

The trinity model of the universe: A hypothetical construct for unification of fundamental forces of nature

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Abstract

The 4 fundamental forces of nature described by standard model are- gravitational force, electromagnetic force, strong nuclear force, weak nuclear force. The true source of these forces tends to remain elusive. Physicists tend to explain the properties of these forces by means of still more elusive “fields” or by means of virtual particles like gluons, gravitons etc. There is a speculation since long that all these forces may be emanating from the same basic source but the nature and origin of such a source is not known as yet. This work discusses this issue in a novel manner. There is a strong pointer that these forces may emanate from a unique relationship between energy, space and time. There are many phenomena like constancy of speed of light, space curvature with matter, length contraction and time dilation with gravity and motion, for which there is no plausible explanation available. This hypothesis strives to explain very briefly the fundamental reason for these in a simple straight manner. It is named ‘trinity model’ as it unveils the unique relationship between 3 basic entities namely energy, space and time.

Keywords: Fundamental forces of nature, space-time, energy, quantum mechanics, force carriers, arrow of time.

Introduction

Standard model explains 4 fundamental forces of nature (Hawking, 2001) i.e. gravitational force, electromagnetic force, strong nuclear force and weak nuclear force. These forces have widely different properties and are explained on the basis of the field theory or so called ‘force carriers’. Field theory envisages ‘fields of force’ around the material bodies (gravitational field) or around a charged particle (electromagnetic field). It imagines lines of force in such fields and assigns various properties to them so as to explain the observed properties of the fields. ‘Force carriers’ are a class of particles called bosons like photons, gravitons, gluons etc. (Lederman, 2007). Although photons have a well proven existence, we cannot be so certain about the rest. In a way, physicists seem to ‘create’ a particle or a force carrier for every observed phenomenon and thus have created a diversified population of elementary particles. This has complicated the picture rather than simplifying it. The true source of natural forces tends to remain obscure. Although field theory has been useful in applied physics, it does not fully solve the fundamental puzzle. There is a speculation that all natural forces are emanating from a common source but field theory is helpless as far as the quest for such a source is concerned. If we can have a pointer for such basic source we can hope to soon find the unified theory. It is now an established fact that energy and matter are inter-convertible and are actually two facets of a single entity (Einstein, 1920). Using proper technology, matter with a small mass can be made to release huge amount of energy. It logically leads to the fact that matter is a concentrated form of energy.

Einstein’s concept of space is that of a dynamic entity closely knit with time, so that 3 dimensions of space and one dimension of time together make a 4 dimensional space-time. Such a space-time is not static and interacts with material entities so that space-time curvature can be found near the material bodies. But Einsteinian model is silent as to why actually such warping of space-time occurs while interacting with matter and how the matter acquires mass. There must be a unique relationship between matter and space and thus between energy and space. As time is

intricately related to space and forms the 4th dimension of space-time continuum, there appear to be 3 basic entities viz. energy, space and time related in a fashion so as to form a self evolving system, the one we refer to as the universe.

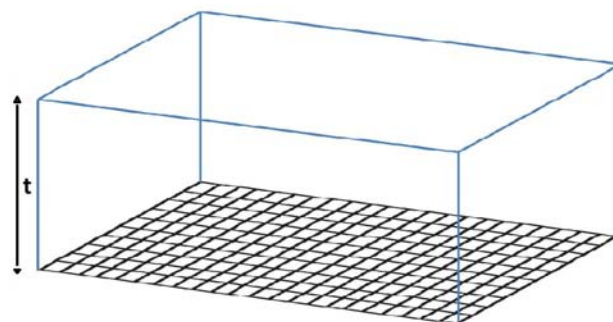
Fundamental relationship

Time and space are knit together in such a way that these form a continuum known to physicists as space-time. In this relationship, if one entity is disturbed the other is bound to be affected. In my model, I envisage a 3rd player in this relationship which has a strong relationship with both space as well as time. This 3rd entity is pure energy. *Pure energy here refers to an entity which is the essence of everything perceived in this universe; can manifest itself in many different inter-convertible forms and during conversion from one form to another can lead sometime to something we call an action.* Pure energy in this model pervades all the spatial dimensions and whole of time dimension uniformly. This refers to the ‘initial’ conditions, when universe is not as such manifest. Energy is uniformly distributed over space-time in an unchanging system that contains entire time dimension in it (Fig. 1).

