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Fundamental Constants: Uniting Gravity and the Accelerated Expansion of the Universe through the Higgs Bosons

M. Makraini*

Relativistic and Fundamental Physics Espana, Spain

***Corresponding Author**
M. Makraini, Relativistic and Fundamental Physics Espana, Spain

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Abstract
This article presents a new reinterpretation of the curved geometry of space-time, where it is considered that space-time undergoes longitudinal contraction. This effect is manifested in changes in the space-time metric that determine how distances and temporal intervals are measured in that region. In other words, a variation in the scale, size, or apparent length of space-time. This reinterpretation is compatible with Einstein's field equations and Maxwell's equations. The universal gravitational constant of Newton, GN, the Hubble constant for the accelerated expansion of the universe, H(0), and the cosmological constant associated with hypothetical dark energy, Λ±, can be obtained and approximated using this new approach, where the mass of the Higgs boson with its unique and privileged characteristics plays a crucial role in addressing numerous open questions in physics and modern cosmology. The reinterpretation of curved geometry through space-time contraction provides a new framework for better understanding gravity. By obtaining very close values of the universal gravitational constant, it is possible to determine the inverse force to gravity responsible for the accelerated expansion of the universe. This is achievable through Gauss's divergence theorem, where the charge distribution determined by the Coulomb constant within the framework of multipolar expansion defined by electromagnetism constitutes a quite solid analogy, being inversely proportional to gravity. This allows for the precise calculation of the value of the Hubble constant, H(0). The cosmological constant Λ±, considered as a potential dark energy driving the accelerated expansion of the universe, can also be obtained and explained through this new approach. The reinterpretation of the curved geometry of gravity as space-time contraction would affect the properties of space-time expansion, where the interpretation of the universe's contraction described by General Relativity must be reinterpreted, understood, and accepted as gravity itself at any scale.

Keywords: Universal Constants, Higgs Boson, General Relativity, Hubble Stress, Cosmological Constant.

1. Introduction

The longitudinal contraction of space-time emerges as a bold proposal in the field of theoretical physics and cosmology, challenging conventional concepts of space-time geometry that try to describe gravity. And the proposal that is postulated in this work, describes a revolutionary fundamental reinterpretation of space-time, in which, the slightest presence of mass and energy, gives rise to a space-time contraction around this mass and energy, both at astronomical levels and from its nature at the quantum level. In this context, a strong connection and similarity arises, with the longitudinal contraction experienced by objects in situations of high speeds close to light, which is inversely proportional and analogous to the spatiotemporal contraction proposed in this work.

We know very well that the theory of Special Relativity masterfully proposed by A. Einstein, establishes that as an object approaches at speeds close to that of light, its length in the direction of movement experiences a contraction relative to an observer at rest [1]. This contraction known as "Lorentz Contraction", is in fact analogous and inversely proportional to the space-time contraction that bodies generate at any quantum or astronomical level to create gravity [2]. The similarity between the contraction of Lorentz and the longitudinal space-time contraction proposed, opens the doors to a deep exploration of the physical and geometric implications associated with external phenomena of movement, speed and energy that describe the gravitational field.

In this work, the convergence between the longitudinal contraction of space-time and the Lorentz contraction will be shown in detail, to mathematically approximate the values of the three most fundamental constants from a technical and rigorous perspective. The implications of this similarity in the conceptual framework of fundamental physics will be analyzed, from which its culmination arises in the global and relevant theoretical set that experimentally demonstrates the standard model of particles, by being able to consider the foundations of space-time geometry, as a result in its vehicular relationship through the interaction of the Higgs mechanism and the percentage difference between the mass of the proton and its constituents, the quarks, proposed in this study supported by experimental results, as the most suitable candidates [3]. solid, responsible for gravity.

The reasoning behind the concepts proposed here emerges from a new perspective in the Michelson-Morley experiment [4]. An unprecedented historical milestone, which once again opens the doors to a deeper understanding of the intrinsic properties between matter, energy, space-time and their connection with the fundamental laws and constants of nature. From which, through this analysis, it is hoped to shed light on the essential nature of space-time and the possibility of a solid fundamental reinterpretation of geometry, at the extreme limits of physics.

2. Curvature Scalar

Whether Line Element for a Rindler-Minkowski Spacetime Depends on the Mass

In a uniformly accelerated reference frame in Rindler-Minkowski space-time, it is possible to obtain an expression for the mass-dependent Laplacian [5]. In this context, the relationship between the gravitational field and the mass, completes in a different way, what is found in General Relativity, where the slightest presence of mass and energy should describe the space-time contraction (gravity) of proportional to any level, then this contraction may be at quantum levels as well as astronomical levels. That is, whatever the mass and minimum energy levels, Newton's universal constant must arise logically and naturally.

Rindler-Minkowski space-time, where space-time is supposed to be flat and not curved, is used to describe a uniformly accelerated reference frame in Special Relativity. In this accelerated system, the concept of a gravitational field can be approximated and modeled through a uniform acceleration. But it is not a real gravitational field generated by the mass distribution, rather it is a solid analogy of the true meaning of the weak equivalence principle.

