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Majorana CP Violation Insights from Decaying Neutrinos

It is well-known that within the standard three flavor neutrino oscillation formalism, the Majorana phases appearing in the neutrino mixing matrix cannot have any effect on neutrino oscillation probabilities thereby evading testability at neutrino oscillation experiments. We consider an effective non-Hermitian Hamiltonian describing three flavor neutrino oscillations with the possibility of neutrino decay and demonstrate that the two Majorana phases can entangle with the off-diagonal decay terms and appear at the level of oscillation probabilities. Using the Cayley-Hamilton theorem, we derive approximate analytical expressions for three flavor neutrino oscillation probabilities in the presence of neutrino decay, taking into account matter effects. In the context of a long baseline neutrino experiment, we then analyse the impact of Majorana phases on the oscillation probabilities for different channels as well as on observables related to CP violation effects in neutrino oscillations. Finally, we discuss the effect of Majorana phases on the parameter degeneracies in the neutrino oscillation framework.

Field of contribution

Phenomenology

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