Birth of the universe

The universe manifests when there is evolution of another spatial dimension (a 5th dimension!) which can

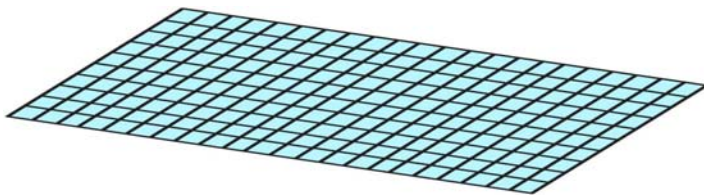
Fig. 1. Isolated, unchanging 4-D system which contains entire time-dimension.



3 dimensional space is represented as 2-D grid & the time-dimension as frame 't'; Energy uniformly pervades all the space-time dimensions.

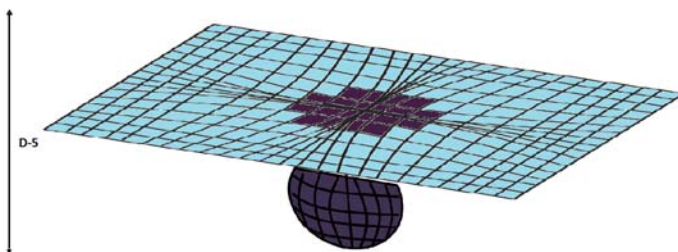
concentrate energy in certain 'entrapments'. Within these entrapments, energy along with corresponding 4 dimensional space-time continuum also gets entrapped due to latter's relationship with the energy. These entrapments are nothing but primordial material units which concentrate huge amount of energy (Fig. 2 & 3). This changes the whole scenario and the system no longer remains uniform. Time and space manifest. The universe is born. Pure energy thus makes the basic ingredient of everything material. Thus, when the universe is not yet manifest, pure energy is uniformly distributed over the space-time so that "energy per unit of space-time volume remains constant." When energy gets trapped inside the material units, it is concentrated to a great extent in the fifth spatial dimension. The corresponding 4-dimensional space-time continuum cannot remain aloof

Fig. 2. An extension of Fig. 1 where the time-dimension is integrated in the 2-D grid and is depicted as blue colour for convenience.



and gets trapped and 'concentrated' as well. It leads to warping of the 4-D space-time in the vicinity of the material particle. The new 5-D system thus formed leads to perception of material bodies at the level of entrapment and 'empty space' outside the entrapment. This model easily explains the curvature or warping of the space as well as the time dilation and all the forces in nature as we will discuss.

Fig. 3. Evolution of 5th dimension (D-5) leading to confinement of energy & as a result that of the space-time into primordial material units; Matter is perceived at the level of confinement while 'empty space' outside such confinement; spatial warping is depicted by the grid deformation while the time warping by change of colour from blue to purple.



Mass-energy equivalence of Einstein gives energy (E) in a particle with mass (m) as

$$E = mc^2 \quad (1)$$

This relationship may be used to get an idea about how much 'concentration' of energy happened with entrapment in the matter particle with mass (m).

$$E/m = c^2 \quad (2)$$

We can deduce how much space-time volume has apparently 'shrunk' inside the matter particle in keeping with its relation to energy. If (S) was the original 4-D space-time volume assigned to energy (E), and the apparent space-time

volume in 5-D system after entrapment within mass (m) be (S')

$$\text{Then, } E/S = m/S'$$

$$E/m = S/S' = c^2 \quad (3)$$

Thus more is the energy trapped inside a particle; more is the mass of the particle and also more is the space-time volume that is trapped inside the particle. Such trapping of 4-D space-time leads to warping of space-time in the vicinity of the particle. Greater mass entraps larger space-time volumes and should lead to greater space-time warping.

