Scientific
Research
Publishing

Journal of High Energy Physics, Gravitation and Cosmology, 2024, 10, 180-184
https://www.scirp.org/journal/jhepgc
ISSN Online: 2380-4335
ISSN Print: 2380-4327

Gedankenexperiment for Modified ZPE and Planck's "Constant", h, in the Beginning of Cosmological Expansion, Partly Due to NLED

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How to cite this paper: Beckwith, A.W. (2024) Gedankenexperiment for Modified ZPE and Planck's "Constant", h, in the Beginning of Cosmological Expansion, Partly Due to NLED. *Journal of High Energy Physics, Gravitation and Cosmology*, **10**, 180-184.
https://doi.org/10.4236/jhepgc.2024.101016

Received: November 28, 2023
Accepted: January 15, 2024
Published: January 18, 2024

Abstract

We initially look at a non singular universe representation of entropy, based in part on what was brought up by Muller and Lousto. This is a gateway to bringing up information and computational steps (as defined by Seth Lloyd) as to what would be available initially due to a modified ZPE formalism. The ZPE formalism is modified as due to Matt Visser's alternation of k (maximum) ~ 1/(Planck length), with a specific initial density giving rise to initial information content which may permit fixing the initial Planck's constant, h, which is pivotal to the setting of physical law. The settings of these parameters depend upon NLED.

Keywords

ZPE, Planck's "Constant", Gedankenexperiment, NLED

1. Introduction

First of all we wish to ascertain if there is a way to treat entropy in the universe, initially, by the usual black hole formulas. Our derivation takes advantage of work done by Muller, and Lousto [1], both of whom have a different formulation of entropy cosmology based upon a modified event horizon, which they call the Cosmological Event Horizon, *i.e.* it represents that the distance a photon emitted at time t can travel. Afterwards, we give an argument, as an extension of what is presented by Muller and Lousto [1], which we claim ties in with Cai [2], as to a bound to entropy, which is stated to be S (entropy) less than or equal to N, with N, in this case, a micro state numerical factor. Then, a connection as to Ng's infinite quantum statistics [3] is raised, *i.e.* afterwards, we are then referencing C. S. Camara a way to ascertain a non zero finite, but extremely small bounce and then we use the scaling, as given by Camara [4], that a resulting density, is scaled as by $\rho \sim a^{-4}$. In addition we will set this scaling as a way to set minimum magnetic field values, commensurate to the modified ZPE density value, as given by Visser [5], with $\rho \sim a^{-4}$ paired off with [5]'s $\rho \sim$ mass(planck)/(length[planck])^3, so then the magnetic fields as given by [4] can in certain cases be estimated. In addition, comparing the results of [4] and [5] permits us to use Waleka's [6] result of a time step ~ 1/square root of $\rho \sim$ mass(planck)/(length[planck])^3 versus a time step ~ 1/square root of $\rho \sim a^{-4}$, with equality giving further constraints upon magnetic fields and a cosmological "constant" Λ. Doing so, will then permit us to make further use of [7] and its relationship between and a cosmological "constant" Λ and an upper bound to the number of produced gravitons. Isolating N (the number of gravitons) and if this is commensurate with entropy due to [2] and [3] will allow us to use Seth Lloyd supposition of [8] as to the number of permitted operations in quantum physics may be permitted. This final step will allow us to go to the final supposition, as to what number of operations/information may be needed to set a value of h (Planck's constant) in the beginning of the universe, ord given in [9] with value, $\hbar$ invariant over time.

$$\hbar(\text{initial}) = E(\text{initial}) \cdot t(\text{initial}) = \rho(\text{initial}) \cdot V(\text{initial}) \cdot t(\text{initial}) \tag{1}$$

Please see the rest of the document as given in reference [10]. We have jumped to the conclusion, <SNIP> with a drop down to the last part of this presentation.

