Modeling of Compact Astrophysical Objects in Relativistic Gravity

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Abstract

The thesis has been organized in the following way: A brief introduction to compact stars and the outline of the process to obtain stellar model is discussed in Chapter. 1. Some of the remarkable works on this particular arena have also been brought up to highlight the known available data for conducting this work. Chapter. 2 focuses on finding a new class of closed-form solutions of the Einstein field equations for spherically symmetric, static, anisotropic matter distribution assuming a physically reasonable metric potential and a specific choice of the anisotropy. The acceptability and the stability of the model has also been discussed. Chapter. 3 presents a class of singularity free interior solutions assuming a physically reasonable metric potential and a specific choice of the anisotropy. The obtained solutions pass all the stability criteria for a compact stellar structure. Chapter. 4 investigates the solution of stellar structure assuming the Finch-Skea metric potential and thus establishes a configuration which is seen to fulfill all the criteria for a anisotropic compact star. The well known metric, Vaidya-Tikekar ansatz has been considered along with polytropic-type equation of state $p_r = k\rho^{1+\frac{1}{n}} - \beta$ have been assumed to study the anisotropic model of a compact star in Chapter. 5. This chapter emphasizes on the impact of the spheroidal curvature parameter K on the stellar structure in view of the relevant physical parameters and on the mass radius relationship. Chapter. 6 examines the stellar model using embedding class I Karmarkar's condition. This chapter investigates two models corresponding to spherically symmetric, static, anisotropic stellar candidates. Assuming special form of Buchdahl ansatz and plugging in the class I condition, the stellar configuration for the Model I has been obtained. Model II represents a class of solutions for a spherically symmetric, anisotropic matter distribution in Vaidya and Tikekar spheroidal geometry. The dependence of the curvature parameter K of the model, which characterizes a departure from homogeneous spherical distribution, is also investigated. Chapter. 7 discusses the concluding remarks and the future scopes on the entire thesis.

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