T 86: Niederenergie-Neutrinophysik und Suche nach Dunkler Materie I

Zeit: Montag 16:45–18:50 Raum: KGII-HS 2004

Gruppenbericht T 86.1 Mo 16:45 KGII-HS 2004

The CRESST experiment: recent results and perspectives — •Federica Petricca for the CRESST-Collaboration — Max-Planck-Institut für Physik, Föhringer Ring 6, 80805 München, Germany

CRESST is a WIMP dark matter search where combined phonon and light signals from scintillating CaWO4 cryogenic detectors are used for active background suppression. During the last years the CRESST setup has been upgraded with a neutron shield, a 66 channel SQUID system, new wiring, new heater and bias electronics, a muon veto and a new DAQ. First results obtained after this major upgrade are presented.

T 86.2 Mo 17:05 KGII-HS 2004

Simulation of the Neutron Background for the CRESST Experiment — •Stephan Scholl, Michael Bauer, Klemens Rottler, Gerhard Deuter, Tobias Lachenmaier, and Josef Jochum — Physikalisches Institut I, Eberhard–Karls–Universität Tübingen

Neutrons present a crucial background in every direct detection dark matter experiment since their signature in a detector cannot be discriminated against a possible WIMP signature. Several possible origins for background neutrons are known; in the scope of this work, we neglect the cosogenic neutrons produced by muons and focus on neutrons from the ambient radioactivity and from internal radio–impurities. Using a GEANT4 code with a improved neutron interaction code, we run simulations of the CRESST setup to obtain quantitative and qualitative information about the expected background seen in the detector modules. The results of these simulations regarding the expected background events in the detectors from the various sources of neutrons will be presented and discussed.

This work is supported by funds of the DFG (Transregio 27: Neutrions and Beyond).

T 86.3 Mo 17:20 KGII-HS 2004

New Results from the CDMS-II experiment — •Tobias Bruch for the CDMS-Collaboration — University of Zurich, Switzerland

The Cryogenic Dark Matter Search experiment (CDMS-II) operates Ge and Si detectors at cryogenic temperatures, to detect non-luminos, non-baryonic Weakly Interacting Massive Particles (WIMPs), that could form the majority of the matter in the Universe, via their elastic scattering off nuclei. The CDMS-II experiment currently runs 5 Towers (30 detectors) with a total mass of 4.75 kg (1.1 kg) Ge (Si), at the Soudan Underground Laboratory. By analyzing the phonon and ionization signal of an interaction in the crystals, the CDMS-II experiment achieved a background free signal window. CDMS-II has been in WIMP search data taking mode from October 2006 to July 2007 accumulating 650 kg days of raw exposure in Ge. The analysis of this data, using new analysis parameters and techniques, result in an increased sensitivity on the WIMP-nucleus scattering cross section with respect to the 90% CL limit of 1.6e-43 cm^2 at a WIMP mass of 60 GeV achieved in earlier runs. We will pesent the latest results along with the implications for theoretical WIMP models.

T 86.4 Mo 17:35 KGII-HS 2004

CDMS-II Backgrounds — •Tobias Bruch for the CDMS-Collaboration — University of Zurich, Switzerland

The Cryogenic Dark Matter Search experiment (CDMS-II) searches for non-luminos, non-baryonic Weakly Interacting Massive Particles (WIMPs), that could form the majority of the matter in the Universe. The CDMS-II experiment operates Ge and Si detectors at cryogenic temperatures, to detect WIMPs via their elastic scattering off nuclei. The kinetic energy imparted to a nucleus in an elastic WIMP-nucleon scatter would range from a few keV to tens of keV. The small recoil energy coupled to an expected low event rate, requires an effective background suppression. Active and passive shielding are used to reduce backgrounds produced outside of the experimental apparatus, leaving decays of radioactive contaminations inside the shielding as the dominant natural radioactivity background. We will present a background model based on new Monte Carlo simulations, which can explain the observed background spectra in the CDMS detectors.

