Pre Octonionic to octonionic Gravity and could Kinetic energy be larger than Potential Energy before inflation?

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Abstract

We look at early universe space-time which is characterized by a transition from Pre Planckian to Planckian space-time. In doing so we also invoke the geometry of Octonionic non-commutative structure and when it breaks down. Doing so is also equivalent to a speculation given earlier by the author as to the kinetic energy of Pre Planckian space-time being significantly larger than the Potential energy, which is the opposite of what happens after the onset of Inflation, with the assumption as to how this is justified given in a (Pre Planckian) Hubble Parameter set as of Eq. (16), and we close with a comparison of this proposal with string cosmology, as represented in the 2nd reference in this paper.

Key words, Octonionic geometry, Cyclic Conformal cosmology (Penrose), Modified HUP

1. What is special about Octonionic structure? Why should one care about it?

We refer the readers to [1] as much of the basic background has some commonality as to [1] in terms of discussing of ideas. This can be contrasted to [2] for reasons we will bring up in the text later.

Our plan is as follows. We state the Modified HUP results, as a Pre Octonionic space-time result, and then we will specify that we are transitioning to Octonionic space time. The transition to Octonionic space time will then preserve one key result,that we have, due to the earlier pre Octonionic space-time, a minimum time step.

In a word, this is the setup of the new physics, plus our resolution

a. In Pre-Octonionic (Pre-Planckian) Space-time there exist conditions for which we form an initial smallest time step, and that the Pre-Planckian Space-time is where we specify initially a modified HUP (Heisenberg Uncertainty principle).

b. In Octonionic (Planckian) Space-time, we recover QM and the usual HUP, but also, we have the real benefits of keeping the minimum time step as to what is given from the Pre Octonionic structure.The Octonionic structure, as mentioned below, is U (1) cross SU (2) cross SU (3). In itself, Octonionic structure only allows for the standard model physics, and so we will describe it below

c. I.e. the division line between the Pre Octonionic Model and the Octonionic model directly correlates a transformation from Pre Planckian physics to Planckian physics. **This is alluded to in Section 3 of this manuscript. And may be linkable to conditions permitting Kinetic energy to be larger than Potential energy in Pre Planckian physics, for reasons we discuss in this document**

Keep in mind one basic fact. If we restrict ourselves solely to Octonionic geometry, we are embedded deeply in only what the Standard Model of physics allows. We should though understand what is implied by the physics of the Octonionic structure and so the rest of this first discussion is devoted to it.

In [3] Wilson gives a generalized structure as to Octonionic geometry, and it is a generalized way to introduce higher level geometry into the formation of standard model physics**.** Crowell, in [4] examines its applications as to presumed space-time structure. Also note what is said in[5] the take away from it, is that as quoted from[6] , that there exists

Quote:

(A linkage to the) ***mathematics of the division algebras and the Standard Model of quarks and leptons with U (1) x SU (2) x SU (3) gauge fields***

End of quote:

Once again, if we have only *U (1) x SU (2) x SU (3) gauge fields, we have only the standard model, and that if we wish to have a minimum time step, we need to go beyond the standard model.*

The division algebras are linked to octonionic structure in a way which is touched upon by Crowell [4], but the main take away is that in the Pre-Planckian space-time regime, that there was specific non commutative structures, as reflected in the document below, which in Pre Planckian space time would eventually become commutative. This development is illustrated in the text below.

The entire transition from Pre Planckian space – time to Planckian space-time would be in tandem with findings by Beckwith, in [6], and [7] as to the physics , as given in both[6,7] that kinetic energy would be greater than potential energy in the Pre Planckian space-time regime, and also to the possibility of a causal discontinuity, as given in [8] which may be linked to the odd situation of which slow roll physics, as usually delineated by [9] becomes dominant,. It is also the considered opinion of the author that E_8 as referenced in [1] as well as [10]in a classical setting which may be linkable to the Octonionic structure , as well as an extension of issues brought up by Lisi in[11] . This is elaborated in greater detail in terms of Octonionic math in [12] by Baez.

