How a Tokamak may allow GW to be duplicated in simulated values, similar to GW from Torsion

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Abstract

Our idea for black hole physics being used for GW generation , is using Torsion to form a cosmological constant. Planck sized black holes allow for a spin density term linked to Torsion.. And we conclude with a black hole versus white hole for creating relic GW frequencies in physics model of Black hole and white holes, linked by a worm hole. In doing so, we review its similarities to frequency values for GW due to a Tokamak simulation. The conclusion of this document will be in bringing up would be values for an initial wave function of the Universe

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Keywords: Cosmological constant, Torsion, Spin density, BEC scaling of Black hole physics, Tokamak, Wavefunction of the Universe , wormholes.

1. Introduction as to plan of presentation

The author has in prior work given the idea that a decay of millions of Planck sized BHs as within the very early universe as in [1] could generate GW and gravitons, due to a breakup of black holes as predicted in [1] but with the present GW spectrum of today very conservatively following [2]. The breakup of black holes may commence due to what is stated in [1] and actually be complimented by what is addressed in [3] which would be if Gravitons acting as similar to a Bose-Einstein condensate contribute to a resulting DE [1]. Either the strict breakup of black holes as in [4] or some conflation with [3] would lead to, likely GW (and Graviton frequencies) initially of the order of 10^10 Hz to maybe 10^19 Hz. In doing so we can consider the duration of an observed signal, its relative noisiness and stochastic noise contributions of a sort which are covered in [5]. In addition, the generation of GW in a Tokamak if commensurate with eLISA data after a step down of 10^-25 to 10^-26 due to 60 or more e folds [6] may allow for a review of adequate polarization states for GW which may or may not need higher dimensions to be in fidelity to the data sets obtained [7]. Having said that, what are the justifications as to using Tokamaks ? This will be the subject of the final part of the document , after we present the basics of the primordial physical distribution of black holes, Planck sized according to the following

To do this review how **Torsion may allow for understanding a quantum number n? And Primordial black holes and the cosmological constant**

Following [1] [2] we do the introduction of black hole physics in terms of a quantum number n.

$$\sqrt{\Lambda} = \frac{k_B E}{\hbar c S_{entropy}} \qquad (1)$$
$$S_{entropy} = k_B N_{particles}$$

And then a BEC condensate given by [1][3] as to

$$m \approx \frac{M_P}{\sqrt{N_{gravitons}}}$$
$$M_{BH} \approx \sqrt{N_{gravitons}} \cdot M_P$$
$$R_{BH} \approx \sqrt{N_{gravitons}} \cdot l_P \qquad (2)$$
$$S_{BH} \approx k_B \cdot N_{gravitons}$$
$$T_{BH} \approx \frac{T_P}{\sqrt{N_{gravitons}}}$$

This is promising but needs to utilize [4] in which we make use of the following. First a time step

$$\tau \approx \sqrt{GM\delta r} \qquad (3)$$

By use of [5] we use Eq. (3) for energy [4] for radiation of a particle pair from a black hole,

$$|E| \approx \left(\sqrt{GM\delta r}\right)^{-1} \hbar \qquad (4)$$

Here we assert that the spatial variation goes as

$$\delta r \approx \ell_P \qquad (5)$$

This is of a Plank length, whereas we assume in Eq. (6) that the mass is a Planck sized black hole

$$M \approx \alpha M_P \qquad (6)$$

This mass of primordial black holes is part of the first table, i.e.

Table 1 from [2] assuming Penrose recycling of the Universe as stated in that document.

End of Prior Universe time frame	Mass (black hole) : super massive end of time BH 1.98910^+41 to about 10^44 grams	Number (black holes) 10^6 to 10^9 of them usually from center of galaxies
Planck era Black hole formation	Mass (black hole)	Number (black holes)

Assuming start of merging of micro black hole pairs	10^-5 to 10^-4 grams (an order of magnitude of the Planck mass value)	10^40 to about 10^45, assuming that there was not too much destruction of matter-energy from the Pre Planck conditions to Planck conditions
Post Planck era black holes with the possibility of using Eq. (1) and Eq. (2) to have say 10^10 gravitons/second released per black hole	Mass (black hole) 10 grams to say 10^6 grams per black hole	Number (black holes) Due to repeated Black hole pair forming a single black hole multiple time. 10^20 to at most 10^25

As to Table 1, we obtain, due to the quantum number n, per black hole. This makes use of [1][2][7][8][9]

The Table 1 data will be connected to the following given consideration of spin density , as to Planck sized black holes

In [1][9] we have the following, i.e., we have a spin density term of [1][9]. And this will be what we input black hole physics into as to forming a spin density term from primordial black holes.

