ISSN 2350-1030

International Journal of Recent Research in Physics and Chemical Sciences (IJRRPCS)
Vol. 4, Issue 1, pp: (8-33), Month: April 2017 – September 2017, Available at: www.paperpublications.org

Theory of Universal Origins (Part A)

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Abstract: **About a century ago, Albert Einstein realized how the Theory of Newton's Universal Gravitation was inadequate to describe nature and needed to be revised in order to be neatly incorporated into the relativistic scheme with its undesirable instantaneous force shortcomings. Since then we have come to adopt the relativistic high energy tensor theory of General Relativity, which saw its inception into mainstream physics in the year 1916. General Relativity has stood firm against varied tests, such as: gravitational lensing, perihelion of mercury, gravitational time dilation, PSR1913+16 etc., but with the steady advancement of Quantum Mechanics, and its overwhelming experimental success, we are yet again faced with the same problem that was faced a century ago, but this time, the problem is much worse, and the elephant in the room is General Relativity. The fact that General relativity and Quantum mechanics, share different views in the description of space and time or space-time, with quantum mechanics in favor of the latter and general relativity of the former; does not allow one to have a smooth transition from one representation to the other. This automatically implies that for scenarios where both quantum mechanics and gravity / general relativity are required, then that scenario is unsolvable with our current model of physics (hence either General Relativity or Quantum Mechanics is flawed). It becomes clear from the microscopic realm of quantum mechanics and the cosmological problems associated with General Relativity, such as dark energy, dark matter, the inflation force... perhaps a bit closer to home for general relativity being the singularities inherent in its own equations, and the very nature of General Relativity, allowing mostly approximate solutions (reason why most physicist, even today still cling to Newtonian dynamics), because of this and more a new theory of gravity is required – the much anticipated "Quantum Gravity" – just as it was required those many years ago. In the theory that I propose, we will see how from the most basic concepts of quantum mechanics, a theory of gravity can emerge that has the power to not only be mathematically simpler than General Relativity, explain dark energy, dark matter and inflation without any ad-hoc mechanisms, but also have the power to unify all the forces of nature into a single unified theory of everything.**

Keywords: **Quantum Gravity, Before the big bang, Theory of Everything, Dark Matter.**

"We may regard the present state of the universe as the effect of its past and the cause of its future. An intellect which at any certain moment would know all forces that set nature into motion, and all positions of all items of which nature is composed, if this intellect were also vast enough to submit this data to analysis, it would embrace in a single formula the movements of the greatest bodies of the universe and those of the tiniest atom; for such an intellect nothing would be uncertain and the future just like the past would be present before its eyes." – **Pierre Simon Laplace.**

1. INTRODUCTION

Gravity, the first fundamental force ever discovered centuries ago, still plagues the modern man as the least understood of all the forces of nature. As Raymond Angelil [4] said, [If we consider the data, we find that the laws of gravity – General Relativity and Newton's Laws – apply incredibly well to solar systems. But what about larger scales? We would expect the same laws that work so well for our solar system to apply for the remote stars orbiting the galactic center. It seems however, that our predictive power suffers a blow at this scale. Indeed the galactic rotation curve does not follow this law.

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The stars orbiting the galactic centers are observed to have a constant velocity with increasing distance from the center. The gravitational force does not fall off with increasing distance as General Relativity describes. Something must change. Einstein's theory of General Relativity, changed almost everything from Newtonian dynamics, mass to energy, force to curvature but left the inverse square law intact, but was this empirically found inverse square law of Hooke and Newton only an approximation to a more fundamental decay? But an even more important question is where do we look? do we look at theories that "twink" with general relativity – still embedded in the curvature of space-time – or a new view such as string theory, loop quantum gravity or a completely new formulation altogether? How do we make a change to avert this Do we simply not understand galaxies properly - i.e., is our understanding of the system lacking; or is it our model of gravity that needs a makeover?] Since the inception of General relativity, and a thousand research papers later, the problem of incorporating it with quantum mechanics has failed, this tells us that in order to solve new problems we need a new view of thinking, since Einstein, gravity has been viewed in a dogmatic view, that gravity can ONLY be represented by differential geometry, but for nearly 300 years, gravity was modeled in terms of Algebra by Newton... is there a better model than both differential geometry and algebra to represent gravity? In the text that follows a different path is followed, one that has its foundations in quantum mechanics. We will see how the De Broglie wavelength's full potential, which dates back to the golden days of quantum mechanics, has not yet been fully realized – at-least, at the macroscopic scale of everyday objects. In a nutshell De Broglie postulated that any particle / object, with mass and velocity should exhibit a sought of wave nature. The main reason why this wavelength is mostly treated with a mild neglect for planets, is due its low wavelength nature, but this, of course is a desirable effect, since this low wavelength nature, implies high frequencies. A moment's pause, leads us to the idea that every macroscopic object has a high energy field around them, of course, this is what in everyday language we call gravity. In this article, we will see how if we treat gravity, as a wave similar to the De Broglie wave, from Quantum Mechanics, a theory of quantum gravity emerges... with great consequences of unifying all the forces of nature and explaining dark energy, dark matter and inflation from first principles, in a Theory of everything, that reduces to Einstein dynamics in the limiting case.

2. POSTULATES OF UNIVERSAL EQUILIBRIUM

Gravity postulate: Gravity is a wave, described by the De Broglie wavelength of electrically neutral particles.

The transmutation principle: Whenever two or more particles, reach a state of neutrality, either by combination or by the weak force, the resultant wave is a transmutation of the individual waves.

Kinematics

None.1 The need for a time variable (τ):

Gravity has been described in varied ways, as he the father of physics (Sir. Isaac Newton) viewed her... as if it were an instantaneous force, or as only the genius of Einstein – or perhaps better suited, novel imagination – as a curvature of space itself. If we could propose a theory of invisible springs, being the cause of gravity, and came up with a model for it, we could in principle, come up with the necessary gravitational equations to describe our newly formed model of gravity as invisible springs. My study has made me come to the firm belief that gravity is not an instantaneous force, curvature of space, or even many invisible springs... but a wave, and although many representations can indeed represent gravity... its true nature, just like electromagnetism, is a wave.

$$R_{\mu\nu} - {}^{1}/_{2}\, g_{\mu\nu}R + \Lambda g_{\mu\nu}R = 8\pi G c^4 T_{\mu\nu}$$

most people look at Einstein's field equations with shear amazement, particularly due to their complexity with 10 independent equations relating the Riemannian Tensor and its contractions to the Stress energy tensor. But this is misguiding, the theory is of great mathematical and physical beauty, but Einstein's gravity is quite simple, it has the form of:

$$Curvature = Energy$$

falling off, with the inverse square law

$$R = constant \times T$$

ISSN 2350-1030

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The complexity, is actually a weakness in the equation in contradiction to popular belief, Newtonian Dynamics on the other hand has the form

$Force = energy$

$$\boxed{F(r) = G\frac{m_1 m_2}{r^2}}$$

falling off, with the inverse square law. Let me quote Einstein, in the early 1950's, regarding the unification of quantum mechanics [... I am no longer sure if differential geometry is the proper framework for further progress, but if it is, than I believe I am on the right track...] [Abraham Pais, The science and the life of Albert Einstein]. Even He, was in doubt of the $Curvature = Energy$, Framework. But almost every physicist today, based on almost every research paper on gravity is based on differential geometry, with absolute certainty that differential geometry is indeed the framework for further progress. I do not share this view.

In this paper we will take the view of a wave representation of gravity, i.e.

$Wave = Energy$

falling off, with the exponential function / natural decay

According to De Broglie, macroscopic objects have an intrinsic wave around them, that follows the relation $\lambda = {}^{h}\!/_{p}$. Meaning an object such as the earth, moon, stars and black holes also possess this peculiar wavelength or frequency. If we could envision this wavelength (wave) around stellar objects, with this wave having a certain color around a planet (perhaps blue), this high frequency / high energy wave, what name would we give it in the macroscopic realm? In quantum mechanics this wave is given the name the De Broglie wavelength, but what is its analogue in classical mechanics? What is this high energy wave that is surrounding massive objects such as planets and stars, with a frequency / energy equal to the mass of that object? From this line of thought it does not take a great leap of imagination to realize that what we call the De Broglie wavelength in Quantum Mechanics is simply Gravity in Classical Mechanics. And if we can find an equation that tells us how the De Broglie wavelength $\lambda = {}^{h}\!/_{p}$ evolves with space and time from the center of the object, then we could calculate the De Broglie wavelength at the surface of the earth, and compare the value we find to that of the gravitational acceleration ($g = 9.81m/s^2$), as such we will have refuted this hypothesis or have found a quantum equation of gravity. Below is the line of thought which I followed to hopefully accomplish this task.

In this study we have found that the relation of the De Broglie wave with distance gives this equation

$$g_{rel}(r) = \gamma mc^2 \Lambda_{(rel)} Gexp(-2i\frac{mc}{\hbar}r)$$

This reduces to standard General Relativity in macroscopic distances, and thus confirming my hypothesis that macroscopic gravity is the same as the De Broglie wave. The reader is encouraged to skip the following preliminaries if he /she wishes to the section of "quantum gravity" where my hypothesis is proven (All sections are largely independent of each other).

To start things of, we will find the Fourier transform of Planck's relation, $E = nhf$, the reason we decided to take this route is because frequency is better suited for microscopic phenomena, whilst time is suited for macroscopic descriptions, such as gravitational time dilation in relativity – time is more natural in the macroscopic world. Fourier gives a way between passing between the two equivalent representations of time and the De Broglie frequency [2]

$$f(t) = \int_{-\infty\infty}^{\infty} f(s)\, e^{-i2\pi nst} ds = \int_0^{\infty} (nhs) e^{-i2\pi nst} ds = nh\int_0^{\infty} se^{-i2\pi nst} ds\ ,$$

Integrating by parts we have

$$f(t) = nh[\frac{s}{-2\pi nt} e^{-i2\pi nst}]_0^{\infty} + nh[\frac{1}{2\pi nt} e^{-2\pi nt}]_0^{\infty} = nh[\frac{0\times\infty}{-2\pi nt} + \frac{1}{2\pi nt}]$$

$$\boxed{f(t) = \frac{h}{2\pi t}}$$

f(t) has the dimensions of energy, so we replace f(t) with the E and write

$E = \beta \frac{h}{2\pi t}$

where, E - Energy and β - is a unitless constant. We know that the product of the wavelength and momentum is related by $\lambda p = h$, and because of the symmetry that exists between momentum and energy, we let $\beta = 2\pi$, therefore, this finally gives us

$\boldsymbol{\tau E = h}$ (1)

or

$\boldsymbol{\tau E = \Lambda}$

if we let $\beta = 1$, where τ - is a new variable, let's call it "Quantum time" and E - is the energy.

