HK 66: Astroteilchenphysik

Zeit: Donnerstag 14:00–16:00 Raum: HSZ-401

Gruppenbericht HK 66.1 Do 14:00 HSZ-401

The neutrino experiment SNO+: Overview and status — •Belina von Krosigk, Valentina Lozza, Nuno Barros, Arnd Sörensen, Felix Krüger, Laura Neumann, Axel Boeltzig, Johannes Petzold, and Kai Zuber — TU Dresden, Deutschland

SNO+ (Sudbury Neutrino Observatory) is an upcoming low energie neutrino experiment. It makes use of the former SNO detector, located at the currently deepest underground laboratory SNOLAB in a mine near Sudbury, Canada. This location provides ca. 6000 m.w.e. overburden for cosmic ray shielding. The core of the detector, a 12 m diameter acrylic vessel, will be filled with about 780 t of liquid scintillator, increasing the light yield compared to the SNO Cherenkov detector by a factor of about 50 and lowering the threshold below 1 MeV. Together with the use of ultra–pure materials SNO+ becomes thus sensitive to low energy neutrinos. The main goal of SNO+ is the search for neutrinoless double beta decay of 150Nd after loading the scintillator with 0.1% to 0.3% natural Nd (referring to about 44 kg to 132 kg 150Nd). In this phase searches for 8B solar-neutrinos, geo-neutrinos originating from radioactivity in the earth, atmospheric neutrinos, the potential observation of supernovae neutrinos and the study of reactor neutrino oscillations are also possible. In a later phase, for the detection of pep and CNO solar neutrinos, the Nd will be removed from the liquid scintillator.

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Proton activation of a natural neodymium target for the SNO+ experiment — •Johannes Petzoldt[1], Valentina Lozza[1], Ondrej Lebeda[2], Jan Sturs a[2], and Kai Zuber[1] — [1]Technical University of Dresden, 01069 Dresden, Germany — [2]Nuclear Physics Institute of the ASCR, 25068 Husinec-Rez, Czech Republic

In experiments searching for rare events, like the neutrinoless double beta decay, background knowledge and reduction is essential. For SNO+, the follow up of the Sudbury Neutrino Observatory experiment, the investigated transition is ^{150}Nd $\rightarrow$ ^{150}Sm with an estimated half-life for the 0ν-channel of $T_{1/2} \approx 10^{25}$ years. SNO+ is a liquid scintillator based detector with a total mass of 780 tons. In order to study the mentioned transition, the detector will be loaded with 0.3 % natural neodymium. Even with the desired amount of 131 kg of ^{150}Nd in SNO+, only few decays are expected. Their observation and the measured half-life would not only give an answer on the effective neutrino mass, but also to other important questions in modern neutrino physics.

Long-living radioisotopes, induced by cosmogenic activation on natural Nd, contribute to the background in SNO+ and are investigated at TU Dresden. Proton activation measurements for determining the excitation functions for different isotopes in the energy range of 10 to 30 MeV were done in 2010/2011 while in 2012 the lower and higher energies were investigated. The procedure and the latest results are presented.

This work was funded by the German Research Foundation DFG.

HK 66.3 Do 14:45 HSZ-401

Sensitivity of KATRIN-like experiments for keV Neutrinos — •Susanne Mertens — Lawrence Berkeley National Laboratory, Berkeley, USA — Helmholtz Alliance for Astroparticle Physics, Karlsruhe, Germany

The KATRIN experiment is designed to probe the absolute neutrino mass scale with a sensitivity of 200 meV at 90% confidence level in a direct and model independent way. This is achieved through a measurement of the spectral shape of tritium beta decay close to the endpoint, where the influence of a non-zero neutrino mass is maximal.

KATRIN makes use of a gaseous molecular tritium source of extremely high activity and stability. These unique source properties allow KATRIN to extent its physics reach from its main goal of measuring the neutrino mass in the sub-eV range to look for contributions of possible neutrinos in the multi-keV range constituting a possible candidate for Warm Dark Matter. A heavy sterile neutrino would manifest itself as a tiny kink and subsequent spectral distortion deep in the beta spectrum, further away from the endpoint.

In this talk a sensitivity study of a KATRIN-like experiment to detect keV neutrinos will be presented. Different statistical analysis techniques, the effect of systematic uncertainties and possible technical realizations will be discussed.

We acknowledge the support by BMBF and HAP.

