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Feasibility and physics potential of detecting 8B solar neutrinos at JUNO

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The Jiangmen Underground Neutrino Observatory (JUNO) features a 20 kt multi-purpose underground liquid scintillator sphere as its main detector. Some of JUNO's features make it an excellent experiment for ^{8}B solar neutrino measurements, such as its low-energy threshold, its high energy resolution compared to water Cherenkov detectors, and its much large target mass compared to previous liquid scintillator detectors. In this talk, we present a comprehensive assessment of JUNO's potential for detecting ^{8}B solar neutrinos via the neutrino-electron elastic scattering process. A reduced 2 MeV threshold on the recoil electron energy is found to be achievable assuming the intrinsic radioactive background ^{238}U and ^{232}Th in the liquid scintillator can be controlled to 10^{-17} g/g. With ten years of data taking, about 60,000 signal and 30,000 background events are expected. This large sample will enable an examination of the distortion of the recoil electron spectrum that is dominated by the neutrino flavor transformation in the dense solar matter, which will shed new light on the tension between the measured electron spectra and the predictions of the standard three-flavor neutrino oscillation framework. If $\Delta m^2_{21} = 4.8 \times 10^{-5}$ (7.5×10^{-5}) eV^2, JUNO can provide evidence of neutrino oscillation in the Earth at the about 3σ (2σ) level by measuring the non-zero signal rate variation with respect to the solar zenith angle. Moveover, JUNO can simultaneously measure Δm^2_{21} using ^{8}B solar neutrinos to a precision of 20% or better depending on the central value and to sub-percent precision using reactor antineutrinos. A comparison of these two measurements from the same detector will help elucidate the current tension between the value of Δm^2_{21} reported by solar neutrino experiments and the KamLAND experiment.

Collaboration name

JUNO

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