Is Nature continuous or discrete, and how can these two conceptions be reconciled?

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Abstract

Our contention, is that reality is actually analog, but that at a critical limit, as when the Octonian gravity condition kicks in, that for a time it appears discrete. This due to al phase transition at the start of the big bang. Our second consideration is, that symmetry breaking models, i.e. the Higgs boson are not necessary for the formation of particles with mass just before Octonionic gravity, arise in pre Planckian physics models without a potential. Finally, the necessity of potentials for pre Octonionic gravity physics can be circumvented via Sherrer k essence physics.

Introduction

The following presentation takes note of several developments. First,a feed into cosmological vacuum energy has been modeled, and that this paper shows how to inter relate four and five dimensional vacuum energies. Secondly, a mechanism for the onset of Octonian gravity is when there is build up of a peak space time temperature for the inception of quantum gravity, at the time space time flattens. The onset of pre Octonionic gravity, with tiny masses associated with gravitons, is in line with Quantum mechanics as embedded within a larger, non linear classical theory Thirdly, the paper defines a transition from curved space time , pre Octonian gravity , ie. involving a transition from a non quantum state, to a quantum state. This non quantum state to quantum state transformation can be shown to be due to a chaotic mapping.
The physics of what we will be working with is summarized as follows:
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Vacuum energy , sources and commentary

Begin first with looking at different value of the cosmological vacuum energy parameters, in four and five dimensions [1]

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

in contrast with the more traditional four-dimensional version of the same, minus the minus sign of the brane world theory version. as given by Park (2003) [2]

$$\Lambda_{4-\dim} \approx c_2 \cdot T^{\beta} \tag{2}$$

If one looks at the range of allowed upper bounds of the cosmological constant, the difference between what Barvinsky (2006) [3] recently predicted, and Park (2003) [2] is:

$$\Lambda_{4-\dim} \propto c_2 \cdot T^{\beta} \xrightarrow[graviton-production-as-time>t(Planck)]{} 360 \cdot m_P^2 << c_2 \cdot \left[T \approx 10^{32} K\right]^{\beta} \tag{3}$$

Right after the gravitons are released, one still sees a drop-off of temperature contributions to the cosmological constant .Then one can write, for small time values $t \approx \delta^1 \cdot t_P, 0 < \delta^1 \le 1$ and integer n [4]

$$\frac{\Lambda_{4-\dim}}{\left|\Lambda_{5-\dim}\right|} - 1 \approx \frac{1}{n} \tag{4}$$

If there is an order of magnitude equivalence between such representations, there is a quantum regime of gravity consistent with fluctuations in energy and growth of entropy. The significance of Eq (4) is that at very high temperatures, it re enforces what the author brought up with Tigran Tchrakian, in Bremen,[5]. When one has, especially for times $t_1, t_2 <$ Planck time t_P and $t_1 \neq t_2$, with temperature $T(t_1) \neq T(t_2)$, then $\Lambda_4(t_1) \neq \Lambda_4(t_2)$. I.e., in the regime of high temperatures, one has $T(t_1) \neq T(t_2)$ for times $t_1, t_2 <$

Planck time t_P and $t_1 \neq t_2$, such that gauge invariance necessary for soliton stability is broken [5]. That breaking of instanton stability due to changes of $\Lambda_4(t_1) \neq \Lambda_4(t_2)$ will be where we move from an embedding of quantum mechanics in an analog reality, to the quantum regime. This involves Renyi [6] and Ng [7] entropy

Table 1. Outline of the relevant steps as to the cosmology involved in this article.

Time	**Main event**	**Role of gravitons**	**Entropy**
Time before 10^{-44} sec	Pre Octionic . Quantum physics embedded in a t'Hooft deterministic structure. QM commutation relations do not hold .	" Massive gravitons" formed, from t'Hooft deterministic structure. Formed and are stable, not unstable.	Renyi entropy
Time about 10^{-44} sec	Octionic , quantum gravity formed, in Planckian space time. QM . Where commutation relations of gravity hold.	Stretching of gravitons 14 orders of magnitude in wave length. To relic HFGW frequency range of about 10 GHz	Y. Ng entropy , ie. S ~ n, i.e. counting algorithm. Regime where Ng "infinite quantum statistics" hold
Time 1 billion years ago	Re acceleration of universe due to "massive gravitons" being effective DE	Gravitons act like effective Dark Energy	More counting entropy, but done per unit phase space of space time./
Time up to collapse of universe, due to millions of black holes. Many billions of years ahead in the future.	Formation of ergodic mapping , of material from one million black holes Into N different cosmologies. NO big crunch. No cyclic behavior in terms of universe spatially collapsing .	Gravitons are de facto information carriers	Unknown . Should be configured as to re absorption of black hole entropy and its connections to Renyi entropy later.

