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New scalar Field Models and Their Relatives

In this work, we investigate novel kinklike structures in a scalar field theory driven by Dirac-Born-Infeld (DBI) dynamics. Analytical features are reached through a first-order formalism and a deformation procedure. The description analyzed ensures the linear stability of the solutions found, and the deformation method permits to detect new topological solutions, given some systems of known solutions. The proposed models vary according to the parameters of the theory. However, in a certain parameter regime, their defect profiles are precisely obtained by standard theories. These are the models relatives. Besides that, we investigate the β–Starobinsky potential in the perspective of topological defects; and we have shown that it can support kinklike solutions, for both canonical and non-canonical kinetics. As a result, we proposed two new kinds of generalizations on the β–Starobinsky model, considering the DBI approach. Then, we explored their main characteristics in this modified scenarios.

These new models and their relatives can be useful to provide both the topological and cosmological inflaton solutions. While in the first case we look for static solutions with spatial dependence, in the second case we look for homogeneous solutions, i.e., time dependent only solutions. From the inflationary cosmology point of view, we need scalar dynamics that can roll slowly enough to get the precise amount of inflation to solve the horizon, flatness and monopole problem. One of the main problems in string theory or supergravity is to find such potentials able to develop this precise behavior. One has found several potentials in these contexts that are easily ruled out by the cosmological observational data. Thus several other approaches keeping some characteristics around fundamental theories as brane inflation, flux compactifications, to quote a few have been addressed in the literature. On the other hand, the DBI dynamics for being directly related to brane dynamics seems to be a good place to look for potentials that can overcome such difficulties. Same can be said to their deformed counterparts since the deformation can make an initial unsuitable potential to a final completely acceptable potential to describe inflationary cosmology. In this sense we consider one of the most celebrated potentials to describe dynamics of inflation, the Starobinsky potential, to address its deformation in the DBI dynamics. As we shall show, their relatives may find applications in both cosmology and (non-)topological solutions.

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