Entropy, neutrino physics, and the lithium problem; why stars with no lithium in early universe exist?

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Abstract:
We review how graviton initial energy values are linkable to possible order of the Lorentz gravitational violation. Counter intuitively, the greatest Lorentz gravitational violation would be at lower to moderate initial velocity value conditions due to pre inflationary conditions. .We assume with rapid build up of graviton energies , convergence to flat space, Lorentz invariance as gravitons , due to a high level of initially extreme inflationary conditions speed up with introduction of massively boosted energies at the onset of the big bang.. The coupling of neutrinos to gravitions would be enhanced as their wave lengths would initially be quite similar, i.e. very short.. Consequences for the Lithium problem in stars, due to stellar formation, and gravitational perturbation on DM and will be discussed toward the end of this document. The neutrino / gravitational wave interaction leads to a damping factor in the intensity of GW of $\left[1-5\cdot(\rho_{neutrino}/\rho)+\vartheta\left([\rho_{neutrino}/\rho]^{2}\right)\right]$ as far as relic GW as could be shown up in the CMBR data sets. This would have no bearing upon the peak of the frequency range, which is another matter entirely. The contention advanced, though is that proper analysis of the big bang, including initial treatment of nucleosynthesis **may show a way forward to explain the recent discovery of early old stars with no lithium. Thereby closing one of the huge holes in the big bang, and lithium abundance.**

Introduction
Following a presentation as given for the Gravity Research foundation award essay by Alejandro Jenkens, 2009, the author makes the same dimensional identification that of energy, and energy variation as carried by a graviton $p^0 \sim \bar{L}\cdot\mu$ and $\Delta E \sim \bar{L}\cdot\mu$ as a way to show how gravitons are linkable to possible order of the Lorentz gravitational Lorentz violation. Note that $\bar{L} \sim (c-v)/c$ for the degree of Lorentz violation which involve gravitons with a dispersion relationship of $E \equiv v\cdot|p|$, where v is a speed of propagation of the graviton. Note that the linkage of dispersion relationships of the graviton specifically are linked to a non relativistic treatment of the graviton. Also, left unsaid as a variance is how the strength of the energy interaction, μ , as brought up is linkable to $\mu/M_{Planck} \sim \bar{L}$, where the graviton is to first order an emergent field Goldstone boson. Note that $\bar{L} \neq 0$ is for extension of physics, beyond the standard Model, whereas the standard model has $\bar{L} \xrightarrow[approach-to-standard-model-physics]{} 0$. This de couples the graviton, as an emergent boson particle, and has consequences for large scale entropy generation at ultra high speeds, and neutrino physics, and solutions for the entropy problem. $\mu/M_{Planck} \sim \bar{L}$ going to zero seems to be inevitable for early universe Graviton physics, with consequences for neutrino physics, unless the graviton is, in this case an emergent 'wave particle' entity at intermediate energy regimes, just before the onset of inflation. Most likely, $\mu/M_{Planck} \sim \bar{L}$ went to zero, very quickly, or close enough to it, leading to interaction between initial gravitons, and neutrinos , in accordance to Bashinsky's (2005) analysis that there is a coupling of neutrino and graviton evolutionary radiation era as of the radiation era, due to an increase in the complexity of what would other wise be a simple elaboration of the standard neutrinoless radiation era result , due to no neutrino anisotropic stress . However, graviton waves appear to be partly damped in absolute magnitude , in the in initial inflation to radiation era. Furthermore, as the author will elaborate upon, the lithium problem in early cosmology may be resolvable by explaining how and why

Dispersion of neutrinos, in early cosmology..

