

Description of processes passing at finite space-time intervals in the framework of quantum field theory

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We consider a novel quantum field-theoretical approach to the description of processes passing at finite space-time intervals based on the Feynman diagram technique in the coordinate representation. The most known processes of this type are neutrino and neutral kaon oscillations, which are described nowadays only in an eclectic quantum-mechanical approach. The experimental setting of these processes requires one to adjust the rules of passing to the momentum representation in the Feynman diagram technique in accordance with it, which leads to a modification of the Feynman propagator in the momentum representation. The approach does not make use of wave packets, both initial and final particle states are described by plane waves, which simplifies the calculations considerably. The description is very similar to the usual one performed in the framework of the Feynman diagram technique in the momentum representation, where the standard propagators are replaced by their modified versions. We demonstrate the validity of the formalism by applying it to three processes: neutrino oscillations, unstable particle decay and neutral kaon oscillations. It is shown that the considered approach correctly reproduces the known results.

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