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Nonunitarity problem in quantum gravity corrections to quantum field theory with Born-Oppenheimer approximation

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The problem of time arising in Quantum Gravity is a core problem for which a common solution is not yet identified. In this talk we will examine the semiclassical approach to the dynamics of a gravity-matter system, with the goal of reproducing the standard quantum field theory on a fixed Wentzel-Kramer-Brillouin metric background and, at the next order of expansion, computing the quantum gravity corrections to the matter fields dynamics. We discuss the suitable choice of expansion parameter and the starting hypotheses of the model that allowed us to obtain a unitary evolution, in contrast with the previous proposals where non-unitary corrections emerged. The proposed approach makes use of the kinematical action, an additional term in the action of the system, that ensures covariance under the choice of different ADM foliations on the background metric. The system is separated using a Born-Oppenheimer-like decomposition and the kinematical action is used as a quantum clock for the matter sector, resulting in a unitary dynamics with quantum gravity corrections. The analogies of the kinematical term with an incoherent dust are briefly presented and applications to cosmological models are discussed.

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