T 107: Niederenergie-Neutrinophysik und Suche nach dunkler Materie I

Zeit: Montag 16:45–19:10 Raum: HG XI

Gruppenbericht T 107.1 Mo 16:45 HG XI

First results of the EDELWEISS-II Dark Matter search with ID-type Ge bolometers — •Valentin Kozlov for the EDELWEISS-Collaboration — Karlsruher Institut für Technologie, Institut für Kernphysik, Postfach 3640, 76021 Karlsruhe

EDELWEISS-II is a direct Dark Matter search experiment located in the underground laboratory, Laboratoire Souterrain de Modane (LSM, France). Recently, the collaboration has developed new cryogenic detectors with interleaved electrodes (ID design) for an improved background rejection (Phys. Lett. B681 (2009) 305). A continuous operation of ten of these bolometers at LSM together with an active muon veto shielding has been achieved. First results based on an effective exposure of 144 kg·d taken in 2009 have been published recently (arXiv:0912.0805). The acquired data correspond to an improvement in sensitivity of almost 20 compared to EDELWEISS-I. We present and discuss the latest bolometer data including the identification of muon-induced background events and special measurement of muon-induced neutrons in LSM.

This work is supported in part by the German Research Foundation (DFG) through its collaborative research center SFB-TR27 ("Neutrinos and Beyond") and by Agence Nationale pour la Recherche.

Gruppenbericht T 107.2 Mo 17:05 HG XI

Direct dark matter search with the XENON100 experiment — •Teresa Marrodán Undagoitia for the XENON100-Collaboration — Universität Zürich, Schweiz

During the last years, liquid noble gases have proven a great potential as detector medium for dark matter searches. Among them, xenon has the advantage of combining a high WIMP (Weakly Interacting Massive Particle) sensitivity with an excellent self-shielding capability for background reduction. A common technique, which has been demonstrated e.g. by the XENON10 experiment, is to employ a two-phase TPC (Time Projection Chamber), where the produced light and charge is detected by photomultiplier tubes.

XENON100 is a 65 kg active volume detector placed at the Gran Sasso underground laboratory in Italy. Currently (autumn 2009), the detector is being commissioned. Due to its low-radioactivity materials (designed for 10 mDRU) and its large mass, it would be able to reach a sensitivity for the WIMP-nucleon cross section of $2 \cdot 10^{-45}\,\mathrm{cm}^2$ at 100 GeV WIMP mass. In this talk, the status of the experiment will be reviewed.

This work is supported by the Alexander von Humboldt foundation.

T 107.3 Mo 17:25 HG XI

Studien des externen Untergrunds eines Flüssig-Xenon-Detektors auf Tonnenskala zum Nachweis von dunkler Materie — •Marijke Haffke für die XENON-Kollaboration — Universität Zürich, Schweiz

Als nächste Stufe des aktuellen Xenon100 Dunkle Materie Experimentes im Gran Sasso Labor ist ein Nachfolge-Experiment mit flüssigem Xenon auf Tonnenskala geplant. Favorisiert sind die Optionen Xenon1t im bestehenden Large Volume Detektor (LVD) zu betreiben oder eine Wasserabschirmung für das neue Experiment zu bauen. In diesem Vortrag werden Studien zum externen Untergrund für beide Möglichkeiten präsentiert.

Der Gammafluß im Kern des Large Volume Detektors und in den unterschiedlichen Hallen des Gran Sasso Untergrundlabors wurde mit Hilfe eines 3 inch NaI-Detektors gemessen. Der Neutronenfluß wurde an diesen Standorten mit einem 11 inch NaI-Detektor über inelastische Na-und I-Einfangreaktionen bestimmt. Die gemessenen Gamma- und Neutronenflüsse wurden für einen Dunkle Materie Detektor mit einer Tonne sensitiven flüssigen Xenons simuliert, um eine effektive Schildgeometrie zu entwerfen.

T 107.4 Mo 17:40 HG XI

A setup for measuring the reflectivity of cold Teflon in the VUV for the XENON project — Elena Aprile[1], Marcus Beck[2], Bin Choi[1], Karl Giboni[1], Volker Hannen[2], •Karen Hugenberg[2], Raphael Lang[1], and Christian Weinheimer[2] for the XENON-Collaboration — [1]Columbia University — [2]Institut für Kernphysik, WWU Münster

The XENON experiment is searching for dark matter by looking for the nuclear recoil signal induced by a WIMP in a 2 phase xenon time projection chamber (TPC). Interactions in the liquid phase will cause scintillation and ionization signals. The electrons are drifted from the liquid into the gaseous phase and accelerated there, causing fluorescence light. Both light signals are detected by photomultipliers. Their ratio and the 3-dimenstional position reconstruction allows to discriminate WIMPs from background (*e.g.* γs) from surrounding materials.

The active volume of the TPC is confined horizontally by a cylindrical wall of Teflon (PTFE). It holds the field shaping wires and should reflect the scintillation light towards the photomultipliers, thus optimizing the light yield. The reflection properties depend on surface conditions and temperature. To determine the specular and diffuse reflectivity at the scintillating wavelength of xenon in the VUV (178 nm) and at liquid xenon temperatures (165 K) a chamber was constructed in which the incident wavelength selected VUV light and the detector position relative to the sample surface can be fully varied.

T 107.5 Mo 17:55 HG XI

Suche nach Axionen galaktischen Ursprungs mit CAST — •Tillmann Guthörl, Horst Fischer, Jürgen Franz, Elisabeth Gruber, Kay Königsmann und Julia Vogel für die CAST-Kollaboration — Albert-Ludwigs-Universität Freiburg

Der Beitrag wurde abgesagt.

