The Transition from Pre octonion to octonion Gravity

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Abstract

The author asks if **octonion** quantum gravity is relevant near the Planck scale. Furthermore, the question is raised if gravitational waves would be generated during the initial phase, δ_0, of the universe when an increase in degrees of freedom have in setting δ_0, so that the result can be observed by a gravitational detector.. The well appreciated .quantum gravity problem that the notion of a quantum state, representing the structure of spacetime at some instant, and the notion of the *evolution* of the state, does not get traction, since there are no real "instants", is avoided by having the initial **octonion** geometry embedded in a larger, non linear "pilot model" (semi classical) embedding structure. The Penrose suggestion of re cycled space time avoiding a 'big crunch' is picked as the embedding structure, so as to avoid the 'instants' of time issue. In addition the favored idea is to avoid the well known string theory trap known as the dimensionality problem of an equation of motion (consistency condition) which is the reason why string theory dimensionality is either (10 or 26) depending upon if super symmetry is imposed. Getting **octonion** gravity as embedded in a larger, Pilot theory embedding structure may restore Quantum Gravity to its rightful place in early cosmology without the lunacy of then afterwards 'Schrodinger equation ' states of the universe, forevermore afterwards. Setting δ_0, in a GW detector due to appropriate measurement procedures may allow the opportunity to find experimental clues as to this embedding structure in which **octonion** gravity may emerge in the Planckian regime.of evolutionary cosmology.

Key words: ***octonion* gravity, Planck scale, Pilot theory embedding structure**

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1. Introduction: What is quantum gravity ? Does Quantum Gravity have relevance to Planckian physics?

In general relativity the metric $g_{ab}(\mathbf{x}, t)$ is a set of numbers associated with each point which gives the distance to neighboring points. I.e. general relativity is a classical theory. The problem is that in quantum mechanics physical variables, either as in (QED) electric and magnetic fields have uncertainty as to their values. As is well known if one makes an arbitrary, high accuracy position measurement of a quantum particle, one has lack of specific momentum values. I.e. its velocity. In **octonion** geometry, the commutation relationships are well defined. There is though a bridge between the classical regime of space time and its synthesis leading to a quantum result. It would be appropriate to put in specific constraints. Note that as an example in gauge theories, the idea is to use ‘gauge fixing’ to remove the extra degrees of freedom. The problem is though that in quantum theory, the resulting theory, (i.e. a quantum gravity theory) may not be independent of the choice of gauge. Secondly…..

In GR, it is possible to extract a time for each solution to the Einstein equations by deparametrizing GR. Then the problem is, in quantum versions of cosmology that if space-time is quantized along these lines, the assumption (of evolving then quantizing) does not make sense in anything but an approximate way. That is, the resulting evolution does not generate a classical space-time! Rather, solutions will be wave-functions (solutions of some Schrödinger-type equation). What is being attempted HERE is to describe the limits of the quantum process so as to avoid having space time wave functions mandated to be Schrodinger clones. I.e. to restore quantum behavior as the geometric limit of specialized space time conditions.

Here is a problem. (In some approaches to canonical gravity, one fixes a time *before* quantizing, and quantizes the spatial portions of the metric only). Frankly fixing time before quantizing and then applying QM to just the spatial part is missing the point. If Quantum gravity is valid, then the commutation relationships in a definite geometric limit must hold. The paper refers to these regimes of space time where the **octonion** commutation relations DO hold. The assertion made, is that before Planck temperature is reached, i.e. there is a natural embedding of space time geometry with the **octonion** structure reached as the initial conditions for expansion of the present universe.

The premise followed in the paper is that before the Planckian regime, there are complex geometrical relationships involving quantum processes, but that the quantum processes are “hidden from view”, due to their combination. The quantum processes are not measurable, in terms of specific quantum mechanical commutation relations until Planck temperature values (very high) are reached in terms of a build up of temperature from an initially much lower temperature regime. **Appendix A** describes an embedding multi verse in terms of the present universe.

Rovelli notes (2007, p. 1304), that modeling the gravitational field as an emergent, collective variable does not imply an absence of quantum effects, and it is possible that collective variables too are governed by quantum theory. Our re statement of this idea is to say that one has quantum effects emerging in highly specialized circumstances, with collective variables behaving like squeezed states of space time matter. The **octonion** gravity regime, obeying quantum commutation behavior has its analog in simplification of collective variable treatment of a gravitational field, which becomes very quantum commutation like in its behavior in the Planck temperature limit. This paper will endeavor as to describe the emergent collective treatment of the gravitational field appropriately so **octonion** gravity is a definite limiting structure emerging in extreme temperatures and state density.

2. Now about conditions to obtain the relevant data for phase δ_0

This paper examines geometric changes that occurred in the earliest phase of the universe, leading to values for data collection of information for phase δ_0, and explores how those geometric changes may be measured through gravitational wave data. The change in geometry is occurring when we have first a pre quantum space time state, in which, in commutation relations (Crowell, 2005) in the pre Octionic space time regime no approach to QM commutations is possible as seen by.

$$\left[x_j, p_i\right] \neq -\beta \cdot \left(l_{Planck}/l\right) \cdot \hbar T_{ijk} x_k \quad and \quad does \quad not \rightarrow i\hbar\delta_{i,j} \tag{1)\_}$$

Eq. (1) is such that even if one is in flat Euclidian space, and i= j, then

$$\left[x_{j,} p_j\right] \neq i \cdot \hbar \tag{1a}$$

In the situation when we approach quantum " octonion gravity applicable" geometry, Eq. (1) becomes

$$\left[x_j, p_i\right] = -\beta \cdot \left(l_{Planck}/l\right) \cdot \hbar T_{ijk} x_k \xrightarrow[Approaching-flat-space]{} i\hbar\delta_{i,j} \tag{2}$$

Eq. (2) is such that even if one is in flat Euclidian space, and i= j, then

$$\left[x_{j,} p_j\right] = i \cdot \hbar \tag{2a}$$

.Also the phase change in gravitational wave data due to a change in the physics and geometry between regions where Eq. (1) and Eq. (2) hold will be given by a change in phase of GW, which may be measured inside a GW detector.

