Homogeneous Plane Symmetric String in Barber's Second Self Creation Theory

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Abstract – **It's determined that plane symmetric string cosmological model doesn't exist for Takabayasi string in spherical frame of reference in Barber's second self creation theory. The string cosmological model exists only .Thus the geometric string is built in spherical frame of reference in Barber's second self creation theory.**

Keywords :- Plane symmetric, string, self creation theory.

1 INTRODUCTION

In recent years researchers have plenty of interest within the consequences of line like topological defects known as cosmic strings which can be created throughout natural process in early universe. Such strings would manufacture density fluctuations on terribly giant scales and should be to blame for the formation of galaxies. Latelier and Stachel[1] studied the gravitative result of cosmic strings normally theory of relativity theory. Einstein's general theory of relativity has several controversies. so several authors planned numer ousalternatives theories by modifying the overall theory of relativity theory. Self creation cosmologies planned by Barber[2] by modifying the Brans and Dicke theory and Einstein's general theory of relativity[3]. These changed theories produce the universe out of self contained gravitative and matter fields.
Brans has identified that Barber's initial theory isn't solely divided with experiment however is really inconsistent . The second theory of Barber could be a modification of Einstein's general theory of relativity to a variable G-theory and predicts native effects that square measure at intervals the experimental limits.

During this paper, we've to construct plane interchangeable string cosmological model in Barber's Second self creation theory in spherical coordinate. so the geometric string is built in spherical frame of reference in Barber's second self creation theory.

2 PLANE SYMMETRIC METRIC

We consider the plane symmetric metric of the form
$$ds^2 = dt^2 - A^2(r^2 d\theta^2 + dr^2) - B^2 r^2 \sin^2\theta \, d\phi^2 \qquad (1)$$

where A and B are the function of cosmic time 't' only. The energy momentum tensor for cloud of massive string is given by
$$T_i^{\ j} = \rho \, u_i u^j - \lambda x_i x^j \qquad (2)$$

Where ρ is rest energy density, λ is the string tension density, u^i is the four velocity for the cloud of particles, x^i is the four vector which represents the strings direction which is the direction of anisotropy and
$$\rho = \rho_p + \lambda$$

Where ρ_p denotes particle energy density. Moreover the direction of strings satisfy the standard relations
$$u^i u_i = -x^i x_i = 1, u^i x_i = 0 \qquad (3)$$
In the co moving coordinate system, we have
$$T_1^1 = T_2^2 = 0 \qquad T_3^3 = \lambda \qquad T_4^4 = \rho$$
$$\text{and} \quad T_j^i = 0 \quad \text{for } i \neq j \qquad (4)$$

The quantities ρ and λ are functions of ' t ' only.

3 Field equation
The field equation in Barber's self creation theory are
$$G_j^i = R_j^i - \frac{1}{2} g_{ij} R = \frac{-8\pi T_j^i}{\phi} \qquad (5)$$

and $\qquad [] \phi = \frac{8}{3} \pi \eta T \qquad (6)$

where η is the coupling constant to be evaluated from experiment and ϕ is the function of 't'. In the limit $\eta \to 0$, the theory approaches to Einstein's theory in every respect.

Thus the field equations (5) & (6) for the metric (1) with the help of (2), (3), (4) can be written as

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$$\frac{A^{''}}{A} + \frac{B^{''}}{B} + \frac{A^{'}B^{'}}{AB} = 0 \qquad (7)$$

$$2\frac{A^{''}}{A} + \left(\frac{A'}{A}\right)^2 = 8\pi\phi^{-1}\lambda \qquad (8)$$

$$\left(\frac{A'}{A}\right)^2 + 2\frac{A^{'}B^{'}}{AB} = 8\pi\phi^{-1}\rho \qquad (9)$$

Hereafter the dash denotes the ordinary differentiation

with respect to time.

4 SOLUTIONS

In this section, we have to construct the plane symmetric string cosmological model in Barber's Second self creation theory in spherical coordinate. The system of field equations is an under determined and to make the system consistent we consider,

$$\rho = (1+\omega)\lambda, \qquad \omega \succ 0$$
$$A = at + a_1$$

Then we get

$$and \quad B = a_2(at + a_1)^{\omega/2}$$

Where a, a_1 & a_2 are constant of integration. Also we get $\omega = 0$. Thus the Takabayasi equation of state is not compatible & we get

$$\rho = \lambda \ \& \ \rho + \lambda = 0.$$

Here we consider the following cases :

Case I :- $\rho = \lambda$

For the given case, from field equation we get

$$A = at + a_1 \quad \& \ B = a_2$$

Which yields the solution

$$\phi = c_1(a_1 t + a_2)^{m_1} + c_2(a_1 t + a_2)^{m_2}$$

Where c_1 & c_2 are the constants of integration &

$$m_1 = \frac{-1 + \sqrt{1 + \frac{4}{3}\eta}}{2}, \qquad m_2 = \frac{-1 - \sqrt{1 + \frac{4}{3}\eta}}{2}$$

Thus, geometry of the universe described by the line element with suitable transformation is obtained as,

$$ds^2 = dT^2 - T^2(dx^2 + dy^2) - dz^2$$

This metric represents string cosmological model for geometric strings in Barber's second self creation theory.

Case II :- $\rho + \lambda = 0$

For the given case, from field equation we get

$$A = at + a_1 \quad \& \ B = a_2(at + a_1)^{-1}$$

Which yields the solution $\phi = \log(at + a_1)^{1/a}$

Where a, a_1 & a_2 are constant of integration.
Here we observed that the sum of the rest energy density & tension density of the cloud of string vanishes.

Thus, geometry of the universe described by the line element with suitable transformation is obtained as,

$$ds^2 = dT^2 - T^2(dx^2 + dy^2) - T^{-2}dz^2$$

5 CONCLUSION

It's over that the undiversified plane interchangeable string cosmological model doesn't exist for Takabayasi string in spherical frame of reference in Barber's second self creation theory. The string cosmological model exist only. Thus the geometric string is built in spherical frame of reference in Barber's second self creation theory.

The abstraction volume of the model for the given metric is that indicated that matter within the universe whenbeing created at the initial epoch will increase with time. additionally the speed of growth becomes slow as timewill increase & the speed of modification decreases as time will increase.

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