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ABSTRACT ONLY

COSMOLOGICAL PERTURBATION THEORY IN $F(R)$ THEORIES OF GRAVITY

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Recent astronomical observations of supernovae (SNIa) and baryonic acoustic oscillations (BAO) indicate that the Universe is in an accelerated expansion period. Interpreted within the framework of General Relativity GR, the acceleration is explained by a positive cosmological constant or exotic matter models known in the literature as dark energy. However, there is an alternative approach to explain the acceleration without exotic matter models. Modifications of GR such as scalar-tensor gravity and high-order derivative gravity theories, naturally offer the explanation for the accelerated phase coming from the geometrical side. One of this higher-order theories is f(R) modified gravity. In this work, we use some mathematical results concerning to the Taylor expansions of tensor fields under the action of one-parameter families of diffeomorphism in the context of f(R) theories in the expanding universe. We mean gauge invariant in the sense of the second-kind gauge following the work exposed in Nakamura. We obtain the general gauge invariant at first-order and second-order equations in f(R) gravity. As an example, we write these first-order equations in f(R) gravity for a perturbed FLRW space-time. The gauge invariant scalar, vector and tensor FLRW perturbations equations for first order are obtained explicitly in f(R) gravity and we obtain solution features. This general formulation is compared with the particular cases of the literature (Newtonian gauge and synchronous gauge).

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