JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

A INVESTIGATION ON STATIC SCALAR GRAVITATIONAL FIELD

Dudheshwar Mahto

Radha Govind University Ramgarh,

Dr. Birendra Kumar Chauhan

Radha Govind University Ramgarh.

Abstract- the metric characterizing the coupled scalar gravitational field equation have intrinsic singularity as X= $-\frac{k_2}{k_1}$, it may be conclude that there are no qualitative changes in the singular structure. When a zero-rest-mass scalar field is added to Taubb's static plane symmetric gravitational field.

Key words - field eqution, spherically symmetric ,gravitational, vaccume, static plane.

INTRODUCTION

Many workers have shown their interest in the presence of a scalar meson field. Janis et. al. have analysed the problem further from the point of view of singularity. Gautreau has extended the study to the case of non spherical Weyl fields. Stephenson has considered the problem of the scalar meson field of non rest mass coupled with electromagnetic fields for static spherically symmetric gravitational fields Mazumdar has obtained solutions of an LRS (locally rationally symmetric) Bianchi I space time filled with perfect fluid. Haji-Boutras and Sfeila and Sri Ram have also obtained some solutions for the same field equations by using their solution generating techniques. Pradhan et. al. have studied LRS Bianchi I space time with zero mass scalar field.

In fact the need for exact solutions in general relativity is well known.

In view of the highly non linear character of the field equations only a limited number of solutions are available in this theory. In this chapter we have tried to generate solutions for the coupled gravitational and scalar fields which study is of considerable interest in preventing singularity.

The possibility of construction of new solution from existing one in some special cases have been explored by many authors. Majumdar as shown that for static Einstein –Maxwell source free field equation the solution can be generated from those of corresponding vacuum solution.This investigation has been further extended by Mishra and Radhakrishna and later by Harrison to the case of non-static Weyl fields. Formulating the idea of reciprocal solutions Buchdahl has developed methods for generating new solutions from those for empty space . the work on generating new solutions has also been done by Bandyopadhyay and Singh .

De has developed results for constructing solution for the coupled gravitational and zero rest mass scalar fields from those of vacuum static fields. Extending this technique to the static plane symmetric solution of Taub and the conform stat solution of Das we have obtained two new exact solution for the combined scalar and gravitational fields.

TECHNIQUE AND THE APPLICATIONS:

The result due to De may be stated as follows: suppose that the metric

$$ds^2 = -e^{-f}\left(\gamma_{\alpha\beta}dx^{\alpha}dx^{\beta}\right) + e^{f}dt^2$$

Is a solution of empty space field equation where f and $\gamma_{\alpha\beta}$ are function

of the space coordinate x^1, x^2, x^3 . Then a solution of the combined scalar gravitational field is given by

$$ds^2 = -e^{-w}\left(\gamma_{\alpha\beta}dx^{\alpha}dx^{\beta}\right) + e^{f}dt^2$$

with

$f = k\phi$

and

$w = b\phi$

Where b is a constant and $k^2 = b^2 - 16\pi$.

Static plane symmetric solution

The static plane symmetric solution of Einstein's vacuum field equation obtained by Taub is given by the metric

$$ds^2 = (k_1x+k_2)^{-1/2}(dt^2 - dx^2) - (k_1x+k_2)(dy^2+dz^2)$$

Where k_1 and k_2 are constant and x^1, x^2, x^3, x^4 correspond respectively to x, y, z, t. this solution corresponds to the gravitational field of an infinite plane parallel to the (x, z) –plane.

The metric can be written as

$$ds^2 = -(k_1x+k_2)^{1/2}\{(k_1x+k_2)^{-1}dx^2+(k_1x+k_2)^{1/2}(dy^2+dz^2)\} + (k_1x+k_2)^{-1}dt^2$$

we have

$$f = -\left(\frac{1}{2}\right)\log(k_1x + k_2)$$

and

$$\left(\gamma_{\alpha\beta}dx^\alpha dx^\beta\right) = \{(k_1x + k_2)^{-1}dx^2 + (k_1x + k_2)^{1/2}(dy^2 + dz^2)\}$$

we get the scalar potential ϕ as

$$\phi = -\left(\frac{1}{2k}\right)\log(k_1x + k_2)$$

The metric characterizing the coupled scalar gravitational field equation is

$$ds^2 = -(k_1x+k_2)^{1/2k}\{(k_1x+k_2)^{-1}dx^2+(k_1x+k_2)^{1/2}(dy^2+dz^2)\} + (k_1x+k_2)^{-b/2k}dt^2$$

(ii) A conformastat solution

The solution for a conformastat gravitational universe obtained by Das is

$$ds^2 = -(1-mx)^4(dx^2+dy^2+dz^2)+(1-mx)^{-2}dt^2$$

Where m is a constant and x^1, x^2, x^3, x^4 correspond respectively to x, y, z, t .

REFERENCES

1. Bandopadhyay, G. (1963): J. Math.Mech.,12, 655.

2. Bergman, O and Leiprik, R. (1957); Phys. Rev., 107, 1157.

3.Brahmachary, R. L. (1960; Prog. Theo. Phys., 23 ,749.

4. Buchdahl, H.A. , Quart. (1954); J. Math., 5, 116.

5. Buchdahl, H.A. , Aust. (M56); J. Phys., 9, 13

6. Buchdahl, H.A. , Nuovo. cimento (1957); Ser. x, 5, 1083.

7. Buchdahl, H.A. , (1959); Phys.Rev. 115, 1325.

8. Das, A. (1971); J. Math. Phys., 12, 1136.

9. De, N. (1964); Prog. Theo. Phys. (Japan), 32, 177.

10. Gautreau, R. (1969); Nuovo cimento B, 62, 360.

11. Harrison, B. K. (1965);Phys. Rev., B138, 488.