THE HYPERGEOMETRICAL UNIVERSE THEORY

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Abstract:

The Hypergeometrical Universe Theory (HU) introduces a novel model of the universe and matter, fundamentally altering our understanding of cosmology, quantum mechanics, and classical forces**[Smarandache, F. (2007)][Smarandache, F., & Christianto, V. (2007)][Pereira, M., 2017][Pereira, M., 2018]**. Central to HU is the concept of the Fundamental Dilator (FD), a quantum mechanical wave generator responsible for shaping space through metric waves. HU posits that all particles are polymers of FDs, existing as shapeshifting space deformation solitons spinning in 4D and traveling at the speed of light along a hyperspherical locus in a 4D spatial manifold. This model redefines matter and **replaces conventional particle-wave dualism with the Quantum Trinity** of the FD, the dilaton field, and the Quantum Lagrangian Principle (QLP).

HU reinterprets spacetime as a mere proxy for events occurring in a 4D spatial manifold, introducing an absolute 4D reference frame and reinterpreting Lorentz transformations in reciprocal space. So, HU replaces all the discussion on metric, spacetime with rotation matrices in a 4D spatial manifold affecting not space but 4D k-vectors. In HU, forces are carried by the dilation field (4D metric waves). Waves' 4D k-vectors transform according to Lorentz transformations. So, HU solves the dynamics problem in the inertial frame and then reverts the solution to the Absolute Reference frame.

By doing so, HU derives the Laws of Nature from first principles and resolves fundamental issues in cosmology, dismissing the need for dark matter, dark energy, and inflation [**Guth, A. ,1981**]. The theory explains the horizon problem with an initial hyperspherical uniform mass distribution and galaxy dynamics with idiosyncratic mass distributions while showing that time dilation is an artifact of diminishing forces as absolute velocities approach the speed of light.

One of HU's significant contributions is the derivation of the laws of gravitation and electromagnetism, demonstrating that both follow the same Lorentz force format. The radial dependence of gravitational forces is shown to be a consequence of reference frame selection, such as one centered on the Sun, where radial symmetry dictates the force's behavior. This revolutionary insight has profound implications for electrodynamics, promising to transform the design of magnetic bottles, stellarators, tokamaks, and space propulsion technologies.

Additionally, HU interprets gravitation as a Van der Waals force, where the carrier dilaton field oscillates at a frequency of 1E24 Hertz. This high-frequency process leads to the dynamic screening of gravitational effects, unifying gravitation and electromagnetism. The theory also facilitates non-perturbative Quantum Chromodynamics (HU-QCD) by mapping its particle model to the Pati-Salam **[Pati, J. C., & Salam, A.,1974]** SU(4) GUT model and eliminating the

need for an integral functional in the Lagrangian Principle through the use of the Quantum Lagrangian Principle (QLP).

Lastly, HU addresses and resolves the Faint Sun Paradox, the Spiral Galaxy Rotation Curve Conundrum, the Early Galaxy Formation Conundrum, the HyperBright Early Galaxies Conundrum, the Cylindrical Galaxy Conundrum (JWST observations) which will be presented in forthcoming work.

Keywords: hypergeometrical universe, cosmology, astrophysics, relativity, dark matter, dark energy, Special Relativity, General Relativity, L-CDM, SN1a

1. INTRODUCTION

In the early days of scientific inquiry into the nature of matter, two prominent figures, Sir Isaac Newton and Christiaan Huygens, presented contrasting views. Newton described particles as discrete entities, essentially small, hard objects interacting through forces. On the other hand, Huygens proposed that particles exhibit wave-like properties, a perspective that laid the groundwork for the wave theory of light.

A parallel debate regarding the nature of light, specifically photons, mirrored the historical debate between Newton and Huygens on the nature of matter.

HU introduced the 4D metric waves or dilaton field. What we call Lights are waving on the top of these metric waves. The Dilaton Field has a wavelength equal to the Hydrogen Atom Compton Wavelength. The whole field is a quantum system; energy is added or extracted from it in quantized packets.

The concept of the Absolute Reference Frame (ARF) is central to HU and is first visualized through the depiction of Minkowski Spacetime in Figure 1. In HU, the ARF comprises a vertical vector perpendicular to the Minkowski hyperplane and any three orthogonal vectors within that hyperplane. When HU replaces the Minkowski hyperplane with the Lightspeed Expanding Hyperspherical Universe (LEHU), the vertical vector becomes the Radial Direction, reflecting the expansion and structure of the universe. This transition from the conventional Minkowski interpretation to the LEHU model emphasizes HU's view that the universe operates within a 4D spatial manifold, challenging traditional perceptions of space and time **[Einstein, A., 1905]**.

The Hypergeometrical Universe Theory (HU) fundamentally redefines our understanding of matter, physics, and quantum mechanics. HU introduces a new model for matter as shapeshifting deformations of space, moving beyond traditional particle concepts. This model operates under the Quantum Lagrangian Principle (QLP), a unifying principle that replaces all existing physical laws. Furthermore, HU corrects the limitations of the particle-wave dualism by proposing a **Quantum Trinity** consisting of the Fundamental Dilator (FD), the dilaton field, and the QLP, providing a complete and consistent framework for describing physical reality

Newton's contributions to physics are monumental, particularly his four laws of dynamics, which have been foundational to our understanding of motion and forces:

1. Newton's First Law (Law of Inertia) **[Newton, I., 1687]**: An object will remain at rest or in uniform motion in a straight line unless acted upon by an external force.
2. Newton's Second Law (Law of Acceleration): The acceleration of an object is directly proportional to the net force acting upon it and inversely proportional to its mass (F = ma).
3. Newton's Third Law (Action and Reaction): For every action, there is an equal and opposite reaction.
4. Newton's Law of Universal Gravitation: Every particle attracts every other particle in the universe with a force directly proportional to the product of their masses and inversely proportional to the square of the distance between their centers.

HU REPLACES MASS AND FORCE BY 3D DISPLACEMENT VOLUME AND ACCELERATION AS FUNDAMENTAL CONSTRUCTS.

The Hypergeometrical Universe Theory (HU) introduces a new perspective on this foundational concept. Instead of focusing on mass and force, HU considers 3D displacement-volume and acceleration as the primary concepts. From these, mass and force can be derived.

HU REPLACES PARTICLE-WAVE DUALISM WITH FUNDAMENTAL DILATOR-DILATON FIELD-QUANTUM LAGRANGIAN PRINCIPLE TRINITY

At the core of HU is the Fundamental Dilator (FD), a wave generator that serves as the monomer of particles. All particles are polymers of the Fundamental Dilator, and these FDs generate metric waves as they interact with the fabric of space. Displacement Volume is the volume a phase of the Fundamental Dilator has at a given time.

The debate between Newton and Huygens continued to evolve, and with the advent of quantum mechanics, a new understanding emerged: the wave-particle duality. This principle posits that particles like electrons and photons exhibit wave-like and particle-like properties, depending on the experimental setup.

Instead of particle-wave duality, HU introduced wave-generator (FDs), wave (dilaton field or metric waves created by FD shapeshifting and spinning in 4D), and the **connection between wave-generators and waves - the Quantum Lagrangian Principle or QLP**.

The **Quantum Lagrangian Principle** states that FDs will move at the speed of light radially and within the 3D hypersurface such that they always land in a position where they dilate space in phase with the local dilaton field.

This is a **Quantum Trinity** - or three intertwined concepts. QLP is the connecting tissue between the wave and the particle in the wave-particle dualism. It is the ONLY Law of Nature and replaces Newton’s Four Laws of Dynamics.

HU REPLACES NEWTON'S LAWS OF DYNAMICS WITH THE QUANTUM LAGRANGIAN PRINCIPLE (QLP) AND A SINGLE FIELD - THE DILATON FIELD

HU derives the laws of Nature from first principles using a single field - the Dilaton Field. The Dilaton Field is the interference pattern from the metric waves generated in all Fundamental Dilators. QLP is a Lagrangian Principle because it postulates that a particle (Fundamental Dilator Polymer) will not do work against or receive energy from its constraint (Space). It is "Quantum" because the Fundamental Dilator is a Quantum Mechanical Construct. In other words, HU is a Quantum Mechanical Theory because its fundamental construct is a Quantum Object.

HU REPLACES INDISTINGUISHABLE 3D REFERENCE FRAMES WITH AN ABSOLUTE 4D REFERENCE FRAME.

HU assigns absolute velocity to be used in Lorentz transformations**[Jackson, J.D., 1998]**, fundamentally changing how we understand these transformations. In traditional physics, Lorentz transformations are applied to time and space. In HU, they are applied both to spacetime and to the 4D spatial manifold.

HU CHANGES THE DOMAIN OF LORENTZ TRANSFORMATION FROM SPACETIME TO THE RECIPROCAL SPACE (WAVELENGTH, PERIOD, AND 4D K-VECTORS).

In 1905, Einstein looked at Physics and recognized these items:

a) Electromagnetism evolved to a point where it became codified into Maxwell's equations.
b) Maxwell's equations allowed you to derive a wave equation coupling electric and magnetic fields, thus indicating that light is an electromagnetic wave.
c) The coupled wave equation wasn't covariant to Galilean Reference Frame transformations; it was only covariant to Lorentz transformations.
d) As we know, a wave is defined by the position of its peaks and troughs, and those are defined not by (x,t) only but by (k.x, w.t). In other words, the wave nature of electromagnetism wouldn't change if one considers that Maxwell's equations are written for the Absolute Reference Frame.
e) HU considers Lorentz transformations effect upon the reciprocal space (λ, T) to derive the Laws of Nature on the Absolute Reference Frame.

HU expanded space to include a fourth spatial dimension and instead applied Lorentz Rotation to dilaton field 4D k-vectors and frequencies. The addition of the extra spatial dimension allows for the identification of an Absolute Reference Frame.

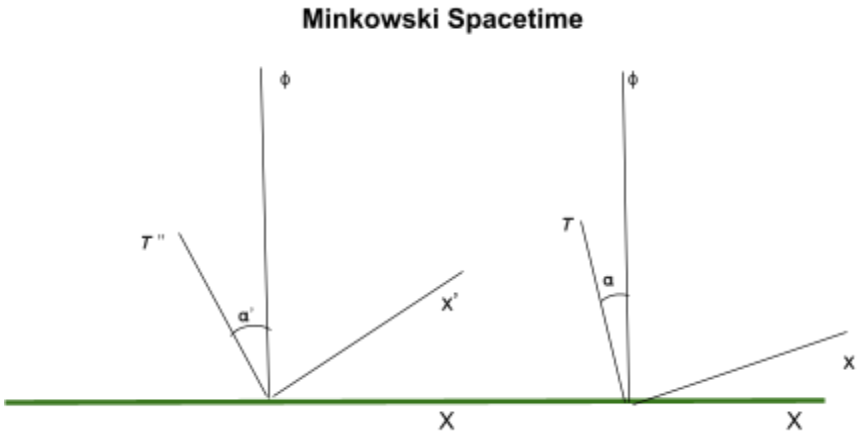


Figure 1. Here, you see the Minkowski Spacetime, where I added a natural **Absolute Reference Frame** (ϕX) with ϕ perpendicular to the hyperplane. Also shown is the Rotation that Herman Minkowski proposed as the interpretation of Lorentz transformations. This same Absolute Reference Frame can be depicted when on consider the universe to be a Ligthspeed Expanding Hyperspherical Hypersurface. The Minkowski's hyperplane becomes a hypersphere and the perpendicular axis becomes the Radial Direction.