We have now found our variable of time, which is simply the inverse Fourier transform of frequency [2]. But this equation has a deeper significance, then its modest inception, as a transform. It tells us that:

- at each point in space the product of time and energy is always constant, just like $\lambda p = h$.

None.2 The Action:

Finding the trajectory of particles is an important cornerstone of physics. In this section we show how the equation we found $\tau E = h$ is linked to the action principle.

Any object that is in motion follows simple formulae, if one wants to determine its path (if a unique path does exist). The following treatment will give us the necessary condition for a unique classical path to exist.

L = Energy of Particle(s) - Energy of externals $= E - \varepsilon$

Where L is the Lagrangian / Trajectory and externals can be the field or other forces e.g. L=T-V

$L = E - \varepsilon = E_1 + E_2 + \cdots E_n - \varepsilon_1 - \varepsilon_2 - \cdots \varepsilon_n = \sum E_i - \sum \varepsilon_i$

The action in physics. Which is an expression that takes on a particular value, depending on the function used is normally understood as a functional with no inherent meaning on its own, or even more so of no particular importance, both in classical mechanics and in quantum mechanics[7][10]. The calculus of variations is based on the principal that, the variation of the action is zero, without any particular reference to the action. We found the relation earlier $\tau E = h$, which is broad in its scope, says how irrespective of where a particle is placed in a gravitational field, the product of time and energy will always be constant. This is a different type of conservation, different from the conservation of a single quantity.

- The conserved quantity in space is the action (I)

(2) $\boldsymbol{I = \tau E}$ ***and*** $\boldsymbol{I = \lambda P}$

where I is the action, with units [J.s] as it should be. Since we have redefined the action, let's see if this new definition / relation will give us any new information, if we used it to derive the Euler-Lagrange equations[7].

$I = \int L dt = \int_t^{t+\Delta t} L dt$

where Δt is a little time later.

now

$I = \int_t^{t+\Delta t} L dt = \int_t^{t+\Delta t} (E - \varepsilon) dt = (E - \varepsilon) \int_t^{t+\Delta t} dt = (E - \varepsilon)\Delta t = \Delta E \Delta t$

but from our formula of $\tau E = h$, we can write $I = \Delta E \Delta t = h$

$\delta I = \int_{t_1}^{t_2} \{ \frac{d}{dt} (\frac{\partial L}{\partial \dot{q}_\alpha}) - (\frac{\partial L}{\partial q_\alpha}) \} \beta(t) dt = \delta h,$

but $\delta h = 0$, implying that $\delta I = 0$. Where $\beta(t_1) = \beta(t_2)$.

So, $\delta I = 0$ iff $I = \tau E$

implying

$$\frac{d}{dt}\left(\frac{\partial L}{\partial q^{\cdot}_{\alpha}}\right) - \left(\frac{\partial L}{\partial q_{\alpha}}\right) = 0$$

Thus $\tau E = h$ is the condition that nature requires to define a unique path. In quantum mechanics the product of time and energy is not a constant, as seen from Heisenberg's uncertainty principle, $\Delta E \Delta t \geq h/4\pi$, let's see how the Euler Lagrange Equations are affected by this.

$I = \Delta E \Delta t \geq \frac{h}{4\pi}$

$$\mathrm{I} \geq \delta(\frac{\hbar}{2})$$

(3) $I \geq 0$

Equation [3] shows how the variational principle is violated, due to our equation $\tau E = h$, this in turn causes the Euler Lagrange equations to lose their single trajectory view.

$\delta I = \int_{t}^{t+\Delta t}\{\frac{d}{dt}(\frac{\partial L}{\partial q^{\cdot}_{\alpha}}) - (\frac{\partial L}{\partial q_{\alpha}})\}\beta(t)dt \geq 0,$

implying that,

$$\mathbf{\frac{d}{dt}(\frac{\partial L}{\partial q^{\cdot}_{\alpha}}) - (\frac{\partial L}{\partial q_{\alpha}}) \geq 0}$$

This leads to infinitely many trajectories, as we have seen in Feynman's Path integral formulation[20].

more generally we can write the variation of the action as,

(4) $\boldsymbol{\delta I = \int_{t_1}^{t_2}\{\frac{d}{dt}(\frac{\partial L}{\partial \dot{q}_{\alpha}}) - (\frac{\partial L}{\partial q_{\alpha}})\}\beta(t)dt = \delta h \begin{Bmatrix} = 0 & \Delta T \Delta E = h \\ \geq 0 & \Delta T \Delta E \geq \frac{h}{4\pi} \end{Bmatrix}}$

we can make similar arguments from momentum space, with the following symmetrical equations

$$\Delta p \Delta \lambda = h \text{ and } \Delta p \Delta x \geq \frac{h}{4\pi}, \text{with } I = \lambda p$$

In this section we have showed how the variational principle and the infinitely many paths of quantum mechanics, is a direct consequence of $\tau E = h$. We have also seen how the Euler Lagrange Equations lose their deterministic power when the "certainty" relation $\tau E = h$ is replaced by the uncertainty relation of quantum mechanics. The equation that we derived $\tau E = h$ or $\lambda P = h$ only holds true in a classical system. As such, we can make the following definition.

- Any phenomena or system is classical if and only if, the following relations will hold $\tau E = h$ or $\lambda P = h$, consequently, the Euler-Lagrange (unique path) equation will also hold, whereas,

- If the equality in the equations $\tau E = h$ or $\lambda P = h$ no longer holds, and is replaced by the Heisenberg, uncertainty relations,$\Delta E \Delta \tau \geq h/4\pi$, and $\Delta p \Delta x \geq h/4\pi$, then the phenomena or system is quantum mechanical in nature, and consequently the Euler-Lagrange (unique path) is replaced by the (infinitely many paths) of Feynman's path integral formulation

None.3 Principle of Universal Equilibrium:

A treatment of gravity without how objects move kinematically would not be complete. This is perhaps the most important principle in the entire universe due to its great generalization into seemingly unrelated disciplines, like the biological sciences, chemistry, engineering and of course the physical sciences. And it has gone by many names from discipline to discipline. Let's consider a few examples:

1. An electron emitting / absorbing a photon and moving to a lower / higher orbit (Quantum mechanics – moving to a state of higher to lower energy to complement its loss)

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2. A compressed or stretched string trying to return to its original state (Hooke's Law)
3. Newton's first and third law (Mechanics)
4. Lenz's Law (electromagnetism)
5. Fermat's principle (optics)
6. Variational Principle (classical mechanics)

It also manifests itself in our everyday lives: for any variation, i.e., you get hungry, instinctively the first thing you wish to do is to eat so as to return to your equilibrium state. As such the true motion of objects is not at rest but rather at an equilibrium state to conserve all their intrinsic properties.

Principle of Universal Equilibrium: Every system or subset of that system, has an intrinsic tendency to retain its equilibrium state with any variation.

Quantum Gravity

None.4 Quantum gravity:

In the quest to determine new equations of quantum gravity, that have the structure of a wave, we will begin by determining the Hamiltonian, i.e., the total energy of the particle(s). From special relativity we know that

$E^2 = (Pc)^2 + (mc^2)^2$, but the energy is second order, which is rather undesirable, and will lead to a Klein-Gordon like equation,

A better starting point would be taking the Dirac Coup[9];

$E = \pm\sqrt{(Pc)^2 + (mc^2)^2}$

This would work very well but the root and antiparticle solutions, would be both tedious and unrealistic for gravity, so let's start with following relation

(5) $E = Pc + mc^2$

, this looks about write, we have the momentum and rest energy, and both the energy and momentum are on the first order, but to make sure this is indeed the total energy, let's take the square of it and compare it with the Klein-Gordon energy,

$E^2 = (Pc + mc^2)^2 = (Pc)^2 + 2(Pc)(mc^2) + (mc^2)^2$, there is an extra term in this equation, so for the total energy in our equation (5), to hold the extra term has to be identically zero. This of course becomes true if the equation $E = Pc + mc^2$ is a matrix, conforming to the Pauli matrices[20]. Such that $\sigma_i\sigma_j = \delta_{ij}$, where

$$\sigma_x = \begin{vmatrix} 0 & 1 \\ 1 & 0 \end{vmatrix}, \sigma_y = \begin{vmatrix} 0 & -1 \\ i & 0 \end{vmatrix}, and\ \sigma_z = \begin{vmatrix} 1 & 0 \\ 0 & -1 \end{vmatrix}$$

applying these to equation (5) gives,

$$i\hbar\frac{\partial}{\partial t}\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}\begin{bmatrix} \psi_1 \\ \psi_2 \end{bmatrix} = i\hbar c\frac{\partial}{\partial x}\begin{bmatrix} 0 & -1 \\ i & 0 \end{bmatrix}\begin{bmatrix} \psi_1 \\ \psi_2 \end{bmatrix} + mc^2\begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}\begin{bmatrix} \psi_1 \\ \psi_2 \end{bmatrix}$$

(6) $$\begin{bmatrix} mc^2 & i\hbar\frac{\partial}{\partial t} - i\hbar c\frac{\partial}{\partial x} \\ i\hbar\frac{\partial}{\partial t} - \hbar c\frac{\partial}{\partial x} & -mc^2 \end{bmatrix}\begin{bmatrix} \psi_1 \\ \psi_2 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

The general solution is a plane wave[9],

$$\psi(x,\ t) = \psi_0 exp(-(\frac{imc}{\hbar})x exp(-\frac{imc^2}{\hbar})t$$

$$\psi(x,\ t) = \psi_0 exp(-(\frac{iP}{\hbar})x exp(-\frac{iE}{\hbar})t$$

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Where we have discarded the $\psi \Rightarrow \infty$ solutions, associated with the +s,

then we have

$$\psi(x,\,t) \;=\; \psi_0 exp(-\frac{i}{\hbar}\int pdx)exp(-\frac{i}{\hbar}\int Edt)$$

But $S_x = \int pdx$ and $S_t = \int Edt$, where S is the action, thus we have.

$$\psi(x,\,t) \;=\; \psi_0 exp(-\frac{i}{\hbar}S_x)exp(-\frac{i}{\hbar}S_t)$$

(7) $\boldsymbol{\psi(x,\,t) \;=\; \psi_0 exp(-\frac{i}{\hbar}S)}$

If we look at equation (7), we see that the infamous term –exp$(-i\hbar S)$ – which is the one postulated by Dirac without justification [[9]Dirac, the principles of quantum mechanics] as the analogue for action in classical mechanics, and later used by Feynman, in the path integral formulation [[10]Thesis-1942-Feynman]. From this article we have showed how using the action as $I_x = \int pdx$ and$I_t = \int Edt$, we can justify their claims.