$$\sigma_{Pl} = n_{Pl}\hbar \approx 10^{71} \tag{7}$$

And, also, the initial energy, [7] per black hole given as

$$E_{Bh} = -\frac{n_{quantum}}{2} \tag{8}$$

We then can use for a Black hole the scaling,

$$\begin{aligned} &\left|E\right| \approx \left(\sqrt{G\cdot\left(\alpha M_P\right)\cdot \ell_P}\right)^{-1}\hbar \\ &\xrightarrow[G=M_P=\hbar=k_B=\ell_P=c=1]{} \left(1/M_{BH}\right)^{1/2} \approx \frac{n_{quantum}}{2} \end{aligned} \tag{9}$$

We then reference Eq. (2) to observe the following,.

$$\begin{aligned} &M_{BH} \approx \sqrt{N_{gravitons}}M_P \\ &\Rightarrow \left(1/M_{BH}\right)^{1/2} \approx \frac{n_{quantum}}{2} \approx \frac{1}{\left(N_{gravitons}\right)^{1/4}} \\ &\Rightarrow n_{quantum} \approx \frac{2}{\left(N_{gravitons}\right)^{1/4}} \end{aligned} \tag{10}$$

This is a stunning result. i.e. Eq. (2) is BEC theory, but due to micro sized black holes, that we assume that the number of the quantum number, n associated goes way UP. Is this implying that corresponding increases in quantum number, per black hole, n, are commensurate with increasing temperature? We start off with Table 1 for conditions with the entropy as given in Eq.(1) and Eq.(2), for primordial black holes as brought up in Table 1. Whereas for the Tokamaks, we eventually have

$$n\Big|_{massive-gravitons/\sec ond} \propto \frac{3\cdot\hbar\cdot e_j}{\mu_0\cdot R^2\cdot\xi^{1/8}\cdot\tilde{\alpha}}\times\frac{\left(T_{\text{Tokamak}-temperature}\right)^{1/4}}{\lambda^2_{Graviton}\bullet m_{graviton}\cdot c^2\cdot(.87)^{5/4}}\sim 1/\lambda^2_{Graviton} scaling \qquad (11)$$

This value of Eq.(11) as to the number of gravitons, would be then related to the quantum number N (gravitons) as related to a quantum number n i.e. only in the very onset of the operation of the Tokamak. I.e. we would have the number of gravitons go UP as we would have a shrinking graviton wavelength for a massive graviton. i.e. more on this later . However, the wave length of the massive graviton as in Eq. (11) as related to GW frequency and Tokamaks will be described when we conclude our document with respect to the Wavefunction of the Universe, i.e. a work partly drawing upon Kieffer, and also Weber. The wavefunction of the universe condition heavily is influenced by the similarities as to Eq.(11) with the quantum number n, per black hole, and the number N, of black holes, as brought up in Table 1, initially presented . To do so we consider Table 1 as giving a template as to a wormhole connecting a prior universe to the present universe

2. wavefunction of the Universe, and the assumption of connecting the prior to the present universe, via say multiple wormholes on account of Table 1. Looking at the Weber book as to reformulate Quantization imposed in GR

We advise readers to review [10][11][12][13][14][15][16][17][18][19] [20][21]extensively before reading this section

Using [10] a statement as to quantization for a would be GR term comes straight from

$$\Psi_{Later} = \int\sum_{H} e^{\left(iI_H/\hbar\right)\left(t,t^0\right)}\Psi_{Earlier}\left(t^0\right)dt^0 \qquad (12)$$

The approximation we are making is to pick one index, so as to have'

$$\Psi_{Later} = \int\sum_{H} e^{\left(iI_H/\hbar\right)\left(t,t^0\right)}\Psi_{Earlier}\left(t^0\right)dt^0 \xrightarrow[H\to 1]{} \int e^{\left(iI_{H_{FIXED}}/\hbar\right)\left(t,t^0\right)}\Psi_{Earlier}\left(t^0\right)dt^0 \qquad (13)$$

This corresponds to say being primarily concerned as to GW generation, which is what we will be examining in our ideas, via using.

$$e^{\left(iI_{H_{FIXED}}/\hbar\right)\left(t,t^0\right)} = \exp\left[\frac{i}{\hbar}\cdot\frac{c^4}{16\pi G}\cdot\int_{\mathrm{M}} dt\cdot d^3r\sqrt{-g}\cdot\left(\Re-2\Lambda\right)\right] \qquad (14)$$