2a. Discussion of the geometry alteration due to the evolution from pre Planckian to Planckian regimes of space time

The simplest way to consider what may be involved in alterations of geometry is seen in the fact that in pre **octonion** space time regime (which is Pre Planckian), one would have (Crowell, 2005)

$$\left[x_j, x_i\right] \neq 0 \quad \textbf{under ANY circumstances, with low to high temperatures, or flat or curved space.} \tag{3}$$

Whereas in the **octonion** gravity space time regime where one would have Eq. (2) hold that for enormous temperature increases (Crowell, 2005)

$$\left[x_j, x_i\right] = i \cdot \left[\Theta_{ji}\right] \xrightarrow[Temp \rightarrow \infty]{} 0 \tag{4}$$

Here,

$$\Theta_{ji} \sim \Lambda_{NC}^{-2} \sim \left[\Lambda_{4-Dim}\right]^{-2} \propto 1 \big/ \left[T^{2\beta}\right] \xrightarrow[T \rightarrow \infty]{} 0 \tag{4a}$$

Specifically Eq. (1) and Eq. (3) when transformed to Eq. (2) and Eq. (4) will undergo physical geometry changes which will show up in δ_0 .The space time shift from pre Planck to the Planck epoch has gravity wave background radiation containing the imprint of the very earliest event. Next, is to consider what happens if Quantum (**octonion** geometry) conditions hold. The supposition as given by in (Lee, 2010)

Considering all these recent developments, it is plausible that quantum mechanics and gravity has information as a common ingredient, and information is the key to explain the strange connection between two.

When quantum geometry holds, as seen by Eq. (2) and Eq. (4) , GW information is loaded into the **octonion** space time regime, and then transmitted to the present via relic GW which identified via the phase shift in GW as measured in a GW detector. This phase shift is δ_0. The following flow chart is a bridge between the two regimes of (Crowell, 2005) the case where the commutators for QM hold and then again to where the commutators for QM do not hold at all.

$$\left[x_j, p_i\right] \neq -\beta\cdot\left(l_{Planck}/l\right)\cdot\hbar T_{ijk}x_k \xrightarrow[Transition-to-Planckian-regime]{} \left[x_j, p_i\right] = -\beta\cdot\left(l_{Planck}/l\right)\cdot\hbar T_{ijk}x_k \tag{5}$$

Eq.(5) above represents the transition from pre Planckian to Planckian geometry.

Also questions relating to how pre and post Planckian geometries evolve can be answered by a comparison of how entropy, in flat space geometry is linked with quantum mechanics (Lee, 2010) . Once Eq.(5) happens, Beckwith hopes to look at the signals in phase shift δ_0

$$\left[x_j, p_i\right] = -\beta\cdot\left(l_{Planck}/l\right)\cdot\hbar T_{ijk}x_k \xrightarrow[Transition-to-release-of-relic-Gravitational-waves-in-flat-space]{} Planckian - Era - Generated - GW \tag{6}$$

Lee's paper (Lee, 2010) gives the details of information theory transfer of information from initially curved space geometry to flat space. When one gets to flat space, then, by Eq. (6) one then has a release of relic GW. The readers are referred to appendix A summarizing the relevant aspects of (Lee, 2010) in connecting space time geometry (initially curved space, of low initial degrees of freedom) to Rindler geometry for the flat space regime occurring when degrees of freedom approach a maxima, initially from t > 0s up to about t <1s as outlined in an argument given in Eq. (7). One of the primary results is reconciling the difference in degrees of freedom versus a discussion of dimensions. Also, as Eq. (5) occurs, there will be a build up in the number of degrees of freedom, from a very low initial level to a higher one, as in the Gaussian mapping (Beckwith, 2010a)

$$x_{i+1} = \exp\left[-\tilde{\alpha}\cdot x_i^2\right] + \tilde{\beta} \tag{7}$$

The feed in of temperature from a low level, to a higher level is in the pre Planckian to Planckian thermal energy input as by (Beckwith, 2010a)

$$E_{thermal} \approx \frac{1}{2}k_B T_{temperature} \propto \left[\Omega_0 \breve{T}\right] \sim \tilde{\beta} \tag{8}$$

Eq. (7) would have low numbers of degrees of freedom, with an eventual Gauss mapping up to 100 to 1000 degrees of freedom, as described by (Kolb and Turner, 1990). The rest of this paper will be in describing an extension of an idea by (Penrose, 2006), by (Beckwith,2011c) which may give multiple universes as put into Eq. (8).

3. Details of the model, in terms of the VeVs used for space time evolution. How to set up cosmological inputs into our universe so as to get appropriate values of δ_0

Further elaboration is tied in with a summary of properties of a mutually unbiased basis (MUB), (Chaturvedi,2007) which is topologically adjusted to properties of flat space Rindler geometry. δ_0 .

