HK 35: Astroparticle Physics I

Zeit: Mittwoch 14:00–16:00 Raum: S1/01 A02

Gruppenbericht HK 35.1 Mi 14:00 S1/01 A02

Status of the XENON experiment — •Teresa Marrodan Undagoitia for the XENON collaboration — Max-Planck-Institut für Kernphysik

The XENON100 detector at the Gran Sasso Underground Laboratory in Italy has been searching for dark matter during the last years. Its data has lead to some of the most constraining upper limits on the WIMP-nucleon interaction cross section. To improve the sensitivity by two orders of magnitude and hopefully measure interactions of dark matter, the larger XENON1T experiment has been constructed. It is also a liquid xenon time-projection chamber containing a total mass of ~ 3.5 tons. The goal is to achieve a spin-independent cross section sensitivity at $\sim 2 \times 10^{47}\,\mathrm{cm}^2$ for a WIMP mass of $50\,\mathrm{GeV}/c^2$. To this end, in addition to an increased target mass, all background contributions have been reduced compared to XENON100. This talk will describe the design and commissioning of the XENON1T detector and its subsystems. First data is expected in 2016.

Gruppenbericht HK 35.2 Mi 14:30 S1/01 A02

Recent Edelweiss WIMP search results and perspectives — •Valentin Kozlov for the EDELWEISS-Collaboration — Karlsruher Institut für Technologie, Institut für Kernphysik, Postfach 3640, 76021 Karlsruhe

EDELWEISS collaboration performs direct dark matter search by means of Germanium low-temperature detectors. A 20-kg array of advanced high-purity detectors is operated at 18 mK in the low-radioactivity environment of the Modane underground laboratory (LSM, France). The current phase of the experiment shows improved resolution and rejection performance relative to the results of the previous phase. A first low WIMP mass analysis of data acquired in a long-term campaign will be presented. To further explore the parameter space for low mass WIMPs (down to ~1 GeV), the current R&D program concentrates on voltage-assisted heat amplification technique (so-called Neganov-Luke mode). Significant improvements in sensitivity can be realized with a moderate exposure of 350 kg.d within the next 2 years. Beyond 2017, the already existing cooperation with Super-CDMS should lead to a common experimental infrastructure in SNO-LAB. Current R&D activities, sensitivity projections and the project towards the SNOLAB cryogenic facility will be discussed as well.

HK 35.3 Mi 15:00 S1/01 A02

Radon Screening for XENON1T — •Natascha Rupp — Max-Planck-Institut für Kernphysik, Heidelberg, Deutschland

The radioactive isotope 222Rn is one of the most dominant intrinsic background sources for experiments dealing with a low event rate like the direct detection Dark Matter experiment XENON1T that starts data taking in 2016. As being part of the primordial decay chain of 238U the noble gas 222Rn permanently emanates from almost all materials. It is crucial to determine the radon emanation rate of those detector components that will be in contact with the xenon target. The technique of the radon emanation measurements, making use of ultra low background proportional counters is presented as well as selected results for XENON1T.

HK 35.4 Mi 15:15 S1/01 A02

Monitoring the Energy Scale of KATRIN with Conversion Electrons of a Solid ^{83m}Kr Source as Nuclear Standard — •Klaus Schloesser for the KATRIN-Collaboration — Karlsruher Institut fuer Technologie /IKP

For KATRIN* to be able to achieve the desired sensitivity of 200meV/c^2 for the effective electron neutrino mass, it is of crucial importance that the energy scale of the main spectrometer (18.6 keV) is under control within +/- 60 mV at any given time over the planned measurement time of approximately 5 years.

Besides conventional high voltage dividers and high precision volt meters, a nuclear standard will be deployed additionally in a separate spectrometer of MAC-E filter type. The filter electrodes of both spectrometers are connected galvanically.

For permanent and continuous monitoring an easy to use ion implanted source containing the noble gas ^{83m}Kr was developed and qualified for HV monitoring at the ppm level in the 30kV regime. This talk will present the methods applied and the achievements made.

Acknowledgements:

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*KArlsruhe TRItium Neutrino experiment

HK 35.5 Mi 15:30 S1/01 A02

Investigation of background processes in the KATRIN main spectrometer — •Axel Müller for the KATRIN-Collaboration — Karlsruhe Institute of Technology (KIT), Institut für Kernphysik (IKP)

The **KA**rlsruhe **TRI**tium **N**eutrino experiment aims to probe the mass of the electron antineutrino in a model-independent way with an unsurpassed sensitivity of m_ν = 200 meV/c^2 (90% C.L.). In order to determine the neutrino mass, the energy spectrum of electrons from the tritium β-decay is analyzed by a high-resolution electrostatic spectrometer which is based on the MAC-E filter principle.

To keep the influence of the spectrometer background on the neutrino mass sensitivity small, KATRIN aims for a background level of 0.01 cps. For the investigation of different background components such as cosmic muons, external gamma radiation and the radioactive decay of isotopes in the volume of the spectrometer or on its surface, a series of dedicated measurements were performed with a combined system of main spectrometer and detector.

This talk will present the results of measurements focusing on the secondary electron production at the inner surface of the spectrometer and compare them with electro-magnetic elctron tracking simulations performed with the KATRIN developed simulation software KASSIOPEIA.

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HK 35.6 Mi 15:45 S1/01 A02

Investigation of the reactor neutrino anomaly with STEREO — •Felix Kandzia — Institut Laue-Langevin, Grenoble

Nuclear reactors are strong sources of electron antineutrinos in the energy range from 1 to 10 MeV, originating from the beta decays of neutron rich fission fragments. Reactors therefore provide a good opportunity to study neutrino oscillations. Recently calculated corrections to the common model of emitted neutrino spectra prompted a re-evaluation of several experiments, resulting in a deficit of about 6% between the observed and predicted antineutrino flux at short distances. This so called 'reactor neutrino anomaly' has a statistical significance of 2.7 sigma. One possible explanation of the deficit could be a fourth neutrino state, which would only participate in the oscillations but not in weak interactions and is therefore called 'sterile'.

This hypothesis has triggered a number of experiments worldwide, searching for sterile neutrinos. One of which is STEREO, which will be presented in this talk. STEREO will investigate neutrino oscillations at a distance of only 10 m from the core of the research reactor of the Institute Laue-Langevin (ILL) in Grenoble, France. The very compact core is suitable for the investigation of the expected short oscillation length of the light sterile neutrinos. The sensitive volume of STEREO is 2000 l of a Gd doped liquid scintillator, detecting antineutrinos via inverse beta decay. The detector is currently under construction and is expected to deliver first results in 2016.