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

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Abstract

Based on the idea of cyclic conformal cosmology, we discuss how torsion may allow for a cosmological constant, which links the ideas given by Beckwith and QaZi 2023 to a presentation as far as Torsion as given by de Sabbata and Sirvaram, Erice 1990 . The 1990 article claims that Torsion cancels Cosmological vacuum energy whereas our formulation leads to a left over cosmological constant 10^-121 times vacuum energy . Meantime speculation as to how all this relates to black hole physics and speculation given by Corda which replaces traditional firewalls with a different formulation are included as that presentation by Corda uses the idea of a quantum number n, which ties into our own Cosmological constant presentation.

Key words, Inflation, Gravitational waves, Penrose CCC

I. Introduction: Review of the purported role of Torsion given by de Sabbata and Sirvaram 1990 in its cancelation of Vacuum energy/ cosmological constant. 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]

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

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]

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

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

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

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

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 Assuming start of merging of micro black hole pairs	Mass (black hole) 10^-5 to 10^-4 grams (an order of magnitude of the Planck mass value)	Number (black holes) 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) 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

II. 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: We first follow the description of [1] to remove Torsion physics from the quacks

To do this, note that in [1] the vacuum energy density is stated to be

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

Whereas the application is given in terms of an antisymmetric field strength $S_{\alpha\beta\gamma}$ [8]

In [1] due to the Einstein Cartan action , in terms of a SL(2,C) gauge theory, we write from [1]

$$L = -R/(16\pi G) + S_{\alpha\beta\gamma}S^{\alpha\beta\gamma}/2\pi G \quad (5)$$

R here is with regards to Ricci scalar and Tensor notation and $S_{\alpha\beta\gamma}$ is related to a conserved current closing in on the SL(2,C) algebra as given by

$$J^{\mu} = J^{\mu} + 1/(16\pi G)\varepsilon^{\mu\alpha\beta\gamma}S_{\alpha\beta\gamma} \quad (6)$$

This is where we define

$$S_{\alpha\beta\gamma} = c_{\alpha} \times f_{\beta\gamma} \quad (7)$$

Where c_{α} is the structure constant for the group SL(2,C), and

$$f_{\beta\gamma} \cdot \bar{g} = F_{\beta\gamma} \quad (8)$$

Where

$$\bar{g} = (g_1, g_2, g_3) \quad (9)$$

Is for tangent vectors to the gauge generators of SL(2,C) , and also for Gauge fields A_{γ}

$$F_{\beta\gamma} = \partial_{\beta}A_{\gamma} - \partial_{\gamma}A_{\beta} + \left[A_{\beta}, A_{\gamma}\right] \quad (10)$$

And that there is furthermore the restriction that

$$\partial_{\rho}\left(\varepsilon^{\rho\alpha\beta\gamma}S_{\alpha\beta\gamma}\right) = 0 \quad (11)$$

Finally in the case of massless particles with torsion present we have a space time metric

$$ds^2 = d\tau^2 + a^2(\tau)d^2\Omega_3 \quad (12)$$

Where $d^2\Omega_3$ is the metric of S^3

Then the Einstein field equations reduce to in this torsion application, (no mass to particles) as

$$(da/d\tau)^2 = \left[1 - \left(r_{\min}^4 / a^4\right)\right] \quad (13)$$

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

$$r_{\min}^4 = 3G^2S^2/8c^4 \quad (14)$$

III. How to modify Eq. (13) in the presence of matter via Yang Mills fields $F_{\mu\nu}^{\beta}$

First of all, this involves a change of Eq. (5) to read

$$L = -R/(16\pi G) + S_{\alpha\beta\gamma}S^{\alpha\beta\gamma}/2\pi G + (1/4g^2)F_{\mu\nu}^{\beta}F_{\beta}^{\mu\nu} \quad (15)$$

And eventually we have a re do of Eq. (13) to read as

$$(da/d\tau)^2 = \left[1 - \left(\beta_1 / a^2\right) - \left(\beta_2 / a^4\right)\right] \tag{16}$$

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

$$(da/d\tau)^2 = \left[1 - \left(\left(\beta_1 = \ell_P^2\right)/a^2\right) - \left(\left(\beta_2 = \ell_P^4\right)/a^4\right)\right] \tag{17}$$

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] as

$$\left(\frac{\dot{\tilde{R}}}{\tilde{R}}\right)^2 = \left(\frac{8\pi G}{3}\right) \cdot \left[\rho - \frac{2\pi G \sigma^2}{3c^4}\right] + \frac{\Lambda c^2}{3} - \frac{\tilde{k} c^2}{\tilde{R}^2} \tag{18}$$