What leads to causal discontinuity in scale factor evolution?

The Friedmann equation [8], for the evolution of a scale factor $a(t)$,

$$(\dot{a}/a)^2 = \frac{8\pi G}{3}\cdot\left[\rho_{rel} + \rho_{matter}\right] + \frac{\Lambda}{3} \tag{5}$$

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: $a(t^*) < l_P$ for $t^* < t_P$ =Planck time, and $a_0 \equiv l_P$, [9]

$$\left[\frac{a(t^* + \delta t)}{a(t^*)}\right] - 1 < (value) \tag{6}$$

Leading to

$$\left(\frac{\delta t \cdot \left[l_P / a(t^*)\right]}{\sqrt{3/8\pi}}\right) \cdot \sqrt{\frac{(\rho_{rel})_0 a_0^4}{a^4(t^*)} + \frac{(\rho_m)_0 a_0^3}{a^3(t^*)}} \approx \varepsilon^+ << 1 \qquad (6a)$$

So in the initial phases of the big bang, with large vacuum energy $\neq \infty$ and $a(t^*) \neq 0, 0 < a(t^*) << 1$, the following relation, which violates (signal) causality, is obtained for small fluctuation $a(t^*) < l_P$ If we examine what happens with $|\Lambda_{5-\dim}| \sim c_2 T^{-\beta}$

Cosmological Λ in 5 and 4 dimensions [4]- Table 2

Time $0 \le t << t_P$	**Time** $0 \le t < t_P$	**Time** $t \ge t_P$	**Time** $t > t_P \rightarrow$ **today**
$\|\Lambda_5\|$ undefined, $T \approx \varepsilon^+ \rightarrow T \approx 10^{32} K$ $\Lambda_{4-\dim} \approx$ almost ∞	$\|\Lambda_5\| \approx \varepsilon^+$, $\Lambda_{4-\dim} \approx$ extremely large $10^{32} K > T > 10^{12} K$	$\|\Lambda_5\| \approx \Lambda_{4-\dim}$, T much smaller than $T \approx 10^{12} K$	$\|\Lambda_5\| \approx$ huge, $\Lambda_{4-\dim} \approx$ constant , $T \approx 3.2K$

For times $t > t_P \rightarrow$ today, a stable instanton is assumed, along the lines brought up by t'Hooft [7], due to the stable $\Lambda_{4-\dim} \approx$ constant ~ small value, roughly at the value given today. The supposition is that the value of N is actually proportional to a numerical graviton density we will refer to as <n>., provided that there is a bias toward HFGW

Consider now what could happen with a phenomenological model bases upon the following inflection point i.e. split regime of different potential behavior

$$V(\phi) = g \cdot \phi^{\alpha} \qquad (13)$$

What we come up with pre, and post Planckian space time regimes, when looking at consistency of emergent structure is the following. Adjusting Weinberg we have [10] . if we modify what Weinberg did.

$$V(\varphi) \propto \phi^{|\alpha|} \quad \text{for } t < t_{PLanck} \qquad (14)$$

Also, we would have

$$V(\varphi) \propto 1/\phi^{|\alpha|} \quad \text{for } t >> t_{PLanck} \qquad (15)$$

The switch between Eq. (14) and Eq. (15) is not justified analytically.. Beckwith designates this as the boundary of a causal discontinuity. According to Weinberg [10] , if $\in = \frac{\lambda^2}{16\pi G}, H = 1/\in t$ one has a scale factor behaving as [10]

$$a(t) \propto t^{1/\in} \qquad (16)$$

Then, if [10]

$$|V(\phi)| << (4\pi G)^{-2} \qquad (17)$$

there are no quantum gravity effects . I.e when there is a drop in a field from ϕ_1 to ϕ_2 for flat space geometry and times t_1 to t_2 [10]

$$\phi(t) = \frac{1}{\lambda}\ln\left[\frac{8\pi G g \in^2 t^2}{3}\right] \tag{18}$$

Then scale factors, from Planckian time scale as [10]

$$\frac{a(t_2)}{a(t_1)} = \left(\frac{t_2}{t_1}\right)^{1/\in} = \exp\left[\frac{(\phi_2 - \phi_1)\lambda}{2\in}\right] \tag{19}$$

The more $\frac{a(t_2)}{a(t_1)} >> 1$, then the less likely there is a tie in with quantum gravity. Note if this is for a flat , Roberson-Walker geometry, and if $t_1 < t_{Planck}$ then Eq. (11) no longer applies

Increase in degrees of freedom in the sub Planckian regime.