But perhaps more than that, the above formula (7), represents the state which Quantum Mechanics and Classical Mechanics diverge, the latter will solve (7) using path integral formulation because our equation for classical behavior $\tau E = h$ no longer holds, is replaced by the Heisenberg uncertainty relation $\Delta E\Delta t \geq h4\pi$, whilst the former will employ the route that we are about to take where our formula $\tau E = h$ dominates, giving us a unique trajectory. To solve (7) in a "classical" manner we need one more piece of information. The WKB method of quantum mechanics[11]

$$\| \psi \|^2 \simeq \frac{\| C \|^2}{P}$$

this allows us to find the "semi-classical" solution to the Schrodinger equation. This approximation will get better and better as we approach a classical field. And thus for gravity we can write

(8) $\lambda\psi^2 = \varepsilon^2$

This relation relates the product of the square of the probability density function and the wavelength, where ε is an arbitrary constant

hence substituting, P for λ, by the De Broglie relation, we arrive at [8]. To find ψ_0 we realize that $E_0 = m_0c^2$ is the energy at the ground state, similarly $\lambda_0 = h/m_0c$, with relation, [8]. this gives us $\psi_0 = \varepsilon\sqrt{\frac{m_0c}{h}}$,

therefore,

$$\psi(x) \;=\; \varepsilon\sqrt{\frac{mc}{h}} exp(-\frac{imc}{\hbar})x$$

$$\frac{\varepsilon}{\sqrt{\lambda}} \;=\; \varepsilon\sqrt{\frac{mc}{h}} exp(-\frac{imc}{\hbar})x$$

$$\frac{1}{\lambda} \;=\; \frac{mc}{h} exp(-2i\,\frac{mc}{\hbar})x$$

(9) $\boldsymbol{\lambda = \frac{h}{mc}exp(2i\,\frac{mc}{\hbar})x}$

where [λ =($h/mc)cos\theta$]Compton wavelength, with ($e^{i\theta} = cos\theta + isin\theta$). So we have found how the De Broglie wavelength evolves with time for classical objects with relation (9), but this does not look like an equation of gravity that we are used to, so let's find a relation between the gravitational acceleration (g) and the wavelength as $g = \Lambda G/\lambda$ where

$\Lambda = \frac{4\pi^2c^2}{h^2}$

ISSN 2350-1030

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We now need to write this equation in terms of g, and remembering our earlier kinematic equations

we have,

(10) $g(x) = \underline{\Lambda} G exp(2i \frac{mc}{\hbar})x$

, where $\underline{\Lambda}=m^3\Lambda$

This is finally our equation of quantum gravity, to prove our initial hypothesis that the De Broglie wavelength gives rise to gravity at large scales, let's see if our equation of gravity can reduce to Newton's Law of universal Gravitation. Let's use the Taylor approximation, of the exponential function.

$\exp(2i\alpha x) = 1 + 2i\alpha x + (2\alpha^2x^2) + ({}^4\!/_3 i\alpha^3x^3) + ({}^2\!/_3\alpha^4x^4) + iO(x^5) + O(x^6)$

, where $\alpha = mc/\hbar$, now

$Reap(2i\alpha x) = 1 + 2\alpha^2x^2 + {}^2\!/_3\alpha^4x^4 + O(x^6)$

Therefore

$$g(x) = \frac{\Lambda G}{RE[\exp(2i\alpha x)]} \simeq \frac{\Lambda G}{1 + 2\alpha^2x^2 + 2/3\alpha^4x^4 + O(x^6)},$$

but on gravity everyday scales, x>>1, thus

$$g(x) \simeq \frac{\Lambda G}{\alpha^2x^2(2 + {}^2\!/_3\alpha^2x^2)} = \frac{\Lambda G}{\alpha^2x^2} + \frac{\Lambda G}{2 + {}^2\!/_3\alpha^2x^2 + {}^4\!/_5\alpha^4x^4},$$

ignoring higher terms we have

$$g(x) \simeq \frac{\Lambda G}{\alpha^2x^2}$$

but we defined $\Lambda = \frac{4\pi^2c^2m^3}{h^2}$ and $\alpha = mc/\hbar$ therefore

$$g(x) \simeq \frac{\Lambda G}{\alpha^2x^2} = \frac{G4\pi^2c^2m^3}{h^2} \times \frac{h^2}{4\pi^2m^2c^2}$$

therefore

(11) $\boldsymbol{g(x) = \frac{GM}{x^2}}$

We obtain Newton's law of Universal Gravitation simply by finding the first Taylor approximation. So the idea that the De Broglie wavelength for macroscopic objects is gravity has been justified, Lets now look at the relativistic form of this equation

None.5 Relativistic Quantum Gravity:

Let's first look at the gravitational acceleration, from the perspective of General Relativity:

Starting with the Schwarzschild metric

$ds^2 = (1 - 2GMc^2r)c^2dt - (1 - 2GMc^2r)c^2dr^2$

Assuming our particle is at rest at radius r and angular parameters zero from the center of mass of the worldline, we get

$x^\mu = (t, r, 0, 0)$

the four velocity and acceleration becomes

$u^\mu = dx^\mu d\tau = ((1 - 2GMc^2r)^{-1\!/_2}, 0, 0, 0)$

$a^\mu = du^\mu d\tau + \Gamma_{\alpha\beta}{}^\mu u^\alpha u^\beta$

Taking the Lorentz norm squared of the four acceleration and the affine connection symbols

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$g_{\mu\nu}a^{\mu}a^{\nu} = \frac{c^2 rs}{4r^4(1-\frac{2GM}{c^2 r})}$

we thus have

$$a = \frac{GM}{r^2}\frac{1}{\sqrt{1-\frac{2GM}{c^2 r}}}$$

or

$$F(r) = \frac{GMm}{r^2}\frac{1}{\sqrt{1-\frac{2GM}{c^2 r}}}$$

Now let's use our equation of quantum gravity to see if we get the same results as General relativity

$$\psi(x) = \psi_0 exp(-(\frac{imc}{\hbar})x$$

$$\frac{\varepsilon}{\sqrt{\lambda}} = \frac{\varepsilon}{\sqrt{\lambda_0}}\ exp(-(\frac{imc}{\hbar})x$$

$$\frac{1}{\lambda} = \frac{1}{\lambda_0}\ exp(-2i\,(\frac{mc}{\hbar})x$$

$$\hat{g}_{rel} = \frac{\underline{\Lambda}_{rel}G}{\lambda_0}\ exp(-2i\,(\frac{mc}{\hbar})x$$

where ($g\lambda = \underline{\Lambda}_{(rel)}G$) and $\Lambda_{rel} - Relativistic$

$$\hat{g}_{rel} = \underline{\Lambda}_{rel}G\frac{\sqrt{(pc)^2+(mc)^2}}{hc}\ exp(-2i\,(\frac{mc}{\hbar})x$$

$$\hat{g}_{rel} = \underline{\Lambda}_{rel}G_{hc}\sqrt{(pc)^2+(mc)^2}exp(-2i\,(\frac{mc}{\hbar})x$$

$\underline{\Lambda}_{(rel)} = \frac{4\pi^2 m^2}{h^2}$ and $\Lambda = \frac{4\pi^2 c^2 m^3}{h^2}$ therefore $\Lambda = \underline{\Lambda}_{(rel)}mc^2$, where Λ is the non-relativistic constant.

(12)

$$\hat{g}_{rel} = \underline{\Lambda}_{rel}G\sqrt{(pc)^2+(mc)^2}exp(-2i\,(\frac{mc}{\hbar})x$$

but $\sqrt{(pc)^2 + (mc^2)^2} = \gamma mc^2$, so we can write:

(13)

$$\hat{g}_{rel} = \gamma mc^2\underline{\Lambda}_{rel}G\ exp(-2i\,(\frac{mc}{\hbar})x$$

Finally, lets define $\underline{\Lambda}_{(rel)}{}^{1} = \frac{4\pi^2 m^2}{h^2\sqrt{1-\frac{2GM}{c^2 r}}}$, this is true because ψ_0 is an arbitrary constant set by the initial conditions, so we choose Λ to correspond to the Schwarzschild metric

$$\hat{g}_{rel} = \gamma mc^2\underline{\Lambda}^1_{rel}G\ exp(-2i\,(\frac{mc}{\hbar})x$$

$$\hat{g}_{rel} = \gamma mc^2(\frac{4\pi^2 m^2}{h^2\sqrt{1-\frac{2GM}{c^2 r}}})\ G\ exp(-2i\,(\frac{mc}{\hbar})x$$

(14)

$$\hat{g}_{rel} = (\frac{\gamma m^3 c^2 G}{\hbar^2\sqrt{1-\frac{2GM}{c^2 r}}})\ exp(-2i\,(\frac{mc}{\hbar})x$$

The first Taylor polynomial, gives

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International Journal of Recent Research in Physics and Chemical Sciences (IJRRPCS)
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$$g_{rel} = \left(\frac{\gamma m^3 c^2 G}{\hbar^2 \sqrt{1-\frac{2GM}{c^2 r}}}\right) \frac{1}{(\frac{mc}{\hbar})^2 r^2}$$

$$g_{rel} = \left(\frac{\gamma m^3 c^2 G}{\hbar^2 \sqrt{1-\frac{2GM}{c^2 r}}}\right) \frac{\hbar^2}{m^2 c^2} \frac{1}{r^2}$$

$$g_{rel} = \gamma m\left(\frac{1}{\sqrt{1-\frac{2GM}{c^2 r}}}\right) \frac{G}{r^2}$$

$$g_{rel} = \frac{\gamma GM}{r^2}\left(\frac{1}{(1-\frac{2GM}{c^2 r})^{1/2}}\right)$$

or

$$F(r)_{rel} = \frac{\gamma GMm}{r^2}\left(\frac{1}{\sqrt{1-\frac{2GM}{c^2 r}}}\right)$$

which is the force of General relativity... and thus our relativistic high energy equation reduces to relativity, in the first Taylor Polynomial of the exponential