IV. What [1] does as to Eq. (18) 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. (18) reduces to

$$\left(\frac{\dot{\tilde{R}}}{\tilde{R}}\right)^2 = \left(\frac{8\pi G}{3}\right) \cdot [\rho] - \frac{\tilde{k} c^2}{\tilde{R}^2} \tag{19}$$

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

$$\left(\frac{\dot{\tilde{R}}}{\tilde{R}}\right)^2 = \left(\frac{8\pi G}{3}\right) \cdot [\rho] + \frac{\Lambda_{0bserved} c^2}{3} - \frac{\tilde{k} c^2}{\tilde{R}^2} \tag{20}$$

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. (19) and Eq. (20) is in the following observation. We will go to Table 1 and make the following assertion

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

V. Filling in the details of the Eq. (19) collapse of the cosmological term, versus the situation given in Eq. (20) via numerical values

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

$$\Lambda_{Pl} c^2 \approx 10^{87} \qquad (21)$$

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, namely

$$\left(\frac{8\pi G}{3}\right) \cdot \left[-\frac{2\pi G \sigma^2}{3c^4}\right] + \frac{\Lambda c^2}{3} = 0 \qquad (22)$$

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

$$\left(\frac{8\pi G}{3}\right) \cdot \left[-\frac{2\pi G \sigma^2}{3c^4}\right] + \frac{\Lambda_{Pl} c^2}{3} \approx 10^{-122} \times \left(\frac{\Lambda_{Pl} c^2}{3}\right) \qquad (23)$$

Our timing as to Eq. (22) is to unleash a Planck time interval t about 10^-43 seconds

As to Eq. (22) versus Eq. (23) the creation of the torsion term is due to a presumed particle density of

$$n_{Pl} \approx 10^{98} cm^{-3} \qquad (24)$$

Finally, we have a spin density term of

$$\sigma_{Pl} = n_{Pl} \hbar \approx 10^{71} \qquad (25)$$

VI. Conclusion and also future works to be commenced as to derivational tasks

We will assume for the moment that Eq. (22) and Eq. (23) share in common Eq. (24) and Eq. (25)

It appears to be trivial, a mere round off, but I can assure you the difference is anything but trivial. And this is where Table 1 really plays a role in terms of why there is a torsion term to begin with, i.e. will make the following determination, i.e.

The term of ‘spin density’ in Eq. (22) by Eq. (25) is defined to be an ad hoc creation, as to [3]. No description as to its origins is really offered

1st

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

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

2nd,

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

In the case of Pre Planckian space-time the idea is to do the following [9] ,i.e. if we have an inflaton field [10]

$$\begin{aligned}&\left|dp_\alpha dx^\alpha\right| \approx \frac{L}{l}\cdot\frac{h}{c}\cdot\left[\frac{dl}{l}\right]^2 \\ &\xrightarrow[\alpha=0]{}\left|dp_0 dx^0\right| \simeq \left|\Delta E\Delta t\right| \approx \left(h/a_{init}{}^2\phi(t)\right) \\ &\Rightarrow \frac{L}{l}\cdot\frac{h}{c}\cdot\left[\frac{dl}{l}\right]^2 \approx \left(h/a_{init}{}^2\phi(t_{init})\right)\end{aligned} \tag{26}$$

Making use of all this leads to[8]to making sense of the quantum number n as given by reference to black holes, [4]

$$E_{Bh} = -\frac{n_{quantum}}{2} \tag{27}$$

3rd

The conclusion of [3] states that Eq.(22) 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. (23) is due to relic black holes with the suppression of the initially gigantic cosmological vacuum energy,

The details of what follow after this initial period of inflation remain a task to be completed in full generality but we are still assuming as a given the following inputs [1] [9]

$$\begin{aligned}&a(t) = a_{initial}t^\nu \\ &\Rightarrow \phi = \ln\left(\sqrt{\frac{8\pi G V_0}{\nu\cdot(3\nu-1)}}\cdot t\right)^{\sqrt{\frac{\nu}{16\pi G}}} \\ &\Rightarrow \dot{\phi} = \sqrt{\frac{\nu}{4\pi G}}\cdot t^{-1} \\ &\Rightarrow \frac{H^2}{\dot{\phi}} \approx \sqrt{\frac{4\pi G}{\nu}}\cdot t \ \cdot T^4\cdot\frac{(1.66)^2\cdot g_*}{m_P^2} \approx 10^{-5}\end{aligned} \tag{28}$$

A possible future endeavor can also make sense of [10] as well

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