# 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, $\delta_0$, of the universe when an increase in degrees of freedom have in setting $\delta_0$, 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 $\delta_0$, 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

## 1.Introduction

In general relativity the metric $g_{ab}(\boldsymbol{x}, t)$ 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…..

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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.

## 2. Now about conditions to obtain the relevant data for phase $\delta_0$

This paper examines geometric changes that occurred in the earliest phase of the universe, leading to values for data collection of information for phase $\delta_0$ , 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 [1] 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

$$\left[x_{j,} p_j\right] = i \cdot \hbar \tag{3}$$

.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.

## 3. 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 [1]

$$\left[x_j, x_i\right] \neq 0 \quad \text{under ANY circumstances, with low to high temperatures, or flat or curved space.} \tag{4}$$

Whereas in the **octonion** gravity space time regime where one would have Eq. (2) hold that for enormous temperature increases [1]

$$\left[x_j, x_i\right] = i \cdot \left[\Theta_{ji}\right] \xrightarrow[Temp \to \infty]{} 0 \tag{5}$$

Here,

$$\Theta_{ji} \sim \Lambda_{NC}^{-2} \sim \left[\Lambda_{4-Dim}\right]^{-2} \propto 1/\left[T^{2\beta}\right] \xrightarrow[T \to \infty]{} 0 \tag{6}$$

Specifically Eq. (1) and Eq. (4) when transformed to Eq. (2) and Eq. (5) will undergo physical geometry changes which will show up in $\delta_0$ .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 [2]

*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 the two.*

When quantum geometry holds, as seen by Eq. (2) and Eq. (5) , 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 $\delta_0$. The following flow chart is a bridge between the two regimes of [1] the case where the commutators for QM hold and then again to where the commutators for QM do not hold at all.

$$\left[x_j, p_i\right] \neq -\beta \cdot \left(l_{Planck}/l\right) \cdot \hbar T_{ijk} x_k \xrightarrow[Transition-to-Planckian-regime]{} \left[x_j, p_i\right] = -\beta \cdot \left(l_{Planck}/l\right) \cdot \hbar T_{ijk} x_k \tag{7}$$

Eq.(7) 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 [2] . Once Eq.(5) happens, Beckwith hopes to look at the signals in phase shift $\delta_0$

$$\left[x_j, p_i\right] = -\beta \cdot \left(l_{Planck}/l\right) \cdot \hbar T_{ijk} x_k \xrightarrow[Transition-to-release-of-relic-Gravitational-waves-in-flat-space]{} Planckian - Era - Generated - GW \qquad (8)$$

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 [2]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. (7) occurs, 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 [3]

$$x_{i+1} = \exp\left[-\tilde{\alpha} \cdot x_i^2\right] + \tilde{\beta} \qquad (9)$$

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 [3]

$$E_{thermal} \approx \frac{1}{2} k_B T_{temperature} \propto \left[\Omega_0 \breve{T}\right] \sim \tilde{\beta} \qquad (10)$$

The rest of the article as written else where has a rich description of how contributions from other universes, as a generalization of Penrose cyclic conformal cosmology [4] will drive the Gaussian mapping as alluded to, in Eq. (9) above.

## 4. 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 [4].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. That is what our results are leading to and which the author will spend much of 2013 working to prove.

## References


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