HK 66.4 Do 15:00 HSZ-401

Ein Jahr Messungen am KATRIN Monitorspektrometer — •Moritz Erhard für die KATRIN-Kollaboration — Karlsruher Institut für Technologie, Institut für Experimentelle Kernphysik

Das Ziel des KArlsruhe TRItium Neutrino Experiments KATRIN ist die Bestimmung der Ruhemasse des Elektron-Antineutrinos, mit der bisher unerreichten Sensitivität von 200 meV/c^2. Für das Experiment wird ein Spektrometer nach dem MAC-E-Filter Prinzip aufgebaut, um damit das Energiespektrum des Tritium-Betazerfalls am Endpunkt zu vermessen. Um diese Sensitivität über die gesamte Messzeit gewährleisten zu können, ist eine langzeitstabile Spannungsüberwachung und Kalibration erforderlich mit einer Unsicherheit von 60 meV bei 18,6 kV. Hierzu werden am Monitorspektrometer, ebenfalls ein MAC-E-Filter der von der Hochspannungsquelle des Hauptspektrometers versorgt wird, monoenergetische Konversionselektronen einer festen, ionenimplantierten Rb/Kr Quelle gemessen. Dieser Vortrag gibt einen Überblick auf über ein Jahr Messungen am Monitorspektrometer und die gewonnen Erkenntnisse zur Charakterisierung Rb/Kr Quelle und ihre Eignung als nuklearer Standard. Gefördert durch das BMBF unter der Kennzeichnung 05A11VK3 und der Helmholtz-Gemeinschaft.

HK 66.5 Do 15:15 HSZ-401

Testmessungen mit nicht-axialsymmetrischem Magnetfeld am Katrin-Monitorspektrometer — •Benjamin Leiber für die KATRIN-Kollaboration — Karlsruher Institut für Technologie (KIT), Institut für Experimentelle Kernphysik

Das **KA**rlsruher **TRI**tium **N**eutrino Experiment wird die Masse des Elektron-Antineutrinos mit einer Sensitivität von 0.2 eV/c^2 (90% C.L.) über die Messung des Tritium β-Spektrums in der Nähe des Endpunktes bestimmen. Um die Energie der Zerfallselektronen zu analysieren, werden diese in einem elektrostatischen Spektrometer nach dem MAC-E Filter-Prinzip entlang von Magnetfeldlinien geführt. Durch die adiabatische Änderung des Feldes um einen Faktor von 20.000 wird die transversale Energie der Zerfallselektronen in longitudinale umgewandelt, welche dann mit dem elektrischen Retardierungspotential analysiert wird. Simulationen haben ergeben, dass durch eine Nicht-Axialsymmetrie des Magnetfeldes, wie sie z.B. durch Verformungen des Luftspulensystems, welches das Hauptspektrometer umschließt und den magnetischen Materialien in der Spektrometerhalle, verursacht wird, eine erhöhte Untergrundrate hervorgerufen wird. Um diesen Effekt zu bewerten wurden Testmessungen am Katrin-Monitorspektrometer durchgeführt, bei denen gezielt ein nicht-axialsymmetrisches Magnetfeld eingeführt wurde. Dieses Projekt wird durch die BMBF-Verbundforschung mit dem Förderkennzeichen 05A08VK2 gefördert.

HK 66.6 Do 15:30 HSZ-401

Application of the A/E pulse shape discrimination method to first Ge-76 enriched BEGe detectors operated in GERDA — •Andrea Lazzaro, Matteo Agostini, Dusan Budjas, and Stefan Schoenert for the GERDA-Collaboration — Physik-Department E15, Technische Universität München, Germany

In 2013 the Gerda experiment will be upgraded to its second phase with more than double of the current ^{76}Ge mass. The additional diodes are custom made Broad Energy Germanium (BEGe) detectors. This design has been chosen to enhance the pulse shape discrimination (PSD) capability, with respect to the Phase I coaxial detectors. The goal of Phase II is to improve by one order of magnitude the current background index; the PSD will bring a major contribution to this result.

Since summer 2012 the first set of five enriched BEGe detectors are operated in Gerda Phase I. This offers us the possibility to test the PSD performances and the signal analysis in an environment as close as possible to the Gerda Phase II configuration. In this talk I will present the A/E analysis, the calibration of the cut parameters and the results in terms of background reduction for the data taken with these enriched BEGe.

This work was supported in part by BMBF (05A11W01).

HK 66.7 Do 15:45 HSZ-401

Investigation and development of the suppression methods of the ^{42}K background in LArGe. — •Alexey Lubashevskiy for the GERDA-Collaboration — Max-Planck-Institut für Kernphysik, Saupfercheckweg 1, D-69117 Heidelberg, Germany

GERDA is an ultra-low background experiment aimed for the neutrinoless double beta decay search. The search is performed using HPGe detectors operated in liquid argon (LAr). One of the most dangerous backgrounds in GERDA is the background from ^{42}K which is a daughter isotope of cosmogenically produced ^{42}Ar. ^{42}K ions are collected towards to the detector by the electric field of the detector. Estimation of the background contribution and development of the suppression methods were performed in the low background test facility LArGe. For this purpose encapsulated HPGe and bare BEGe detectors were operated in 1m^3 of LAr in the LArGe setup. It is equipped with scintillation veto, so particles which deposit part of their energy in LAr can be detected by 9 PMTs. In order to better understand background and to increase statistics the LAr of LArGe was spiked with specially produced ^{42}Ar. All these investigations allowed us to estimate background contribution from ^{42}K and demonstrate the possibility to suppress it in future measurements in GERDA Phase II.