Now that we have made note of the geometry, it is time to look at the metric tensor based fluctuations of space time which may be the bridge between the Pre Planckian space-time behavior, and standard Planckian space-time

Now in order to come up with an energy flux, we will mention background initially brought up in part by [1]

1a. the basic bridge, looking at a basic re do of the HUP, in terms of metric tensors, from [7]

First of all, why would we have a different version of the HUP, in Pre Octonionic geometry? So as to answer this question we will look at a Proto SUSY potential, and the inflaton , if $\phi \sim \xi^{+} << M_{Planck}$ which is what we assert we work with. This step, next then will allow us to reference an initial time step, which is non zero. We state that the HUP is modified, due to the existence of $\phi \sim \xi^{+} << M_{Planck}$ for an inflaton, and we outline what this deviance from the Standard model of physics says about the formation of an alternative statement of the HUP. From there we will then go to the use of the modified HUP to the formation of a minimum time step.

Now, start with the HUP as given in Pre Planckian space-time Physics. As given in [7] we have that the following fluctuation may be germane to our problem, namely as given by a

Quote from [5] as

1. **Examining what happens to Eq. (1) if in Pre Planckian Space time $\dot{\phi}^2 >> V_{SUSY}$ due to $\phi \sim \xi^{+} << M_{Planck}$**

If we look at the Susy potential as given by [13]

$$V(\phi) = \mu^4 \cdot \left[b \cdot \ln^2\left(\frac{\phi}{m_{Planck}} \right) + \left(1 - \left(\frac{\phi}{m_{Planck}} \right)^2 \right)^2 \right] \quad (1)$$

We will be looking at the value of Eq. (1) if $\phi \sim \xi^{+} << M_{Planck}$. In short, we have then that

$$(\Delta l)_{ij} = \frac{\delta g_{ij}}{g_{ij}} \cdot \frac{l}{2}$$
$$(\Delta p)_{ij} = \Delta T_{ij} \cdot \delta t \cdot \Delta A \tag{1a}$$

If we use the following, from the Roberson-Walker metric [13, 14, 15] .

$$\begin{aligned} g_{tt} &= 1 \\ g_{rr} &= \frac{-a^2(t)}{1-k \cdot r^2} \\ g_{\theta\theta} &= -a^2(t) \cdot r^2 \\ g_{\phi\phi} &= -a^2(t) \cdot \sin^2\theta \cdot d\phi^2 \end{aligned} \tag{2}$$

Following Unruh[16, 17] , write then, an uncertainty of metric tensor as, with the following inputs

$$a(t) \sim 10^{-55}, r = l_P \sim 10^{-35} meters \tag{3}$$

Then, the surviving version of Eq. (1) and Eq. (2) is, then, if $\Delta T_{tt} \sim \Delta\rho$, [13, 16, 17]

$$\begin{aligned} & V^{(4)} = \delta t \cdot \Delta A \cdot r \\ & \delta g_{tt} \cdot \Delta T_{tt} \cdot \delta t \cdot \Delta A \cdot \frac{r}{2} \geq \frac{\hbar}{2} \\ & \Leftrightarrow \delta g_{tt} \cdot \Delta T_{tt} \geq \frac{\hbar}{V^{(4)}} \end{aligned} \tag{4}$$

This Eq. (4) is such that we can extract, up to a point the HUP principle for uncertainty in time and energy, with one very large caveat added, namely if we use the fluid approximation of space-time [18]

$$T_{ii} = diag(\rho, -p, -p, -p) \tag{5}$$

Then by [1, 13]

$$\Delta T_{tt} \sim \Delta\rho \sim \frac{\Delta E}{V^{(3)}} \tag{6}$$

Then,

$$\begin{aligned} & \Delta E \Delta t \sim \hbar / \delta g^{tt} \neq \hbar / 2 \\ & unless \quad \delta g^{tt} \sim O(1) \end{aligned} \tag{7}$$

This Change in the HUP, as outlined above, will be part and parcel of the transformation from Pre-Octonionic space time, to Octonionic, i.e. from Pre Planckian to Planckian physics, with all the resulting consequences, which will be outlined below

Before doing so, we say something about the introduction of what is meant by a metric tensor to begin with.

