T 87: Neutrino Physics V

Time: Friday 9:00–10:30 Location: AudiMax

T 87.1 Fri 9:00 AudiMax

Position and Energy Reconstruction in OSIRIS — Thilo Birkenfeld, •Elisabeth Neuerburg, Achim Stahl, and Christopher Wiebusch — RWTH Achen

During the filling of the Jiangmen Underground Neutrino Observatory (JUNO) in 2025, the Online Scintillator Internal Radioactivity Investigation System (OSIRIS) monitored the radiopurity of the liquid scintillator (LS). OSIRIS has 64 20"-PMTs surrounding a cylindrical acrylic vessel holding 20-ton batches of LS. Uranium and Thorium impurities are estimated by counting the Bismuth-Polonium coincidence occurring in both decay chains, identified using time, distance, and energy cuts. The position of an event is reconstructed using a maximum-likelihood estimation, with Lookup Tables to calculate the expected amount of light. The energy is reconstructed from the event's position and the amount of light detected. The resolutions are estimated from simulation data and cross-checked against calibration data obtained by lowering a multi-gamma source into the vessel. In this talk, the position and energy reconstruction methods in OSIRIS and their respective performances are presented.

T 87.2 Fri 9:15 AudiMax

Gravitationally induced Decoherence in Neutrino Oscillations: Bridging between Phenomenological and Microscopic Models — Alba Domi[1], João Coelho[3], Kristina Giesel[1], Max Joseph Fahn[2], Renata Ferrero[1], and •Roman Kemper[1] — [1]Friedrich-Alexander Universität Erlangen-Nürnberg, Germany — [2]Università di Bologna, Italy — [3]APC, Paris

In this talk, the role of gravitationally induced decoherence in open quantum systems is discussed in the context of neutrino oscillations. Often in phenomenological models, the decoherence parameters appear as free parameters encoded in a vectorised dissipator. The properties of a class of such dissipators are examined. Possible links to underlying gravitational microscopic models are discussed, which can provide a physical interpretation of the involved decoherence parameters. In addition, it is considered how different physical assumptions entering the decoherence model are reflected in the resulting neutrino oscillation probabilities.

T 87.3 Fri 9:30 AudiMax

Quantum Decoherence with KM3NeT/ORCA — •Mays Massarwa for the KM3NET-ERLANGEN-Collaboration — Friedrich-Alexander-Universität Erlangen-Nürnberg, ECAP, Erlangen, Germany

KM3NeT is a research infrastructure currently under construction in the Mediterranean Sea, that consists of two water Cherenkov detectors: ARCA, whose main purpose is to search for cosmic neutrinos in the TeV-PeV range and ORCA that uses atmospheric neutrinos for measurements of neutrino oscillations. ORCA is sensitive to effects beyond the standard model (BSM), such as quantum decoherence.

Treating neutrinos as an open quantum system interacting with an external environment leads to non-unitary time evolution, which can be described by a Lindblad master equation. This results in deviations from the standard neutrino oscillation probabilities and provides a phenomenological description of neutrino decoherence.

Several models propose that quantum gravity could leave a potentially observable imprint in the evolution of the neutrino as an open quantum system. This motivates the study of neutrino decoherence with the ORCA detector by investigating deviations from the expected standard 3-flavour neutrino oscillations. This contribution will report the projected sensitivity of an intermediate detector configuration of ORCA to this effect.

T 87.4 Fri 9:45 AudiMax

Electron-nucleus scattering at MAMI as a benchmark for precision neutrino interaction models. — •Khwaja Idrees Hassan and Luca Doria — Institut für Kernphysik, JGU Mainz

Achieving the precision required for next-generation neutrino experiments depends critically on a detailed understanding of the fundamental processes governing neutrino-nucleus interactions in detectors. At present, uncertainties associated with these interactions remain at the O(10%) level, whereas upcoming experiments demand O(1%) precision.

Electron-nucleus scattering provides a high-precision benchmark for event generator codes used in neutrino experiments, helping reduce systematic uncertainties and ensure the consistency of nuclear models.

The A1 Collaboration at MAMI has initiated an experimental program to precisely measure nuclear cross sections relevant to neutrino physics, with particular emphasis on the needs of future long-baseline experiments such as DUNE and Hyper-Kamiokande. In this contribution, we present current results on ^{12}C and ^{40}Ar cross-section measurements and provide an outlook on future experiments for ^{16}O.

T 87.5 Fri 10:00 AudiMax

Extended range measurement of the KATRIN energy loss function up to 200 eV — •Volker Hannen for the KATRIN-Collaboration — Universität Münster, Institut für Kernphysik, Wilhelm-Klemm-Str. 9, 48149 Münster

The Karlsruhe Tritium Neutrino Experiment (KATRIN) aims to determine the effective electron neutrino-mass via a precision measurement of the endpoint region of the tritium beta-decay spectrum. One of the dominant systematic uncertainties of the measurement are energy losses of the decay electrons due to inelastic scattering off tritium molecules while traversing the gaseous tritium source of the experiment. Measurements of the energy loss function in a range up to 60 eV, which is relevant for the neutrino mass analysis, have already been performed using an angular selective, mono-energetic photo-electron source. The energy loss function is also required for the determination of the column density of the tritium source where regular measurements are taken at selected surplus energies up to 200 eV. To avoid uncertainties related to the extrapolation of the current energy loss function to this value, we have performed extended range measurements of the inelastic electron scattering up to 200 eV. The talk will present results of the analysis of the new energy loss data in this extended range. This work is supported by BMFTR under contract number 05A23PMA.

T 87.6 Fri 10:15 AudiMax

The Plasma Systematic in the KATRIN Experiment — •Karo Erhardt for the KATRIN-Collaboration — Karlsruher Institut of Technologie

The KATRIN experiment aims at a direct kinematic measurement of the absolute neutrino mass with an expected sensitivity below 300 meV (90% CL), achieved through high-resolution, high-statistics spectroscopy of tritium beta decay. To reach this sensitivity, systematic effects that modify the measured electron spectrum must be modeled and controlled via dedicated calibration measurements. One key systematic effect is related to the starting potential of electrons in the gaseous molecular tritium source, which behaves as a cold plasma in a tesla-scale magnetic field. In this talk, after introducing the starting-potential-related effects, we present the analysis of calibration measurements using gaseous krypton-83m. The impact on the neutrino mass analysis is evaluated, and steps toward a robust source-potential description are discussed. This work is supported by the Helmholtz Association and by the Ministry for Research, Technology and Space BMFTR (grant numbers 05A23PMA, 05A23PX2, 05A23VK2 and 05A23WO6)