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Neutrino oscillation probabilities due to possible non-standard interactions

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In this work, we studied the modifications of the neutrino oscillation probabilities due to possible non-standard interactions (NSI) with matter (taking into account a constant matter density profile), focused on the channels $\nu\,\mu \longrightarrow \nu\,\mu$ and $\nu\,\mu \longrightarrow \nu\,e$. First, the neutrino oscillation probability in matter without NSI was studied and then we proceeded with NSI. The most relevant NSI parameters that affect the oscillation phenomenon were also studied. To carry out this study, a code was written using the MathematicaTM software, in which the Hamiltonian was defined in terms of non-standard interaction, the evolution operator and the initial and final states of the neutrinos, then the parameters $\Delta m\,231$ and $\theta\,23$ were changed at 1σ and 3σ of Confidence Level (C.L) for the particular configuration of the NOν A and DUNE experiments. As a result, the $\nu\,e$ appearance probability is affected by the parameters ee , $e\mu$, $e\tau$, $\tau\,\tau$ and $\mu\tau$, and their range of allowed values are found, taking into account the current experimental oscillation measurements and uncertainties. Unlike the channel of $\nu\,e$ appearance, in muon neutrino disappearance channel there is only one NSI parameter that affects this probability and this is $\mu\tau$ that takes the range $-0.07 \leq \mu\tau \leq 0.07$ a 1σ and $-0.176 \leq \mu\tau \leq 0.132$ a 3σ for thet NOνA experimen and for the DUNE experiment a range was found within the values $-0.032 \leq \mu\tau \leq 0.032$ at 1σ and $-0.083 \leq \mu\tau \leq 0.090$ 3σ of C.L.

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