T 72: Niederenergie Neutrinophysik IV

Zeit: Mittwoch 16:45–18:50 Raum: I.13.71 (HS 28)

Gruppenbericht T 72.1 Mi 16:45 I.13.71 (HS 28)

The OPERA Experiment - Latest Results — •Annika Hollnagel for the OPERA-Hamburg-Collaboration — Universität Hamburg, Institut für Experimentalphysik

The long-baseline neutrino oscillation experiment OPERA has been designed for the direct observation of ν_τ appearance in the CNGS ν_μ beam.
The OPERA detector is located at the LNGS underground laboratory, with a distance of 730 km from the neutrino source at CERN. It is a hybrid detector, combining the micrometric precision of emulsion cloud chambers with electronic detector elements for online readout.
While CNGS beam data taking lasted from 2008 to 2012, the neutrino oscillation analysis is still ongoing. Updated results with increased statistics will be presented, including the recent observation of ν_τ appearance.

T 72.2 Mi 17:05 I.13.71 (HS 28)

Simulationsstudien zu einem Untergrund-Tagger für das SHiP-Experiment — •Martin Franke, Janet Dietrich und Heiko Lacker — Institut für Physik, Humboldt-Universität zu Berlin, Berlin, Deutschland

In einem neuen Experimentvorschlag für das CERN-SPS soll mithilfe eines Beam-Dump-Experiments mit 400GeV-Protonen nach Teilchen eines Hidden Sectors gesucht werden: Search for Hidden Particles (SHiP). Das SHiP-Experiment soll aus einem Protontarget, einem Hadronabsorber, einem aktiven Myonfilter, einem tau-Neutrinodetektor (für tau-Neutrino-Physik), einer langen Vakuumkammer, in der die Zerfälle von langlebigen Teilchen eines Hidden Sectors stattfinden können und einem sich daran anschließenden Detektor, der diese Zerfälle rekonstruieren soll.

Der Vortrag beschäftigt sich mit dem die Vakuumkammer umgebenden sogenannten Untergrund-Tagger, der mit Hilfe eines Flüssigszintillators nachweisen soll, ob rekonstruierte Ereignisse im Detektor durch Untergrund verursacht wurden. Als mögliche Untergrundquellen werden dabei Myonen aus der kosmischen Strahlung, sowie Myonen und Neutrinos aus der Target- und Hadronabsorberregion studiert.

T 72.3 Mi 17:20 I.13.71 (HS 28)

Calorimetric measurement of the SOX anti-neutrino source for sterile neutrino search — •Konrad Altenmüller, Matteo Agostini, Laszlo Papp, and Stefan Schönert for the Borexino-Collaboration — Physik Department and Excellence Cluster Universe, Technische Universität München, Germany

A thermal calorimeter is under development to measure with <1% accuracy the heat release of the Cerium anti-neutrino source for the SOX experiment, which is looking for eV-scale sterile neutrinos. The heat release is proportional to the source activity and thus to the emitted neutrino flux, which is an important parameter of the experiment. The calorimeter design is based on a copper heat exchanger mounted around the source with integrated water lines for the heat extraction. Heat loss through conduction and radiation is minimized by suspending the set-up through Kevlar ropes and inserting it inside a thermalized vacuum tank with radiation shields. The device is currently being assembled and tested at TUM in Garching.
This work is supported by the DFG cluster of excellence “Origin and Structure of the Universe”.

T 72.4 Mi 17:35 I.13.71 (HS 28)

Antineutrino Spectrum Modeling and Monte Carlo Generation for SOX — •Mikko Meyer, Daniel Bick, Caren Hagner, and Markus Kaiser — Institut für Experimentalphysik, Universität Hamburg

Several observed anomalies in the neutrino sector could be explained by a fourth (sterile) neutrino with a squared mass difference in the order of 1eV^2 compared to the other three standard neutrinos. This hypothesis can be tested with a kCi antineutrino (Ce-144/Pr-144) source deployed near or inside a large low background liquid scintillator detector like Borexino. The SOX project (short baseline neutrino oscillation with Borexino) aims for the detection of sterile neutrinos. The precise knowledge of the antineutrino spectral shape is especially important to predict the number of antineutrino interactions inside Borexino.

This talk will summarize two of the key elements for the upcoming analysis: the antineutrino spectrum modeling and the Monte Carlo generation.

T 72.5 Mi 17:50 I.13.71 (HS 28)

A Calibration Source for SOX — •Stefan Weinz — Universität Mainz

Several anomalies in datasets of different short baseline reactor and radioactive source experiments indicate a lower $\overset{(-)}{\nu_e}$ flux than expected. A prominent explanation of deviation is the hypothetical oscillation to one or more sterile neutrinos, which do not interact with the detectors.

