Constraints on Higher Dimensional Inflation

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Abstract

The possibility that our Universe contains a large extra dimension has recently received renewed attention through the dark dimension scenario, which arises from swampland considerations and predicts the existence of a micron-sized extra dimension. Such a framework has profound implications for early-Universe cosmology. In this talk, I will discuss the constraints that a large extra dimension imposes on inflation. I will show that the requirement of avoiding excessive Kaluza–Klein gravitons production strongly limits the reheating temperature, while consistency with the Higuchi bound forces the inflationary Hubble scale to lie below the compactification scale, implying extremely low-scale inflation if the extra dimension is already stabilized. I will then present a higher-dimensional inflationary scenario in which the extra dimension dynamically evolves to its large size during inflation. Although this construction alleviates the Higuchi constraint, I will show that its parameter space is severely restricted by the Trans-Planckian Censorship Conjecture. I will conclude by discussing how a pre-inflationary phase may account for the remaining viable region of parameter space.

Keywords: Cosmology, Inflation, Large Extra Dimensions, Dark Dimension, TransPlanckian Censorship Conjecture, Swampland

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