

The Theory of Exponential Expansion of the Universe

Prithwijit Sarkar

111, Nsc Bose Road, Pressman APPTS Flat 4C&D, Kolkata

Abstract The universe is currently expanding exponentially. So the question remains is why is the universe expanding exponentially? And what is the reason for the exponential rate in the expansion pattern of the universe?

Keywords Black hole Mechanics, Hawking Radiation and General Relativity

1. Introduction

From the current records it is known that the universe is expanding. And it is expanding and cooling since inception or The Big Bang.

But currently the universe is expanding exponentially. One relation of such pattern of expansion may be related with the cooling of the universe and to relate this procedure mathematically need the help or accumulation of the below given theories mathematically.

1. Black Hole Mechanics
2. Hawking Radiation
3. General Theory of Relativity

2. Symbols

- a. S_{bh} - Entropy of black hole
1. S_U - Entropy of the universe
- b. κ_b - Boltzmann's Constant
- c. $4lp^2$ - Planck's Length
- d. κ - Surface Gravity
- e. M - Mass
- f. Ω - Angular Velocity
- g. J - Angular Momentum
- h. ϕ - Electrostatic Potential
- i. Q - Charge
- j. c - Speed of Light
- k. A - Area

3. The Theory of Exponential Expansion of the Universe

* Corresponding author:

sarkarprithwijit@gmail.com (Prithwijit Sarkar)

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As known that the universe is expanding and cooling since the Big Bang. And as it is expanding it is cooling at the same time. So there is a relation between the expansion and the cooling of the universe. Or rather there is a relation between Entropy of the universe (S_U) and the expansion of the universe.

The theory of exponential expansion of the universe states that the entropy of the universe is directly proportional to the expansion of the universe.

4. Equation

$$-\delta M = \kappa \delta A / 8\pi G + \Omega \delta J + \phi \delta Q \quad (1)$$

$$\delta E / c^2 = \kappa \delta A / 8\pi G + \Omega \delta J + \phi \delta Q \quad (2)$$

$$\delta E = c^2 \kappa \delta A / 8\pi G + c^2 \Omega \delta J + c^2 \phi \delta Q \quad (3)$$

$$-c^2 \kappa \delta A / 8\pi G = c^2 \Omega \delta J + c^2 \phi \delta Q - \delta E \quad (4)$$

$$-\kappa \delta A / 8\pi G = \Omega \delta J + \phi \delta Q - \delta E / c^2 \quad (5)$$

$$\kappa \delta A / 8\pi G = \delta M - \Omega \delta J - \phi \delta Q \quad (6)$$

$$\kappa \delta A = 8\pi G (\delta M - \Omega \delta J - \phi \delta Q) \quad (7)$$

$$\delta A = 8\pi G (\delta M - \Omega \delta J - \phi \delta Q) / \kappa \quad (8)$$

From the Hawking Radiation:

$$S_{bh} = \kappa_b A / 4lp^2 \quad (9)$$

$$\delta A = \delta S_{bh} * 4lp^2 / \kappa_b \quad (10)$$

As known that the universe has evolved from a singularity, hence implementing the formulation of Hawking radiation to the whole universe.

$$\delta S_U * 4lp^2 / \kappa_b = 8\pi G (\delta M - \Omega \delta J - \phi \delta Q) / \kappa \quad (11)$$

$$\delta S_U * 4lp^2 = \kappa_b \{ 8\pi G (\delta M - \Omega \delta J - \phi \delta Q) / \kappa \} \quad (12)$$

$$\delta S_U = \kappa_b \{ 8\pi G (\delta M - \Omega \delta J - \phi \delta Q) / \kappa \} / 4lp^2 \quad (13)$$

From the General Theory of Relativity:

$$G_{\mu\nu} = R_{\mu\nu} - 1/2 R g_{\mu\nu} = 8\pi G / c^4 \cdot T_{\mu\nu} \quad (14)$$

$$R_{\mu\nu} - 1/2 R g_{\mu\nu} = 8\pi G/c^4 \cdot T_{\mu\nu} \quad (15)$$

$$c^4(R_{\mu\nu} - 1/2 R g_{\mu\nu}) = 8\pi G \cdot T_{\mu\nu} \quad (16)$$

$$c^4(R_{\mu\nu} - 1/2 R g_{\mu\nu}) / T_{\mu\nu} = 8\pi G \quad (17)$$

$$8\pi G = c^4(R_{\mu\nu} - 1/2 R g_{\mu\nu}) / T_{\mu\nu} \quad (18)$$

$$\delta S_U = \kappa_b \{ c^4(R_{\mu\nu} - 1/2 R g_{\mu\nu}) / T_{\mu\nu} (\delta M - \Omega \delta J - \phi \delta Q) / \kappa \} / 4lp^2 \quad (19)$$

5. Result

From the up given formulated equation it is clear that:

δS_U is directly proportional to the Ricci Tensor ($R_{\mu\nu}$).

Hence, the curvature of space – time fabric is directly proportional. To the entropy and reason behind the exponential expansion of the Universe is that the universe is cooling exponentially at the same time or in other words the entropy of the universe is increasing exponentially.

6. Conclusions

The reason behind the exponential expansion of the universe is related to the rate of increase in the entropy of the universe or the cooling of the universe. And currently the universe is expanding exponentially as the entropy is increasing exponentially.

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