

Cortez, Jerónimo; Mena Marugán, Guillermo A.; Velhinho, José M.

Quantum unitary dynamics in cosmological spacetimes. (English) Zbl 1360.83087
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Summary: We address the question of unitary implementation of the dynamics for scalar fields in cosmological scenarios. Together with invariance under spatial isometries, the requirement of a unitary evolution singles out a rescaling of the scalar field and a unitary equivalence class of Fock representations for the associated canonical commutation relations. Moreover, this criterion provides as well a privileged quantization for the unscaled field, even though the associated dynamics is not unitarily implementable in that case. We discuss the relation between the initial data that determine the Fock representations in the rescaled and unscaled descriptions, and clarify that the S-matrix is well defined in both cases. In our discussion, we also comment on a recently proposed generalized notion of unitary implementation of the dynamics, making clear the difference with the standard unitarity criterion and showing that the two approaches are not equivalent.

MSC:

83F05 Cosmology

83C47 Methods of quantum field theory in general relativity and gravitational theory

81T20 Quantum field theory on curved space or space-time backgrounds

Cited in 4 Documents

Keywords:

quantum field theory; curved spacetime; unitary dynamics; uniqueness criteria

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