It is easy to see that:

$$\frac{d\Phi}{d\tau} = \cos h(\alpha) \qquad (1)$$

In other words, Lorentz transformations dilate the Period of the Fundamental Dilator Coherence instead of dilating Time. The Fundamental Dilator coherence is the Cosmological Clock. If one dilates the period of the clock, one is effectively dilating time and more importantly slowing down dynamics. The latter is HU's interpretation of events. By keeping track of the existence of an Absolute Time and a Cosmological Clock, HU avoids the pitfalls of "Dilating Time without a Clock". Currently, that kind of reasoning leads to absurd conclusions like "A person falling into a Black Hole will see the end of times" or "there is an accumulation layer of things falling into a Black Hole."

Similarly, Lorentz transformations dilate the Wavelength of the Fundamental Dilator Coherence instead of dilating length.

This is a requirement for the Fundamental Dilator always be at the Lightspeed Expanding Hyperspherical Locus of our 3D Universe. In other words, the period and wavelength adjust to remain traveling with our universe. That is expected if one considers the Conservation of Linear Momentum along the radial direction.

All forces are carried by the dilaton field (metric waves) and indirectly through space elasticity.

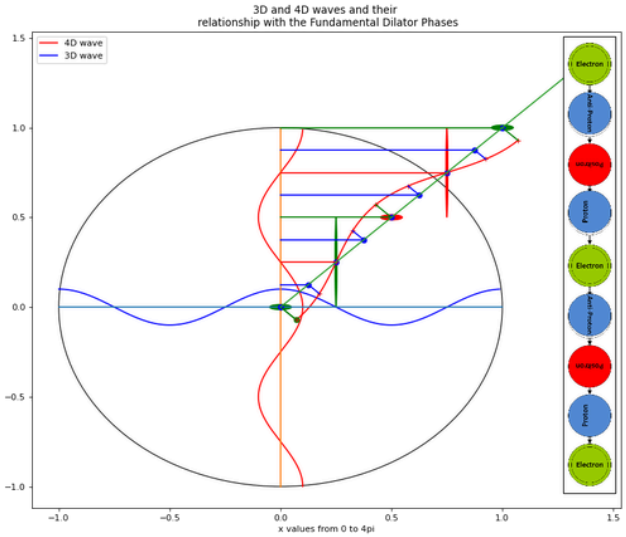


Figure 2. Here, it shows how the Fundamental Dilator wavelength stretches with time dilation. This is a requirement because everything is regulated by the elasticity of space. Notice that the diagonal green line represents the proper r or τ,depending if you are considering this cross-section to be in the 4D spatial manifold or in the 4D spacetime.

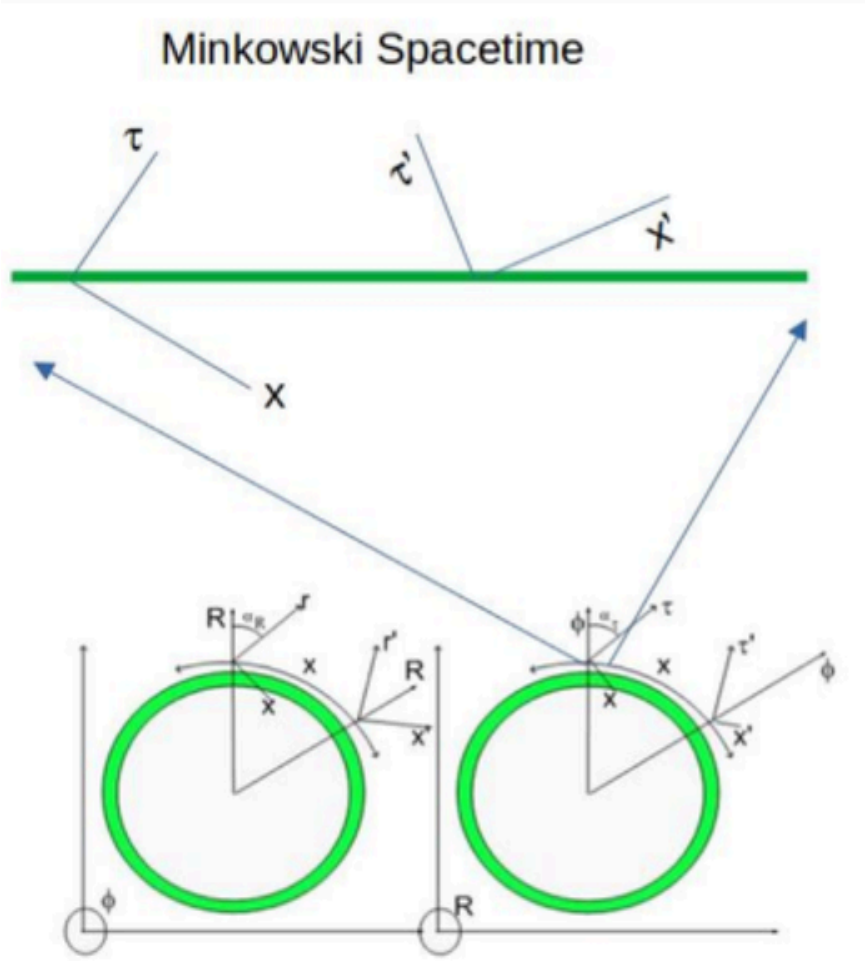


Figure 3. Here, you see the cross-sections of the 4D spatial manifold and 4D spacetime. You can identify the unperturbed Fabric of Space, represented by the circles and the Radial direction R, perpendicular to our 3D spatial manifold at every point. Notice that for short distances (local phenomenon), the circle on the right becomes the familiar Minkowski Spacetime Hyperplane.

One can see that Minkowski Spacetime (on the right panel) is just a local homology to what happens in the actual universe, represented by the circle in the left panel. In other words, everything exists in a 4D Spatial Manifold.

When one considers that HU applies it to the wavelength and period, it is straightforward to understand why the speed of light is constant, irrespective of which inertial frame one uses. Light Velocity is the ratio between wavelength and period, and these are modified by the same cosh(α). This means that HU recognized that Lorentz transformations govern not space and time or spacetime but the reciprocal space to spacetime (wavelength and period).

In other words, HU disavowed all later developments in metrics and geodesics. To be 100% clear, HU retakes Physics to the point before Einstein and Minkowski drove into spacetime and

differential geometry. In HU, the Universe exists in a 4D Spatial Manifold. Time is there just to time processes.

HU PROVIDES THE FUNDAMENTAL PROCESS, THE TIMEPIECE FOR THE WHOLE UNIVERSE. THIS PROCESS IS THE FUNDAMENTAL DILATOR TUNNELING PROCESS AND THE GENERATED METRIC WAVES.

Unlike Relativity (current Physics), HU has an underlying process (the tunneling of the Fundamental Dilator) that provides Time with meaning. Lorentz transformations dilate wavelength and period for this process, assuring that the Fundamental Dilator, the dilaton field, and the electromagnetic field (waves on the top of a finer wave) keep pace with the Lightspeed Expanding Hyperspherical Universe.

This approach highlights the true essence of Lorentz transformations: ensuring that the laws of physics remain consistent across all reference frames when expressed in terms of the Absolute Reference Frame.

HU CREATES COVARIANCE BY MAKING THE FORCE IN ALL INERTIAL REFERENCE FRAMES EQUAL TO THE FORCE IN THE ABSOLUTE REFERENCE FRAME

The relationship between force and acceleration in HU is given by:

$$F = m_{3D}c^2 \frac{d\tanh(\alpha)}{dR} = m_{3D}c^2\left(1 + \tanh^2(\alpha)\right)\frac{d\alpha}{dR} = \left(1 - \frac{v^2}{c^2}\right)m_{3D}c^2\frac{d\alpha}{dR} \tag{2}$$

with $\tanh(\alpha) = \frac{v}{ic}$

$$F = m_{3D}\frac{dv}{dt} = m_{3D}\frac{d^2x}{dt^2} = \left(1 - \frac{v^2}{c^2}\right)m_{3D}c^2\frac{d\alpha}{dR} \tag{3}$$

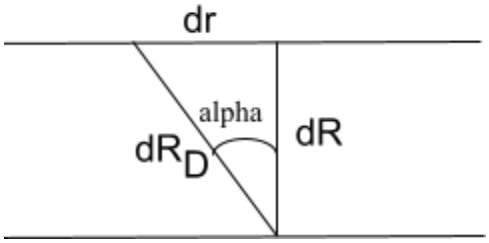
$$F = m_{3D}\frac{d^2x}{dt'^2} = m_{3D}c^2\frac{d\alpha}{dR} \tag{4}$$

Where R is the Radial Direction (perpendicular to our 3D Universe), $m_{3D}c^2\frac{d\alpha}{dR}$ is the nonrelativistic force and

$$dt' = dt \cdot \sqrt{1 - \frac{v^2}{c^2}} \tag{5}$$

is the time dilation interpretation.

What is the Kinetic Energy of a body of mass m driven from Absolute Velocity 0 to v_0?



