The Hypergeometrical Universe: Cosmology and Standard Model

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Abstract. This paper presents a simple and purely geometrical Grand Unification Theory. Quantum Gravity, Electrostatic and Magnetic interactions are shown in a unified framework. Newton's, Gauss' and Biot-Savart's Laws are derived from first principles. Unification symmetry is defined for all the existing forces. This alternative model does not require Strong and Electroweak forces. A 4D Shock-Wave Hyperspherical topology is proposed for the Universe which together with a Quantum Lagrangian Principle and a Dilator based model for matter result in a quantized stepwise expansion for the whole Universe along a radial direction within a 4D spatial manifold. The Hypergeometrical Standard Model for matter, Universe Topology and a new Law of Gravitation are presented. Superluminal neutrinos are explained.

INTRODUCTION

Grand Unification Theories are the subject of intense research. Among current theories, Superstring, M-Theory, Kaluza-Klein based 5D Gauge Theories have shown diverse degrees of success. All theories try to keep the current conceptual framework of science. Kaluza-Klein melded both Electromagnetism and Einstein Gravitational equations in a 5D metric.

Here is presented a theory that departs radically from other theories and tries to bridge the conceptual gap as opposed to explore the formalism gap. Most research is concerned on how to express some view of Nature in a mathematically elegant formalism while keeping what we already know. It has been said that for a theory to be correct, it has to be beautiful.

This work concentrates on what to say, the conceptual framework of Nature instead. All the common constructs: mass, charge, color, hypercharge are dropped in favor of just dilator positions and dilaton fields, which are metric modulators and traveling modulations, respectively. There is no need for the concepts of charge or mass. Mass is modeled as quantity proportional to the 4D metric displacement volume at **precise phases of de Broglie cycles**. Charge sign is modeled by dilaton phase (sign) on those specific phases. The mapping is needed to demonstrate that the geometrical framework replicates current scientific knowledge.

The logical framework is presented on the Hypergeometrical Universe Topology section.

On the Cosmological Coherence section, the consequences of the topology of the hypergeometrical universe and the homogeneity proposed in the Fundamental Dilator based model for matter is shown to result in a cosmological coherence, that is, the whole 3D universe expands radially at light speed and in de Broglie (Compton) steps.

When cosmological coherence is mentioned it is within the framework of absolute time and absolute 4D space (RXYZ or ΦXYZ). There is no sense in speaking of synchronous motion within frameworks containing proper time τ. All force derivations are done considering a framework at rest with respect to the Fabric of Space.

A new Quantum Lagrangian Principle (QLP) is created to describe the interaction of dilators and dilatons. Quantum gravity, electrostatics and magnetism laws are derived subsequently as the result of simple constructive interference of five-dimensional spacetime wave overlaid on an expanding hyperspherical universe. In the electrostatics and magnetism derivation, a 1.007825046 atomic mass unit (atomic mass of a Hydrogen Atom) electron or fat electron is used. This means that the dilatons being 5D spacetime waves driven by coherent metric modulations are coherently produced by all phases of the dilator coherence.

Hypergeometrical Standard Model Section contains a brief description of the Hypergeometrical Standard Model. It shows that hyperons and the elements are modeled as longer coherences of tumbling 4D deformations. Nuclear energy is proposed to be stored on sub-coherence local twisting of the fabric of space.

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A grand unification theory is a far-reaching theory and touches many areas of knowledge. Arguments supporting this kind of theory have by definition to be equally scattered. Many arguments will be presented with little discussion when they are immediate conclusions of the topology or simple logic.

HYPERSPHERICAL UNIVERSE TOPOLOGY

The picture shown in Fig. 1 represents cross sections of the proposed hyperspherical light speed expanding universe. The universe is hypothesized to be created by a four-dimensional explosion, a Big Bang in a Four Dimensional Spatial Manifold. **The evolution of such Big Bang is a lightspeed expanding three-dimensional hypersurface on quantized de Broglie steps. The steps have length equal to the Compton wavelength associated with the fundamental dilator (the atomic mass of a hydrogen atom).** All times (proper time τ and Cosmological time Φ) are made dimensional by the multiplication by the speed of light c.

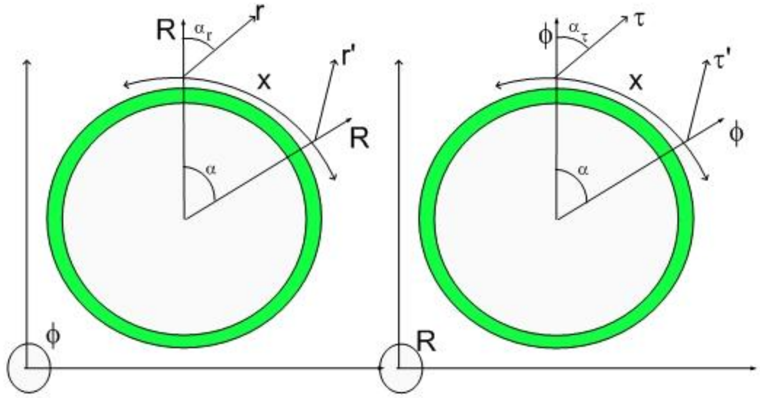

FIGURE 1. These are the cross-sections Xτ and XR for the expanding universe. The universe direction along X is represented by the band. X (or Y or Z) is displayed along the perimeter of the circle. Also shown in the diagram is Φ (cosmological time),proper time τ, radial direction R, proper radial projection r, the Cosmological Angle α between two reference frames XYZτ and X'Y'Z'τ', the local torsion angles $\alpha\tau$ and αr.

Pseudo-Time Quantization/de Broglie Stepwise Expansion of the Universe are the result of the proposed model for matter based upon the Fundamental Dilator together with the proposed topology. These concepts will become clearer when the Fundamental Dilator is presented.

Definitions and simple topology based conclusions:

Cosmological time Φ represents an absolute time frame, as envisioned by Newton and Mach - it is a fifth dimension in the Hypergeometrical Universe Model. It times the expansion of the Universe.

Proper time τ, τ' are projections of the Cosmological Time Φ on the respective reference frames.

Fabric of Space (FS) is the Lightspeed traveling locus where our 3D Universe exists. This is a 3D hypersurface of a shockwave within a 4D spatial manifold. Anything at rest with respect to the Fabric of Space would just travel radially at the speed of light. At the Big Bang all dilators would be initially traveling at the speed of light not only radially but also tangentially in all directions. When the Universe is a point, there is no difference between tangential and radial directions. As the Universe aged, dilators would, on average, reach equilibrium and a low velocity with respect to FS.

The radial direction is a preferential direction in 4D space. It is the radial expansion direction. This direction doubles as a direction on 4D Space and a projection of the cosmological time, since they are related by the expansion speed (light speed).

The 3D Universe has a radius of curvature equal to the age of the Universe time the speed of light. This radius is independent of mass distribution. This is not the same as stating that General Relativity theory cannot reproduce Gravitation effects by mass induced curvature of spacetime (XYZτ).

It will be derived that the Gravitational Constant G is inversely proportional to the 4D radius of the Universe, thus being stronger in the earlier Universe. This should affect the mass of stellar candles such that earlier (far away) stellar candles would have smaller mass and thus smaller energy release, thus misleading intensity based distance measurements.

The Universe is finite but cannot be traversed since it is expanding at the speed of light. Simple geometry can provide the volume of the Universe.

One can only see the Universe up to cosmological angle α=45 degrees.

Any observer is always at the center of their Universe.

The 4D Big Bang occurred on each and every point of the 3D Universe.

Since one can only see the past, cosmological angle α=45 degrees corresponds to the Big Bang or thereabouts.

Doppler shifted Gamma radiation is hypothesized to be the Microwave Cosmic Background [1]. A geometric mechanism for Doppler shifting will be presented later.

The moving frame aspect of this model requires the **actual speed of light to be** $\sqrt{2} * c$ since all measurements of the **observed** speed of light c can only be done at distances small in comparison to the 4D radius of the Universe.

α_R and α_τ represent a direction of propagation and a deformation of the local fabric of space. Since these angles point to direction of propagation it is clear that a local deformation of the fabric of space maps directly to a state of motion. Motion is the result of the relaxation process of the local FS (Hypergeometrical Universe interpretation of Newton's first law) as the FS expands.

$RXYZ$ is modeled as a Cartesian space

ΦXYZ is modeled as a hyperbolic space and thus consistent with Strict Relativity [2,3] if one considers that the Lorentz transformation is a rotation on an imaginary angle equal to atan(v/c).

The rate of torsion of the local FS is proportional to the force (Hypergeometrical Universe interpretation of Newton's second law).

$$F = m_0 c^2 \frac{d \tanh(\alpha_\tau)}{d\tau} \tag{1}$$

Adding the extra spatial dimension implies that:

$$F = m_{04D} c^2 \frac{d \tan(\alpha_r)}{dr} = m_{03D} c^2 \frac{d \tanh(\alpha_\tau)}{d\tau} \tag{2}$$

In this theory, a force capable of moving a body corresponds to a stress capable of deforming the Fabric of Space where that body is located. Notice that the body only has footprints on the FS where the dilators are. The strains are given by $\frac{d \tanh(\alpha_\tau)}{d\tau}$ and $\frac{d \tan(\alpha_r)}{dr}$ where the angles are shown on the two cross-sections on Fig. 1. The "areas" where the strain takes place are given by $m_{04D}c^2$ and $m_{03D}c^2$, respectively. They provide the extensive nature associated with mass in our current view.

Deformation of the Fabric of Space can be understood as acceleration from equation (2).

Newton's Third Law also has a representation within this theory. The stress on interacting dilators (bodies) is also the same with opposing signs; this is equivalent to say that the force felt on each other is equal with opposite signs. This law is valid both on the RXYZ and in the ΦXYZ. Newton's fourth law is the Natural Law of Gravitation which will be derived later from first principles.

The above equations are the basis for the more fundamental theoretical development in this theory. In first analysis, it is just an extrapolation of Newton's Law, which only covers the 3D space and introduces an unknown quantity F. The introduction of a four spatial dimension allows for the creation of the purely geometric tautology relating Stress on the two cross-sections shown on Fig.1. The stress associated with interaction is then same on both cross-sections. The strain is expressed differently in each cross-section and that permits the derivation of our fundamental laws of physics (Newton's, Gauss's, Biot-Savart's) from first principles. If you replace the masses by displacement volumes (4D) and displacement volumes overlap with FS (3D), it becomes clear that Newton's equation can be thought as a Stress-Strain description, where the fundamental laws can be derived from comparing strain on different cross-sections of the Universe.

FUNDAMENTAL DILATOR

We propose that dilators are the basic building block of matter. They are coherences between two metric deformation stationary states in a rotating four-dimensional double well potential. A single coherence between two 4D-space deformation states or fundamental dilator is shown to account of all the constituents of non-exotic matter (elements, neutrons, electrons and protons and their antimatter counterparties) and hyper-nuclei (hyperons) on Hypergeometrical Universe Standard Model Section. This coherence is between two deformation states with 4D volumes corresponding to the electron and proton, or electron-proton coherence. **Here the proton, anti-proton,**

electron and positron are considered to be the same particle or the fundamental dilator, just four faces of the same coin.

Electron and Proton Model

4D Displacement Volume Composition e=(0,-2/3,-1/3), p=(2/3,2/3,-1/3)

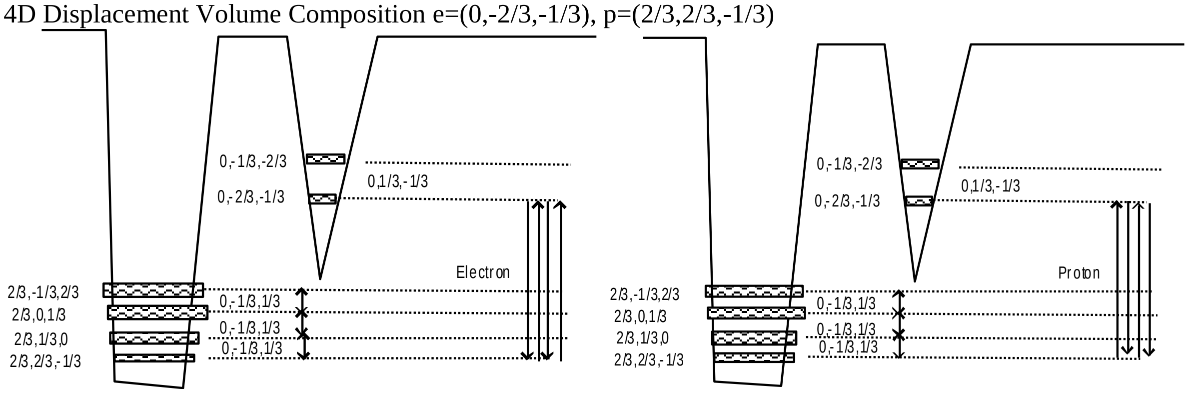

FIGURE 2. 4D Stationary Deformation State diagram for electron and proton.