The Meaning of the Quantum Gravity Equation

The Equation of gravity is a vast representation of nature which is mostly

$$\hat{g}_{rel} = \gamma mc^2 \underline{\Lambda}_{rel}^1 G\; exp(-2i\,(\frac{mc}{\hbar})x$$

The Equation can be written into four equations, and these four equations span the entire range of Gravitational dynamics, namely: the semi-microscopic, Newtonian, Extra Galactic, and Extra Galactic constant gravity range:

we see that by finding the first two Taylor polynomials of $Re[\exp(2i\alpha x)] = 1 + 2\alpha^2 x^2$, we get

$$g_{rel} = \frac{\gamma mc^2 \underline{\Lambda}_{rel}^1 G}{1+2\alpha^2 x^2}$$

In the semi-microscopic range x<<1, thus we have

(15) $g_{rel} = \gamma mc^2 \underline{\Lambda}_{(rel)}{}^1 G$

and for the Macroscopic Newtonian regime, x>>1,

(16)

$$g_{rel} = \frac{\gamma mc^2 \underline{\Lambda}_{rel}^1 G}{2\alpha^2 x^2}$$

this can be written as

$$F(r)_{rel} = \frac{\gamma GMm}{r^2}\left(\frac{1}{\sqrt{1-\frac{2GM}{c^2 r}}}\right)$$

which is the Familiar Newton and Einstein Regime, the third equation corresponds to the higher terms of the exponential

(17)

$$g_{rel} = \beta \frac{\gamma mc^2 \underline{\Lambda}_{rel}^1 G}{2\alpha^2 x^2}$$

Where the value of β is obtained from;

ISSN 2350-1030

International Journal of Recent Research in Physics and Chemical Sciences (IJRRPCS)
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$g(x) \simeq \Lambda G\alpha^2x^2 + \Lambda G2^4 4!\alpha^2x^2 + \Lambda G2^2 6!/4!\alpha^2x^2 + \Lambda G2^4 8!/6!\alpha^2x^2 + \cdots + \Lambda G2^2 n!/(n-2)!\alpha^{(n-2)-2}x^{(n-2)-2})$

$$g(x) \simeq \frac{\Lambda G}{\alpha^2x^2} + \frac{\Lambda G}{\frac{2^4}{4!}\alpha^2x^2} + \frac{\Lambda G}{\frac{2^2}{6!/4!}\alpha^2x^2} + \frac{\Lambda G}{\frac{2^4}{8!/6!}\alpha^2x^2} + \cdots + \frac{\Lambda G}{\frac{2^2}{n!/(n-2)!}\alpha^{(n-2)-2}x^{(n-2)-2}}$$

$$g(x) \simeq \frac{\Lambda G}{\alpha^2x^2}\left(1 + \frac{4!}{2^4} + \cdots\right) = \beta\frac{\Lambda G}{\alpha^2x^2}$$

so we can write

$$F(r)_{rel} = \frac{\gamma\beta GMm}{r^2}\left(\frac{1}{\sqrt{1-\frac{2GM}{c^2r}}}\right)$$

This being the Extra-Galactic, dark matter regime. Finally, we saw how the series of the higher order terms converges

$$Re[exp(2i\alpha x)] = \lim_{n\to\infty}\left[(1 + \frac{2^4}{4!} + \sum_{n=6}^{N}\frac{4}{(n+2)(n+1)})\right] = (consant) = \Omega$$

Allowing us to write:

$$\hat{g}_{rel} = \gamma mc^2\underline{\Lambda}^1_{rel}G\, exp(-2i\,(\frac{mc}{\hbar})r$$

as

(18) $g_{rel} = \gamma mc^2\underline{\Lambda}_{(rel)}G(1/\xi)$ *or* $g_{rel} = \gamma\Omega mc^2\underline{\Lambda}_{(rel)}G$

Being the Extra-Galactic, constant gravity regime. Putting all this together we have:

(19)

$$\hat{g}_{rel} = \gamma mc^2\underline{\Lambda}^1_{rel}G\, exp(-2i\left(\frac{mc}{\hbar}\right)r = \begin{cases} grel = \gamma mc^2\Lambda^1_{(rel)}G & semi-microscopic\, regime \\ g_{rel} = \frac{\gamma GM}{r^2}\left(\frac{1}{(1-\frac{2GM}{c^2r})^{1/2}}\right) & Newton-Einstein\, regime \\ g_{rel} = \frac{\gamma\beta GM}{r^2}\left(\frac{1}{(1-\frac{2GM}{c^2r})^{1/2}}\right) & Dark\ Matter\ regime \\ grel = \gamma\Omega mc^2\Lambda_{(rel)}G & constant\ gravity\ regime \end{cases}$$

This equation, will allow us to compute gravity on all scales. From the tiniest atoms to the largest bodies, as Laplace, once envisioned.

None.6 Dark Matter

The idea of dark matter is a consequence of how galactic objects disobey the laws of gravity, at large radii, we would expect gravity to continue to fall off with the inverse square law as General Relativity would tell us, but, it turns out this is not the case... we find that gravity becomes constant with the increase in distance[13]. There are ultimately two reasons for this (1) As if there is some form of hidden / unseen matter that causes the gravitation or (2) our laws of physics are inadequate to describe galactic phenomena. The problem with dark matter, is that after almost a century since Zwicky famously came up with the idea of dark matter not a single object or particle has ever been experimentally found. With the laws of gravity on the other hand, MOND and its derivatives such as TEVES, RAQUAL have been relatively successful in solving this dark matter problem, but their greatest challenge is that they are built to fix a particular problem besides explaining why the problem is there in the first place. It also does not completely eliminate the need for dark matter[6, 5].

$$\hat{g}_{rel} = \gamma mc^2\underline{\Lambda}^1_{rel}G\, exp(-2i\,(\frac{mc}{\hbar})r$$

From our equation of quantum gravity, we see how we have traded the inverse square law of Kepler, Hooke, Newton and Einstein for an exponential decay. But the inverse square law, was an empirical law made to describe local phenomena,

ISSN 2350-1030
International Journal of Recent Research in Physics and Chemical Sciences (IJRRPCS)
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such as everyday projectiles and the solar system. Its validity beyond the macroscopic world has never been proven. In fact, in the theory of General Relativity, Einstein, generalized every component of Newton's gravitation. Mass became the Stress Energy Tensor, gravitational field into curvature of space-time, Galilean Relativity to Lorentzian Relativity, but he left the inverse square law unchanged. Let's see what happens when we expand this exponential.

$\exp(2i\alpha x) = 1 + 2i\alpha x + (2\alpha^2x^2) + (\tfrac{4}{3}i\alpha^3x^3) + (\tfrac{2}{3}\alpha^4x^4) + \tfrac{32}{120}i\alpha^5x^5 + (\tfrac{4}{45}\alpha^6x^6) + iO(x^7) + O(x^8)$

We see that this can be written in a more compact way as:

$Re[\exp(2i\alpha x)] = 1 + 2\alpha^2x^2 + 2^4 4!\alpha^4x^4 + 2^6 6!\alpha^6x^6 + 2^8 8!\alpha^8x^8 + 2^{10}10!\alpha^{10}x^{10} + \ldots$

$Re[\exp(2i\alpha x)] = \alpha^2x^2(2 + 2^4 4!\alpha^2x^2 + 2^6 6!\alpha^4x^4 + 2^8 8!\alpha^6x^6 + 2^{10}10!\alpha^8x^8 + 2^{12}12!\alpha^{10}x^{10} + 2^{14}14!\alpha^{12}x^{12} + 2^{16}16!\alpha^{14}x^{14}\ldots)$

let's put this into our equation

$$g(x) = \frac{\Lambda G}{RE[exp(2i\alpha x)]}$$

$g(x) = \Lambda G/[\alpha^2x^2(2 + 2^4 4!\alpha^2x^2 + 2^6 6!\alpha^4x^4 + 2^8 8!\alpha^6x^6 + 2^{10}10!\alpha^8x^8 + 2^{12}12!\alpha^{10}x^{10} + 2^{14}14!\alpha^{12}x^{12} + 2^{16}16!\alpha^{14}x^{14}\ldots)]$

but we know how, $\frac{\Lambda G}{xz} = \frac{\Lambda G}{x} + \beta(x)\frac{\Lambda G}{z}$, where $\Gamma(x) = \frac{1-z}{x}$, therefore,

$$g(x) \simeq \frac{\Lambda G}{\alpha^2x^2} + \frac{\Gamma(x)\Lambda G}{\frac{2^4}{4!}\alpha^2x^2(1 + \frac{2^2}{\frac{6!}{4!}}\alpha^2x^2 + \frac{2^4}{\frac{8!}{6!}}\alpha^4x^4 + \cdots + \frac{2^{n-4}}{\frac{n!}{4!!}}\alpha^{(n-2)}x^{(n-2)})}$$

where,

$\Gamma(x) = [2^4 4!\alpha^2x^2 + 2^6 6!\alpha^4x^4 + 2^8 8!\alpha^6x^6 + 2^{10}10!\alpha^8x^8 + 2^{12}12!\alpha^{10}x^{10} + 2^{14}14!\alpha^{12}x^{12} + 2^{16}16!\alpha^{14}x^{14}\ldots] \div 2^4 4!\alpha^2x^2$

$\Gamma(x) = 1 + [(2^2\alpha^2x^2) \div 6!/4!] + [2^4\alpha^4x^4 \div (8!/4!)] + \ldots + [2^{n-4}\alpha^{n-2}x^{n-2}(n!/4!)]$

$$g(x) \simeq \frac{\Lambda G}{\alpha^2x^2} + \frac{\Lambda G}{\frac{2^4}{4!}\alpha^2x^2} + \frac{\Gamma(x)\Lambda G}{(1 + \frac{2^2}{\frac{6!}{4!}}\alpha^2x^2 + \frac{2^4}{\frac{8!}{6!}}\alpha^4x^4 + \cdots + \frac{2^{n-4}}{\frac{n!}{4!!}}\alpha^{(n-2)}x^{(n-2)})}$$

to see if this equation is indeed approximately equal to the one before, at large distances, let's multiply them out and check.

