Is Octonionic Quantum Gravity in the Pre- Planckian Regime of Space time violated? Input from a worm hole bridge from another universe considered as a model for examining this issue.

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Abstract: Linking a shrinking prior universe via a wormhole solution for a pseudo time dependent Wheeler-De Witt equation may permit the formation of a short-term quintessence scalar field. We claim that the addition of the wormhole could be equated to an initial configuration of the Einstein field equations, allowing for high-frequency gravitational waves (HFGW) at the onset of inflation. The virtual worm hole with a large fluctuation permits the interior region to tunnel into a nascent cosmology with a large vacuum energy defined by that fluctuation in energy. The universe or cosmology it tunnels from is unaffected from this, other than having a tiny bit of vacuum energy "robbed." The worm hole is a high energy, but zero temperature, virtual fluctuation. Use of this construction may permit us to ask if Octonionic quantum gravity[1] constructions are relevant in the pre Planckian regime of space time.

Keywords: Wormhole, High-frequency Gravitational Waves (HFGW), symmetry, causal discontinuity
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INTRODUCTION

As brought up by Beckwith, and Glinka [2], (assuming a vacuum energy $\rho_{Vacuum} = [\Lambda/8\pi \cdot G]$ initially), with Λ part of a closed FRW Friedman Equation solution.

$$a(t) = \frac{1}{\sqrt{\Lambda/3}} \cosh\left[\sqrt{\Lambda/3} \cdot t\right] \tag{1}$$

to a flat space FRW equation of the form [4]

$$\left[\frac{\dot{a}}{a}\right]^2 + \frac{1}{a^2} = \frac{\Lambda}{3} \tag{2}$$

Which is so one forms a 1-dimensional Schrodinger equation [2],[3], [4]

$$\left[\frac{\partial^2}{\partial \cdot \tilde{a}^2} - \frac{9\pi^2}{4G^2}\left[\tilde{a}^2 - \frac{\Lambda}{3}\tilde{a}^4\right]\right]\psi = 0 \tag{3}$$

, with $\tilde{a}_0$ a turning point to potential [2],[3],[4]

$$U(a) = \frac{9\pi^2}{4G^2}\left[\tilde{a}^2 - \frac{\Lambda}{3}\tilde{a}^4\right]. \tag{4}$$

What we are doing afterwards is refinement as to this initial statement of the problem in terms of giving further definition of the term $\rho_{Vacuum} = [\Lambda/8\pi \cdot G]$ initially speaking. The worm hole is a high energy, but zero temperature, virtual fluctuation. We will model inputs into the initial value of Λ as high energy fluctuations, and see if they contribute to examination of the formation of non commutative geometry in the beginning/ just before the inflationary era. This $\rho_{Vacuum} = [\Lambda/8\pi \cdot G]$ if stated correctly may enable tying in initial VeV behavior with the following diagram.Note that cosmology models have to be consistent with regards to the following diagram.

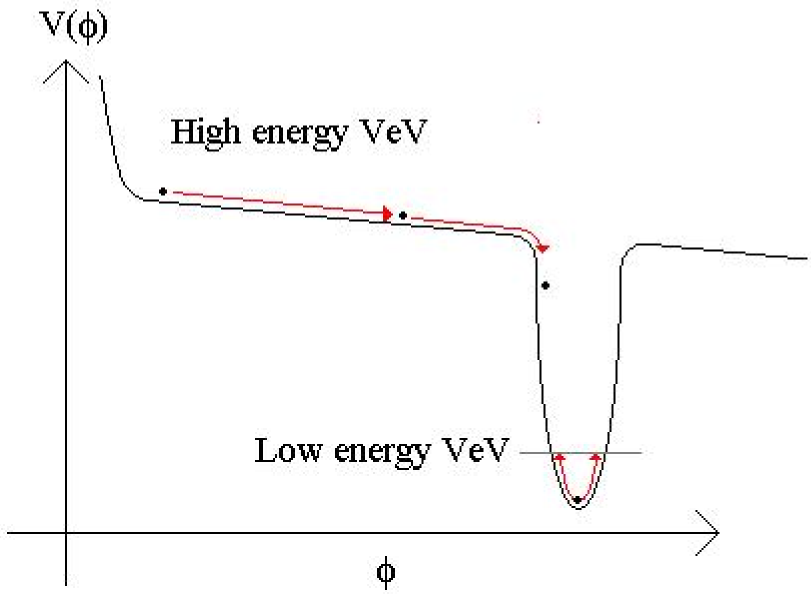

Figure 1, as supplied by L. Crowell, in correspondence to A. W. Beckwith, October 24, 2010

As stated by L. Crowell [5], in e mail sent to A. Beckwith, the way to delineate **the evolution of the VeV issue is to consider an initially huge VeV, due to initial inflationary geometry**

Quote, from L. Crowell [5]:

