

T-violation at future neutrino factories

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We study the possibility of measuring T-violation in future long baseline neutrino oscillation experiments. By assuming a neutrino factory as a staging scenario of a muon collider at the J-PARC site, we find that the $\nu_e \rightarrow \nu_\mu$ oscillation probabilities can be measured with a good accuracy at the Hyper-Kamiokande detector. By comparing with the probability of the time-reversal process, $\nu_\mu \rightarrow \nu_e$, measured at the T2K/T2HK experiments, one can determine the CP phase δ in the neutrino mixing matrix if $|\sin(\delta)|$ is large enough. The determination of δ can be made with poor knowledge of the matter density of the earth as T-violation is insensitive to the matter effects. The comparison of CP and T-violation measurements, à la the CPT theorem, provides us with a non-trivial check of the three neutrino paradigm based on the quantum field theory.

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