Taking into account a Rindler-Minkowski space-time, we can make an approximation within another approximation, expressing it by making the Newtonian limit by this line element [6].

$$ds^2 = -\left(1 + 2\hat{\Phi}\right) c^2\ dt^2 + dx^2 + dy^2 + dz^2 \tag{2.1}$$

Where $\hat{\Phi} = \frac{\Phi}{mc^2}$ and proposing that $\Phi = m_\phi^2 \phi^2$, we can calculate the Ricci tensor of the line element, but first, it is necessary to compute the Christoffel symbols for the following metric:

$$g_{00} = -1 - \frac{2m_\phi \phi^2}{c^2} \qquad g_{11} = 1 \qquad g_{22} = 1 \qquad g_{33} = 1 \tag{2.2}$$

Now, using the formula:

$$\Gamma^\alpha_{\beta\gamma} = \frac{1}{2} g^{\alpha\mu} \left(\partial_\gamma g_{\beta\mu} + \partial_\beta g_{\gamma\mu} - \partial_\mu g_{\beta\gamma}\right) \tag{2.3}$$

Where, for the term $\Gamma^\alpha{}_{00}$, we have:

$$\begin{aligned} \Gamma^\alpha_{00} &= \frac{1}{2} g^{\alpha\mu} \left(\partial_0 g_{0\mu} + \partial_0 g_{0\mu} - \partial_\mu g_{00}\right) \\ &= \frac{1}{2} g^{\alpha\mu} \partial_\mu \left(-1 - \frac{2m_\phi \phi^2}{c^2}\right) = \frac{1}{2} g^{\alpha\mu} \partial_\mu \frac{2m_\phi \phi^2}{c^2} \end{aligned} \tag{2.4}$$

So, we simplify and rearrange to get the Christoffel symbol for $\Gamma^\alpha{}_{00}$, as:

$$\Gamma^\alpha_{00} = \frac{m_\phi}{c^2} g^{\beta\mu} \partial_\mu \phi^2 \tag{2.5}$$

Calculating the same for the term $\Gamma^0{}_{\beta 0}$, we have that:

$$\begin{aligned} \Gamma^0_{\beta 0} &= \frac{1}{2} g^{0\mu} \left(\partial_0 g_{\beta\mu} + \partial_\beta g_{0\mu} - \partial_\mu g_{\beta 0}\right) \\ &= \frac{1}{2} g^{00} \left(\partial_\beta g_{00} - \partial_0 g_{\beta 0}\right) = \frac{1}{2} g_{00} \partial_\mu g_{00} \\ &= \frac{1}{2} \frac{1}{g_{00}} \partial_\beta \left(-1 - \frac{2m_\phi \phi^2}{c^2}\right) = -\frac{m_\phi}{c^2} \frac{1}{g_{00}} \partial_\beta \phi^2 \end{aligned} \tag{2.6}$$

So, substituting g_{00}, we have:

$$\Gamma^0_{\beta 0} = \frac{m_\phi}{c^2} \frac{1}{1 + \dfrac{2m_\phi \phi^2}{c^2}} \partial_\beta \phi^2 \tag{2.7}$$

Now, we can calculate the Ricci tensor:

$$R_{\sigma\nu} = \partial_\mu \Gamma^\mu_{\nu\sigma} - \partial_\nu \Gamma^\mu_{\mu\sigma} + \Gamma\Gamma - \Gamma\Gamma \tag{2.8}$$

In the approximation for a weak field in Rindler-Minkowski spacetime, we can dispense with the components $\Gamma\Gamma - \Gamma\Gamma$. Being the Ricci tensor, for weak fields, in this way:

$$R_{\sigma\nu} \simeq \partial_\mu \Gamma^\mu_{\nu\sigma} - \partial_\nu \Gamma^\mu_{\mu\sigma} \tag{2.9}$$

Then, to calculate the component R_{00} of the Ricci tensor, we have:

$$R_{00} = \partial_\beta \Gamma^\mu_{00} = \partial_\mu \left(\frac{m_\phi}{c^2} g^{\beta\mu} \partial_\mu \phi^2 \right) \tag{2.10}$$

Where:

$$\begin{aligned} R_{00} = \frac{m_\phi}{c^2} &\left[\partial_0 \left(g^{0\mu} \partial_\mu \phi^2 \right) + \partial_1 \left(g^{1\mu} \partial_\mu \phi^2 \right) + \partial_2 \left(g^{2\mu} \partial_\mu \phi^2 \right) + \partial_3 \left(g^{3\mu} \partial_\mu \phi^2 \right) \right] \\ &= \frac{m_\phi}{c^2} \left[\partial_1 \left(g^{11} \partial_1 \phi^2 \right) + \partial_2 \left(g^{22} \partial_2 \phi^2 \right) + \partial_3 \left(g^{33} \partial_3 \phi^2 \right) \right] \\ &\qquad = \frac{m_\phi}{c^2} \left[\partial_1^2 \phi^2 + \partial_2^2 \phi^2 + \partial_3^2 \phi^2 \right] \end{aligned} \tag{2.11}$$

And finally, we have that the result for R_{00} of the Ricci tensor is:

$$R_{00} = \frac{m_\phi}{c^2} \nabla^2 \phi^2 \tag{2.12}$$

Here, the Laplacian scalar ϕ^2 in Rindler-Minkowski spacetime can effectively depend on mass via the term $\frac{m_\phi}{c^2}$ for a very large gravitational field. weak or practically none. However, at quantum scales, the intensity of the gravitational field will be proportional to the energy or mass of the particle. In this context, the Higgs boson (without spin and without charge) could be the perfect candidate to explain gravity.

