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Observing of reactor antineutrino signal in the TAO detector

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The Taishan Antineutrino Observatory (TAO), a satellite experiment of the JUNO project, is located at a short baseline from one of the reactor cores of the Taishan Nuclear Power Plant. Its primary objective is to achieve a high-statistics and high-energy resolution measurement of the reactor antineutrino energy spectrum. The detector contains a ton-scale liquid scintillator doped with gadolinium and operated at approximately −50 ℃. Silicon photomultipliers provide a high-coverage light collection, enabling an energy resolution of about 2.8 % at 1 MeV. Data from the initial physics runs are analysed using a dedicated calibration programme and event reconstruction techniques, which allow precise characterisation of the detector's energy response. Inverse beta decay candidates are identified via the prompt–delayed coincidence signature, while residual backgrounds are constrained using reactor-off data. A statistically significant reactor-correlated antineutrino signal is observed, and the measured prompt energy spectrum is consistent with the reference prediction within the current uncertainties. These results confirm the excellent performance of the TAO detector and provide a reference spectrum for the JUNO experiment, facilitate studies of fine spectral structures, and enable searches for light sterile neutrinos.

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