

Brief information about the project

Name of the project	Study of cosmological effects of scalar fields interacting with Einstein-Gauss-Bonnet gravity
Relevance	The relevance of the research conducted by the project's scientific team is linked to the development of new technologies in the fields of observational cosmology and astrophysics, as well as the emergence of new, more precise telescopes and other experimental facilities that make it possible to test theories of gravity and cosmological models.
Purpose	The project is aimed at the study of dynamics of scalar fields, interacting with Einstein-Gauss-Bonnet gravity during cosmological inflation. Such interactions are predicted by effective field theory, and are expected to appear during cosmological inflation, modifying the standard dynamics of the scalar fields. The main goal of the project is to answer the question of how Einstein-Gauss-Bonnet gravity changes the dynamics of scalar fields and the structure of various symmetries during inflation.
Objectives	1. Investigation of symmetry breaking and restoration scenarios triggered by interactions of scalar fields with Gauss-Bonnet term. Gauss-Bonnet term coupled to a scalar field introduces new effective potential in the Klein-Gordon equation, which can lead to new non-trivial stationary points in de Sitter or quasi-de Sitter vacuum, such as during inflation. These stationary points can spontaneously break or restore symmetries of particle physics. Our first objective is to study Gauss-Bonnet-induced symmetry breaking and restoration during inflation. 2. Derivation of a new class of cosmic defects generated by Gauss-Bonnet-induced symmetry breaking. Spontaneous symmetry breaking often leads to the formation cosmic defects (i.e. solitons). These defects can decay after inflation, and play a crucial role in particle production and cosmological structure formation. Gauss-Bonnet-induced symmetry breaking is expected to generate a new class of cosmic defects which will be studied as part of the project. 3. Investigation of multi-scalar Gauss-Bonnet coupling. In the cosmology literature, studies of the Gauss-Bonnet term focus on its interaction with a single scalar field. The objective in this case, is to study multi-scalar coupling of the Gauss-Bonnet term, and to find new stationary points of such a system in the context of inflation.
Expected and achieved results	A new mechanism for symmetry breaking caused by the Gauss-Bonnet coupling to a scalar field has been obtained. A new class of topological defects induced by the Gauss-Bonnet coupling to a scalar field has been derived using

	domain walls as an example. The evolution of such defects during inflation has been analyzed. String and monopole defects will be studied further. A theoretical framework for studying inflation with multiscalar Gauss-Bonnet coupling will be developed. New stationary de Sitter points will be obtained and their influence on inflation will be studied.
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