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Neutrino decoherence in Normal matter

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We consider the decoherence effects in the propagation of active neutrinos due to the non-forward neutrino scattering processes in a matter background composed of normal matter. We calculate the contribution to the imaginary part of the neutrino self-energy arising from such processes. Since the initial neutrino state is depleted but does not actually disappear (the initial neutrino transitions into a neutrino of a different flavor but does not decay) those processes should be associated with decoherence effects. Using the notion of the stochastic evolution of the state, we identify the jump operators, as used in the context of the Lindblad equation, in terms of the results of the the calculation of the non-forward neutrino scattering contribution to the imaginary part of the neutrino self-energy. We consider the solution to the evolution equation in the two-generation case. We give formulae that are useful for estimating the effects of the decoherence terms under various conditions and environments, including the typical conditions applicable to long baseline experiments, where matter effects are important. In those contexts the effects appear to be small, and indicative that if significant decoherence effects were to be found they would be due to non-standard contributions to the decoherence terms.

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