Note that, M. Marklund, G. Brodin, and P.K. Shukla (1999) posted their own version of not only neutrino mass, as given by $m_{\nu}^{2} = -g_{\alpha\ \beta} p^{\alpha} p^{\beta}$, where the overall mass is set by

$m_{\nu}^{2} = -g_{\alpha\ \beta} p^{\alpha} p^{\beta} \equiv \left[\hbar \cdot \sqrt{|g_{00}| \cdot \omega_{F}^{2} - g_{\alpha\beta} k^{\alpha} k^{\beta} - 2\omega_{F} g_{0\alpha} k^{\alpha}}\right]^{2}$. . If , as if often expected in inflation, space becomes abruptly flat at the onset of inflation, then for a neutrino mass, as the $\bar{L} \xrightarrow[approach-to-s\tan dard-\mathrm{mod}\, el-physics]{} 0$ will then lead to the following inequality.

$$m_{\nu}^{2} \equiv \left[\hbar \cdot \sqrt{|g_{00}| \cdot \omega_{F}^{2} - g_{\alpha\beta} k^{\alpha} k^{\beta} - 2\omega_{F} g_{0\alpha} k^{\alpha}}\right]^{2}$$

$$\xrightarrow[Flat-Space]{} \left[\hbar \cdot \sqrt{|g_{00}| \cdot \omega_{F}^{2} - g_{\alpha\alpha} \left[k^{\alpha}\right]^{2} - 2\omega_{F} g_{00} k^{0}}\right]^{2} > 0 \qquad (0)$$

$$\Leftrightarrow |g_{00}| \cdot \omega_{F}^{2} > g_{\alpha\alpha} \left[k^{\alpha}\right]^{2} + 2\omega_{F} g_{00} k^{0} \Rightarrow |g_{00}| \cdot \omega_{F}^{2} > g_{\alpha\alpha} \left[k^{\alpha}\right]^{2} + 2\omega_{F} g_{00} k^{0}$$

However, eqn (0) has the consequence that for flat space, one is looking at the dynamics

$$\omega_{F}^{2} > \left(g_{\alpha\alpha} / |g_{00}|\right) \cdot \left[k^{\alpha}\right]^{2} + 2\omega_{F} \left(g_{00} / |g_{00}|\right) k^{0} \qquad (0a)$$

The author is accessing the neutrino-gravition interactions as to find out when Eqn (0a) is true, based upon in part, some of the arguments presented by Barvinsky(2005) . This will appear in a subsequent document.

Note, here, that the potential for where the frequency comes from is, here , is $U = \hbar \cdot \omega_{F}$, and , according to Birgit Eberle and Andreas Ringwald, may have lightest relic neutrino masses of the order of

$$m_{relic-neutrino} \propto .1eV/c^{2} \qquad (0b)$$

as opposed to, as given by D, Valev(2006)

$$m_{graviton} \leq 2 \times 10^{-29} \breve{h}^{-1} eV / c^{2} \qquad (0c)$$

Where $\breve{h} \approx .65$, is a dimensionless Hubble constant, Very roughly put, for relic early universe conditions, one may be seeing that the neutrino has $10^{28} - 10^{29}$ the effective mass than a graviton. Furthermore, for a neutrino we have the happy value of (which we give an approximate vale for , later for neutrinos)

$$\lambda_{k} \approx \frac{hc}{E_{k}} + \frac{hm_{\nu k}^{2} c^{5}}{2E_{k}^{3}} \qquad (0d)$$

If Valev's value of mass , for gravitons which may be generated by solar system conditions .

$$m_{graviton} \leq 4.4 \times 10^{-22} h^{-1} eV / c^{2} \Leftrightarrow \lambda_{graviton} \equiv \frac{\hbar}{m_{graviton} \cdot c} \sim 2.8 \times 10^{15} meters \qquad (0e)$$

versus

$$m_{neutrino-relic-condt} \leq .5 \times 10^{-1} h^{-1} eV / c^{2} \Leftrightarrow \lambda_{neutrino-relic-condt.} \equiv \frac{\hbar}{m_{n} \cdot c} \sim 2.8 \times 10^{-8} meters \qquad (0f)$$

I.e. for non relativistic conditions, the contribution of the neutrino is $10^{22} - 10^{23}$ times larger than for a graviton. And it can perhaps in certain models be over 10^{30} times larger than for a graviton.