The standard inflationary cosmology involves a scalar field φ which obeys a standard wave equation. The potential is this function which I diagram 'above'. The scalar field starts at the left and rolls down the slope until it reaches a value of φ where the potential is V(φ) ~ φ^2. The enormous VeV at the start is about 14 orders of magnitude smaller than the Planck energy density ~ (1/L_p)^4 on the long slope. The field then enters the quadratic region, where a lot of that large VeV energy is thermalized, with a tiny bit left that is the VeV and CC of the observable universe. The universe during this roll down the long small slope has a large cosmological constant, actually variable λ = λ(φ,∂φ), which forces the exponential expansion. There are about 60-efolds of the universe through that period. Then at the low energy VeV the much smaller CC gives the universe with the configuration we see today

One of the ways to relate an energy density, related to cosmological parameters and a vacuum energy density may be using a relation as given by , if λ_{QCD} ~ at least 200MeV is similar to the QCD scale parameter of the SU(3) gauge coupling constant, and H a Hubble parameter, then as given by Poplawski [6]

$$\rho_{\Lambda} = H\lambda_{QCD} \tag{5}$$

Here, we state that there would be , $\rho_{Vacuum} = [\Lambda/8\pi \cdot G]$ results and a value for [7] $V \sim 3\langle H\rangle^4 / 16\pi^2$ .would be to consider if there is a relationship between Eq. (5) above and $\rho_{Vacuum} = [\Lambda/8\pi \cdot G]$. I.e. then the formation of inputs into $V \sim 3\langle H\rangle^4 / 16\pi^2$, and also equating $V \sim 3\langle H\rangle^4 / 16\pi^2$ with V(φ) ~ φ^2 [5] would be consistent. I.e our idea is as follows, if V(φ) ~ φ^2 is for an inflaton treatment of initial inflation:

$$\rho_{Vacuum} = [\Lambda/8\pi \cdot G] \approx \rho_{\Lambda} \approx H\lambda_{QCD} \Leftrightarrow V \sim 3\langle H\rangle^4 / 16\pi^2 \sim V_{\inf} \approx \phi^2 \tag{6}$$

Different models for the Hubble parameter, H exist, and can be directly linked to how one forms the inflaton. The datum also which was investigated by the authors was in what happens to the relations as given in Eq. (6)

HOW A WORMHOLE FORMS

The Friedman equation referenced in this paper allows for determining the rate of cosmological expansion.. We referenced the Reissner-Nordstrom metric.. Crowell [1] used this solution as a model of a bridge between a prior universe and our own. To show this, one can use results from Crowell [1] on quantum fluctuations in space-time, which provides a model from a pseudo time component version of the Wheeler De Witt equation, using the Reinssner-Nordstrom metric to help obtain a solution that passes through a thin shell separating two space-times. The radius of the shell, $r_0(t)$ separating the two space-times is of length l_P in approximate magnitude, leading to a multiplication of the time component for the Reissner-Nordstrom metric:

$$dS^2 = -F(r) \cdot dt^2 + \frac{dr^2}{F(r)} + d\Omega^2 \quad . \tag{7}$$

This has:

$$F(r) = 1 - \frac{2M}{r} + \frac{Q^2}{r^2} - \frac{\Lambda}{3} \cdot r^2 \xrightarrow[T \to 10^{32}\ Kelvin \sim \infty]{} -\frac{\Lambda}{3} \cdot (r = l_P)^2 \quad . \tag{8}$$

Note that Equation (8) referenced above is a way to link this metric to space-times via the following model of energy density equation, linked to a so called “membrane” model of two universes separated by a small “rescaled distance” $r_0(t)$. In practical modeling, $r_0(t)$ is usually of the order of magnitude of the smallest possible unit of space-time, the Planck distance, $l_P \sim 10^{-35}\,cm$, quantum approximation put into general relativity.. The equation linking Eqn.(7) to energy density ρ is of the form:

$$\rho = \frac{1}{2\pi \cdot r_0} \cdot \sqrt{F(r_0) - r_0^2} \quad . \tag{9}$$

Frequently, this is simplified with the term, $\dot{r}_0(t) \cong 0$. In addition, following temperature dependence of this parameter, as outlined by Park [8] leads to [9]

$$\frac{\partial F}{\partial r} \sim -2 \cdot \frac{\Lambda}{3} \cdot (r \approx l_P) \equiv \eta(T) \cdot (r \approx l_P) \quad . \tag{10}$$

This is a wave functional solution to a Wheeler De Witt equation bridging two space-times. The solution bridging two space-times is similar to one made by Crowell between these two space-times with “instantaneous” transfer of thermal heat [1]

$$\Psi(T) \propto -A \cdot \{\eta^2 \cdot C_1\} + A \cdot \eta \cdot \omega^2 \cdot C_2 \quad . \tag{11}$$

