A Mathematical Approach of General Theory of Relativity

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ABSTRACT

Here in this chapter, we have obtained an exact analytical solution of Einstein's field equations for static anisotropic fluid sphere by assuming that space-time is conformably flat and by taking a judicious choice of energy density ϱ. The model is physically reasonable and free from singularity, Energy density ϱ, radial and tangential pressure have been calculated for the model. It is seen that densities for these models drop continuously from their maximum values at the centre to the values which are positive at the boundary.

THE FIELD EQUATION

We consider the static spherically symmetric line element in the form given by

$$ds^2=e^{v}dt^2-e^{\lambda}dr^2-r^2(d\theta^2+\sin^2\theta d\phi^2)\ldots\ldots\ldots\ldots\ldots(1)$$

Where λ and v function of τ only.

The Einstein's field equation

$$R^{\alpha}_{\beta}-\frac{1}{2}R\delta^{\alpha}_{\beta}= -8\pi T^{\alpha}_{\beta}\ldots\ldots\ldots\ldots\ldots(2)$$

For the metric (2.2.1) give (Tolman [25])

$$-8\pi T^1_1 = e^{-\lambda}(\frac{v^1}{r}+\frac{1}{r^2}) -\frac{1}{r^2}\ldots\ldots\ldots\ldots\ldots(3)$$

$$-8\pi T^2_2 =-8\pi T^3_3$$

$$= -e^{-\lambda}(\frac{v^{11}}{2}+\frac{\lambda^1 v^1}{4}+\frac{v^{12}}{4}+\frac{v^1-\lambda^1}{2r})\ldots\ldots\ldots\ldots\ldots(4)$$

$$-8\pi T^4_4= e^{-\lambda}(\frac{\lambda^1}{r}-\frac{1}{r^2})+\frac{1}{r^2}\ldots\ldots\ldots\ldots\ldots(5)$$

Where differentiation with respect to r is indicated by a prime.

Keywords: Einstein's field, Energy, Density

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