Note, that in such a scenario, the degree of variance away from Lorentz invariance as to what was stated by Alejandro Jenkens, 2009,is , here that $p^0 \sim \bar{L} \cdot \mu$ and $\Delta E \sim \bar{L} \cdot \mu$, so that here, for a non relativistic graviton, $\mu / M_{Planck} \sim \bar{L} \propto \frac{c-v}{c} \Leftrightarrow \frac{p^0}{\mu} \leq 1$. This can be compared to what happens if we have if we put in traveling relativistic speeds to the graviton, with,

$$\bar{L} \sim [(c-v)/c] \approx \frac{\mu}{M_{Planck}} \xrightarrow[\mu \to 0]{relativistic-conditions-for-graviton-speed,} 0 \qquad (0g)$$

Note that in Gravitational Cherenkov radiation, that $\frac{\mu}{M_{Planck}} \sim \bar{L} \leq 10^{-15}$

Now. Let us review what can be done with entropy calculations, and the relative size of contributing wave lengths. The given example is for DM, and HIGH ENERGY gravitons. Note though, that in assuming gravitons with much shorter wave length than eqn (0d), i.e perhaps as short as in eqn. (4e), or even smaller, due to eqn. (0f), that we are re affirming Sergi Bashinsky's premise , as of (2005) in his introduction, where he states that the primordial power of gravity waves is a measure of inflation energy scale. Bashinsky's analysis is that there is a coupling of neutrino and graviton evolutionary effects as of the evolution of CMBR perturbations, with a damp out of perturbations occurring due to the interaction between neutrinos, and gravitons

Entropy generation via Ng's infinite quantum statistics

We wish to understand the linkage between dark matter and gravitons, To consider just that, we look at the "size" of the nucleation space, V DM. V for nucleation is HUGE. Graviton space V for nucleation is tiny , well inside inflation/ Therefore, the log factor drops OUT of entropy S if V chosen properly for both eqn 1 and eqn 2. Ng's result begins with a modification of the entropy/ partition function Ng used the following approximation of temperature and its variation with respect to a spatial parameter, starting with temperature $T \approx R_H^{-1}$ (R_H can be thought of as a representation of the region of space where we take statistics of the particles in question). Furthermore, assume that the volume of space to be analyzed is of the form $V \approx R_H^3$ and look at a preliminary numerical factor we shall call $N \sim (R_H / l_P)^2$, where the denominator is Planck's length (on the order of 10^{-35} centimeters). We also specify a "wavelength" parameter $\lambda \approx T^{-1}$. So the value of $\lambda \approx T^{-1}$ and of R_H are approximately the same order of magnitude. Now this is how Jack Ng changes conventional statistics: he outlines how to get $S \approx N$, which with additional arguments we refine to be $S \approx \langle n \rangle$ (where <n> is graviton density). Begin with a partition function

$$Z_N \sim \left(\frac{1}{N!}\right) \cdot \left(\frac{V}{\lambda^3}\right)^N \qquad (1)$$

This, according to Ng, leads to entropy of the limiting value of, if $S = (\log[Z_N])$

$$S \approx N \cdot \left(\log\left[V / N\lambda^3\right] + 5/2\right) \xrightarrow[Ng-\inf inite-Quantum-Statistics]{} N \cdot \left(\log\left[V/\lambda^3\right] + 5/2\right) \approx N \qquad (2)$$

But $V \approx R_H^3 \approx \lambda^3$, so unless N in Eqn (2) above is about 1, S (entropy) would be < 0, which is a contradiction. Now this is where Jack Ng introduces removing the N! term in Eqn (1) above , i.e., inside the Log expression we remove the expression of N in Eqn. (2) above. The modification of Ng's entropy expression is in the region of space time for which the general temperature dependent entropy Kolb and Turner expression breaks down. In particular, the evaluation of entropy we do via the modified Ng argument above is in regions of space time where g before re heat is an unknown, unmeasurable number of degrees of freedom The Kolb and Turner entropy expression has a temperature T related entropy density which leads to that we are able to state total entropy as the entropy density time's space time volume V_4 with $g_{re-heat} \approx 1000$, according to De Vega, while dropping to $g_{electro-weakt} \approx 100$ in the electro weak era. This value of the space time degrees of freedom, according to de Vega has reached a low of $g_{today} \approx 2-3$ today. We assert that Eqn (2) above occurs in a region of space time before $g_{re-heat} \approx 1000$, so after re heating Eqn (2) no longer holds, and we instead can look at