This equation has $C_1 = C_1(\omega, t, r)$ as a cyclic and evolving function of frequency, time, and spatial function, also applicable to $C_2 = C_2(\omega, t, r)$ with, $C_1 = C_1(\omega, t, r) \neq C_2(\omega, t, r)$ It is asserted here that a thermal bridge in wormhole form exists as a bridge between a prior and present universe. This assumes that a release of gravitons occurs, which leads to a removal of graviton energy stored contributions to this cosmological parameter, with m_P as the Planck mass, i.e. the mass of a black hole of "radius" on the order of magnitude of Planck length $l_P \sim 10^{-35}$ m. This leads to Planck's mass $m_P \approx 2.17645 \times 10^{-8}$ kilograms, as alluded to by Barvinsky [9], [10] .

$$\Lambda_{4-\dim} \propto c_2 \cdot T^{\beta} \xrightarrow[graviton-production]{} 360 \cdot m_P^2 << c_2 \cdot \left[T \approx 10^{32} K \right] \quad . \tag{12}$$

Right after the gravitons are released, there is still a drop off of temperature contributions to the cosmological constant. For a small time value, $t \approx \delta^1 \cdot t_P$,where $0 < \delta^1 \leq 1$ and for temperatures sharply lower than= 10 to the 32nd power Kelvin, this difference is the ratio of the value of the four-dimensional version of the cosmological constant divided by the absolute value of the five dimensional cosmological constant, which is equal to 1 plus 1/n, where n is a positive integer. The transition outlined in Eqn. (12) above has a starting point with extremely high temperatures given by a vacuum energy transferal between a prior universe and our present universe. We will next then, look at this model for a possible increase in the degrees of freedom, initially

Increase in degrees of freedom in the sub Planckian regime.

Starting with [2]

$$E_{thermal} \approx \frac{1}{2} k_B T_{temperature} \propto \left[\Omega_0 \breve{T} \right] \sim \tilde{\beta} \tag{13}$$

The assumption wouild be that there would be an initial fixed entropy arising, with $\overline{N}$ a nucleated structure arising in a short time interval as a temperature $T_{temperature} \varepsilon \left(0^+, 10^{19} GeV \right)$ arrives. So then, one will have, dimensionally speaking [2],

$$\frac{\Delta \tilde{\beta}}{dist} \cong \left(5 k_B \Delta T_{temp} / 2 \right) \cdot \frac{\overline{N}}{dist} \sim q E_{net-electric-field} \sim \left[T \Delta S / dist \right] \tag{14}$$

The parameter, as given by $\Delta \tilde{\beta}$ will be one of the parameters used to define chaotic Gaussian mappings. Candidates as to the inflaton potential would be in powers of the inflaton, i.e. in terms of ϕ^N , with N=4 effectively ruled out, and perhaps N=2 an admissible candidate (chaotic inflation). For N = 2, one gets [2], [11]

$$\left[\Delta S \right] = \left[\hbar / T \right] \cdot \left[2k^2 - \frac{1}{\eta^2} \left[M_{Planck}^2 \cdot \left[\left[\frac{6}{4\pi} - \frac{12}{4\pi} \right] \cdot \left[\frac{1}{\phi} \right]^2 - \frac{6}{4\pi} \cdot \left[\frac{1}{\phi^2} \right] \right] \right] \right]^{1/2} \sim n_{Particle-Count} \tag{15}$$

If the inputs into the inflaton, as given by ϕ^2 becomes from Eq. (6) a random influx of thermal energy from temperature, we will see the particle count on the right hand side of Eq. (15) above a partly random creation of $n_{Particle-Count}$ which we claim has its counter part in the following treatment of an increase in degrees of freedom. Namely, we look at In a word, the way to introduce the expansion of the degrees of freedom from nearly zero, at the maximum point of contraction to having **N(T)~ 10^3** is to first of all define the classical and quantum regimes of gravity in such a way as to minimize the point of the bifurcation diagram affected by quantum processes.[12] I.e.

classical physics, with smoothness of space time structure down to a grid size of $l_{Planck} \sim 10^{33}$ centimeters at the start of inflationary expansion. Have, when doing this construction what would be needed would be to look at the maximum point of contraction, set at $l_{Planck} \sim 10^{33}$ centimeters as the quantum 'dot' , as a de facto measure zero set, as the bounce point, with classical physics behavior before and after the bounce 'through' the quantum dot. Dynamical systems modeling could be directly employed right 'after' evolution through the 'quantum dot' regime, with a transfer of crunched in energy to Hemoltz free energy, as the driver 'force' for a Gauss map type chaotic diagram right after the transition to the quantum 'dot' point of maximum contraction. The diagram, in a bifurcation sense would look like an application of the Gauss mapping of [12]

$$x_{i+1} = \exp\left[-\tilde{\alpha} \cdot x_i^2\right] + \tilde{\beta} \qquad (16)$$

