# Use Torsion for Cosmological Constant and Massive Gravity

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**Abstract**

We discuss how torsion may allow for a cosmological constant, which links the ideas given by Beckwith and QaZi 2023 to a presentation for Torsion as given by de Sabbata and Sirvaram,.Our formulation leads to a leftover cosmological constant 10^-121 times vacuum energy

## Introduction: Review of the purported role of Torsion given by de Sabbataand Sirvaram 1990 Versus a preview of what we will be doing

To begin this, look at [1] [2][3] which purports to show a global cancellation of a vacuum energy term, which is akin, as we discuss later to cancelling the following completely [3] [4][5]

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

In [1], 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 fact, in our formulation our reduction to the second line of Eq. (1) will be to confirm the following change in the Planck energy term given by [1]

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

The term n (quantum) comes from a Corda derived expression as to energy level of relic black holes [4]. We argue that our application of [1] [2] will be commensurate with Eq. (2) 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 given in Eq. (1) whereas what is done in Eq.(1) by [1] [2] is restricted to a different venue which is reproduced below, namely cancellation of the following by Torsion

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

Furthermore, the claim in [1] is that there is no cosmological constant, i.e. that Torsion always cancelling Eq. (3) which we view is incommensurate with Table 1 as of [3] which is given below

. We claim that the influence of Torsion will aid in the decomposition of what is given in Table 1 below from [3] and will furthermore lead to the influx of primordial black holes which we claim is responsible for the behavior of Eq. (2) above
Table 1 from [2] assuming Penrose recycling of the Universe as stated in that document [6]

| | | |
|---|---|---|
| End of Prior Universe time frame | Mass (black hole) :<br><br>super massive end of time BH<br><br>1.98910^+41 to about 10^44 grams | Number (black holes)<br><br>10^6 to 10^9 of them usually from center of galaxies |
| Planck era Black hole formation<br><br>Assuming start of merging of micro black hole pairs | Mass (black hole)<br><br>10^-5 to 10^-4 grams ( an order of magnitude of the Planck mass value) | Number (black holes)<br><br>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) to have say 10^10 gravitons/second released per black hole | Mass (black hole)<br><br>10 grams to say 10^6 grams per black hole | Number (black holes)<br><br>Due to repeated Black hole pair forming a single black hole multiple time.<br><br>10^20 to at most 10^25 |

Now for the statement of the Torsion problem as given in [1] with a nod to [6] [7][8], in the massless particle case, initially**.**

The author is very much aware as to quack science as to purported torsion physics presentations and wishes to state that the torsion problem is not linked to anything other than disruption as to the initial configuration of the expansion of the universe and cosmology, more in the spirit of [6], [7] and is nothing else. Hence, in saying this we wish to delve into what was given in [1] with a subsequent follow up and modification: To do this, note that in [1] the vacuum energydensity is stated to be.

$$\rho_{vac} = \Lambda_{eff} c^4 / 8\pi G \quad (4)$$

And

$$(da/d\tau)^2 = \left[1 - \left(r_{\min}^4 / a^4\right)\right] \quad (5)$$

With, if S is the so called spin scalar S and identified as the basic h unit of spin

$$r_{\min}^4 = 3G^2 S^2 / 8c^4 \quad (6)$$

How to modify Eq. (5) in the presence of matter via Yang Mills fields $F_{\mu v}^{\beta}$

If $g = \mathrm{h}c$ we have $\beta_1 = r_{\min}^2, \beta_2 = r_{\min}^4$, and the minimum radius is identified with a Planck Radius so then.

$$(da/d\tau)^2 = \left[1 - \left(\left(\beta_1 = 1_P^2\right)/a^2\right) - \left(\left(\beta_2 = 1_P^4\right)/a^4\right)\right] \quad (7)$$

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 $\sigma$ is a torsion spin term added due to [1] as

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

What [1] does as to Eq. (8)

In the case of [1] we would see $\sigma$ be identified as due to torsion so that Eq. (8) reduces to

$$\left(\frac{\dot{R}}{R}\right)^2 = \left(\frac{8\pi G}{3}\right)\cdot[\rho] - \frac{kc^2}{R^2} \quad (9)$$

The claim is made in [1] 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.

$$\left(\frac{\dot{R}}{R}\right)^2 = \left(\frac{8\pi G}{3}\right)\cdot[\rho] + \frac{\Lambda_{0bserved}c^2}{3} - \frac{kc^2}{R^2} \quad (10)$$

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. (9) and Eq. (10) is in the following observation. We will go to Table 1 and make the following assertion.Mainly that the reason for the existence of $\sigma^2$ is due to the dynamics of spinning black holes in the precursor to the big bang,

Filling in the details of the Eq. (9) collapse of the cosmological term, versus the situation given in Eq. (10)

First look at numbers provided by [3] as to inputs, i.e. these are very revealing.