We will use the following, namely, if Λ is a constant, do the following for the Ricci scalar [17]

$$\Re = \frac{2}{r^2} \qquad (15)$$

If so then we can write the following, namely: Eq.(14) becomes, if we have an invariant Cosmological constant, so we write $\Lambda \xrightarrow[all-time]{} \Lambda_0$ everywhere, then [10]

$$e^{\left(iI_{H_{FIXED}}/\hbar\right)\left(t,t^0\right)} = \exp\left[\frac{i}{\hbar}\cdot\frac{c^4\cdot\pi\cdot t^0}{16G}\cdot\left(r-r^3\Lambda_0\right)\right] \qquad (16)$$

Then, we have that Eq. (12) is re written to be

$$\Psi_{Later} = \int \sum_{H} e^{(iI_H/\hbar)(t,t^0)} \Psi_{Earlier}\left(t^0\right) dt^0$$
$$\xrightarrow[at-wormhole]{} \int \exp\left[\frac{i}{\hbar}\cdot\frac{c^4\cdot\pi\cdot t^0}{16G}\cdot\left(r-r^3\Lambda_0\right)\right]\Psi_{Earlier}\left(t^0\right)dt^0 \tag{17}$$

3. Examining the behavior of the Earlier wavefunction in Eq. (17)

[13] states a Hartle-Hawking wave function which we will adapt for the earlier wave function as stated in Eq. (6) so as to read as follows

$$\Psi_{Earlier}\left(t^0\right) \approx \Psi_{HH} \propto \exp\left(\frac{-\pi}{2GH^2}\cdot\left(1-\sinh\left(Ht\right)\right)^{3/2}\right) \tag{18}$$

Here, making use of Sarkar [14], we set, if say g_* is the degree of freedom allowed

$$H = 1.66\sqrt{g_*}T_{temp}^2 \Big/ M_{Planck} \tag{19}$$

We assume initially a relatively uniformly given temperature, that H is constant.
So then we will be attempting to write out an expansion as to what the Eq.(6) gives us while we use Eq. (18) and Eq. (19), with H approximately constant. If so then

4. Methods used in Calculating Eq. (17), with interpretation of the results

If so then

$$\Psi_{Later} = \int \exp\left[\frac{i}{\hbar}\cdot\frac{c^4\cdot\pi\cdot t^0}{16G}\cdot\left(r-r^3\Lambda_0\right)\right]\exp\left(\frac{-\pi}{2GH^2}\cdot\left(1-\sinh\left(Ht\right)\right)^{3/2}\right)dt^0 \tag{20}$$

Then using numerical integration, [18],[19],[20]

$$\Psi_{Later} \xrightarrow[t_M\to\varepsilon^+]{} \int_0^{t_M} e^{i\cdot(\tilde{\alpha}1)\cdot t-(\tilde{\alpha}2)\cdot(1-\sinh(Ht))^{3/2}}dt$$
$$\approx \frac{t_M}{2}\cdot\left(e^{i\cdot(\tilde{\alpha}1)\cdot t_M-(\tilde{\alpha}2)\cdot(1-\sinh(H\cdot t_M))^{3/2}}-1\right) \tag{21}$$
$$\tilde{\alpha}1 = \left[\frac{c^4\cdot\pi}{16G\hbar}\cdot\left(r-r^3\Lambda_0\right)\right],\quad \tilde{\alpha}2 = \frac{\pi}{2GH^2}$$

Notice the terms for the H factor, and from here we will be making our prediction. If the energy, E, has the following breakdown

$$H = 1.66\sqrt{g_*}T_{temp}^2 \Big/ M_{Planck}$$
$$\Rightarrow E \approx k_B T_{Temp} \approx \hbar\cdot\omega_{signal} \tag{22}$$
$$\Rightarrow \omega_{signal} \approx \frac{k_B\cdot\sqrt{M_{Planck}H}}{\hbar\cdot\sqrt{1.66\sqrt{g_*}}}$$

The upshot is that we have, in this, a way to obtain a signal frequency by looking at the real part of Eq. (22) above, if we have a small t, initially (small time step)

5. How to compare with a Kieffer solution and thereby isolate the Cosmological constant contribution

This means looking at [21] Eq. (11) would imply an initial frequency dependence,. What we are doing next is to strategize as to understand the contribution of the cosmological constant in this sort of problem. I.e. the way to do it would be to analyze a Kieffer "dust solution" as a signal from the Wormhole. i.e. look at [21], where we assume that t, would be in this case the same as in Eq. (21) above. I.e. in this case we will write having

$$\Delta\omega_{signal}\Delta t \approx 1 \tag{23}$$

If so then we can assume, that the time would be small enough so that

$$\Delta t \approx \frac{\hbar\sqrt{1.66\sqrt{g_*}}}{k_B \cdot \sqrt{M_{Planck} H}} \tag{24}$$