The coherence four notes are meant to repeat forever since this is a coherence between ground states. He 4D Displacement Volume corresponds to the three axes length of a 4D ellipsoid of revolution.

Where p=(2/3,2/3,-1/3), p*=(2/3,-1/3,2/3),e=(0,-2/3,-1/3),e*=(0,-1/3,-2/3) are a subset of states involved in the three most common "particles"= proton, electron and neutron. Notice that p(e) and p*(e*) differs only by orientation. In this dynamic model, spatial degeneracy is lifted due to the finite time it takes for a proton or electron to rotate within the 3D hypersurface. This subcoherences involving the * states introduce dephasing between tunneling and spinning (rotating perpendicular to R and a direction X or Y or Z), increasing tension on the FS and changing which phase is in phase with the FS. For that, they are referred to as transmutation notes.

A half-cycle shifted diagram would account for positron and antiproton, this just means, that when a Proton is expanding space, an antiproton would be contracting space.

Below is another representation of the electron and positron.

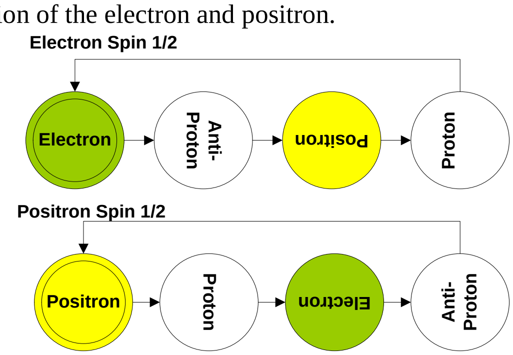

FIGURE 3. Dimensional notes associated with Electron and Positron. Lighter = positive charge, darker = Negative charge, White = Invisible in 3D due to 4D orientation – perpendicular to the Fabric of Space.

The term dimensional note was used to emphasize the similarity between the dilators (metric modulators) and musical instruments and the dilatons (traveling metric modulations) and sounds. The Fundamental Dilator is the ensemble of four dimensional notes, each one corresponding to a dilation or contraction of the local metric. The two involved states correspond to two metric volume displacements mapped to proton and electron masses. Simple inspection of Fig. 3 clarifies the why the usage of a Fat Electron with a mass equal to the mass of a Hydrogen Atom. The mass we are referring to is a 4D Mass, which is the basis for the dissociation of Inertial Mass (3D Mass) and Gravitational (Electromagnetic) Mass (4D Mass). One associated the 4D Mass to the ability to generate a dilaton field. It is clear that with this representation for protons and electrons, they ability to generate a dilaton field is the same (same 4D Mass), since the coherent addition of dilaton fields at 45 degrees does not depend upon which phase of the coherence is in phase with the FS.

Inertial Mass or 3D Mass is the overlap of the Fundamental Dilator with the FS at phases 0, π, 2π and so on. The lettering shown on Fig. 3 indicates the orientation of the state with respect to the FS. Vertical lettering indicates minimum overlap with the FS, thus minimum interaction. Horizontal lettering indicates perfect overlap. It is clear that only at a very specific phase there is interaction, thus one would expect an intermittently interaction Universe. The phase would be randomized after a while if there wasn't a reason for dilators to rephase themselves at each de Broglie step. This reason is the Quantum Lagrangian Principle.

Notice that the first and last elements of the coherence chain are the same and that the coherence repeats itself for its lifetime. In the case of a proton/electron, that lifetime is infinite, since that coherence is between two ground states. Belly up states represent anti-states (anti-proton or positron states).

Since in the theory, there is an absolute time, one can define an absolute phase and that is what distinguishes an electron from a positron. Later it will be clear that more complex coherences involving the p* state (neutrino) will result in a phase shift of the tunneling process with respect to the tumbling process, thus modifying which state is in phase with the shock-wave universe.

The colors are shown only for states that have both a FS overlap and the same frequency as the fundamental dilator.

Another important element of the model is the bolding of the third axis length (e.g. p=(2/3,2/3,**-1/3**)). This means that the spin is a tumbling process around and rotational axis perpendicular to both the radial direction (perpendicular to all three spatial coordinates and the z coordinate). This defines a 4D angular momentum which has to be conserved. More complex coherences like the ones associated with Delta and Sigma particles differs just by the final spin and thus by how the sub-coherences tumbles to make up the final amount of spinning. Details will be

Here is the representation of a proton and an antiproton.

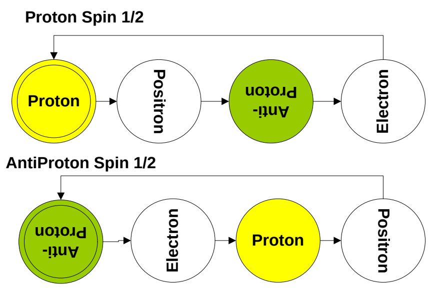

FIGURE 4. Dimensional notes associated with Proton and anti-Proton.

Neutron Model

4D Displacement Volume Composition: neutron = e(0,-2/3,-1/3) plus p(2/3,2/3,-1/3) plus antineutrino(0,-1/3,1/3)= (2/3,-1/3,-1/3)

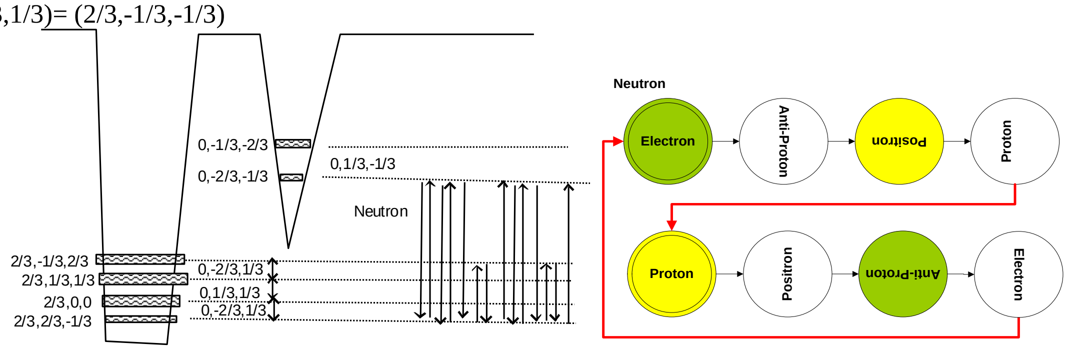

FIGURE 5. Neutron coherence. Notice the electron coherence followed by a subcoherence corresponding to a 90 degrees rotation within the FS followed by a proton coherence and another 90 degrees rotation within FS. Right panel shows Neutron diagram displaying the two fundamental subcoherences and two transmutation notes (half-antineutrino each).

The subcoherences corresponds to the electron antineutrino and changes the phase relationship between tunneling and spinning, permitting a change in the nature of the state in phase with FS. This means that at each de Broglie state, the neutron changes character from electron to proton. Another aspect of this model is its dimer character. Due to the uncertainty on the phase of the initial dilator state, neutron is better described as a dimer (proton/electron) in a pseudo-rotation of 180 degrees at each de Broglie step. A de Broglie step encompasses the four phases of the fundamental dilator subcoherence.

The red lines correspond to the Electron-Proton-Electron transmutation notes. Currently they are assigned to a 3D rotation of the fundamental dilator while in the proton state, due to the larger inertia (displacement volume) of this state, thus slower rotation. The alternative assignment would be that the transmutation note and thus the halv-neutrino subcoherence to be assigned to a 3D rotation while the Fundamental Dilator is in the electron state. This assignment is not cruxial to the theory.

Notice that the electron neutrino corresponds to a subcoherence between states (2/3,2/3,-1/3) and (2/3,-1/3,2/3). This is equivalent to the shrinking of the local metric along axis Y and simultaneous expansion of the same metric along the Z axis. This forms the basis for the assignment of the electron neutrino as an asymmetric dilaton field when free. The difference in dilaton frequency and nature (symmetric for light versus asymmetric for the electron neutrino) forms the basis for my explanation on why an electron neutrino would have a different speed that light. In this case, the asymmetric dilaton mode with higher frequency has a higher speed than the symmetric dilaton mode (light).

Antineutrino Model

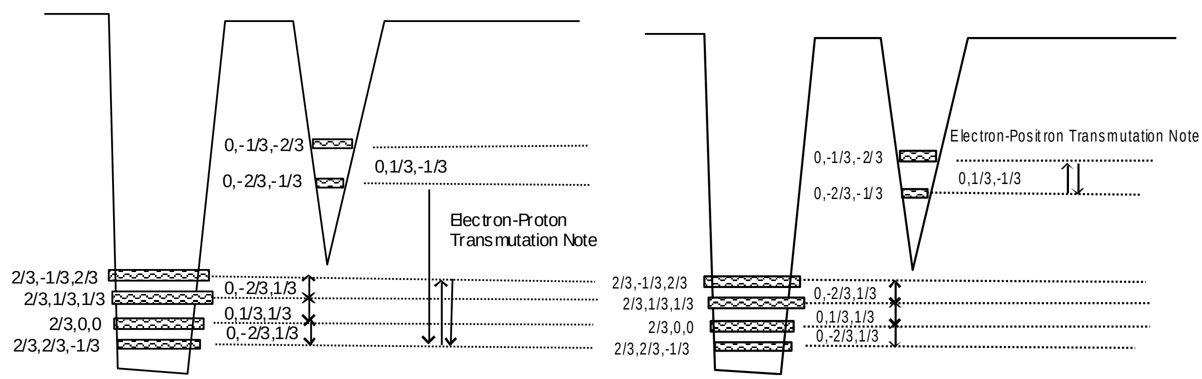

FIGURE 6. Electron-Proton/Proton-Electron and Electron-Positron/Positron-Electron transmutation notes

Each one of these two transmutation notes contribute to a dephasing angle to particles which contain it. The electron-proton transmutation note is present in neutrons while the electron-positron note is present in pions. Two eletron-proton transmutation notes form an antineutrino.

The half-antineutrinos subcoherences (transmutation notes) change the relative phase between tunneling and spinning, thus changing the nature of the FS in-phase coherence from electron to proton and later vice-versa. They also introduces the spring tension associated the nuclear energy stored in a neutron. The pseudo-rotation accompanies a local FS deformation associated with a strong centrifugal acceleration as the dimer rotates within the 3D space. The total deformation is equal to the stored nuclear energy of the particle. When a neutron decays, it generates an antineutrino and a proton and an energetic electron. The energy is stored in the Fabric of Space and the associated angle can be easily calculated. The shift in phase is such that the electron/proton fabric of space twisting is 43.90266/-0.07294 degrees for a neutron at rest, respectively. This is the fabric of space twisting that would result in the observed relative exit velocities plus antineutrino after neutron decaying. Notice that twisting the fabric of space results in an increase in the observed mass or FS overlap of the 4D volume displacement associated with different states, and thus explains the extra mass involved in the neutron formation. This “extra mass or extra overlap” concept is an artifact of the current choice of laws of motion. If one could remain in the logical framework of this theory, the explanation for “larger inertia” is just due to the fact that the larger the twisting of the local FS, the smaller subsequent twisting will be for the same dilaton field. This is due to the fact that interaction always occurs at 45 degrees and that is the maximum angle one can twist FS through this mechanism (dilaton-dilator interference).

The same reasoning is applicable to all particles and elements. The elements and isotopes are modeled as simple coherences involving only the fundamental dilator (electron and proton) and the Electron-Proton transmutation note. Elements and isotopes are represented by more complex polymeric coherences (a neutron is a dimer in this theory). A polymeric coherences containing n Dilators pseudo-rotates by ($2\pi/n$) at each de Broglie step of Universe expansion. The uncertainty on the orientation of the axis of rotation in the 3D manifold is due to our inability to point to the radial direction within a 3D manifold. The axis of rotation undetermined until measured.

Further research should follow to pinpoint the exact angles and their application to the mass calculation of the subatomic particles and isotopes.