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

Where $T < 10^{32} K$. We can compare eqn (1) and (2) , as how they stack up with Glinka's (2007) quantum gas, if we identify $\Omega = \frac{1}{2|u|^2 - 1}$ as a partition function (with u part of a Bogoliubov transformation) due to a graviton-quintessence gas, to get information theory based entropy

$$S \equiv \ln \Omega \tag{4}$$

Such a linkage would open up the possibility that the density of 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

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

The given condition for gravitons, with

$$m_{graviton}\Big|_{NON-RELATIVISTIC} \leq 4.4 \times 10^{-22} h^{-1} eV/c^2 \Leftrightarrow \lambda_{graviton} \equiv \frac{\hbar}{m_{graviton} \cdot c} \sim 2.8 \times 10^{15} meters$$

Becomes, instead

$$m_{graviton}\Big|_{RELATIVISTIC} < 4.4 \times 10^{-22} h^{-1} eV/c^2 \Leftrightarrow \lambda_{graviton} \equiv \frac{\hbar}{m_{graviton} \cdot c} < 2.8 \times 10^{-8} meters \tag{6}$$

Also, the graviton wave length, in accordance to calculations could be even within the initial sphere of the onset of inflation, but this would be due to full power put into the relic gravitons i.e. at least initially, due to the suppression of non flat, curved space deviations from $\bar{L} \sim [(c-v)/c] \approx \left[\frac{\mu}{M_{Planck}}\right] \xrightarrow[\mu \to 0]{relativistic-conditions-for-graviton-speed,} 0$, which Beckwith claim are essential for higher levels of entropy production, initially, due to gravitons, before the matter era of cosmology.

Gravitational wave, and the CMBR, i.e. transition to the matter era

Where gravitational physics would reach the status of CMBR data in gravitational wave analysis would be when the radiation and matter densities of GW and neutrinos and photons are approximately the same. As Barvinsky notes, the graviton energy in the transition to the matter era has adiabatic character due to $(\ddot{a}/a) \sim H^2$ becomes not a dominant effect. leading to more complex development of Dark matter and baryonic matter structure when $k \geq k_{equilibrium} \equiv \tau^{-1}_{equilibrium} \sim 10^{-2} Mpc^{-1}$. Here is a brief review by

Beckwith, as to the importance of entropy generated structure due to GW/graviton perturbations which Beckwith (2009) believes is important to the transition to the adiabatic regime, which has $(\ddot{a}/a) \sim H^2$, with H the Hubble parameter, evolving over time. It was initially proposed by Beckwith, in the Rencontres De Blois (2009) meeting, was specifically invoked by Beckwith in a presentation by Beckwith(2009) in the 12 Marcel Grossman meeting and is an evolving project as to the concentration of lithium in comparatively young stars.

First of all, a table of results as to relic / high frequency gravitational waves, which will be referred to later

Table 1: magnitude, sources, and top frequency values for HFGW (from Li et al. 2009)

Sources	Amplitude	frequency	Characteristics
HFGW in Quintessence inflationary models	$h_{rms} \sim 10^{-30} - 10^{-32} / \sqrt{Hz}$	$\nu \sim 10^{9} - 10^{10}\,Hz$	**Random background**
HFGW in some string theory scenarios	$h_{rms} \sim 10^{-30} - 10^{-34} / \sqrt{Hz}$	$\nu \sim 10^{8} - 10^{11}\,Hz$	**Random background**
Solar Plasma	$h_{rms} \sim 10^{-39} / \sqrt{Hz}$	$\nu \sim 10^{15}\,Hz$	**On the Earth**
High energy particles, e.g. Fermi Ring	$h_{rms} \sim 10^{-39} - 10^{-41} / \sqrt{Hz}$	$\nu \sim 10^{4} - 10^{5}\,Hz$	**On the center the frequency depends upon the rotational frequency of particles in the Fermi Ring**
Stanford Linear Accelerator	$h_{rms} \sim 10^{-39} / \sqrt{Hz}$	$\nu \sim 10^{23}\,Hz$	**On the collision center, the frequency depends upon the self energy and the Lorentz factor of high energy e^+e^- beams**
LHC- Large Hadron collider			**Spectra of high energy gravitons**
Nano-piezo electric crystal array, with size of about 100 nanometers	$h_{rms} \sim 10^{-28} - 10^{-31} / \sqrt{Hz}$	$\nu \sim 10^{9} - 10^{10}\,Hz$	**On the wave WHAT IS A "WAVE ZONE"? with an effective cross section of or less than .01 meters squared, for gravitational radiation**