It is important to note that this idea is related to a specific model of approximation and uniform acceleration in Special Relativity. By incorporating even the smallest amount of mass and energy, a strong relationship emerges. By considering the mass of the Higgs boson as a solution of Einstein's field equations and incorporating the tensor of the electromagnetic field, it is possible to approximate the values of the three most fundamental constants.

2.1 Chiral Symmetry Breaking

It is an example of spontaneous symmetry breaking that affects the chiral symmetry of strong interactions in particle physics. It is a property of quantum chromodynamics, the quantum field theory that describes these interactions, being responsible for most of the mass (more than 99%) of nucleons, and therefore of all ordinary matter, since which converts very light quarks that are bound as constituents into 100 times heavier among the baryons [7].

As a consequence, the effective theory of QCD bound states, such as baryons, must now include a mass term for these states, ostensibly prohibited by unbroken chiral symmetry. Therefore, chiral symmetry breaking induces most of the mass of baryons, such as nucleons, and explains the origin of most of all the mass that makes up visible matter [8].

3. Electromagnetic Energy Density:
Momentum Energy Tensor of the Electromagnetic Field

Consider the energy-momentum tensor $T^{\mu\nu}$ in an electromagnetic field. In the static and uniform case, the only nonzero components of the tensor are T^{00} and T^{ij}, but this time we will focus only on the T^{00} component. For a static and uniform electromagnetic field, the energy-momentum tensor takes the following form:

$$T^{00} = \frac{1}{8\pi}\left(E^2 + c^2B^2\right) \tag{3.1}$$

In a vacuum, with no free charges or currents ($\rho = 0$ and J = 0), Maxwell's equations are further simplified:

$$\nabla\cdot\mathbf{E} = 0; \quad \nabla\cdot\mathbf{B} = 0; \quad \nabla\times\mathbf{E} = 0; \quad \nabla\times\mathbf{B} = 0; \tag{3.2}$$

Given that $\nabla \times E = 0$ and $\nabla \times B = 0$, we can conclude that the electric and magnetic fields are conservative, that is, they can be expressed as the gradient of some scalar potential ϕ and vector A:

$$\mathbf{E} = -\nabla\phi \quad \mathbf{B} = \nabla\times\mathbf{A} \tag{3.3}$$

Gauss's law for the electric field $\nabla \cdot E = 0$ implies that the Laplacian of the electric potential ϕ is zero:

$$\nabla^2\phi = 0 \tag{3.4}$$

Now, using the vector potential A, the Amp`ere-Maxwell law $\nabla \times B = 0$ becomes:

$$\nabla\times\nabla\times\mathbf{A} = 0 \tag{3.5}$$

Applying the vector identity $\nabla \times \nabla \times A = \nabla(\nabla \cdot A) - \nabla^2 A$, and given that $\nabla^2 A = 0$ due to $\nabla \cdot B = 0$, we get:

$$\nabla^2\mathbf{A} = -\nabla(\nabla\cdot\mathbf{A}) = 0 \tag{3.6}$$

Therefore, we can also state that the vector potential A satisfies Laplace's equation $\nabla^2 A = 0$. In the static and uniform case, we can assume that the electric and magnetic fields do not depend on time and are constant in space. If we take the limit as $c \to \infty$, the terms proportional to c^2 in the energy-momentum tensor T^{00} become negligible. Then, the energy momentum tensor simplifies to:

$$T^{00} = \frac{1}{8\pi}E^2 \tag{3.7}$$

In the static case $\nabla \cdot E = 0$, we can ensure that the scalar potential ϕ is simply a constant. By convention, we can take $\phi = 0$, which leads to:

$$\mathbf{E} = -\nabla\phi = 0 \tag{3.8}$$

This implies that the static and uniform electric field is zero.

