

Measuring Inelastic-Neutrino Scattering on Lead Using a Cherenkov Detector at the Spallation Neutron Source at ORNL

Friday, 21 June 2024 17:30 (2 hours)

Neutrino-Induced Neutrinos (NINs) are neutrons produced as a result of the interaction between neutrinos and nuclei. NINs are central to supernova early warning systems such as the Helium and Lead Observatory (HALO) and also appear as background in accelerator-based neutrino experiments. The occurrence of NINs affects the measurement of neutrino interaction rate (cross-section). In 2015, the COHERENT collaboration deployed a detector at the Spallation Neutron Source (SNS) at Oak Ridge National Laboratory (ORNL) to measure NINs production in lead (Pb). The detector —referred to as the neutrino cube (nube) —was designed using ~900 kgs of cast lead and 4 liquid scintillators detectors. Despite the meticulous design and execution of the nube experiment, the data obtained yielded NINs rate that was a factor of 3 lower than predictions. The discrepancies between the experimental observations and theoretical predictions underscore the potential for groundbreaking discoveries in nuclear physics. To study these unexpected findings, we proposed deploying a prototype Cherenkov detector as a precursor to a larger neutrino detector initiative.

In July 2023, we successfully deployed a Cherenkov prototype detector at the Neutrino Alley, a basement corridor, at the SNS at ORNL. The prototype consists of Pb glass weighing ~40 kgs, 2 photomultiplier tubes, and no shielding. We collected about 12 terabytes of beam-on data with additional beam-off data. Our detector measures Cherenkov radiation facilitating a more comprehensive analysis of the electromagnetic component of charged-current neutrino interactions on ^{208}Pb . The initial analysis and implications from the prototype will be presented. Plans for 2024 deployment of a multi-array Pb glass detector at the SNS will also be presented.

Poster prize

Yes

Given name

Nixon

Surname

Ogoi

First affiliation

North Carolina Central University

Second affiliation

Triangle Universities Nuclear Laboratory

Institutional email

nogoi@eagles.nccu.edu

Gender

Male

Collaboration (if any)

COHERENT

Primary authors: OGOI, Nixon (North Carolina Central University); Ms ZAALISHVILI, Ana (Duke University); Ms JONES, Natalie (Duke University); Mr JOHNSON, Tyler (Duke University); Prof. MARKOFF, Diane (North Carolina Central University); Prof. BARBEAU, Phil (Duke University)

Presenter: OGOI, Nixon (North Carolina Central University)

Session Classification: Poster session and reception 2

Track Classification: Neutrino interactions