$$g(x) \simeq \frac{\Lambda G}{\alpha^2x^2} + \frac{\Lambda G\left(1 + \frac{2^2}{\frac{6!}{4!}}\alpha^2x^2 + \frac{2^4}{\frac{8!}{6!}}\alpha^4x^4 + \cdots + \frac{2^{n-4}}{\frac{n!}{4!!}}\alpha^{(n-2)}x^{(n-2)}\right) + 1 + \frac{2^2}{\frac{6!}{4!}}\alpha^2x^2 + \frac{2^4}{\frac{8!}{6!}}\alpha^4x^4 + \cdots + \frac{2^{n-4}}{\frac{n!}{4!!}}\alpha^{(n-2)}x^{(n-2)})}{\frac{2^4}{4!}\alpha^2x^2\left(1 + \frac{2^2}{\frac{6!}{4!}}\alpha^2x^2 + \frac{2^4}{\frac{8!}{6!}}\alpha^4x^4 + \cdots + \frac{2^{n-4}}{\frac{n!}{4!!}}\alpha^{(n-2)}x^{(n-2)}\right)}$$

$$g(x) \simeq \frac{\Lambda G}{\alpha^2x^2} + \frac{2\Lambda G\left(1 + \frac{2^2}{\frac{6!}{4!}}\alpha^2x^2 + \frac{2^4}{\frac{8!}{6!}}\alpha^4x^4 + \cdots + \frac{2^{n-4}}{\frac{n!}{4!!}}\alpha^{(n-2)}x^{(n-2)}\right)}{\frac{2^4}{4!}\alpha^2x^2\left(1 + \frac{2^2}{\frac{6!}{4!}}\alpha^2x^2 + \frac{2^4}{\frac{8!}{6!}}\alpha^4x^4 + \cdots + \frac{2^{n-4}}{\frac{n!}{4!!}}\alpha^{(n-2)}x^{(n-2)}\right)}$$

this allows us to write all subsequent terms, in terms of

ISSN 2350-1030

International Journal of Recent Research in Physics and Chemical Sciences (IJRRPCS)
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$$g(x) \simeq \frac{\Lambda G}{\alpha^2 x^2} + \frac{\Lambda G}{\frac{2^4}{4!}\alpha^2 x^2} + \frac{\Lambda G}{\frac{2^2}{\frac{6!}{4!}}\alpha^2 x^2} + \frac{\Lambda G}{\frac{2^4}{\frac{8!}{6!}}\alpha^2 x^2} + \cdots + \frac{\Lambda G}{\frac{2^2}{n!/(n-2)!}\alpha^{(n-2)-2}x^{(n-2)-2}}$$

We, saw how the term that preceded, became only applicable after making the assumption that we were moving further and further from the object, meaning the inverse square law, is only applicable for a certain range.

$g(x) = GM$ (Microscopic region, where x<<1)

$g(x) = GM/r^2$ (Newtonian / Einstein – applicable for solar system dynamics)

$g(x) = 2.5Gm/r^2$ *or* $g(x) = G(2.5M)/r^2$ (First Newtonian correction $\delta^1 N$, ($2^4 4!$))

$g(x) = 10GM/r^2$ (Second Newtonian correction $\delta^2 N$, ($2^6 6!$)), etc.

This being the extra "mass" we associate to dark matter. Let's now analyze the limit at extremely large distances.

$$g(x) \simeq \frac{\Lambda G}{\alpha^2 x^2} + \frac{\Lambda G}{\frac{2^4}{4!}\alpha^2 x^2} + \frac{\Lambda G}{\frac{2^2}{\frac{6!}{4!}}\alpha^2 x^2} + \frac{\Lambda G}{\frac{2^4}{\frac{8!}{6!}}\alpha^2 x^2} + \cdots + \frac{\Lambda G}{\frac{2^2}{n!/(n-2)!}\alpha^{(n-2)-2}x^{(n-2)-2}}$$

$g(x) \simeq \frac{\Lambda G}{\alpha^2 x^2}(1 + \frac{2^4}{4!} + \sum_{n=6}^{\infty}\frac{n!}{(n+2)!})^{-1} = \frac{\Lambda G}{\alpha^2 x^2}\left[(1 + \frac{2^4}{4!} + \sum_{n=6}^{\infty}\frac{4}{(n+2)(n+1)})^{-1}\right]$,where n=6,8,10...

let's look at the sum, since the denominator $(n + 2)(n + 1) = n^2 + 3n + 2$, then

$$\sum_{n=6}^{\infty}\frac{4}{n^2+3n+2} < \sum_{n=6}^{\infty}\frac{4}{n^2}$$

then our sum converges. this implies that

$Re[\exp(2i\alpha x)] = \frac{\Lambda G}{\alpha^2 x^2}\left[(1 + \frac{2^4}{4!} + \sum_{n=6}^{\infty}\frac{4}{(n+2)(n+1)})\right] = \frac{\Lambda G}{\alpha^2 x^2}(constant) = \Omega\frac{\Lambda G}{\alpha^2 x^2}$

where $\Omega < \infty$.

Putting this in our equation of quantum gravity,

$$\hat{g}_{rel} = \gamma mc^2 \underline{\Lambda}^1_{rel} G\ exp(-2i\ (\frac{mc}{\hbar})r$$

Gives:

$g_{rel} = \gamma mc^2 \underline{\Lambda}_{(rel)} G(1/\Omega)$ *or* $g_{rel} = \gamma\epsilon mc^2 \underline{\Lambda}_{(rel)} G$

This tells us that at the limit $n \to \infty$ (extremely large distances), gravity will become constant with increase in distance, and this is precisely what we see, with the rotational curves of galaxies being constant with the increase in distance.

Let's now see if our new formulation does indeed solve a practical dark matter problem, let's look at the Magellanic Clouds[6], which can be well approximated as test particles moving in the gravitational field of the galaxy. We will compare our equation with the CDM model for dark matter.

CDM HALO MODEL: The dark matter halo is assumed spherical and its gravitational potential can be represented by the logarithmic formula of the form (Binney and Tremaine, 1987)

$U_{halo} = v_{halo}{}^2 \ln(r^2 + d^2)$

where $v_{halo} = 114 km/s$ and $d = 12kpc$This halo model implies the halo mass formula

$$M_{halo} = \frac{2v_{halo}^2 r^3}{G(r^2+d^2)}$$

giving mass of the Galaxy halo (Iorio, 2009)

$M_{halo}(r = 60kpc) = 3.5 \times 10^{11}$

in agreement with the observed value of

$M_{halo}(r = 60kpc) = (4.0\pm0.7) \times 10^{11}$

used in (Xue et al., 2008). For different models of the CDM halo (see e.g. Einstein, 1939; Lake, 2004; Haager, 1997, 1998; Saxton and Ferreras, 2010).

Now let's look at how our view compares using the equation we found earlier

$$\hat{g}_{rel} = \gamma mc^2 \underline{\Lambda}^1_{rel} G\ exp(-2i\ (\frac{mc}{\hbar})r$$

$\beta = 0.53$ for these terms

In the weak field limit, this reduces to

$$g = \frac{\gamma\beta Gm}{x^2}$$

neglecting relativistic effects for the velocity of the halo $v_{halo} = 114km/s$, we have;

$$g = \frac{\gamma\beta Gm}{r^2} = \frac{v^2}{r}$$

Let's then calculate the radius of the halo from this model, which should be 60kpc, including dark matter.

$r = \beta GM_{halo} \div v_{halo}{}^2 = \beta(6.67 \times 10^{-11})(4 \times 10^{11}M_\Theta) \div (114 \times 10^3)^2 = \beta(116Kpc)$

this of course is off, we expected a value of 60kpc, so Newtonian and General Relativity, implies and additional dark matter, but in case of our quantum Gravity, we saw how $\beta^{-1} = 0.53$, thus

$r = \beta(116Kpc) = (0.53)(116kpc) = 61.48kpc$

and,

$M_{halo}(r + d) = 4.08 \times 10^{11}$ $(Our\ Model)$

$M_{halo}(r + d) = 4 \times 10^{11}$ $(Dark\ Matter\ Model)$

$M_{halo}(r + d) = 2.2 \times 10^{11}$ $(General\ Relativity\ and\ Newton)$

$M_{halo}(r = 60kpc) = (4.0\pm0.7) \times 10^{11}$ $(observed)$

From this we can see that our model is in agreement with the observed data. Although I have showed how our equation of quantum gravity does not require any dark matter on the Magellanic Clouds, I believe that this will be true in general.

The Time Domain

Power in Quantum Gravity

$$\psi(x,\ t)\ =\ exp(-\frac{imc}{\hbar})x exp(-\frac{imc^2}{\hbar})t$$

$$\psi(t)\ =\ exp(-\frac{imc^2}{\hbar})t$$

following similar arguments as before, let's write

(20) $\tau\psi^2 = \varepsilon^2$

$$\tau = \frac{h}{\gamma mc^2} exp(\ 2i \frac{mc^2}{\hbar})t$$

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$$E(t) = \gamma mc^2 exp(-2i\frac{mc^2}{\hbar})t$$

(21)

$$P(t) = \frac{dE}{dt} = \frac{-i\gamma mc^2}{\hbar} exp(-2i\frac{mc^2}{\hbar})t$$

the first Taylor polynomial gives: $\exp(-2i(mc^2/\hbar)t = 1 - 4i(mc^2/\hbar)t$, and for t>>1, we have

$$P(t) = \frac{dE}{dt} = \frac{-i\gamma mc^4}{\hbar\left(\frac{4mc^2}{\hbar}t\right)} = \frac{1}{4}\frac{\gamma mc^2}{t} + \frac{3}{2}\frac{\gamma mc^2}{t} + \cdots$$

Quantization of Space and time:

from our equation of quantum gravity,

$$\lambda = \frac{hc}{\sqrt{E^2 - (mc^2)^2}} exp\frac{mc}{\hbar}(r + ct)$$

let's consider the time-independent solution for the quantization of space with constraints that would apply for a body such as the earth.

$$\lambda = \frac{hc}{\sqrt{E^2 - (mc^2)^2}} exp\frac{mc}{\hbar}x$$

The Earth is in the Newtonian regime, with weak fields, non-relativistic speeds

$$\lambda = \frac{h}{mc}(\frac{\hbar^2}{m^2c^2})\frac{1}{x^2}$$

$$\lambda = (\frac{h^3}{4\pi^2 m^3c^3})\frac{1}{x^2}$$

but $\lambda = h/mc \rightarrow m = h/\lambda c$,

$$\lambda = (\frac{h^3}{4\pi^2c^3})(\frac{\lambda^3c^3}{h^3})\frac{1}{x^2}$$

$$\frac{\lambda}{\lambda^3} = (\frac{1}{4\pi^2})\frac{1}{x^2}$$

$$x = \frac{1}{2\pi}\lambda$$

if we write $\sigma = 1/2\pi$

(22) $\xi x = \sigma\lambda$

where ξx denotes, the quantum of distance and $\sigma = 1/2\pi$ is a constant. This is something we did not expect, the equation tells us that the distance that we measure is constant multiples of $\sigma\lambda$. So $x_1 = \sigma\lambda$, $x_2 = 2\sigma\lambda$, $x_3 = 3\sigma\lambda\cdots$ We see that our equation of quantum gravity, says that the distance that our rods measure is quantized into scalar multiples of $\sigma\lambda$. This result, tells us how the concept of length in a gravitational field is not arbitrary, length can only be measured in discrete quantas of length.