Minkowski Diagram

For that, one needs to calculate dW = F.dr and integrate it for velocities 0 to v_0.

$$Force = F = m_{3D} \cdot \frac{dv}{idt} = m_{3D} c^2 \cdot \frac{d\left(\frac{v}{ic}\right)}{cdt} = m_{3D} c^2 \cdot \frac{d(\tanh(\alpha))}{dR} \tag{6}$$

$$\text{since } cdt = dR \tag{7}$$

$$\sinh(\alpha) = \frac{\left(\frac{v}{ic}\right)}{\sqrt{1 - \frac{v^2}{c^2}}} \tag{8}$$

$$\cosh(\alpha) = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} \tag{9}$$

Work done in accelerating a body accumulate into Kinetic Energy (Energy Conservation), so let's calculate the work:

$$dW = F.dr = m_{3D} c^2 \frac{d\tanh(\alpha)}{dR} dr = m_{3D} c^2 \frac{d\tanh(\alpha)}{dR_D} \frac{dR_D}{dR} dR_D \sinh(\alpha) \tag{10}$$

Where R_D is the distance along the diagonal. Changing integration variable to **α**:

$$dW = m_{3D} c^2 \frac{d\tanh(\alpha)}{d\alpha} d\alpha \frac{dR_D}{dR} \sinh(\alpha) \tag{11}$$

Noticing that $\cosh(\alpha) = \frac{dR}{dR_D}$

$$dW = m_{3D}c^2 \frac{sinh(\alpha)}{\cosh h(\alpha)^3} d\alpha \tag{12}$$

$$\text{Kinetic Energy} = W\left(0 \to \alpha_0\right) = m_{3D}c^2 \int_0^{\alpha_0} \frac{\sinh(\alpha)}{\cosh(\alpha)^3} d\alpha = m_{3D}c^2 \frac{\tanh^2(\alpha)}{2} \tag{13}$$

$$\text{Relativistic Kinetic Energy} = \frac{m_{3D}v^2}{2} = \text{Classical Kinetic Energy} \tag{14}$$

HU EXPERIMENT PROPOSAL AND THE CREATION OF A SPACECRAFT'S SHIELD FOR WARP TRAVELING

This result provides a simple experiment that could tell us if General Relativity is wrong. If one places a calorimeter and precisely measures the energy of "TeV" protons with a calorimeter, it would be evidence if the energy measured were

$$\text{HU Max Kinetic Energy} = \frac{m_p c^2}{2} = \frac{938\ MeV}{2} = 469\ MeV$$

If that were the case, then the particle penetration into detector's surface would indicate that Absolute Relativistic Velocities also provide particles "A Shield". HU predicts interaction to diminish with Absolute Velocity and that resembles the Shield a Spacecraft needs when traveling at Relativistic speeds.

HU CHANGES THE CONCEPT OF TIME DILATION TO ABSOLUTE-VELOCITY-DEPENDENCE OF FORCES VANISHING WHEN THE ABSOLUTE VELOCITY APPROACHES C

Here, v, dr, and α are all defined in the Absolute Reference Frame. This consistency ensures that all reference frames obey the same HU laws, emphasizing that time dilation is an artifact. It arises because forces approach zero as absolute velocity approaches the speed of light c, as equation (2) demonstrates. That is expected since, in HU, forces are carried by the dilaton field, metric waves that travel at the speed of light.

2. HYPERGEOMETRICAL UNIVERSE THEORY HYPOTHESES

SPACETIME IS JUST A PROXY OF WHAT HAPPENS IN THE 4D SPATIAL MANIFOLD

Not unlike and representation as a straight line for the linear motion of a car along a straight road.

DIMENSIONALITY REDUCTION AND PARTICLE DYNAMICS

A key aspect of the Hypergeometrical Universe (HU) theory is the concept of dimensionality reduction. This concept is similar to surfers riding circular waves in a pond.

Figure 4. In a two-dimensional pond, waves propagate radially, but the surfers can only move tangentially, constrained to one dimension. This modulates the dimensionality perception since there is no forces that can change the radial position at will. Surfers are dragged by the wave.

Likewise, in the lightspeed-expanding 4D hyperspherical universe, particles are restricted in their radial motion because they surf the Inner Dilation Layer, effectively experiencing a reduction in their degrees of freedom.

To elaborate, imagine being inside a lightspeed expanding 4D hypersurface. This hypersurface is analogous to the 3D surface of a sphere but exists in a higher dimension. Particles within this universe move along the Inner Dilation Layer, a negative energy 4D dilation wave. This process is similar to the behavior of a Prince Rupert Drop, where particles are ejected because of the Entropic Explosion resulting from dilation in its inner layers and contraction in the outer layers. Consequently, they do not perceive the existence of the 4th spatial dimension, leading to an apparent reduction in dimensionality from their perspective.

The Stroboscopic Universe concept within HU illustrates how the perception of time and motion is fundamentally tied to the quantization of Absolute Time. This quantization arises from the discrete nature of the tunneling process of the Fundamental Dilator and the resulting intermittent interaction. Unlike metric waves, which are continuous, the interaction and enforcement of the Quantum Lagrangian Principle (QLP) occur only at specific phases of the Fundamental Dilator's coherence. Similar to how a strobe light creates the illusion of continuous motion by flashing at intervals, the Stroboscopic Universe reflects how interactions happen only during discrete phases of tunneling. These phases vary depending on the Inertial Reference Frame (see Fig.2), creating differences in how time quatization is perceived across reference frames. This approach ties the dynamics of the Quantum Trinity directly to the QLP, illustrating that our perception of continuous time is an effect of the discrete and intermittent nature of these fundamental interactions.

THE LIGHTSPEED EXPANDING HYPERSPHERICAL UNIVERSE (LEHU TOPOLOGY)

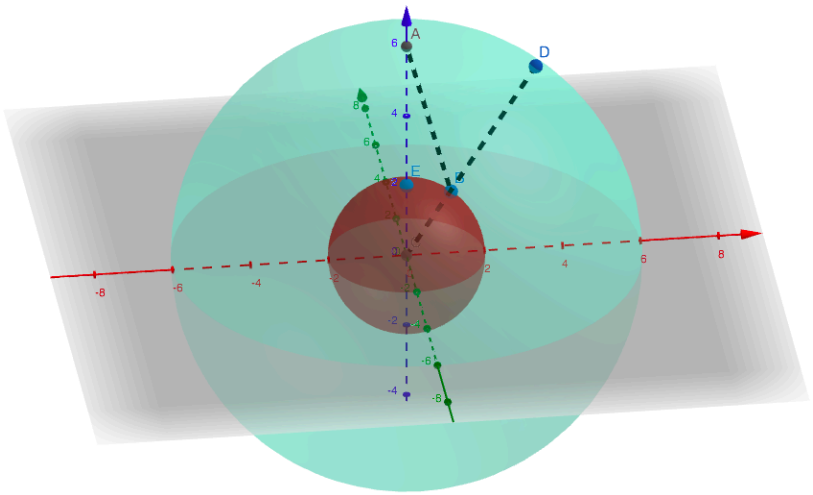


Figure 5. LEHU: This figure shows yourself at position A, looking into the sky and seeing the light of a Type 1a Supernova (SN1a) at position B when the universe was smaller, denser, and more homogeneous. The SN1 and the host galaxy will travel radially to point D. This means that HU provides the mechanism to predict the current map of the universe from what we see in the sky.

THE FUNDAMENTAL DILATOR PARADIGM

The Fundamental Dilator and the Quantum Lagrangian Principle expand the concept of particle-wave dualism. Instead of an immutable particle connected to a de Broglie or Compton wave - without any connecting logic between them **[Compton, A.H., 1923]**, HU introduced particles as Wave-Generators (coherence between stationary states of deformation of space) that both generate metric waves and interact with those waves in a way as never exchange any energy with the elastic space medium. Notice that elastic space is not Aether. Aether is a material medium that has been debunked by the Michelson-Morley experiment. Space has no mass and cannot be dragged by gravitational fields.

This figure depicts the Fundamental Dilator coherence. Each ball represents a localized deformation of space. The phases are relative to each other after the initial phase following the recombination of the Initial Metric Fluctuation (see Appendix N). In other words, after the Universe executed its first step in the hyperspherical expansion, being positively or negatively charged became a relative matter. In the figure, I depicted yellow as positive and green as negative.

The orientation of the letters indicates the orientation of the phase with respect to our 3D hypersurface. The phases are modeled as pizza-like objects (with a small height with respect to the Radial Direction).

FOUR PHASES OF THE FUNDAMENTAL DILATOR

Here are the four phases of the Fundamental Dilator:

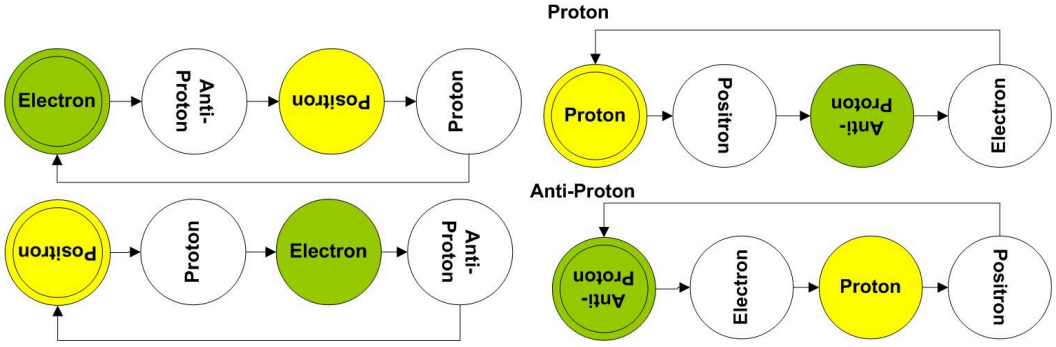


Figure 6. **Fundamental Dilator Phases**: The second and third images show the four phases of the fundamental dilator, corresponding to the four fundamental particles (electron, positron, proton, and antiproton). Other fundamental particles are due to subcoherences between orientationally distinct states within the 3D hypersurface. Intermediate phases are perpendicular to our 3D Universe and don't interact. That is results in an **Absolute Time Quantization or the Stroboscopic Universe**.

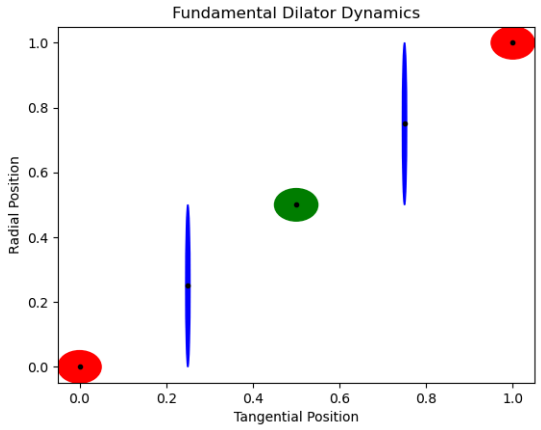


Figure 7. **The phase sequence of an electron.** Colors are used to express dilation or contraction. Notice that the perpendicular phases with respect to the 3D hypersurface (our 3D Universe) do not interact and have zero cross-section.