In dynamical systems type parlance, one would achieve a diagram, with tree structure looking like what was given by Binous [12], using material written up by Lynch [13] , i.e. by looking at his bifurcation diagram for the Gauss map .Binous's demonstration plots the bifurcation diagram for user-set values of the parameter . Different values of the parameter lead to bifurcation, period doubling, and other types of chaotic dynamical behavior. For the authors purposes, the parameter x_{i+1} and x_i^2 as put in Eq. (16) would represent the evolution of number of number of degrees of freedom, with ironically, the near zero behavior, plus a Hemoltz degree of freedom parameter set in as feed into $\tilde{\beta}$. In a word, the quantum 'dot' contribution would be a measure set zero glitch in the mapping given by Eq. (15), with the understanding that where the parameter $\tilde{\beta}$ 'turns on' would be right AFTER the 'bounce' through the infinitesimally small quantum 'dot' regime. Far from being trivial, there would be a specific interative chaotic behavior initiated by the turning on of parameter $\tilde{\beta}$,corresponding as brought up by Dickau [14] as a connection between octo-octonionic space and the degrees of freedom available at the beginning of inflation. I.e. turning on the parameter $\tilde{\beta}$ would be a way to have Lisi's E8 structure [15] be nucleated at the beginning of space time.As the author sees it, $\tilde{\beta}$ would be proportional to the Hemoltz free energy, F, where as Mandl [16] relates, page 272, the usual definition of F=E - TS , becomes, instead, here, using partition function, Z, with $\overline{N}$ a 'numerical count factor', so that [2], [16]

$$F = -k_B T \cdot \ln Z(T, V, \overline{N}) \qquad (17)$$

Note that Y. Jack Ng.[17] sets a modification of $Z_N \sim \left(\frac{1}{N!}\right) \cdot \left(\frac{V}{\lambda^3}\right)^N$ as in the use of his infinite quantum statistics, with the outcome that [2] $F = -k_B T \cdot \ln Z(T, V, \overline{N}) \equiv -k_B T N\left[\ln(V/\lambda^3) + 5/2\right]$with V ~ (Planck length)^3 , and the Entropy obeying [2], [17]

$$S \approx N \cdot \left(\log\left[V/N\lambda^3\right] + 5/2\right) \xrightarrow[Ng-\text{inf}\, inite-Quantum-Statistics]{} N \cdot \left(\log\left[V/\lambda^3\right] + 5/2\right) \approx N \quad (18)$$

Such that the free energy, using Ng. infinite quantum statistics reasoning would be [2], [17] a feed into a nucleated structure, A structure which will be examined in the next section via looking at the absolute value of $F = -k_B T \cdot \ln Z(T, V, \overline{N}) \equiv -\frac{5}{2} \cdot k_B T \overline{N}$. Note, here, that the absolute value of F given is a driver to chaotic dynamics, while $x_{i+1} = \exp\left[-\tilde{\alpha} \cdot x_i^2\right] + \tilde{\beta}$, has $\tilde{\beta} \cong |F|$, with coefficient $\tilde{\beta} \cong |F|$ turning on at the start of the inflationary era due to a temperature flux starting as a driving force, and $\tilde{\alpha}$ being a coefficient of damping of degrees of freedom to near zero, as the contraction phase of the 'universe' , while $x_i \sim$ degree of degrees of freedom, which would grow dramatically, once $\tilde{\beta} \cong |F|$ turns on .

Consequences of having a radical increase in the degrees of freedom initially

The first part of the following discussion is meant to be motivational, with references from the other papers as being refinements which will be worked on in additional publications. The main idea is,that $\breve{\beta}$ increasing up to a maximum temperature T would enable the evolution and spontaneous construction of the Lisi E8 structure as given by [15]. As Beckwith wrote up [2], including in additional energy due to an increase of $\breve{\beta}$ due to increasing temperature T would have striking similarities to the following. We argue that the increase in degrees of freedom is connected to a nucleation space for particles, according to the following argument. Observe the following argument as given by V. F. Mukhanov, and Swinitzki [2], [18] , as to additional particles being 'created' due to what is an infusion of energy in an oscillator , obeying the following equations of motion [2], [18]

$$\ddot{q}(t)+\omega_0^2 q(t)=0, \text{ for } t<0 \text{ and } t>\breve{T};$$

$$\ddot{q}(t)-\Omega_0^2 q(t)=0, \text{ for } 0<t<\breve{T} \tag{19}$$

,Given $\Omega_0\breve{T} >> 1$, with a starting solution of $q(t)\equiv q_1 \sin(\omega_0 t)$ if t <0, Mukhanov state that for [2], [18] $t>\breve{T}$;

$$q_2 \approx \frac{1}{2}\sqrt{1+\frac{\omega_0^2}{\Omega_0^2}}\cdot \exp\left[\Omega_0\breve{T}\right] \tag{20}$$