Next, we will refer to perturbations resulting due to the high frequency gravitational waves

Consider now how spacetime was created at the onset of the big bang.. The universe was "really small" compared what it is today, and all that matter and energy were crammed in very small volume.. The energy dispersed and matter began to form from the energy. Everything was still beyond the temperature in stars. But the matter-emergy plasma mix was cooling Corda (2008) has modeled adiabatically-amplified zero-point fluctuations processes in order to show how the standard inflationary scenario for the early universe can provide a distinctive spectrum of relic gravitational waves. De Laurentis, Mariafelicia, and Capozziello, Salvatore(2009) have further extended this idea to give a qualified estimate of GW from relic conditions which will be re produced here. Begin with De Laurentis's idea of a gravitational wave spectrum

$$\Omega_{sgw} = \frac{16}{9} \cdot \left(\frac{\rho_{dS}}{\rho_{Planck}} \Big/ 1 + z_{eq} \right) \xrightarrow[f \to low-value]{} f^{-2} \Leftrightarrow f\big|_{present=era} > (1+z_{eq})^{1/2} \cdot H_0 \qquad \textbf{(7)}$$

Here, H_0 is today's Hubble parameter, while f is GW frequency, and z_{eq} is the red shift value of when the universe became matter dominated. I.e. redshift z = 1.55 with an estimated age of 3.5 Gyr, or larger, would be a good starting point. I.e. this is for larger than 3.5 giga years for when matter domination became most prominent.. This border value for redshift z, as the dividing line for when matter domination was brought up by Lawrence Krauss (1996) as to what times could matter formation become significant. I.e. the further back z_{eq} goes the larger the upper bound for frequency f. The upper range for f appears to be about 100 Hertz. Needless to state, though, if z_{eq} drifted to a value of $z_{eq} \sim 10$ then the upper bound to $f \sim 1000$ Hertz. Note that there are string theory based calculations predicting relic GW at or lower than 1 Hertz. **,** as suggested by B Lamine**.** A Lambrecht, M T Jaekel and S Reynaud ***(2004)*** As a dominant GW frequency. Their article states, that **"**relic gravitational wave background is expected to be statistically isotropic, but the actual value of the associated spacetime metric should break isotropy. We propose to detect the resulting anisotropy by using an optical interferometer mounted on a rotating platformIs**"** this the last word ? Not necessarily**.** Grishchuck, (2008) from a non string theory perspective, predicted a dominant relic GW frequency range of up to 10^{10} Hertz, while as early as 1995, R. Brustein, M. Gasperini, M. Giovannini, and G. Veneziano (1995) predicted, on the basis of string theory, ultra high GW from relic big bang processes. Effectively with NO limitations as to HFGW from relic inflationary processes.To be very blunt, there has been an understandable pressure to try to obtain GW from relic conditions which would be within the sensitivity peak effectiveness of LIGO, as an example within 10 to 100 Hertz , i.e. $10Hz < f < 100Hz$ .One of the studies doing just that was a well done contribution: Buonanno, A.; Ungarelli, ***C.(2008). It would be considered definitive, if the following did not exist, i.e.*** **http://www.ba.infn.it/~gasperin/** ***which is a compendium of different string cosmology predictions.***I.e. the predictions which are on this Gasperini supplied link as to the relative import of either high or low frequency contributions to the GW production at or near the 'big bang" are all over the block. It is time for some definitive measurements to be taken and to end this problem once and for all. In addition, the author states unequivocally, that LIGO, as far as relic condition GW detection has been a failure. The possibility of very high GW frequencies cannot be dismissed, in lieu of the null results obtained by LIGO. Secondly, if or not the low frequency, to high frequency regimes of GW are dominant will also be impacted upon to the degree of the classical nature of GW/ gravity itself. Note that Christian Corda (2007) wrote that "The investigation of the transverse effect of gravitational waves (GW's) could constitute a further tool to discriminate among several relativistic theories of gravity on the ground.. Realistic tests of this issue, as well as non LIGO alternatives as to gravity should be investigated. I.e. the jury is still out on this issue of which frequency of GW is most important for relic conditions.

