Preprint Series in Particles and Cosmos Physics

nº IPARCOS-UCM-24-011

INSTITUTO DE FÍSICA
DE PARTÍCULAS Y DEL COSMOS

IPARCOS

An adiabatic approach to the trans-Planckian problem in Loop Quantum Cosmology

by L. J. Garay, M. López González, M. Martín-Benito, R. B. Neves

February 2024

Plaza de las Ciencias, 1 28040 Madrid, Spain

www.ucm.es/iparcos/

UNIVERSIDAD COMPLUTENSE MADRID

INSTITUTO DE FÍSICA
DE PARTÍCULAS Y DEL COSMOS

IPARCOS

Abstract

We study the scalar modes that, being observable today, were trans-Planckian before inflation, within the context of hybrid Loop Quantum Cosmology (LQC). We analyze the dynamics of these highly ultraviolet modes by introducing modified dispersion relations to their equations of motion and discuss the impact that these relations would introduce in the power spectrum by computing the adiabaticity coefficient. More precisely, we consider two different models compatible with observations for the standard linear dispersion relation which are based on different initial conditions for the perturbations and background. One of these models avoids the issue altogether by generating less e-folds of inflation, so that the observable modes are never trans-Planckian, whereas the other suffers (arguably softly) from the trans-Planckian problem. This shows that the existence of the trans-Planckian problem in LQC is model-dependent.arguments.

UNIVERSIDAD
COMPLUTENSE
MADRID