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ORIGINAL ARTICLE

A class of new solutions of generalized charged analogues of Buchdahl's type super-dense star

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Abstract The present paper reports a class of new solutions of charged fluid spheres expressed by a space time with its hypersurfaces $t =$ const. as spheroid for the case $0 < K < 1$ with surface density 2×10^{14} gm/cm^3. When the Buchdahl's type fluid spheres are electrified with generalized charged intensity and it is utilized to construct a super-dense star and found that star satisfies all reality conditions except the casual condition for $0 < K \leq 0.05$. The maximum mass occupied and the corresponding radius have been obtained 8.130871 M_Θ and 24.60916 km respectively. Further, the redshift at the centre and on the surface are noted by $z_0 = 0.933729$ and $z_a = 0.383808$ respectively.

Keywords Perfect fluids · Electric intensity · Reissner-Nordstrom metric · Reality conditions · Casual condition · General relativity

1 Introduction

1.1 Charged Fluid

It is well known that static, spherically symmetric, uncharged perfect fluids cannot be held in equilibrium below a certain radius without developing singularities inside. Since the inception of Reissner-Nordstrom metric, research workers have been busy in deriving interior regular charged perfect fluid solutions. A good account of the same can be had from the work of Ivanov (2002). The relevance of the study of charged fluid distributions is connected with the following interesting facts such as: (i) Charge dust (CD) (pressure free distribution) may be realized in the slight ionization of neutral hydrogen. (ii) CD may possess arbitrary mass and radius , can attain very large redshifts, their exteriors can be made arbitrarily near to the exterior of an extreme charged black hole. (iii) A classical model of an electron is likely to be represented by CD if many of its characteristics remain finite and non-trivial while the junction radius shrinks to zero. (iv) Besides many other speciality, the charge in the fluid distribution helps in countering the gravitational collapse by means of the Colombian repulsion together with the pressure gradient. Although one can reach this goal with non perfect fluids, a perfect fluid solution of the type mentioned was recently found (Gupta and Kumar 2005a) but with the presence of an electric charge. Presence of electric charge the gravitational collapse of a spherically symmetric distribution of matter to a point singularity may be avoided as the gravitational attraction is counterbalanced by the repulsive Coulombian force in addition to the negative pressure gradient due to the matter. Also the presence of the charge function serves as a safety valve, which absorbs much of the fine tuning necessary in the uncharged case (Ivanov 2002). After the model is charged thorough a specific electric intensity (charge function) it starts possessing the negative density gradient which is necessary for a physically valid model. Vaidya and Tikekar (1982) coined a space-time involving a parameter K whose hypersurfaces $t =$ constant were spheroids for $K < 1$. They also obtained a perfect fluid distribution (for $K = -2$) which was utilized to describe a superdense star model. In fact the above space-time owes its origin to Buchdahl (1959) with a passage of time perfect fluid models were obtained for all K except for $0 < K < 1$ Gupta and Jasim (2003). Then the fluid spheres so obtained were electrified by means of a particular elec-

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