Abstract

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The thesis consists of a series of articles dedicated to applications of non-product noncommutative geometries both in particle physics and in the description of modified gravity models. The thesis has three parts. The first of them provides an introduction to noncommutative geometry, reviews its methods, and summarizes the current state of the art in mathematical formalism as well as applications to physical models. The second part contains results that are already published in three articles together with supplemental material with new findings that are available as preprints. The first two of these articles are dedicated to the application of non-product geometries to the description of the Standard Model of elementary particles. As a result, we get a model without the fermion doubling, the explanation of the geometric origin of the CP symmetry breaking and we have demonstrated the role of Lorentz symmetry. The remaining material is dedicated to derivation, within the formalism of non-product geometry, a class of cosmological models possessing features characteristic to bimetric gravity models. They are analysed from the perspective of their cosmological implications. The thesis is closed with a chapter summarizing the main findings and suggesting further directions of research.