Starting with [11], [12]

$$E_{thermal} \approx \frac{1}{2} k_B T_{temperature} \propto \left[\Omega_0 \breve{T}\right] \sim \tilde{\beta} \tag{21}$$

The assumption is that there is an initial fixed entropy arising, with $\overline{N}$ as a nucleated structure arising in a short time interval as temperature $T_{temperature}\varepsilon\left(0^+, 10^{19}GeV\right)$ arrives. Then by [11], [12]

$$\frac{\Delta\tilde{\beta}}{dist} \cong \left(5k_B \Delta T_{temp}/2\right)\cdot\frac{\overline{N}}{dist} \sim qE_{net-electric-field} \sim \left[T\Delta S/dist\right] \tag{22}$$

The parameter, as given by $\Delta\tilde{\beta}$ is used to define chaotic Gaussian mappings. Candidates as to an inflaton potential would be in powers of the inflation, i.e. in terms of ϕ^N, with N=4 ruled out, and N=2 an admissible candidate (chaotic inflation). For N = 2, one gets [11], [12]

$$\left[\Delta S\right] = \left[\hbar/T\right]\cdot\left[2k^2 - \frac{1}{\eta^2}\left[M^2_{Planck}\cdot\left[\left[\frac{6}{4\pi} - \frac{12}{4\pi}\right]\cdot\left[\frac{1}{\phi}\right]^2 - \frac{6}{4\pi}\cdot\left[\frac{1}{\phi^2}\right]\right]\right]\right]^{1/2} \sim n_{Particle-Count} \tag{23}$$

This above is in part of fact about the same as what Ng did, 2006, in units of phase space [7]:

$$S_{Phase-Space} \sim n_{Phase-space-particle-count} \tag{23a}$$

If the inputs into the inflaton, as given by ϕ^2 becomes from Eq. (18)a random influx of thermal energy from temperature, we will see the particle count on the right hand side of Eq. (23) above a random creation of $n_{Particle-Count}$. The way to introduce the expansion of the degrees of freedom from nearly zero to having **N(T)~ 10³** is to 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.[11] If we suppose smoothness of space time structure to a grid size of $l_{Planck} \sim 10^{-33}$ centimeters at the start of inflationary expansion we have what would be needed to look at the maximum point of contraction, setting at $l_{Planck} \sim 10^{-33}$ centimeters the quantum 'dot' or infometron, as a 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 employed right 'after' evolution through the 'quantum dot' regime. The diagram, would look like an application of the Gauss mapping of [11].[12]

$$x_{i+1} = \exp\left[-\tilde{\alpha}\cdot x_i^2\right] + \tilde{\beta} \tag{24}$$

Now that we have a model as to a change in space time geometry, let us consider what happen during the Higgs mechanism and why it does not apply in very early universe geometry

Higgs Mechanism, in the onset of inflation. I.e. why it could break down

Let us begin first with a U(1) gauge theory, the Fermion ψ would transform locally [13]

$$\psi \to \psi' = \left(\exp\left[-ig\vartheta \cdot q(x)\right]\right)\cdot \psi \tag{25}$$

A way to allow for the mass to be factored in, i.e. look at $\phi \to \phi' = \left(\exp\left[-ig\vartheta \cdot q(x)\right]\right)\cdot \phi$, and then

$$\varsigma(\phi) = iD^{\varpi}\phi^{+}D_{\mu}\phi - \frac{1}{2}\mu^{2}\phi^{+}\phi - \frac{1}{4}\lambda\left(\phi^{+}\phi\right)^{2} \tag{26}$$