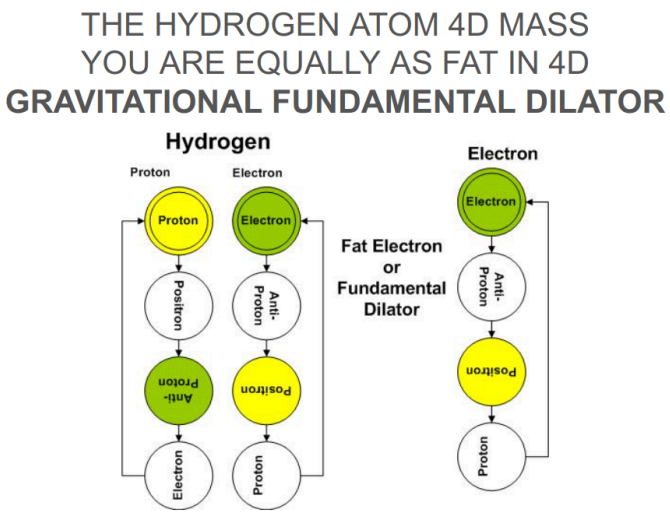


Figure 8. **The Gravitational Fundamental Dilator is a Hydrogen Atom.** This means the Electromagnetic Fundamental Dilator is mapped to a 4D Mass equal to half of a Hydrogen Atom. When you join two FDs, you get a Hydrogen Atom with a 4D Mass equal to the mass of a Hydrogen Atom. In other words, the 3D and 4D masses of a Hydrogen Atom are the same. The 4D mass is used to calculate the Compton Wavelength of the dilaton field. It is straightforward to see that both phases (Proton-Electron and Antiproton-Positron are neutral and indistinguishable). That does not happen for a single dilator since electron and positron phases will differ in dilation or contraction. Hence, the electromagnetic FD has a wavelength that is twice that of the gravitational FD.

It will be shown that the forces are not dependent on the dilaton field's wavelength or the dilator's mass.

Electron and Proton states are expected to be narrow along the radial direction. This means that when they rotate 90 degrees, their overlap (footprint or 3D volume) with the 3D hypersurface goes to zero. Zero 3D-volume implies that those phases do not interact. This allows for this shapeshifting, spinning in 4D construct to keep particles' nature (charge, inertial mass, dipole, multipole moments, and 3D-volume).

If one assumes that mass is some density multiplied by a displacement volume, it should be clear that the 4D mass of the Fundamental Dilator is equal to half the mass of a Hydrogen Atom. This simple model competes with the Higgs Model.

QUANTUM LAGRANGIAN PRINCIPLE (QLP)

QLP is a replacement for Newton's Laws of Dynamics. **It states that FDs will move into positions where they dilate space in phase with the local dilaton field.** The Dilaton field is the interference pattern from the traveling metric waves generated by the shapeshifting metric deformations (a.k.a. particles). This Lagrangian Principle describes the interaction of the dilator

(matter) with its boundaries (space). Particles are not supposed to gain or lose energy to space just by existing. Particles don't dissipate, which explains the need for QLP.

In other words, HU materializes metric waves in a 4D spatial manifold **[Dirac, P.A.M., 1928]**. HU distinguishes four kinds of metric waves:

a) Hypersuperficial. These metric waves are created by the Fundamental Dilator 3D footprint onto the traveling surface of the Universe. They are sensitive only to the FD phases in phase with the Universe, and thus, they are sensitive only to the characteristic mass of the FD phase. They are mapped to de Broglie Waves.
b) Hypervolumetric. These metric waves travel through the 4D space and are responsible for Gravitation and Electromagnetism. Later, we will show that other forces (strong and weak) are also due to these metric waves.
c) Shear. Shear Metric Waves are the reason for entanglement **[Aspect, A., 1982]**. At this time, it is not clear if they are Shear Metric Waves of spatial or spacetime nature. That will become clearer when we have data on the speed of entanglement. If instantaneous, the shear metric waves would have a spacetime nature and travel through time. If entanglement is just really fast, then shear metric waves of a spatial nature would suffice.
d) Tsunami Metric Waves - These are long wavelength metric waves similar to those that carry all particles in the Universe (the Inner Dilation Layer). Being carried by these waves means maximum acceleration (0 to c in one Compton Wavelength). The energy associated with an instantaneous acceleration is mc^2. This explains the at-rest energy of a particle since all particles are surfing the Inner Dilation Layer. This also explains the energy component of particles subject to non-instantaneous accelerations($mv^2/2$).

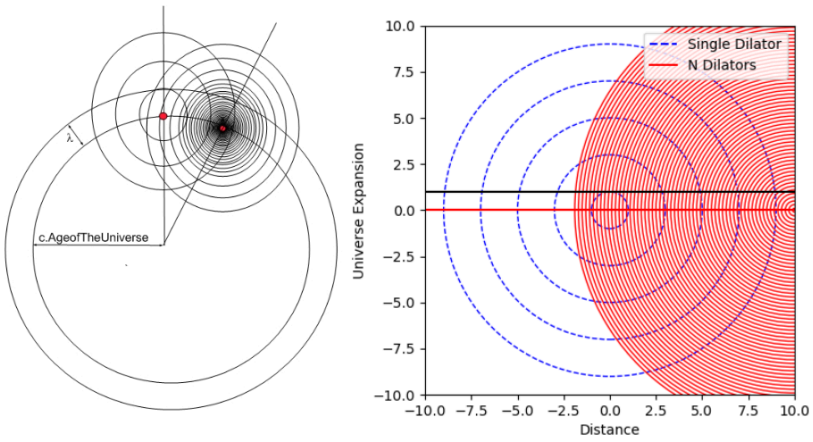
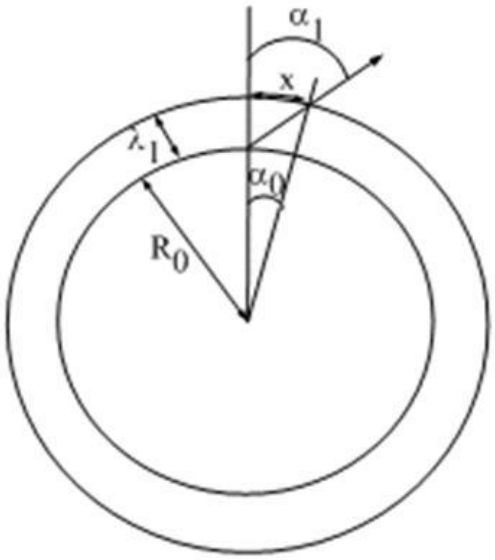


Figure 9. **Interaction of Dilators**: This image depicts a probe dilator and a large mass of dilators interacting as the universe executes its lightspeed stepwise expansion. Notice the metric waves or dilaton field. The interference pattern on the metric waves created by the large dilator mass simulates a dilaton field with a much finer wavelength (λ/N where N is the number of dilators and λ is the Compton Wavelength of a Hydrogen Atom).



$\alpha_0 = \frac{x}{R_0}$

Where R_0=14.04 billion light-year

$\alpha_1 = \frac{x}{\lambda_1}$

where λ_1 is the Compton Wavelenght of a Hydrogen Atom or 1.32E-15 meters.

α_0 corresponds to Gravitation

α_1 corresponds to Electromagnetism

Figure 10. **Space Stress-Strain Relationship**: The dilaton field has a wavelength equal to the Compton Wavelength of a Hydrogen Atom or 1.32 femtometers. The 4D radius of the Univers is 14.04 billion light-years—their ratio maps to the ratio between Gravitational and Electromagnetic forces. From the ratio between HU-derived G and the observed Newton's Gravitational Constant G, HU derives the natural frequency of metric/gravitational waves.

PARTICLE-WAVE DUALISM IS REPLACED BY WAVE-GENERATOR, WAVE, AND QLP

The HU model for matter replaces the particle-wave description of matter with the recognition that particles create metric waves and interact with them through the QLP. Wavefunctions become the loci for FD 3D footprints as they obey the non-deterministic QLP. The final result is the same.

HU WAVEFUNCTION INTERPRETATION [Schrödinger, E., 1926]

HU explains the motion of particles using the Fundamental Dilator Paradigm. QLP defines where the Fundamental Dilator will land in the 3D Hypersurface. In other words, particle motions are subject to the interference pattern created by their dilaton fields. That results in an inherent uncertainty in particle motion. If you add the frequency at which these jumps occur (1E24 Hertz), it is easy to understand that the locus on 3D (our moving 3D hypersurface) of the solution to QLP is what we call Wavefunction. It is a seemingly random distribution of points created by a single particle (electron in the case of the Hydrogen Atom) following QLP. It contains information about its momentum imprinted in the shape of the dilaton field.

Observation is any interaction with the moving dilator, which modifies its momentum and future trajectory.

Hence, HU provides a much more mundane interpretation of Quantum Mechanics and Wavefunctions. Those are inconsistent with Multiverse, Many World Interpretation of Quantum Mechanics **[Everett, H., 1957]**, which is a good thing since there is no evidence whatsoever of a Multiverse, and the idea of splitting timelines every time one makes an arbitrary decision is ludicrous.

1. DERIVING THE LAWS OF NATURE

THE DERIVATION OF GAUSS LAW

EPOCH-DEPENDENT G IS INVERSELY PROPORTIONAL TO 4D RADIUS [Teller, E., 1948]

THE DILATON FIELD OF A SINGLE DILATOR

The dilaton field is just a wave described by a cosinusoidal function multiplied by an envelope function that reduces intensity linearly with the number of cycles.

$$\Phi(r) = \frac{\cos(k_1 r)}{1 + \frac{1}{2\pi\alpha}\left(\frac{r}{\lambda_1}\right)} \quad \text{where} \quad \text{n = number of cycles} = \left(\frac{r}{\lambda_1}\right) \tag{15}$$

Notice that for a large number of cycles, we get the physical meaning of the Fine Structure Constant.

For large n:

$$\Phi(r) = \frac{2\pi\alpha}{n}\cos(k_1 r) \tag{16}$$

The amplitude imposed by the dilator (for n=0) is 1. Later, this intensity is distributed over a circle where the linear intensity is α. At each cycle, the total amplitude decays with the number n, the number of cycles.

The fine-structure constant, denoted as α, is a fundamental physical constant that characterizes the strength of the electromagnetic interaction between elementary charged particles.

1. The current alpha definition has no clear Physics capable of shedding light on the physical meaning of the Fine Structure Constant.

2. The dilaton field amplitude, equal to 2πα, decays with the number of wavelengths and not with distance!

3. Sir Isaac Newton and current Physics have fields decaying with distance because they don't have a pervasive process occurring everywhere.
4. Current Physics view fields as an inelastic deformation of a spacetime metric.
5. HU sees the Dilaton Field as an ELASTIC DEFORMATION OF SPACE.
6. Notice that the definition of alpha is for an amplitude distributed over a 2D circular wave within a 4D spatial manifold. In other words, the precise definition of alpha is consistent with the ansatz used in the Hypergeometrical Universe Theory to describe the Dilaton Field or Metric Waves.
7. In Quantum Mechanics, one would say that the photon wavefunction collapses at absorption (dephasing). That is equivalent to saying that the intensity of the dilaton field can be modeled as circles in a 4D spatial manifold.

