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Constraints on neutrino non-standard interactions from COHERENT, PandaX-4T and XENONnT

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We investigate constraints on neutrino non-standard interactions (NSIs) in the effective field theory framework, using data from the first measurement of solar ^{8}B neutrinos via coherent elastic neutrino-nucleus scattering (CEνNS) in the PandaX-4T and XENONnT experiments and data from the COHERENT experiment. The impacts of neutrino NSIs on the CEνNS cross section and the matter effect in the propagation of solar neutrinos are included, while we obtain that the expected number of CEνNS events is more sensitive to neutrino NSIs appearing in the cross section.

Due to relatively large statistical uncertainties, the sensitivities of the PandaX-4T and XENONnT experiments to the neutrino NSIs are currently limited, compared to the COHERENT experiment. Besides, we find that since the central value of the measured CEνNS counts significantly differs from the Standard Model prediction, the sensitivity of PandaX-4T experiment is even more restricted compared to XENONnT.

However, the measurements of PandaX-4T and XENONnT are uniquely sensitive to the neutrino NSIs for the τ flavor due to oscillation feature of the solar ^{8}B neutrinos.

We also assess how the experimental central value, exposure, and systematic uncertainties will affect the constraints on neutrino NSIs from various CEνNS measurements in the future.

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