Gedankerexperiment for contributions to cosmological constant initial conditions from kinematic viscosity in non-singular Pre Plank Space-time

A. B. Beckwith†

Physics Department, Chongqing University,
Chongqing 40014, PRC
†*E-mail: abeckwith@uh.edu, rwill9955b@gmail.com*

This paper is to address using what a fluctuation of a metric tensor leads to, in pre Planckian physics, namely $\delta t \Delta E \geq \frac{\hbar}{\delta g_{tt}} \neq \frac{\hbar}{2}$. If so then, we pick the conditions for an equality, with a small δg_{tt}, to come up with restraints initial temperature, particle count and entropy as would be affected by a small nonsingular region of space-time. The resulting density will be of the form $\frac{\Delta \rho}{\Delta t} \sim (visc) \times \left(H_{\text{int}}{}^{2} \right) \times a^{4}$ with the first term, on the right viscosity, of space-time, the 2nd on the right the square of an initial expansion rate, and due to the non singular nature of initial space time the fourth power of a scale factor, with $a \sim a_{init} \sim 10^{-55}$ This leads to an initial graviton production due to a minimum magnetic field, as established in our analysis. Which we relate to the inflaton as it initially would be configured and evaluated; with $\Delta \rho \sim [V_3 (volume)]^{-1} \times N_{initial-count} \times m_{gr}$, and with the change in the initial cosmological constant $\Delta \Lambda_{initial} \sim M_{total-space-time-mass}$

Keywords: Emergent time, heavy gravity, metric tensor perturbations, HUP

1. Introduction .

This article starts with updating what was done in [1,2,3,4] , which is symbolized by, if the scale factor is very small, metric variance [2,3]

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$$\left\langle \left(\delta g_{uv}\right)^2 \left(\hat{T}_{uv}\right)^2 \right\rangle \geq \frac{\hbar^2}{V_{Volume}^2}$$
$$\xrightarrow[uv \to tt]{} \left\langle \left(\delta g_{tt}\right)^2 \left(\hat{T}_{tt}\right)^2 \right\rangle \geq \frac{\hbar^2}{V_{Volume}^2} \qquad (1)$$
$$\& \quad \delta g_{rr} \sim \delta g_{\theta\theta} \sim \delta g_{\phi\phi} \sim 0^+$$

In [4] this lead to

$$\delta t \Delta E \geq \frac{\hbar}{\delta g_{tt}} \neq \frac{\hbar}{2} \qquad (2)$$
$$Unless \quad \delta g_{tt} \sim O(1)$$

We assume δg_{tt} is a small perturbation and look at $\delta t \Delta E = \frac{\hbar}{\delta g_{tt}}$ with

$$\Delta t_{time}(initial) = \hbar / \left(\delta g_{tt} E_{initial}\right) = \frac{2\hbar}{\delta g_{tt} \cdot g_{*s}(initial) \cdot T_{initial}} \qquad (3)$$

The take away from [1,2,3,4] is that we can then initiate looking at what this minimum time step pertains to as to the change in Pre-Planckian density which we will write up as[5]

$$\frac{\Delta\rho}{\Delta t} \sim (visc) \times \left(H_{\text{int}}{}^2\right) \times a^4 \qquad (4)$$

Whereas we will assume that the Hubble parameter, initially will be as given in the Pre Planckian era as a constant, and that the scale factor, we will approximate via[6]

$$a_{\min} \sim \left(10^{-123/4}\right) \sim \left(\Delta E / E_P\right)^{3/2}$$
$$\& \phi_{initial}^2 \sim o\left(\sqrt{\Delta E \cdot \gamma \cdot L_P} \Big/ \hbar^2\right) \qquad (5)$$

2. What about adding in the magnetic field contribution ?

To do this we will be utilizing from [6] the following.

$$\alpha_0 = \sqrt{\frac{4\pi G}{3\mu_0 c}} B_0$$
$$\hat{\lambda}(defined) = \Lambda c^2 / 3 \quad (6)$$

$$a_{\min} = a_0 \cdot \left[\frac{\alpha_0}{2\hat{\lambda}(defined)} \left(\sqrt{\alpha_0^2 + 32\hat{\lambda}(defined) \cdot \mu_0 \omega \cdot B_0^2} - \alpha_0 \right) \right]^{1/4}$$

The above will be combined with a generalized use of Eq. (6) to come up with a hypothesized initial Pre Planckian energy density we give as

$$\rho_\Lambda \sim \frac{G}{c^8 \hbar^4} \cdot \left(\frac{\hbar}{\Delta t \cdot \left(\delta g_{tt} \approx a_{\min}^2 \phi_{initial} \right)} \right)^6 \quad (7)$$

And [1,2,3,4]

$$V_{volume(initial)} \sim V^{(4)} = \delta t \cdot \Delta A_{surface-area} \cdot \left(r \leq l_{Planck} \right) \quad (8)$$