The key point is an inter relationship between a change in MUB, from initial highly complex geometric structure, to flat space time, as a new way to quantify a phase transition, for experimentally verifiable detection of δ_0.The values of δ_0 are set by the difference between Renyi entropy (Salvail, 2009) , and a particle count version of entropy, i.e. S ~ <n>. The topological transition is due to a change in basis / geometry from the regime of Renyi entropy to entropy in a particle count version of entropy, i.e. S ~ <n> (Ng, 2008). As by (Beckwith and Glinka . 2010) (assuming a vacuum energy $\rho_{Vacuum} = [\Lambda/8\pi \cdot G]$ initially), with Λ part of a closed FRW Friedman Equation solution.

$$a(t) = \frac{1}{\sqrt{\Lambda/3}} \cosh\left[\sqrt{\Lambda/3} \cdot t\right] \tag{9}$$

to flat space FRW equation of the form (Beckwith and Glinka, 2010)

$$\left[\frac{\dot{a}}{a}\right]^2 + \frac{1}{a^2} = \frac{\Lambda}{3} \tag{10}$$

Beckwith tried inputs into the initial value of Λ as high energy fluctuations,. This $\rho_{Vacuum} = [\Lambda/8\pi \cdot G]$ links initial vacuum expectation value (VeV) behavior with the following diagram. Note that cosmology models have to be consistent with the following diagram.

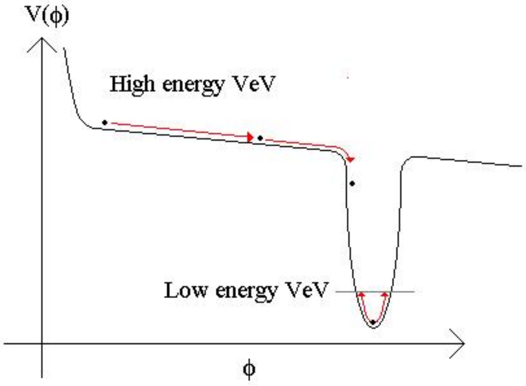

Figure 1, as supplied by (Crowell , 2010)

As stated by (Crowell,2010), the way to delineate the evolution of the VeV is to consider an initially huge VeV, due to inflationary geometry. Note by Eq. (13), (Poplawski, 2011):

$$\rho_{\Lambda} = H\lambda_{QCD} \tag{13}$$

Where λ_{QCD} is 200MeV and similar to the QCD scale parameter of the SU(3) gauge coupling constant, where H a Hubble parameter. Here if there is a relationship between Eq. (5) above and $\rho_{Vacuum} = [\Lambda / 8\pi \cdot G]$ then the formation of inputs into our vacuum expectation values $V \sim 3\langle H \rangle^4 / 16\pi^2$, and equating $V \sim 3\langle H \rangle^4 / 16\pi^2$ with V(φ) ~ φ^2 would be consistent with an inflaton treatment of inflation which has similarities to (Kuchiev and Yu, 2008). Then equate vacuum potential with vacuum expectation values as:

$$\rho_{Vacuum} = [\Lambda / 8\pi \cdot G] \approx \rho_{\Lambda} \approx H\lambda_{QCD} \Leftrightarrow V \sim 3\langle H \rangle^4 / 16\pi^2 \sim V_{\inf} \approx \phi^2 \qquad (14)$$

Different models for the Hubble parameter, H exist, and are linked to how one forms the inflaton. The author presently explore what happens to the relations as given in Eq. (14) before, during, and after inflation. **Table** 1 **below**. is how to obtain inflation.

4. First, thermal input into the new universe. In terms of vacuum energy

We will briefly allude to temperature drivers which may say something about how thermal energy will be introduced into the onset of a universe.. Begin first with (Beckwith, 2008)

$$\left|\Lambda_{5-\dim}\right| \approx c_1 \cdot \left(1/T^{\alpha}\right) \qquad (15)$$

in contrast with the traditional four-dimensional version of the same, as given by (Park, 2002)

$$\Lambda_{4-\dim} \approx c_2 \cdot T^{\beta} \qquad (16)$$

If one looks at the range of allowed upper bounds of the cosmological constant, the difference between what (Barvinsky,2006) predicted, and (Park , 2002) is:

$$\Lambda_{4-\dim} \propto c_2 \cdot T^{\beta} \xrightarrow[graviton-production-as-time>t(Planck)]{} 360 \cdot m_P^2 << c_2 \cdot \left[T \approx 10^{32} K\right]^{\beta} \qquad (17)$$

Right after the gravitons are released, one sees a drop-off of temperature contributions to the cosmological constant .Then for time values $t \approx \delta^1 \cdot t_P$, $0 < \delta^1 \le 1$ and integer n (Beckwith, 2008)

$$\frac{\Lambda_{4-\dim}}{\left|\Lambda_{5-\dim}\right|} - 1 \approx \frac{1}{n} \qquad (18)$$

Initial phases of the big bang, with large vacuum energy $\neq \infty$ and $a(t^*) \neq 0, 0 < a(t^*) << 1$, then

Table 1: Cosmological Λ in 5 and 4 dimensions (Beckwith, 2008)

Time $0 \le t << t_P$	**Time** $0 \le t < t_P$	**Time** $t \ge t_P$
$\left|\Lambda_5\right|$ undefined, $T \approx \varepsilon^+ \to T \approx 10^{32} K$	$\left|\Lambda_5\right| \approx \varepsilon^+$, $\Lambda_{4-\dim} \approx$ extremely	$\left|\Lambda_5\right| \approx \Lambda_{4-\dim}$,

$\Lambda_{4-\dim} \approx$ almost ∞	large $10^{32}K > T > 10^{12}K$	T much smaller $T \approx 10^{12}K$

Table 1 may suggest a discontinuity in the pre Planckian regime, for scale factors (Beckwith,2008).

$$\left[\frac{a\left(t^{*}+\delta t\right)}{a\left(t^{*}\right)}\right]-1<(value)\approx\varepsilon^{+}<<1 \qquad (19)$$

