Contribution ID: **363** Type: **Oral**

Search for keV-Scale Sterile Neutrinos via ^{3}H Beta Decay in LiF Crystals

Thursday 28 August 2025 17:20 (20 minutes)

Understanding the nature of dark matter is one of the fundamental challenges in modern physics. Numerous experimental and theoretical attempts have explored the possibility that keV-scale sterile neutrinos could serve as a strong dark matter candidate. Although satellite observations have placed stringent limits on the mixing of sterile neutrinos with active Standard Model neutrinos, these constraints can vary depending on early-universe models. A precise measurement of a beta decay spectrum offers a model-independent approach to investigating the mixing angle between active and sterile neutrinos.
We have conducted the LiF Experiment for keV Sterile Neutrino Search (LiFE-SNS) by measuring the tritium beta decay energy spectrum using LiF crystals read out by magnetic microcalorimeters (MMCs) at millikelvin temperatures. Over a four-month data-taking period, two LiF detectors, each containing approximately 30 Bq of tritium embedded through neutron activation, were operated with an energy threshold of approximately 1 keV.
We present the analysis procedures used to extract a precise beta spectrum from the measured signals, based on Monte Carlo simulations that incorporate both the theoretical beta spectrum and experimental noise data. We will present search results for sterile neutrinos in the 1–17 keV mass range, covering mixing amplitudes between $10^{-}4$ and $10^{-}2$.

Collaboration you are representing

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Session Classification: Neutrino Physics and Astrophysics

Track Classification: Neutrino Physics and Astrophysics