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Neutrino decoherence due to radioactive decay

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The phenomena of neutrino oscillations can proceed only in the case of the coherent superposition of neutrino mass states. An external environment can modify a neutrino evolution in a way that conditions for the coherent superposition of neutrino mass states are violated. Such a violation results in quantum decoherence of neutrino states and leads to suppression of flavor neutrino oscillations. In general, the quantum decoherence can be engendered by three different reasons: 1) dephasing, 2) entanglement with the environment and 3) revelation of "which-path"information. Another type of decoherence due to neutrino wave separation is usually referred to a classic decoherence and it is well studied. In the presented studies we consider the influence of the neutrino radioactive decay in dense media on neutrino oscillations. It is shown that in this case neutrino oscillations undergo all three types of quantum decoherence. The corresponding damping of neutrino oscillations in the presence of an electron media and a magnetic field is calculated. The formalism of quantum electrodynamics of open systems is used in the performed evaluations. The studied phenomena can be significant for description of neutrino oscillations in extreme conditions of astrophysical environments peculiar to supernovae, neutron stars or quasars.

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