If Eq. (24) is of a value somewhat close to t, in terms of general initial time, we can write [21]

$$\psi_{\tilde{n},\lambda}(t,r) \equiv \frac{1}{\sqrt{2\pi}} \cdot \frac{\tilde{n}! \cdot (2\lambda)^{\tilde{n}+1/2}}{\sqrt{(2\tilde{n})!}} \cdot \left[\frac{1}{(\lambda + i\cdot t + i\cdot r)^{\tilde{n}+1}} - \frac{1}{(\lambda + i\cdot t - i\cdot r)^{\tilde{n}+1}} \right] \tag{25}$$

Here the time t would be proportional to Planck time, and r would be proportional to Planck length, whereas we set

$$\lambda \approx \sqrt{\frac{8\pi G}{V_{volume}\hbar^2 t^2}} \xrightarrow[G=\hbar=\ell_{Planck}=k_B=1]{} \sqrt{\frac{8\pi}{t^2}} \equiv \frac{\sqrt{8\pi}}{t} \tag{26}$$

Then a preliminary emergent space-time wave function would be

$$\begin{aligned}&\psi_{\tilde{n},\lambda}(\Delta t,r) \\ &\equiv \frac{1}{\sqrt{2\pi}} \cdot \frac{\tilde{n}! \cdot \left(2\cdot\sqrt{8\pi}\cdot(\Delta t)^{-1}\right)^{\tilde{n}+1/2}}{\sqrt{(2\tilde{n})!}} \cdot \left[\begin{array}{c} \dfrac{1}{\left(\sqrt{8\pi}\cdot(\Delta t)^{-1} + i\cdot\Delta t + i\cdot r\right)^{\tilde{n}+1}} \\ -\dfrac{1}{\left(\sqrt{8\pi}\cdot(\Delta t)^{-1} + i\cdot\Delta t - i\cdot r\right)^{\tilde{n}+1}} \end{array} \right]\end{aligned} \tag{27}$$

Just at the surface of the bubble of space-time, with $t_{Planck} \propto \Delta t$ **, and** $r \propto \ell_{Planck}$

This is from a section, page 239 of the 3rd edition of Kieffer's book, as to a quantum theory of collapsing dust shells, . And so, then we have the following procedure as to isolate out the contribution of the Cosmological constant. Namely, take the **REAL part of Eq. (27)** and compare it with the Real part of Eq. (21)

Another way to visualize this situation and this is a different way to interpret Eq, (26). To do so we examine looking at page 239 of Kieffer, namely [21] where one has an expectation value to energy we can write as

$$\langle E \rangle_{\kappa=n,\lambda} = \frac{(\kappa = n) + 1/2}{\lambda} \xrightarrow[\lambda\approx 1/\hbar\omega]{} \hbar\omega\cdot\left((\kappa=n)+1/2\right) \tag{28}$$

What we can do, is to ascertain the last step would be to make the Eq. (28) in a sense partly related to the simple harmonic oscillator,. But we should take into consideration the normalization using that if $\hbar = \ell_P = G = t_P = k_B = 1$ is done via Plank unit normalization[14][15]. If so, then we have that frequency is proportional to 1/t, where t is time. I.e. hence if there is a value of n=0 and making use of the frequency, we then would be able to write Eq. (27) as [21]

$$\Psi_{1,\kappa=n=0} \approx \sqrt{\frac{\omega}{\pi}} \cdot \left[\frac{1}{\omega + i\cdot(t+r)} - \frac{1}{\omega + i\cdot(t-r)} \right] \tag{29}$$

Or,

$$\Psi_{2,\kappa=n=0} \approx \frac{1}{\sqrt{\pi}} \sqrt{\frac{\sqrt{8\pi}}{t}} \cdot \left[\frac{1}{\frac{\sqrt{8\pi}}{t} + i\cdot(t+r)} - \frac{1}{+\frac{\sqrt{8\pi}}{t} i\cdot(t-r)} \right] \tag{30}$$

With, say.