How would DM be influenced by gravitons, in 4 dimensions

We will also discuss the inter relationship of structure of DM, with challenges to Gaussianity. The formula as given by

$$\delta \equiv -\left[\frac{3}{2}\cdot\Omega_m\cdot H^2\right]^{-1}\cdot\nabla^2\Phi \tag{8}$$

will be gone into. The variation, so alluded to which we will link to a statement about the relative contribution of Gaussianity, via looking at the gravitational potential

$$\Phi \equiv \Phi_L + f_{NL}\cdot\left[\Phi_L^2 - \left\langle \Phi_L^2 \right\rangle\right] + g_{NL}\cdot\Phi_L^3 \tag{9}$$

We assert that the function f_{NL} is largely due to entropy variations, some of which occurred during relic GW/graviton production. Here the expression $f_{NL} =$ variations from Gaussianity, while the statements as to what contributes, or does not contribute will be stated in our presentation. Furthermore, Φ_L is a linear Gaussian potential, and the over all gravitational potential is altered by inputs from the term, presented, f_{NL} . The author discussed inputs into variations from Gaussianity, which were admittedly done from a highly theoretical perspective with Sabino Matarre, on July 10, with his contributions to non Guassianity being constricted to a reported range of $-4 < f_{NL} < 80$, as given to Matarre, by Senatore, et al, 2009. The author, Beckwith, prefers a narrower range along the lines of $.5 < f_{NL} < 20$ for reasons which will be gone into, in the text. . Needless to state, though, dealing with what we can and cannot measure, what is ascertained as far as DM , via a density profile variation needs to have it reconciled with DM detection values

$$\sigma_{DM-dectecion} \le 3\times 10^{-8} \quad \text{pb (pico barns)} \qquad (10)$$

Consequences of this DM density variation, as brought up above. Partly due to damping due to GW and neutrino interactions.

At or about when $k \ge k_{equilibrium} \equiv \tau_{equilibrium}^{-1} \sim 10^{-2}\, Mpc^{-1}$ begins to delineate the neutrino-GW interaction becoming a significant damping impact upon each other, one would be seeing variations from the usual structure formation, as given by the following diagram.

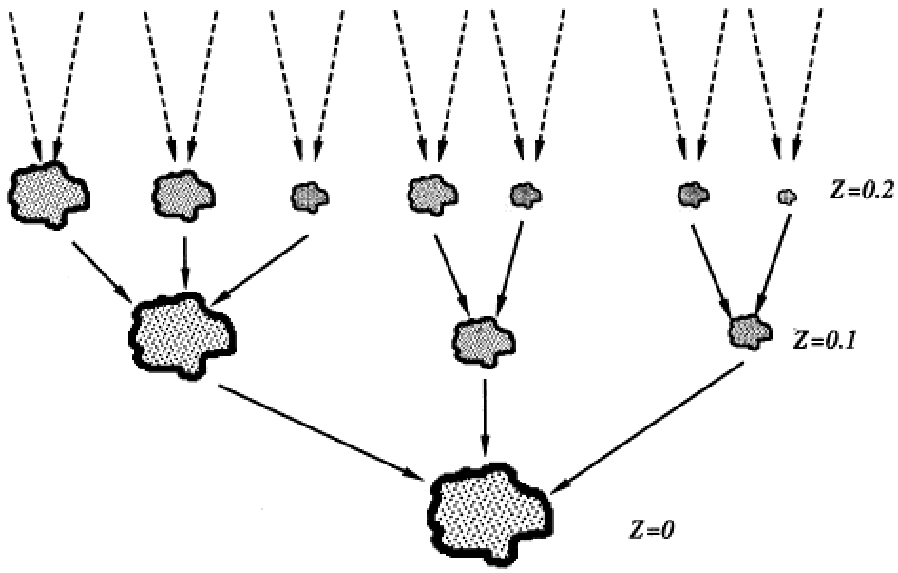

Figure 1. A schematic representation of a halo merging history 'tree'.

