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Neutrino spin and spin-flavour procession in transversally moving or polarized matter and arbitrary constant magnetic field

It was shown for the first time in [1] that neutrino spin (or spin-flavor) precession can be engendered not only by neutrino interaction with the transversal magnetic field but also by neutrino interaction with matter in the case when there is a transversal matter current or matter polarization. The generalized Bargmann-Michel-Telegdi equation [2-4] for description of the neutrino spin evolution in moving matter was used in [1].
Recently the effect of neutrino spin precession in transversally moving matter
has attracted reasonable interest within studies of neutrino fluxes from supernovae [5-8]. In [9] we have demonstrated a consistent derivation of the effect of the neutrino spin and spin-flavor oscillations in the transversal matter currents based on the direct calculation of the neutrino evolution effective Hamiltonian. In the proposed presentation we continue this line and present a regroups derivation of neutrino spin and spin-flavor evolution effective Hamiltonians accounting for effects of neutrino vacuum mixing, neutrino mass states interaction with a constant magnetic field (the transversal and longitudinal components) with a particular focus on effects of neutrino flavour interactions with matter transversal and longitudinal currents. The neutrino spin and spin-flavor oscillation probabilities are obtained for different cases that are of interest for astrophysical applications.

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