$$\omega \approx \frac{\sqrt{8\pi}}{t} \tag{31}$$

And this in a setting where we have the dimensional reset of Planck Units

$$\hbar = \ell_P = G = t_P = k_B = 1 \tag{32}$$

7. The big picture, polarization of signals from a wormhole mouth may affect GW astronomy investigations

We will be referencing [22] and [23]. i.e. for [22] we have a rate of production from the worm hole mouth we can quantify as

$$\Gamma \approx \exp\left(\omega_{signal} / T_{temperature}\right) \tag{33}$$

Whereas we have from [23] a probability for "scalar" particle production from the wormhole given as

$$\Gamma \approx \exp\left(-E / T_{temperature}\right) \tag{34}$$

Whereas if we assume that there is a "negative temperature in Eq. (34) and say rewrite Eq. (34) as obeying having

$$\left(\omega_{signal} / T_{temperature}\right) \approx \left(-E / T_{temperature}\right) \tag{35}$$

This is specifying a rate of particle production from the wormhole. And so then : If we refer to black holes , with extra dimension, n, of Planck sized mass , we have a lifetime of the value of

$$\tau \sim \frac{1}{M_*}\left(\frac{M_{\mathrm{BH}}}{M_*}\right)^{\frac{n+3}{n+1}} \xrightarrow[M_{\mathrm{BH}} \approx M_{Planck}]{} 10^{-26} \sec onds$$

about $M_* \approx$ *is the low energy scale,* (36)

which could be as low as a few TeV,

The idea would be that there would be n additional dimensions, as given in Eq. (38) which would then lay the door open to investigating [24] and [25] in terms of applications, with [30] of additional polarization states to be investigated, as to signals from the mouth of the wormhole. We will next then go into some predictions into first, the strength of the signals, the frequency range, and several characteristics as to the production rate of Planck sized black holes which conceivably could get evicted by use of Eq. (36), in terms of what could be observed via instrumentation.

8. A First order guess as to the rate of production of Planck sized black holes through a wormhole, using Eq.(35)

In order to do this, we will be estimating that the temperature would be of the order of Planck temperature, i.e., using ideas from [25] and [26]

$$\frac{\omega_p}{T_p} \equiv \frac{\sqrt{G k_B^2}}{\hbar} \xrightarrow[\hbar = G = k_B = 1]{} 1 \qquad (37)$$

If so, then there would be to first order the following rate of production. of Gravitons, associated with a White – Hole, black hole pair, with the white hole in the prior universe and the Black hole in the present universe, i.e. per white hole to black hole transition per unit of Planck time, as a production rate looking like

$$\Gamma_{rate-of-production} \approx e \approx 2-3 \qquad (38)$$

9. Interpretation of Eq. (38) in lieu of Table 1

What we are seeing is that Table 1, is implicitly assuming millions of white hole (prior universe) to black hole (present universe) transitions, and ENORMOUS generation of gravitons as a wormhole transition. i.e. if so then, we can then relate this to our problem, via the cosmological transition as by the following argument

The reason for using this table is because of the modification of Dark Energy and the cosmological constant [1] [2] [3] [4] To begin this look at [2]

$$\rho_\Lambda c^2 = \int_0^{E_{Plank}/c} \frac{4\pi p^2 dp}{(2\pi\hbar)^3} \cdot \left(\frac{1}{2} \cdot \sqrt{p^2 c^2 + m^2 c^4} \right) \approx \frac{\left(3 \times 10^{19} GeV\right)^4}{(2\pi\hbar)^3}$$
$$\xrightarrow[E_{Plank}/c \to 10\text{^}-30]{} \frac{\left(2.5 \times 10^{-11} GeV\right)^4}{(2\pi\hbar)^3} \qquad (39)$$

In [2], the first line is the vacuum energy which is completely cancelled in their formulation of application of Torsion. In our article we are arguing for the second line . In facto by [2] we can assume we are having DE created by the following

$$\frac{\Delta E}{c} = 10^{18} GeV - \frac{n_{quantum}}{2c} \approx 10^{-12} GeV \qquad (40)$$

The term n (quantum) comes from a Corda expression as to energy level of relic black holes [7].We argue that our application of [1] [2] will be commensurate with Eq. (39) which uses the value given in [2] as to the following .i.e. relic black holes will contribute to the generation of a cut off of the energy of the integral

$$\rho_{\Lambda} c^2 = \int_0^{E_{Plank}/c} \frac{4\pi p^2 dp}{(2\pi\hbar)^3} \cdot \left(\frac{1}{2} \cdot \sqrt{p^2 c^2 + m^2 c^4} \right) \approx \frac{\left(3 \times 10^{19} GeV\right)^4}{(2\pi\hbar)^3} \tag{41}$$

Furthermore, the claim in [2] is that there is no cosmological constant, i.e. that Torsion always cancelling Eq. (30) which we view is incommensurate with Table 1 as of [2] . We claim that the influence of Torsion will aid in the decomposition of what is given in Table 1 and will furthermore lead to the influx of primordial black holes which we claim is responsible for the behavior of Eq. (30) above

