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Calculation of Mass Energy Density for a Collapsing Dust Sphere

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ABSTRACT

In this paper, we have considered an internal state of a collapsing body including in the course of the process its compression below the Schwarzschild (Schwarzschild, 1916) sphere, which requires the solution of the Einstein equations for the gravitational field in the material medium. In the centrally symmetric i.e. the velocity at each point must be directed along the radius, it represents the field outside a spherically symmetric mass in otherwise, empty space, later was also recognized as the solution representing both the outside and the inside of a non-rotating black hole. Schwarzschild solution allows the exact calculation of several of the post Newtonian effects of general relativity (GR) including the precession of planetary orbits, the bending of light around the sun, the exact gravitational frequency shift, the Shapiro (Shapiro and Teukolsky, 1991) time delay of light passing near the sun. and the precession of orbiting gyroscopes. In this work, we have considered that the fields equations can be solved in general form if we neglect the pressure of the dust like sphere, i.e. $p = 0$. Although the approximation made is not usually admissible in real situations, the general solution of this problem has considerable methodological interest. Here we have calculated the gravitational collapse of a dust like star in consultation with some coordinates, i.e. the time coordinates $\tau \sim \tau_0$. Ultimately our conclusion towards the total gravitational collapse of the large scale structure of the universe when time τ synchronizes to τ_0, then a singular situation arise, which is called the beginning of the universe, i.e. big bang, at this moment the density was infinitely high.

Keywords: Schwarzschild solution, material medium, gravitational field, collapsing dust star, mass energy density.