T 88: Niederenergie-Neutrinophysik und Suche nach Dunkler Materie III

Zeit: Mittwoch 16:45–18:50 Raum: KGI-HS 1098

Gruppenbericht T 88.1 Mi 16:45 KGI-HS 1098

First results from Borexino — •Grzegorz Zuzel for the BOREXINO-Collaboration — Max-Planck-Institut für Kernphysik

In May 2007 the Borexino detector was successfully completed and the data taking began. The aim of the experiment, located in the underground laboratory of the LNGS in Italy, is to measure low energy (around 1 MeV) solar neutrinos in real time via elastic neutrino-electron scattering in liquid scintillator. To achieve that goal extremely high radio-purity of the scintillator had to be reached basing on a long R&D program. Data collected so far show that the background level in the detector is superior to the design specification. For U and Th we have measured <1E-17 g/g (1E-16 g/g was specified) and C14/C12 was found to be at the level of 1E-18 (as measured with the Counting Test Facility). Four Kr85 fast coincidences have been recorded in a 121-day live time period indicating probably a small air leak during filling. The main contamination of the scintillator comes from Po210 with the rate of about 60 counts/day/ton. A fit to the recorded energy spectra gives the Be7-neutrino rate of (47 +- 7{stat} +- 12{sys}) counts/day/100 t. This is in a very good agreement with the Standard Solar Model and neutrino oscillation with LMA-MSW parameters [1]. Present status of the experiment, data analysis and future plans will be discussed.

[1] C. Arpesella et al., Borexino Collaboration, Phys. Lett. B In Press, Corrected Proof, (2007)

T 88.2 Mi 17:05 KGI-HS 1098

Muon Track Reconstruction in the Outer Detector of Borexino — •Michael Wurm, Franz von Feilitzsch, Marianne Göger-Neff, Timo Lewke, Quirin Meindl, Lothar Oberauer, and Jürgen Winter for the BOREXINO-Collaboration — Technische Universität München, Physik-Dpt. E15

The Borexino Detector is designed for the detection of low-energetic solar neutrinos. Cosmic muons and their spallation products are an important background for these measurements.

The Inner Detector of the experiment containing the liquid-scintillator target is surrounded by an additional Water Cherenkov Detector. This Outer Detector can be used to reconstruct the tracks of cosmic muons that are crossing both Inner and Outer Detector. The approach of the reconstruction, estimates of the systematic uncertainties and its impact on data analysis will be discussed.

(This work is funded by the Maier-Leibnitz-Laboratorium and by the Excellence Cluster "Origin and Structure of the Universe".)

T 88.3 Mi 17:20 KGI-HS 1098

Muon veto efficiency of the BOREXINO detector — •Timo Lewke for the BOREXINO-Collaboration — Physik-Department E15, Technische Universität München, James-Franck-Straße, 85748 Garching

Borexino is an organic liquid-scintillator detector for the measurement of the low-energy part of the solar neutrino spectrum. It consists of a 300 t PC (Pseudocumene) inner detector surrounded by approximately 1 kt of non-scintillating buffer liquid. As outer shilding, a water-filled tank is used. It also serves as a water Cherenkov muon veto. Starting measurements in May 2007, Borexino published the first real-time detection of ^{7}Be neutrinos in August 2007.

In order to distinguish between neutrino events and cosmogenic background, muons have to be identified. Both outer and inner detector can be used to tag atmospheric muons. In this talk, different possibilities for muon identification in Borexino are explained. Moreover, the overall efficiency of the veto is presented.

T 88.4 Mi 17:35 KGI-HS 1098

Ergebnisse der elektromagnetischen Messungen mit dem KATRIN Vorspektrometer — •Florian Habermehl für die KATRIN-Kollaboration — Institut für Experimentelle Kernphysik, Universität Karlsruhe

Das KArlsruhe TRItium Neutrino Experiment (KATRIN) verfolgt das Ziel der direkten Messung der Elektronantineutrinomasse aus der Kinematik des Tritium-β-Zerfalls. Der Messaufbau setzt sich zusammen aus einer fensterlosen gasförmigen molekularen Tritiumquelle mit anschließender differentiell bzw. kryogen gepumpter Elektronen-Transportstrecke, einem elektrostatischen Tandemspektrometersystem zur Analyse der Elektronenergien und einer Detektoreinheit zum Nachweis der Zerfallselektronen. Die erforderliche Energieauflösung des Hauptspektrometers (Länge: 24 m, Durchmesser: 10 m) ist <1 eV bei 18.6 keV Elektronenergie. Das Erreichen einer Sensitivität von 0.2 eV/c^2 auf die Neutrinomasse erfordert unter anderem ein sehr niedriges Untergrundniveau.

Ein umfangreiches Messprogramm für das Vorspektrometer dient der Verifizierung des elektromagnetischen Designs der KATRIN-Spektrometer. Abschließende Ergebnisse dieser Messungen werden präsentiert.

Teilweise gefördert vom BMBF unter den Förderkennzeichen 05CK5VKA/5, 05CK5REA/0, 05CK5PMA/0 und 05CK5UMA/3.