The Mukhanov et al argument [2],[18]leads to an exercise which Mukhanov claims is solutions to the exercise yields an increase in number count, as can be given by setting the oscillator in the ground state with $q_1=\omega_0^{-1/2}$, with the number of particles linked to amplitude by $\breve{n}=[1/2]\cdot\left(q_0^2\omega_0-1\right)$, leading to [2],[18]

$$\breve{n}=[1/2]\cdot\left(1+\left[\omega_0^2/\Omega_0^2\right]\right)\cdot\sinh^2\left[\Omega_0\breve{T}\right] \tag{21}$$

I.e. for non zero $\left[\Omega_0\breve{T}\right]$, Eq (21) leads to exponential expansion of the numerical state. For sufficiently large $\left[\Omega_0\breve{T}\right]$, Eq. (25) and Eq. (26) are equivalent to placing of energy into a system, leading to vacuum nucleation. A further step in this direction is given by Mukhanov on page 82 of his book leading to a Bogoluybov particle number density of becoming exponentially large [2],[18]

$$\breve{\breve{n}} \sim \cdot\sinh^2\left[m_0\eta_1\right] \tag{22}$$

Eq. (21) to Eq. (22) are , for sufficiently large $\left[\Omega_0\breve{T}\right]$ a way to quantify what happens if initial thermal energy are placed in a harmonic system, leading to vacuum particle ' creation' Eq. (22) is the formal Bogolyubov coefficient limit of particle creation . Note that $\ddot{q}(t)-\Omega_0^2 q(t)=0, \text{ for } 0<t<\breve{T}$ corresponds to a thermal flux of energy into a time interval $0<t<\breve{T}$. Furthermore, consequence of Verlinde's [19] generalization of entropy as also discussed by Beckwith[2] , and the number of 'bits' yields the following consideration, which will be put here for startling effect. Namely, if a net acceleration is such that $a_{accel}=2\pi k_B cT/\hbar$ as mentioned by Verlinde [2], [19] as an Unruh result, and that the number of 'bits' is

$$n_{Bit} = \frac{\Delta S}{\Delta x} \cdot \frac{c^2}{\pi \cdot k_B^2 T} \approx \frac{3 \cdot (1.66)^2 g^*}{\left[\Delta x \cong l_p\right]} \cdot \frac{c^2 \cdot T^2}{\pi \cdot k_B^2} \qquad (23)$$

This Eq. (23) has a T^2 temperature dependence for information bits , as opposed to [2]

$$S \sim 3 \cdot \left[1.66 \cdot \sqrt{\tilde{g}_*}\right]^2 T^3 \sim n_f \qquad (24)$$

Should the $\Delta x \cong l_p$ order of magnitude minimum grid size hold, then conceivably when T ~ 10^{19} GeV[2]

$$n_{Bit} \approx \frac{3 \cdot (1.66)^2 g^*}{\left[\Delta x \cong l_p\right]} \cdot \frac{c^2 \cdot T^2}{\pi \cdot k_B^2} \sim 3 \cdot \left[1.66 \cdot \sqrt{\tilde{g}_*}\right]^2 T^3 \qquad (25)$$

The situation for which one has [2], [19] $\Delta x \cong l^{1/3} l_{Planck}^{2/3}$ with $l \sim l_{Planck}$ corresponds to $n_{Bit} \propto T^3$ whereas $n_{Bit} \propto T^2$ if $\Delta x \cong l^{1/3} l_{Planck}^{2/3} >> l_{Planck}$.

SETH LLOYD'S UNIVERSE AS A MODIFIED QUANTUM COMPUTER MODEL

Many people would not understand why computational models of the universe would be important to either cosmology or to propulsion. What we establish though this model is a way to explain why the dominant contribution to gravity waves from a wormhole transferal of vacuum energy to our present universe is tilted toward a dominant high-frequency spectrum. This allows us to understand what sort of initial conditions would be favored for graviton production, which it is claimed, is the way to go for an advanced propulsion system in spacecraft design. One can make use of the formula given by Seth Lloyd [20], which relates the number of operations the "Universe" can "compute" during its evolution. Lloyd [20] uses the idea, which he attributed to Landauer, to the effect that the universe is a physical system that has information being processed over its evolutionary history. Lloyd also makes reference to a prior paper where he attributes an upper bound to the permitted speed a physical system can have in performing operations in lieu of the Margolis/Levitin theorem, with a quantum mechanically given upper limit value (assuming E is the average energy of the system above a ground state value), obtaining a *first limit* of a quantum mechanical average energy bound value, if $\# operations / \sec = \tilde{N}$:

$$\tilde{N} \leq 2E/\pi\hbar \quad . \qquad (26)$$

tThe second limit is the number of operations, linked to entropy, due to limits to memory space, as Lloyd writes:

$$\tilde{N} \cdot \sec \leq S(entropy) / \left(k_B \cdot \ln 2\right) \quad . \qquad (27)$$

What we are suggesting, is that in both Eq. (26) and Eq. (27) that we replace the upper bound limits of both of the equations with

$$\tilde{N} \leq 2 \cdot (V(scalar - potential))/\pi\hbar . \approx 2 \cdot \left[V \sim 3\langle H\rangle^4 / 16\pi^2\right] / \pi\hbar \qquad (28)$$

