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UV Finite Power Spectrum in a DFR-like Cosmological Spacetime

Tuesday, 1 December 2026 16:00 (30 minutes)

In this work, we present a model of gauge-invariant scalar perturbations of the metric and inflaton field within the framework of perturbative Algebraic Quantum Field Theory (pAQFT) on cosmological spacetimes, where we incorporate non-local effects motivated by a model of quantum spacetime based on non-commutative geometry, proposed in 1995 by Doplicher, Fredenhagen, and Roberts (DFR), by introducing non-local Gaussian kernels in the (n)-point functions of the gauge-invariant fields, described in terms of the Mukhanov–Sasaki variable and the Bardeen potentials.

We show that the primordial power spectrum of the Mukhanov–Sasaki variable, and consequently the corresponding curvature perturbations, is ultraviolet finite for inflationary and radiation-dominated backgrounds when the field is quantized in an adiabatic vacuum. Thus, the non-local effective theory provides a natural ultraviolet regularization, with the non-locality scale characterized by a parameter of the order of the Planck length.

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