10. Stating what black hole physics will be useful for in our modeling of Dark Energy. I.e. inputs into the Torsion Spin Density term

In [2] [9] we have the following, i.e., we have a spin density term of [1]][2][9]. And this will be what we input black hole physics into as to forming a spin density term from primordial black holes. $\sigma_{Pl} = n_{Pl}\hbar \approx 10^{71}$ as given in Eq. (7)

11. Now for the statement of the Torsion problem as given in [1] [2] [9]

Eventually in the case of an unpolarized spinning fluid in the immediate aftermath of the big bang, we would see a Roberson Walker universe given as, if σ is a torsion spin term added due to [1][2][9]as

$$\left(\frac{\dot{\tilde{R}}}{\tilde{R}}\right)^2 = \left(\frac{8\pi G}{3}\right) \cdot \left[\rho - \frac{2\pi G \sigma^2}{3c^4}\right] + \frac{\Lambda c^2}{3} - \frac{\tilde{k} c^2}{\tilde{R}^2} \tag{42}$$

12. What [9] does as to Eq. (42) versus what we would do and why

In the case of [1] we would see σ be identified as due to torsion so that Eq. (42) reduces to

$$\left(\frac{\dot{\tilde{R}}}{\tilde{R}}\right)^2 = \left(\frac{8\pi G}{3}\right) \cdot [\rho] - \frac{\tilde{k} c^2}{\tilde{R}^2} \tag{43}$$

The claim is made in [2] that this is due to spinning particles which remain invariant so the cosmological vacuum energy, or cosmological constant is always cancelled. Our approach instead will yield [1][2] [9]

$$\left(\frac{\dot{\tilde{R}}}{\tilde{R}}\right)^2 = \left(\frac{8\pi G}{3}\right) \cdot [\rho] + \frac{\Lambda_{0bserved} c^2}{3} - \frac{\tilde{k} c^2}{\tilde{R}^2} \tag{44}$$

I.e. the observed cosmological constant $\Lambda_{0bserved}$ is 10^-122 times smaller than the initial vacuum energy

The main reason for the difference in the Eq. (39) and Eq. (41) is in the following observation

Mainly that the reason for the existence of σ^2 is due to the dynamics of spinning black holes in the precursor to the big bang, to the Planckian regime, of space time, whereas in the aftermath of the big bang, we would have a vanishing of the torsion spin term. i.e. the Table 1 dynamics in the aftermath of the Planckian regime of space time would largely eliminate the σ^2 term

13. Filling in the details of the collapse of the cosmological term, versus the situation given in Eq. (33) via numerical values

First look at numbers provided by [17] as to inputs, i.e. these are very revealing

$$\Lambda_{Pl}c^2 \approx 10^{87} \tag{45}$$

This is the number for the vacuum energy and this enormous value is 10^122 times larger than the observed cosmological constant. Torsion physics, as given by [17] is solely to remove this giant number . In order to remove it, the reference [1][17]proceeds to make the following identification, namely

$$\left(\frac{8\pi G}{3}\right)\cdot\left[-\frac{2\pi G\sigma^2}{3c^4}\right]+\frac{\Lambda c^2}{3}=0 \tag{46}$$

What we are arguing is that instead, one is seeing, instead[2]

$$\left(\frac{8\pi G}{3}\right)\cdot\left[-\frac{2\pi G\sigma^2}{3c^4}\right]+\frac{\Lambda_{Pl}c^2}{3}\approx 10^{-122}\times\left(\frac{\Lambda_{Pl}c^2}{3}\right) \tag{47}$$

Our timing as to Eq. (47) is to unleash a Planck time interval t about 10^-43 seconds. As to Eq. (46) versus Eq. (47) the creation of the torsion term is due to a presumed particle density of

$$n_{Pl} \approx 10^{98} cm^{-3} \tag{48}$$

Finally, we have a spin density term of $\sigma_{Pl} = n_{Pl}\hbar \approx 10^{71}$ which is due to innumerable black holes initially

14. Brief recap of Tokamak physics obtaining Eq. (11) **Comparison with Grishchuk and Sachin results. For obtaining GW generation count**

Russian physicists Grishchuk and Sachin [27] obtained the amplitude of a Gravitational wave (GW) in a plasma as

$$\mathrm{A(amplitude-GW)} = \mathrm{h} \sim \frac{\mathrm{G}}{c^4}\cdot E^2\cdot\lambda_{GW}^2 \cdot \tag{49}$$

This is compared with [28], and we diagram the situation out as follows[28]