SOX (Short distance neutrino Oscillations with BoreXino) is a radioactive source experiment starting in 2015 which is supposed to either confirm or discard the mentioned anomalies and therefore the existence of new physics. Due to the fact that SOX is in principle a $\overset{(-)}{\nu_e}$ counting experiment, it is of crucial importance to have a precise estimate of the number of emitted $\overset{(-)}{\nu_e}$ by the employed radioactive source (^{51}Cr, ^{144}Ce). This is accomplished by measuring the thermal power radiated by the source. For the calibration of the respective calorimeter a dummy source (mockup) producing heat by electrical power is built. The talk focuses on the experimental setup, limitations and current status of the calibration procedure.

T 72.6 Mi 18:05 I.13.71 (HS 28)

Positron discrimination in large-volume liquid scintillator detectors using 3D topological reconstruction — •Björn Wonsak — Universität Hamburg, Hamburg

Over the last 20 years, large-volume liquid scintillator detectors have been very successful in measuring neutrinos with energies of a few MeV. One main feature responsible for this is the coincidence between a prompt positron signal and the delayed neutron signal coming from an inverse beta decay. This is used to identify electron anti-neutrinos with high efficiency. However, background mimicking this coincidence e.g. from cosmogenics can still be a limiting factor for this kind of experiments. Therefore, the possibilty to individually identify positrons is highly desirable. In addition, this capability would enable the discrimination of beta+ decays and thus increase the potential to discover CNO-neutrinos from the Sun where the beta+ decay of C-11 is a major background source.

In this talk, we present a new reconstruction method delivering 3D topological pictures of the energy deposition in large-volume liquid scintillator detectors with a resolution of better than 20 cm. This method was originally developed for high-energy particles of a few GeV. However, it turned out that even at low energies it can reveal some topological information containing hints on the presence of photons accompanying a positron annihilation.

T 72.7 Mi 18:20 I.13.71 (HS 28)

Studies on muon track reconstruction with the JUNO liquid scintillator neutrino detector — •Christoph Genster, Marta Meloni, Michael Soiron, Achim Stahl, Marcel Weifels, and Christopher Wiebusch — RWTH Aachen University - III. Physikalisches Institut B

The Jiangmen Underground Neutrino Observatory (JUNO) is a 20kt liquid scintillator detector. It is sensitive to reactor neutrinos from two nuclear power plants at medium baseline of about 50km. Its main goal is the determination of the neutrino mass hierarchy. Fast and effective muon tracking is essential for the veto of atmospheric muons and the detection of atmospheric muon neutrinos. In water Cherenkov detectors muons are tracked by imaging the Cherenkov rings. In liquid scintillator detectors tracking is more difficult due to the isotropic emission of light. First results of muon reconstruction are presented.

T 72.8 Mi 18:35 I.13.71 (HS 28)

Szintillatorreinigung mit Aluminiumoxid für den JUNO - Detektor — •Sabrina Prummer[1], Dominikus Hellgartner[1], Lothar Oberauer[1], Julia Sawatzki[1], Andreas Ulrich[2] und Vincenz Zimmer[1] — [1]Technische Universität München, Physik Department E15, James-Franck-Straße, 85748 Garching — [2]Technische Universität München, Physik Department E12, James-Franck-Straße, 85748 Garching

Das primäre Ziel des geplanten JUNO - Experiments ist die Bestimmung der Neutrino-Massenhierarchie durch Präzisionsmessung der Reaktor(antielektron)neutrinoüberlebenswahrscheinlichkeit. Geplant ist ein 20 kT Flüssigszintillatordetektor mit 30 m Durchmesser, was hohe Anforderungen an die optischen Eigenschaften des verwendeten Szintillators setzt. Da der verwendete Szintillator jedoch bisher industriell nicht rein genug hergestellt werden kann, ist es erforderlich, ein Reinigungsverfahren zu entwickeln, welches die optischen Eigenschaften, speziell die Abschwächlänge, verbessert. Dazu wurde in einer Versuchsreihe das Lösungsmittel LAB (Linearalkylbenzol) mit Hilfe verschiedener Aluminiumoxiden gefiltert und die erhaltenen optischen Abschwächlängen miteinander verglichen.

Diese Arbeit wird unterstützt vom DFG Cluster of Excellence 'Origin and Structure of the Universe' und vom Maier-Leibniz-Laboratorium.