$x = n\sigma\lambda$

, where n = 1, 2, 3, ...

(23) $\Delta x = \eta\lambda$

let's define $\eta = n\sigma$, as the "scalar invariant of distance". From $\Delta x = \eta x$, we know that $\eta \geq 1$, this further implies that $\Delta x \geq \lambda$

ISSN 2350-1030

International Journal of Recent Research in Physics and Chemical Sciences (IJRRPCS)
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Similarly for time we have

$$\tau = \frac{h}{\gamma mc^2} exp(\ 2i\frac{mc^2}{\hbar})t$$

again taking the first Taylor polynomial, we have:

$$\tau = \frac{h}{\gamma mc^2}\frac{\hbar}{mc^2 t}$$

but $\gamma \to 1$ in our everyday lives, thus;

$$\tau = \frac{h^2}{2\pi m^2 c^4 t}$$

but $m^{-2} = (\tau^2 c^4 / h^2)$ from the Planck's relation and $\tau E = h$, hence,

$$\tau = \frac{h^2}{2\pi m^2 c^4 t}\frac{\tau^2 c^4}{h^2}$$

$$\tau^{-1} = \frac{1}{2\pi t}$$

$\xi t = \sigma\tau$

where, ξt is the quantum of time. This is something we did not expect as well, the equation tells us that the time that we measure is constant multiples of σ. So $t_1 = \sigma\tau$, $t_2 = 2\sigma\tau$, $t_3 = 3\sigma\tau\cdots$

$t = n\sigma\tau$

, where n = 1, 2, 3, ...

(24) $\Delta t = \eta\tau$

let's define $\eta = n\sigma$, as the "scalar invariant of time". We know that $\eta \geq 1$, this further implies that $\Delta t \geq \tau$.

Let's consider these results a bit more closely. One can never measure a physically acceptable time or length at random, for we have just seen that there are times and distances that are forbidden and we can never measure. Thus there are certain physical processes that we can never detect or observe because they fall under the forbidden time and distance zones (by forbidden I do not mean that these processes can never occur, but rather that we will not be able to detect them). The only processes that we can detect are those that occur in multiples of $\eta = n\sigma$. Finally let's give an example, if a fundamental particle, say χ^+ takes a time $t = \frac{1}{2}\sigma\tau$, to decay, we can never detect this process in our earth based laboratories, as it falls into the forbidden time zones by Quantum Gravity.

Experimental justifications for quantized Space and Time

We defined $g\lambda = \Lambda$, where

$$\Lambda = \frac{4\pi^2 m^3 G}{h^2\sqrt{1-\frac{2GM}{c^2 r}}}$$

for weak fields we have

$$\Lambda = \frac{4\pi^2 m^3 G}{h^2}$$

therefore

$$g\lambda = \frac{4\pi^2 m^3 G}{h^2}$$

with but mass and the wavelength are equivalent, $\lambda = h/mc$

ISSN 2350-1030

International Journal of Recent Research in Physics and Chemical Sciences (IJRRPCS)
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$$g\lambda^4 = \frac{16\pi^4 hG}{c}$$

we get

(25) $\boldsymbol{\lambda = 4\pi^2(\sqrt[4]{\frac{hG}{gc}})}$

This is the relation between the gravitational acceleration (g) and the wavelength (λ) at each point in space. If we calculate the wavelength at the surface of the earth ($g = 9.81m/s^2$), we have

$$\lambda = 4\pi^2\left(\sqrt[4]{\frac{(6.626 \times 10 - 34)(6.67 \times 10 - 11)}{(9.81)(299792458)}}\right) = 2.458 \times 10 - 12m$$

But with the quantization of length formula we derived earlier,

$\xi x = \sigma\lambda = (2.458 \times 10^{-12}m) \div 2\pi = 3.91 \times 10^{-13}m \simeq 4 \times 10^{-13}m$

Our equation of gravity predicts that since $\xi x \leq \lambda$, then the shortest possible distance that can be measured on the surface of the earth is about $\xi x \simeq 4 \times 10^{-13}m$, furthermore any physically meaningful distance, on the surface of the earth will be quantized into $\Delta x = n\xi x$.

We can also calculate the shortest possible time. We will use the relation $\lambda = c\tau$

$$\tau = \frac{\lambda}{c} = \frac{2.458 \times 10 - 12}{299792458} = 8.199 \times 10 - 21s$$

$\tau = \lambda c = 2.458 \times 10^{-12}m299792458 = 8.199 \times 10^{-21}s$

To compute the shortest time, let's use the relation

$\xi t = \sigma\tau = 1.3 \times 10^{-21}s$

Finally, lets compute smallest possible mass that can be measured in our earth based laboratories, we will use $\lambda = h/mc$, and $\lambda = c\tau$

$\xi m = h\lambda \div c = (6.626 \times 10^{-34}) \div [(2.458 \times 10^{-12})(299792458)] = 8.99 \times 10^{-31}kg \simeq 9 \times 10^{-31}kg$

This implies that all particles with rest mass $< 8.99 \times 10^{-31}kg$, can never be measured on earth based laboratories. Meaning if fundamental particles such as quarks had a mass less than ξm, they could never be observed in the laboratory, as well as mass values that fall in the forbidden mass zones such as

$$\xi m = \frac{h}{(^1/_2)\sigma\tau c^2} \neq phyical\ mass$$

Let's compare our value of ξm, that our theory implies is the smallest mass that can be measured, to the smallest particle that has been measured directly, the electron[20]

$\frac{9.1 \times 10 - 31 - 8.99 \times 10 - 31}{9.1 \times 10 - 31} \times 100\% = 1.2\%$

Our value is in agreement, with the value of the electron by 1.2%. "Physicists from Ludwig-Maximilians-Universität Munich, the Technische Universität München and the Max Planck Institute of Quantum Optics[1] have recorded an internal atomic event with an accuracy of a trillionth of a billionth of a second. Being shortest time ever recorded [2016]" let's compare their findings to our shortest time $\xi t = 8.199 \times 10^{-21}s$,

They were able to measure events up to a rate of 850 femtoseconds = $8.5 \times 10^{-19}s$, if this value corresponded to the minimum time that could be measured (or has ever been measured). Our theory of quantum gravity predicts that time in our earth bound laboratories can only be measured in discrete time quanta's of

$\xi t = \sigma\tau = 4.6 \times 10^{-19}s$

$\xi t = 2\sigma\tau = 2 \times 4.6 \times 10^{-19} s$

$\xi t = 2\sigma\tau = 3 \times 4.6 \times 10^{-19} s$

comparing this with the value they found of 850 zeptoseconds we get

$\xi t = 654\sigma\tau = 850 zeptoseconds$

This experiment is in agreement with our initial hypothesis, that time is quantized with only 0.02% deviation. Which is mostly due to the fact that the value of g was not exactly (9.81) in the laboratory which the experiment was made. This shows that the experimental value discovered by [M. Ossiander, F. Siegrist, V. Shirvanyan, R. Pazourek, A. Sommer, T. Latka, A. Guggenmos, S. Nagele, J. Feist, J. Burgdörfer, R. Kienberger and M. Schultze Attosecond correlation dynamics Nature Physics, 7. November 2016,DOI: 10.1038/nphys3941] [1]

Has much greater significance, not just as the shortest time measured to date... but as validity, to a certain degree, that time is indeed quantized. If we now consider the data, in the particle accelerators, shortest distance and time experiments of the 21st century... the shortcomings of General relativity. And we consider how a theory that has been deduced from the rich fabric of quantum mechanics being theoretically consistent and not requiring any ad-hoc manipulations, applied to the macroscopic and extra galactic world can explain known discrepancies such as dark matter as well as impose boundaries to the precise measurement of dynamical variables, in perfect agreement with all experiments. Then we are inclined to test this new theory, to see if it does indeed give an accurate picture of the universe we live in.

None.7 The Scalar Invariant (η):

Relativity has shown us how, two observers can never agree about $\Delta t = n\sigma\tau = \eta\tau$, the time their clocks measure Δt, because this time that we measure depends on gravity and the relative speed between those observers, we have seen this in our treatment of quantum gravity, as

(26) $\Delta t = \eta \frac{h}{\gamma mc^2} exp(2i \frac{mc^2}{\hbar}) x$

this generalizes,

$$\Delta t = exp[\frac{1}{c^2} \int g(x')dx']$$

of general relativity[16]. Both Δt and τ depend on their position, within a gravitational field as well as the relative speed, but the invariant scalar $\eta = n\sigma$ is invariant in all frames. All observers will measure the same value for η it measures the true "how long" an event took place.

(27) $\eta_t = \frac{\Delta t}{\tau}$

with $\eta \geq 0$.

To make this more lucid, let's propose a thought experiment. Say you are conversing with extraterrestrial life about current affairs, somewhere along this intriguing conversation, you asked the Alien, call him Bob, how long is your day, mine is 24hr, so I know what time to call you tomorrow. Bob quickly replies that his day is 324ξ. A great misunderstanding would ensue. Any use of fundamental constants, is relative, without invoking manmade standards, as well as the probable idea that they, have they have not yet discovered that constant. The invariant scalar solves this problem, by requiring Alien Bob to provide his quantum time as well (or simply his value of g), say $\tau = 0.002\xi$ with this we could use equation of η_t to determine the scalar invariant, thereafter convert to hours.

$\eta = 324\xi \div 0.002\xi = 162000$

observe this measure of time has no units. And it will be the same all observers in the universe. Similarly we can define the invariant length

(28) $\eta_x = \Delta x \div \lambda$

and invariant speed.

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(29) $\eta_v = \eta_{x \div} \eta_t$

All observers will agree on the value of the unitless invariant scalar, regardless of the units used, just like all observers will agree about the value of π or e.

