(2+1)-dimensional Starbinsky cosmological models in f (R) gravity with Λ(R, T)

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Abstract :- We investigate a new type of isotropic cosmological models in (2+1)-dimensions without singularity. Starobinsky inflation is a modification of general relativity in order to explain cosmological inflation. The authors [Alexandros Kehagias et al., Physical Review D 89, 043527 (2014)], have pointed out that the ability of some models of inflation, such as the Higgs inflation and the universal attractor models at large values of the coupling ξ , in reproducing the available data, is attributed to their relation to the Starobinsky model of inflation. We study such a particular Starbinsky model in modified gravity where, f(R)=R+R^2.

In this paper, we also intend to study a new feature of cosmological models in f (R) modified theories of gravity, hence define the cosmological constant Λ as a function of the trace of the stress energy-momentum-tensor T and the Ricci scalar R, and name such a model Λ(R,T) gravity where we have specified a certain form of Λ(R, T). Λ(R, T) is also deduced in the perfect fluid and dust case. Certain physical and geometric properties of the model are also enunciated. The pressure, density and energy conditions are studied both when Λ is a positive constant as well as when Λ = Λ(t), i.e a function of cosmological time, t. We study behavior of some cosmological quantities such as Hubble and deceleration parameters. The model is innovative in the sense that it has been explained in terms of both R and T and display better understanding of the cosmological observations.

We discuss the physical significance of the model, when p=\omega \rho, with $-1 < \omega < 1$. The cosmological constant, \Lambda, can be interpreted as arising from a form of energy which has negative pressure, equal in magnitude to its (positive) energy density where $\omega = -1$. Such form of energy - a generalization of the notion of a cosmological constant is known as dark energy. On the other hand if $\omega = - 1/3$, we get a quintessence field which is a hypothetical form of dark energy, more precisely a scalar field and postulated as an explanation of the observation of an accelerating rate of expansion of the universe.