T 107.6 Mo 18:10 HG XI

Realisierung einer Neutronenquelle zur Kalibrierung von CRESST und EURECA — •Gerhard Deuter, Michael Bauer, Josef Jochum, Marcel Kimmerle, Klemens Rottler, Christof Sailer, Christian Strandhagen und Igor Usherov — Physikalisches Institut 1 - Subatomare Physik, Universität Tübingen

Tieftemperaturexperimente zur Suche nach Dunkler Materie können mit Neutronen kalibriert werden. Neutronenquellen wie 252Cf oder Radium-Beryllium-Präparate sind in Experimenten und Laboren mit geringer Untergrundstrahlung unerwünscht, aber bislang unumgänglich. In diesem Vortrag werden Konzept und die geplante Umsetzung einer pyroelektrischen Neutronenquelle auf Basis der D(D,n)3He-Fusionsreaktion vorgestellt. Die durch Heizen- bzw. Kühlen eines pyroelektischen Kristalls erzeugte Hochspannung reicht aus, um Deuterium aus der Gasphase zu ionisieren und auf deuteriertes Material zu beschleunigen. Diese kompakte Quelle soll ein-, ausschaltbar und portabel sein sowie einen für die Kalibrierung ausreichenden Neutronenfluss liefern.

T 107.7 Mo 18:25 HG XI

Application of the Neganov-Luke Effect for Scintillation-Light Detectors — •Christian Isaila[1], Christian Ciemniak[1], Chiara Coppi[1], Franz von Feilitzsch[1], Achim Gütlein[1], Tobias Lachenmaier[1], Jean-Côme Lanfranchi[1], Sebastian Pfister[1], Walter Potzel[1], Sabine Roth[1], Moritz von Sivers[1], Raimund Strauss[1], and Wolfgang Westphal[1,2] — [1]Technische Universität München, Physik-Department E15, James-Franck Str., 85748 Garching — [2]Deceased

For an active suppression of the background induced by electron recoils in the CRESST experiment both phonons and scintillation light generated in a CaWO4 crystal are detected simultaneously using detectors based on transition-edge sensors (TES). Taking into account that only a small fraction (about 1%) of the energy deposited in the crystal is detected as light, very sensitive light detectors are required for an efficient background discrimination. Following Neganov and Luke, the threshold of the light detectors can be improved by drifting the electron-hole pairs generated by the scintillation photons by an applied electric field. Thus, additional phonons are created leading to an amplification of the phonon signal. The application of the Neganov-Luke effect made it possible to improve the signal-to-noise ratio by a factor of 10 resulting in a 5-sigma energy threshold of about 10 eV. Results from measurements with Neganov-Luke amplification will be presented. This work has been supported by funds of the DFG (Transregio 27: Neutrinos and Beyond), the Excellence Cluster (Origin and Structure of the Universe) and the Maier-Leibnitz-Laboratorium (Garching).

T 107.8 Mo 18:40 HG XI

Czochralski growth of scintillating $CaWO_4$ crystals for cryo-

genic dark matter search and Monte-Carlo simulations for optimal crystal shape — •Moritz von Sivers, Christian Ciemniak, Chiara Coppi, Franz von Feilitzsch, Christian Isaila, Jean-Come Lanfranchi, Sebastian Pfister, Walter Potzel, Sabine Roth, and Raimund Strauss — Technische Universität München, Physik-Department, E15

To ensure the availability of inorganic scintillators that meet the requirements of cryogenic dark matter searches like the CRESST and future EURECA experiments, $CaWO_4$ crystals are being produced with a Czochralski furnace at the crystal laboratory of the Technische Universität München (TUM) in Garching. In this setup crystals of different shapes with a diameter up to $35mm$ and a length up to $150mm$ have been produced. An overview of the crystal-growth process and results of measurements of the crystals' light yield and radiopurity are presented. The high refractive index of $CaWO_4$ ($n \approx 1.93$) potentially leaves a large fraction of scintillation photons trapped inside the cylindrical crystals that are currently used in CRESST. The talk will give the results of a MC simulation based on GEANT4, to study the amount of trapped light and the effects of differently shaped crystals on the light collection in a CRESST-like detector module.

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

T 107.9 Mo 18:55 HG XI

Low-Temperature Setup for Quenching-Factor Measurements of $CaWO_4$ with Neutrons — Christian Ciemniak[1], •Chiara Coppi[1], Franz von Feilitzsch[1], Achim Gütlein[1], Christian Isaila[1], Jean-Côme Lanfranchi[1], Sebastian Pfister[1], Walter Potzel[1], Sabine Roth[1], Moritz von Sivers[1], Raimund Strauss[1], and Wolfgang Westphal[1,2] — [1]Technische Universität München, Physik-Department E15, James- Franck-Str. — [2]Deceased

CRESST is an experiment for the direct detection of dark matter (WIMPs) via nuclear recoil measurements on a CaWO4 crystal. Different quenching factors for the nuclei allow the discrimination between background and a possible signal. To measure the quenching factors at low temperatures, a neutron scattering facility has been set up at the Maier-Leibnitz-Laboratorium in Garching. In 2007 a cryostat was installed and first measurements were performed. For further optimization and to allow flight-time measurements at a fixed scattering angle, the complete data-acquisition hardware and software has been updated. We report on first results and ongoing upgrades.

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