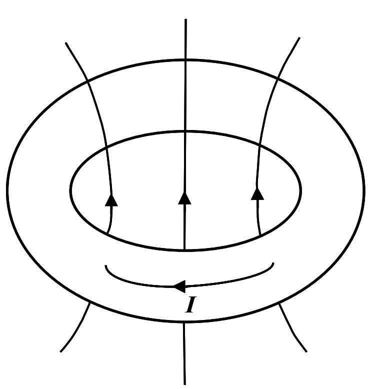

Fig. 1 *We outline the direction of Gravitational wave "flux". If the arrow in the middle of the Tokamak ring perpendicular to the direction of the current represents the z axis, we represent where to put the GW detection device as 5 meters above the Tokamak ring along the z axis. This diagram was initially from Wesson[*29]

Note that a simple model of how to provide a current in the Toroid is provided by a transformer core. This diagram is an example of how to induce the current I, used in the simple Ohms law derivation referred to in the first part of the text. Here, E is the electric field whereas λ_{Gw} is the gravitational wavelength for GW generated by the Tokamak in our model. In the original Griskchuk model, we would have very small strain values, which will comment upon but which require the following relationship between GW wavelength and resultant frequency. Note, if $\omega_{GW} \sim 10^{6}\,Hz \Rightarrow \lambda_{Gw} \sim 300\ meters$, so we will be assuming a baseline of the order of setting $\omega_{GW} \sim 10^{9}\,Hz \Rightarrow \lambda_{Gw} \sim .3\ meters$, as a baseline measurement for GW detection above the Tokamak. Furthermore,

15 ..Restating the energy density and power using the formalism of Eq.(49) directly

$$W_E \cdot V_{volume} \sim \tilde{\alpha} \cdot \lambda_{GW}^2 \cdot \frac{\xi^{1/4} \tilde{\alpha}^2 T^2_{Temp-plasma-fusion-burning}}{e_j^{\ 2}} \qquad (50)$$

The temperature for Plasma fusion burning, is then about between 30 to 100 KeV, as given by Wesson [29] The corresponding power as given by Wesson is then for the Tokamak [29]

$$P_\Omega = E \cdot J \leq \frac{E}{\mu_0} \cdot \frac{B_\phi}{R} \qquad (51)$$

In a one second interval, if we use the input power as an experimentally supplied quantity, then the effective E field is

$$E_{applied} \sim \frac{\xi^{1/8} \cdot \tilde{\alpha}}{e_j} \times T_{\text{Tokamak}-temperature} \qquad (52)$$

What is found is, that if Eq. (50) and Eq.(51) hold. Then by Wesson[29] , pp. 242-243, if $Z_{eff} \sim 1.5, q_a q_0 \sim 1.5, \left(R / \tilde{a}\right) \approx 3$ Then the temperature of a Tokamak, to good approximation would be between 30 to 100 KeV, and then one has[29]

$$B_\phi^{4/5} \sim .87 \cdot \left(\tilde{T} = T_{Tokamak-temperature}\right) \qquad (53)$$

Then the power for the Tokamak is

$$P_\Omega\Big|_{Tokamak-toroid} \leq \frac{\xi^{1/8} \cdot \tilde{\alpha}}{\mu_0 \cdot e_j \cdot R} \times \frac{\left(T_{\text{Tokamak}-temperature}\right)^{9/4}}{(.87)^{5/4}} \qquad (54)$$

Then, per second, the author derived the following rate of production per second of a $10^{-34}\,eV$ graviton, as, brought up in Eq. (11)

$$n\Big|_{massive-gravitons/\sec ond} \propto \frac{3 \cdot \hbar \cdot e_j}{\mu_0 \cdot R^2 \cdot \xi^{1/8} \cdot \tilde{\alpha}} \times \frac{\left(T_{\text{Tokamak}-temperature}\right)^{1/4}}{\lambda^2_{Graviton} \bullet m_{graviton} \cdot c^2 \cdot (.87)^{5/4}} \sim 1 / \lambda^2_{Graviton} scaling$$

15. Wrapping it all up. Some specific inter connections. For future work

I.e. We can state that Eq. (11) is also tied into the quantum number n, as given in eq. (10) which in turn is linkable to N, as the black hole number, In addition, we have also stated that if we have multiple wormhole style connections between a black hole and a white hole with the white hole as given in the pre Planckian section of space time, and the black hole in the present era, that we should pay attention to what Eq. (38) is saying is commensurate with Table 1. In short, lots of inter connections, and proof of Eq. (11) by Tokamak physics may be extremely important.