Furthermore, the assumption is that there is an initial fixed entropy , with $\overline{N}$ as a nucleated structure in short time interval as temperature $T_{temperature}\varepsilon\left(0^{+},10^{19}GeV\right)$ arrives. Then (Beckwith, 2010a)

$$\left[\Delta S\right]=\left[\hbar/T\right]\cdot\left[2k^{2}-\frac{1}{\eta^{2}}\left[M_{Planck}^{2}\cdot\left[\left[\frac{6}{4\pi}-\frac{12}{4\pi}\right]\cdot\left[\frac{1}{\phi}\right]^{2}-\frac{6}{4\pi}\cdot\left[\frac{1}{\phi^{2}}\right]\right]\right]\right]^{1/2}\sim n_{Particle-Count} \qquad (20)$$

If the inputs into the inflaton ϕ, as given by a random influx of thermal energy from temperature, we will see the particle count on the right hand side of Eq. (20) as a random creation of $n_{Particle-Count}$. The way to introduce the expansion of the degrees of freedom from zero to **N(T) ~ 10^2 - 10^3** is to define the classical and quantum regimes of gravity to minimize the point of the bifurcation diagram affected by quantum processes As by (Beckwith, 2010a)

$$\frac{\Delta\tilde{\beta}}{dist}\cong\left(5k_{B}\Delta T_{temp}/2\right)\cdot\frac{\overline{N}}{dist}\sim qE_{net-electric-field}\sim \textbf{change in degrees of freedom} \qquad (21)$$

Eq. (15) is the regime in which we see a thermal increase in temperature, up to the Planckian regime. If so, then we can next look at what is the feeding in mechanism from the **end of a universe, or universes**, and inputs into Eq.(14) , Eq.(15)

5 A new idea extending Penrose’s suggestion of cyclic universes, black hole evaporation, and the embedding structure our universe is contained within

Beckwith strongly suspects that there are no fewer than N universes undergoing Penrose ‘infinite expansion’ (Penrose, 2006) contained in a mega universe structure. Furthermore, each of the N universes has black hole evaporation, with the Hawking radiation from decaying black holes. If each of the N universes is defined by a partition function, called $\left\{\Xi_{i}\right\}_{i\equiv N}^{i\equiv 1}$, then there exist an information ensemble of mixed minimum information correlated as about $10^{7}-10^{8}$ bits of information per partition function in the set $\left.\left\{\Xi_{i}\right\}_{i\equiv N}^{i\equiv 1}\right|_{before}$, so minimum information is conserved between a set of partition functions per universe

$$\left.\left\{\Xi_{i}\right\}_{i\equiv N}^{i\equiv 1}\right|_{before}\equiv\left.\left\{\Xi_{i}\right\}_{i\equiv N}^{i\equiv 1}\right|_{after} \qquad (22)$$

However, there is non uniqueness of information put into each partition function $\left\{\Xi_i\right\}_{i\ \equiv N}^{i\ \equiv 1}$.

Furthermore Hawking radiation from the black holes is collated via a strange attractor collection in the mega universe structure to form a new big bang for each of the N universes represented by $\left\{\Xi_i\right\}_{i\ \equiv N}^{i\ \equiv 1}$. Verification of this mega structure compression and expansion of information with a non uniqueness of information placed in each of the N universes favors Ergodic mixing treatments of initial values for each of N universes expanding from a singularity beginning. The n_f value, will be using (Ng, 2008) $S_{entropy} \sim n_f$. . How to tie in this energy expression, as in Eq. (23) will be to look at the formation of a non trivial gravitational measure as a new big bang for each of the N universes as by $n(E_i)\cdot$ the density of states at a given energy E_i for a partition function. **(**. Poplawski**, 2011)**

$$\left\{\Xi_i\right\}_{i\ \equiv 1}^{i\ \equiv N} \propto \left\{\int_0^{\infty} dE_i \cdot n(E_i)\cdot e^{-E_i}\right\}_{i\ \equiv 1}^{i\ \equiv N}. \qquad (23)$$

Each of E_i identified with Eq.(8) above,are with the iteration for N universes (Penrose, 2006)

$$\frac{1}{N}\cdot\sum_{j=1}^{N}\Xi_j\Big|_{j-before-nucleation-regime} \xrightarrow[vacuum-nucleation-tranfer]{} \Xi_i\Big|_{i-fixed-after-nucleation-regime} \qquad (24)$$

For N number of universes, with each $\Xi_j\Big|_{j-before-nucleation-regime}$ for j = 1 to N being the partition function of each universe just before the blend into the RHS of Eq. (24) above for our present universe. Also, each of the independent universes given by $\Xi_j\Big|_{j-before-nucleation-regime}$ are constructed by the absorption of one million black holes taking in energy**. I.e. , (Penrose, 2006)**

$$\Xi_j\Big|_{j-before-nucleation-regime} \approx \sum_{k=1}^{Max}\tilde{\Xi}_k\Big|_{black-holes-jth-universe} \qquad (25)$$

6. Analysis of the action of these two mappings on the formation of Quantum gravity

In particular, in the regime where there is a build up of temperature,(Crowell, 2005) Eq. (26)

$$\oint[x_j, p_i]dx_k \approx -\oint p_i[x_j, dx_k] = -\beta\cdot l_P\cdot T_{j,k,l}\oint p_i dx_l \neq -\hbar\beta\cdot l_P\cdot T_{i,j,k} \qquad (26)$$

Very likely, across a causal boundary, between $\pm l_P$ across the boundary due to the causal barrier, one gets (Crowell, 2005)

$$\oint p_i\, dx_k \neq \hbar\delta_{i,k}, \oint p_i\, dx_k \equiv 0 \qquad (27)$$

I.e.

$$\oint_{\pm l_P} p_i dx_k\Big|_{i=k} \to 0 \qquad (28)$$

If so,(Crowell, 2005) the regime of space time, for the feed in of , prior to the introduction of QM, that Eq. (28) in itself would mean that in the pre Planckian physics regime, and in between $\pm l_p$, QM no longer applies.