Pion Minus Model

The state diagram should read as an electron coherence followed by a electron-positron transmutation note (rotation in the 3D Space in the electron metric deformation state). This transmutation note changes the phase relationship between tunneling and spinning making the next phase to be in phase with the FS to be a positron coherence. This repeat twice (electron->positron->electron) followed by an electron-proton and a proton-electron transmutation notes.

Assignments were made for all hyperon family and will be presented elsewhere.

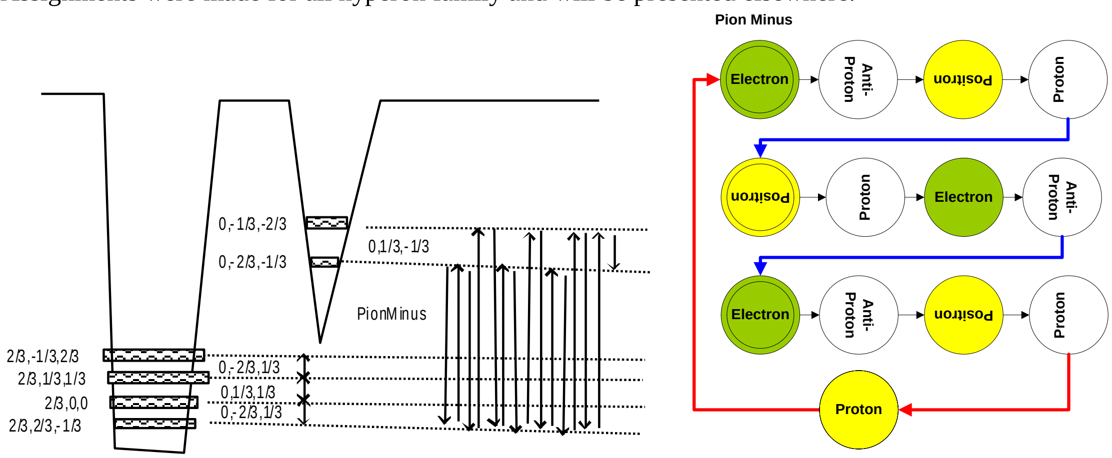

FIGURE 7. Pion Minus Coherence and diagram. Pion minus contains two electrons and one positron subcoherences and form a trimer in the 3D space rotating 120 degrees at each de Broglie expansion step.

PSEUDO TIME-QUANTIZATION AND THE STROBOSCOPIC UNIVERSE

Pseudo Time-Quantization arises when one considers Newton's Law, where mass attracts mass at the direct products of their values. On the intermediate phases, the 3D overlap of the fundamental dilator with the FS goes to zero and so goes its perceived 3D mass, resulting in an intermittent interacting Universe (Stroboscopic Universe).

This pseudo-time quantization and the introduction of a four spatial dimension creates inherent uncertainties in the dynamics of dilator which together with the Quantum Lagrangian Principle would result in the basis for Quantum Mechanics.

QUANTUM LAGRANGIAN PRINCIPLE

The Quantum Lagrangian Principle is nothing more than a direct result of the quantization of space deformation or metric deformation. It states that:

DILATORS ALWAYS DILATE IN PHASE WITH THE SURROUNDING DILATON FIELD

Since Gravitation and everything else is described in terms of metric deformations, all fields are quantized in a sense but not in another. Gravitational/Electromagnetism fields are dependent upon dilaton fields from dilators which provide quantized dilations amplitudes and have to be at any given time on a well defined spatial interference patterned grid, although not at quantized distances. This means that the generation of the field is quantized but the actual dilaton field is not.

This means that interacting dilators (e.g. Hydrogen atom composed of electron and proton), will always be at the nearest maximum dilation (contraction) for proton (electron) at each de Broglie step of the Universe expansion. The phase choice is arbitrary. This means that the electron (the most mobile) with have an uncertain trajectory (due to the azimuthally nature of the interferometric dilaton pattern resulting from proton-electron interaction.

Due to the Quantum Lagrangian Principle, peak dilaton field and dilator position can be thought as being the same, that is, a dilator will surf a dilaton field, which has the real physical meaning of a local metric deformation. The dilaton field-FS overlap on ΦXYZ cross-section corresponds to the de Broglie material waves. While traveling within a 4D spatial manifold, a dilator will always surf the total dilaton field according to RXYZ cross-section. One should be careful not to interpret that particles (dilators) follow just an interference pattern in our 3D Universe. The perceived reality in the 4D spacetime (τXYZ) depends upon the solution of the Hypergeometrical Universe Newton's equation of motion.

ELECTROMAGNETIC AND GRAVITATIONAL DILATORS

The archetypical Electromagnetic Dilator is represented by the Proton or Electron coherences presented previously. The Gravitational Dilator is represented by a spin zero Hydrogen Atom shown below:

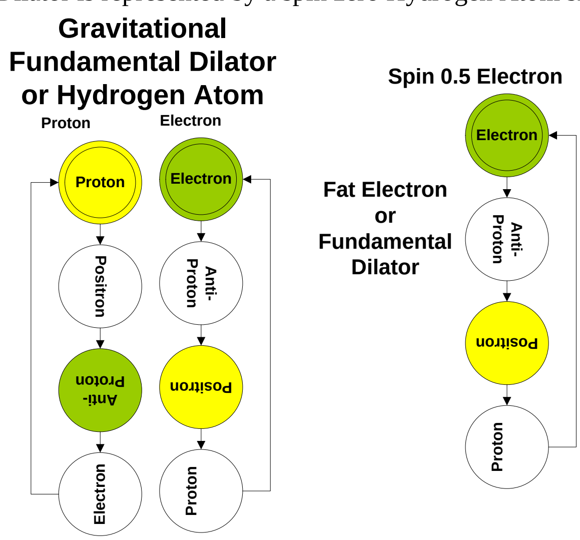

FIGURE 8. Archetypical Gravitational Fundamental Dilator (zero spin Hydrogen atom) and Electromagnetic Fundamental Dilator (electron).

The first thing that comes to mind is that the Gravitational Fundamental Dilator contains two Electromagnetic Fundamental Dilators. Positive and negative phases of the dilator are positioned such as to minimize dilator work, that is, the phases are positioned to be in phase with the surrounding dilaton field.

Their 3D mass or inertial mass behaves as expected. An Electrostatic Fundamental Dilator on an electron pattern has the inertial mass of an electron. A Fundamental Dilator on a proton pattern has the inertial mass of a proton. The reason for a light speed expansion of the shockwave Universe and the synchronization event that forever synched all dilator's spinning will be explained later when we briefly review Cosmogenesis in the Beginning of Times section.

THE MEANING OF INERTIA

Inertia maps to the overlap of the dilator with FS at specific phases when the Universe interacts. At those phases, the larger the overlap, the larger the inertia will be. The reason lies on the Stress-Strain view of interaction. Interacting dilators create dilaton fields which affect the position of other dilators at subsequent de Broglie steps.

This is equivalent to changing the propagation direction within the 4D spatial manifold and thus to a local deformation of the FS. The larger the area that should be deformed the larger the required stress (Force), thus the larger the inertia.

The intersection of this 4D dilator displacement volume with the very thin 4D Universe (Fabric of Space) multiplied by a 4D mass density corresponds to the perceived 3D mass, a familiar concept. Since both the dilator and the Fabric of Space are very thin, the intersection decreases extremely rapidly with spinning angle. The interaction between dilators and dilaton fields (generated by other dilators) is directly dependent upon that footprint. Since the footprint is non-null only at specific spinning angles, interaction is quantized and "existence" is quantized. Where existence was construed according to the following paradigm: "I interact, thus I exist". Neutrinos have been called "Ghostly Particles" due to their very small interaction with the rest of the Universe (dilators). It will be shown that neutrinos correspond to coherences with different wavelength or frequency than the Fundamental Dilator, thus resulting in alternating interactions that are only effective at very short range, thus making neutrino matter interaction cross-section very small.

COSMOLOGICAL COHERENCE

Given that dilators obey the Quantum Lagrangian Principle, thus are never dephased by interactions, then it becomes clear that all dilators are in phase throughout the Universe, creating a Cosmological Coherence.

The existence of macroscopic coherence is the underlying reason why the concept of field can work. If one considers a field to be a property of space, then the coherent addition of dilaton fields is a requirement for the fields to be an extensive property of the number of dilators.

THE PIONEER ANOMALY

The Pioneer Anomaly can be derived directly understood from the Hypergeometrical Universe topology. The anomaly is an unexpected deceleration that cannot be explained by all known facts.

It is our current understanding that only matter curves spacetime, this means that locally the curvature is quite well defined by the inexistence of localized matte. In the vicinity of Pioneer without the obvious occurrence of matter, it is equal to zero. The addition of another spatial dimension in the Hypergeometrical Universe theory changes things, since there are now many curvatures to talk about.

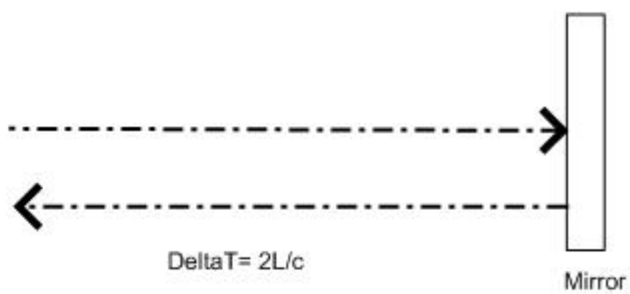

FIGURE 9. Figure showing the reflected radiation bouncing back from the mirror at rest, posing as the Pioneer spacecraft.

Let's see what happens when one measures the speed of light within our standard paradigm. The measure time delay between shooting the laser pulse and measuring the reflection is equal to twice the distance divided by the speed of light.

For a static mirror, the relationship between frequency, wavelength and the speed of light states that:

$$f = \frac{c}{\lambda} \tag{3}$$

Now if we place the mirror in motion we arrive at the standard derivation of the Doppler Effect:

$$f_{Shifted} = \frac{c+v}{\lambda} \tag{4}$$

The Doppler shift is given by:

$$\Delta f = \frac{v}{c} f \tag{5}$$

The derivation is different if one allows both c and v to vary:

$$f_{Shifted}(0) = \frac{c+v}{\lambda} \tag{6}$$

$$f_{Shifted}(\Delta t) = \frac{c+\dot{c}\Delta t + v + \dot{v}\Delta t}{\lambda} \tag{7}$$

Resulting:

$$\frac{\Delta f_{Shifted}}{\Delta \mathrm{t}} = \frac{\dot{c}+\dot{v}}{c} f \tag{8}$$

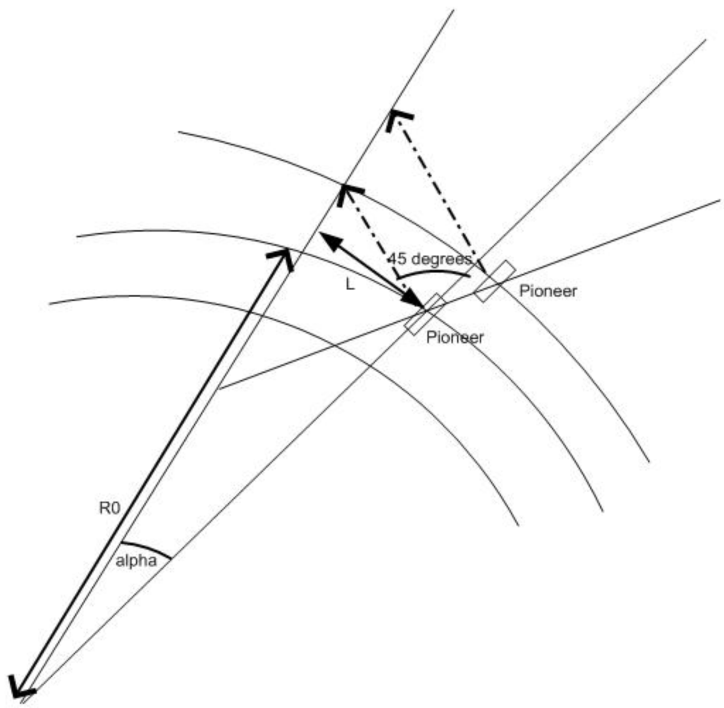

FIGURE 10. Geometry of reflected radiation bouncing back from the Pioneer spacecraft as it travels away.

This means that both accelerations on the speed of light or the actual speed of the Pioneer spacecraft would contribute to the Doppler Shift. The figure below shows how the perceived speed of light would vary as a function of the spacecraft distance.

