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STUDY ON THE THEORY OF RELATIVITY AND PLANE SYMMETRY

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ABSTRACT

It is seen that general theory of relativity or Einstein's theory of gravitation is coordinate invariant. It fills in as assistance behind models of the universe. At the relentless situation with evolution, the matter distribution in the universe is clearly circularly symmetric and it is guessed that isotropic and homogeneous, considering everything.

In its beginning times of evolution, it would never have anytime had such a streamlined picture. The veritable factors truly confirm that plane symmetry is less prohibitive than round symmetry and gives a setting to study inhomogeneous models that anticipate a fundamental part in seeing a couple of significant parts of the universe.

KEYWORDS:

General, Relativity, Plane, Symmetry

INTRODUCTION

The plane symmetric model anticipates a fundamental part inside seeing clearly coupled massless scalar field and wellspring of free electromagnetic field and bewildering fluid.

Plane symmetry can't really try not to be symmetry of a model in the Euclidean plane: that is, a separation in the plane that gives any directional lines to lines and jam a critical number distances. Expecting one has a model in the plane, the set of plane symmetries that watch the model shapes a group. The groups that emerge as such are plane symmetry groups and are of monstrous mathematical interest.

General relativity is a metric theory of gravitation. At its center are Einstein's equations, which depict the association between the geometry of a four-dimensional pseudo-Riemannian complex having a tendency to space-time, and the energy-force contained in that space-time.

Qualities that in old mechanics are credited to the development of the power of gravity (like drop, orbital motion, and spacecraft course), stand separated from inertial motion inside a twisted geometry of space time in general relativity; there is no gravitational power avoiding objects from their OK, but definitely not great, straight ways.

Considering everything, gravity accomplices with changes in the properties of space and time, which appropriately changes the straightest-potential ways that things will routinely follow.

While general relativity replaces the scalar gravitational requirement of dated material science by a symmetric position two tensor, the last decision lessens to the past in unambiguous restricting cases. For delicate gravitational fields and slow speed relative with the speed of light, the theory's questions combine on those of Newton's law of clearing gravitation.

A firm fluid and dispersed radiation equation of state is of much interest in general theory of relativity since it keeps an eye out for the most past crazy possible case for an ideal fluid. In this equation the speed of light is unclear from the speed of sound.

Einstein general theory of relativity gives depiction of gravitation uncommonness in synchronization with the perceptions and is perhaps the most astonishing structure. The theory has been plausible careful and till date there is trademark which clashes with general relativity.

The accomplishment of Newtonian mechanics considering the three laws of motion and Newtonian gravitation considering the general law of Gravitation is famous. This happened exactly as expected into the surprising theory of relativity because of the virtuoso Albert Einstein in 1905. This theory gives better methodology for considering space and time to manage the standard thoughts.

Also, the issue of plane symmetric space-time with ideal fluid as the source has been taken up perspective on conceivable applications to stargazing, cosmology and amazing relativistic hydrodynamics.

GENERAL THEORY OF RELATIVITY WITH A REFERENCE TO THE PLANE SYMMETRY

Consider plane symmetric metric in the form

$$ds^2 = dt^2 - A^2 (dx^2 + dy^2) – B^2.dz^2 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

where A and B are functions of t only.

The relativistic field equations for linearly coupled charged perfect fluid and massless scalar fields are

$$G_{ij} = R_{ij} – ½ g_{ij} R = -8 (E_{ij} + T_{ij} + S_{ij})$$

where Gij is the Einstein's tensor, Rij is the Ricci tensor, R is the Ricci scalar, Eij is the stress energy force tensor of electromagnetic field, Tij is energy tensor of massless scalar field and Sij is the energy tensor of astounding fluid distribution separately. Here the units are picked so the speed of light c = 1 and gravitational consistent G = 1.