7. Formal proof that increase in thermal temperatures as given in Table 1 leads to approaching quantum mechanics

We look at the (Ecker,2007) article as to how to look at the way one may have , if temperatures increase, as stated in **Table 1** above, from a low point to a higher one, for a flattening of space time. This non commutative geometry due to rising temperatures signifies conditions for the emergence of Eq. (4) to become (Crowell, 2005)

$$\lfloor x_j , p_i \rfloor \xrightarrow[Temp \to \infty]{} i\hbar\delta_{i,j} \tag{29}$$

In order to get conditions for Eq. (29) we referred to non commutative geometry breakdown (Ecker, 2007)

$$\lfloor x_j , x_i \rfloor = i \cdot \Theta_{ji} \sim i\Lambda_{NC}^{-2} \sim i \cdot \left[\Lambda_{4-Dim}\right]^{-2} \propto i / \left[T^{2\beta}\right] \xrightarrow[T \to \infty]{} 0 \tag{30}$$

When Eq. (30) goes to zero we submit that Eq. (30) is recovering quantum / Octoinian gravity. Eq. (30) above, according to the (Ecker, 2007) , page **79**, is linkable to initial violations of Lorentz invariance. The claim is that the entire argument of Eq. (30) with rising temperature is a way to understand the removal of non Euclidian space to approach Euclidian flat space. Beckwith shall next examine how this increasing temperature may lead to an explosion of the degrees of freedom present.

8. Understanding how phase shift in Gravitational waves may be affected by the transition to a causal discontinuity, and different models of emergent structure

In research work as given by (Li, and Yang, 2009), (Beckwith, 2010b) outlined in Chongquing November 2010 the following representation of amplitude, i.e. as by reading (Li, and Nang, 2009) the following case for amplitude

$$A_{\otimes} = A_{\oplus} = \breve{A} \tag{31}$$

Furthermore, first order perturbative terms of an E&M field have its components written as .(Li, and Yang, 2009)

$$\tilde{F}^{(1)}_{0\,2} = i\tilde{F}^{(1)}_{0\,1} \tag{32}$$

Secondly, there is a way to represent the" number" of transverse first order perturbative photon flux density as given in an earth bound high frequency GW detector .(Li, and Yang, 2009).

$$n_r^{(1)} = \frac{c}{2\mu_0\hbar\omega_{e^-}} \mathrm{Re}\{\ \} \tag{33}$$

$$\{\ \} = i\left(\exp\left[-i\theta\right]\right) \cdot \tilde{F}^{(1)*}_{0\,1} \cdot \left[\frac{i}{\omega_{e^-}} \cdot \left(\frac{\partial \Psi_x}{\partial y} - \frac{\partial \Psi_y}{\partial x}\right)\right] \tag{34}$$

Here the quantity $\frac{i}{\omega_{e^-}}\cdot\left(\frac{\partial\Psi_x}{\partial y}-\frac{\partial\Psi_y}{\partial x}\right)$ represents the z component of the magnetic field of a Gaussian beam used in an EM cavity to detect GW. We introduce the quantity Q, the quality factor of the detector cavity set up to observe GW, and $\breve{A}$, the experimental GW amplitude. In the simplest case, $\hat{B}_y^{(0)}$ is a static magnetic field. Then $\tilde{F}_{0\,2}^{(1)} = i\tilde{F}_{0\,1}^{(1)}$ leads to (Li, and Yang, 2009)

$$\tilde{F}_{0\,1}^{(1)} = i2\breve{A}\hat{B}_y^{(0)}Q\cdot\left[\sin\left[\frac{n\pi z}{b}\right]\right]\cdot\exp\left[i\left(-\omega_g t+\delta_0\right)\right] \tag{35}$$

The formula $E_{thermal}\approx\frac{1}{2}k_B T_{temperature}\propto\tilde{\beta}$ is a feed into ω_g provided time $t\propto$ Planck time, and set Eq. (35) with $\omega_g\sim\omega_g$ by setting up $E_{thermal}\approx\frac{1}{2}k_B T_{temperature}\approx\tilde{\beta}$. In other words, for relic GW production, a interrelationship between $\tilde{\alpha}$ and $E_{thermal}\approx\frac{1}{2}k_B T_{temperature}\propto\tilde{\beta}$ for \increases in degrees of freedom. This is a different perspective than what is normally used in analyzing what happens in a transition between initial Planck time ~ 10^{-44} seconds, and cosmological evolution up to 10^{-30} seconds The next discussion is on research done by .(Li, et al, 2003), as to identifying traces of massive gravitons. (Beckwith, 2011b)

9. Re casting the problem of GW / Graviton in a detector for “massive” Gravitons

We now turn to the problem of detection. The following discussion is based upon with the work of Dr. Li, Dr/ Beckwith, and other physics researchers in Chongqing University .(Li, et al, 2003), (Beckwith,2010b).**.** What (Li et al, 2003) have shown in 2003 which Beckwith made an extension (Beckwith, 2011b) is to obtain a way to present first order pertubative electromagnetic power flux, i.e. $\overset{(1)}{T}{}^{uv}$ in terms of a non zero four dimensional graviton rest mass, in a detector , in the presence of uniform magnetic field (Li et. al., 2003), (Beckwith, 2010b) .What if we have curved space time with an energy momentum tensor of the electro magnetic fields in GW fields as given by (Li et. al., 2003) ?

