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Supernova Neutrino Energy Spectrum Reconstruction in JUNO with a probabilistic unfolding method

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Observation of Supernovae through their neutrino emission is a major fundamental point to understand both supernovae dynamics and neutrino physical properties. JUNO is a multi- purpose neutrino experiment with a 20 kton liquid scintillator detector under construction in Jiangmen, China. The main aim of the experiment is to determine neutrino mass hierarchy by precisely measuring the energy spectrum of reactor electron antineutrinos at a distance of ~ 53 km from the reactors. For the next galactic core-collapse supernova (SN),JUNO has the capability of detecting a high statistics of SN events. While existing data from SN neutrino consist only of a few events coming from the SN1987A, the detection of a SN burst in JUNO from a progenitor star at 10 kpc will yield ~ 5 × 103 IBD events from electron antineutrinos, around 2000 events from all flavor elastic neutrino-proton scattering, as well as more than 300 events from neutrino-electron scattering, and the charge current and neutral current interaction of neutrinos on the 12C nuclei. In this work an study of SN neutrino events with the JUNO detector through their main three channels is presented with the aim of reconstructing the neutrino energy spectrum separately and all together. The reconstruction of the supernova neutrino energy spectra is based on a probabilistic unfolding method.

Collaboration name

Juno Collaboration

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