The problem as we will outline just below, though, is that there may be effectively no way to transmit bits of information through a four dimensional continuum. To look at this, we need to consider

Connection with the directionality of time issue, for Planckian space – time

We are re duplicating part of the argument used, in order to make a point about the origins of the Bunch – Davies representation of the initial vacuum state. We note here a subtle point, i.e. if there is, in a four dimensional representation of Λ, with a temperature component, as given by Park[8], that it is then necessary for a semi classical treatment of the wavefunction of the universe, to assume, initially that the TEMPERATURE of the pre Planckian space time state, would have to be very small . The argument as presented by Beckwith and Glinka is as follows.[2]

1. Beckwith and Glinka noted in a recent publication have argued that the wave function of the universe interpretation of the Wheeler-DeWitt equation depends upon a WKB airy function, which has its argument dependent upon z. When z ~ $\left(\frac{3\pi\cdot\tilde{a}_0^2}{4G}\right)^{2/3}\cdot\left[1-\left[\frac{\tilde{a}^2}{\tilde{a}_0^2}\right]\right]\xrightarrow[\tilde{a}\to 0]{}\left(\frac{3\pi\cdot\tilde{a}_0^2}{4G}\right)^{2/3}$ right at the start of the big bang, the wave function of the universe is a small positive value, as given by Kolb and Turner [9]. Having $\tilde{a}\to 0$ corresponds to a classically forbidden region, with a Schrödinger equation of the form (assuming a vacuum energy $\rho_{Vacuum}=[\Lambda/8\pi\cdot G]$ initially), with Λ part of a closed FRW Friedman equation solution . Since we do not wish to repeat what was stated initially, the readers should review Eq. (1) to eq. (4) initially. One should note that .The vacuum energy, is for $\rho_{Vacuum}=[\Lambda/8\pi\cdot G]$, for definition of the Λ FRW metric, and is undefined for the regime $0<\tilde{a}<1/\sqrt{\Lambda/3}$. I.e. the classically undefined regions for evolution of Eq. (1) to Eq (4) are the same. The problem is this, having $\tilde{a}\to 0$ makes a statement about the existence, quantum mechanically about having a (semi classical) approximation for ψ , when in fact the key part of the solution for ψ , namely $\rho_{Vacuum}=[\Lambda/8\pi\cdot G]$ is not definable for Eq. (36) if $0<\tilde{a}<1/\sqrt{\Lambda/3}$, whereas the classically forbidden region for Eq. (1) depends upon $0<\tilde{a}<\tilde{a}_0$ where $\tilde{a}_0$ is a turning point for Eq. (3) above. Λ is undefined classically, and is a free parameter, of sorts especially in the regime $0<\tilde{a}<1/\sqrt{\Lambda/3}$. As $\tilde{a}\to 0$, unless $\Lambda\to 0$, there is no "classical" way to justify the WKB as $\tilde{a}\to 0$. $\Lambda\to 0$, according to Park in a four dimensional space time if and ONLY if, the temperature in the pre Planckian space time condition were initially equal to ZERO. I.e. if there is such a regime, it means that in an interval of space time just before the Planckian regime that two conditions would happen. For times less than a Planck time interval, the following are equivalent

1. $\Lambda_{4-Dim}\to 0$ if there is time BEFORE Planck time, i.e. 10^{-44} seconds, corresponding to an effective, for OUR universe zero temperature

2. $\rho_{Vacuum}\big|_{4-Dim}=[\Lambda_{4-Dim}/8\pi\cdot G]\to 0$

The authors argue, that in order to make the above two conditions match up, that there has to be a causal discontinuity in 5 dimensional space time , i.e. perhaps only information which can be transmitted via evolution of the Hubble parameter would pass from a prior to the present cycle. I.e. temperature, which presumably would be transferred via a higher, fifth dimension

Causal discontinuity, and Dowkers axiomatic approach to space time physics time in the aftermath of the pre Planckian space time regime 5 dimensional discontinuity

The existence of a nonlinear equation for early universe scale factor evolution introduces a de facto "information" barrier between a prior universe, which can only include thermal bounce input to the new nucleation phase of our present universe. To see this, refer to Dowker's [21] paper on causal sets. These require the following ordering with a relation $\prec$, where we assume that initial relic space-time is replaced by an assembly of discrete elements, so as to create, initially, a partially ordered set C :

(1) If $x \prec y$, and $y \prec z$, then $x \prec z$

(2) If $x \prec y$, and $y \prec x$, then $x = y$ for $x, y \quad \varepsilon \quad C$

(3) For any pair of fixed elements x and z of elements in C, the set $\{y \mid x \prec y \prec z\}$ of elements lying in between x and z is always assumed to be a finite valued set.