If $\mu^2 < 0$, the potential has a minimum, with $\langle \phi^{+}\phi \rangle = v^2 = -\mu^2/\lambda > 0$, with a VeV $\langle \phi \rangle = v$. Then

$$\phi = (\eta + v)\exp\left[i\sigma / v\right] \tag{27}$$

As stated a kinetic energy term for the scalar field, $g^2 v^2 A^{\mu}A_{\mu} \subset D^{\mu}\phi^{+}D_{\mu}\phi$ is such that a mass term may exist. Now as to why this procedure breaks down. A scalar field will no longer be massless if the following step is taken, namely an explicit symmetry breaking term $m^2\left(\phi\phi + \phi^{*}\phi^{*}\right)$ will allow a scalar field ϕ to be expanded about a VeV $\langle \phi \rangle = v$ with

$$\phi = (\eta + v)\exp\left[i\sigma / v\right] \sim \eta + v + i\sigma - \sigma^2/2v \tag{28}$$

so that the mass of σ is m^2, with σ a pseudo nambu goldstone boson. If one has VeVs, then [13]

$$SU(5) \to SU(4)\times U(1) \Rightarrow \langle \phi \rangle = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & -4 \end{pmatrix} \tag{29}$$

$$SU(5) \to SU(3)\times SU(2)\times U(1) \Rightarrow \langle \phi \rangle = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & -3/2 & 0 \\ 0 & 0 & 0 & 0 & -3/2 \end{pmatrix} \tag{30}$$

In the case of when the VeV is congruent with a broken symmetry potential, as of the form $m^2\left(\phi\phi + \phi^{*}\phi^{*}\right)$, which no longer exists in the situation where one is looking at k essence inflation, The main point why the Higgs paradigm may break down is that emergent structure is formulated without a broken symmetry potential $m^2\left(\phi\phi + \phi^{*}\phi^{*}\right)$.

How to have particle formation without a broken symmetry potential. Use of Sherrer k Esesence

In particular, the situation to watch is the k essence scenario . So we have a small growth of density perturbations' [14], [15]

$$C_S^2 \cong \frac{1}{1 + 2\cdot\left(X_0 + \tilde{\varepsilon}_0\right)\cdot\left(1/\tilde{\varepsilon}_0\right)} \equiv \frac{1}{1 + 2\cdot\left(1 + \dfrac{X_0}{\cdot\tilde{\varepsilon}_0}\right)} \tag{31}$$

if we have a small contribution w.r.t. time variation, but a large spatial variation of phase

$$\left|X_0\right| \approx \frac{1}{2}\cdot\left(\frac{\partial\phi}{\partial x}\right)^2 >> \tilde{\varepsilon}_0 \tag{31b}$$

$$0 \le C_S^2 \approx \varepsilon^+ << 1 \tag{32}$$

and

$$w \equiv \frac{p}{\rho} \cong \frac{-1}{1-4\cdot\left(X_0+\tilde{\varepsilon}_0\right)\cdot\left(\frac{F_2}{F_0+F_2\cdot\left(\tilde{\varepsilon}_0\right)^2}\cdot\tilde{\varepsilon}_0\right)} \approx 0 \tag{33}$$

We get values for phase being a 'box' of height scaled to about $2\cdot\pi$ and width $\boldsymbol{L}$. Obtained by [16]

$$\phi \approx \pi\cdot\left[\tanh b\cdot(x+L/2)-\tanh b\cdot(x-L/2)\right] \tag{34}$$

This means that initial conditions are in line with the equation of state conditions for a cosmological constant but near zero effective sound speed . So,

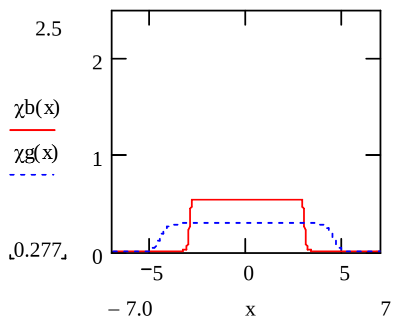

Fig 1

Evolution of the phase from a thin wall approximation to a thicker wall approximation with increasing L between S-S' instanton componets. The 'height' drops and the 'width' L increases corresponds to evolution of the thin wall approximation. This is in tandem with a 'potential' system to the chaotic scalar ϕ^2 *potential system of Guth***[17].** **t***he 'hill' flattens, the physical system approacsed cosmological constant behavior.*

This is occurring in the regime in which Octonian gravity initially does not apply and which eventually it does apply. So, let us look at the following

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

Crowell [18] wrote on page 309 that in his Eq. (8.141), namely

$$\left[x_j, p_i\right] \cong -\beta\cdot\left(l_{Planck}/l\right)\cdot\hbar T_{ijk}x_k \to i\hbar\delta_{i,j} \tag{36}$$

