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EXACT SOLUTIONS OF EINSTEIN FIELD EQUATIONS DESCRIBING ANISOTROPIC FLUID SPHERE

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In recent years a number of authors have found solutions to the Einstein field equations for static spherically symmetric gravitational fields with anisotropic matter. These exact solutions must match at the boundary to the unique Schwarzschild metric which is the exterior space-time for a spherically symmetric distribution of matter. The models generated are used to describe relativistic spheres with strong gravitational fields. It is for this reason that many investigators use a variety of techniques to attain exact solutions. In this work we consider the Einstein field equations in the context of isotropic coordinates for matter distributions with anisotropy pressure in the absence of an electromagnetic field. The main objective of this paper is to generate a class of exact solutions to the Einstein field equations for spherically symmetric relativistic star describing anisotropic fluid sphere. In the methodology we give the expression of the line element modelling the interior of relativistic star which allows us to rewrite the Einstein field equations in terms of new variables. Then the integration of the system is reduced to solving the condition of pressure anisotropy which is the second order ordinary differential equation. We solve the equation by making the choices as rational functions in terms of the radial coordinate for one of the gravitational potentials and the anisotropic factor which are physically reasonable. Exact solutions are found in terms of elementary functions, Bassel functions and modified Bessel functions. A physical analysis indicates that the matter distributions are well behaved and regular throughout the stellar structure. Our results contains uncharged anisotropic models found previously. Some previous well known charged models may be regained as a special case when the anisotropic factor is replaced by a suitable choice of electric field; this suggests that our generalized solution may be used to describe relativistic compact sphere.

Keywords: *Exact solutions, Einstein field equations, Anisotropic factor*