$$\Lambda_{Pl}c^2 \approx 10^{87} \quad (11)$$

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 [3] is solely to remove this giant number. In order to remove it, the reference [3] proceeds to make the following identification,

$$\left(\frac{8\pi G}{3}\right)\cdot\left[-\frac{2\pi G\sigma^2}{3c^4}\right] + \frac{\Lambda c^2}{3} = 0 \quad (12)$$

What we are arguing is that instead, one is seeing, instead.

$$\left(\frac{8\pi G}{3}\right)\cdot\left[-\frac{2\pi G\sigma^2}{3c^4}\right]+\frac{\Lambda_{Pl}c^2}{3}\approx 10^{-122}\times\left(\frac{\Lambda_{Pl}c^2}{3}\right)(13)$$

Our timing as to Eq. (12) is to unleash a Planck time interval t to about 10^-43 seconds. As to Eq. (12) versus Eq. (13) the creation of the torsion term is due to a presumed particle density of

$$n_{Pl}\approx 10^{98}cm^{-3} \quad (14)$$

Finally, we have a spin density term of

$$\sigma_{Pl}=n_{Pl}\mathrm{h}\approx 10^{71} \quad (15)$$

Conclusion what about massive gravity**?**

We will assume for the moment that Eq. (12) and Eq. (3) share Eq. (14) and Eq. (15)
Does this all mesh in with more classical relativity assumptions?First, if this is related to the following.If so, by Novello [9] we then have a bridge to the cosmological constant as given b

$$m_g=\frac{\mathrm{h}\cdot\sqrt{\Lambda}}{c}(16)$$

We state that in the future a task will be to derive in a coherent fashion the following, i.e. the term

$\left(\frac{8\pi G}{3}\right)\cdot\left[-\frac{2\pi G\sigma^2}{3c^4}\right]$ arising because of the dynamics of Table 1, as given in the manuscript: In addition

The conclusion of [3] states that Eq. (12) would remain invariant for the life of the evolution of the universe. We make no such assumption. We assume that, as will be followed up later that Eq. (13) is due to relic black holes with the suppression of the initially gigantic cosmological vacuum energy,

We state that the term $\left(\frac{8\pi G}{3}\right)\cdot\left[-\frac{2\pi G\sigma^2}{3c^4}\right]$ is due to initial micro black holes, as to the creation of a Cosmological term. This would follow from Eq. (2) being utilized, i.e. what we are seeking is utilization of the following.Making use of all this leads to[9]to making sense of the quantum number n as given by reference to black holes, [5]

$$E_{Bh}=-\frac{n_{quantum}}{2} \quad (17)$$

Bibliography

[1] de Sabbata, V. and Sirvaram, " Quantum Effects and the Problem of Cosmological Constant", pp 19-36 in "Gravitation and Modern Cosmology, the Cosmological Constant Problem": edited by Zichichi, A., de Sabbata, V. and Sachez, N. , Volume 56, Ettore Majorana

International Science series (Physical sciences), Plenum Press, New York City New York, USA, 1991

[2] Beckwith, A. ,"New Conservation Law as to Hubble Parameter, Squared Divided by Time Derivative of Inflaton in Early and Late Universe, Compared with Discussion of HUP in Pre Planckian to Planckian Physics, and Relevance of Fifth Force Analysis to Gravitons and GW", pp 1 -18 in, Gravitational Waves - Theory and Observations ,edited by Prof. Carlos Frajuca, published by lntechopen, London UK, 2023 Submitted: October 24th, 2022 Reviewed: October 30th, 2022 Published: December 22nd, 2022 DOI: 10.5992/intechopen.1000577,https://www.intechopen.com/online-first/1125889

[3] Beckwith, A. and Ghafoor, Q. (2023) Using Model of a Universe as Similar to a Black Hole, Ask If We Have to Have Singularities, If We Are Looking at Initial Time Step and Entropy, from the Beginning. Journal of High Energy Physics, Gravitation and Cosmology, **9**, 708-719. doi: 10.4236/jhepgc.2023.93058.

[4] Cheng Ta-Pei, "Relativity, Gravitation and cosmology, a Basic introduction" Oxford University press united kingdom , 2008

[5] Corda, Christian, "Black Hole spectra from Vaz's Quantum gravitational collapse", https://arxiv.org/abs/2305.02184, 11 pages,Fortschr. Phys. 2023, 2300028.

[6] Beckwith, A. (2024) How Torsion as Presented by De Sabbata and Sivaram in Erice 1990 Argument as Modified May Permit Cosmological Constant, and Baseline as to Dark Energy. Journal of High Energy Physics, Gravitation and Cosmology, **10**, 138-148. doi: 10.4236/jhepgc.2024.101012.

[7] Sciama, D.W. (1964), "The physical structure of general relativity", Rev. Mod. Phys., **36** (1): 463, Bibcode:1964RvMP...36..463S, doi:10.1103/RevModPhys.36.463

[8] de Sabbata, V., And Gasperini, G., Introduction to Gravitation, World Scientific, Singapore, Republic of Singapore, 1989

[9] Novello, M., "The mass of the graviton and the cosmological constant puzzle", https://arxiv.org/abs/astro-ph/0504505