IS THERE A CHANGE IN THE BARYONIC STRUCTURE FORMATION IF QUARK STRINGS AND DOMAIN WALLS EXIST AT ABOUT THE ELECTRO-WEAK ERA?

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Abstract

The structural formation and baryonic fluctutations being presented initially come from an article by Chechin as to perturbation growth in the early universe. Due to a set of notes as written up by Sahoo, and Misra the author has reviewed what would be the consequences of adding in strange quark matter, cosmic strings and also domain walls, which change the nature of the initial baryonic model perturbations. The conclusion which jumps out, via what is the consequences for domain walls and galaxy formation , after the electro weak, is that the initial perturbations are heavily influenced by domain wall tension. I.e. almost as a free parameter, which is troubling since there is no experimental way to quantify what sort of domain wall tension is suitable at/ before the electro-weak regime.

Keywords: domain wall tension, strange quark matter, baryonic perturbation density growth, electro-weak regime

1 Introduction

In models we will identify, the evolution of baryonic matter fluctuations is given by [1], [2], namely

$$\ddot{\delta} + 2\mathrm{H}\dot{\delta} + v_S^2 k^2 \delta - 4\pi G \rho_b \delta = 0 \qquad (1)$$

The derivation given by [1], [2] will be subsequently alterered as to ρ_b which will have a stress – energy tensor component added in, plus some factors coming in due to the presence of domain walls, strange quark matter, cosmic strings and the results are very revealing. How δ evolves is primarily influenced by the purported domain wall tension, and that will raise some questions as to if this purported domain wall tension is amendable to experimental analysis.

In order to do a first order analysis of (1) the author makes as of the electro-weak era several approximations as to insure a simple input into this (1) evolution, but the end result is to underline the importance as to domain wall tension.

2 De complexifying the (1) equation , and adding in Domain wall tension

Sahoo, and Misra [3] as well as [4] give details as to ρ_b which we will fill in, outlining the importance of proper modeling of the quark-gluon plasma in early universe conditions. The simplification, including assuming INITIALLY that H is a constant, and that the following are also constants, namely that in the regime at/ before the electro weak the following can also be set as a working approximation:

$$v_S^2 k^2 \delta - 4\pi G \rho_b \delta \equiv \left[v_S^2 k^2 - 4\pi G \cdot \left(\rho_b = T_i^i - \lambda \right) \right] = \textbf{constant} \qquad (2)$$

One of the assumptions is that the speed of the 'baryonic' concentrated matter-energy is given to first approximation as $v_S = c \equiv 1$, and also that the wave vector k be such that:

$$k = \frac{9\omega_1^2}{4a_0^2 \ln^2 \aleph t} \qquad (3)$$

Here, the spatial component [3] , [4] is such that

$$x = \frac{2}{\omega_1} \cdot \ln \aleph t \qquad (4)$$

So that the Hubble parameter becomes

$$H = \frac{\dot{x}}{x} \equiv \frac{1}{\ln \aleph t} \qquad (5)$$

And in a short period of time, the scale factor has

$$a = \frac{2a_0}{\omega_1} \cdot \ln \aleph t \qquad (6)$$

We space-time average, in a short period of time, as of less than 10^{-20} seconds (5) and (6) as constants at / before the electro-weak regime, and then we have (3) and (4) as well can be treated in the interval of time. The net consequence of this averaging of inputs and also (2) itself is up to the electro-weak regime we have that it is completely feasible to make a good first order approximation of

$$\delta \equiv \exp(\Theta \cdot t) \qquad (7)$$

Put this into (1) and also assume that we have then (2) - (6) as to first approximation space time averaged to constant values within 10^{-20} seconds, then

$$\Theta^2 - 2H \cdot \Theta + \left[k^2 + 4\pi G \cdot \left(T_i^i - \lambda\right)\right] = 0 \qquad (8)$$

So then that via the quadratic equation, and nothing fancy, we look at, if H is usually very large

$$\Theta = \frac{1}{2} \cdot \left[2H \left(1 \pm \sqrt{1 - \frac{\left(4k^2 - 4\pi G \cdot \left(T_i^i - \lambda\right)\right)}{4H^2}} \right) \right] \qquad (9)$$

$$\Theta \approx \left[H \left(1 \pm 1 \mp \left(\frac{\left(4k^2 - 4\pi G \cdot \left(T_i^i - \lambda\right)\right)}{8H^2} \right) \right) \right] \quad (10)$$

I.e. either , when H is very large, as expected initially

$$\Theta_{\max} \cong 2H - \frac{\left(4k^2 - 4\pi G \cdot \left(T_i^i - \lambda\right)\right)}{8H} \quad (11)$$

$$\Theta_{\min} \cong \frac{\left(4k^2 - 4\pi G \cdot \left(T_i^i - \lambda\right)\right)}{8H} \quad (12)$$

Here the way to treat the stress-energy tensor is to write by [1] , [2], with Bc for boundary condition against a domain wall,

$$T_1^1 = T_2^2 = T_4^4 = \rho = \rho_q + \lambda + Bc = \rho_m + \sigma_\omega \quad (13)$$

$$T_3^3 = P = P_m - \sigma_\omega \quad (14)$$

Here, σ_ω is the domain wall tension, and if P_q is for quark pressure, and ρ_q is for quark density, so then that [1], [2] uses what is called the vacuum energy constant, Bc, which [1] refers to as the bag constant[5]

$$P_m = P_q - Bc \quad (15)$$

$$\rho_m = \rho_q + Bc \quad (16)$$

This above if we write quark matter as attached to a string cloud, [3] with velocity u^i, and position x_i

$$T_j^i = \rho u^i u_j - \lambda x^i x_j \quad (17)$$

Where for the quark density ρ_q we have

$$\rho = \rho_q + \lambda + Bc \quad (18)$$

Also, from [3], and [4]

$$u^i u_i = 1,$$
$$x^i x_i = -1, \quad (19)$$
$$u^i x_i = 0$$

3. Conclusion, having a domain wall initially as a dominant influence for a value of δ for baryonic fluctuation?

What is the result of (7), (11),(12),(13),(14) is that the value of δ for baryonic fluctuation ? We argue that the domain wall tension being such a large factor, initially is in common with the initial entropy being so low, as by

$$S_{entropy-initial} \sim 10^5 - 10^6 \text{ At or about } 10^{-43} \text{ seconds} \quad (20)$$

Secondly, the initial entropy being so low will be in tandem with the initial non relevance of quantum mechanics in forming initial $\hbar$ values, as given by Beckwith [6] in the Hadronic press calculation. In addition having a domanin wall as a dominant factor, initially will be in syc with the regime of space time conditiosn given by Beckwith [6]

TABLE 1

.Time Interval	Dynamical consequences	Does QM/WdW apply?
Just before Electroweak era	Form $\hbar$ from early E & M fields, and use Maxwell's Equations with necessary to implement boundary conditions created from change from Octonionic geometry to flat space	NO
Electro-Weak Era	$\hbar$ kept constant due to Machian relations	YES
Post Electro-Weak Era to today	$\hbar$ kept constant due to Machian relations	YES Wave function of Universe

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