Fig. 10 shows what would be the path traversed by each pulse emitted by the Pioneer spacecraft. The angle of the light ray is always 45 degrees is consistent with a lightspeed expanding shockwave Universe and with a real speed of light that is $\sqrt{2}c$. The leftmost radial line represents Earth position. This means that when Pioneer is far from Earth by 45 degrees or $\frac{\pi}{4}R_0$, light will never come back (the light ray will be parallel to the Earth radial line. Two parallel lines never meet. From the point of view of being on Earth, this could be interpreted as if the Pioneer spacecraft had reached the speed of light, which it did just by being at that position if one considers the lightspeed expansion of the hyperspherical surface.

Let's say that at time zero, Pioneer is at R_0 from the 4D Center of the Universe and L from Earth and let's derive the deceleration from the simple geometry.

Let R(t) be the Radius of the Universe at the time t:

$$R(t) = R_0 + ct \tag{9}$$

Where time is being measured after a light pulse is emitted from the Pioneer while it is at distance from the 4D Center of the Universe equal to R_0.

The Cosmological Angle associated with Pioneer at time t given by:

$$\alpha(t)=\frac{(L+ct)}{(R_0+ct)} \tag{10}$$

for calculating the deceleration of the speed of light and

$$\alpha(t)=\frac{(L+vt)}{(R_0+ct)} \tag{11}$$

for calculating the deceleration of the speed of the Pioneer spacecraft.

The Cosmological Angle alpha is measured from the actual Center of the Universe. The time that measures the expansion of the Universe is the Cosmological Time Φ, but for quasi-relaxed fabric of space (low velocities), the Cosmological Time is a reasonable approximation to the proper time.

The equation for the photon trajectory leaving the Spacecraft and reaching Earth later is given by:

$$y\left(t,t'\right)=R(t)\sin\left(\propto(t)\right)-c\sqrt{2}t'\sin\left(\frac{\pi}{4}-\alpha(t)\right) \tag{12}$$

Where y(t,t') is the tangential distance represented in the Fig. 10 of the reflected light beam as a function of time t', which starts counting at the reflection moment. The time t refers to the t governing the expansion of the Universe from some given initial condition (R_0, L).

Equating this equation to zero and solving for t', one obtains the time it takes for light to come from Pioneer to Earth at any given time or Pioneer position.

The perceived distance traversed is given by x=c.t':

$$x=ct'=\frac{R(t)\sin\left(\propto(t)\right)}{\sqrt{2}\sin\left(\frac{\pi}{4}-\alpha(t)\right)} \tag{13}$$

Taking the second derivative, expanding in Taylor Series and simplifying to obtain the acceleration as:

$$\frac{d^2x}{dt^2}=\frac{2c^2}{R_0}+\frac{2v^2}{R_0} \tag{14}$$

The observed acceleration is 8.75e-10 m/s^2, the speed of light = 299792458 m / s. This yields a value for R_0= 2.05E+26 meters. Since the Pioneer velocity is much smaller than c and the second term can be neglected.

The 4D observed velocity of light is $\sqrt{2}$c but the Universe expansion velocity is just c. This means that the Universe is $\frac{R_0}{c}$ (**21.72 billion years old**) and not $\frac{R_0}{\sqrt{2}c}$ (1.5364E+10 years old). Analysis using Hubble constant would yield the incorrect results of 15.36 billion years old. Hubble constant is only valid for short cosmological distances. For long distances one should use this equation:

$$H=\frac{\sqrt{2}c}{R_0\cos(\frac{\pi}{4}-\alpha)} \tag{15}$$

Where α is the Cosmological Angle.

Setting $\alpha = 0$ recovers:

$$H=\frac{\sqrt{2}c}{R_0} \tag{16}$$

This is the standard Hubble constant or the inverse of 1.5364E+10 years in seconds.

While observing the past by peering further into space, one changes the angle of observation from 45 degrees for short distances to zero degrees when looking at the Big Bang. This change in the direction of propagation of light as seen from the 4D spatial manifold implies that light wavelength will change (red shift) just by geometrical considerations, thus the Hypergeometrical Universe theory provides a geometrical mechanism for Hubble's red shift.

The conclusions in this section are very important because they break the symmetry between dilators and dilatons, in the sense that they do not travel at the same speed. On the other hand, this velocity relationship is strictly necessary for the Quantum Lagrangian Principle to make all dilators to surf the surrounding dilaton field, since dilators always see retarded dilaton fields at 45 degrees with respect to R.

THE BEGINNING OF TIMES

At the time of the Big Bang, the Universe is a small macroscopic metric fluctuation in a 4D spatial manifold. We speculate that this moment followed a dimensional transition that made the process entropically irreversible.

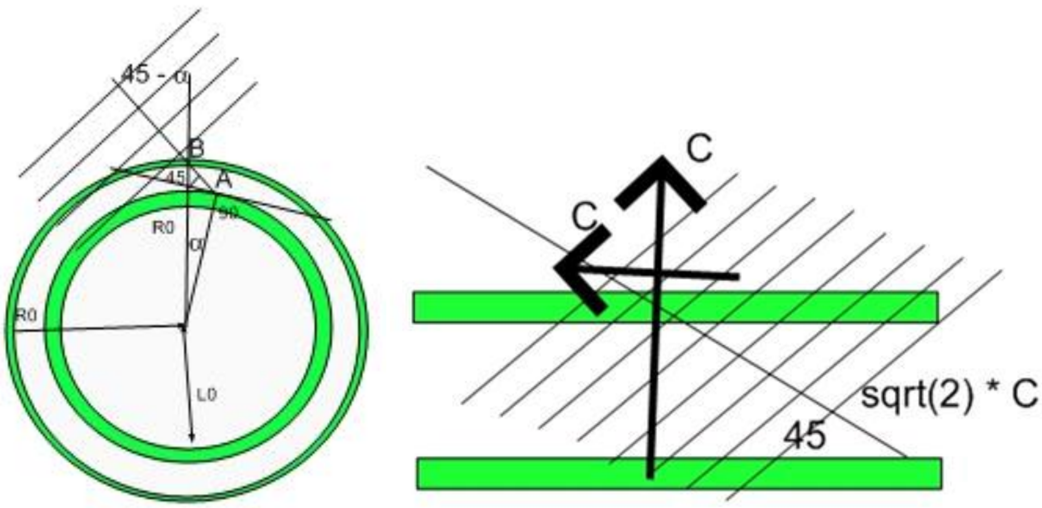

FIGURE 11. Time zero boundary conditions are shown.

In the subsequent instant, the initial metric fluctuation decays into a myriad of smaller metric coherences (dilators) which start to recombine creating Gamma Radiation. The initial burst of Gamma Radiation propels all dilators with the correct spinning phase outwards. This is the synching event that synchronized the spinning of all dilators.

The symmetry of the problem makes radial and tangential degrees of freedom equivalent. Since one would expect equipartition of energy among all degrees of freedom, them one would expect that dilators would be accelerated to the same speed on all directions. Once the Universe is more than a point, the surfing of the retarded dilaton field requires interaction to take place on 45 degrees with respect to the radial direction for the equipartition of energy to take place. This and the first principle derivation of the natural laws of physics are the basis for considering that the initial Universe was accelerated to c at time zero.

Fig. 11 left panel also shows how we peer into the past. Looking at close epochs means looking at a small cosmological angle α where the two near hyperspheres can be approximated by a two hyperplanes. The farther we look, the smaller the hyperspherical Universe was. Light travels at 45 degrees with respect to R from prior epochs. When the inner circle (prior epoch) gets really small, the cosmological angle α moves towards 45 degrees.

QUANTUM GRAVITY AND ELECTROSTATIC INTERACTION

First let’s express Gauss law in terms of two interacting bodies of one Kg4D (4D Mass of one Kg) of dilators separated by one meter distance. The reason for expressing Gauss Law in term of 4DMass is to have a term of comparison with Newton’s Law, that is, both Gravitational and Electrostatic laws should be measuring the effect of the same number of dilators(1Kg4D of electrons or 1Kg3D of Hydrogen Atoms). Due to Fundamental Dilator Model, electron, positron, antiproton and proton are all equivalent to a Hydrogen atom.

The standard MKS equation for electrostatic force between two one Kg4D bodies of electrons (χ a.m.u. “electrons” or “protons”) = x Coulombs, is giving by:

$$F_{Electrostatic} = \frac{1}{4\pi\varepsilon_0}\left(\frac{Coulomb}{1meter}\right)^2\left(\frac{DilatorE}{Coulomb}\right)^2\left(\frac{1Kg4D}{DilatorE}\right)^2\left(\frac{Kg4D}{Kg3D}\right)^2\left(\frac{Kg3D}{Kg3D}\right)^2 = G^{4D}_{Electrostatic}\left(\frac{Kg3D}{meter}\right)^2 \quad \textbf{(17)}$$

Where
Gravitational Fundamental Dilator=DilatorG
Electromagnetic Fundamental Dilator = DilatorE
Kg3D (Kg4D) is one Kg of 3DMass(4DMass)
Electromagnetic Fundamental Dilator 4D Mass= Hydrogen 3DMass=χ= 1.00794u
$\left(\frac{1Kg4D}{1Kg3D}\right)$=Spatial Anisotropy = κ
G is the gravitational constant = 6.6720E-11 $m^3.Kg^{-1}.s^{-2}$
N=1Kg4D of DilatorE =0.5Kg3D of DilatorG ≅1000 Avogrado's Number/χ=5.97470265E+26 dilators per Kg4D.

$$\left(\frac{DilatorE}{Coulomb}\right) = \frac{e}{Coulomb} \quad (18)$$

$$\left(\frac{1Kg_{4D}}{DilatorE}\right) = N = 5.97470265\mathrm{E}+26 \quad (19)$$

$$G^{4D}_{Electrostatic} = \frac{1}{4\pi\varepsilon_0}\left(\frac{N}{1Kg3D}.e\kappa\right)^2 = 8.23558\mathrm{E}+25\kappa^2 \quad \textbf{(20)}$$

Similarly Newton's Gravitational Law can be written for 1Kg4D of Gravitational Fundamental Dilators (Hydrogen Atoms).

$$F_{Gravitational} = G\left(\frac{Kg3D}{1meter}\right)^2\left(\frac{Kg4D}{Kg3D}\right)^2 = G^{4D}_{Gravitational}\left(\frac{Kg3D}{1meter}\right)^2 \quad \textbf{(21)}$$

Resulting:

$$G^{4D}_{Gravitational} = G\kappa^2 = 6.6720\mathrm{E}-11\kappa^2 \quad \textbf{(22)}$$

N ≅ 1000*Avogrado/1 Kg4D/χ=5.97470265E+23.
λ_1 ≅ h*1000*Avogrado/(1 Kg4D * c)/χ /κ= 1.32054E-15/κ meters (in the MKS system).
$\lambda_2=\lambda_{1Kg4D}$≅ h/(1Kg4D x c) /κ= 2.2102E-42/κ meters (in the MKS system).= λ_1/N
e=Single electric charge (1.6022E-19 Coulomb).
ε_0=permittivity of the vacuum = 8.8542E-12 $C^2.N^{-1}.m^{-2}$ (MKS)
Thus

$$\frac{G^{4D}_{Electrostatic}}{G^{4D}_{Gravitational}} == \frac{\frac{1}{4\pi\varepsilon_0}\left(\frac{N}{1Kg3D}e\kappa^2\right)^2}{G\kappa^2} = \frac{8.23558\mathrm{E}+25\kappa^2}{6.6720\mathrm{E}-11\kappa^2} = 1.23435\mathrm{E}+36 \quad (23)$$

To analyze the interaction between a probe dilator and a 1Kg4D body, let's express the dilaton field for a single particle as:

$$\psi_1(x,y,z,\rho,\Phi) = \frac{\cos(\vec{k}_1.\vec{r})}{1+P.f(\vec{k}_1,\vec{r}-\vec{r}_0)} \quad \textbf{(24)}$$

where

$$f(\vec{k}_1,\vec{r}) = \left|\vec{k}_1.\vec{r}\right| \quad \textbf{(25)}$$

For $\left|\vec{k}_1.\vec{r}\right| < 2\pi$ we have $f(\vec{k}_1,\vec{r}) = 0$,that is there is not decay within the first cycle

|| means absolute value

P (absolute value of the phase volume) is 3. The meaning of P is that for one de Broglie wavelength traversed path along R by the hyperspherical universe, a propagating spacetime wave spreads along by a factor of P2π (6π) due to the number of cross-sections involved.