If (ζ) denotes the space-time warping then

$$m \propto \zeta \quad (4)$$

From (1) and (4), we can infer that more is the energy (E) 'entrapped' in a particle, more is the space-time volume warped by it.

$$E \propto \zeta \quad (4)$$

This relationship underlines the basic assumption of my model that energy remains uniformly distributed in the space in the 'pre-universal' state, and with the entrapment of energy in the 'material units' corresponding space also gets trapped so that more is the energy content, more is the space-time volume warped.

Two basic forms of energy

With formation of matter, pure energy manifests in two basic forms of perceptible energy. Energy content trapped from 3 spatial dimensions remains confined in the particle and gives the particle its mass. We will refer to this form of energy as 'mass energy' (E_M). Entrapment of E_M in a material unit leads to trapping and deformation of 4-D space-time continuum as discussed earlier. It is the ability of the material unit to trap and deform 3-D space which is perceived as its mass. Second form is the energy content from time dimension and is responsible for the spatial motion of the material unit. This form will be referred to as 'kinetic energy' (E_K). E_K content of a particle deforms the time dimension in its vicinity and leads to slowing of time or time dilation which is perceived as motion of the particle. E_K is relatively liberated form and can shift from one particle to another. Whenever any two particles get into contact this energy gets evenly distributed amongst them. Every material unit has differing contents of these 2 types of energy. For any given particle its mass energy content remains constant, while kinetic energy content varies. Two particles with different E_K are on different time fronts in the time dimension and appear to be in relative motion in 5 dimensional system. Photon represents pure E_K without any attached mass energy. It is therefore mass less. It is restricted only in time dimension. Some ultra-light particles like electron have minuscule E_M content and a relatively higher proportion of E_K . Such particles are less restricted in space as compared to heavier particles like proton or neutron.

Gravitational force

Material bodies, by virtue of their ability to confine the energy, deform the space-time. This distortion leads to various kinds of forces operating in the nature. Two material units placed at a distance will deform the space-time between them in such a way so as to bring together their space-time interfaces leading to perception of an 'attractive force' pulling them together. This attractive force is known to

us as gravitational force. Space warping near material bodies leads to corresponding strain over rest of the space so that gravitation is perceived throughout the space. Warping of the time dimension is perceived as time dilation near the material body and also as motion relative to other particles with different warps.

Relationship with time

Perception of time is inherently linked to motion. In a particle, the energy content from time-dimension is labeled as E_K . Entrapment of E_K leads to time-dimension warping near a material unit. Due to this warping, any particle with higher E_K will be at a different time front in the time-dimension as compared to a particle with lesser E_K . Thus the two particles seem to be in a state of relative spatial motion in the five-dimensional system. Such a warping near the moving particle is also responsible for the time dilation in its vicinity. Different particles have their own perception of time and the motion of time varies at various levels of perception. As an example, two photons with different energy levels perceive the time differently reflected as difference in the frequency (Fig. 4).

Arrow of time

It is the redistribution of E_K that establishes the arrow of time (unidirectional time line). When a particle comes in contact with other particles, their kinetic energy is redistributed amongst themselves equally. A unit with higher energy content gives a portion of its energy to the unit with lesser energy. Reverse is not possible i.e. when two particles with equal E_K come in contact with each other, one of the particles cannot steal all the energy. This is the fundamental reason for unidirectional time line which cannot be reversed (This explanation is in conformity with principle of entropy and thermodynamic equilibrium).