Now, let's consider a specific case. Suppose there is a point charge q located at the origin of the coordinate system. The charge density ρ associated with the point charge is:

$$\mathbf{E}(\mathbf{r}) = q\delta^3(\mathbf{r}) \tag{3.9}$$

Where $\delta^3 (r)$ is the Dirac delta in three dimensions. The electric field E due to a point charge is given by Coulomb's law:

$$\mathbf{E}(\mathbf{r}) = \frac{q}{4\pi\epsilon_0}\frac{\mathbf{r}}{r^3} \tag{3.10}$$

To calculate the energy-momentum tensor in this case, we need to calculate the square of the electric field E^2. Taking the coordinate system as (x,y,z) and the position vector $\mathbf{r} = (x,y,z)$, we obtain:

$$E^2 = (\mathbf{E})^2 = \left(\frac{q}{4\pi\epsilon_0}\right)^2\frac{(\mathbf{r})^2}{r^6} \tag{3.11}$$

since there is spherical symmetry in the system, we can write $x^i x^i = r^2$, and the square of the electric field simplifies to:

$$E^2 = \left(\frac{q}{4\pi\epsilon_0}\right)^2\frac{r^2}{r^6} = \left(\frac{q}{4\pi\epsilon_0}\right)^2\frac{1}{r^4} \tag{3.12}$$

Substituting the component T^{00} of the energy-momentum tensor, we obtain:

$$T^{00} = \frac{1}{8\pi}E^2 = \frac{1}{8\pi}\left(\frac{q}{4\pi\epsilon_0}\right)^2 \frac{1}{r^4} = \frac{q^2}{32\pi^3\epsilon_0^2}\frac{1}{r^4} \tag{3.13}$$

So, always considering the case of a static and uniform electromagnetic field for a point charge at the origin of the coordinate system, and so that this equation maintains its form and physical meaning in the framework of special relativity, we include the term c^0 to be able to express the electromagnetic energy-momentum tensor in this way:

$$T^{00} = -\frac{1}{32\pi^3\epsilon_0^2 c_0} \tag{3.14}$$

Where, we can highlight that this equation has fundamental applications in electromagnetic theory and particle physics.

4. Variational Principle of the Actions of Coupled Gravitational and Electromagnetic Theory

Einstein's equations are an improvement on Newton's equations. So, we can appreciate this difference in a very notable way, when gravity is intense and for speeds comparable to light. But when gravity is not strong and speeds are not very high, we clearly recover Newton's equations. Now, if we accept that gravity exists in an infinitesimal region for a Rindler-Minkowski space-time, where the intensity of the gravitational field is very weak, being practically negligible, then, gravity being an effect of deformation and contraction of space -time, and although the intensity is very negligible at quantum levels, gravity exists proportionally to the mass and energy of the particle. And if the deformation due to space-time contraction is proportional at quantum levels, the only candidate particle due to its special characteristics with a solid connection so that energy and mass proportionally can have a close relationship to deform space-time, is the Higgs boson.

And if we consider that at quantum levels where the gravitational field is infinitely weak or practically very negligible, then the same equations that are derived from the actions of the gravitational field must perfectly describe the approximate values of the three most fundamental constants of physics.

So, to achieve this, we are going to calculate the variation of the Hilbert-Einstein action and the action of matter given by the energy-momentum tensor, but coupling in between, the action of the electromagnetic field in this way:

$$S[g] = \int d^4x\sqrt{-g}R + \int d^4x\sqrt{-g}\mathcal{L}_{em} + \int d^4x\sqrt{-g}\mathcal{L}_{matt} \tag{4.1}$$

We multiply the first two terms of the action by an unknown constant λ:

$$S[g] = \lambda\left[\int d^4x\sqrt{-g}R + \int d^4x\sqrt{-g}\mathcal{L}_{em}\right] + \int d^4x\sqrt{-g}\mathcal{L}_{matt} \tag{4.2}$$

Next, we first perform the variation with respect to the metric $g^{\mu\nu}$:

$$\frac{\delta S[g]}{g_{\mu\nu}} = \lambda\left[\frac{\delta}{\delta g_{\mu\nu}}\int d^4x\sqrt{-g}R + \frac{\delta}{\delta g_{\mu\nu}}\int d^4x\sqrt{-g}\mathcal{L}_{em}\right] + \frac{\delta}{\delta g_{\mu\nu}}\int d^4x\sqrt{-g}\mathcal{L}_{matt} \tag{4.3}$$

The variation of the metric in the first integral affects the curvature R, considering at all times an infinitely weak or practically negligible gravitational field, and in the second integral, it affects the electromagnetic tensor $F_{\mu\nu}F^{\mu\nu}$.

Continuing with the variation with respect to $g_{\mu\nu}$, we obtain:

$$\frac{\delta}{\delta g_{\mu\nu}}\int d^4x\sqrt{-g}R = \sqrt{-g}G_{\mu\nu} \tag{4.4}$$

Where we know perfectly well that $G_{\mu\nu}$ is the Einstein tensor:

$$G_{\mu\nu} \equiv R_{\mu\nu} - \frac{1}{2}g_{\mu\nu}R \tag{4.5}$$

The variation of the electromagnetic term is as follows:

$$\frac{\delta}{\delta g_{\mu\nu}}\int d^4x\sqrt{-g}\mathcal{L}_{em} = -\frac{1}{4}\sqrt{-g}F_{\mu\nu}F^{\mu\nu} \tag{4.6}$$

And the variation of the matter term that we know perfectly well is given by the energy-momentum tensor:

$$\frac{\delta}{\delta g_{\mu\nu}}\int d^4x\sqrt{-g}\mathcal{L}_{matt} = \frac{1}{2}\sqrt{-g}T_{\mu\nu} \tag{4.7}$$