8. Once dephased, a photon, a 4D wave, has a curved path connecting the dephasing point to the emitting point.

Similarly, the amplitude could be distributed over the "area" of a microscopic hypersphere of radius r (normalized with the Compton Wavelength of a Hydrogen Atom or FD wavelength):

For large n:

$$\Phi(r) = \frac{2\pi^2 r^3}{n}\cos\left(k_1 r\right) \tag{17}$$

$$\frac{1}{2\pi\alpha} = 2\pi^2 r^3 \tag{18}$$

$$\alpha = \frac{1}{4\pi^3 r^3} = \frac{1}{124.025106721 \cdot r^3} = \frac{1}{137.035999177} \tag{19}$$

$$r = \left(\frac{137.035999177}{124.025106721}\right)^{\frac{1}{3}} = 1.0338122812 \tag{20}$$

The meaning of this normalized radius is that while the Fundamental Dilator goes through the four phases of the coherence, the Universe travels 3.38122812% more than the FD wavelength.

The reason is the latency on the four phases of the dilation. Divided equally upon the four phases, we get 0.8453% for each phase. Since the FD only interacts on two of the four phases, the universe is interactive only 1.69% of the time. That is why HU proposes the paradigm of a Stroboscopic Universe and that the Absolute Time is Quantized.

THE DILATON FIELD OF N-DILATORS MASS (OR CHARGE)

The dilaton field created by N fundamental dilators highlights the change in the effective wavelength due to interference.

Notice that the envelope function has the same form as the envelope function for a single dilator. The reason is that no dilation ever produces λ_2. The wavelength dependence upon mass is an approximation since dilators are not evenly spaced.

The interference pattern of N dilators can be approximated by a single dilator with a higher frequency or smaller wavelength).

Notice the amplitude of the oscillation scale with the number of dilators because each dilator's contribution to the dilaton wave is added coherently.

$$\Phi_2(R-r) = \frac{N\cos\left(k_2 \cdot (R-r)\right)}{1+\frac{1}{2\pi\alpha}\cdot\frac{(R-r)}{\lambda_1}} \tag{21}$$

$$k_2 = \frac{2\pi}{\lambda_2} = \frac{2\pi N}{\lambda_1} \tag{22}$$

LARGE N APPROXIMATION

The dilaton field created by N fundamental dilators can be approximated by the envelope.

$$\Phi_2(R-r) = \frac{N\cos\left(k_2 \cdot (R-r)\right)}{1+\frac{1}{2\pi\alpha}\cdot\frac{(R-r)}{\lambda_1}} \cong \frac{N}{1+\frac{1}{2\pi\alpha}\cdot\frac{(R-r)}{\lambda_1}} \tag{23}$$

since the crests are too close and Φ_2 can be approximated by the envelope.

Total Dilaton Field

The Superposition of Dilaton Fields and the QLP

The sum of the individual dilator fields is used to create the total field at position r, which describes the overall effect of single and collective dilator influences.

$$\Phi_{total}(r,R) = \Phi_1(r) + \Phi_2(R-r) \tag{24}$$

$$\frac{d\Phi_{total}(r,R)}{dr} = \frac{d\Phi_1(r)}{dr} + \frac{d\Phi_2(R-r)}{dr} = 0 \tag{25}$$

Despite the formula, the envelope should have a null derivative at r=0 and the second term below should be neglected:

$$\frac{d\Phi_1(r)}{dr} = -\frac{k_1 \sin\left(k_1 \cdot r\right)}{\left(1+\frac{1}{2\pi\alpha}\cdot\frac{r}{\lambda_1}\right)} - \frac{1}{2\pi\alpha\lambda_1}\frac{\cos\left(k_1 \cdot r\right)}{\left(1+\frac{1}{2\pi\alpha}\cdot\frac{r}{\lambda_1}\right)^2} \tag{26}$$

$$\frac{d\Phi_1(r)}{dr} \cong -k_1{}^2 \cdot r \tag{27}$$

For ϕ_2, here are the derivatives

$$\frac{d\Phi_2(R-r)}{dr} = \frac{1}{2\pi\alpha\lambda_1}\frac{N}{\left(1+\frac{1}{2\pi\alpha}\cdot\frac{(R-r)}{\lambda_1}\right)^2} \tag{28}$$

$$\frac{d\Phi_2(R-r)}{dr} \cong \frac{1}{2\pi\alpha\lambda_1}\frac{N}{\left(\frac{1}{2\pi\alpha}\cdot\frac{R}{\lambda_1}\right)^2} = 2\pi N\alpha\lambda_1\frac{1}{R^2} = 2\pi\alpha N\lambda_1\frac{1}{R^2} \tag{29}$$

DERIVATION OF THE GRAND UNIFICATION EQUATION

$$\frac{d\Phi_{\text{total}}(r)}{dr} = -\left(\frac{2\pi}{\lambda_1}\right)^2 r + \frac{2\pi\alpha N\lambda_1}{R^2} = 0 \tag{30}$$

SCALAR GRAND UNIFICATION EQUATION

$$r = \frac{N\alpha\lambda_1{}^3}{2\pi R^2} \tag{31}$$

THE MEANING OF THE FINE STRUCTURE CONSTANT

Since:

$$\tanh(\alpha) = \frac{v}{c} \tag{32}$$

$$F = m_0\frac{dv}{d\tau} = m_0 c\frac{d\left(\frac{v}{c}\right)}{d\tau} = m_0 c^2\frac{d\left(\frac{v}{c}\right)}{dr} = m_0 c^2\frac{d\tanh(\alpha)}{dr} \tag{33}$$

$$F = m_0 c^2\left(1-\tanh^2(\alpha)\right)\frac{d\alpha}{dr} = m_0 c^2\left(1-\tanh^2(\alpha)\right)\frac{d\left(\frac{x}{\lambda_1}\right)}{dr} \tag{34}$$

$$\frac{d\left(\frac{x}{\lambda_1}\right)}{dr} = \frac{\left(\frac{x}{\lambda_1}\right)}{\lambda_1} = \frac{x}{{\lambda_1}^2} = \frac{N\alpha\lambda_1}{2\pi R^2} \tag{35}$$

For non-relativistic Absolute Velocities

$$F(\text{ N-dilators on Single}) \cong m_0 \cdot c^2 \frac{N\alpha\lambda_1}{2\pi R^2} = \frac{Ne^2}{4\pi\varepsilon_0 R^2} \tag{36}$$

where we equated HU force with the force calculated using Gauss Law.

This is done to confirm the value of α.

Compton Wavelength of the Fundamental Dilator

Since

$$m_0 c = \frac{h}{\lambda_1} \tag{37}$$

Then

$$m_0 \cdot c \cdot \lambda_1 = h \tag{38}$$

Substituting it and equating the force with what one expects from Gauss Law **[Gauss, C.F., 1835]**:

$$\frac{Nhc\alpha}{2\pi R^2} = \frac{Ne^2}{4\pi\varepsilon_0 R^2} \tag{39}$$

One can get the value for our α and confirm it to be the Fine Structure Constant:

$$\alpha = \frac{e^2}{2\varepsilon_0 hc} = \frac{1}{4\pi\varepsilon_0}\frac{e^2}{\hbar c} \tag{40}$$

Q.E.D.

Electrostatic Force between N1 and N2 Electrostatic Fundamental Dilators:

$$F\left(N_1, N_2\right) \cong m_0 \cdot c^2 \frac{N_1 N_2 \alpha\lambda_1}{2\pi R^2} = \frac{N_1 N_2 e^2}{4\pi\varepsilon_0 R^2} \tag{41}$$

THE DERIVATION OF GRAVITOSTATICS

One can derive this equation from Figure 4, relating the angle alpha with the tangential velocity. It showcases the natural way Lorentz transformations enter HU Physics.

$$F = m_0 c^2 \left(1 - \tanh^2(\alpha) \right) \frac{d\alpha}{dr} = m_0 c^2 \left(1 - \tanh^2(\alpha) \right) \frac{d\left(\frac{x}{R_0}\right)}{dr} \tag{42}$$

$$\frac{d\left(\frac{x}{R_0}\right)}{dr} = \frac{\left(\frac{x}{R_0}\right)}{\lambda_1} = \frac{1}{R_0 \lambda_1} x = \frac{1}{R_0 \lambda_1} \frac{N \alpha {\lambda_1}^3}{2\pi R^2} \tag{43}$$

Or static or non-relativistic Gravitational Interactions:

$$F(\text{ N-dilators on N-dilators}) \cong \frac{m_0 c^2 N^2 \alpha {\lambda_1}^2}{2\pi R_0} \frac{M \cdot M}{R^2} = G \frac{M \cdot M}{R^2} \tag{44}$$

$$G_{HU} = \frac{m_0 c^2 N^2 \alpha {\lambda_1}^2}{2\pi R_0 \left(1\ kg^2 \right)} = 8.19036032E-16\ \frac{m^2 N}{kg^2} \tag{45}$$

$$\delta = \frac{G}{G_{HU}} = 81489.69936511 \tag{46}$$

To get the HU value for G, one just has to plug the numbers in. The value is much smaller than the observed value. This means that the dynamic screening of Gravitational Dilators is not perfect, and a significant Van der Waals force is present. That makes the Fabric of Space (normal to the 3D volumes of particles) twist much further—8,489.69936511 times more.

