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Searching for Majorana neutrinos with nEXO

Dr. Raymond Tsang

Dept. of Physics and Astronomy

University of Alabama

Abstract: The Standard Model (SM) of particle physics is a successful theory that describes the electromagnetic, weak, and strong interactions. However, limitations of the model have been found. Neutrino oscillation experiments have shown that neutrinos have mass. This contradicts the SM in which neutrinos have been assumed massless. This discovery opens up many theoretical possibilities, including that neutrinos may be their own antiparticles -- or so-called Majorana particles. If proven, it would imply non-conservation of lepton number, and it may provide clues to the puzzle of the matter-antimatter asymmetry in the universe. Neutrinoless double beta decay ($0\nu\beta\beta$) is a sensitive probe of the potential Majorana nature of neutrinos. In contrast to the SM-allowed two-neutrino mode of double beta decay which emits two antineutrinos along with two electrons, the neutrinoless mode does not emit any antineutrinos. Collaborations worldwide have been searching for $0\nu\beta\beta$ for the past decades, while more sensitive experiments are being developed and planned. Among the most promising future experiments is the next-generation Enriched Xenon Observatory (nEXO). nEXO will search for $0\nu\beta\beta$ of Xe-136 using a time projection chamber with 5 metric tonnes of liquid Xe enriched to 90% in the 136 isotope. The nEXO experiment is currently in R&D and is on the path to data-taking next decade. In this talk, I will explain the physics background, describe the nEXO experiment, and report on the current status of the nEXO R&D.

Bio: Dr. Raymond Tsang is currently a senior postdoctoral fellow at the University of Alabama. He obtained his BSc in Mathematics and his MPhil in Physics at the University of Hong Kong, and his PhD at CalTech, where he worked on measuring the Non-zero neutrino mixing angle using the Daya Bay antineutrino detectors. Following his PhD, he has worked on a variety of large scale particle and nuclear physics experiments, including nEDM and EXO-200 and nEXO during postdocs at the University of Alabama and Pacific Northwest National Laboratory. He was part of the team that obtained the 2016 Breakthrough Prize on Fundamental Physics, awarded to the Daya Bay Collaboration.

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