

The Mukhanov-Sasaki Hamiltonian in the context of adiabatic vacua and the Lewis-Riesenfeld invariant

We apply the method of the Lewis-Riesenfeld invariant to analyze the dynamical properties of the Mukhanov-Sasaki Hamiltonian and, following this approach, investigate whether we can obtain possible candidates for initial states in the context of inflation. Our main interest lies in the question to which extent these already well-established methods for time-dependent oscillators at the classical and quantum level for finitely many degrees of freedom can be generalized to field theory. It turns out that the generalization to field theory has to be taken with care in order to ensure that the corresponding operator is also unitary on Fock space. Furthermore, the relation of this approach to the framework of adiabatic vacua will be discussed. Finally, we will discuss possible applications of this framework within loop quantum cosmology.