Similarly, for a 1 Kg4D of DilatorE body located at position $\vec{R}$:

$$\psi_2(x,y,z,r,\Phi) = \frac{M.N.\cos(\vec{k}_2.(\vec{R}-\vec{r}))}{1+P.f(\vec{k}_2,\vec{R}-\vec{r})} \tag{26}$$

where the effect of the 1 Kg4D mass is implicit in the k_2-vector and expressed by the factor N. The wave intensity scales up with the number of particles (N). One kilogram of mass has N=1000/χ moles of χ a.m.u. Fundamental Dilators or $|k_2|$ = 1000.Avogadro/χ. $|k_1|$=(N). $|k_1|$, where

M=1 for neutral matter-matter, or antimatter-antimatter interactions or opposite charge interactions

M=-1 for same charge or matter-antimatter interactions

To calculate the effect of gravitational/electrostatic attraction, one needs to calculate the displacement on the dilaton field maximum around each particle or body due to interaction with the dilatons generated by the other body.

This is done for the lighter particle, by calculating the derivative of the waveform and considering the extremely fast varying gravitational wave from the macroscopic body always equal to one, since the maxima of these oscillations are too close to each other and can be considered a continuum.

The total waveform is given by:

$$\psi_{total}(x,y,z,r,\Phi) = \frac{\cos(\vec{k}_1.\vec{r})}{1+P.f(\vec{k}_1,\vec{r}-\vec{r}_0)} + \frac{M*N}{1+P.f(\vec{k}_2,\vec{R}-\vec{r})} \tag{27}$$

Why is the lightspeed c the limiting speed in this Universe?

The reason can be seem from equation (27). Taking of the derivative equation (27) with respect to r and equating it to zero, yields:

$$\frac{\vec{k}_1\sin(\vec{k}_1.\vec{r})}{\left(1+P.|\,\vec{k}_1.(\vec{r}-\vec{r}_0)\,|\right)} - \frac{\vec{k}_1\cos(\vec{k}_1.\vec{r})}{\left(1+P.|\,\vec{k}_1.(\vec{r}-\vec{r}_0)\,|\right)^2} = 0 \tag{28}$$

Notice that the second term was considered saturated, that is, independent upon r.

As interaction increases, r shifts asymptotically to some $\vec{r}_0$, that is, $\vec{r}=\vec{r}_0$ is achieved at saturation. The resulting saturation equation states that:

$$\cos(\vec{k}_1.\vec{r}_0) = \sin(\vec{k}_1.\vec{r}_0) \tag{29}$$

This means that the limiting angle of acceleration is 45 degrees or the speed of light. Notice that there was no use of any postulate as in the Theory of Relativity. This speed limit is the direct result of the choice of interaction and the proposed topology.

Equation (27) is the one and only unification equation, that is, it is the four-dimensional wave equation that yields all the forces, when one considers four-dimensional wave constructive interference. It shows that anti-matter will have gravitational repulsion or anti-gravity with respect to normal matter. The derivative for ψ_1 is given by:

$$\left.\frac{\partial\psi_1(x,y,z,r,\Phi)}{\partial x}\right|_{r=\lambda_1} \cong -k_1^2 r \tag{30}$$

$\nabla\left(P.f(\vec{k}_1,\vec{r}-\vec{r}_0)\right)=0$ **due to** $\left|\vec{k}_1.(\vec{r}-\vec{r}_0)\right|$ **<< 2π.**

Similarly

$$\left.\frac{\partial\psi_2(x,y,z,r,\varphi)}{\partial x}\right|_{r=\lambda_1} \cong \frac{NM}{Pk_2.R^2} \tag{31}$$

Solving for x:

$$x = \frac{N}{P{k_1}^2 k_2.R^2} = \frac{{\lambda_1}^2 \lambda_2 NM}{P(2\pi)^3 R^2} \tag{32}$$

There are two regimen of spacetime travel for the probing dilator and they are depicted in Figure 12 below:

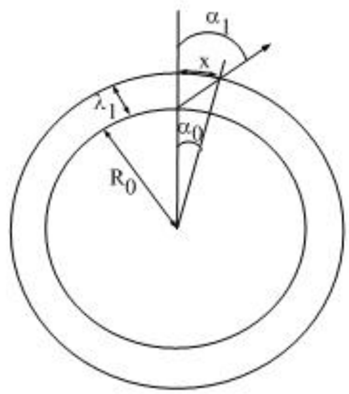

FIGURE 12. This figure shows the geometry of a surface bound particle. This is a X versus R cross-section of the hyperspherical expanding universe. Notice that the two circles represent a one step de Broglie expansion of the hyperspherical universe.

At each de Broglie step both types of particles (zero and non-zero spin) change position by the same amount x and that defines a change in their k-vector direction. The difference is with which referential that change in angle occurs. In the case of volumetric waves (non-zero spin particles), the k-vector is allowed to change by the angle α_1, while in the case of superficial waves (zero spin particles), the k-vector changes just by the amount given by α_0 since its k-vector has to remain perpendicular to the fabric of space. Tan(α) is given by $\tan(\alpha_1) = x/\lambda_1$ or by $\tan(\alpha_0) = x/\lambda_1 * (\lambda_1/R_0)$ depending upon if the interaction is such that the particle k-vector shifts as in α_1 or it just acquires the radial pointing direction as in α_0. A further refinement introduced by equation (33) below introduces a level of local deformation of the de Broglie hypersurface or fabric of space. A change in angle α_0 corresponds to a much smaller angle change between the radial directions (by a factor λ_1/R_0 = 6.43E-42, with R_0 (circa 21.72 billion light-years) as the dimensional age of the Universe). The experimental spacetime torsion due to gravitational interaction lies someplace in between 1 and 10^{-41}, thus showcasing a level of local deformation of the fabric of space. From Fig. 12, one calculates tan(α) as:

$$\tan(\alpha) = \frac{x}{\lambda_1}\delta = \frac{\lambda_1 \lambda_2 N}{P(2\pi)^3 R^2}\delta \tag{33}$$

Where $6.43\mathrm{E}-42 = \frac{\lambda_1}{R_0} \le \delta \le 1$ and M=1. It will be shown that the upper limit is valid for charged particle interaction, while the lower limit modified by a slight deformation of the fabric of space will be associated with gravitational interaction. For the case of light, one has:

$$\tan(\alpha_0) = 1 \tag{34}$$

That is, light propagates with proper time projection/propagation direction τ at 45^0 with respect to the radial direction. To calculate the derivative of tan (α) with respect to τ, one can use the following relationship:

$$\frac{\partial}{\partial r}\tan(\alpha_0) = \frac{\tan(\alpha_0)}{\lambda_1} = \frac{\lambda_2 N}{P(2\pi)^3 R^2}\delta \tag{35}$$

Acceleration is given by:

$$a = c^2 \frac{\partial}{\partial r}\tan(\alpha_0) = \frac{c^2 \lambda_2 N}{P(2\pi)^3 R^2}\delta \tag{36}$$

To calculate the force between two 1 Kg4D masses separated by one meter distance expressed in terms of Kg3D, one needs to multiply equation (36) by $N\left(1Kg_{3D}\right)\kappa^2$ since the acceleration was calculated by a 1Kg4D of DilatorE:

$$F = G_{Calculated}\,(\delta)\frac{(1Kg3D)^2}{(1meter)^2} = -\frac{c^2\lambda_2 * N^2\left(\frac{1Kg4D}{1Kg3D}\right)^2}{P(2\pi)^3(1Kg3D)}\,\delta\,\frac{(1Kg3D)^2}{(1meter)^2} \quad \textbf{(37)}$$

For δ=1 and P=3 one obtains the $G_{Electrostatic}$ (20).

$$G_{Calculated}\,(\delta=1) = \frac{c^2(N\kappa)^2\lambda_2}{P(2\pi)^3(1Kg3D)} = 8.23558\mathrm{E}+25\kappa^2 = G^{4D}_{Electrostatic} \quad \textbf{(38)}$$

With anisotropy given by:

$$\kappa = 1.157055733$$

Remembering of the κ dependence of λ_1. It is important to notice that in the derivation of the $G_{Calculated}$ never made use of any electrostatic property of vacuum, charge etc. It only mattered the mass (spacetime volumetric deformation) and spin. Of course, one used the Planck constant and the speed of light and Avogadro's number. **By setting δ=1 one recovers the electrostatic value of G!**

To analyze gravitational interaction, let's consider our estimate the universe as being around 21.72 Billion Years old or 2.05E+26 meters radius. To obtain the elasticity coefficient of spacetime, let's rewrite $\delta = (\lambda_1/R_0)\xi$ on equation (36) and equate the $G_{Calculated}$ to $G_{Gravitational}$ for two bodies of 1 Kg3D separated by 1 meter.

$$F = G^{4D}_{Gravitational}\frac{(1Kg3D)^2}{(1meter)^2} = -6.6720\text{ E-}11\kappa^2\frac{(1Kg3D)^2}{(1meter)^2} = -\frac{c^2N^2\lambda_2}{(1Kg3D)P(2\pi)^3}\frac{\lambda_1}{R_0}\kappa^2\xi\frac{(1Kg3D)^2}{(1meter)^2} \quad \textbf{(39)}$$

Where P =3 since we are considering a spin-zero interaction. Solving for ξ:

$$\boxed{\xi = \frac{P(2\pi)^3 R_0 G(1Kg3D)}{c^2N\lambda_1{}^2} = 1.457645\mathrm{E}+05} \quad \textbf{(40)}$$

If we consider that the force is given by mass times acceleration:

$$F = m_{Mass}a_x = m_{Mass}c^2\frac{\partial\tan(\theta)}{\partial\lambda} = \frac{m_{Mass}c^2}{\lambda^2_1}\frac{\lambda_1}{R_0}\xi.x \quad \textbf{(41)}$$

$$F = \frac{m_{Mass}c^2}{\lambda_1R_0}\xi.x = m_{Mass}\left(2\pi.\Omega^G{}_{Universe}\right)^2.x \quad \textbf{(42)}$$

The natural frequency of spacetime oscillations is:

$$\Omega^G{}_{Universe} = \frac{1}{2\pi}\sqrt{\frac{c^2\xi}{\lambda_1R_0}} = 37.6\text{ KHz} \quad \textbf{(43)}$$

Notice that this is not dependent upon any masses. That should be the best frequency to look for or to create gravitational waves. Of course, Hubble red shift considerations should be used to determine the precise frequency from a specific region of the universe. At last one can calculate the value of the vacuum permittivity from equations (20) and (27) as:

$$G_{Calculated}\,(\delta=1) = \frac{c^2(N\kappa)^2\lambda_2}{P(2\pi)^3(1Kg3D)} \quad \textbf{(44)}$$

$$G_{Electrostatic} = \frac{1}{4\pi\varepsilon_0}\left(\frac{N}{1Kg3D}e\right)^2 = \frac{c^2N^2\kappa^2\lambda_2}{P(2\pi)^3(1Kg3D)} \quad \textbf{(45)}$$

$$\varepsilon_0 = \frac{6\pi^2 e^2}{(1Kg3D)c^2\lambda_2} = 8.85418782\text{E-}12 \qquad \textbf{(46)}$$

Not surprisingly, there is a perfect match between theoretical and experimental (8.85418782E-12 $C^2.N^{-1}.m^{-2}$) values. The Space Anisotropy coefficient κ was derived to make this identity true. It is important to notice that this derivation don't use any parameterization. The Space Anisotropy coefficient κ and the "FS elasticity ξ" are predictions of the theory, which uses only electron charge, speed of light, Avogadro's number and Planck's constant to relate it to non-hypergeometrical physics.

The complete gravitation equation is given by:

$$F_{Gravitational} = \left[\frac{c^2 N^2 \lambda_2}{P(2\pi)^3 (1Kg3D)} \kappa^2 \frac{\lambda_1}{R_0} \xi \right] \frac{m_1 m_2}{R^2} \qquad \textbf{(47)}$$

Quantum aspects can be recovered by not using fast oscillation approximations. It is also important to notice that equations (26) and (27) can be used to calculate the interaction between any particles (matter or anti-matter) or to perform quantum mechanical calculations in a manner similar to molecular dynamic simulations. The quantum character is implicit in the de Broglie wavelength stepwise quantization. It is also relativistic in essence, as it will become clear when one analyzes magnetism next.