This also means we can safely review the issues given in [27-37] with this in mind

16. Future project as to explicitly working in prior Universe white hole linked to present universe black hole, via a special wormhole, for each wormhole linking prior to present universes

What we are doing is using the following wormhole connection, i.e.

In doing this we should note that we are assuming as a future work that there would be black holes, in our initial configuration, plus a white hole in the immediate pre inflationary regime. Likely in a recycled universe. Reference [17][7] is what we will start off with [17][7] and its given metric as far as a black hole to white hole solution. i.e.

$$dS^2 = -A(r,a)dt^2 + B(r,a)^{-1}dr^2 + g^2(r,a)d\Omega^2 \qquad (55)$$

We can perform a major simplification by setting, then

$$A(r,a) = B(r,a) = f(r,a) \qquad (56)$$

In doing so, [7] gives us the following stress energy tensor values as give

$$\begin{aligned}
T_t^t &= \frac{1}{8\pi}\cdot\left(\frac{1}{g}\cdot\left(f'g' + 2fg''\right) - \frac{1}{g^2}\cdot\left(1 - fg'^2\right)\right) \\
T_r^r &= \frac{1}{8\pi}\cdot\left(\frac{1}{g}\cdot\left(f'g'\right) - \frac{1}{g^2}\cdot\left(1 - fg'^2\right)\right) \\
T_\theta^\theta = T_\phi^\phi &= \frac{1}{8\pi}\cdot\left(\frac{1}{g}\cdot\left(f'g' + fg''\right) + \frac{1}{2}\cdot\left(f''\right)\right)
\end{aligned} \qquad (57)$$

In doing this, we will chose the primed coordinate as representing a derivative with respect to r. Also in the case of black hole to white hole joining, we will be looking at a gluing surface as to the worm hole joining a black hole to white hole given as with regards to a gluing surface connecting a black hole to a white hole which we give as ξ. And $\tilde{\tilde{n}}$ is a quantum gravity index. Note that in [7] the authors often set it at 3, if so then for a black hole, to white hole to worm hole configuration they give

$$\begin{aligned}
g(r,a) &= \left\{r^2 + a^2(1 - \frac{r^2}{\xi^2})^{\tilde{\tilde{n}}} \right\}, when\left(r \le \xi\right) \\
g(r,a) &= \left\{r^2 \right\}, when\left(r > \rho\right)
\end{aligned} \qquad (58)$$

We then make the following connection to energy density in a black hole to white hole system, i.e

$$\rho_{black-hole-white-hole-wormhole} \equiv -T_r^r \approx \hbar \omega_{black-hole-white-hole-wormhole} \tilde{n}_{black-hole-white-hole-wormhole} \tag{59}$$

This will lead to , if we use Planck units where we normalize h bar to being 1, of

$$\tilde{n}_{black-hole-white-hole-wormhole} = \frac{1}{8\pi} \cdot \left(\frac{1}{g} \cdot \left(f'g' \right) - \frac{1}{g^2} \cdot \left(1 - fg'^2 \right) \right) \cdot \frac{1}{\omega_{black-hole-white-hole-wormhole}} \tag{60}$$

If we are restricting ourselves to quantum geometry at the start of expansion of the universe, it means that say we can set these values to be compared to the inputs of quantum number n used to specify a quantum number n, and it furthermore if

$$a \approx \ell_P = Planck - length \xrightarrow[Planck-normalization]{} 1 \tag{61}$$

We get further restrictions as to the quantum number in Eq.(60) when we compare it to where we had a value of n given in the first section of our document. Furthermore, it means that we can use this to model say, with additional work in a future project how a white hole (specified as in the prior universe .If we go back to table 1 of this document, there will be a join between the prior to present universes, where Eq.(61) will be subsequently modified.

17. Conclusions, for this document

First, the tokamak may enable a connection between the number of gravitons generated, from say early universe black holes to be formally worked out. I.e. this is tricky and will require a lot of work. Secondly, black holes generate gravitons and we have stated a relationship between gravitons and a quantum number n. Three, we are assuming that relic black holes have a quantum number as well . Four we have tried through table 1 to specify regimes between prior to our universe, to our present universe black holes, assuming a collapse and rebirth of a universe structure. Five, a wormhole connection between white holes, in the prior universe, to black holes in our present universe, as discussed in Table 1, is alluded to as a formal wormhole connection, I.e. this has to be formally worked out. Six, the rudiments of a wave function of the universe, as discussed by Kieffer is also discussed, and set up for further elaborations in future research. Main item to be considered is if we can get Pre Planck to Plank spacetime metrics understood as to explicitly understand the details of Section 17 fully. We also leave as a future investigation the items brought up in [38][39][40] as to their feasibility and application to this document

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