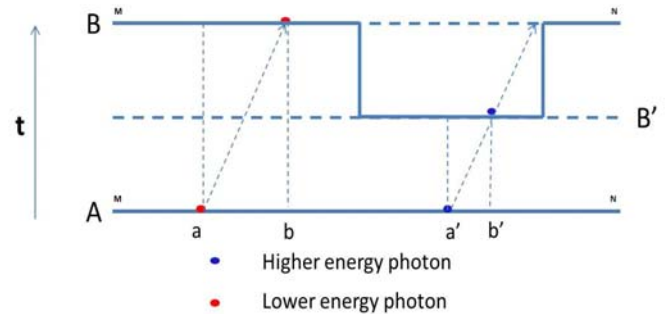
Charge & electrical field

There is a vast accumulation of theoretical knowledge and great advance in the applications of so called 'charged' particles. Even then it is still not known why these charged particles are 'charged'. What gives them unique properties associated with charge? What this charge actually is? Let us see it from a newer perspective keeping in mind the fundamental concepts of our hypothesis. Each particle of matter, charged or neutral is basically the trapped energy. Uniform spatial distribution of energy 'inside' a material particle leads to even distortion of space in all dimensions. Such particles are perceived as 'neutral' particles. In certain particles however energy is distributed in such a manner so that there is uneven distortion of space in various dimensions. Such particles are perceived as 'charged' particles. Two such kinds of configurations are known which we refer to as 'positive' and 'negative' charges. These 2 configurations are complimentary to each other and when two particles with different charges interact with each other, these lead to correction of uneven distortion so as to make it even. Resultant unit is perceived as 'neutral'.

Magnetic interactions

If charge is the expression of unique distortion of the spatial dimensions, magnetism is the expression of such distortion in the time dimension. Magnetism results from motion of 'charged particles' leading to unique time-dimension distortions which are perceived as magnetic field.

Fig. 4. Plane M-N lies in space where two photons at positions a and a' , are at a point in time A; Higher energy photon at a' deforms the time-dimension to a greater degree (shown as a pit in plane MN) as compared to lower energy photon at a ; As a result time MN moves slowly for the former so that it reaches only point B' when the latter reaches point B in time-dimension; the whole affair is perceived in space-time as the difference in the wavelengths ($ab > a'b'$) and frequency ($AB < AB'$).



As motion is a vector associated with direction, the magnetic field has a polarity associated with it. If the motion is reversed, the magnetic poles are also reversed.

Subatomic particles

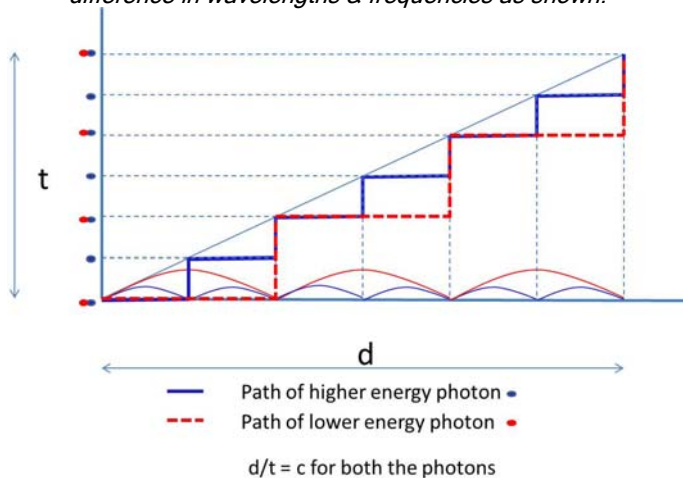
Some of the subatomic particles like proton, neutron and electron have well established theoretical and practical ground although others like quarks are still hypothetical. Although these elementary particles have different characteristics, according to our hypothesis these are actually different forms of same pure energy entrapped in various ways. It is only the manner of entrapment which varies in different elementary particles; otherwise the fundamental ingredient is the same i.e. pure energy. Further, energy in my model is confined in material units possibly in 3 different manners: 1) Particle causing a unique uneven distortion of space, perceived as positive charge: A proton. 2) Particle with an uneven distortion of space complimentary to, but different from, the first one, perceived as negative charge: An electron. 3) Particle entrapping only E_K and thus distorting only time dimension: A photon.

A neutron has its share of energy confined in all the above modules. It is therefore less stable and various energy modules can dissociate so that a free neutron is less stable (life ~ 15 min). Its disintegration leads to release of energy in the form of a proton, electron and bosons (so called weak nuclear force).