Here, β is a scaling factor, while we have, above, a Kroniker function so that at a small distance from the confines of Planck time, we recover quantum mechanical behavior. Our contention is, that since Eq. (36)

depends upon Energy- momentum being conserved as an average about quantum fluctuations, that if energy-momentum is violated that Eq. (36) falls apart. How Crowell forms Eq. (36) at the Planck scale depends heavily upon Energy- Momentum being conserved.[18] Our construction VIOLATES energy – momentum conservation. N. Poplawski[19] also has a revealing construction for vacuum energy, and cosmological constant reproduced here

$$\Lambda = \left[\frac{3\kappa^2}{16}\right]\cdot\left(\overline{\psi}\gamma_j\gamma^5\psi\right)\cdot\left(\overline{\psi}\gamma^j\gamma^5\psi\right) \text{ And } \rho_\Lambda = \left[\frac{3\kappa}{16}\right]\cdot\left(\overline{\psi}\gamma_j\gamma^5\psi\right)\cdot\left(\overline{\psi}\gamma^j\gamma^5\psi\right) \tag{37}$$

Poplawski [19],write his formulation of a quark- gluon QCD based condensate. Our contention is that once a QCD style condensate breaks up there will afterwards be NO equivalent structure to Eq. (37) and Eq. (38) even at the beginning of inflation. Once that condensate structure is not possible then by Eq. (8.140) of Crowell non flat space has a geometric non-commutativity protocol which is delineated by the following spatial relationship. When Eq. (38) goes to zero, we recover the regime in which quantum mechanics holds.

$$\left[x_j, x_k\right] = \beta \cdot l_P \cdot T_{j,k,l} \cdot x_l \tag{38}$$

Does the (QCD) condensate occur post plankian, and not work for pre plankian regime ? Yes. The problem lies with Eq. (8.140) of Crowell [18] .If one integrates across a causal barrier,

$$\oint [x_j, p_i]dx_k \approx -\oint p_i[x_j, dx_k] = -\beta \cdot l_P \cdot T_{j,k,l} \oint p_i dx_l \neq -\hbar\beta \cdot l_P \cdot T_{i,j,k} \tag{39}$$

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

$$\oint p_i\, dx_k \neq \hbar\delta_{i,k}, \oint p_i\, dx_k \equiv 0 \tag{40}$$

I.e.

$$\left.\oint_{\pm l_P} p_i dx_k\right|_{i=k} \to 0 \tag{41}$$

If so,[18]

$$\left[x_j, p_i\right] \neq -\beta \cdot \left(l_{Planck}/l\right)\cdot \hbar T_{ijk} x_k \quad and \quad does \quad not \to i\hbar\delta_{i,j} \tag{42}$$

Eq. (42) in itself would mean that in the pre Planckian physics regime, and in between $\pm l_P$, QM no longer applies. What we will do is determining where Eq. (44) no longer holds via experimental data **.**

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

$\left[x_j, x_i\right] \neq 0$ **under ANY circumstances, with low to high temperatures, or flat or curved space.** (43)

Whereas in the Octionic gravity space-time regime,Eq(44) implies that for enormous temperature increases (Crowell, 2005)

$$\left[x_j, x_i\right] = i\cdot\Theta_{ji} \sim i\Lambda_{NC}^{-2} \sim i\cdot\left[\Lambda_{4-Dim}\right]^{-2} \propto i/\left[T^{2\beta}\right] \xrightarrow[T\to\infty]{} 0 \quad \text{, i.e.}$$
$$\left[x_j, x_i\right] = i\cdot\left[\Theta_{ji}\right] \xrightarrow[Temp\to\infty]{} 0 \tag{44}$$

Which is more specifically in flat space leading to the regime of

$$\left[x_j, p_i\right] = -\beta\cdot\left(l_{Planck}/l\right)\cdot\hbar T_{ijk} x_k \xrightarrow[Transition-to-release-of-relic-Gravitational-waves-in-flat-space]{} Planckian-Era-Generated-GW \tag{45}$$

