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JUNO-TAO: Status and Prospects

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The Taishan Antineutrino Observatory (JUNO-TAO) is a satellite experiment of the JUNO detector. TAO consists of a ton-level liquid scintillator (LS) detector placed at ~30 meters from a reactor core of the Taishan Nuclear Power Plant in Guangdong, China.
The main purposes of TAO are to provide a reference antineutrino spectrum for JUNO, removing possible model dependencies in the determination of the neutrino mass ordering, and to provide a benchmark measurement to test nuclear databases. The search for light sterile neutrinos around 1 eV will be another interesting physics opportunity. Moreover, precise inputs for nuclear physics and reliability tests of reactor monitor and safeguard will be obtained.
TAO is built around a Central Detector (CD) with 2.8 ton Gadolinium-doped LS (GdLS) contained in a spherical acrylic vessel of 1.8 m diameter. The event rate in the fiducial mass of ~1 ton will be ~2000 (~4000) events/day considering (or not) the detection efficiency. About 4500 p.e./MeV are expected with an almost full coverage (~10 m2) of SiPMs with >50% photon detection efficiency. The detector operates at -50◦C to lower the dark noise of SiPMs to ~100 Hz/mm2. Considering the dark noise, cross talk, and charge resolution of the SiPMs, the expected energy resolution of TAO will be sub-percent in most of the relevant energy region.
The central detector is shielded by 1.2 m thick water tanks on the sides and 1 m High Density Polyethylene (HDPE) on the top. Cosmic muons will be detected in the water tanks equipped with PMTs and by Plastic Scintillator (PS) on the top.
The detector R&D started in 2018. A GdLS recipe has been developed and showed good transparency and light yield at -50◦C. The SiPMs and the readout electronics have been preliminarily tested at the same temperature. A prototype detector is being tested at -50◦C. The TAO experiment is expected to start operation in 2022. The status of the detector design, R&D and expected performances will be presented.

Collaboration name

JUNO

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