T 88.5 Mi 17:50 KGI-HS 1098

Das KATRIN Hauptspektrometer: Erste Messergebnisse, Status und Ausblick. — •Florian Fränkle für die KATRIN-Kollaboration — Universität Karlsruhe, IEKP, Postfach 3640, 76021 Karlsruhe

Das **KA**rlsruher **TRI**tium **N**eutrino Experiment (KATRIN) verfolgt das Ziel der direkten Messung der Elektronantineutrinomasse aus der Kinematik des Tritium-β-Zerfalls mit einer bisher unerreichten Sensitivtät von 0.2 eV/c^2. Der Messaufbau setzt sich zusammen aus einer fensterlosen gasförmigen molekularen Tritiumquelle mit anschließender differentiell bzw. kryogen gepumpter Elektronen-Transportstrecke, einem elektrostatischen Tandemspektrometersystem zur Analyse der Elektronenenergien und einer Detektoreinheit zum Nachweis der Zerfallselektronen. Die erforderliche Energieauflösung des Hauptspektrometers (Volumen: 1240 m^3, Oberfläche: 690 m^2) ist <1 eV bei 18.6 keV Elektronenenergie. Um das für die angestrebte Sensitivität erforderliche Untergrundniveau zu erreichen ist es unter anderem erforderlich im Hauptspektrometer einen Druck von 10^{-11} mbar oder weniger zu erzeugen. In dem Vortrag werden die ersten Ergebnisse der Vakuummessungen am Hauptspektrometer vorgestellt sowie über den aktuellen Status des Hauptspektrometers berichtet.

Dieses Projekt wird teilweise vom BMBF unter den Kennzeichen 05CK5VKA/5, 05CK5REA/0, 05CK5PMA/0 und 05CK5UMA/3 gefördert.

T 88.6 Mi 18:05 KGI-HS 1098

LENA: A low-energy neutrino observatory and proton decay detector — •Jürgen Winter, Franz von Feilitzsch, Marianne Göger-Neff, Teresa Marrodán Undagoitia, Lothar Oberauer, Walter Potzel, and Michael Wurm — Physik-Department E15, Technische Universität München, James-Franck-Straße, 85748 Garching

The proposed project LENA (Low Energy Neutrino Astronomy) comprises a 50 kt liquid-scintillator multipurpose detector. Thanks to a low energy threshold, high energy resolution, and a large detector volume, LENA could offer the possibility to answer numerous physics questions. The goals of LENA extend to the fields of astrophysics (e.g. the observation of supernova, diffuse supernova and solar neutrinos), particle physics (search for proton decay), and geophysics (geoneutrinos). An overview of the potential of LENA is given in this talk, along with an introduction to scintillator physics and detector simulation.

LENA is a part of the European LAGUNA (Large Apparatus for Grand Unification and Neutrino Physics) collaboration that has been founded in order to study the feasibility of large-scale detectors with a common physics program. Apart from the liquid-scintillator detector LENA, it involves a 0.5 Mt water Cherenkov detector (MEMPHYS) and a 100 kt liquid Argon time projection chamber (GLACIER).

This work is supported by funds of the DFG (Transregio 27: Neutrinos and Beyond), the Cluster of Excellence 'Origin and Structure of the Universe' and the Maier-Leibnitz-Laboratorium (Garching).

T 88.7 Mi 18:20 KGI-HS 1098

Penning discharge in the KATRIN pre-spectrometer — •Ferenc Glück[1], Lutz Bornschein[1], Florian Fränkle[1], Florian Habermehl[1], Karen Hugenberg[2], Michelle Leber[3], Kathrin Valerius[2], and Christian Weinheimer[2] for the KATRIN-Collaboration — [1]Universität Karlsruhe — [2]Universität Münster — [3]University of Washington, Seattle

The KATRIN pre-spectrometer is a MAC-E filter (electrostatic spectrometer with magnetic adiabatic collimation), with the purpose of reducing the background in the KATRIN neutrino mass experiment. Various investigations conducted in winter 2006-2007 showed the presence of strong Penning discharges, exhibiting increase of pressure inside of the pre-spectrometer and of power supply leakage current, even for rather small tank potential and magnetic field. Calculations showed the presence of deep Penning traps at the two end-regions of the pre-spectrometer, close to the ground electrodes. Experiments indicated a clear correlation between the deepness of the Penning traps and the strength of the discharge; using electrode configurations without Penning traps no discharge was observed. In order to get rid of the deep Penning traps, new shielding electrodes were designed, constructed and installed into the spectrometer. According to the recent experiments, the presence of these electrodes completely solved the Penning discharge problem. The experiences obtained with the pre-spectrometer are very important in order to avoid Penning discharges inside the KATRIN main spectrometer and at the detector system.

T 88.8 Mi 18:35 KGI-HS 1098

Background electrons in MAC-E filters — •Ferenc Glück for the KATRIN-Collaboration — Universität Karlsruhe

Small background level is an important requirement for the precise and reliable neutrino mass measurements (Mainz, Troitsk, KATRIN) using MAC-E filters (electrostatic spectrometers with magnetic adiabatic collimation). Background experiments done with the Mainz spectrometer show that a substantial part of the background is due to low energy secondary electrons coming from the electrodes. The magnetic flux going through the detector is usually not connected with the electrodes, therefore the electrons can reach the detector only by radial motion (perpendicular to the field lines). According to trajectory calculations and to general arguments, the electrons have no radial motion in axisymmetric system; only with non-axisymmetric fields is the radial electron motion possible. Thus, the background level could increase with increasing deviation from axial symmetry. In addition, deviation from adiabaticity in the presence of non-axisymmetric fields also increases the radial electron motion, and therefore the background level. The trajectory calculations with non-axially symmetric fields yield qualitative explanations for most of the background experiments in Mainz. The background at the KATRIN main spectrometer, due to its optimal adiabaticity and axial symmetry conditions, is expected to be small.