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"Theoretical and Observational Bound on Scalar fields In Modified Symmetric Teleparallel Gravity"

In this presentation, I will provide an overview of our recent research contributions in the context of scalar field cosmology within the framework of symmetric teleparallel gravity. Specifically, I will discuss the findings from our three published papers, along with two additional manuscripts that are currently under review.

A significant portion of our work focuses on the Dirac-Born-Infeld (DBI) scalar field, which is motivated by string theory and serves as a compelling candidate for modeling dark energy and cosmic inflation due to its non-canonical kinetic structure. We explore the dynamics of this field in symmetric teleparallel gravity and examine how its potential can be constrained using the most up-to-date cosmological observations, particularly the latest data from the Dark Energy Spectroscopic Instrument (DESI).

Additionally, we evaluate the compatibility of our models with the Swampland conjectures, which aim to distinguish effective field theories that can be consistently embedded in a quantum theory of gravity from those that cannot. For this purpose, we employ a statistical Gaussian approach to assess the likelihood of various scalar potentials satisfying the Swampland criteria.

Furthermore, we extend our analysis by incorporating curvature perturbations into the dynamical system. We demonstrate how the full system of cosmological equations—including both background dynamics and first-order scalar perturbations—can be solved exactly within our theoretical framework. This allows us to probe the evolution of structure in the universe and refine our understanding of viable scalar field models in modified gravity theories.

References:

1.https://onlinelibrary.wiley.com/doi/10.1002/prop.202300006
2.https://iopscience.iop.org/article/10.1088/1402-4896/ad39b5
3.https://iopscience.iop.org/article/10.1088/1674-1137/ad50aa

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