

A NEW MODEL OF PHYSICS

Proposed by

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Abstract: According to this model, particle-antiparticle pair are created when our flat three dimensional (3D) universe; which is supposed to be a grand 3D hyper spherical surface separating two super grand 4D worlds on either side; is deformed locally into two sides forming two 4D Gaussian structures. The model stands on classical mechanics, but it supports quantum mechanics by deriving Schrödinger equation and de Broglie hypothesis. The model gives new ideas and simple explanations of some puzzles of physics such as: internal structure of fundamental particle, origin of mass, origin of charge, origin of strong force and wave- particle duality of matter and radiation. The model also describes a 4D classical technique (named as spiral transformation) for conversion of radiation into matter and vice versa. Again using external structures of particles, the model gives simple answers to questions: 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.

Introduction:

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. This new idea along with another two enables the author to design this new model. One of these two ideas is the special property of Gaussian structure whose surface or hyper surface area minus base area is finite and varies as square of its height but its enclosed finite volume or hyper volume varies simply as its height. For 4D Gaussian structure the unit of hyper surface area is cubic meter. In third section it is mentioned how this property is responsible for stability of fundamental particles. The other important idea is

the idea of shape determining the property of charge and size determining the property of mass of fundamental particles. This idea justifies that similar shape is responsible for equal magnitude of charges of electron, proton and many other unstable particles, otherwise it is very hard to imagine how nature dopes exactly equal amount of charges into particles of different masses. Elaborate discussions on origin of charge will be done in a separate article with a view to limit the size of this article.

1. Structure of fundamental particles as per our new model:

According to our new model, structures of fundamental particles are closely associated with the structure of universe. Fundamental particles with opposite charges are created when our flat three dimensional universe (which is supposed to be a 3D hyper-surface separating two 4D world on either side) is deformed into two sides forming two 4D Gaussian structures given by the equation

$$w = \pm ae^{-b(x^2+y^2+z^2)} \dots\dots\dots (1)$$

where w is the displacement along fourth dimension perpendicular to x , y and z directions. Here ' b ' is a constant because shape is similar for all particles, ' a ' is height of the Gaussian structure and is different for particles of different masses, ' a ' is positive for a particle with negative charge and is negative for a particle with positive charge. For equation (1) to represent a particle localized at the origin the value of ' b ' should be very large.

2. Structure of our universe as per the new model:

In order to give a concrete shape to our new model, let us introduce some basic assumptions that space is four dimensional and the whole universe 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.

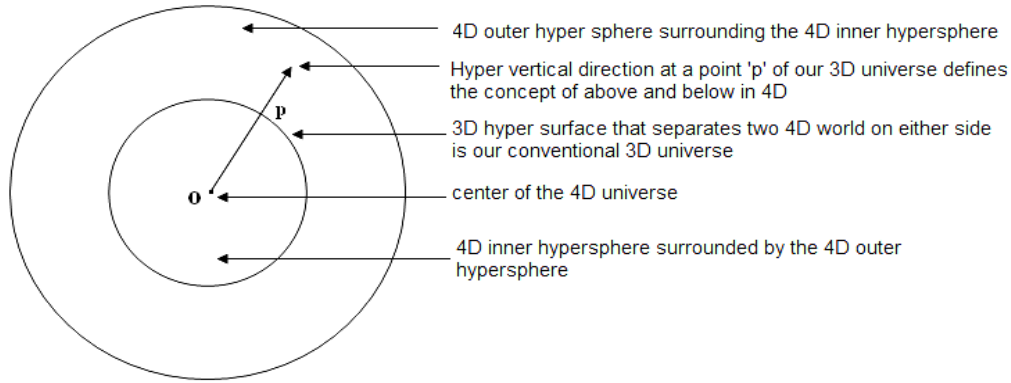


Fig.1

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.