The electromagnetic energy momentum tensor is

$$Eij\ = ¼\ [Fia\ Fj – ¼\ 8ij\ F_{ab}\ F^{ab}]$$

iφwhere Fij is the electromagnetic field tensor derived from the four potential and is defined as

$$Fij = aij – qji$$

$$Fij = -4\ psUi$$

In coordinate system, the magnetic field is brought z-axis, with the goal that the just non-disappearing part of electromagnetic field tensor Fij is F12.

The first set of Maxwell's equation:

Fij, k + Fjk, I + Fki,j = 0

Leads to:

F12 = constant = H, other all components are zero.

The energy momentum tensor Tij for massless scalar field is given by

Tij = Vi Vj – ½ gij Vs V's

and massless scalar field V also satisfy the equation

gij Vij = σ

is the charge density, comma (,) and semicolon (;) denotes partial andσwhere covariant differentiation respectively.

Also, the energy momentum tensor Sij for perfect fluid distribution is given by:

Sij = (p + p) Ui Uj + gij p

together with

g+ UiUj = -1

and where Ui, ρ p, are internal pressure, rest mass density and four velocity vectors of the distribution respectively.

From (3), (7) and (9), the non vanishing components of Eij, Tij and Sij, respectively are:

$$E_1^1 = E_2^2 = -E_3^3 = -E_4^4 = \frac{H^2}{8\pi A^4}, \qquad (11)$$

$$T_1^1 = T_2^2 = T_3^3 = -T_4^4 = \frac{-\dot{V}^2}{2}, \qquad (12)$$

$$S_1^1 = S_2^2 = S_3^3 = -p, \quad S_4^4 = \rho. \qquad (13)$$

With the help of equation (11) to (13), the field equation (2) for the metric (1) can be written as:

Here dot denote differentiation w. r. t. ‘t’.

SOLUTIONS

The set of field equations (14)–(16) contains three equations. An additional constraint relating these parameters is ρ known as A, B, p, required to obtained explicit solutions of the system.

We assume a relation between the metric potential:

A = Bn (17)

p = p (18)

Using (17), (18) the set of field equation (14)–(16) reduce to

$$B^{(4n+1)}\ddot{B} + \alpha B^{4n}\dot{B}^2 = \frac{-2H^2B^2}{(3n+1)}. \qquad (19)$$

This can be written as:

$$\frac{df^2}{dB} + 2\frac{\alpha}{B}f^2 = \frac{-4H^2B^2}{(3n+1)B^{(4n+1)}},$$

where $$\alpha = 2n \qquad (20)$$
and

$$\dot{B} = f(B). \qquad (21)$$

From (21), we obtain

$$\left(\frac{dB}{dt}\right)^2 = \left(\frac{-2H^2}{(3n+1)B^{(4n-2)}} + \frac{C}{B^{4n}}\right), \qquad (22)$$

where C is the integration constant.

Using F12 = constant = (H) and $U^4 \neq 0$, the equation (3) gives the values of charge density σ

$$\sigma = 0 \qquad (23)$$

Using equation (23), the equation (8) can be written as:

$$\ddot{V} + \left(2\frac{\dot{A}}{A} + \frac{\dot{B}}{B}\right)\dot{V} = 0. \qquad (24)$$

After solving this equation, we have

$$\dot{V} = \frac{C_1}{B^{(2n+1)}}. \qquad (25)$$

After suitable transformation of coordinates, the metric (1) reduces to the form

$$ds^2 = \left(\frac{-2H^2}{(3n+1)T^{4n-2}} + \frac{C}{T^{4n}}\right)^{-\frac{1}{2}} dT^2 - T^{2n}(dx^2 + dy^2) - T^2dz^2. \qquad (26)$$

CONCLUSION

General relativity has arisen as a fundamentally strong model of gravitation and cosmology, which has at this point passed different unambiguous observational and exploratory tests. Notwithstanding, there are solid signs that the theory is partitioned. The issue of quantum gravity and the subject of the truth of space-time singularities stay open. Mathematical relativists endeavor to get a handle on the chance of singularities and the basic properties of Einstein's equations while mathematical relativists run solid areas for sensibly experiences.

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