Putting all the contributions together and setting the variance equal to zero, we can rewrite the action like this:

$$\delta S\left[g\right] = \lambda\left[R_{\mu\nu} - \frac{1}{2}g_{\mu\nu}R - \frac{1}{4}g_{\mu\nu}F_{\mu\nu}F^{\mu\nu}\right] + \frac{1}{2}T_{\mu\nu} = 0 \tag{4.8}$$

Finally we rearrange terms to arrive at the following equation:

$$R_{\mu\nu} - \frac{1}{2}g_{\mu\nu}R - \frac{1}{4}g_{\mu\nu}F_{\mu\nu}F^{\mu\nu} = -\frac{1}{2\lambda}T_{\mu\nu} \tag{4.9}$$

With these equations, we can represent the coupled gravitational and electromagnetic field equations.

4.1 Calculation of the Trace for the Coupling between the Gravitational and Electromagnetic Field

To calculate the trace of the equation [4.9], we do the following:

$$g^{\mu\nu}R_{\mu\nu} - \frac{1}{2}g^{\mu\nu}g_{\mu\nu}R - \frac{1}{4}g^{\mu\nu}g_{\mu\nu}g^{\mu\nu}F_{\mu\nu}g^{\mu\nu}F^{\mu\nu} = -\frac{1}{2\lambda}g^{\mu\nu}T_{\mu\nu} \tag{4.10}$$

Being the values for $g^{\mu\nu}g_{\mu\nu} = 4$ both for the Einstein tensor and for the electromagnetic tensor and for $g^{\mu\nu}F_{\mu\ mu}g^{\mu\nu}F^{\mu\nu} = 0$ since one is the inverse of the other, then we have:

$$R - 2R = -\frac{1}{2\lambda}g^{\mu\nu}T_{\mu\nu} \qquad \Longrightarrow \qquad R = \frac{1}{2\lambda}g^{\mu\nu}T_{\mu\nu} \tag{4.11}$$

We simplify by taking $g^{\mu\nu}T\mu\nu = g^{00}T_{00}$, we can rewrite it like this:

$$R_{00} = \frac{1}{2\lambda}g^{00}T_{00} \tag{4.12}$$

We copy the equation [4.9] again, rearranging and simplifying, being interested at all times in the 00 components of the equation:

$$R_{00} = -\frac{1}{2\lambda}T_{00} + \left[\frac{1}{2} + \frac{1}{4}\right]\frac{1}{2\lambda}T_{00} \tag{4.13}$$

So, we are left with:

$$R_{00} = -\frac{1}{8\lambda}T_{00} \tag{4.14}$$

We know that the calculation of the line element for a weak or practically negligible gravitational field, for a RindlerMinkowski space-time within the framework of General Relativity $R_{00} = \frac{1}{c^2}\ nabla^2 V$. But accepting the calculation of the scalar Laplacian ϕ^2 of the equation [2.12], we have:

$$\frac{m_\phi \phi^2}{c^2} = -\frac{1}{8\lambda}T_{00} \qquad \Longrightarrow \qquad -\frac{c^4}{8\lambda m_\phi \phi^2} \tag{4.15}$$

If we first equate the result with that obtained in the equation [3.14]:

$$-\frac{c^4}{8\lambda m_\phi \phi^2} = -\frac{1}{32\pi^3\epsilon_0^2 c} \qquad \Longrightarrow \qquad -\frac{32\pi^3\epsilon_0^2 c^5}{8\lambda m_\phi \phi^2} \tag{4.16}$$

And then, this same result, we equalize it by the Einstein constant 8πG, taking into account that c^4 already appears in the calculations, and since the objective of this article is to obtain the approximate value of G_N and from two other constants, we finally have the value of lambda λ:

$$\lambda = -\frac{4\pi^2\epsilon_0^2c^3}{8m_\phi/c^2} \tag{4.17}$$

Substitute λ in the equation [4.9] and simplify, leaving as follows:

$$R_{\mu\nu} - \frac{1}{2}g_{\mu\nu}R - \frac{1}{4}g_{\mu\nu}F_{\mu\nu}F^{\mu\nu} = \frac{m_\phi/c^2}{\pi^2\epsilon_0^2c^3} \tag{4.18}$$

And finally, if we accept that $m_\phi/c^2 = m_H = 125\text{Gev}/c^2$ then, knowing the most exact value of the boson mass of Higgs, we can greatly approximate the value of G_N [9].

$$G_{Newton} \approx \frac{125\text{Gev}/c^2}{\pi^2\epsilon_0^2c^3} = 6.6712819049 \times 10^{-11} \tag{4.19}$$

5. The Cosmological Constant, The Higgs Boson and the Accelerated Expansion of the Universe

That the Higgs boson is related to the accelerated expansion of the universe may seem impossible to prove, but if we have shown the relationship with gravity, it makes all the possible sense that it is also related to the cosmological constant and the accelerated expansion of the universe. This relationship exists inversely proportional to gravity and to demonstrate it it is necessary to make use of the results of the Michelson-Morley experiment, since it is the true precursor to firmly believe that the longitudinal contraction suffered by the arms of the interferometer is analogous to to reinterpret gravity as a spatiotemporal contraction effect, a much more intuitive and physically correct interpretation.