MAGNETIC INTERACTION

The Derivation of the Biot-Savart Law

Let's consider two wires with currents i_1 and i_2 separated by a distance R. Let's consider i_2 on the element of length dl_2 as the result of a moving charge of mass of 1Kg4D of electromagnetic fundamental dilators. This is done to obtain the correct scaling factor.

Without loss of generality, let's consider that the distance between the two elements of current is given by:

$$\vec{R} = \frac{R}{\sqrt{3}} \begin{pmatrix} 1 \\ 1 \\ 1 \\ 0 \\ 0 \end{pmatrix} = R\hat{I} \quad \textbf{and} \quad \vec{r}_0 = \begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} \qquad \textbf{(48)}$$

The velocities are:

$$\vec{V}_1 = v_1 \begin{pmatrix} \alpha_1 \\ \beta_1 \\ \gamma_1 \\ 0 \\ 0 \end{pmatrix} \quad \textbf{and} \quad \vec{V}_2 = v_2 \begin{pmatrix} \alpha_2 \\ \beta_2 \\ \gamma_2 \\ 0 \\ 0 \end{pmatrix} \qquad \textbf{(49)}$$

Due to the spin half, one has after a two de Broglie cycles:

$$\vec{r} = \begin{pmatrix} \frac{r}{\sqrt{3}}.(1+\frac{v_2}{c}\alpha_2\sqrt{3}) \\ \frac{r}{\sqrt{3}}.(1+\frac{v_2}{c}\beta_2\sqrt{3}) \\ \frac{r}{\sqrt{3}}.(1+\frac{v_2}{c}\gamma_2\sqrt{3}) \\ 2\lambda_1 \\ 2\lambda_1 \end{pmatrix} \quad \textbf{and} \quad \vec{R} = \begin{pmatrix} \frac{R}{\sqrt{3}} \\ \frac{R}{\sqrt{3}} \\ \frac{R}{\sqrt{3}} \\ 2\lambda_1 \\ 2\lambda_1 \end{pmatrix} \quad \textbf{and} \quad \vec{r}_0 = \begin{pmatrix} 0 \\ 0 \\ 0 \\ 2\lambda_1 \\ 2\lambda_1 \end{pmatrix} \qquad \textbf{(50)}$$

Since one expects that the motion of particle 2 will produce a drag on the particle 1 along particle 2 direction of motion.

The figure below showcase the geometry associated with these two currents.

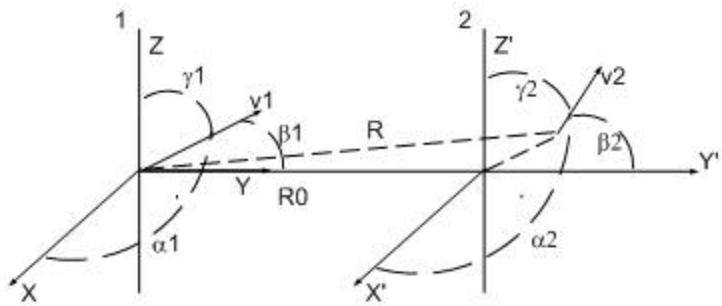

FIGURE 13. Derivation of Biot-Savart law using spacetime waves.

Notice also that the effect of the ½ spin is to slow down the rate of phase variation along the dimensional time τ in half.

In the case of currents, the velocities are not relativistic and one can make the following approximations to the five-dimensional rotation matrix or metric: $\cosh(\alpha) \cong 1$ and $\sinh(\alpha_\iota) \cong v_i/c$ where v_i is the velocity along the axis i.

The k-vectors for the two electrons on the static reference frame are given by:

$$\vec{k}_1 \cong \frac{2\pi}{\lambda_1}\begin{bmatrix} \frac{1}{\sqrt{3}} & \frac{1}{\sqrt{3}} & \frac{1}{\sqrt{3}} & -1 & \frac{1}{2} \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & -\alpha_1\frac{v_1}{c} & 0 \\ 0 & 1 & 0 & -\beta_1\frac{v_1}{c} & 0 \\ 0 & 0 & 1 & -\gamma_1\frac{v_1}{c} & 0 \\ -\alpha_1\frac{v_1}{c} & -\beta_1\frac{v_1}{c} & -\gamma_1\frac{v_1}{c} & -1 & 0 \\ 0 & 0 & 0 & 0 & -1 \end{bmatrix} \qquad (51)$$

$$\vec{k}_1 \cong \frac{2\pi}{\lambda_1}\left[\left(\frac{1}{\sqrt{3}}+\alpha_1\frac{v_1}{c}\right) \ \left(\frac{1}{\sqrt{3}}+\beta_1\frac{v_1}{c}\right) \ \left(\frac{1}{\sqrt{3}}+\gamma_1\frac{v_1}{c}\right) \ \left(-\left(\alpha_1\frac{v_1}{c}+\beta_1\frac{v_1}{c}+\gamma_1\frac{v_1}{c}\right)-1\right) \ \left(-\frac{1}{2}\right)\right] \qquad \textbf{(52)}$$

Similarly:

$$\vec{k}_2 \cong \frac{2\pi}{\lambda_2}\left[\left(\frac{1}{\sqrt{3}}+\alpha_2\frac{v_2}{c}\right)\ \left(\frac{1}{\sqrt{3}}+\beta_2\frac{v_2}{c}\right)\ \left(\frac{1}{\sqrt{3}}+\gamma_2\frac{v_2}{c}\right)\ \left(-\alpha_2\frac{v_2}{c}-\beta_2\frac{v_2}{c}-\gamma_2\frac{v_2}{c}-1\right)\ \left(-\frac{1}{2}\right)\right] \quad \textbf{(53)}$$

The wave intensities at $\vec{r}$ are:

$$\psi_1(x,y,z,r,\Phi)=\frac{\cos(\vec{k}_1.\vec{r})}{1+P.f(\vec{k}_1,\vec{r}-\vec{r}_0)} \quad \textbf{(54)}$$

$$\psi_2(x,y,z,r,\Phi)=\frac{N.\cos(\vec{k}_2.(\vec{R}-\vec{r}))}{1+P.f(\vec{k}_2,\vec{R}-\vec{r})} \quad \textbf{(55)}$$

Where N= 1000 Avogadro/χ, λ_1= de Broglie wavelength of a χ a.m.u (atomic mass unit) particle/κ, λ_2=de Broglie wavelength of a 1Kg4D particle= λ_1/N.

Now one can calculate:

$$\vec{k}_1.\left(\vec{r}-\vec{r}_0\right)\cong$$

$$\cong\frac{2\pi}{\lambda_1}\left[\left(\frac{1}{\sqrt{3}}+\alpha_1\frac{v_1}{c}\right)\ \left(\frac{1}{\sqrt{3}}+\beta_1\frac{v_1}{c}\right)\ \left(\frac{1}{\sqrt{3}}+\gamma_1\frac{v_1}{c}\right)\ \left(-\left(\alpha_1\frac{v_1}{c}+\beta_1\frac{v_1}{c}+\gamma_1\frac{v_1}{c}\right)-1\right)\ \left(-\frac{1}{2}\right)\right]\begin{pmatrix}\frac{r}{\sqrt{3}}.(1+\frac{v_2}{c}\alpha_2\sqrt{3})\\ \frac{r}{\sqrt{3}}.(1+\frac{v_2}{c}\beta_2\sqrt{3})\\ \frac{r}{\sqrt{3}}.(1+\frac{v_2}{c}\gamma_2\sqrt{3})\\ 0\\ 0\end{pmatrix} \quad \textbf{(56)}$$

$$\vec{k}_1.\vec{r}\cong\frac{2\pi r}{\lambda_1}\left(1+\frac{\vec{V}_1.\hat{R}}{c}+\frac{\vec{V}_2.\hat{R}}{c}+\frac{\vec{V}_1.\vec{V}_2}{c^2}\right)+2\pi \quad \textbf{(57)}$$

$$\nabla\left(\vec{k}_1.\left(\vec{r}-\vec{r}_0\right)\right)=\nabla\left(\vec{k}_1.\vec{r}\right)\cong\frac{2\pi}{\lambda_1}\left(1+\frac{\vec{V}_1.\hat{R}}{c}+\frac{\vec{V}_2.\hat{R}}{c}+\frac{\vec{V}_1.\vec{V}_2}{c^2}\right)\hat{R} \quad \textbf{(58)}$$

$$\nabla\left(P.f(\vec{k}_1,\vec{r}-\vec{r}_0)\right)\cong 0 \text{ due to } \left|\vec{k}_1.\left(\vec{r}-\vec{r}_0\right)\right| << 2\pi. \quad \textbf{(59)}$$

Similarly:

$$\vec{k}_2.\left(\vec{R}-\vec{r}\right)\cong$$

$$\cong\frac{2\pi}{\lambda_2}\left[\left(\frac{1}{\sqrt{3}}+\alpha_2\frac{v_2}{c}\right)\ \left(\frac{1}{\sqrt{3}}+\beta_2\frac{v_2}{c}\right)\ \left(\frac{1}{\sqrt{3}}+\gamma_2\frac{v_2}{c}\right)\ \left(-\alpha_2\frac{v_2}{c}-\beta_2\frac{v_2}{c}-\gamma_2\frac{v_2}{c}-1\right)\ \left(-\frac{1}{2}\right)\right]\begin{pmatrix}\frac{R}{\sqrt{3}}-\frac{r}{\sqrt{3}}.(1+\frac{v_2}{c}\alpha_2\sqrt{3})\\ \frac{R}{\sqrt{3}}-\frac{r}{\sqrt{3}}.(1+\frac{v_2}{c}\beta_2\sqrt{3})\\ \frac{R}{\sqrt{3}}-\frac{r}{\sqrt{3}}.(1+\frac{v_2}{c}\gamma_2\sqrt{3})\\ 0\\ 0\end{pmatrix}$$

$$\cong\frac{2\pi R}{\lambda_2}\left(1+\frac{\vec{V}_2.\hat{R}}{c}\right) \quad \textbf{(60)}$$

$$\nabla\left(f(\vec{k}_2,\vec{R}-\vec{r})\right)\cong$$

$$\cong\frac{2\pi}{\lambda_2}\left[\left(\frac{1}{\sqrt{3}}+\alpha_2\frac{v_2}{c}\right)\quad\left(\frac{1}{\sqrt{3}}+\beta_2\frac{v_2}{c}\right)\quad\left(\frac{1}{\sqrt{3}}+\gamma_2\frac{v_2}{c}\right)\quad\left(-\alpha_2\frac{v_2}{c}-\beta_2\frac{v_2}{c}-\gamma_2\frac{v_2}{c}-1\right)\quad\left(-\frac{1}{2}\right)\right]\begin{pmatrix}-\frac{1}{\sqrt{3}}.(1+\frac{v_2}{c}\alpha_2\sqrt{3})\\ -\frac{1}{\sqrt{3}}.(1+\frac{v_2}{c}\beta_2\sqrt{3})\\ -\frac{1}{\sqrt{3}}.(1+\frac{v_2}{c}\gamma_2\sqrt{3})\\ 0\\ 0\end{pmatrix} \quad \textbf{(61)}$$

$$\nabla\left(f(\vec{k}_2,\vec{R}-\vec{r})\right)\cong-\frac{2\pi}{\lambda_2}\left(1+\frac{\vec{V}_2.\hat{R}}{c}\right)\hat{R} \quad \textbf{(62)}$$

Hence:

$$\nabla\psi_1(x,y,z,r,\Phi)\cong-\frac{\nabla(\vec{k}_1..\vec{r})}{1+P.f(\vec{k}_1,\vec{r}-\vec{r}_0)}\sin(\vec{k}_1.\vec{r}) \quad \textbf{(63)}$$

$$\nabla\psi_1(x,y,z,r,\Phi)\cong-\left(\frac{2\pi}{\lambda_1}\right)^2\left(1+\frac{\vec{V}_1.\hat{R}}{c}+\frac{\vec{V}_2.\hat{R}}{c}+\frac{\vec{V}_1.\vec{V}_2}{c^2}\right)^2 r\hat{R} \quad \textbf{(64)}$$

And

$$\nabla\psi_2(\vec{r},r,\Phi)\cong-\frac{NP\nabla(f(\vec{k}_2,\vec{R}-\vec{r}))}{\left(1+P.f(\vec{k}_2,\vec{R}-\vec{r})\right)^2}=-\frac{N}{P\frac{2\pi}{\lambda_2}.\left(1+\frac{\vec{V}_2.\hat{R}}{c}\right)}\frac{\hat{R}}{R^2}\cong-\left(\frac{N\lambda_2}{2\pi P}\right)\left(1-\frac{\vec{V}_2.\hat{R}}{c}\right)\frac{\hat{R}}{R^2} \quad \textbf{(65)}$$