See the next mini session as to why the issue of the minimum fluctuation of the metric tensor is so important.

Having said this, we will be referring to Eq. (7a) in our document as far as specifics, in the rest of this paper.

1b. having formed this minimum HUP, as given in Eq. (7), now how do we use it to form a minimum time step?

The basic issue is, given as follows

$$\delta t \Delta E \geq \frac{\hbar}{\delta g_{tt}} \Leftrightarrow \delta t \geq \frac{\hbar}{\delta g_{tt} \Delta E} \tag{7a}$$

The change in energy, as given in ΔE is enormous, i.e. almost equivalent to the entire energy budget of the Universe, at the start of the big bang, hence, to keep the minimum time step as larger than or equal to zero, it will require specific analysis of the fluctuation of the quantity δg_{tt}, but before doing this we need to understand what the metric tensor is physically, before initiating a description of what we are doing in Eq. (7a) as to δg_{tt}.

1c. Introduction to the Metric Tensor as contribution to Quantum Gravity: What is quantum gravity? Does Quantum Gravity have relevance to Planckian physics?

In general relativity the metric $g_{ab}(x,t)$ 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 Octonionic geometry, the commutation relationships are well defined. There is through 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 DE parametrizing 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 octonionic 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 octonionic 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 buildup of temperature from an initially much lower temperature regime. Rovelli [19] 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 octonionic 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 octonionic gravity is a definite limiting structure emerging in extreme temperatures and state density. This also happens to be a replay of points raised in [20] as to conditions of flatness, or lack of, in early universe conditions.

2. Here is the key point. I.e. explosion of the number of degrees of freedom due to forming of change in energy, and this tied to pre-Octonion to Octonion physics setting shift

Also, there will be a buildup in the number of degrees of freedom, from a very low initial level to a higher one, as in the Gaussian mapping [1], [21] (Beckwith, 2010)

$$x_{i+1} = \exp\left[-\tilde{\alpha}\cdot x_i\right] + \tilde{\beta} \tag{8}$$

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) [1], [21]

$$E_{thermal} \approx \frac{k_B}{2}\cdot T_{temperature} \propto \Omega_0 \cdot T_{temperature} \sim \tilde{\beta} \tag{9}$$

Eq. (8) 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) [22]. Our supposition is that this is in part due to assuming that we would have the fluctuation of energy, from Pre Planck to Planck given in the Pre Octonionic to Octonionic stage, with the degrees of freedom exploding as given in Eq. (8) and a net increase in temperature leading to thermal energy , as added to the change in energy, as alluded to in our HUP, as given above. So then, with this, we assume a recycling of the universe in terms of the Penrose CCC[23], with modifications as was alluded to by Beckwith, [23]which in turn would be examining[24] i.e. suggesting a discontinuity in the pre Planckian regime, for scale factors[1],[25] (Beckwith, 2008).

$$\left[\frac{a\left(t^* + \delta t\right)}{a\left(t^*\right)}\right] - 1 < (value) \approx \varepsilon^+ << 1 \tag{10}$$

2. We are then going to get the following expression for the energy / frequency spread in the Penrose alternation of the big 'crunch' model[24]

Start with working with the expression given by Eq. (9). This is for time $\breve{T} \sim 0^{+}$ *to* 10^{-44} seconds, $h_0^2\ \Omega_{GW} \sim 10^{-6}$ and a frequency variance [1]

$$1GHz < \Omega_0 < 10GHz \tag{11}$$

This Eq. (11) 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

One of the main things to consider is resolution of the following: [26] (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[27]. 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 echoes [28] (Smolin, **1997)**.