THE NATURAL FREQUENCY OF METRIC WAVES

From the experimental value for G, one can calculate the natural frequency of metric fluctuations:

For 3D Forces and their representation:

$$x = \frac{N \alpha {\lambda_1}^3}{2\pi R^2} \tag{47}$$

$$F = m_0 c^2 \frac{d\tanh(\alpha_0)}{dr} = \frac{m_0 c^2}{\gamma^2} \frac{\frac{\delta x}{R_0}}{\lambda_1} = \frac{m_0 c^2}{4\pi \gamma^2} 2\alpha hc \frac{N}{R_0^2} \tag{48}$$

$$F = mc^2 \frac{d\tanh(\alpha_0)}{dr} = \frac{mc^2}{\gamma^2} \frac{\frac{\delta x}{R_0}}{\lambda_1} = m(2\pi f)^2 x \tag{49}$$

$$f = \frac{c}{2\pi}\sqrt{\frac{\delta}{\lambda_1 R_0 \gamma^2}} = 32,519.642 \text{ Hertz} \tag{50}$$

This is the natural frequency of space deformations, calculated using a simple spring model—the place to look for gravitational waves. **THIS IS THE PATH TO INTERSTELLAR TRAVEL.**

THE DERIVATION OF DYNAMIC LAWS OF NATURE

INTERACTION IN THE 4D SPATIAL MANIFOLD

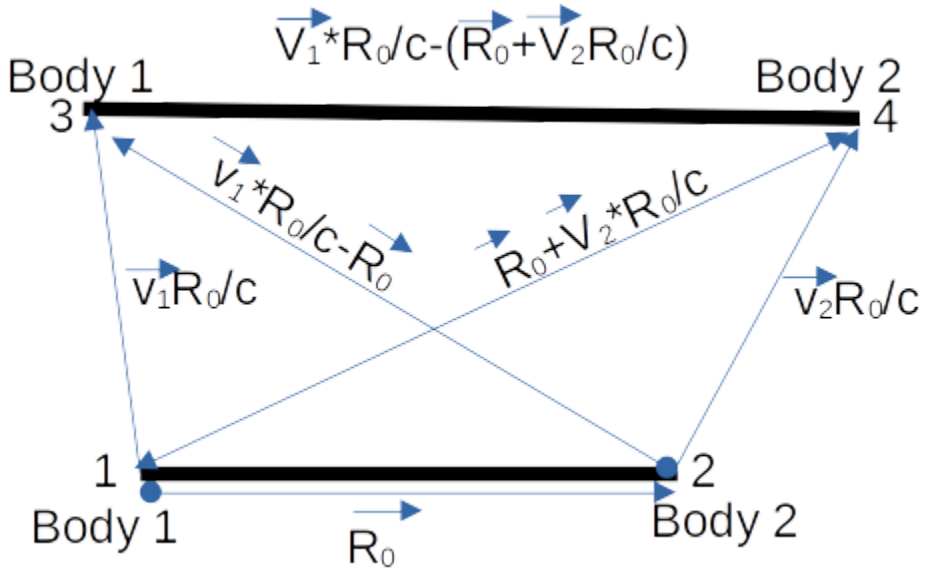


Figure 11. This is a side view of a 4D diagram. The Projection Plane is defined by R_0 and the Radial Direction (perpendicular to our 3D Universe). The horizontal lines show two epochs differing in Absolute Time by R_0/c. The observation of body 1 happens across r_{13}. Notice that distances are normalized on R_0. That will become relevant when choosing which 3D vector to use in the Laws of Nature.

General 3D Lorentz transformation $M(\vec{V})$

$$M(\vec{V}) = \left(\vec{1} - P(\vec{V})\right) + \gamma P(\vec{V}) = \vec{1} + (\gamma - 1) P(\vec{V}) \tag{51}$$

Where

$$P(\vec{V}) = \hat{V}.(\hat{V}.) \tag{52}$$

$$P(\vec{V})\,\vec{X} = \hat{V}.(\hat{V}.\vec{X}) \tag{53}$$

$\hat{V}$ is the unitary vector along the $\vec{V}$ direction

HOW TO CONVERT K-VECTOR BACK TO THE ABSOLUTE REFERENCE FRAME

How do we convert the k-vector of the metric waves created by a dilator traveling with Absolute Velocity V to the Absolute Reference Frame is given by:

$$\vec{k}^{\,1}.\vec{r}^{\,1} = \vec{k}^{\,0}.\vec{r}^{\,0} \tag{54}$$

$$\vec{r}^{\,1} = M.\vec{r}^{\,0} \tag{55}$$

$$\vec{k}^{\,1}.M.\vec{r}^{\,0} = \vec{k}^{\,0}.\vec{r}^{\,0} \tag{56}$$

$$\vec{k}^{\,1}.M = \vec{k}^{\,0} \tag{57}$$

The goal is to convert the k-vectors to the Absolute Reference Frame and to impose QLP to moving dilators.

To achieve that, one just needs to multiply the k-vector by the Lorentz Matrix M(V)

$$\vec{k}^{\,1}.M\,(\vec{V}) = \vec{k}^{\,0} \tag{58}$$

Notice that 1 and 0, refers to inertial reference frame 1 and Absolute Reference frame 0.

Defining Velocity and Position Vectors

$$\vec{V}_1 = v_1\hat{V}_1 \tag{59}$$

$$\vec{V}_2 = v_2\hat{V}_2 \tag{60}$$

$$\vec{R}_0 = R_0\hat{R}_0 \tag{61}$$

$$\vec{r}_{\,1} = \vec{r}_{\,13} = \vec{V}_1\frac{R_0}{c} + x\hat{r} \tag{62}$$

$$\vec{r}_{\,2} = \vec{r}_{\,23} = \vec{V}_2\frac{R_0}{c} - R_0\hat{R}_0 + x\hat{r} \tag{63}$$

$$M_1 = I + (\gamma_{v1} - 1)\frac{V_1 V_1^T}{v_1^2} \tag{64}$$

$$M_2 = I + (\gamma_{v2} - 1)\frac{V_2 V_2^T}{v_2^2} \tag{65}$$

$$k_1 = \frac{2\pi r_1^T M_1}{\lambda_1 P_1} \tag{66}$$

$$k_2 = \frac{2\pi r_2^T M_2}{\lambda_1 P_2} \tag{67}$$

Notice that one makes use of that:

$$\left|\vec{k}_1\right| = \frac{2\pi}{\lambda_1} \text{ and has a direction } \hat{r}_1 = \frac{r_1^T}{P_1}, \text{ with } P_1 = \left|\vec{r}_1\right| \tag{68}$$

in the inertial reference frame for v_1, before converting it to the Absolute Reference Frame.

DILATON FIELDS

$$\frac{d\Phi_1(\vec{r}_1)}{dx} + \frac{d\Phi_2(\vec{r}_2)}{dx} = 0 \tag{69}$$

$$\Phi_1(\vec{r}_1) = \frac{\cos\left(\vec{k}_1 \cdot \vec{r}_1\right)}{\left(1 + \frac{1}{4\pi^2\alpha} \cdot \left(\vec{k}_1 \cdot \vec{r}_1\right)\right)} \tag{70}$$

$$\frac{d\Phi_1(\vec{r}_1)}{dx} \cong -\left(\vec{k}_1 . \hat{r}\right)^2 x \tag{71}$$

$$\Phi_2(\vec{r}_2) \cong \frac{N}{\left(1 + \frac{1}{4\pi^2\alpha} \cdot \left(\vec{k}_2 \cdot \vec{r}_2\right)\right)} \tag{72}$$

$$\frac{d\Phi_2(\vec{r}_2)}{dx} \cong \frac{1}{4\pi^2\alpha}\cdot\frac{\vec{k}_2\cdot\hat{r}}{\lambda_1}\frac{N}{\left(1+\frac{1}{4\pi^2\alpha}\cdot\frac{\vec{k}_2\cdot\vec{r}_2}{\lambda_1}\right)^2} \tag{73}$$

$$\frac{d\Phi_2(\vec{r}_2)}{dx} \cong \frac{4\pi^2\alpha\,\lambda_1\left(\vec{k}_2\cdot\hat{r}\right)}{\left(\vec{k}_2\cdot\vec{r}_2\right)^2} \tag{74}$$

GRAND UNIFICATION DYNAMIC EQUATION

$$r = 4\pi^2\alpha\,\lambda_1 N\frac{\left(\vec{k}_2\cdot\hat{r}_2\right)}{\left(\vec{k}_1.\hat{r}_1\right)^2\left(\vec{k}_2\cdot\vec{r}_2\right)^2} \tag{75}$$

HU-FACTOR

$$HU_{Factor}\left(v_1,v_2\right) = \frac{\left(\gamma_{v2}-1\right)\left(\hat{r}.\widehat{V}_2\right)^2+\hat{r}.\hat{r}}{\left(\gamma_{v1}-1\right)\left(\hat{r}.\widehat{V}_1\right)^2+\hat{r}.\hat{r}}\frac{\gamma_{v1}{}^3\sqrt{1+\left(\frac{v_1}{c}\right)^2-2\left(\frac{\dot{r}}{c}\right)}}{\left(\left(\gamma_{v2}-1\right)\frac{\left(\vec{r}_2.\widehat{V}_2\right)^2}{\vec{r}_2.\vec{r}_2}+1\right)^2} \tag{76}$$

For the case where one considers the Sun as the Absolute Reference Frame, as in the case of Mercury Perihelion Precession modeling, one has v_2=0.

$$HU_{Factor}\left(v_1,v_2=0\right) = \frac{\hat{r}.\hat{r}}{\left(\gamma_{v1}-1\right)\left(\hat{r}.\widehat{V}_1\right)^2+\hat{r}.\hat{r}}\left(1-\left(\frac{v_1}{c}\right)^2\right)^{3/2}\sqrt{1+\left(\frac{v_1}{c}\right)^2-2\left(\frac{\dot{r}}{c}\right)} \tag{77}$$

With

$$\hat{r}=\hat{r}_2=\frac{\vec{V}_1}{c}-\widehat{R}_0 \tag{78}$$

ELECTROMAGNETIC FORCE

$$\vec{F}_{EM} = \frac{N^2e^2c^2\mu_0\,C_1C_2}{P_2{}^3\;4\pi\,(1C)^2}\,HU_{Factor}\,\vec{r}_2 \tag{79}$$

$$\hat{r} = \left(\frac{\vec{V}_1}{c} X \left(\frac{\vec{V}_2}{c} X \hat{r}_2 \right) \right) \tag{80}$$

ELECTROMAGNETISM AND GRAVITO-DYNAMICS

$$\vec{F}_{EM} = \frac{N^2 hc\alpha}{2\pi (1C)^2} \frac{1}{P_2{}^3} \left(\frac{\vec{V}_1}{c} X \left(\frac{\vec{V}_2}{c} X \vec{r}_2 \right) \right) HU_{Factor} = \frac{\mu_0}{4\pi} \frac{\vec{J}_1 X \left(\vec{J}_2 X \vec{r}_2 \right)}{P_2{}^3} HU_{Factor} \tag{81}$$

$$\vec{F}_G = \frac{N^2 hc\alpha \, \delta\lambda_1}{2\pi R_{4D} (1Kg)^2} \frac{1}{P_2{}^3} \left(\frac{\vec{J}_1}{c} X \left(\frac{\vec{J}_2}{c} X \vec{r}_2 \right) \right) HU_{Factor} = \frac{G}{c^2} \frac{\vec{J}_1 X \left(\vec{J}_2 X \vec{r}_2 \right)}{P_2{}^3} HU_{Factor} \tag{82}$$

$$\vec{J}_1 = M_1 \vec{V}_1 \ or \ C_1 \vec{V}_1 \tag{83}$$

$$\vec{J}_2 = M_2 \vec{V}_2 \ or \ C_2 \vec{V}_2 \tag{84}$$

In analogy to electromagnetism:

$$\vec{B}_G = \frac{G/c^2}{P_2{}^3} \left(\vec{J}_2 X \vec{r}_2 \right) HU_{Factor} \tag{85}$$

With $\vec{r}_2 = \vec{r}_{23}$.