Photon

A photon is a more liberated form of energy as compared to electron, proton or neutron. It has all its energy content as E_K . As there is no E_M content, it has no mass and is not restricted in the spatial dimensions. In fact we can say that it is restricted only by the 'motion of time' in time dimension. It means that it 'moves' instantaneously in the space that is allowed to it by time (Fig. 5). That is why there is cap on the motion of photon and it has a 'fixed' velocity. To explain it further, 5-D space-time interface as experienced by the fundamental particles does not seem to be a continuous spread but a grainy structure. Such 'quantized' space-time interface limits the speed of photon which should otherwise be instantaneous. The photon 'moves' instantaneously in the available quantum of space and then, at the space-time

Fig.5. Comparison of the paths of 2 photons with different energy levels in space-time; Photons move instantaneously in the space till they encounter the space-time interface where they 'move' in the time dimension until next space-time quantum and so on; For higher energy photon, the space-time quanta are more warped & time moves slowly (as explained in Fig. 4) as compared to lower energy photon; thus, the energy difference is perceived as difference in wavelengths & frequencies as shown.



interface, it hops in the time dimension to the next quantum. It thus leaps in the space-time. At any given point it has a fuzzy location in both space and time dimensions and perceives both the future and history within the limit imposed by the space-time interface quanta (Miniature God we can say!).

Photon has no E_M content, does not disfigure the spatial dimensions and so has no mass. It has E_K content and thus disfigures only time-dimension. This gives it the motion. Also its spread in time dimension at a given moment is perceived as uncertainty in its definitive location in the space. It seems to have a hold on past and future both, over a range of time. This fact also explains the 'wave' nature of the photons. A photon traps E_K in a number of defined ways. Minimal energy content in the photon is expressed by a longest wavelength radiation. If more energy is added, the wavelength decreases and frequency increases (Fig.4,& 5).

Quantum considerations

Quantum mechanics is based on a few pillars like uncertainty principle and Pauli's exclusion. It describes the dual particle-wave nature of the particles. Its principles seem to be counter-intuitive and baffle even the trained physicists. This model explains the less understood mechanics behind the so called 'quantum nature' of the universe excellently. 'Quantum particles' like photon or electron have a major fraction of their energy as E_K . As we have already discussed, E_K represents particle's 'spread' in the time dimension. In other words, such particles with high E_K content look simultaneously into past, present and future within the limit imposed by the quantization of the time-dimension. This forms the basic reason for the fuzziness of their location in the space-time and thus for perception of the wave nature. It also explains the underlying fact for uncertainty principle and tunnel effect. In the famous double-slit experiment to demonstrate the wave nature of photons and electrons, the fact that these particles seem to 'know' their future paths and

behave accordingly still baffles the physicists (Feynman *et al.*, 1963; Tomomura *et al.*, 1989). As explained above, this model provides such ability to the quantum particles where they are 'aware' of their past as well as future within certain limits. That the electrons can acquire E_K in non-fractional manner in the form of photons is also explained by the grainy or quantized nature of the 5-D system. It satisfies Pauli's exclusion and provides stability to atomic structure.

Quantum mechanics illustrates the limit of our perception. The grand scheme of the universe 'in all probability' seems to be deterministic with a predefined destiny and this model presumes it to be so right at the beginning. Although due to limit imposed by the quantization of the space-time, information travels in a broken manner and to the in-system players in the universe, the system appears to be in-deterministic. As a result we have to depend upon the probabilities to assess or predict the course of events.

Strong nuclear force

Keeping in mind the basic concepts of this hypothesis, we can now construct a model for the atomic nucleus and the process of nuclear fusion. When a number of protons are compressed together while they are possessing high kinetic energy, a part of this energy is assimilated into structure of some of protons so as to alter their basic structure and form neutrons. The resultant neutrons share a part of the energy with the remaining protons which is exchanged between them. The atomic nucleus, therefore, has neither static protons nor static neutrons, but a multitude of 'nucleons'. Each nucleon remains in dynamic relationship with other nucleons and alternates between being a proton or neutron. This sharing of energy leads to strong force between the nucleons and also provides stability to the atomic nucleus.

Conclusions

This hypothetical construct suggests an inherent relationship between 3 basic entities namely energy, space and time. This fundamental relationship seems to be the source of all the natural forces. Some basic statements are: Energy and 4-D space-time are related fundamentally in such a fashion that energy per unit of space-time remains constant. Energy distortions in this uniform system due to any factor (e.g. an additional dimension able to concentrate or distort energy) lead to corresponding space-time distortions. Such distortions explain all the natural forces and phenomena with the help of a suitable conceptual model.

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