Items (1) and (2) show that C is a partially ordered set, and the third statement permits local finiteness. Stated as a model for how the universe evolves via a scale factor equation permits us to write, after we substitute $a(t^*) < l_P$ for $t^* < t_P =$ Planck time, and $a_0 \equiv l_P$, and $a_0 / a(t^*) \equiv 10^{\alpha}$ for $\alpha >> 0$ into a discrete equation model of a 5 dimensional model of the Friedman equation would lead to the existence of a de facto causal discontinuity in the arrow of time and blockage of information flow, once the scale factor evolution leads to a break in the causal set construction written above .[9]

CLAIM 1 : The Friedmann equation for the evolution of a scale factor $a(t)$, suggests a non partially ordered set evolution of the scale factor with evolving time, thereby implying a causal discontinuity**.** The validity of this formalism is established by rewriting the Friedman equation as follows: in 5 dimensions looking at Λ_{5-Dim} going to infinity as time goes to zero. I.e. if $\delta \cdot t$ is vanishingly small, then…[9]

$$\left[\frac{a(t^* + \delta t)}{a(t^*)}\right] - 1 < \frac{\left(\delta t \cdot l_P\right)}{\sqrt{\Lambda_{5-Dim}/3}} \cdot \left[1 + \frac{8\pi}{\Lambda_{5-Dim}} \cdot \left[(\rho_{rel})_0 \cdot 10^{4\alpha} + (\rho_m)_0 \cdot 10^{3\alpha}\right]\right]^{1/2} \xrightarrow[\Lambda 5-\dim \to \infty]{} 0 \quad . \tag{29}$$

So in the initial phases before the big bang, with a very large 5 dimensional vacuum energy and a vanishing 4 dimensional vacuum energy , the following relation, which violates (signal) causality, is obtained for any given fluctuation of time in the "positive" direction within the confines of time evolution within the pre Planckian regime[9] :

$$\left[\frac{a(t^* + \delta \cdot t)}{a(t^*)}\right] < 1 \quad . \tag{30}$$

The existence of such a violation of a causal set arrangement in the evolution of a scale factor argues for a break in information above a minimal level of complexity being propagated from a prior universe to our present universe. This has just proved non-partially ordered set evolution, by deriving a contradiction from the partially ordered set assumption.Doing this, means that in order to cement having uni directionality of the time flow itself, we would need to define a starting flow for time flow, in one direction starting at the instant of space time created by the Planckian unit of time, and not just before it. We also make a 2nd claim which will be, in five dimensions stated as follows:

CLAIM 2: The following are equivalent (In a space-time evolution sense?)

1. There exists a Reisnner-Nordstrom Metric with -F(r) dt^2 dominated by a cosmological vacuum energy term, $(-\Lambda/3)$ times dt^2, for early universe conditions in the time range less than or equal to Planck's time t_P.
2. A solution for a pseudo-time dependent version of the Wheeler De Witt equation exists, with a wave function $\Psi(r,t,T)$ forming a wormhole bridge between two universe domains, with $\Psi(r,t,T) = \Psi(r,-t,T)$ for a region of space-time before signal causality discontinuity for times $|t| < t_P$.

3. The heat flux-dominated vacuum energy value given by $\Psi(r,t,T)$ contributes to a relic graviton burst, in a region of time less than or equal to Planck's time t_P.

The third postulate of Claim 2, is in line with a minimum complexity of a structure which conceivably could transit from one universe to another.

Relevance to Octonian Quantum gravity constructions? Where does non commutative geometry come into play ?

We argue that getting by Eq. (29) and Eq. (30) are essential ingredients for starting a non commuting geometry construction of space time. Crowell [1] wrote on page 309 that in his Eq. (8.141) , namely

$$\lfloor x_j , p_i \rfloor \cong -\beta \cdot (l_{Planck} / l) \cdot \hbar T_{ijk} x_k \rightarrow i\hbar \delta_{i,j} \qquad (31)$$

Here, β is a scaling factor, while we have, above, after a certain spatial distance, a Kroniker function so that at a small distance from the confines of Planck time, we recover our quantum mechanical behavior.

Our contention is, that since Eq. (31) depends upon Energy- momentum being conserved as an average about quantum fluctuations, that if energy-momentum is violated, in part, that Eq. (31) falls apart . How Crowell forms Eq. (31) at the Planck scale depends heavily upon Energy- Momentum being conserved.[1]

Our construction VIOLATES energy – momentum conservation. Note, also, too though that N. Poplawski[6] also has a very revealing construction for the vacuum energy, and cosmological constant which we reproduce, here

$$\Lambda = \left[\frac{3\kappa^2}{16}\right] \cdot \left(\overline{\psi}\gamma_j \gamma^5 \psi\right) \cdot \left(\overline{\psi}\gamma^j \gamma^5 \psi\right) \qquad (32)$$