Notice that the two values for N are different. For Electromagnetism, N is the number of electrons in one Coulomb, and for Gravity, N is the number of hydrogen atoms in one kilogram. **δ** is 81489.699.

So, Gravitation is also a Lorentz Force, one that is always attractive. Notice that because of its dependence upon the 4D radius of the Universe, it is also epoch-dependent.

WHAT ABOUT THE GRAVITATION FORCE BEING RADIAL?

That is due to placing the Absolute Reference Frame on the Sun or its center of mass. Under those conditions, $v_2 = 0$.

$$\vec{F}_G = \frac{GMm}{P_2{}^2} \frac{\vec{r}_2}{P_2} HU_{Factor} \left(v_1, v_2 = 0 \right) \tag{86}$$

LAPLACE AND THE INSTANTANEOUS SPEED OF GRAVITATION

Notice that the dependence is upon "instantaneous distance," as Gravitation has traveled from the Sun to the planets while the planet traversed a distance $v_1 * R_0 / c$. The reason is that gravitation is carried by the dilaton field, which is always on. So, the gravitation planets are sensing right now, which was created R_0/c seconds before, where R_0 was the distance at that time.

Radar measurements give distances to planets. At the time of the emission, the distance was R_0. Light traveled $(R_0 + V_1 * R_0/c)$, bounced on the planet, and returned, traversing twice that distance. That is how a distance is measured, which is the definition of P_2.

This puzzled Laplace that the Law of Gravitation would depend upon an instantaneous distance. This led him to consider that Gravitation was instantaneous.

NATURAL FREQUENCY OF GRAVITATIONAL WAVES - THE UNIVERSE OM

$$F_G = m_0 c^2 \frac{dtan(\alpha_0)}{dr} = \frac{m_0 c^2}{\gamma^2} \frac{\frac{\delta x}{R_0}}{\lambda_1} = \frac{m_0 c^2}{4\pi\gamma^2} 2\alpha hc \frac{N}{R_0^2} \tag{87}$$

$$F_G = mc^2 \frac{dtan(\alpha_0)}{dr} = \frac{mc^2}{\gamma^2} \frac{\frac{\delta x}{R_0}}{\lambda_1} = m(2\pi f)^2 x \tag{88}$$

$$f = \frac{c}{2\pi} \sqrt{\frac{\delta}{\lambda_1 R_0 \gamma^2}} = 32,519.642 \text{ Hertz} \tag{89}$$

Where one used the CMB-based Milky Way velocity of 0.2% c for calculating ɣ **[Penzias, A.A., and Wilson, R.W., 1965][Planck Collaboration, 2018]**.

WHAT IS THE NATURE OF GRAVITATION?

In the Hypergeometrical Universe theory, gravitation is essentially a van der Waals force and is not distinct from electromagnetism. The same dilaton field generated by charged particles, such as electrons and protons, also generates gravitational effects when these particles form neutral entities, like hydrogen atoms. This unification of forces has been obscured by our lack of knowledge about the Fundamental Dilator, the Quantum Lagrangian Principle, and the extremely fast relaxation process occurring at a frequency of 1E24 Hertz.

The key to understanding why gravitation appears so weak compared to electromagnetism lies in this extremely fast relaxation of charge distributions. This high-frequency relaxation process,

reflected in the wavefunctions of Fundamental Dilators as they interact with our Universe, results in almost perfect dynamic screening. Consequently, gravitation manifests as a weak van der Waals force, effectively screened by the high-frequency tunneling processes.

HU MODEL FOR PHOTONS

Photons Are Undulations On Top Of The 4D Dilaton Field Due To The Oscillating Fundamental Dilator During Emission Or Absorption.

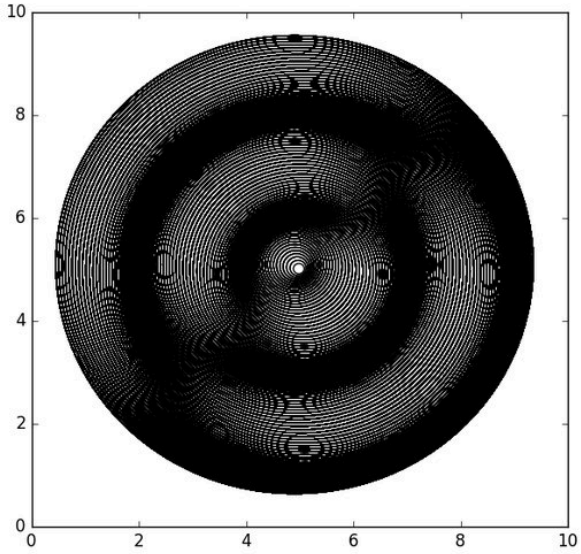


Figure 12. Here, we show HU's interpretation of light as an undulation on the top of a much finer carrier (the dilation field). Light propagation happens in a 4D space, but because of the constraint that all possible dephasors (absorbers, scatterers) are surfing the inner dilation layer (dimensionality reduction), the intensity depends on quadratic distances as opposed to cubic ones.

HU-QCD

As expected, the Hypergeometrical Universe Theory task related to QCD is to find what the mapping between the language of QCD and HU constructs (LEHU, Fundamental Dilator and QLP) is.

It is straightforward to see that there is a natural mapping between HU representation for the four phases of the Fundamental Dilator and the SU(4) basis set. The basis set should be composed of four four-dimensional vectors where the sum of components is zero.

Mapping the Hypergeometrical Universe Theory to the Pati-Salam Model

The **Hypergeometrical Universe Theory (HU)** proposes a novel framework for understanding the structure of the universe and the nature of matter. It posits that the universe is a **Lightspeed Expanding Hyperspherical Hypersurface (LEHU)**, expanding in a higher-dimensional space. Matter, in this context, is modeled as polymers of a fundamental entity known as the **Fundamental Dilator (FD)**. These FDs are coherences between deformation states of space, specifically between electron and proton states. HU aligns with the observation that all particles eventually decay into electrons, protons, and neutrinos, suggesting a foundational role for these particles in the structure of matter.

This section presents a mapping of HU to the **Pati-Salam Model**, an extension of the Standard Model in particle physics. It also explores how HU provides a physical basis for spin and the antisymmetric nature of fermionic wavefunctions, making it inherently compatible with **SU(2)(_L) × SU(2)(_R)** symmetries.

Mapping HU to the Pati-Salam Model

HU Basis Set and SU(4) Representations

In the HU framework, particles are represented by four-component vectors that correspond to states in SU(4) symmetry. The electron and proton are extended to these vectors as follows:

$$\begin{aligned} &ElectronState: \vec{v}_{\text{electron}} = \left(-\frac{1}{3},\ -\frac{1}{3},\ -\frac{1}{3},\ 1\right) \\ &ProtonStates: \ \vec{v}_{\text{proton}} = \left(\frac{2}{3},\ \frac{2}{3},\ -\frac{1}{3},\ -1\right), \quad \text{and its permutations} \end{aligned} \tag{90}$$

The first three components of these vectors represent the color charges associated with Quantum Chromodynamics (QCD), while the fourth component corresponds to the **baryon number minus lepton number ((B - L))**. The electron's first three components sum to (-1), indicating neutrality under $SU(3)_C$ color transformations, consistent with leptons being color singlets. The proton states, with their various permutations, correspond to the three color charges of quarks in QCD.

Decomposition of SU(4) into $SU(3)_C \times U(1)_{B-L}$

The SU(4) symmetry in HU can be decomposed into $SU(3)_C$ *and* $U(1)_{B-L}$ symmetries, aligning with the Pati-Salam Model's approach:

$$\mathrm{SU}(4) \rightarrow \mathrm{SU}(3)_C \times \mathrm{U}(1)_{B-L} \tag{91}$$

To achieve this decomposition, the U(1) generator (Q) must commute with all SU(3) generators (T_i) embedded within SU(4):

$$[Q, T_i] = 0 \tag{92}$$

In HU, the U(1) generator (Q) is defined as a diagonal (4 X 4) matrix:

$$Q=\begin{bmatrix} \frac{1}{\sqrt{6}} & 0 & 0 & 0 \\ 0 & \frac{1}{\sqrt{6}} & 0 & 0 \\ 0 & 0 & \frac{1}{\sqrt{6}} & 0 \\ 0 & 0 & 0 & \frac{-3}{\sqrt{6}} \end{bmatrix} \tag{93}$$

This matrix commutes with the embedded SU(3) generators, ensuring the proper separation of color and (B - L) symmetries and confirming the consistency of HU with the Pati-Salam Model.

Alignment with the Pati-Salam Model

The Pati-Salam Model extends the Standard Model's gauge symmetry to:

$$\mathrm{SU}(4) \times \mathrm{SU}(2)_L \times \mathrm{SU}(2)_R \tag{94}$$

By incorporating leptons as a fourth color, the model unifies quarks and leptons within the SU(4) framework. The HU basis set fits naturally into this structure, with the electron and proton states forming part of the fundamental representation of SU(4). The decomposition into $SU(3)_C$ *and* $U(1)_{B\text{-}L}$ in HU mirrors the symmetry breaking in the Pati-Salam Model, reinforcing the alignment between the two theories.

Spin in the Hypergeometrical Universe

Spin as a Rotation in Four-Dimensional Space

In HU, spin is conceptualized as an actual rotation in a four-dimensional spatial manifold, rather than an abstract quantum number. The Fundamental Dilator cycles through specific phases, representing different deformation states of space. The sequences for the two spin states are:

- $Spin(+\frac{1}{2})$:[Electron → Proton → Positron → Antiproton] (95)
- $Spin(-\frac{1}{2})$:[Electron → Antiproton → Positron → Proton] (96)

These sequences correspond to rotations in opposite directions (clockwise and counterclockwise) in four-dimensional space. The difference in the order of the perpendicular phases (those not interacting directly with our three-dimensional hypersurface) distinguishes the spin states and introduces chirality into the model.

Connection to Chirality and $SU(2)_L \times SU(2)_R$ Symmetry

The rotational nature of spin in HU naturally embeds chirality, a fundamental property distinguishing left-handed and right-handed fermions in particle physics. In HU:

- **Spin (+1/2)** corresponds to one chirality (e.g., left-handed fermions).
- **Spin (-1/2)** corresponds to the opposite chirality (e.g., right-handed fermions).