2. Conclusion

Order of magnitude estimate as to existence of necessary and sufficient conditions for calculation of h bar in the early Universe, leading to effective initial time as set not equal to zero

We will now give a first-order estimate as to calculation of h bar, *i.e.* Equation (1), *i.e.* isolate the actual spatial length, for the creation of a present day h bar Planck's constant. To do this look at [11] [12]

$$\Delta x \Delta p \geq \hbar + \frac{l_{\text{Planck}}^2}{\hbar} \cdot (\Delta p)^2 \tag{2}$$

Then the following are equivalent. The idea would be that the Planck constant, h bar would be formulated as of the present day value. Also, the modification for the string length, would have $\Delta x|_{\min} \sim 10^{\beta} l_{\text{Planck}}$, so then

$$\begin{aligned}
& \Delta x|_{\min} \Delta p \approx \hbar + \frac{l_{\text{Planck}}^2}{\hbar} \cdot (\Delta p)^2 \\
& \hbar^2 - \hbar \Delta x|_{\min} \Delta p + l_{\text{Planck}}^2 \cdot (\Delta p)^2 \approx 0 \\
\hbar & \approx \frac{\Delta x|_{\min} \Delta p}{2} \cdot \left(1 + \sqrt{1 - 4 \frac{l_{\text{Planck}}^2}{\left(\Delta x|_{\min} \right)^2}} \right) \\
\hbar & \approx \frac{\Delta x|_{\min} \Delta p}{2} \cdot \left(1 + \sqrt{1 - 4 \cdot 10^{-2\beta}} \right) \\
& \approx \Delta x|_{\min} \Delta p \cdot \left(1 - \frac{2}{10^{2\beta}} \right)
\end{aligned} \tag{3}$$

Then,

$$\begin{aligned}&\text{if } \Delta p \sim N_{\text{graviton}} \cdot m_{\text{graviton}} \cdot c \\ &\hbar \approx \Delta x\big|_{\min} \cdot N_{\text{graviton}} \cdot m_{\text{graviton}} \cdot c \cdot \left(1 - \frac{2}{10^{2\beta}}\right) \\ &\Delta x\big|_{\min} \approx \frac{\hbar}{N_{\text{graviton}} \cdot m_{\text{graviton}} \cdot c \cdot \left(1 - \frac{2}{10^{2\beta}}\right)}\end{aligned} \tag{4}$$

This should be greater than a Plank length, mainly due to the situation of

$$\left(1 - \frac{2}{10^{2\beta}}\right)^{-1} \sim 1 + \frac{2}{10^{2\beta}} \tag{5}$$

We assume, here that this will be occurring in an interval of time approximately the value of Planck time given by

$$\begin{aligned}&t(\text{initial}) \sim \hbar / \rho(\text{initial}) \cdot V(\text{initial}) \\ &\sim \frac{\hbar}{\left(\frac{m_{\text{Planck}}}{l_{\text{Planck}}^{3}}\right)} \left(\frac{\hbar}{N_{\text{graviton}} \cdot m_{\text{graviton}} \cdot c \cdot \left(1 - \frac{2}{10^{2\beta}}\right)}\right)^{-3}\end{aligned} \tag{6}$$

Here, the number, N, is given as the number of gravitons, and the important factor is that Equation (6) is non zero.

Whereas this will then lead to a fixed magnetic field behavior as to N being defined above, by Equation (6) and the N so being defined, leading to a bound on Λ.

We will, from now on give definite cases as to what these parameters should be in future work.

The upshot is that the entropy, at the close of the inflationary era, would be dominated by graviton production.

We will consider what happens as of about the electroweak era, and this would have consequences as far as information , as can be seen by the approximation given by Seth Lloyd [8] on page 14 of the article, as to the number of operations # being roughly about

$$\# \leq (1/2\pi) \cdot (r/l_P) \cdot (t/t_P) \tag{7}$$

In the electro-weak era, we would be having Equation (7) as giving a number of "computational steps" many times larger (10 orders of magnitude) than the entropy of the Electro-weak,

$$\#(\text{Electro-weak}) \sim 10^{49} \tag{8}$$

In the immediate aftermath of inflation, this number would be, instead about 10^5 - 10^7.

Some work so required will lead to an understanding of the number of steps needed, computationally for forming h bar will be done in the next rendition of this project. Whereas we would hope that the magnetic fields, would be shown to be commensurate with the E and M calculations as given in [13], while keeping in mind what was brought up by [14] about Graviton mass and other parameters.

Acknowledgements

This work is supported in part by National Nature Science Foundation of China grant No. 11375279.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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