3. 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 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 for equilibrium size

$$h\nu_0 = m_0c^2 = \text{magnitude of hyper surface energy}$$

$$= \text{magnitude of hyper gravitational energy} \dots \dots \dots (2)$$

Now we shall show that equilibrium 4D Gaussian structures exist due to a special property of Gaussian structure. It can be verified that hyper volume of 4D Gaussian structure is proportional to its height ' a ' but its hyper surface area minus base area is proportional to ' a^2 '. 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 '. Whatever may be exact nature of variation of these two energies with ' a ', but it is assumed that the graph will have two points of intersection where hyper surface energy is equal to hyper gravitational energy. The point of intersection at A (see fig.2) 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.

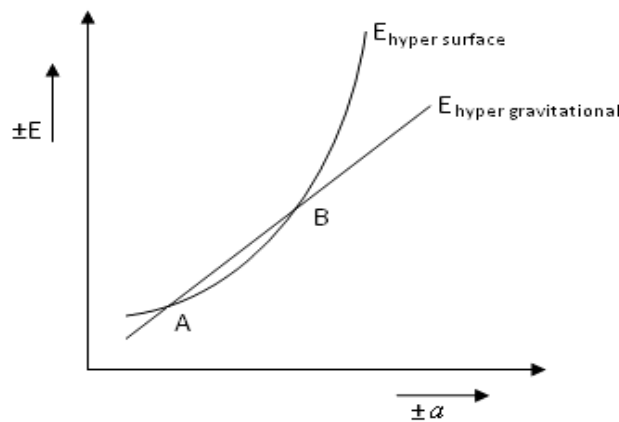
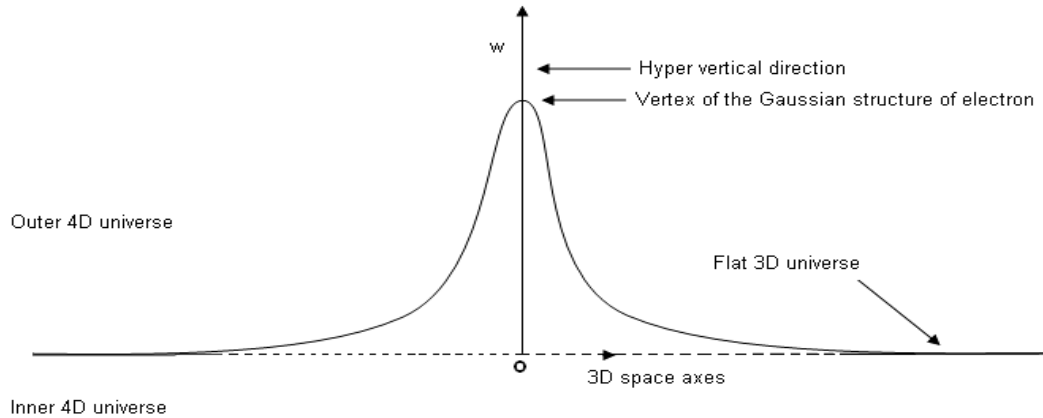


Fig.2

The K.E. received by the Gaussian structures of electron and proton 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). Further investigation will reveal the fact that positron and anti-proton are unstable in spite of gain in kinetic energy.

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

Fundamental particle and anti particle pair such as electron and positron are created when a high frequency photon, under certain condition, deform our flat 3D universe into two sides creating two 4D Gaussian structures on either side, and 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. (2).



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Fig.3

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 masses are added spirally to the 4D Gaussian structure when it is under rotation. 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 (2) is satisfied at every stage of the transformation process. 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.

Spiral transformation process can also explain the radiation 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. The 3D surface of separation provides a definite path along which a photon can enter into or emerge from an atom. This ensures reversible nature of radiation and absorption process.

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

$$w = ae^{-b(x-vt)^2} \text{-----} (3)$$

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 vibrations along hyper vertical direction. Just like the apparent motion of wave energy 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.

