Configuration of the Arrow of Time, in initial Start of Inflation?

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Initial relic entropy growth is presented in the context of a zero valued chemical potential and different formulations of overall energy values, which may be tied into massive gravitons appearing at the onset of inflation This is contrasted with the role of gravitons with non zero rest mass in four dimensions a billion years ago. Questions as to if an interplay between two different regimes for 'heavy' gravity are presented s open research issues.

1. Introduction

We wish to present an initial value to the arrow of time problem, with regards to if gravitons may, or may not in four dimensions have a non zero rest mass. If a rest mass for four dimensional gravitons is not set equal to zero, and if there is a resolution of the entropy count issue, as brought up by Ng, of $\Delta S \approx \Delta N_{relic-particles}$, so as to explain how $S_{initial} \approx 10^5$ or higher, as possibly indicated by G. Smoot in 2007 in his lecture, in Paris , then what does this say about the probability of having gravitons contribute to re acceleration of the universe a billion years ago ?

2. Entropy via $S \equiv [E - \mu N]/T \to S \propto T^3$ For Different Energy Values if $\mu \to 0$

We hope to refine $S \propto T^3$ to be congruent with $S \approx \langle n \rangle$ (where <n> is a relic particle density). Begin with re setting the degrees of freedom $g_* \sim 100$ of the electro weak era, to $g_* \sim 1000$ at the onset of inflation , which may entail using , if $T \approx T_{Plank} \sim 10^{19}\, GeV$ .Then $S \equiv [E]/T \sim 10^5 \sim S \propto T^3$ for temperatures in the neighborhood of $T_{Plank} \sim 10^{19}\, GeV$ .So then , if the effective graviton energy is given by

$$E_{graviton-effective}\left(\nu \approx 10^{10}\, Hz\right) \approx 2\hbar \cdot \left[\nu \equiv 10^{10}\, Hz\right] \approx 5 \times 10^{-5}\, eV \tag{1}$$

in conjunction with an effective maximum energy density specified by LQG in a quantum bounce, such that

$$E_{eff} \propto 2.07 \cdot l^3_{Planck} \cdot \rho_{planck} \sim 5 \times 10^{24}\, GeV \tag{2}$$

$$S \equiv E_{eff}/T \sim \left[10^{38} \times E_{graviton-effective}\left(\nu \approx 10^{10}\, Hz\right)\right] / \left[T \sim 10^{19}\, GeV\right] \approx 10^5 \tag{3}$$

This is without assuming a non zero rest mass to the 4 dimensional graviton, but it leads to, if gravitons are a primary carrier of information from a prior universe to come to terms with the 10^{38} factor. Beckwith suggests that in order to do so, one may have to consider coherent groups of relic gravitons, i.e. keeping in mind that coherent bunches of gravitons as postulated may be what is actually in store for relic stochastically generated GW at the big bang. Doing so may be allowing us to make a bridge between Eq. (3) above to

$$S_{total} \equiv s_{Density} \cdot V_4 = \frac{2\pi^2}{45} \cdot g_{\bullet} \cdot T^3 \cdot V_4 \tag{4}$$

where $T < 10^{32} K \sim 10^{19} GeV$. I.e. such a linkage would open up the possibility that the density of early primordial gravitational waves could be examined, and linked to modeling gravity as an effective theory. The details of linking what is done with (2) and bridging it to (3) await additional theoretical development , and are probably conceptually understandable if the following is used to link the two regimes. I.e. we can use the number of space time operations used to create (2), via Seth Lloyds

$$I = S_{total} / k_B \ln 2 = [\#operations]^{3/4} = \left[\rho \cdot c^5 \cdot t^4 / \hbar\right]^{3/4} \tag{5}$$

3. What non zero Graviton mass may say about re acceleration of the Universe 1 Billion Years Ago. Are Coherent clumps of Gravitons the answer?

Either there is clumping of gravitons into coherent GW states, as may be the resolution of the 10^{38} factor in Eq. (3) , and the GW frequency drops dramatically a billion years ago , to take into account having, instead of the energy associated with relic gravitons of value $\approx 5 \times 10^{-5} eV$, as assumed in Eq (1) , or else Y. J. Ng's $S \approx < n >$ will only work for particles with $E_{relic-particles-effective} \approx 100 \cdot GeV$ which is the energy-mass value of WIMP DM. Needless to say, if the coherent GW state interpretation is correct, for relic GW, as clumped to make $S \approx < n >$ correct, then if there is a drop in frequency a billion years ago, for existing Gravitons, with an effective rest mass per graviton , one may have an explanation for Beckwith's re acceleration graph when Beckwith found at z ~ **. 423**, a billion years ago, that acceleration of the universe increased, as shown in Figure 1 which uses a de celebration parameter defined by

$$q = -\frac{\ddot{a}a}{\dot{a}^2} \equiv -1 - \frac{\dot{H}}{H^2} \approx -1 + \frac{2}{2 + \delta(z)} \tag{6}$$

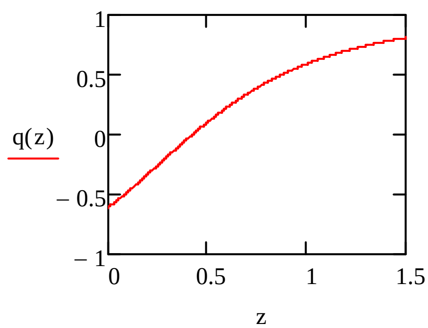

FIGURE 1 : Reacceleration of the universe based on Beckwith's Dark Side of the Universe lecture (note that q < 0 if z< .423

4. Conclusion

Reconciling (1) and (2) may enable resolving if coherent states of gravitons are important in relic GW generation. The entire problem of if a linkage between a temperature dependent entropy, if linked to coherent states of gravitons being in a Ng style particle count algorithm, may enable linkage of the physics of Figure 1 above, with early universe graviton production. This is currently an active area of investigation Beckwith is pursuing in 2010.

References

1. A.W. Beckwith, viXra:1008.0050 submitted on 18 Aug 2010