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Many fields quantization formalism

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In this work, we review a quantization formalism that can be applied for systems which are described by many fields. Such systems occur in lots of models for the primordial universe, such as many fields inflation and perturbed Bianchi models. We begin with a classical theory by defining a n-dimension configuration manifold whose associated cotangent bundle is defined as the system's phase space. In phase space, we define the usual canonical symplectic 2-form Ω, which is used to rewrite the Hamilton equations. We then proceed to show that Ω is preserved by the time evolution. Next, we diagonalize the Laplace operator and show that its normal modes can be used to obtain the usual canonical commutation relations for the creation and annihilation operators in the associated quantum theory. We conclude by showing that such modes are equivalent up to class equivalence to an imaginary matrix J and a real matrix M, which can be used to define a vacuum state for the theory.

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