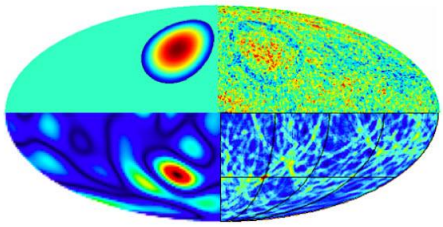

Fig 1, Based upon: First Observational Tests of Eternal Inflation [26] (Feeney, et.al. 2011)

Another way to look at the Eternal inflation paradigm involves a review of a similar situation as the one given in reference [27] **(**.Gurzadyan, Penrose, 2011) . That is to consider what we have brought up before in an earlier publication, [28] which is conditions for where we have kinetic energy larger than potential energy in Pre Planckian space-time. Readers can refer to the earlier arguments in [28]whereas we will proceed to another argument which is more along the lines of the similarities with Pre Octonionic to Octonionic space time transtions.

To do so, in our new argument, we look at first a simple way to frame the cosmological constant problem as given by Guth [29] as given by

$$\Lambda_{\cos-const}\cdot g_{uv}=\left\langle 0\left|T_{uv}\right|0\right\rangle$$
$$\xrightarrow[(u,v)\to(0,0)\,\mathrm{Pre-Planckian}]{}$$
$$\Lambda_{\cos-const}\cdot g_{00}=\left\langle 0\left|\left(T_{00}=\rho\right)\right|0\right\rangle$$
$$\Leftrightarrow \rho=\frac{\dot{\phi}}{2}+V\left(\phi\right)+\frac{\left(\nabla\phi\right)^2}{2} \tag{12}$$
$$\xrightarrow[(u,v)\to(0,0)\,\mathrm{Pre-Planckian}]{}$$
$$\rho=\frac{\dot{\phi}}{2}+V\left(\phi\right)$$

This last line, namely $\Lambda_{\cos-const}=\left\langle 0\left|\left(T_{00}=\rho\right)\right|0\right\rangle\cdot\left(g_{00}\right)^{-1}$ is assumed to have the same value as the cosmological constant today, i.e. no quintessence, so what we will be doing is to examine what this says about an inflaton mass, in the spirit of what was said by Corda in [30] In the pre Planckian regime we are having that $\left(\nabla\phi\right)^2$ would be of small import, and that there is still though, a small regime of space-time, i.e. a bounce ball of the form given in [31]and[32] and[33] which would have the inflaton only change by time, not space, and then refer to[34] which has an inflaton mass of the form given by , if we use the variable change of $z=\dot{\phi}/H$, and assume that $\dot{\phi}$ is approximately a constant in the interval of time, in the Pre Planckian space-time regime, so that the inflaton mass is given by, if in Pre Planckian space-time

$$d\tau^2=a^2\left(\tau\right)dt^2\sim\left(a_{\mathrm{Pre-planckian}}=a_{\min}\right)^2dt^2 \tag{13}$$

With $a_{\min}$ defined in [32] , then the equation given in [34] for inflation mass would in the Pre Planckian space-time

$$m^2\sim-z^{-1}\frac{d^2z}{d\tau^2} \tag{14}$$

Becomes

$$m^2\sim-\frac{H}{a_{\min}}\cdot\frac{d^2H^{-1}}{dt^2} \tag{15}$$

In order to do this, we will be setting the following presentation for the inverse of the Hubble parameter

$$H^{-1}=H^{-1}_{Planckian-regime}+\frac{H^{-1}_{\mathrm{Pre-Planckian-regime}}}{2}\cdot\left(t\cdot t_{Planck}-t^2\right) \tag{16}$$

The parameter $H^{-1}_{\mathrm{Pre-Planckian-regime}}$ is set for half of the Planck time interval, and the net result is that Eq.(15) becomes scaled as

$$m^2 \sim -\frac{H}{a_{\min}} \cdot \frac{d^2 H^{-1}}{dt^2}$$

$$\sim \frac{H^{-1}_{\mathrm{Pre-Planckian-regime}}}{a_{\min} \cdot \left[H^{-1}_{Planckian-regime} + \frac{H^{-1}_{\mathrm{Pre-Planckian-regime}}}{2} \cdot \left(t \cdot t_{Planck} - t^2 \right) \right]} \quad (17)$$

