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Behaviour of universe with Finsler-Modified Randers Cosmological Model in Lyra Theory

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Abstract. In this manuscript, we have considered the Finsler-Modified Randers Cosmological Model (FMRCM) with cosmological constant Λ for generalized Finsler-Randers space-time, to investigate the solutions of this model in Lyra theory of cosmology under different variations of energy conditions. Further, we have analyzed the role of cosmological constant Λ in various framework, exploring its impact on both accelerating and decelerating phases of cosmic expansion with graphical and geometrical impact.

Keywords: Cosmological constant Λ , Finsler-Modified Cosmological Model, Generalized Finsler-Randers Cosmological Model (FMRCM), Curvature Parameter of Universe, Lyra Theory

Introduction. The accelerating expansion of the universe refers to the phenomenon in which galaxies are observed to be receding from us at an increasing rate over time, indicating that the expansion is not only ongoing but speeding up.

One of the major unresolved challenges in modern cosmology is determining the precise value of the cosmological constant Λ [1]. In general, by extending the Riemannian metric structure, one can construct a Finslerian geometric framework on a manifold, laying the foundation for more generalized theories of gravitation. Finsler geometry has seen rapid progress in its applications to fundamental theories of relativity, especially in general relativity, astrophysics, and cosmology. Several authors [1–7] and [8] have investigated Bianchi-type cosmological models under various physical conditions, incorporating a time-dependent gauge function β within the framework of Lyra geometry for perfect fluid distributions. G. Lyra proposed a modification to Riemannian geometry by introducing a gauge function into an otherwise structureless manifold. More recently, D.D. Pawar et al. [7] explored magnetized dark energy cosmological models with a time-dependent cosmological term in Lyra geometry, specifically focusing on a magnetized dark energy Bianchi type VI_0 space-time. Their work examines scenarios involving both uniform and time-varying displacement fields within the Lyra manifold.

Methods and materials; results. In this context, Stavrinos et. al. [5] showed that the field equations derived from Finsler — Randers geometry yield a Hubble parameter that includes an additional geometric term. This term could potentially be interpreted as a source of dark energy.

In this research paper, we explore a Friedmann-like Robertson — Walker model and the role of the cosmological constant Λ within the framework of generalized Finsler — Randers cosmology. Our study focuses on examining both the accelerating and decelerating phases of cosmic expansion in Lyra geometry with graphical and geometrical impact.

Conclusion. In this research paper, we have proposed a cosmological model that explores various energy conditions in terms of the cosmological constant. We have considered the cosmological constant in two distinct framework accelerating and decelerating phases of the universe. Within these contexts, we have derived several theoretical solutions, including de Sitter solutions and power-law solutions, incorporating the cosmological constant under different scenarios. Both the geometrical and graphical impacts of these solutions are thoroughly analyzed.

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