Thus,

$$r\cong-\frac{\left(\frac{N\lambda_2}{2\pi P}\right)\left(1-\frac{\vec{V}_2.\hat{R}}{c}\right)\frac{\hat{R}}{R^2}}{\left(\frac{2\pi}{\lambda_1}\right)^2\left(1+\frac{\vec{V}_1.\hat{R}}{c}+\frac{\vec{V}_2.\hat{R}}{c}+\frac{\vec{V}_1.\vec{V}_2}{c^2}\right)^2}\cong-\left(N\lambda_1{}^2\lambda_2\right)\frac{\left(1-\frac{\vec{V}_2.\hat{R}}{c}\right)\left(\hat{R}.\hat{R}-2\frac{\vec{V}_1.\hat{R}}{c}-2\frac{\vec{V}_2.\hat{R}}{c}-2\frac{\vec{V}_1.\vec{V}_2}{c^2}\right)}{(2\pi)^3P}\frac{\hat{R}}{R^2} \quad \textbf{(66)}$$

$$r_{ee}\cong-\left(N\lambda_1{}^2\lambda_2\right)\frac{\left(\hat{R}.\hat{R}-2\frac{\vec{V}_1.\hat{R}}{c}-2\frac{\vec{V}_2.\hat{R}}{c}-2\frac{\vec{V}_1.\vec{V}_2}{c^2}-2\frac{\vec{V}_2.\hat{R}}{c}+2\left(\frac{\vec{V}_1.\hat{R}}{c}\right)\left(\frac{\vec{V}_2.\hat{R}}{c}\right)+2\left(\frac{\vec{V}_2.\hat{R}}{c}\right)\left(\frac{\vec{V}_2.\hat{R}}{c}\right)+2\left(\frac{\vec{V}_1.\vec{V}_2}{c^2}\right)\left(\frac{\vec{V}_2.\hat{R}}{c}\right)\right)}{(2\pi)^3P}\frac{\hat{R}}{R^2} \quad \textbf{(67)}$$

$$r_{ep}\cong+\left(N\lambda_1{}^2\lambda_2\right)\frac{\left(\hat{R}.\hat{R}-2\frac{\vec{V}_1.\hat{R}}{c}\right)}{(2\pi)^3P}\frac{\hat{R}}{R^2}$$

since v2=0 **(68)**

$$r_{pe} \cong \left(N\lambda_1^{\,2}\lambda_2\right)\frac{\left(\hat{R}.\hat{R}-2\frac{\vec{V}_2.\hat{R}}{c}-2\frac{\vec{V}_2.\hat{R}}{c}+2\left(\frac{\vec{V}_2.\hat{R}}{c}\right)\left(\frac{\vec{V}_2.\hat{R}}{c}\right)\right)}{(2\pi)^3 P}\frac{\hat{R}}{R^2}$$ since v1=0 **(69)**

$$r_{pp} \cong -\left(N\lambda_1^{\,2}\lambda_2\right)\frac{\left(\hat{R}.\hat{R}\right)}{(2\pi)^3 P}\frac{\hat{R}}{R^2}$$

since v1=v2=0 **(70)**

$$r_{total} \cong r_{ee}+r_{ep}+r_{pe}+r_{pp} = -\left(N\lambda_1^{\,2}\lambda_2\right)\frac{\left(2\left(\frac{\vec{V}_1.\hat{R}}{c}\right)\left(\frac{\vec{V}_2.\hat{R}}{c}\right)-2\left(\frac{\vec{V}_1.\vec{V}_2}{c^2}\right)\left(1-\left(\frac{\vec{V}_2.\hat{R}}{c}\right)\right)\right)}{(2\pi)^3 P}\frac{\hat{R}}{R^2} \quad \textbf{(71)}$$

Where p stands for proton and e for electron.

$$r \cong -\left(N\lambda_1^{\,2}\lambda_2\right)\frac{\left(-2\frac{\vec{V}_1.\vec{V}_2}{c^2}+2\left(\frac{\vec{V}_1.\hat{R}}{c}\right)\left(\frac{\vec{V}_2.\hat{R}}{c}\right)\right)}{(2\pi)^3 P}\frac{\hat{R}}{R^2} \quad \textbf{(68)}$$

Here we introduce the correction to the 5D speed of light. From the Pioneer Anomaly analysis, $c->c\sqrt{2}$ yielding:

$$r \cong \left(N\lambda_1^{\,2}\lambda_2\right)\frac{\left(\left[V_1\otimes\left(V_2\otimes\hat{R}\right)\right].\hat{R}\right)}{(2\pi)^3 Pc^2}\frac{\hat{R}}{R^2} \quad \textbf{(69)}$$

Where non-velocity dependent and single velocity dependent contributions where neglected due to the counterbalancing wave contributions from static positively charged centers.

The force between two 1 Kg4D dilators is given by:

$$\vec{F} = N*(1Kg3D)\kappa^2c^2\frac{\partial\tan(\alpha)}{\partial r} = N\kappa^2(1Kg3D)c^2\frac{r}{\lambda_1^2} = N^2\kappa^2(1Kg3D)\frac{\lambda_2}{(2\pi)^3 P}\left(\left[V_1\otimes\left(V_2\otimes\hat{R}\right)\right].\hat{R}\right)\frac{\vec{R}}{R^3} \quad \textbf{(70)}$$

To scale this force into the force between two Coulomb charges traveling with velocities v1 and v2 one just have to multiply the equation by (1C/Neκ)^2:

$$\vec{F} = \left(\frac{1C}{eN\kappa}\right)^2\frac{N^2\kappa^2(1Kg3D)\lambda_2 v_1.v_2}{(2\pi)^3 P}\left(\left[d\hat{l}_1\otimes\left(d\hat{l}_2\otimes\hat{R}\right)\right].\hat{R}\right)\frac{\vec{R}}{R^3} \quad \textbf{(71)}$$

Where one took into consideration that a particle with spin half has a cycle of 2 λ_1 instead of λ_1.

The Biot-Savart law can be written as:

$$d\vec{F} = \frac{\mu_0 I_1.I_2}{4\pi}\frac{(d\vec{l}_1.d\vec{l}_2)\vec{x}_{12}}{|\,\vec{x}_{12}\,|^3} \quad \textbf{(72)}$$

Comparing the two equations one obtains:

$$\frac{\mu_0}{4\pi} = \frac{(1Kg3D)\lambda_2}{(2\pi)^3 e^2 P} \quad \textbf{(73)}$$

Thus

$$\mu_0 = 1Kg3D\frac{\lambda_2}{2\pi^2 e^2 P} \tag{74}$$

From equation (45)

$$\varepsilon_0 = \frac{2P\pi^2 Ne^2}{(1Kg3D)c^2\lambda_1} \tag{75}$$

Thus

$$\mu_0.\varepsilon_0 = \frac{\lambda_2(1Kg3D)}{2P\pi^2 e^2}\frac{2P\pi^2 Ne^2}{c^2\lambda_1(1Kg3D)} = \frac{1}{c^2} \tag{76}$$

Thus one recovers the relationship between μ_0 and ε_0.

We recovered the Biot-Savart law for infinitesimal elements of current. This was achieved by considering the many contributions of positive and negative center charges and using the low velocity approximation. Within a Tokamak Nuclear Fusion device, currents are both positive and negative (hot plasma) and velocities are relativistic. Under these conditions one should use the non-approximated equation derived from equation (62):

$$r \cong -\frac{\left(\frac{N\lambda_2}{2\pi P}\right)\left(1-\frac{\vec{V}_2.\hat{R}}{c}\right)\frac{\hat{R}}{R^2}}{\left(\frac{2\pi}{\lambda_1}\right)^2\left(1+\frac{\vec{V}_1.\hat{R}}{c}+\frac{\vec{V}_2.\hat{R}}{c}+\frac{\vec{V}_1.\vec{V}_2}{c^2}\right)^2} \cong \left(\frac{\lambda_1^3}{P(2\pi)^3}\right)\frac{\left(1-\frac{\vec{V}_2.\hat{R}}{c}\right)}{\left(1+\frac{\vec{V}_1.\hat{R}}{c}+\frac{\vec{V}_2.\hat{R}}{c}+\frac{\vec{V}_1.\vec{V}_2}{c^2}\right)^2}\frac{\hat{R}}{R^2} \tag{77}$$

The force between two 1 Kg4D dilators is given by:

$$\vec{F} = \left(1Kg3D\right)\kappa^2 Nc^2\frac{\partial\tan(\alpha)}{\partial r} = \left(1Kg3D\right)\kappa^2 Nc^2\frac{r}{\lambda^2{}_1} = \left(1Kg3D\right)\kappa^2 c^2\left(\frac{N\lambda_1}{P(2\pi)^3}\right)\frac{\left(1-\frac{\vec{V}_2.\hat{R}}{c}\right)}{\left(1+\frac{\vec{V}_1.\hat{R}}{c}+\frac{\vec{V}_2.\hat{R}}{c}+\frac{\vec{V}_1.\vec{V}_2}{c^2}\right)^2}\frac{\hat{R}}{R^2} \tag{78}$$

To scale this force into the force between two Coulomb charges traveling with velocities v1 and v2 one just have to multiply the equation by $(1C/Ne\kappa)^2$:

$$\vec{F}_1 = \frac{\mu_0 c^2 C_1 C_2}{4\pi}\frac{\left(1-\frac{\vec{V}_2.\hat{R}}{c}\right)}{\left(1+\frac{\vec{V}_1.\hat{R}}{c}+\frac{\vec{V}_2.\hat{R}}{c}+\frac{\vec{V}_1.\vec{V}_2}{c^2}\right)^2}\frac{\hat{R}}{R^2} \tag{79}$$

Or

$$\vec{F}_1 = \frac{C_1 C_2}{4\pi\varepsilon_0}\frac{\left(1-\frac{\vec{V}_2.\hat{R}}{c}\right)}{\left(1+\frac{\vec{V}_1.\hat{R}}{c}+\frac{\vec{V}_2.\hat{R}}{c}+\frac{\vec{V}_1.\vec{V}_2}{c^2}\right)^2}\frac{\hat{R}}{R^2} \tag{80}$$

Where C1 and C2 are the charges traveling at V1 and V2 and c is the speed of light.

GYROGRAVITATION-ELECTROMAGNETISM UNIFICATION

Similarly one can derive the Gravitational Biot-Savart equation by simple analogy to our derivation of the Gravitation Law.

The limit with zero velocity independent term corresponds to the steady state gravitational field (Newton's Law).

$$F_{Gravitaional} = \left[\frac{c^2 N \lambda_1}{(1Kg3D) P (2\pi)^3} \frac{\lambda_1}{R_0} \xi \right] \frac{m_1 m_2}{R^2} = G \frac{m_1 m_2}{R^2} \tag{81}$$

Notice that the value of the Gravitational Constant G is inversely proportional to the 4D Radius of the Universe R_0. This means that at earlier epochs, Gravitation was stronger and at a precise time in the life of the Universe all forces had the same strength. It also means that Stellar Candles would contain smaller masses in the past than they do at later epochs. This means that current measurements of distances across the Universe based upon Stellar Candles might not work properly and indicate unreasonable large distance incompatible with the age of the Universe.

For non-zero relative speed, we obtain the Hypergeometrical Universe Law of Gravitation:

$$\vec{F}_1 = G m_1 m_2 \frac{\hat{R}}{R^2} \left(\frac{\left(1 - \frac{\vec{V}_2 . \hat{R}}{c}\right)}{\left(1 + \frac{\vec{V}_1 . \hat{R}}{c} + \frac{\vec{V}_2 . \hat{R}}{c} + \frac{\vec{V}_1 . \vec{V}_2}{c^2}\right)^2} \right) \tag{82}$$

Equations (79-80) express the force for two elements of charge in motion. They recover Gauss Law under conditions of rest and have identical form as equation (81). This means that a single equation describes everything we know about electrostatics, electromagnetism and gravitation.