Time Dilation and length Contraction

Consider two observers A and B, in the last section, we saw how, these observers will always measure the same value for the invariant scalar $\eta_A = \Delta x_A / \lambda_A$ and $\eta_B = \Delta x_B / \lambda_B$ this implies

(30) $\boldsymbol{\Delta x_0 = \frac{\lambda_0}{\lambda} \Delta x}$

We see that this is the length contraction due to the wavelength (gravity), or

Similarly,

(31) $\boldsymbol{\Delta t_0 = \frac{\tau_0}{\tau} \Delta t}$

is the time dilation due to gravity.

But from Relativity we know that: $\Delta x_0 = \Delta x\sqrt{1-(v/c)^2}$ and $\Delta t_0 = \Delta t\sqrt{1-(v/c)^2}$

therefore the full length contraction is given by,

(32) $\boldsymbol{\Delta L = \Delta L_0 \frac{\tau_0}{\tau} + \Delta L_0\sqrt{1-(\frac{v}{c})^2} = \Delta L_0(\frac{\tau_0}{\tau} + \sqrt{1-(\frac{v}{c})^2})}$

similarly for the time dilation,

(33) $\boldsymbol{\Delta t = \Delta t_0 \frac{\lambda_0}{\lambda} + \Delta t_0\sqrt{1-(\frac{v}{c})^2} = \Delta t_0(\frac{\lambda_0}{\lambda} + \sqrt{1-(\frac{v}{c})^2})}$

These are the complete length and time contractions and dilations respectively. The Length contraction (equation 30) tells us how the length of everyday objects is relative... if a short person where to travel to another planet he would be surprised to see how he has become taller. This is the analogue of gravitational contraction normally discussed with black holes[15]. Similarly, with equation 28, if it takes a stone 3 seconds on earth to reach the ground, then on the moon, there will be a sought of time dilation, "slow motion of some sought" due to these contractions.

The Quantum Classical Relation (QC Relation):

From relativity, we have come to appreciate the lesson of how the laws of classical mechanics needed to be revised when $v \to c$, this is because the speed of the gravity wave emanates from a body at speed $c = \lambda\tau$ so any object that is in the gravity wave / field, cannot travel faster than the medium it is in – a maximum velocity boundary condition. ($v \le c$)

$$v\begin{cases} < c & for\ objects \\ = c & for\ waves \end{cases}$$

There is another condition that lies on our equation $\Delta t = \eta\tau$, since $\eta \ge 0$, then $\Delta t \ge \tau$. This condition is simply how clocks can never measure less time, then the time of the wave that the clocks are in – a minimum time boundary – this implies just like that latter argument of $v \le c$ that just like the laws of mechanics had to be revised for large velocities at the boundary, they also need to be revised for $\Delta t \to \tau$ (the minimum time boundary). but $\Delta t \to \tau$ is simply quantum mechanics. We could have anticipated the strangeness of quantum mechanics from this boundary.

These two boundaries of short time and maximum velocity, give rise to the shortest distance that can ever be measured as;

(34) $\xi = c\tau$

where ξ is the shortest distance.

We can represent all of nature with the following formula:

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$$Nature = \begin{cases} Relativistic & v \rightarrow c \\ Classical & \Delta t >> \tau, \ and \ v << c \\ Quantum & \Delta t \rightarrow \tau, \ \ or \ \ \Delta x \rightarrow \lambda \end{cases}$$

$$\psi 2 = \begin{cases} probability\ of\ det. the\ particle\ or\ wave & \Delta t \rightarrow \tau \\ certainty\ of\ det. the\ properties\ of\ the\ particle\ and\ wave & \Delta t >> \tau \end{cases}$$

In this wave view, we realize that our laws of physics are not distinct and different theories but simply subject to constraints of dwelling in a wave. Furthermore

$$\psi(x,\ t) = \psi_0 exp\left(-\frac{i}{\hbar}S\right) = \psi_0 exp\left(-\frac{i}{\hbar}\int pdx\right) = \psi_0 \cos\left(\frac{1}{\hbar}\int_{x_2}^{x_1} pdx\right) = \psi_0 \sin\left(\frac{1}{\hbar}\int_{x_2}^{x_1} pdx\right) + \frac{\pi}{4}$$

$$\frac{1}{\hbar}\int_{x_2}^{x_1} pdx = \frac{1}{\hbar}\int_{x_2}^{x_1} pdx + \frac{\pi}{4}$$

therefore,

$$\int_{x_2}^{x_1} pdx = \pi\hbar(n + 1)$$

similarly

$$\int_{x_2}^{x_1} Edt = \pi\hbar(n + 1)$$

this offers the discreteness of the Quantum realm. Allowing us to write our equation of gravity

$$\hat{g}_{rel} = \gamma mc^2 \underline{\Lambda}_{rel}^1 G\ exp(-2i\ (\frac{mc}{\hbar})r$$

as,

$$\hat{g}_{rel} \approx \gamma mc^2 \underline{\Lambda}_{rel}^1 G \sum \cos(\pi\hbar(n + 1))$$

Let's write our kinematic wave equations as:

$E = hf$

$E = mc^2$

$\lambda = h/mc$

$\tau E = h$

$\lambda p = h$

$c = f\lambda$

$E = pc$

$\lambda = \tau c$

$g\lambda = \Lambda$

$\lambda\psi^2 = \varepsilon^2$

$I = \tau E$

None.11 Requirements for a new theory of gravity:

$$\hat{g}_{rel} = \gamma mc^2 \underline{\Lambda}_{rel}^1 G\ exp(-2i\ (\frac{mc}{\hbar})r$$

In order for our new equation to successfully become the new standard theory of gravity, i will quote Raymond Angelil [4] and Berkenstein [5], on the requirements the new theory of gravity must adhere too:

ISSN 2350-1030

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What kind of features should we expect in a new theory of gravity in addition to describing new phenomena?

[The greatest challenge for any gravitational theory would be to explain the observed galactic rotation curve and a modification of physical laws is no easy task. In the formulation of such, we stand to possibly lose key requirements (which need to be satisfied in order to be taken seriously), and principles (which are intrinsic to any gravitational formulation). For instance: a modification that ’fixes’ our problem [of dark matter] might well introduce others. We would require the overall features of such a theory to still contain the bulk of traditional gravity, so as to keep the previous achievements of gravitational theory ’in-line’ with what we expect. (We need such phenomenae to not only exist in our theory, but remain unchanged enough - i.e. reducible to Einstein and / or Newtonian Gravity only in a certain limit.)[4]

- Agreement with conventional theories at extra-galactic scales. The weak field approximation should be recovered in the region of low-mass distribution. We need our theory of gravity to approach Einstein gravity in a certain low-mass limit, which automatically means we will hit the Newtonian gravity regime on some further limit.

- Agreement with the dynamics of the Solar System. An array of measurable phenomenae in the Solar System should be predictable by the theory, and should concur with experimental tests. These include the deflection of light rays, the time delay of radar signals, and the precessions of the perihelia of the inner planets; all of which are accounted for by Einstein gravity.

- Agreement with binary pulsar tests Binary pulsar systems are used to measure such effects as relativistic time-delay, periastron procession and orbit decay due to energy loss via gravitational radiation. It is in this arena that we test the strong field limit of the theory, and thus the arena in which we are most likely to see departures from conventional Einstein gravity. Indeed, our theory will face its toughest challenge here, as the orbital decay of the binary pulsar system PSR1913+16 due to energy loss via gravitational waves has been remarkably well predicted by Einstein gravity.

- Concurrence with cosmological essentials The Friedman equations for this theory should predict the same cosmological phenomenology that has been developed and confirmed from Einstein gravity. These include the Hubble expansion, the timescale for various eras, the existence of a microwave background, and light element abundances from primordial photosynthesis which has been strongly verified by modern cosmological theory.

While this list contains essentially the observable features of the universe which we shun from losing in our theoretical framework, a theory of gravity needs to comply to the following fundamental physical principles that we require to hold true. A theory exhibiting all of the above-mentioned requirements, which does not contain the following principles, can be said to be only an effective theory - one which has been constructed from the top down, and not the other way round.

Principles:

- The Action Principle: The equations of motion of our theory must be able to be directly derivable from an Action. This way, we guarantee the conservation laws of energy, and angular and linear momentum, which we of course require.

- General covariance: The equations of our theory must be written in the language of traditional Einstein gravity. The action must be relativistic so that Poincare invariance is not lost, and that when we ’look closely enough’ at any region of our space-time manifold, we recover Special Relativity.

- Equivalence principle: The theory must be metric - the matter or non-gravitational (like electromagnetism, the weak force etc.) laws of physics should be expressible simply by rewriting their actions by replacing the Lorentzian metric with gravitational one.

- Causality: To preserve the logical consistency of the theory, we require that the theory remain causal. This means that the maximum possible speed of propagation of any measurable field or of energy and linear and angular momentum is not superluminal. Luminal speed is the speed which is invariant under Lorentz transformations. Because Maxwell’s equations are invariant under Lorentz transformations, this luminal speed is the speed of light.

Our theory of Quantum Gravity:

- The benefit of being able to make a smooth transition from quantum mechanics to gravity / classical mechanics and vice versa.

- Derived from a quantum mechanics paradigm, equivalent to that of Dirac, as a wavefunction gravity, so most of the inherent properties of Dirac are still present in our equation.
- Mathematically simpler then tensor formulations of gravity, allowing exact solutions and not having to always revert to numerical analysis
- Explaining dark energy, inflation and dark matter from first principles
- Better suited to model the universe
- No inherent singularities
- does not use the strictly empirically justified inverse square law to describe gravity, hence suitable for not just macroscopic but microscopic and cosmological ranges as well
- The graph of the exponential decay found in our theory vs. the inverse square law of Einstein and Newton, shows how they agree reasonably well at macroscopic (the inverse square being the first Taylor approximation), but diverges on the microscopic and cosmological scales. The cosmological scales where the apparent dark matter is present or gravity no longer follows the inverse square law.
- Our equation was built "down-up", i.e., from the rich foundation of quantum mechanics

Applications:

The greatest technological advancement for mankind in the 21st century is simple, we have to generate gravity. Every day "modern" equipment or innovations, such as ladders, elevators, trains, etc. could only be useful at a museum, if we could successfully harness the power of gravity... as we have seen in the equations wave = wave.

