n-n, p-p (see below) and n-p combinations.

9. Finding an expression for unified Coulomb and strong force

Let Gaussian structures of two fundamental particles are given by equations

$$w = a \exp[-b(x^2 + y^2 + z^2)]$$

and

$$w' = a' \exp[-b(x'^2 + y'^2 + z'^2)]$$

If center of their bases lie on common $x - x'$ axis, then force between them will depends on derivatives with respect to x or x' . The force on the particle with height 'a' is given as

$$F_a = K/ x^4 \times \frac{d^2w}{dx^2} / \frac{dw}{dx} \times \frac{d^2w'}{dx'^2} / \frac{dw'}{dx'} \times (a - w) / a \dots\dots\dots (14)$$

This equation is obtained on trial basis, not derived.

Now suppressing y, y', z and z' coordinates we get

$$F_a = K/ x^4 \times 2ab \exp(-bx^2)(2bx^2 - 1) / -2abx \exp(-bx^2) \times 2a'b' \exp(-bx'^2)(2bx'^2 - 1) / -2a'bx' \exp(-bx'^2) \times [1 - \exp(-bx^2)]$$

If particles are two protons then $a = a'$, $x = x'$,

and we get

$$F = K \frac{(2bx^2-1)^2}{x^6} [1 - \exp(-bx^2)] \quad \dots\dots\dots (15)$$

This is the expression for unified force between two protons separated by a distance $2x$.

The force is repulsive over entire range as both d^2w/dx^2 and d^2w'/dx'^2 changes sign simultaneously at

$x = x' = \frac{1}{\sqrt{2b}}$. That is why p-p combination is unstable.

For Coulomb range ($x \gg 10^{-15}$), $\exp(-bx^2)$ and -1 in the brackets of equation(13) are neglected as $b \approx 10^{30}$.

So we get

$$F_{coul} = K \frac{4b^2}{x^2} \quad \dots\dots\dots (16)$$

This equation shows that Coulomb force is inverse square and depends on 'b' (shape) not on 'a' (size).

10. Origin of charge

Traditionally we have no clear concept for charges of fundamental particles. We fail to answer: (a) Why there are two kinds of charge? (b) How Nature dopes exactly equal amount of charges into particles of different masses? (c) How charge of a fundamental particle is forced to concentrate near a point where there are forces of repulsion between its constituent parts? (d) How to deal with infinite Coulomb force and infinite energy when the distance between two charged particles approaches zero? New model answers all these questions simply by accepting the result of equation (16) which states that that shape (and not size) of the Gaussian structure determines the property of charge. Charges are not quantities to be doped into particles of different masses. It is the Coulomb force which gives the concept of charge. Thus magnitude of Coulomb force between any two fundamental particles (with charges $\pm e$) irrespective of their masses is same because it depends on the value 'b' (and not on 'a') which is constant as all particles have similar shape. Negative charge ('a' is +ve) and positive charge ('a' is -ve) are formed on upper and lower sides of our universe respectively. The force between two Gaussian structures is free from singularity as 'w' in equation (1) and its 1st derivative are differentiable at all points including origin.

Conclusion

At present our new model is silent about many other fundamental particles of nature, but it is hoped that future research on this model will find a way out of this problem. For neutron an idea may be suggested that it is formed when high velocity electron is slipped into proton whose larger size provides an approximate flat path for small size electron. Unlike spiral transformation this slipping is a different process in which mass or size of both electron and proton remain unchanged. New model can also hint the idea behind the origin of spin. The fourth quantum number spin is supposed to originate from extra 4th dimension. Spin takes finite number of values such as $\pm 1/2$, ± 1 etc. because structures of fundamental particles cover a finite small distance along 4th dimension (Unlike other three quantum numbers which can take infinite number of values because the distance to which an electron can go in 3D space is not bounded). Lastly author strongly believes that spiral transformation process, which is associated with basic assumptions of this new model, can be used to derive equation (14). This derivation will confirm the validity of this new model. A wrong model, by chance, may explain or interpret a limited few number of physical laws or phenomena whereas a valid model can do this in large number of cases. Does, explanations or interpretations of large number of physical laws or phenomena by the new model, not justify its validity?

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