This correspondence aligns with the $\mathbf{SU(2)_L \times SU(2)_R}$ symmetries that govern the weak interaction in the Standard Model. The $\mathbf{SU(2)_L}$ symmetry acts on left-handed fermions, while $\mathbf{SU(2)_R}$ acts on right-handed fermions. By providing a physical basis for chirality through spin sequences, HU inherently incorporates these symmetries, making the theory compatible with the left-right structure of weak interactions.

Physical Basis for Fermion Spinors and the Exclusion Principle

Explaining Antisymmetric Wavefunctions

In conventional quantum mechanics, fermions are described by antisymmetric wavefunctions, a mathematical property that leads to the **Pauli Exclusion Principle**. However, this property lacks a physical mechanism in the standard framework. HU offers a physical explanation by modeling spin as rotations with specific phase sequences.

The interactions between Fundamental Dilators with the same spin state result in the exclusion principle:

- **Flushed Phases**: Phases that are "flushed" with our three-dimensional hypersurface (electron and positron phases) repel each other.
- **Perpendicular Phases**: Phases perpendicular to our hypersurface (proton and antiproton phases) attract each other.
- **Net Interaction**: The combination of these interactions leads to a net interaction that prevents identical fermions from occupying the same quantum state.

This physical mechanism provides a tangible basis for the antisymmetry of fermionic wavefunctions and justifies the use of spinors in representing fermions.

Compatibility with Quantum Mechanics

While HU introduces new physical interpretations, it complements rather than replaces the established framework of quantum mechanics. By offering a physical rationale for the mathematical formalism, HU enhances our understanding of fundamental principles:

- **Justification of Spinors**: The geometric representation of spin as rotations in higher-dimensional space explains why fermions are described by spinors, which are mathematical objects accounting for half-integer spin.
- **Exclusion Principle**: The physical interactions in HU underpin the Pauli Exclusion Principle, providing a deeper insight into why fermions exhibit antisymmetric behavior.

- **Mathematical Consistency**: HU's predictions align with those of quantum mechanics, ensuring that the successful aspects of the theory are preserved.

CONCLUSIONS

The **Hypergeometrical Universe Theory (HU)** proposes a transformative perspective on the structure of the universe, unifying cosmology, quantum mechanics, and classical physics. The theory introduces the **Fundamental Dilator (FD)**, a quantum wave generator that interacts with the dilaton field and follows the **Quantum Lagrangian Principle (QLP) [Feynman, R.P., and Hibbs, A.R., 1965]**, forming the basis for all matter and forces. This trinity replaces the traditional particle-wave dualism **[Dirac, P.A.M., 1928][Feynman, R.P., and Hibbs, A.R., 1965]** and shifts the foundational constructs of physics from mass and force to **displacement volume and acceleration**, providing a unified framework for describing nature.

HU's redefinition of the universe as a lightspeed-expanding hyperspherical hypersurface eliminates the need for concepts like dark matter, dark energy **[Riess, A.G., et al., 1998]**, and inflation. By introducing an absolute 4D reference frame, HU provides a new interpretation of Lorentz transformations as rotations in 4D space, fundamentally altering our understanding of time dilation as an artifact rather than a physical reality.

HU resolves longstanding issues in cosmology, such as the need for dark matter, dark energy, and inflation, by addressing the horizon problem and galaxy dynamics using simple idiosyncratic expoential mass distributions. The theory also introduces an absolute 4D reference frame, reinterpreting Lorentz transformations and establishing a new understanding of time dilation as an artifact rather than a physical reality.

A major contribution of HU is its derivation of the Laws of Gravitation and Electromagnetism, showing that both forces follow the same Lorentz force format. The theory's interpretation of gravitation as a Van der Waals force, with the dilaton field oscillating at 1E24 Hertz, unifies it with electromagnetism and provides insights into why gravitation appears weaker than electromagnetic forces. This framework suggests revolutionary advancements in technologies such as magnetic confinement systems and space propulsion.

The Absolute Reference Frame (ARF) model provides a kinetic energy formulation that diverges from traditional relativistic expectations, adhering to a mass-dependent energy cap as velocity approaches lightspeed. The formula for HU Kinetic Energy is the same as the Classical Mechanics formula. This contrasts with relativistic predictions and suggests novel experimental approaches, such as temperature-sensitive calorimeters, which could isolate thermal energy deposition without relying on relativistic calibration assumptions. If validated, this approach would not only affirm the ARF model but also reinforce the Hypergeometrical Universe Theory (HU), challenging the framework of General Relativity and indicating that particle dynamics and kinetic energy may need reevaluation within the ARF model. Such insights reinforce HU's foundation and underscore the theory's implications for future explorations in particle dynamics and aerospace applications.

One of HU's pivotal contributions is the creation of a Cosmological Clock. The coherence of the Fundamental Dilator and the dilaton field (metric waves) keep track of Absolute Time, providing a one-to-one relationship between any inertial reference frame and the absolute time measured within it. This feature bridges the gap between relative motion and absolute timing, offering a clear framework for understanding time in the universe.

Crucially, HU derives the laws of gravitation and electromagnetism, showing that both have the same format as Lorentz forces. The radial dependence of gravitational forces is explained by reference frame selection, particularly in cases where symmetry, such as centering the frame on the Sun, dictates the radial nature of the force. This derivation challenges conventional interpretations and promises revolutionary advancements in electrodynamics, including the design of magnetic confinement systems (magnetic bottles, stellarators, tokamaks), as well as space propulsion technologies.

Moreover, HU interprets gravitation as a Van der Waals force **[Van der Waals, J.D., 1873]**, with a carrier dilaton field oscillating at a frequency of 1E24 Hertz. This interpretation offers a unified view of gravitation and electromagnetism and explains the dynamic screening that makes gravitation appear weaker than electromagnetic forces.

The Hypergeometrical Universe Theory presents a compelling framework that aligns with the Pati-Salam Model through its SU(4) representation and decomposition into $SU(3)_C$ *and* $U(1)_{B-L}$ symmetries. By modeling spin as a physical rotation in four-dimensional space and explaining fermionic behavior through phase sequences, HU provides a physical basis for chirality and the behavior of fermions. This approach naturally incorporates $\mathbf{SU(2)_L \times SU(2)_R}$ symmetries, making HU compatible with the weak interaction's left-right structure.

The compatibility of HU with the Pati-Salam Model, particularly its SU(4) representation and decomposition into $SU(3)_C$ *and* $U(1)_{B-L}$ symmetries, highlights its robustness.

Moreover, HU offers a physical explanation for the antisymmetric nature of fermionic wavefunctions and the Pauli Exclusion Principle, enhancing our understanding of these fundamental concepts. By bridging the gap between physical phenomena and mathematical descriptions, HU complements quantum mechanics and provides new insights into the nature of matter and the universe.

The elimination of the need for an integral functional in the Lagrangian Principle, combined with the mapping of HU to the Pati-Salam SU(4) model, opens the door to non-perturbative Quantum Chromodynamics (HU-QCD). This approach avoids the complexities of Lattice Quantum Chromodynamics and sets the stage for a new understanding of quantum forces.

Finally, HU provides a solution to the Faint Sun Paradox, further solidifying its role as a comprehensive framework capable of addressing key challenges in modern physics. This paradox, along with other cosmological phenomena, will be discussed in future work.

The introduction of HU’s model for matter as deformations of space not only redefines our perception of particles but aligns with observable physical phenomena, offering a coherent

explanation for complex dynamics. The Quantum Lagrangian Principle (QLP) demonstrates its capability as the singular governing law, unifying various aspects of physics traditionally described by multiple, distinct laws. Finally, the replacement of the particle-wave dualism with HU's **Quantum Trinity** resolves inconsistencies in quantum mechanics, showcasing a complete framework that aligns theory with experimental results and advances our understanding of fundamental forces and particles.

The Hypergeometrical Universe Theory (HU) derives the laws of nature from first principles using the Quantum Lagrangian Principle (QLP), which states that no particle should perform or receive work from the constraints (the space itself). In HU, with the correct universe topology (LEHU) and a model for matter where particles are coherences between stationary states of deformation of space, all laws of nature emerge from a single field—the dilaton field. HU shows that both electromagnetism and gravitation are governed by simple absolute-velocity-dependent forces, demonstrating that gravitation is a Van der Waals electromagnetic interaction with a 1E-24 second relaxation time. This approach offers a more straightforward and practical framework for relativistic calculations in multi-body systems than deforming spacetime and deriving geodesics. HU's derivations also explain why gravitation appears as a radial force when, in fact, it is a Lorentz force, resolving a longstanding question in physics. HU provides a means to derive gravitational magnetic fields, gravitational Poynting vectors, and gravitational irradiation power—concepts not accessible through traditional GR. The gravitational lensing and perihelion precession rates are derived using classical and quantum mechanics without the need for relativity (see Appendices C and B respectively), showcasing HU's capability to reproduce Einstein's successes using force-based dynamics.

The Hypergeometrical Universe Theory (HU) introduces an epoch-dependent gravitational constant (G) **[Teller, E., 1948] [Sahni, V., and Shtanov, Y., 2014]** that fundamentally reshapes our understanding of cosmological distances. This dependency implies that Type Ia Supernovae (SN1a), traditionally considered standard candles based on their detonation at the Chandrasekhar mass limit, should be reinterpreted, as their photometric distances depend on the epoch's value of G ($G^{(-3/2)}$). HU's approach corrects the Cosmic Distance Ladder, removing the need for dark matter or dark energy to explain supernova data (see Appendix L). Additionally, HU explains spiral galaxy rotation curves through idiosyncratic radially exponentially decaying densities rather than distant light-mass density estimates, further eliminating the need for dark matter. These adjustments not only remove the need for space stretching and inflation but also address the issue of absurd distances that exceed what is possible at the speed of light. By creating the universe from an energy-neutral initial metric fluctuation, HU bypasses the need for a Big Bang explosion or false vacuum decay. In essence, HU simplifies the cosmological model and unifies phenomena without resorting to speculative constructs.

HU shows that it doesn't take an infinite amount of energy to bring a massive body to the speed of light. In fact, the amount is the same as in the classical case. This is supportive of possible applications of the theory in Instantaneous Lightspeed Accelerators.

The Hypergeometrical Universe Theory (HU) fundamentally redefines our understanding of cosmic and stellar evolution, unifying diverse phenomena through an absolute 4D framework

and epoch-dependent forces. HU's solutions to the faint young Sun paradox and the Fermi Paradox illustrate its broader implications for astrophysics and the potential for interstellar travel, marking HU as a comprehensive model that bridges theoretical physics with observable phenomena.

In conclusion, the Hypergeometrical Universe Theory lays the foundation for a new era in physics. It replaces outdated paradigms with a cohesive, quantum mechanical framework that unifies forces, reinterprets cosmological events, and reshapes the understanding of the fundamental nature of matter and the universe.

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