Beckwith [20] shows how the change in geometry implied by Eq. (45)could be measured by the initial phase, δ_0, of relic GW in a detector. The regime of deterministic quantum mechanics, as given by t'Hooft, [21] would be when Eq. (46)was not zero. When Eq. (44)approaches zero, then Quantum Mechanics DOES hold. The regime of deterministic embedding of quantum physics as given by (t'Hooft,[21] then does not hold. Next is to consider what happens if quantum (Octionic geometry) conditions hold . See Eq. (46).

$$\lfloor x_j , p_i \rfloor \neq -\beta \cdot (l_{Planck} / l) \cdot \hbar T_{ijk} x_k \xrightarrow[Transition-to-Planckian-regime]{} \lfloor x_j , p_i \rfloor = -\beta \cdot (l_{Planck} / l) \cdot \hbar T_{ijk} x_k \quad (46)$$

Table 3, the three regimes of application of different commutation relatioships

Pre Octionic. Time before a Planck time interval 10 ^ -44 seconds	**No quantum commutation relationships. Regime of t'Hooft embedding of quantum mechanics in a higher dimensional theory. There are 2 degrees of freedom. Low initial temp.**	**Template formed from re done Penrose cosmology from multiple universes . I.e. one does not have "something from nothing"**
Octionic. Time about 10 ^ - 44 seconds	**Quantum commutation relations , likely in curved space time. Evolution approaching least 100 degrees of freedom in space time. Sharp temperature increase.**	**Template formed from Pre Octionic space time.**
Post Octionic. Time after 10 ^ - 44 seconds to today.	**Quantum commutation relations, in flat space . 100 degrees of freedom in space time. Temp. decreases.**	**Template formed from Octionic space time.**

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' [22] and all these are 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, we can call $\{\Xi_i\}_{i \equiv N}^{i \equiv 1}$, then there exist an information minimum ensemble of mixed minimum information roughly correlated as about $10^7 - 10^8$ bits of information per partition function in the set $\{\Xi_i\}_{i \equiv N}^{i \equiv 1}\Big|_{before}$, so minimum information is conserved between a set of partition functions per each universe

$$\{\Xi_i\}_{i \equiv N}^{i \equiv 1}\Big|_{before} \equiv \{\Xi_i\}_{i \equiv N}^{i \equiv 1}\Big|_{after} \quad (49)$$

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

Verification of this mega structure compression and expansion of information with a non unique venue 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. I.e. start with Alcubierre's formalism about energy flux, assuming a solid angle for energy distribution Ω for energy flux to travel through. [23], [24]

$$\frac{dE}{dt} = [\lim r \to \infty] \left[\frac{r^2}{16\pi} \right] \oint \left| \int_{-\infty}^{t} \Psi_4 dt' \right|^2 \cdot d\Omega \quad (50)$$

The expression Ψ_4 is a Weyl scalar which we will, before the electro weak phase transition, assume no time dependence of both h^+ and h^x and that initially $h^+ \approx h^x$, so as to initiate Ψ_4 as

$$\Psi_4 \cong -\frac{1}{4}\cdot\left[+\partial_r^2 h^+\right]\cdot\left(-1+i\right) \quad (51)$$

The upshot, is that the initial energy flux about the inflationary regime would lead to [23],[24] an initial energy flux at the onset of inflation .

$$E_{initial-flux} \cong \left[\frac{r^2}{64\pi}\right]\cdot\left|+\partial_r^2 h^+\right|^2\cdot\left[\tilde{n}\cdot t_{Planck}\right]^3\cdot\Omega_{effective} \quad (52)$$

Inputs into both the expression $\left|\partial_r^2 h^+\right|$, as well as $\Omega_{effective}$ will be done later in modeling. The derived value of $\Omega_{effective}$ as well as $E_{initial-flux}$ will be tied into a way to present energy per graviton, as a way of obtaining n_f . The n_f value, will be used to algorithm of [7]. $S_{entropy} \sim n_f$ . . How to tie in this energy expression, as in Eq. (51) will be to look at the formation of a non trivial gravitational measure which we can state as a new big bang for each of the N universes as by [23],**[24]** and $n(E_i)\cdot$ the density of states at a given energy E_i for a partition function. **[23],[24],l [25]**

$$\left\{\Xi_i\right\}_{i\equiv 1}^{i\equiv N} \propto \left\{\int_0^\infty dE_i\cdot n(E_i)\cdot e^{-E_i}\right\}_{i\equiv 1}^{i\equiv N}. \quad (53)$$