5. Wave particle duality of radiation:

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 definite 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 definite 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 of definite length is absorbed serially, but instantly because the time interval between beginning and end of spiral transformation process is very short. (e) The progressive transverse wave nature of light can explain double slit experiment and all optical phenomena in usual manner.

6. Wave particle duality of matter:

We know that the localized particle wave packet is not stable as it spreads with the passage of time, so it can not represent a stable particle. But our 4D Gaussian wave pulse represented by the equation (3) is both localized and stable, so it truly represents a particle. In equation (3) '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

$$\text{Or } v = v\lambda \quad \text{-----} \quad (4)$$

If $h\nu$ is the energy access 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

$$\frac{1}{2}h\nu = \frac{1}{2}mv^2 \text{ or } h\nu = mv^2 \quad \text{-----} \quad (5)$$

$$\text{Equations (4) and (5) give } \lambda = \frac{h}{mv} . \quad \text{-----} \quad (6)$$

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 was attributed to the particle using the relation $h\nu = mc^2$. But this point of view is questionable because only a part of this energy is used in providing velocity to the particle, rest being used in providing for rest mass energy.

7. How Schrödinger equation can be obtained from this new model:

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

$$w = ae^{zi(kx-\omega t)}, \quad \text{where } k = \frac{2\pi}{\lambda}, \quad \omega = 2\pi\nu \text{ and } z = \frac{ibh^2}{4\pi^2 m^2 v^2} (kx - \omega t) \quad [\text{an imaginary number}]$$

So we get $w = ae^{i(kx-\omega t)+i(kx-\omega t)+ \dots \dots \dots \text{summed for } z \text{ times}}$

Or $w = a'e^{i(kx-\omega t)} \times a'e^{i(kx-\omega t)} \times a'e^{i(kx-\omega t)} \dots \dots \dots$ multiplied for z times,

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

If we take $\Psi = a'e^{i(kx-\omega t)}$ ----- (7)

then equation (3) becomes, $w = \Psi \times \Psi \times \Psi \dots \dots \dots$ multiplied for z times

..... (8)

Thus we see that the displacement 'w' in equation (3) can be expressed as the product of z number of equal displacement Ψ of a plane progressive wave represented by equation (7). So if 'w' of equation (3) describes the behavior of a fundamental particle, then we assume that Ψ of equation (7) will also describes the behavior of the same particle. We know how equation (7) can be used to derive Schrödinger equation. Thus as per the above arguments quantum mechanics has its origin from equation (3) which describes the classical motion of the fundamental particles.

8. Origin of strong force:

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

$$w = ae^{-bx^2} \text{ ----- (9)}$$

$$\text{then, } \frac{dw}{dx} = -2abxe^{-bx^2} \text{ ----- (10)}$$

$$\text{and } \frac{d^2w}{dx^2} = 2abe^{-bx^2}(2bx^2 - 1) \text{ ----- (11)}$$

The slope of the Gaussian curve at any point is found from equation (10). The slope of the curve is zero at $x=0$. The slope decreases as x increases and becomes maximum negative at $x = \frac{1}{\sqrt{2b}}$, which is the point of inflexion satisfying the condition $\frac{d^2w}{dx^2} = 0$. 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 $\frac{d^2w}{dx^2}$ 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 (9) is taken as the order of 10^{30} in S.I. units then point of inflexion will be at a distance of $\frac{1}{\sqrt{2b}} \approx 10^{-15}$ 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 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 and n-p combinations.

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. At this point it is worth discussing that, theoretically as per equation (1) the Gaussian structure of a fundamental particle extends from $-\infty$ to $+\infty$, but practically its effective size is very small, because most parts of the base side of the Gaussian structure remain either above or below 3D surface of separation due to overlapping with the other particles of the universe. The parts of the 3D Gaussian hyper surface that coincide with the 3D surface of separation only contribute to the effective particle structure.

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