Then inflaton based kinetic energy would be , if M_{Planck} is Planck mass

$$\frac{\dot{\phi}^2}{2} \sim \frac{3M_{Planck}}{\left[H^{-1}_{Planckian-regime} + \frac{H^{-1}_{\mathrm{Pre-Planckian-regime}}}{2} \cdot \left(t \cdot t_{Planck} - t^2 \right) \right]} \quad (18)$$

$$\Leftrightarrow V(\phi)\big|_{\mathrm{Pre-Planckian-regime}} \sim \lambda \phi^4 \big|_{\mathrm{Pre-Planckian-regime}} << \frac{\dot{\phi}^2}{2}$$

The Physics inherent from Eq. (16) to Eq. (18) would also be in tandem with a functional equivalence between $\Lambda_{\mathrm{C.Const,Pre-Planckian}} = \langle 0 | (T_{00} = \rho)_{\mathrm{Pre-Planckian}} | 0 \rangle \cdot g_{00}^{-1}$ which has yet to be explored more fully. But would also be linked to Figure 1 above. Having said that, we now go to the summary of our results. This in part uses some of the thinking from[35].

3. First part of Conclusion: In terms of the Planckian evolution, as well as the contribution into it from different universes[35,36]

Analog, reality feed in from other universes may be the driving force behind the evolution of inflationary physics. We presume going to Octonionic gravity is then, quantum [36] (Beckwith,2011c).Pre Octonionic gravity physics (analog regime of reality) features a breakdown of the Octonionic 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 Octonionic regime holds. Analog physics, prior to the buildup 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[37] (t'Hooft, 2006) .Theoretically, inputs into Eq. (1) and Eq. (3) await experimentally falsifiable experiments.

Note that[36] [24] has the following quote

Quote

A modified form of the holographic bound that applies to a post-inflationary universe follows from the generalized second law. However, in a spatially closed universe, or inside a black hole event horizon, there is no simple relationship that connects the area of a region to the maximum entropy it can contain.

The choice between these two reflects upon if there is a multiverse, or if there is, even more to the point if there is information transfer and mixing between components of universes which may hold if the following quasi ergodic process holds, according to [38] .

We also have to be aware of the startling possibility raised in [39] , namely that

Quote

In theories in which the cosmological constant takes a variety of values in different "subuniverses," the probability distribution of its observed values is conditioned by the requirement that there be someone to measure it. This probability is proportional to the fraction of matter that is destined to condense out of the background into mass concentrations large enough to form observers. We calculate this "collapsed fraction" with a simple, pressure-free, spherically symmetric, nonlinear model for the growth of density fluctuations in a flat universe with arbitrary value of the cosmological constant, applied in a statistical way to the observed spectrum of density fluctuations at recombination.

However, there is another way to model a "cosmological constant" as given in [40] , namely a model for the cosmological "constant" which is a consequence of the generalized HUP they derive. Their HUP though has none of the flourishes put in, as far as the work which has been alluded to for Pre Planckian to Planckian physics evolution as reported in [6,7] and as in the beginning of our text.

I.e. a worthy project would be to differentiate between either choosing [39] or [40] and if a variant of [40][60] is chosen, to substitute the HUP as given by[40] by what has been derived and published in [6].

The details of such a choice would have profound implications as far as heavy gravity, as well as the current given in Eq.(19) [1] This also leads to the issue brought up in [1] and also [41]

$$J_{eff} \cong n_{count} \cdot m_{4-\dim-(Graviton)} \tag{19}$$

As stated [1] [42] $m_{4-\dim-(Graviton)} \sim 10^{-65} grams$, while n_{count} is the number of gravitons which may be in the detector sample. As was discussed in [1], with the mass of a graviton given in [1], [42]

In addition, the details of the Pre Planckian to Planckian Space-time could be investigated more thoroughly.

We argue that the details of the division algebras, and the links to Octonionic geometry as alluded to in the beginning of the text would be either falsified, by experimental measurements, or confirmed, which could lead to researchers adding more details as to [3],and [4] , and [5] as well as confirming the central importance of what Lisi attempted working with in [11]. It would be interesting and perhaps useful to compare this with the predictions given by Abbot [43] . As well as the issue brought up by [44].