Each of the terms E_i would be identified with Eq.(52) above, with the following iteration for N universes

$$\frac{1}{N}\cdot\sum_{j=1}^{N}\Xi_j\Big|_{j-before-nucleation-regime} \xrightarrow[vacuum-nucleation-tranfer]{} \Xi_i\Big|_{i-fixed-after-nucleation-regime} \quad (54)$$

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. (54) above for our present universe. Also, each of the independent universes given by $\Xi_j\Big|_{j-before-nucleation-regime}$ would be constructed by the absorption of one million black holes sucking in energy**. I.e. in the end**

$$\Xi_j\Big|_{j-before-nucleation-regime} \approx \sum_{k=1}^{Max}\tilde{\Xi}_k\Big|_{black-holes-jth-universe} \quad (55)$$

One can treat Eq. (54) as a de facto Ergodic mixing of prior universes to a present universe, with the partition function of each of the universes defined by Eq. (53) above. Filling in the inputs into Eq. (53) to Eq. (55) is what will be done in the months ahead.

Conclusion: Several reasons for the Analog nature of reality with digital a sub set of a larger Analog basis

We wish to summarize what we have presented in an orderly fashion. Doing so is a way of stating that Analog, reality is the driving force behind the evolution of inflationary physics

a) Pre Octonian gravity physics (analog regime of reality) features a break down of the Octonian 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 out is where the Octonian regime holds. Corresponding to Octonian gravity, when one has flat space, after a significant increase in temperature.**

b) Analog physics, prior to the build up of temperature can be represented by the mappings given by Eq. (54) and Eq. (55) . The first of these mappings is an ergotic mapping , a perfect mixing regime from many universes into our own present universe. This mapping requires a deterministic quantum limit as similar to what tHooft included in his embedding of Quantum physics in a larger, non linear theory [21]. This is approximated by current Pilot model build up of an embedding of QM within a more elaborate super structure.

c) **The types of discontinuities presented, in Eq. (42), etc. are ways to show [26],[27],given** only $\eta \neq 0, \varepsilon \to \infty$, instead of $\eta \to 0^{+}$, with **the later case designating when entropy vanishes, which would correspond to no information from prior universes being transferred. I.e. non zero viscosity corresponding to, with almost infinite energy, of when the approach to Octonionic gravity occurs. The other case when viscosity vanishes would be tantamount to when no information is exchanged.**

Understanding the nature of the ergotic mapping in Eq. (53) and Eq. (54) would allow for a rigorous understanding of **the necessity of** $\left|\frac{\eta}{s} \approx \varepsilon^{+}\right| << \frac{1}{4\pi}$ giving only $\eta \neq 0, \varepsilon \to \infty$, instead of $\eta \to 0^{+}$ for determining how K essence physics can contribute to emergent structure. In doing so, we see first Analog physics in pre Planckian space time, then, briefly the formation of Digital reality he following table contains frequency ranges of what should be considered as far as ranges of data to how to fill in Table 3. This assumes a uniform metric of

$$h_0^2 \Omega_{GW} \sim 10^{-6} \tag{56}$$

Next, we will commence to note the difference and the variances from using $h_0^2 \Omega_{GW} \sim 10^{-6}$ as a unified measurement which will be in the different models discussed **.** We will next give several of our considerations as to early universe geometry which we think are appropriate as to Maggiore's [27]treatment of both wavelength, strain, and Ω_{GW} . To begin with , look at Maggiore's Ω_{GW} formulation, strain, which ties in with the ten to the 14 power increase as to wave length from pre Planckian physics to 1-10 GHz inflationary GW frequencies.. We proceed to look at how the conclusions factor in with information exchange between different universes .We begin with the following , with h_C a critical sensitivity value, with [28] $h_C \leq \left(2.82 \times 10^{-21}\right) \cdot \left(\frac{1Hz}{f}\right)$, and

Table4 Managing GW generation from Pre Planckian physics

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

Matching this table above, with suitable inputs will be to determine once and for all if the following is true. It is hoped this production can be made experimentally falsifiable.

Analog, reality feed in from other universes may be the driving force behind the evolution of inflationary physics. We presume going to Octionic gravity is then, quantum Beckwith,[21].Pre Octionic gravity physics (analog regime of reality) features a break down of the Octionic gravity commutation relationships when one has curved space-time.If so, the goal is to experimentally confirm Tables 1, 2, 3, through information gleaned by Table 4 above, as well as phase shift δ_0 [21] which may be determined by the measuring device discussed by Woods et. al [29]

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