T 31: Dunkle Materie II

Zeit: Montag 16:45–18:40 Raum: K.11.24 (HS 33)

Gruppenbericht T 31.1 Mo 16:45 K.11.24 (HS 33)

Operation of an InGrid based X-ray detector at the CAST experiment — •Christoph Krieger, Klaus Desch, Jochen Kaminski, and Michael Lupberger — Physikalisches Institut, Universität Bonn, Nußallee 12, 53115 Bonn

The CERN Axion Solar Telescope (CAST) is searching for axions and other new particles emerging from the Sun and coupling to photons. Those particles are converted into soft X-ray photons in a high magnetic field. To enhance sensitivity for physics beyond the Standard Model it is necessary to cope with weak couplings and low energies, thus requiring an efficient background discrimination as well as a detection threshold below 1 keV.

Both requirements are fulfilled by an X-ray detector based on the combination of a Micromegas gas amplification stage with a highly integrated pixel chip (InGrid) which allows to make full use of the Micromegas structure's granularity. The necessary precision in fabrication is achieved by the use of photolithographic postprocessing techniques. The high spatial resolution allows for a topological suppression of background events originating from cosmic rays as well as for the low detection threshold as single electrons can be detected.

After the detector's energy threshold was evaluated at an X-ray generator to be low enough to allow for the detection of the carbon K_α line at 277 eV, the detector was mounted at one of CAST's X-ray telescopes and installed along with the necessary infrastructure in 2014.

The data taken during the CAST run 2014 is being analysed. Background studies and rates will be presented as a first result.

Gruppenbericht T 31.2 Mo 17:05 K.11.24 (HS 33)

CRESST-II Phase 2 - First results and outlook — •Christian Strandhagen for the CRESST-Collaboration — Eberhard-Karls-Universität Tübingen, D-72076 Tübingen, Germany

The CRESST (Cryogenic Rare Event Search with Superconducting Thermometers) experiment, located in the Gran Sasso underground laboratory (LNGS) in Italy, aims at the direct detection of Dark Matter in the form of weakly interacting massive particles (WIMPs). The simultaneous measurement of phonons and scintillation light produced in cryogenic detectors consisting of $CaWO_4$ crystals is used to discriminate radioactive backgrounds from a possible WIMP signal. First results from the ongoing measurement campaign using a single upgraded detector module with a low threshold of $\approx$ 600 eV are presented. We discuss the prospects of the full dataset with a planned exposure of about 500 kg days. Finally the plans for a future upgrade will be outlined.

T 31.3 Mo 17:25 K.11.24 (HS 33)

Quenching Faktor Messungen mit dem CRESST/EURECA Neutronenstreuexperiment — •Stephan Wawoczny[1], Phillip Bauer[1], Cecilia Bruhn[1], Achim Gütlein[1], Raphael Jakoby[1], Raphael Kneissl[1], Jean-Côme Lanfrachi[1], Andrea Münster[1], Walter Potzel[1], Sabine Roth[1], Moritz v. Sivers[1], Raimund Strauss[2], Michael Willers[1], Marc Wüstrich[2] und Andreas Zöller[2] — [1]Physik Department E15, Technische Universität München, James-Franck-Str. 1, 85748 Garching — [2]Max-Planck-Institut für Physik, Föhringer Ring 6, 80805 München

Für Experimente zur Suche nach Dunkler Materie wie CRESST und das geplante Multitargetexperiment EURECA, die szintillierende Bolometer einsetzen, ist eine genaue Kenntnis der Quenching Faktoern (Abschwächung der Lichtausbeute relativ zu Elektronrückstößen) der verschiedenen Targetkerne essentiell. Mit dem Neutronenstreuexperiment am Maier-Leibnitz Laboratorium in Garching können Quenching Faktoren schwerer Kerne bei mK-Temperaturen gemessen werden. Dazu wird ein spezielles Kryodetektormodul mit monoenergetischen Neutronen (11 MeV, mit Beschleuniger erzeugt) bestrahlt. Es werden der experimentelle Aufbau und erste vielversprechende Ergebnisse präsentiert. Diese Arbeit wurde unterstützt von dem DFG Excellenzcluster Origin and Structure of the Universe, dem DFG Transregio 27: Neutrinos and Beyond, der Helmholtz Alliance for Astroparticle Phyiscs, dem Maier-Leibnitz-Laboratorium (Garching)und dem BMBF: Project 05A11WOC EURECA-XENON

T 31.4 Mo 17:40 K.11.24 (HS 33)

Pulse Shape Analysis in Cryogenic Detectors for Rare Event Search — •Ferdinand Hitzler for the CRESST-Collaboration — Physik Department E15, Technische Universität München, 85748 München

Based on an established pulse shape analysis with an Artificial Neural Network (ANN) we investigate new network designs. To study this an extended pulse simulation is necessary and will therefore be explained in this talk. Furthermore, we will introduce ideas to increase the overall performance of the nets. First results concerning the cut efficiency and the purity of the signal with these new ANNs will be shown. This research was supported by the DFG cluster of excellence Origin and Structure of the Universe, by the Maier-Leibnitz-Laboratorium (Garching), by the BMBF: Project 05A11WOC EURECA-XENON.

