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Neutrino oscillations in a magnetic field: the three-flavor case

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We develop the approach to the problem of neutrino oscillations in a magnetic field introduced in [1] and extend it to the case of three neutrino generations. The theoretical framework suitable for computation of the Dirac neutrino spin, flavour and spin-flavour oscillations probabilities in a magnetic field is given. The closed analytic expressions for the probabilities of oscillations are obtained accounting for the normal and inverted hierarchies and the possible effect of CP violation. In particular, it is shown that the probabilities of the conversions without neutrino flavor change, i.e. $\nu_e^L \to \nu_e^L$ and $\nu_e^L \to \nu_e^R$, do not exhibit the dependence on the CP phase, while the other neutrino conversions are affected by the CP phase. In general, the neutrino oscillation probabilities exhibit quite a complicated interplay of oscillations on the magnetic $\mu_\nu B$ and vacuum frequencies. The obtained results are of interest in applications to neutrino oscillations under the influence of extreme astrophysical environments, for example peculiar to magnetars and supernovas, as well as in studying neutrino propagation in interstellar magnetic fields (see [2]).

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Secondary track (number)

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