$$T^{uv} = \frac{1}{\mu_0}\cdot\left[-F^{\mu}_{\alpha}F^{\nu\alpha}+\frac{1}{4}\cdot g^{\mu\nu}F_{\alpha\beta}F^{\alpha\beta}\right] \tag{38}$$

(Li et al,2003) state that $F_{\mu\nu}=F^{(0)}_{\mu\nu}+\tilde{F}^{(1)}_{\mu\nu}$, with $\left|\tilde{F}^{(1)}_{\mu\nu}\right| << \left|F^{(0)}_{\mu\nu}\right|$ will lead to

$$T^{uv} = \overset{(0)}{T}{}^{uv}+\overset{(1)}{T}{}^{uv}+\overset{(2)}{T}{}^{uv} \tag{39}$$

The 1st term to the right side of Eq. (39) is the energy – momentum tensor of the back ground electro magnetic field, and the 2nd term to the right hand side of Eq. (39) is the first order perturbation of an electro magnetic field due to the presence of gravitational waves (Beckwith, 2011b and 2011c)

$$J_{effective}\cong n_{count}\cdot m_{4-D-Graviton} \tag{40}$$

As stated (Beckwith, 2010b and 2011b) $m_{4-D-Graviton}\sim 10^{-65}\,grams$, while n_{count} is the number of gravitons which may be in the detector sample. What Beckwith and Li intend to do is to isolate out an $\overset{(1)}{T}{}^{uv}$ assuming a non zero graviton rest mass. . I.e. use $\tilde{\beta}\cong|F|$ and make a linkage with $\overset{(1)}{T}{}^{00}$.

The term $\overset{(1)}{T}{}^{00}$ isolated out from $\overset{(1)}{T}{}^{uv}$. The point is that detected GW helps constrain Eq. (40). If this is done, the next step will be different GW measurement protocols.

$$h_0^2 \Omega_{GW} \sim 10^{-6} \tag{40a}$$

Next we note the results of using $h_0^2 \Omega_{GW} \sim 10^{-6}$ in GW measurements

10 Wavelength, sensitivity and other such constructions from Maggiore, with our adaptations and comments

We will next give several basic considerations as to early universe geometry which are appropriate as to the (Maggiore, 2000) treatment of both wavelength, strain, and Ω_{GW}.. The idea will be to look at how the ten to the tenth stretch out of generated wave length may tie in with early universe models..We want to, if $h_0 = .51 \pm .14$, understand what affects an expansion of GW wave lengths.

Table 2: Managing GW generation from Pre Planckian physics (Maggiorie, 2000), (Beckwith, 2011c)

$h_C \leq 2.82 \times 10^{-33}$	$f_{GW} \sim 10^{12}\, Hertz$	$\lambda_{GW} \sim 10^{-4}\, meters$
$h_C \leq 2.82 \times 10^{-29}$	$f_{GW} \sim 10^{8}\, Hertz$	$\lambda_{GW} \sim 10^{0}\, meters$
$h_C \leq 2.82 \times 10^{-25}$	$f_{GW} \sim 10^{4}\, Hertz$	$\lambda_{GW} \sim 10^{1}\, kilometer$
$h_C \leq 2.82 \times 10^{-23}$	$f_{GW} \sim 10^{2}\, Hertz$	$\lambda_{GW} \sim 10^{3}\, kilometer$

What Beckwith expects, (Crowell, 2011) is that initial waves, in the the Planckian regime have about $\lambda_{GW} \sim 10^{-14}\, meters$ for $f_{GW} \sim 10^{22}\, Hertz$ which would turn into $\lambda_{GW} \sim 10^{-1}\, meters$, for $f_{GW} \sim 10^{9}\, Hertz$**,** and sensitivity of $h_C \leq 2.82 \times 10^{-30}$**.** It is important to note that the $h_0^2 \Omega_{GW} \sim 10^{-6}$ is the first measurement metric which is drastically altered. h_C which is mentioned in **Eq. (40c)** is an upper bound. In reality, only the 2nd and 3rd columns in table 1 above escape being inaccurate. , since the interactions of gravitational waves / gravitons with quark – gluon plasmas deform by an order of magnitude h_C. So for table 1, the first column is an upper bound which, even if using **Eq. (40c)** is off by an order of magnitude. More seriously, the number of gravitons per unit volume of phase space is dependent upon $h_0^2 \Omega_{GW} \sim 10^{-6}$. If that is changed, **Eq. (40b)** is less valid.. Beckwith refers the readers to (Beckwith,2011c) which gives Eq. (40b) values.

The particle per phase state count is, (Maggiorie, 2000)

$$n_f \sim h_0^2 \Omega_{GW} \cdot \frac{10^{37}}{3.6} \cdot \left[\frac{1000 Hz}{f} \right]^4 \tag{40b}$$

Secondly detector strain for device physics is given by (Maggiorie, 2000)

$$h_C \leq \left(2.82\times 10^{-21}\right)\cdot\left(\frac{1Hz}{f}\right) \qquad (40c)$$

These values of strain, the numerical count, and also of n_f give a bit count and entropy which will lead to limits as to how much information is transferred. Note after the start of inflation with at the beginning of relic inflation $\lambda_{GW} \sim 10^{-1} meters \Rightarrow n_f \propto 10^{6}\, graviton/unit-phase-space$ for $f_{GW} \sim 10^{9}\, Hertz$ This is to have, say a starting point in pre inflationary physics of $f_{GW} \sim 10^{22}\, Hertz$ when $\lambda_{GW} \sim 10^{-14} meters$, i.e. a change of $\sim 10^{13}$ orders of magnitude in about 10^{-25}seconds. **The challenge will be to** come up with an input model which will justify a new data model, (Maggiorie, 2000)