3. CONCLUSION

In the text that precedes this discussion, we have showed how great is the power of transmutation, in unifying the forces of nature, the vastness and beauty of the principle of universal equilibrium, as well as the elusive nature that links quantum mechanics and classical theory and finally how from a rudimentary idea such as the De Broglie wavelength, a theory of Quantum Gravity would emerge, that quantizes time... with the explanatory power of explaining dark energy, the inflation force and successfully explaining the dark matter problem. I will quote Albert Einstein in a letter to Besso in 1954[28] [I consider it quite possible that physics cannot be based on the field concept, i.e. continuous structures. In that case, nothing remains of my entire castle in the air, my gravitational theory included], It is with a heavy heart that we must abandon, our geometric space-time view of gravity in favor of the Quantum Mechanics view

(discrete structures) of space and time – a wave view of gravity – as we once did the instantaneous force... one sees that there is economy in this way of thinking, and this change, is not only consequential... but inevitable.

Theory of Universal Origins (Part B)

The Big Bang of the standard model is an impressive theory, explaining all we see in our varied telescopes, with the immense power of explaining the very origin of our universe. At its core it addresses, perhaps the most important question that man has ever asked? where do we come from, where does the universe come from... it explains the origins of everything based not on superstition but scientific reasoning and experimental data. Since the time of Aristotle, the universe was always perceived to be constant, without ending or beginning, without growth, age... timesless and infinite. For generations and generations this was not just an idea, but what we thought was reality. The solution that perhaps the universe was not "steady" after all, that it might be expanding or compressing, was stumbled upon by Albert Einstein, in his famous equations that today we call the Einstein Field Equations, in his equation. there existed an extra term, called the cosmological constant (Λ).

$$R_{\mu\nu} - 12g_{\mu\nu}R + \Lambda g_{\mu\nu}R = 8\pi Gc^4T_{\mu\nu}$$

When the equation is applied to the universe the term did not add anything new about how gravity behaves, but rather it adds an unknown force, that causes the universe to expand, contract or remain steady. But to Einstein an expanding or

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contracting universe did not seem viable to him, thus he abandoned the cosmological constant, calling it the biggest blunder of his life. in the early 20th century it was the collective work of Vesto Slipher, Alexander Friedmann, Georges Lemaître, Albert Einstein and Edwin Hubble, who theoretically and experimentally showed the universe is expanding. This was a revelation into the birth of our universe, because what it meant was if on this year of 2017, the universe has a certain finite size, and is increasing it means in the year 2000 the universe was smaller than it is now, in the year 1900 smaller still – and so on, and so on – but if we rewind this video, we find an infinitely dense, extremely high temperature universe which we call the big bang. The revelation was beautiful, but that was the end of it, simply beautiful. The theory lacks a foundation. it lacks the how, it does not address fundamental questions such as where did all this energy come from? why do we have the constants that we do such as the speed of light? And if such a monumental abundance of energy can emerge from nothing why aren't universes being created from nothing today? The Big Bang tells us what happened in those first seconds, but fails to explain what happened in the very beginning or before[22]. In the discussion that follows we will find an answer to these questions of how did the universe begin.

Although space is all around us, encompassing everything, it is by far the most alien concept that has ever existed, primarily because it does not interact with energy, the one, and **only** thing in the entire universe that does not interact with energy. Space is massless, timeless, no subdivisions or quanta's... this could lead one to believe that space is basically nothing – but nothing could be any further from the truth – It is a complex three dimensional structure that is infinite in all its dimensions, that is just as real as ordinary matter, but even more so, more fundamental, and the evolution of the cosmos would be impossible without it.

To begin our quest, let's start by writing the equation of everything. Everything we see around us is a consequence of this formula.

$Everything = Space + Energy$

$\Xi = \mathbb{R} + E = \mathbb{R}^3 + E$

where $\Xi - Everything$ and $\mathbb{R}^3$is the three dimensional Euclidean space and E is the total energy of the universe.

We can write E as the sum of the particles and waves. E=Energy of particle(s) + Energy of Wave(s), so we can write

$\Xi = \mathbb{R} + E + \varepsilon = \mathbb{R}^3 + \sum E_i + \sum \varepsilon_i$

(41) $\Xi = \mathbb{R}^3 + \sum^N E_i + \sum^N \mathcal{E}_i$

where N< ∞ and $\sum^N E_i + \sum^N \varepsilon_i < \infty$.

but if one thinks about what we investigated earlier in the Theory of Universal Equilibrium, that: Energy of particle = Energy of wave ($i\hbar\partial\partial t = H$), so Energy of Particle - Energy of wave = 0

hence

$\Xi = \mathbb{R} + E = \mathbb{R}^3 + E = \mathbb{R}^3 + 0$

This is the fundamental property of nothing. this shows us that everything is simply nothing.

- The universal property of nothing: The total sum of everything in the universe is nothing.

we use this nothingness property in everyday algebra as:

x + 1 = 2

x + 1 + 0 = 2

x + 1 + (-1) = 2 + (-1)

x=1

So if a charge where to exist, it had to have the property

0 = +e + (-e) = 0

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In the beginning there was nothing, but nothing is a very broad term. for example

$0\ apples\ before = 1 apple - 1 antiapple = 0 apples\ after$

in all three scenarios the universe contains nothing.

None.11.1 Before the big bang (Time T<0)

This is the time before the Big Bang, the universe contains nothing, and this nothingness property is the loophole for everything; it gives rise to conservations, more importantly conservation of energy. Let's take a short detour and explain these emerging particles. Let us look at the electron / positron pair, with charge $\pm 1.602 \times 10^{-19} C$, it is not a coincidence that they have equal but opposite charges, because when they combine the total charge is still nothing, thus "no charge was ever created in the universe.". All the conservation laws are just a consequence of nothingness property, that does not necessarily mean nothing can occur but rather, whatever that occurs, the total sum of it is still nothing. With this in mind we can see how an electron-positron pair can emerge from the fabric of space, so long as the total sum of all its combined properties, such as spin and charge is zero – nothing.

But there is a flaw in this way of thinking, the total mass is not zero, $mass\ of\ the\ electron + mass\ of\ the\ positron \neq nothing$ to solve this we have to look at the time-energy uncertainty principle, which is notorious for ill defining energy at certain time scales. But more importantly we ask ourselves, why is it that the Hamiltonian (H), the energy of the field, is exactly equal to the particles? Why is it that the energy contained in the mass is exactly equal to the gravitational field. To explain this in mathematical form we will have

$Energy\ of\ the\ particle(s) = Energy\ of\ the\ wave$

$Energy / mass\ of\ the\ particle(s) - Energy\ of\ the\ wave = 0 = nothing$

Thus it is the combination of the field and the mass that constitutes nothing.

So particles can emerge from nothing, so long as the nothingness property is obeyed. From this we see that this three dimensional space becomes "habitable", although strangely so.

- To conclude, any particle(s) that emerges from the fabric of space, will emerge with a set of laws and constants that full describe those particle(s)

For example: if a circle were to emerge from the fabric of pure space, it would emerge with a set of laws (equations, constants etc.) that fully describe its behavior in $\mathbb{R}^3$. In the case of a circle, $A = \pi r^2$.

- The emergent principle: Anything that emerges from the fabric of space, emerges with its own emergent laws, constants, etc. that fully describe its behavior and interaction in $\mathbb{R}^3$

None.11.2 The Big Bang (Time T=0)

At time T=0, the stage is set for particles to emerge as long as they respect the nothingness properties of space. At this time an extremely rare event occurred, improbable, but possible. All the fundamental particles that we know today: the quarks and leptons, with their anti-particles, emerged from the fabric of space at the same position and at the same time (each with its own particle – obeying the property of nothingness). Because they all emerged from space at the same time and place they started to interact with each other instead of annihilating as they usually do as particle-antiparticle pairs (this could have similarly been the gluons), they emerged with the Yang-Mill's theory, as well as all the fundamental constants of physics, that are necessary to fully describe them. But I used the words, at a precise location, and precise time. We know how Heisenberg's uncertainty principles forbid the simultaneous knowledge of momentum and position (an extremely small volume, since they had to interact) or energy and time (at precisely the same time, so they do not annihilate). This precise knowledge of position and time caused a massive uncertainty in Energy and Momentum, they became extremely large, causing the temperature to be at exponential orders.

None.11.3 After the Big Bang (T>0)

The emergent particles, emerged with all the physical laws, all the "DNA" suitable to describe them. and by $\Delta E \Delta t \geq h 4\pi$particles were created (not emerging), from the wave / field, instead of emerging from space itself, which would imply new laws for each particle. The evolution of the universe was vastly controlled by the temperature, as we have seen in our treatment of the Theory of Universal Equilibrium, of how the forces transform due to the temperature, and the universe expanded. the Law of large numbers further made certain that the universe is isotropic. I will not dare and try about speaking about the age of the universe, for such calculations, would require us to understand the gravity at each moment from T=0, and since gravity was dynamic, it is a dire task to calculate the age of the universe with certainty.

Conclusion and Final Remarks:

To believe that this improbable, but possible event, happened once and only once, would be a fool's hope of centralizing his own existence. Similar to the ancient's of the geocentric model or a shell fish blindly stuck to a rock, not realizing the vastness of the sea. I have strong convictions that our universe cannot be the only universe that was able to evolve. Although such universes would be mind blowingly different, harboring different laws and constants and fundamental shapes that merged at their respective "big bangs". The interactions of such universes would still be determined from our equation of everything.

$\Xi_1 + \Xi_2 = \mathbb{R}^3 + E_1 - (\mathbb{R}^3 + E_2) = \mathbb{R}^3 + (E_1 - E_2) = \mathbb{R}^3 + \mathbf{L}$

therefore

(42) $\Xi = \mathbb{R}^3 + \mathbf{L}$

where **L** is the Lagrangian, or trajectory of the universes. If one agrees with my line of thought, and agrees that particles / universes can emerge from nothing... allow me to elaborate further that the big bang (the birth of a universe) is an extremely rare occasion, but imagine an absolutely rare occasion, whereby not simply an innate object emerges from the space, but a conscious being emerging. The laws of physics agree with this idea of a super being emerging from the realm of space although is the most rare form of emergence.

"... Much can be said about these universes that are embedded in this truly magnificently infinite multiversed space, and the possibility of a conscious being, that unlike us was not born but emerged, but as our knowledge about this complexity emerges, our narrow, pinhole view of the laws of physics seem to be approaching ever more closer to the mind of God."

ACKNOWLEDGMENTS

N To my student Linington, who forever and always encouraged me to publish my life long work.

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