The time lag calculated and expected by Michelson and Morley for the speed of light relative to the Aether, was to be a non-zero $\Delta t \neq 0$ result [10].

$$\boldsymbol{\Delta t} = \frac{2\left(\boldsymbol{L}_1 + \boldsymbol{L}_2\right)}{c}\left[\frac{1}{1 - V^2/c^2} - \frac{1}{\sqrt{1 - V^2/c^2}}\right] \tag{5.1}$$

Obtaining in all the attempts, a result opposite to what was expected, and therefore $\Delta t = 0$, meant that the experiment was a total failure. But a solution to the problem, the Dutch Lorentz and the Irish George Francis Fitz-Gerald came up with independently, consisted of contracting the arm of the interferometer in the direction of movement just the right amount to obtain a result $\Delta t = 0$.

So for this to be true:

$$\left[\frac{1}{1 - V^2/c^2} - \frac{1}{\sqrt{1 - V^2/c^2}}\right] = 0 \tag{5.2}$$

The length of the interferometer arm in the direction of motion should contract by a factor $\sqrt{1 - V^2/c^2}$, leaving Δt expressed in this way:

$$\boldsymbol{\Delta t} = \frac{2\left(\boldsymbol{L}_1 + \boldsymbol{L}_2\right)}{c}\left[\frac{1}{\sqrt{1 - V^2/c^2}} - \frac{1}{\sqrt{1 - V^2/c^2}}\right] \tag{5.3}$$

Now if we equate Δt with the result of the equation [4.19], we can obtain an approximate value to associate it with the cosmological constant, then:

$$\frac{2\left(\boldsymbol{L}_1 + \boldsymbol{L}_2\right)}{c\boldsymbol{\Delta t}} = \frac{125\text{Gev}/c^2}{\pi^2\epsilon_0^2c^3} \quad\Longrightarrow\quad \frac{\left(\boldsymbol{L}_1 + \boldsymbol{L}_2\right)}{\boldsymbol{\Delta t}} = \frac{125\text{Gev}/c^2}{2\pi^2\epsilon_0^2c^2} \simeq 0.01 \tag{5.4}$$

6. Theoretical Model of Space-Time Contraction Deformation Inversely Proportional to the Density of A Planet: An Analogous Approach Based On General Relativity

Let us consider a hypothetical model in which the maximum density of a planet causes a contraction warp of space-time in its surroundings. Suppose that the deformation of space-time is inversely proportional to the density of the total volume of the planet.

The density of the planet is inversely related to the contraction or curvature of space-time that is generated around it. Being zero gravity at the planet's core, where its maximum density is found, the space-time contraction becomes more pronounced near the planet's surface. This inverse relationship can be defined simply by a mathematical function that describes the percentage relationship between the density of the planet and the space-time contraction.

The mathematical function used in this approach models the inverse relationship between the density of the planet and the contraction of space-time. It can be a function like $f(k) = 1/d$, where $f(k)$ represents the contraction of space-time at a given point, d is the total volume percent density of the planet at that point for all scales of deformation. That is, $f(K) = 1/100$.

In this model, 1% of the planet's total volume marks the maximum point of space-time contraction. That is to say, that the density of the planet, which corresponds to 1% of the total volume, contracts space-time in an inversely proportional way at that point.

If we consider this approach as real and possible, then we can think that the maximum density of the planet and its inverse percentage relationship with the contraction or curvature of space-time, can be described by a mathematical function that models the space-time warp inversely proportional.

Assuming this approach, it is possible to mathematically define the approximate value of Newton's universal gravitational constant **G**, where inversely and proportionally, introducing the constant of multipole expansion and charge distribution of electromagnetism, is also It is possible to define the approximate value of the Hubble constant $\mathbf{H}_{(0)}$ for the accelerated expansion of the universe. And if we consider that **G** and $\mathbf{H}_{(0)}$ must be inversely proportional, then Λ_- must not describe the contraction of the universe, but the contraction of space time: gravity. And on the other hand Λ_+, should describe the accelerated expansion of the universe.

Now, assuming that $\Lambda_\pm$ is a constant that has two components whose values are inversely proportional to each other, we will impose exact values of $\Lambda_\pm$ to calculate **G,** $\mathbf{\Lambda+} = 10^2$ and $\mathbf{H}_{(0)}$. Only assuming this, it is possible to arrive at a solution to answer about dark matter, dark energy and gravity itself, where it is believed in the existence of an ordinary gravitational force that results from passing particles and anti-particles with mass, which slow down the expansion of the Universe and the repulsive force that results from the dark energy of the vacuum, which is believed to be responsible for the accelerated expansion of the universe.