And

$$\rho_\Lambda = \left[\frac{3\kappa}{16}\right] \cdot \left(\overline{\psi}\gamma_j \gamma^5 \psi\right) \cdot \left(\overline{\psi}\gamma^j \gamma^5 \psi\right) \qquad (33)$$

Poplawski writes that formation of the above, is "*Such a torsion-induced cosmological constant depends on spinor fields, so it is not constant in time (it is constant in space at cosmological scales in a homogeneous and isotropic universe). However, if these fields can form a condensate then the vacuum expectation value of* (Eq. 33) *will behave like a real cosmological constant*"

Poplawski write his formulation in terms of a quark- gluon QCD based condensate. Our contention is that once a QCD style condensate breaks up, i.e. that there will still be an equivalent structure to Eq. (32) and Eq. (33) even at the beginning of inflation. However, due to the existence of a causal discontinuity structure, as referenced by Eq. (29) above, that neither momentum conservation ,and condensate formation as given by Eq. (32) and Eq. (33) are going to be remotely possible in the pre Planckian state. Once that condensate structure is not possible, partly due to causal discontinuity, as given by Eq (29) above, that neither Eq. (32) and Eq. (33) could possibly form. If Eq. (33) due to no condensate forming, then as of Eq. (8.140) of Crowell [1] , the following will not hold as before.

$$\oint p_i \, dx_k = \hbar \delta_{i,k} \qquad (34)$$

no longer holds. Eq. (8.40) of the Crowell manuscript makes the assumption is true, namely

$$\lfloor x_j , x_k \rfloor = \beta \cdot l_P \cdot T_{j,k,l} \cdot x_l \qquad (35)$$

The problem is not with Eq. (16), i.e. Crowell's [1] (8.139), it lies with Eq. (8.140) of Crowell with the final equality not necessarily holding. If one were integrating across a causal barrier,

$$\oint [x_j, p_i] dx_k \approx -\oint p_i [x_j, dx_k] = -\beta \cdot l_P \cdot T_{j,k,l} \oint p_i dx_l \neq -\hbar\beta \cdot l_P \cdot T_{i,j,k} \tag{36}$$

Very likely, across a causal boundary, between $\pm l_P$ across the boundary due to the causal barrier, one would have

$$\oint p_i \, dx_k \neq \hbar \delta_{i,k}, \oint p_i \, dx_k \equiv 0 \tag{37}$$

I.e.

$$\left. \oint_{\pm l_P} p_i dx_k \right|_{i=k} \rightarrow 0 \tag{38}$$

If so, then [1]

$$\left[x_j, p_i\right] \neq -\beta \cdot \left(l_{Planck} / l\right) \cdot \hbar T_{ijk} x_k \quad and \quad does \quad not \rightarrow i\hbar \delta_{i,j} \tag{39}$$

Eq. (39) in itself would mean that in the pre Planckian physics regime, and in between $\pm l_P$, QM no longer applies.

Conclusion: Analogue of this sort of break down via string theory language

We hope that there is confirmation of what is brought up in Eq. (6) above. Next. in Dp brane dynamics, a Dp brane action from a reduced field theory, as given by Szabo, on page 103 of his manuscript is a super symmetric Yang Mills theory on a Dp world volume, involving a Yang-Mills potential as given by [22]

$$V(\Phi) = \sum_{m \neq n} Tr\left[\Phi^m, \Phi^n\right]^2 \tag{40}$$

Here, the $N \times N$ Hermitian matrix fields can be written as, with x_i^m co ordinates giving positions of N distinct D branes in the m-th transverse dimension.

$$\Phi^m = U \cdot \; Diag\left[x_1^m, x_2^m, \ldots.., x_N^m\right] \cdot U^{-1} \tag{41}$$

The Dp branes, we argue, would have no chance of survival in a causal discontinuity regime, i.e. our next paper will discuss the break down of this sort of structure as cited by Szabo [22] . I.e. in the case of p=0, the matrices as given by Eq. (22) are giving a geometrical interpretation in terms of a necessary non commutative geometry, of the sort which breaks down, as implied by Eq. (20) above.

Our conclusion is that if Eq. (40) is true, that even in the case super symmetric matrix mechanics, that a break down down of the matrix representation of the Yang-Mills potential in terms of Eq. 41 will be to essentially invalidate the structure of instanton D0 branes (points) so one is looking at a situation where , even with super symmetry that there will be no structure duplicating non commutative geometry. Without that geometry, there is no chance, in the regime Pre Plankian space time holds that QM can be utilized. The authors are aware that even, at times, the cosmological parameters used and identified with the cosmological constant are very controversial [23], but we are confident that there is much to explore and learn from, especially about the inter relationship of classical and quantum fields, and a space time linkage between the which we expect will be better understood in the future [2] . This document is a step in that direction. The issues brought up [24] by N.E. Mavromatos_and R.J. Szabo are well done but we view them as incomplete for the reasons brought up above. Completing the analogies, and also reconciling them with Fig 1 above are worthy research objectives.

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