Figure 1. I.e. how we obtain from the 'bottom up' development of galactic super structure

Now, how would variation from the above " halo Merging history tree', partly due to the modulation , via entropy, of DM structure formation, due to GW/gravitons affecting DM profile affect the concentration for lithium in stars, and perhaps lead to the famous 'lithium problem" being resolved ?

Conclusion : Lithium-free stars plug hole in Big Bang ? How could this happen?

Danny Kingsley has reported in Science (2009) about the discovery of lithium free stars. In a quote from the magazine article, he writes the following: "*The existence of lithium-free stars has been problematic for astronomers because it has called into question their understanding of the Big Bang theory, the name given to the rapid expansion of the Universe that heralded not only the beginning of space and time but the origin of all matter. "This might have indicated there were stars formed that didn't have any lithium in them at all," said Professor Mike Bessell from the Research School of Astronomy and Astrophysics at the Australian National University.If that was the case, he said, it could have meant that lithium didn't originate in the Big Bang, and that posed a major problem. It's always been accepted that lithium was one* *of the elements created right at the beginning along with hydrogen and helium. But if that wasn't so, maybe the lithium seen in other stars was formed in some other way – and that would mean reconsidering the whole Big Bang event*"

We should high light the very important datum not to be forgotten. First star formation occurred BEFORE the formation of galactic clusters, and galaxy formation. But the author believes that the defects in our nucleosynthesis back ground, allowing for not being able to explain lithium free stars is also linked as to why the formation tree for galactic structure, as given by figure 1 above, is incorrect. I.e. note

Let us review how, and why nucleosynthesis of elements occurred in the big bang. I.e the following is known and is relevant according to the Big Bang theory, particles of matter ceased to interact with radiation. Decoupling happened at different times, and therefore at different temperatures, for different particles. Neutrinos, for example, decoupled from the background radiation at a temperature of about 10^{10} Kelvin (about 1 second after the Big Bang) while ordinary matter decoupled at a temperature of a few thousand degrees K (after about 300 000 years). After matter and radiation decoupled, the background radiation propagated freely through the expanding Universe. The de coupling of neutrinos was significantly earlier than what would be expected with lithium, and in fact, the evidence of lithium free stars indicates that density fluctuations partly damped and affected by gravity wave/ graviton production, and neutrinos at the cusp of the big bang may have affected lithium synthesis

In addition, lithium free stars were referenced earlier, namely in Astronomy & *Astrophysics* (Vol 388(3), L53: June IV, 2002). **...** *LITHIUM-FREE STARS PLUG HOLE IN BIG BANG.* The question remains though what can be made of traditional nucleosynthesis theory and the big bang. . Usually at a few MeV values for de creasing temperature, after the big bang, it is expected, according to Matt Roos (2003), that fusion reactions begin to build up light elements. Note that Big Bang Nucleosynthesis (BBN) is the synthesis of the light nuclei, Deuterium, ^{3}He, ^{4}He and ^{7}Li during the first few minutes of the universe. This review concentrates on recent improvements in the measurement of the primordial (after BBN, and prior to modification) abundances of these nuclei.

The supposition being advanced, that in order to accommodate the existence of lithium free stars, as initially stated, that the interaction of GW/gravitons, with neutrinos, as brought up by Barvinsky (2005) needs to be re investigated . This is one very active area which the author expects to come up with results which will be released as of before the end of 2009 . And that entropy production, and its impact upon DM profile clumping and clustering, will be part of why lithium free stars can occur in the first place.

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