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Unification: inflation and dark epochs from multi-field theory

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A two scalar field model that incorporates non Riemannian Measures of integration or usually called Two Measures Theory (TMT) is introduced, in order to unify the early and present universe. In the Einstein frame a K-essence is generated and, as a consequence for the early universe, we can have Inflation and then subsequent early and present present dark epochs with consistent generation of dark energy (DE), dark matter (DM) and stiff matter. The scale invariance is introduced and then is spontaneously broken from the integration of the degrees of freedom associated with the modified measures. The resulting effective potentials and K-essence in the Einstein frame produce three flat regions corresponding to the different epochs mentioned before. For the first flat region we can obtain an inflationary universe. Also assuming this first plateau, we study the inflation in the framework of the slow-roll approximation, which brings us to an easy transition transition to the first DE region. In this scenario under the slow roll approximation we obtain a linear combination that is a constant. The corresponding cosmological perturbations in our model are determined and we also obtain the different constrains on the parameter-space from the Planck data. The slow roll approximation can be arranged so that the transition from inflation to the next flat region can be achieved without problems.

In the following flat regions, representing the Early Dark Energy and Late Dark Energy periods, DE and also the DM, which do not need to be introduced separately, they are instead a result of a K-essence induced by the multi measures, multi field theory. Therefore the scalars generate both the DE and the DM . Also a stiff matter component, which decays very fast, is automatically generated from the K-essence theory from two scalar fields.

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