$$\Lambda = \Lambda_- + \Lambda_+ = 10^{-53} m^{-2} \approx 0 \tag{6.1}$$

Paul Davies, an internationally recognized British physicist, writer and broadcaster. He speculates that the ordinary gravitational force resulting from the transient existence of particles and anti-particles with ordinary mass has the following value:

$$\Lambda_+ \approx 10^{-53}(1 + 10^{51}) \approx 10^{-51} + 10^{-2} = (1 + 10^{-51})^* 10^{-2} m^{-2} \tag{6.2}$$

And in the following equation, speculate by defining the contribution of the repulsive component $\Lambda-$ and m_ϕ as the mass of the Higgs boson [11].

$$\Lambda_- = -\pi G m_\phi^2 / \sqrt{2c^4 g_w} = -10^{-2} m^{-2} \tag{6.3}$$

$$\Lambda_\pm = \frac{\Lambda_-}{\Lambda_+} = \frac{\Lambda - \Lambda_-}{\Lambda_+} = \frac{10^{-53} - (-10^{-2})}{1 + 10^{-51}(10^{-2})} = 0.01 \tag{6.4}$$

Thus, assuming approximate values for $\Lambda_\pm$ such as $\Lambda_- = 10^{-2}$ and $\Lambda_+ = 10^2$, we can find solutions for the metric in cosmological measurements as well as for the tensor metric that defines gravity.boson [11].

6.1 Hubble Stress and Gravity, a Surprising Relationship: Exploring the Fundamental Constants and the Metric of the Universe

The Hubble Stress refers to the discrepancy observed in the measurement of the constant $H(0)$, which represents the expansion rate of the universe, using two different methods. One method suggests faster expansion, while another indicates slower expansion. Although the numerical difference might seem insignificant, its astronomical and cosmological importance is crucial for the study of the universe.

If we consider gravity, the most fundamental force of nature, as a convergent attraction towards the center of mass of a massive object, we can imagine that the force that accelerates and expands the universe has done so divergently in all three spatial dimensions since a starting point. Under this perspective, it is feasible to consider that the force that drives the expansion of the universe and gravity are inversely proportional forces. This means that the Hubble constant $H(0)$ and the Newtonian universal gravitational constant G_N could be inversely related, as long as a sense for the difference in magnitudes is established.

To arrive at this surprising relationship, it is necessary to describe and relate the parallax metric used in astronomy and cosmology, which uses units of measurement such as the "*Parsec*" and the astronomical unit "*AU*", with the SI unit of measure, the "*Meter*", but in a particularly unique way.

Then we know that 1 Parsec = 206264.80624548031ua = 3.2616 light years = $3.0857\times10^{16}m$, that is:

$$1pc = \frac{1}{Tan(1'')} = 206264.80624548031\text{UA} \tag{6.5}$$

And now transforming the tangent for a value at $\Lambda- = 0.01$, we have the following:

$$\frac{1}{Tan(0.01'')} \simeq 100pc \qquad \rightarrow \qquad \frac{1}{Tan(\Lambda''_-)} = \Lambda_+ pc \tag{6.6}$$

Then we can also say that $1meter = 3.241 \times 10^{-17}$ parsecs, where also $1parsec = 3.0857 \times 10^{16}$ *meters*, and exchanging the magnitudes we have:

$$3.0857 \times 10^{17} \ \times \ 3.241 \times 10^{-16} \simeq 100 \tag{6.7}$$

Where the result of $\Lambda_+ \simeq 100$ can be units in Parsecs or Meters, depending on the interest of our measure.
So, if we take the equation [4.8] to add by adding another unknown constant λ, we can write the equation like this: magnitudes we have:

$$\delta S\left[g\right] = \lambda \left[R_{\mu\nu} - \frac{1}{2}g_{\mu\nu}R - \frac{1}{4}g_{\mu\nu}F_{\mu\nu}F^{\mu\nu}\right] + \lambda + \frac{1}{2}T_{\mu\nu} = 0 \tag{6.8}$$

We rearrange and simplify terms to arrive at the following equation:

$$G_{\mu\nu} - F_{\mu\nu} - \frac{\lambda}{4} + \frac{1}{2}T_{\mu\nu} = 0 \qquad \Longrightarrow \qquad G_{\mu\nu} - F_{\mu\nu} - \frac{1}{4} = -\frac{1}{2\lambda}T_{\mu\nu} \tag{6.9}$$

Now, considering the propagation of an electromagnetic wave in a vacuum, where there is neither charge density nor current, then we can equate the equation $G_{\mu\nu} - F_{\mu\nu} - \frac{1}{4}$ like this:

$$G_{\mu\nu} - F_{\mu\nu} - \frac{1}{4} = \frac{4\pi\epsilon_0}{c} \qquad \Longrightarrow \qquad G_{\mu\nu} - F_{\mu\nu} - \frac{c}{16\pi\epsilon_0}$$

So, we can perfectly write the equation this way:

$$G_{\mu\nu} - F_{\mu\nu} - \frac{c}{16\pi\epsilon_0} = -\frac{1}{2\lambda}c^2 \qquad \rightarrow \qquad G_{\mu\nu} - F_{\mu\nu} = 8\pi\epsilon_0 c$$

7. Challenge to the Measurements On the Accelerated Expansion of the Universe: Approximate Value For the Hubble Constant

The measurements made by the team led by Adam G.Riess, Nobel Prize winner in the discovery of the accelerated expansion of the universe together with Saul Perlmutter and Brian P.Schmindt, obtained a value of $H(0) = 73.02 \pm 1.79$ *Km/s/Mcf* with an uncertainty of 2.4%. The WFC3 (Wide Field Camera 3) camera of NASA's Hubble telescope was used for the measurement. The importance of this value differs by 3 sigmas from that obtained thanks to the microwave background [12].

