Contribution ID: **152** Type: **Oral**

The precision measurement of the electron anti-neutrino spectrum in beta-decay of ^{144}Ce-^{144}Pr nuclei

Thursday 3 July 2025 17:40 (20 minutes)

Sterile neutrino search is one of the most challenging frontiers in modern particle physics. There are already present indications of neutrino oscillation to the sterile state coming from both reactor scintillator-based experiments and radiochemical experiments with artificial sources. Still, one of the most promising approaches is usage of an organic scintillator detector with an artificial antineutrino source.
One of the best radioactive sources for such experiments is ^{144}Ce-^{144}Pr due to its ground state transition endpoint energy of almost 3 MeV. The main problem of such source usage is poor spectral shape knowledge producing huge systematic uncertainties to the sterile neutrino search. In this study we evaluate the spectral shape of ^{144}Pr spectrum with a significantly improved precision. The final value of the total cross section of inverse beta-decay on hydrogen that we obtain is (4.7448±0.0003stat ±0.0041syst)×10−44cm^2 disregarding the theoretical precision of the cross-section calculation. Such precision should make the systematic uncertainty related to the spectral shape negligible with respect to the other essential experimental uncertainties.

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Session Classification: 5. Physics of neutrino and nuclear astrophysics

Track Classification: Section 5. Physics of neutrino and nuclear astrophysics.