T 31.5 Mo 17:55 K.11.24 (HS 33)

Artificial Neural Network Based Pulse Shape Analysis in Cryogenic Detectors for Rare Event Searches — •Andreas Zöller for the CRESST-Collaboration — Physik Department E15, Technische Universität München, 85748 Garching

We present a method based on an Artificial Neural Network for a pulse shape analysis in cryogenic detectors. To train the neural network a huge amount of pulses with known properties are necessary. Therefore, a data-driven simulation used to generate these sets will be explained. Furthermore, these simulations allow detailed studies, especially of the cut efficiency and the signal purity of the developed cut. First results will be presented and compared with the performance of alternative algorithms. This research was supported by the DFG cluster of excellence Origin and Structure of the Universe, by the Maier-Leibnitz-Laboratorium (Garching), by the BMBF: Project 05A11WOC EURECA-XENON.

T 31.6 Mo 18:10 K.11.24 (HS 33)

Radiopurity of $CaWO_4$ Crystals for Direct Dark Matter Search with CRESST and EURECA — •Andrea Münster for the CRESST-Collaboration — Physik Department E15, Technische Universität München, 85748 Garching

The direct dark matter search experiment CRESST uses scintillating $CaWO_4$ single crystals as targets for possible WIMP recoils. A particle interaction in the crystal produces phonons as well as scintillation light. As the light signal is dependent on the kind of interacting particle, e^--recoils and α-decays mainly originating from intrinsic impurities of the crystal can be discriminated from nuclear recoils (e.g. due to possible WIMP scatterings). To achieve the best possible discrimination a high light output and a high radiopurity of the crystals are crucial. Since 2011 $CaWO_4$ crystals are grown in the crystal lab of TU Munich. In this way we can directly influence the growth parameters and find a method to improve light output and radiopurity which is required by CRESST and the future tonne-scale multi-material experiment EURECA. In this talk we will discuss the investigated radiopurity of the raw materials WO_3 and $CaCO_3$ as well as of TUM-grown crystals which are currently taking data in CRESST II Phase 2. This research was supported by the DFG cluster of excellence 'Origin and Structure of the Universe', by the Maier-Leibnitz-Laboratorium (Garching), by the BMBF: Project 05A11WOC EURECA-XENON, by the Spanish Ministerio de Economía y Competitividad and the European Regional Development Fund (MINECO-FEDER), and by the Consolider-Ingenio 2010 Programme under grant MULTIDARK CSD2009-00064.

T 31.7 Mo 18:25 K.11.24 (HS 33)

Scintillator Non-Proportionality in $CaWO_4$ Crystals — •Cecilia Bruhn, Philipp Bauer, Ferdinand Hitzler, Raphael Jakoby, Raphael Jakoby, Jean-Côme Lanfranchi, Alexander Langenkämper, Andrea Münster, Walter Potzel, Sabine Roth, Stefan Schönert, Stephan Wawoczny, Michael Willers, and Andreas Zöller for the CRESST-Collaboration — Physik-Department E15, Technische Universität München, 85748 Garching

CRESST-II is a direct dark matter search experiment whose goal is to find elastic WIMP-nucleus scatterings. It utilizes scintillating $CaWO_4$ crystals as target material, which are produced at the TUM. A particle interaction in the crystal produces phonons and scintillating light. The light output depends on the type of interacting particle, thus enabling a discrimination between electron recoils, which are due to background, and nuclear recoils, which could be a possible WIMP signal. For energies under 100 keV the amount of scintillating light produced is not proportional to the energy deposited. This is the scintillator non-proportionality, which can cause problems when distinguishing electron recoils from nuclear recoils. In this talk we will discuss an experimental setup for measuring the crystal dependency of the scintillator non-proportionality. This research was supported by the DFG cluster of excellence *Origin and Structure of the Universe*, by the Maier-Leibnitz-Laboratorium (Garching), by the BMBF: Project 05A11WOC EURECA-XENON, and by the Consolider-Ingenio 2010 Programme under grant MULTIDARK CSD2009-00064.