T 86.5 Mo 17:50 KGII-HS 2004

Thermal Detector Model for Cryogenic Composite Detectors for the Dark Matter Experiments CRESST and EURECA — •Sabine Roth, Christian Ciemniak, Chiara Coppi, Franz von Feilitzsch, Achim Gütlein, Christian Isaila, Jean-Côme Lanfranchi, Sebastian Pfister, Walter Potzel, and Wolfgang Westphal — Physik-Department E15, Technische Universität München, James-Franck-Straße, D-85748 Garching

Weakly Interacting Massive Particles (WIMPs) are candidates for non-baryonic cold Dark Matter. The Dark Matter experiments CRESST (Cryogenic Rare Event Search with Superconducting Thermometers) and the EURECA (European Underground Rare Event Calorimeter Array) project are aimed at the direct detection of WIMPs with modularised cryogenic detectors. To decouple the transition edge sensor production from the choice of the target material and to avoid heating cycles of the absorber crystal, a composite detector design is developed and studied. On the basis of an existing thermal detector model for cryogenic detectors, an extension to this model has been developed. This extended model can be expected to provide an enormous help when tailoring composite detectors to the requirements of various experiments.

This work has been supported by funds of the DFG (SFB 375, Transregio 27: "Neutrinos and Beyond"), the Munich Excellence Cluster Universe, the EU networks for Cryogenic Detectors (ERB-FMRXCT980167) and for Applied Cryogenic Detectors (HPRN-CT2002-00322), and the Maier-Leibnitz-Laboratorium (Garching).

T 86.6 Mo 18:05 KGII-HS 2004

Material Screening Measurements of XENON100 Detector with GATOR Set-up at LNGS — •Ali Askin for the XENON-Collaboration — Physik Institut Universitaet Zurich

The main goal of the XENON dark matter search is to detect Weakly Interacting Massive Particles (WIMPs), which are compelling particle dark matter candidates,via their elastic scattering on Xe nuclei. Since dark matter events are expected to be very rare, one of the most important points in these challenging searches is to suppress the limiting background as much as possible. As a proof of principle, the XENON10 detector has been constructed and operated succesfully at the Laboratori Nazionali del Gran Sasso (LNGS) deep underground facilities. In the second phase of the experiment (XENON100), it is aimed to increase the sensitivity of the experiment by increasing the detector mass and at the same time decreasing of the residual background by the careful selection of the construction materials. In order to study the background emitted from the detector materials, a high purity germanium spectrometer(HPGe), named GATOR, has been installed at LNGS in 2007. Screening of different XENON100 materials and their monte carlo simulations are currently proceeding. Comparison of data obtained from simulations for each different material to the data obtained from GATOR, give us the opportunity to understand the radioactivity of the materials in terms of their 238-U, 232-Th, 40- K, 60-Co and 137-Cs contamination, and thus to predict the background expected for the XENON100 experiment.

T 86.7 Mo 18:20 KGII-HS 2004

Background predictions for the Xenon100 Experiment at the Gran Sasso Underground Laboratory — •Alexander Kish for the XENON-Collaboration — Physik-Institut UZH, Schweiz

The Xenon10 experiment has achieved the world's most stringent limits on spin-independent WIMP-nucleon cross sections after six months of stable underground operation. A substantial increase in sensitivity requires a larger sensitive mass coupled to a strong decrease in background. Xenon100, which is currently under construction, will operate a total mass of 150 kg of liquid Xenon, viewed by 250 PMTs, in the XENON10 shield starting in spring 2008. One of the new features is an active liquid Xenon layer around the target volume, which, along with a strong selection of detector and shield materials, and the removal of electrical feed-throughs and the cooling system from the vicinity of the detector, will allow a reduction in the expected background by about two orders of magnitude. Here we will present background predictions from both gamma- and neutron-induced events, based on Geant4 Monte Carlo simulations of the detailed XENON100 detector geometry.

T 86.8 Mo 18:35 KGII-HS 2004

Backgrounds of the XENON10 Experiment at the Gran Sasso Underground Laboratory — •Marijke Haffke for the XENON-Collaboration — Universität Zürich

The XENON10 Experiment is designed for direct detection of dark matter particles via their elastic scattering of Xe nuclei. It was deployed in Gran Sasso Underground Laboratory in spring 2006 and took data until November 2007.

One of the best motivated candidates for cold dark matter are WIMPs. To detect these weakly interacting particles it is crucial to reduce, and to identify the origin of all the background components.

The XENON10 detector is shielded by 33 tonnes of Pb and 1.5 tonnes of polyethylene, which sufficiently reduce the external background from natural radioactivity. The primary sources of the internal gamma background are U, Th, K, Cs and Co decays in the detector materials. The sources of the internal neutron background are (alpha,n) and fission reactions in the detector and shield materials.

We will present a complete background model based on Monte Carlo simulations of the detailed XENON10 geometry, and compare with data obtained during the WIMP search runs.