11 : Providing a curve for the fifth cosmology model, as a modification / extension of the Penrose model

One can look now at the following approximate model for the discontinuity put in, due to the heating up implied in Table 1 .This is (Beckwith, 2008)

$$\frac{\Lambda_{Max} V_4}{8\cdot\pi\cdot G} \sim T^{00} V_4 \equiv \rho\cdot V_4 = E_{total} \qquad (41)$$

The approximation in this treatment is that $E_{total} \propto V(\phi)$ where we are looking at a potential energy term.(Barvinsky , 2006).What we pay attention to, is an exponential potential (Weinberg, 2008)

$$V(\phi) = g\cdot\phi^{\alpha} \qquad (42)$$

What we come up with pre, and post Planckian space time regimes, when looking at consistency of the emergent structure is the following. Namely, (Weinberg, 2008) , and (Beckwith, 2011c) ,

$$V(\varphi) \propto \phi^{|\alpha|} \quad \text{For } t < t_{PLanck} \qquad (43a)$$

Also, we would have $V(\varphi) \propto 1/\phi^{|\alpha|}$ for $t >> t_{PLanck}$ (43b)

The switch between Eq. (48a) and Eq. (48b) is not provable.. (Beckwith 2011c) designated this as the boundary of a causal discontinuity. According to (Weinberg , 2008), if $\in = \frac{\lambda^2}{16\pi G}, H = 1/\in t$ so that a scale factor behaves as

$$a(t) \propto t^{1/\in} \qquad (44)$$

Then, if (Weinberg, 2008)

$$|V(\phi)| << (4\pi G)^{-2} \qquad (45)$$

There are no quantum gravity effects . I.e., if one uses an exponential potential a scalar field could take the value of, when there is a drop from ϕ_1 to ϕ_2 for flat space geometry (Weinberg, 2008)

$$\phi(t) = \frac{1}{\lambda}\ln\left[\frac{8\pi G g \in^2 t^2}{3}\right] \tag{46}$$

Then the scale factors, from (Weinberg, 2008)

$$\frac{a(t_2)}{a(t_1)} = \left(\frac{t_2}{t_1}\right)^{1/\in} = \exp\left[\frac{(\phi_2 - \phi_1)\lambda}{2\in}\right] \tag{47}$$

The more $\frac{a(t_2)}{a(t_1)} >> 1$, then the less likely there is a tie in with quantum gravity. Note those that the way this potential is defined is for a flat , Roberson-Walker geometry, and that if $t_1 < t_{Planck}$ then Eq. (47) no longer applies, and that one is not having connection with an Octionic Gravity regime.

12. We are then going to get the following expression for the energy / frequency spread in the Penrose alternation of the big 'crunch' model

Start with working with the expression by (Beckwith, 2010b and 2011c) , i.e. Eq. (8). This is for time $\breve{T} \sim 0^+ \quad to \quad 10^{-44}$ seconds, $\Omega_{GW} \sim 10^6$ **,**and a frequency variance

$$\Omega_0 \varepsilon \left[1GHz, \; 10GHz\right] \tag{48}$$

This Eq.48) is due to $T_{temperature} \sim 10^{32}$ Kelvin at the point of generation of the discontinuity leading to a discontinuity for a signal generation as given by δ_0 at $\breve{T} \sim 10^{-44}$ seconds. This process above. is for inputs into $\left[\Omega_0 \breve{T}\right] \sim \tilde{\beta}$ The assumption is that the discontinuity, as given by δ_0 getting to temperature $T_{temperature} \sim 10^{32}$ Kelvin , for $\Omega_{GW} \sim 10^6$**,** meaning that the peak curve of frequency will be between 1 to 10 GHz for $\Omega_{GW} \sim 10^6$, with a falling value of Ω_{GW} for frequencies < 1 GHz

13: Can a researcher Find an appropriate $\overset{(1)}{T}{}^{uv}$ if one has non zero graviton rest mass?

It depends upon understanding what is meant by emergent structure, as a way to generalize what is known in mathematics as the concept of "self-organized criticality. In 2001, (Zimmermann and Voelcker, 2001) refer to a abstract mathematical self organized criticality structure. We assert that the mathematical self organized criticality structure is akin to a definition as to how Dp branes arise at the start of inflation. What is the emergent structure permitting $\oint p_i \, dx_k = \hbar \delta_{i,k}$ to hold? What is the self organized criticality structure leading to forming an appropriate $\overset{(1)}{T}{}^{uv}$ if one has non zero graviton rest mass? Answering such questions will permit us to understand how to link $\overset{(1)}{T}{}^{uv}$ in a GW detector, to $\tilde{\beta}$ in Eq. (8). The following construction is used to elucidate how a EM Gaussian beam can be used to help in isolating $\overset{(1)}{T}{}^{uv}$ in a GW detector. One of the main things to consider is resolution of the following: (Feeney, et.al., 2011) at University College London say they've found evidence of four collisions with other universes in the form of circular patterns in the cosmic microwave background. In their model, called "eternal inflation," the universe is a bubble in a much larger cosmos. This cosmos is filled with other bubbles, all of which are other universes where the laws of physics may be different from ours. As seen in Figure 3. This also echos (Smolin, **1997)**.