I.e. our model of the evolution of a cosmological constant, as given in the use of the Park model, as in[45] we are considering possible "subuniverse" contributions to the cosmological constant, as given by modeling the cosmological constant as conflated with Dark Energy.

4. Second part of conclusion. Future issues, as we call it

IN [2] there is a call to review string theory cosmology. In it

Quote, page 2 of [2]

The cosmological constant problem [46] *is the question of why the cosmologically observed value of the total, effective vacuum energy, $\rho \sim 10\text{^-}47GeV$, is so much smaller than the expected quantum field theory estimate of the vacuum energy (empty space)*

end of quote

Then

Quote, page 2 of [2]
The second problem is the so-called singularity, or initial state, problem. According to the singularity theorems of general relativity, spacetime singularities are a generic prediction of the theory under very plausible assumptions of the causal and matter character (global hyperbolicity, positivity of energy density), usually accompanied with a blow up in the spacetime curvature and the thermodynamical properties of matter [47]. *This means that spacetime must come to an end at generic spacetime singularities*

Having correctly identified the MAIN problems in cosmology, as known, the paper concludes with

Quote [2], page 20

5.3 Braneworld solutions, asymptotic limits

As we discussed in previous sections of this paper, it is possible to have a complete profile of all asymptotic situations that emerge when we have a bulk 5-geometry (V, g_5) containing an embedded 4-dimensional braneworld (M, g_4) that is either a 4-dimensional Minkowski, or de Sitter, or Anti-de Sitter spacetime, cf. [48]. *In general, all asymptotic solutions have a form dictated by the method of asymptotic splittings .This may be described in a series of steps:*

end of quote

. In short, though, as the author judges it, the proposals all are attempts to window dress extremely complex geometry to the supposition elegantly phrased that singularities are unavoidable in 4 dimensional geometry at the start of space-time. This is partly contravened by [49] where Rovelli and Vidotto, in their loop quantum gravity have their own version of a quantum bounce, and our own work is to further give substance to perhaps having a different non-singular start to cosmology without appealing to brane worlds. The reader is also invited to review [31] as well.

A review of this reference, [2] with [41] needs to be done, carefully and hopefully with data sets via experimental gravitational physics. We view this as a castle of sand construction unless it is rigorously back with additional experimental gravity supporting data.

In doing all this, the author remands the readers to review the classic reference by Coleman [50]

Quote [50]
Finally, we must comment on the problem of the cosmological constant in the context of spontaneous symmetry breakdown. This problem was raised some years ago' and we have little new to say about it, but our work here has brought it home to us with new force.[51]

Coleman viewed the Cosmological constant as crucial to early universe activity, and not well understood, and we refer to it in [1] as well, which then bridges to our final part, which is to refer to nonlinear electrodynamics and the present state of experimental gravitation.

The experimental gravity considerations are covered in [52] ,[53] , [54], and [55] , and the idea should be especially to in our work to examine if [52] and [54] in terms of gravity are adhered to. As these are LIGO projects, we should be looking to see if what we are doing contravenes or backs the post Newtonian approximations of physics, so brought up.

Reference [54] is a must to review. In it, Corda reviews GR tests and our document must not contravene these basics. Can we obtain through our representation of gravitons, confirmation, or refutation of if the data sets are in adherence, or partially refute General Relativity. As far as [55], in terms of quantum cosmology, it is another similar parallel development to the ideas raised here. I urge readers to investigate it.

As to [56] as it is, is a summary of what the author views as to what would be foundational investigation of gravity, and to see if it can be made in adherence to GR. That plus Appendix A of [57]

Finally, [58] is a useful, interesting counterpart to standard theory reference as a non singular cosmology, which the author thinks deserves being compared to the rest of our derivational work. It also makes reference to Maxwell's equations, too, which is an intriguing linkage to NLED which we think needs to be reviewed.

15. **Acknowledgements**

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