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Physics potential of detecting solar neutrinos at JUNO

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The Jiangmen Underground Neutrino Observatory (JUNO) [1] is a next-generation neutrino experiment located in China. Although the main goals of JUNO are to determine the neutrino mass ordering (NMO) and to perform sub-percent precision measurements of oscillation parameters with reactor antineutrinos, its physics program is broader and also includes studies on solar neutrinos [2, 3].

The JUNO central detector is an acrylic sphere 35.4 meters in diameter filled with 20 kt of liquid scintillator (LS). It is equipped with photomultiplier tubes (PMTs) of two types: 17612 20-inch PMTs and 25600 3-inch PMTs. The central detector is designed to provide an unprecedented energy resolution of 3% at 1 MeV. Although the target level of radiopurity of LS for performing the NMO analysis is set at 10^{-15} g/g of ^{238}U and ^{232}Th, solar neutrino analysis targets a level below 10^{-17} g/g.

The exceptional radiopurity of JUNO will enable the detection of neutrinos produced in the Sun in the pp chain —specifically ^{8}B, ^{7}Be, pep neutrinos —as well as neutrinos from the CNO cycle. The primary detection channel for solar neutrinos in JUNO is the neutrino-electron elastic scattering process. Depending on the radiopurity that JUNO will achieve, it will set stringent limits on the fluxes of ^{7}Be, pep and CNO neutrinos, exceeding the limits of Borexino in a few years of data-taking.

In this talk, we will provide an overview of JUNO's solar neutrino physics prospects and its potential for detecting ^{8}B, ^{7}Be, pep, and CNO neutrinos.

[1] F. An et al., J. Phys. G 43 no.3, 030401 (2016).
[2] J. Zhao et al., Astrophys. J. 965 no.2, 122 (2024).
[3] A. Abusleme et al., JCAP 10, 022 (2023).

Collaboration(s)

the JUNO Collaboration

Author: GAVRIKOV, Arsenii

Presenter: GAVRIKOV, Arsenii

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