Vacuum selection and inflation via particle production in anomalous U(1) models

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Abstract

Anomalous U(1) gauge symmetry plays an important role not only in solving the doublet-triplet splitting problem but also in obtaining realistic quark and lepton masses and mixings with the reasonable assumption that all interaction which are allowed by the symmetry are introduced. However, under the assumption, infinite unexpected vacua appear in general.

If vacuum selection via particle production, which has been discussed by Kofman-Linde-Liu-Maloney-McAllister-Silverstein in the paper “Beauty is attractive”, applies to this problem, the physically expected vacuum which are near the enhanced symmetry point (ESP), may be selected in the history of the universe. In the paper, they have studied only the case in which produced particle masses are proportional to the VEV of the moduli. However, in the anomalous U(1) models, generically, many particles whose masses are proportional to some power of the VEVs of fields.

First, we discuss the effects from the particles whose masses are induced via higher dimensional interactions. We show that the particles whose masses are induced via higher dimensional interactions can be produced with longer distance from the ESP. In the anomalous U(1) models, the ESP is on the top of the hill. We discuss the possibility that inflation occurs after vacuum selection.