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On the precanonical structure of the Schroedinger wave functional in curved space-time

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I outline the approach of precanonical quantization applied to a scalar field on curved space-time. It leads to the description of quantum fields as sections of the Clifford bundle over the bundle of field variables over space-time. The approach does not require 3+1 decomposition and the corresponding description of quantum fields is a hypercomplex rather than an infinite-dimensional generalization of quantum mechanics. I show how the classical field equations are obtained from the precanonical analogue of the Schroedinger equation as the equations for expectation values of the corresponding operators. I discuss the relationship between the precanonical description and the standard formulation of quantum scalar fields on a curved space-time background in the functional Schroedinger representation. The canonical description is shown to emerge from the precanonical one in a singular limiting case in which, after the 3+1 decomposition, the canonical functional derivative Schroedinger equation is derived from the partial derivative precanonical Schroedinger equation and an explicit formula is obtained which relates the Schroedinger wave functional with the trace of the product integral of precanonical wave functions taken along the surface of initial data.

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