The Force derivation uses a boundary condition where the dilator is at rest with respect to the FS. This is equivalent to say that all forces are partial derivatives with respect to R while keeping velocity constant. This is important since the force is velocity dependent. To obtain a potential from which one can calculate dynamics, one need to integrate the equation (81) with respect to R.

$$V_2(R, \vec{V}_1, \vec{V}_2) = G m_1 m_2 \frac{1}{R} \left(\frac{\left(1 - \frac{\vec{V}_1 . \hat{R}}{c}\right)}{\left(1 + \frac{\vec{V}_1 . \hat{R}}{c} + \frac{\vec{V}_2 . \hat{R}}{c} + \frac{\vec{V}_1 . \vec{V}_2}{c^2}\right)^2} \right) \tag{83}$$

This potential can be used in calculating the equations of motion of Mercury around the Sun for instance.

From equation (47) it is clear that R points from position 1 to position 2, F_1 is force acting upon body 1 under the influence of body 2. There is an inherent asymmetry due to the usage of a third inertial reference frame which is inertial. Any reference frame based upon either body would be non-inertial. This equation was derived under the regimen of weak (normal) gravitational pull. It would be easy to derive the same equation for conditions in the surroundings of a Black Hole. One would just not use the derivative approximations.

This means that there is AntiGravity (weakening of Gravitation) right within the Law of Gravitation. If for a moment one sets the referential frame on body 1, thus having V_1=0, the Gravitational Force on F_2 becomes:

$$\vec{F}_2 = G m_1 m_2 \frac{\hat{R}}{R^2} \frac{1}{\left(1 + \frac{\vec{V}_2 . \hat{R}}{c}\right)^2} \approx G m_1 m_2 \frac{\hat{R}}{R^2} \left(1 - 2 \frac{\vec{V}_2 . \hat{R}}{c}\right) \tag{84}$$

This is a much more complex view of Gravitation and it is a view derived from a more fundamental model. It reduces to Newton's Law at zero relative velocity.

This equation is likely to explain jets emanating from Black Holes since it shows that as the Black Hole pulls matter inwards it suffer a stronger pull than when it tries to slow down that same matter. This should be expected since the maximum inward speed is the speed of light. This asymmetric pull makes the Black Hole capable of propelling itself forward by asymmetric acceleration of the matter in front of it. In the case of a symmetric distribution of matter, one would expect double jets.

PRECESSION OF MERCURY PERIHELION

Let's consider equation (80) with V_1=0, that is, body 1 is not rotating. The new potential is given by:

$$V_2(R,V_2) = Gm_1m_2 \frac{1}{R\left(1+\frac{\vec{V}_2.\hat{R}}{c}\right)^2} = Gm_1m_2 \frac{1}{R\left(1-\frac{1}{c}\frac{dR}{dt}\right)^2} \quad \textbf{(85)}$$

This is the Gerber's potential [5,6] which correctly predicts the precession of Mercury perihelion (42.3 arc seconds per century).

GRAVITATIONAL LENSING

To calculate Gravitational Lensing one has to remember that Electromagnetic Waves are modeled as source-position modulated dilaton fields, that is, EM are dilaton fields (extremely small wavelength = Compton wavelength of a hydrogen atom) modulated by the motion of the dilators that create them. Of course, dilators slow motion yields much larger wavelengths consistent with the electromagnetic waves they generate.

To obtain the predictions of the Hypergeometrical Model for the gravitational refraction of an electromagnetic wave, one has to remember that a Force is represented as a Stress in this model. Acceleration is modeled as a local deformation of the Fabric of Space. This is shown in the equation below:

$$F = m_0c^2 \frac{d\tanh(\alpha_\tau)}{d\tau} = c\frac{dm_0v}{d\tau} = c\frac{d(\hbar k)}{d\tau} = \hbar c\frac{\Delta k}{\Delta\tau} \quad \textbf{(86)}$$

Where dτ is equal to cdt, that is, it is a dimensionalized time. The momentum of an electromagnetic wave was represented by hk and its mass by this equation:

$$m = \frac{\hbar k}{c} \quad \textbf{(87)}$$

Light always travels at 45 degrees with respect to the Fabric of Space. This means that Gravitation only affects the direction of propagation within the Fabric of Space. That cross-section is shown below:

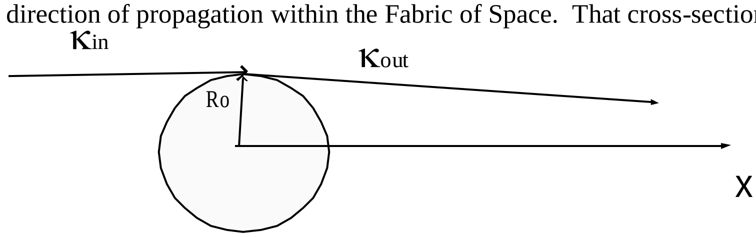

FIGURE 14. Gravitational induced scattering due to Gravitational Force acting upon a photon.

At the position of scattering R=Ro, dR/dt=0 since one cannot increase the speed of light nor decrease it. One can only change its direction within the 3D hypersphere.

The change in direction is shown in the diagram below:

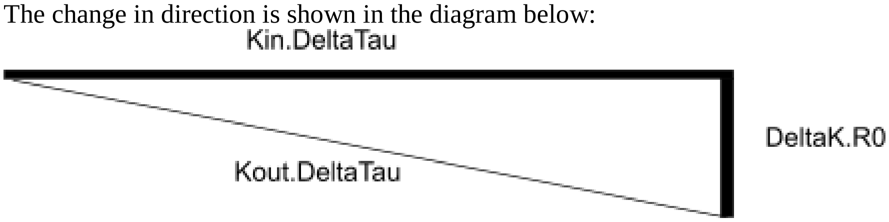

FIGURE 15. Phasematching condition on Gravitational Lensing event.

Δτ is the de Broglie step in the Hypergeometrical Expansion of the Universe. The angle is given by:

$$\alpha = \frac{\Delta kR_0}{k\Delta\tau} \quad \textbf{(88)}$$

The Force can be written in terms of Gravitational fields as:

$$F_2(R,\vec{V}_2) = -Gm_1 m_2 \frac{\hat{R}}{R^2} \quad \textbf{(89)}$$

The equation of motion for an electromagnetic wave is given by:

$$F = \hbar c \frac{\Delta k\hat{R}}{\Delta \tau} = -GMm\frac{\hat{R}}{R^2} = -GM\frac{\hbar k}{c}\frac{\hat{R}}{R^2} \quad \textbf{(90)}$$

From our equation of motion, we obtain:

$$\alpha = \frac{\Delta kR_0}{k\Delta\tau} = \frac{GM}{c^2 R_0} \quad \textbf{(91)}$$

Which is the observed Gravitational Lensing.

SUPERLUMINAL NEUTRINOS

The latest research results from CERN indicates a possibility that neutrinos travel faster than the speed of light. To understand how the Hypergeometrical Universe Theory is compatible with this result, one has to review how the theory models light and electron neutrinos.

What is light?

Electromagnetic interaction (Light) was derived just from the dilaton field as the source moved. This means that Light in the Hypergeometrical Universe Theory is just the positional modulation of the dilaton field source. That motion and its momentum is passed by through the rule of motion (Quantum Lagrangian Principle). As motion takes place, the dilaton field itself is Doppler shifted, changing the perceived dilaton wavelength. This Doppler shift is due to the intersection of the four-dimensional dilaton field with our tridimensional shockwave hyperspherical universe changes depending upon the orientation of the k-vector of the dilaton field. Motion changes the local fabric of space orientation and the k-vector is perpendicular to the fabric of space where the dilator sits at each de Broglie step of the Universe expansion.

In summary, light is a volumetric, propagating deformation of the space in which all the four dimensions are expanded or contracted in phase with amplitudes corresponding to the stationary state of the coherence at any given time. In the electromagnetic interaction, the source of the dilaton field is in motion with respect to the probing dilator.

What is an Electron Neutrino?

As stated on the model for the Neutron presented before, the electron neutrino corresponds to a subcoherence between states (2/3,2/3,-1/3) and (2/3,-1/3,2/3). This is equivalent to the shrinking of the local metric along axis Y and simultaneous expansion of the same metric along the Z axis. This forms the basis for the assignment of the electron neutrino as an asymmetric dilaton field when free. The difference in dilaton frequency and nature (symmetric for light versus asymmetric for the electron neutrino) forms the basis for my explanation on why an electron neutrino would have a different speed that light. In this case, the asymmetric dilaton mode with higher frequency has a higher speed than the symmetric dilaton mode (light).

GRAND UNIFICATION SUPERSYMMETRY

As the dimensional age of the universe becomes smaller, the relative strength of gravitation interaction increases. Conversely, one expects that as the universe expands gravity will become weaker and weaker. This and the four-dimensional light speed expanding hyperspherical universe topology explain the acceleration of expansion without the need of anti-gravitational dark matter.

For gravitation the spring coefficient is given by:

$$F = m_{neutron} * a_x = m_{neutron} c^2 \frac{\partial \tan(\theta)}{\partial \lambda} = \frac{m_{neutron} c^2}{\lambda_1^2} \xi \frac{\lambda_1}{R_0} = \frac{m_{neutron} c^2}{\lambda_1^2} \frac{14.57\mathrm{E}4 \lambda_1}{R_0} x = \kappa_g x \tag{92}$$

Similarly for electrostatic interaction, one has:

$$F = m_{neutron} * a_x = m_{neutron} c^2 \frac{\partial \tan(\theta)}{\partial \lambda} = \frac{m_{neutron} c^2}{\lambda_1^2} x = \kappa_e x \tag{93}$$

Thus

$$\frac{\kappa_g}{\kappa_e} = \frac{14.57 E 4 \lambda_1}{R_0} \tag{94}$$

Thus when R_0 was smaller than $14.57\, 10^4$ times λ_1 (at 6.40E-19s into the Universe life), gravitational and electromagnetic interactions had equal strength. They were certainly indistinguishable when the radius of the universe was one de Broglie wavelength long. This section is called Grand unification supersymmetry, because condition in equation (94) plays the role of the envisioned group theoretical supersymmetry of the grand unification force. Of course, it has a geometrical interpretation. At that exact radius, an elastic spring constant of the fabric of space allows for a change in the local normal such that it is parallel to the redirection of k-vector of a freely moving dilator.

CONCLUSIONS

The Hypergeometrical Universe Model provides alternative views on matter and forces by changing the paradigm under which to describe events. The model provides an alternative Standard Model, Cosmology, Cosmogenesys while maintaining compatibility with Relativity and Quantum Mechanics.

The Fundamental Dilator together with the LightSpeed Expanding Universe and the Quantum Lagrangian Principle provides the basis for Quantum Mechanics.

New Cosmology provides simple explanation for Hubble Expansion, Stellar Candles, and Cosmic Microwave Background. It also provides a new estimate for the age of the Universe (**21.72 billion years old**), Natural Frequency of Gravitational Waves (37.02 KHz), a new estimate of the real velocity of light ($\sqrt{2}$c). The observed velocity of light is c as usual.

Using the Quantum Lagrangian Principle to model dynamics naturally bring about the observed speed of light as being the maximum speed in this Universe. It also explains the reason for increased inertial mass and the slowing down of time with speed (increase twisting of local FS). The larger the speed (local FS twist), the smaller the effect of subsequent interactions (accelerations) will be. The twin in a spacecraft would see its chemistry (aging) altered from the external observer point of view because all the dynamics (interactions) would be creating smaller changes at each de Broglie step. Smaller changes per de Broglie step means slower aging. Nuclear lifetimes [7] are also affected by the local twisting. A more detailed analysis is outside the scope of this paper and will be presented elsewhere.

The concept of the Fundamental Dilator brings about a view of a Stroboscopic Universe where interaction is intermittent and where particle substructure is easily explained by the polymeric nature of dilator coherences. It also brings about the possibility of thinking of matter in terms of metric deformations, thus capable of beating and nonlinear hadronics processes. We proposed new experiments that might bring about Coherent Nuclear Fusion along the lines of nonlinear optical interactions. Phase matching angle for coherent hadronic processes is tuned by changing the relative interaction velocity, which is an angle or direction in the 4D spatial manifold.

The theory was applied to standard tests (Precession of Mercury Perihelion, Gravitational Lensing), was used to explain the Stellar Candle paradox without the use of inflation, Hubble expansion without Dark Energy, Neutron Decay without Electroweak Interaction, Particle Substructure without quark composition and Black Hole's Double Jets with the use of Gyrogravitation.

The Fabric of Space Stress-Strain paradigm applied to the two cross-sections of the Universe (RXYZ and ΦXYZ) allowed for the derivation from first principles of natural laws (Gauss, Biot-Savart, Newton's Gravitation) and the derivation of a more general equation that applies to all forces.

This is a simple theory in terms of formalism, which provides new insights and testable predictions.

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