We will explicitly use comparison of Eq. (7) with Eq. (4) and from there extract a role as to the presumed small bubble of space-time viscosity term, vis, which is in Eq. (4) and the magnetic field and also look at an emergent expression for the inter relationship between the cosmological “constant” , and an overall mass, M, which will be used, in conjunction with a presumed magnetic field, for conditions to be fulfilled for understanding the emergence of the cosmological “constant”, in Pre Planckian Space-time to Planckian space-time. After which in doing so we would also try to extract the physics of Space-time in terms of presumed non zero entropy, as given by assuming a massive graviton, as given by [7,8,9]

$$\Delta\rho \sim \left[V_3(volume) \right]^{-1} \times N_{initial-count} \times m_{graviton} \quad (9)$$

This would be assuming that the V(volume) with subscript 3, is a per unit time evaluation if Eq. (8), and also of using Ng’s infinite quantum statistics, as given by [10] i.e. the term N, would be nonzero, and this in tandem with an alteration of the initial Penrose singularity theorem as brought up in [11, 12], which would also be in tandem with an emergent cosmological constant parameter as

$$\Delta\Lambda \sim \left(\alpha^2 \sim \frac{1}{(137)^2} \right) \times M_{initial}^4 \quad (10)$$

3. CONCLUSION: Isolation out of the contributions to Eq. (10) above, from first principles

To do this we need to examine Eq.(10) and to look at what is contributing to , say emergent structure. To do this, we begin with

$$\Delta\Lambda \sim \left(\alpha^{2} \sim \frac{1}{(137)^{2}}\right) \times M_{initial}^{4} \sim \frac{\left(N_{gravitons} \times m_{graviton}\right)^{4}}{(137)^{2}}$$
$$\sim \left(\frac{G}{c^{8}\hbar^{4}} \cdot \left(\frac{\hbar}{\Delta t \cdot \left(\delta g_{tt} \approx a_{\min}^{2}\phi_{initial}\right)}\right)^{6}\right)^{4} \times \left(\cdot \Delta A_{surface-area} \cdot \left(r \leq l_{Planck}\right)\right)^{4} \tag{11}$$

Here, the minimum scale factor has a factor of Λ which we interpret as todays value of the cosmological constant. So what we have here, in Eq. (11) is an emergent space-time value of what the Cosmological constant would be after initial emergence at Planck space-time, from the Pre Planckian space-time values. This adds substance to what was brought up by Beckwith in [13] namely that we have a minimum scale factor of Eq. (5)

In doing so, we need to consider initial conditions so considered that Eq. (11) and should be consistent with the inflaton and 'gravity's breath' document by Corda, [14] . This takes into consideration [15, 16]

In addition Freeze's statement of initial conditions for inflation, as given by [17] should be adhered to. It is also extremely important that the LIGO results, even if this is of relic gravitational waves, as seen by Abbott in [18,19, 20] not be contravened.

This, even if we use the following values. As given below[21]

$$
\begin{aligned}
& a \approx a_{\min} t^{\gamma} \\
& \Leftrightarrow \phi \approx \sqrt{\frac{\gamma}{4\pi G}} \cdot \ln\left\{ \sqrt{\frac{8\pi G V_0}{\gamma \cdot (3\gamma - 1)}} \cdot t \right\} \\
& \Leftrightarrow V \approx V_0 \cdot \exp\left\{ -\sqrt{\frac{16\pi G}{\gamma}} \cdot \phi(t) \right\}
\end{aligned}
\tag{12}
$$

So as talked about with [14] setting a minimum energy density given by [15, 16]

$$
\rho_{\Lambda} \approx \frac{G(E/c^2)^2}{l} l^{-3} = \frac{GE^6}{c^8 \hbar^4} \tag{13}
$$

And this has been applied. Hopefull this will allow investigation of what Corda asked about concerning Scalar-tensor gravity models.[22]

Note that the minimum scale factor used in Eq. (11) depends upon magnetic fields, as from the Non Linear Electrodynamcis pricnples for early cosmology.

In addition we postulate that the existende of massive gravitons is syominous with the classical – quantum mechanics linkage as given in [23] . i.e. on page 121 of [23] the authors manage to convert a D' Alembert wave equation is converted to a Schrodinger equation, if the group velocity is included as having the form

$$
v_{group} \propto E / \sqrt{2(E - V} < c \tag{14}
$$

Presumably in [23] the normalization of c =1 means that (14) is if it refers to an equation like the D'Alembert equation one for which it has classical behavior, to the Schrodinger equation.

Note that as given in [24] that massive gravitons travel at less than the speed of light. Our suggestion is that by inference, that massive gravitons, then would be commensurate with the HUP which we brought up in this document and that the formulation is consistent.

All this should also be tied into an investigation of how the viscosity of Eq. (4) would also tie into the results above, with the interplay of Eq.(3) and Eq. (4) maybe giving by default some information as to condition for which the quantization condition linkage in the classical regime (represented by the

Classical De Alembert equation) and the quantum Schrodinger equation have analogies in our model.

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