

Workshop on Advanced Radiation Detector and Instrumentation in Nuclear and Particle Physics (Online)



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Characterization of Sapphire detector for CE ν NS search at MINER

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Abstract:

The Mitchell Institute Neutrino Experiment at Reactor (MINER) at Texas A&M University, USA is a reactor based neutrino experiment which aims to measure coherent elastic neutrino-nucleus scattering (CE ν NS) where a neutrino interacts with a nucleus as a whole creating a nuclear recoil [1, 2]. One of the main challenges for this experiment is to deploy detectors capable of measuring low-recoil energies. A novel sapphire detector made up of Al₂O₃ substrate with dimension 7.62 mm \times 4 mm with mass 73 g has been fabricated and characterized. Particle interactions are detected through phonons and scintillation photons. The phonons are detected through Transition edge sensors (TES) photo-lithographically placed on the surface of the detector. The photons are detected through their interactions with a Si HV [3] detector in coincidence. We will report the characterization and performance of the sapphire detector in reactor and non-reactor environments.

Reference:

- [1] D Z Freedman, D N Schramm, and D L Tubbs. "The Weak Neutral Current and its Effects in Stellar Collapse". In: Annual Review of Nuclear Science 27.1 (1977), pp. 167–207. doi: 10.1146/annurev.ns.27.120177.001123.
- [2] A. Drukier and L. Stodolsky. "Principles and applications of a neutral-current detector for neutrino physics and astronomy". In: Physical Review D 30 (11 1984), pp. 2295–2309. doi: 10.1103/PhysRevD.30.2295.
- [3] V. Iyer et al. "Large mass single electron resolution detector for dark matter and neutrino elastic interaction searches". In: Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment 1010 (2021), p. 165489. issn: 0168-9002. doi: <https://doi.org/10.1016/j.nima.2021.165489>.

What is your experiment?

Mitchell Institute Neutrino Experiment at Reactor (MINER)

Primary author: Ms CHAUDHURI, Mouli (National Institute of Science Education and Research)

Presenter: Ms CHAUDHURI, Mouli (National Institute of Science Education and Research)

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