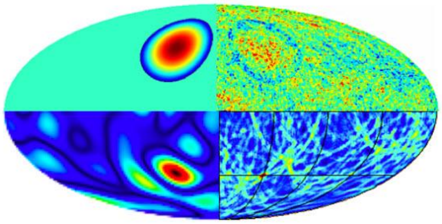

Fig 3, Based upon: First Observational Tests of Eternal Inflation (Feeney, et.al., 2011)

Chongquing university researchers are attempting to add more information than Fig (3) above, via suitable analysis of $\overset{(1)}{T}^{uv}$, (.Gurzadyan,Penrose, 2011)

14. Conclusion: In terms of the Planckian evolution, as well as the contribution into it from different universes

Analog, reality feed in from other universes may be the driving force behind the evolution of inflationary physics. We presume going to **octonion** gravity is then, quantum (Beckwith,2011c).Pre **octonion** gravity physics (analog regime of reality) features a break down of the Octionic gravity commutation relationships when one has curved space time. This corresponds, as brought up in the Jacobi iterated mapping for the evolution of degrees of freedom to a build up of temperature for an increase in degrees of freedom from 2 to over 100. Per unit volume of space time. The peak regime of where the degrees of freedom maximize is where the Octionic regime holds. Analog physics, prior to the build up of temperature can be represented by Eq. (1) and Eq. (3). The input into Eq. (1) and Eq. (3) is Eq. (24) which is an ergodic mapping, from many universes into our own present universe. This mapping requires a deterministic quantum limit as similar to what (t'Hooft , 2006) .Theoretically, inputs into Eq. (1) and Eq. (3) await experimentally falsifiable experiments . If what the author suspects, i.e. ergodic characteristics may be leading to a feed into Eq. (1) and Eq. (3) due to Eq. (24). We want verification of Eq. (24). This is what (Woods, et. al. , 2011) are attempting to do.

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Appendix A: Highlights of J.-W. Lee's paper

The following formulation is to highlight how entropy generation blends in with quantum mechanics, and how the break down of some of the assumptions used in Lee's paper coincide with the growth of degrees of freedom. What is crucial to Lee's formulation, is Rindler geometry, not the curved space formulation of initial universe conditions.. First of all. (Lee, 2010),

"Considering all these recent developments, it is plausible that quantum mechanics and gravity has information as a common ingredient, and information is the key to explain the strange connection between two. If gravity and Newton mechanics can be derived by considering information at Rindler horizons, it is natural to think quantum mechanics might have a similar origin. In this paper, along this line, it is suggested that quantum field theory (QFT) and quantum mechanics can be obtained from information theory applied to causal (Rindler) horizons, and that quantum randomness arises from information blocking by the horizons

To start this we look at the Rindler partition function, as by (Lee, 2010)

$$Z_R = \sum_{i=1}^{n} \exp\left[-\beta H(x_i)\right] = Trace \cdot \left(\exp\left[-\beta H\right]\right) \qquad \text{(A.1)}$$

As stated by Lee [48] , ..*we expect* Z_R *to be equal to the quantum mechanical partition function of a particle with mass* m *in Minkowski space time*. Furthermore, there exists the datum that: Lee made an equivalence between Eq. (A1) and (Lee, 2010)

$$Z_Q = N_1 \int \wp x \cdot \exp\left[\frac{-i}{\hbar} \cdot I(x_i)\right] \qquad \text{(A2)}$$

Where $I(x_i)$ is the action 'integral' for each path x_i, leading to a wave function for each path x_i

$$\psi \sim \exp\left[\frac{-i}{\hbar} \cdot I(x_i)\right] \qquad \text{(A3)}$$

If we do a rescale $\hbar = 1$, then the above wave equation can lead to a Schrodinger equation,

The example given by (Lee , 2010) is that there is a Hamiltonian for which

$$H(\phi) = \int d^3 x \cdot \left\{ \frac{1}{2} \cdot \left(\frac{\partial \phi}{\partial t}\right)^2 + \frac{1}{2} \cdot (\nabla \phi)^2 + V(\phi) \right\} \qquad \text{(A4)}$$

Here, V is a potential, and ϕ can have arbitrary values before measurement, and to a degree, Z represent uncertainty in measurement. In Rindler co-ordinates, $H \to H_R$, in co-ordinates (η, r, x_2, x_3) with proper time variance $ard\eta$ then

$$H_R(\phi) = \int drdx_{\perp} ar \cdot \left\{ \frac{1}{2} \cdot \left(\frac{\partial \phi}{\partial r}\right)^2 + \frac{1}{2} \cdot \left(\frac{\partial \phi}{ar\partial \eta}\right)^2 + \frac{1}{2} \cdot (\nabla_{\perp} \phi)^2 + V(\phi) \right\} \qquad \text{(A5)}$$

Here, the $\perp$ is a plane orthogonal to the (η, r) plane. If so then

$$Z = tr \exp\left[-\beta H\right] \mapsto Z_R = tr \exp\left[-\beta H_R\right] \qquad \text{(A6)}$$

Now, for the above situation, the following are equivalent

1. Z_R thermal partition function is from information loss about field beyond the Rindler Horizon
2. QFT formation is equivalent to purely information based statistical treatment suggested in this paper
3. QM emerges from information theory emerging from Rindler co-ordinate

Lee also forms a Euclidian version for the following partition function, if $I_E(x_i)$ is the Euclidian action for the scalar field in the initial frame. I.e.

$$Z_Q^E = N_1 \int \wp x \cdot \exp\left[\frac{-i}{\hbar} \cdot I_E(x_i)\right] \qquad \text{(A7)}$$

There exist analytic continuation of $\tilde{t} \mapsto it$ leading to $Z_Q^E \mapsto Z_Q =$ Usual zero temperature QM partition function of Z_Q for ϕ fields.

Important Claim: The following are equivalent

1. Z_R and Z_Q are obtained by analytic continuation from Z_Q^E
2. Z_R and Z_Q are equivalent .

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