$H(0) = 67{,}6 \pm 0{,}6$ *Km/s/Mpc*
$(Planck\Pi + LowP + BA0)$
Results obtained in 2015, but subsequent estimates obtained by SPT-3G, allow us to estimate the Hubble constant at:
$H(0) = 67{,}24 \pm 0{,}54$ *Km/s/Mpc*

Now, considering the accelerated expansion of the universe inversely proportional to gravity, and taking into account said expansion in all spatial directions, then we write the result as:

$$G_{\mu\nu} - F_{\mu\nu} = 8\pi\epsilon_0 c\Lambda_+^3 = \frac{2c}{k_e}\Lambda_+^3 = \frac{2c\,(100)^3}{1/4\pi\epsilon_0} \simeq 66,71281903495602\ Km/s/Mpc \qquad (7.1)$$

To give consistency to these results and taking into account that there is a close inversely proportional relationship between Hubble's constant and Newton's universal constant, we can equate the term $\frac{1}{16\pi\epsilon_0 c}$ with the magnetic constant of the Biot-Savart law in this way:

$$-\frac{1}{16\pi\epsilon_0 c} = -\frac{\mu_0}{4\pi} \qquad \Longrightarrow \qquad G_{\mu\nu} - F_{\mu\nu} = 2\mu_0\epsilon_0 c\Lambda_- = \frac{2\,(0.01)}{c} \simeq G_{Newton} \qquad (7.2)$$

8. Conclusions

The gravitational field equations, which are described by General Relativity, are presented as highly complex nonlinear differential equations both in the mathematical and physical fields. This historically unprecedented complexity poses a fundamental challenge: the unification of gravity with quantum mechanics. The exploration that we have presented in this article opens doors of immense dimensions to shed light on the most transcendental questions of modern physics.

Our approach opens the possibility of interpreting dark energy as a manifestation of the universe in a multidirectional free fall in space-time. In addition, we propose that dark matter, although difficult to develop a theory consistent with observations, could be explained by the constant compression of space-time from the center to the outside of galaxies. This space-time compression, a phenomenon described by General Relativity, could be driving the movement of matter in galaxies, eliminating the need to resort to inert and invisible dark matter.

The presence of black holes in the nuclei of most galaxies becomes relevant in this context. The rotation of these black holes may be compressing space-time in a way that simulates the existence of dark matter, thus offering an alternative explanation for the constant rotation curve observed in galaxies. This interpretation stands in stark contrast to the fruitless search for elusive dark matter.

It is crucial to recognize that the rotations of planetary systems, such as our own, are not adequate analogues to justify the existence of dark matter. Rotation patterns in planetary systems differ significantly from galaxies, where space-time compression is a dominant factor.

We encourage the scientific community to explore and develop equations that support this innovative perspective. Our unwavering commitment to this new research direction drives us to seek a deeper understanding of physics, including the puzzle of quantum entanglement. We encourage collaboration and discussion around these ideas, in the hope that our work will inspire significant advances in our understanding of the fundamental nature of the universe.

In short, our research presents a provocative approach that invites a reconsideration of the nature of energy and dark matter, challenging conventional assumptions and opening new avenues for scientific exploration at the intersection of gravity, quantum mechanics, and General Relativity.

References

1. Einstein, A. (1905). On the electrodynamics of moving bodies. Annalen der physik, 17(10), 891-921.
2. Einstein, A. (1905). On the electrodynamics of moving bodies. Annals of physics, 4.
3. *The Higgs boson, The Brout-Englert-Higgs mechanism,* CERN
4. Michelson, A. A. (1887). On the relative motion of the earth and the luminiferous aether. BEYOND BOOKS HUB.
5. Rindler, W. (2003). Relativity: special, general, and cosmological.
6. Javier Garcıa. "General Relativity Course".
7. Wikipedia *Chiral Spontaneous Symmetry Breaking.*
8. Wikipedia *Chirality of baryonic matter.*
9. Experiment, C. M. S. (2012). Observation of a New Particle with a Mass of 125 GeV. Press statement. Compact Muon Solenoid Experiment at CERN.
10. A. A. Michelson and E.W. (1887). Morley *Philos Mag*.
11. Davies, P. C. (1984). The accidental universe. CUP Archive.
12. Riess, A. G., Macri, L. M., Hoffmann, S. L., Scolnic, D., Casertano, S., Filippenko, A. V., & Foley, R. J. (2016). A 2.4% determination of the local value of the Hubble constant. The Astrophysical Journal, 826(1), 56.