T 104: Search for Dark Matter 5

Time: Thursday 16:15–18:05 Location: T-H36

Group Report T 104.1 Thu 16:15 T-H36

Status of the COSINUS Experiment at Gran Sasso — •Martin Stahlberg for the COSINUS-Collaboration — Max-Planck-Institut für Physik, 80805 München

The upcoming COSINUS experiment aims at clarifying the origin of the modulation signal reported by the DAMA-LIBRA collaboration since many years, which is in strong contrast to null-results from other direct dark matter search experiments. Construction of the COSINUS facility has started at Laboratori Nazionali del Gran Sasso (LNGS) in 2021, and first results are expected in 2024. COSINUS cryogenic NaI calorimeters will feature two-channel readout of heat and scintillation signal, and recoil energy thresholds of only few keV. We will give an overview on the status of the experimental setup, as well as outlook on the physics reach, and present first results from remoTES prototype detector measurements.

T 104.2 Thu 16:35 T-H36

remoTES sensors: Development of a novel detector design for NaI cryogenic calorimeters for the COSINUS dark matter experiment — •Mukund Bharadwaj for the COSINUS-Collaboration — Max Planck Institute for Physics, Fohringer Ring 6, Munich, Germany - 80805

The COSINUS experiment is an upcoming low-threshold, cryogenic experiment being setup at the Laboratori Nazionali Del Gran Sasso, Italy. It aims to provide a model independent cross-check of the DAMA/LIBRA claim of a potential dark-matter like modulating signal, the result of which is contrary to data reported by other direct dark matter experiments over the past few decades.

COSINUS utilizes a dual-channel readout system based on transition edge sensors(TESs) that allows for particle discrimination. It consists of ultra-pure scintillating sodium iodide (NaI) crystals enclosed by a silicon detector which function as the phonon and light channels respectively. The physical and chemical properties of NaI prevent the direct deposition of a TES on it's surface. In order to overcome this, a new prototype detector design dubbed **remoTES** has been developed. It utilizes a gold pad coupled to the absorber crystal as the primary interface to transmit the phonon signal to the TES, which is fabricated on a separate wafer substrate. The first preliminary results from above ground R&D measurements are reported in this talk.

T 104.3 Thu 16:50 T-H36

Operation of low threshold cryogenic calorimeters in a dry dilution refrigerator in the COSINUS experiment — •Moritz Kellermann, Karl-Heinz Ackermann, Henrik Ansorge, Mukund Bharadwaj, Torsten Frank, Karoline Schäffner, Robert Stadler, Martin Stahlberg, and Vanessa Zema — Max-Planck-Institut für Physik, Föhringer Ring 6, 80805 München

For 25 years the DAMA/LIBRA dark matter search measures an annually modulated signal, using sodium iodide (NaI)-scintillators at room temperature. The COSINUS experiment aims to give a model-independent cross-check of the DAMA/LIBRA results by operating pure NaI absorber crystals as cryogenic scintillating calorimeters at mK-temperatures.

COSINUS will be among the first experiments to operate low-threshold calorimeters in a dry dilution refrigerator, being sensitive to temperature changes on a micro-Kelvin level. A pulse tube cooler will be used to arrive at 3K, trading simplified handling for an increased mechanical vibration noise level in the acoustic frequency range. In order to maintain the thermal stability to operate low-threshold calorimeters, it will be necessary to decouple the detectors from possible noise sources. For COSINUS, a spring-based passive decoupling system is planned and tested using piezo-based accelerometers at room temperature. This talk will focus on the design and test results of the in-house developed decoupling system.

T 104.4 Thu 17:05 T-H36

Direct dark matter search with CRESST-III experiment — •Lucia Canonica for the CRESST-Collaboration — Max-Planck-Institut für Physik, D-80805 München, Germany

CRESST (Cryogenic Rare Event Search with Superconducting Thermometers) is a direct dark matter search experiment located at the Gran Sasso Underground Laboratory (Italy) that uses scintillating cryogenic calorimeters as a target material for elastic DM-nucleus scattering.

The current phase of the experiment, CRESST-III, is optimized for low-energy nuclear recoil detection. It has reached an unprecedented value of 30 eV for nuclear recoil energy thresholds on a $CaWO_4$ target, allowing the exploration of low-mass dark matter candidates down to 0.16 GeV/c^2. At higher masses the sensitivity is currently limited by a rising event rate (from threshold up to few hundreds of eV) from a so-far unknown origin.

Currently dedicated measurements with upgraded detectors (including different target materials) are being performed at the Gran Sasso Underground Laboratory, with the goal of investigating and identifying the origin of the event excess.

In this contribution, the current stage of the CRESST-III experiment, together with the most recent dark matter results, will be presented.

T 104.5 Thu 17:20 T-H36

Development of a Cryogenic Alpha Screening Facility at TUM — •Angelina Kinast[1], Andreas Erb[1,2], Andreas Erhart[1], Fiona Hamilton[1], Margarita Kaznacheeva[1], Alexander Langenkämper[1], Tobias Ortmann[1], Luca Pattavina[1,3], Walter Potzel[1], Johannes Rothe[1], Nicole Schermer[1], Stefan Schönert[1], Raimund Strauss[1], Victoria Wagner[1], and Alexander Wex[1] — [1]Physik-Department E15, Technische Universität München, D-85748 Garching, Germany — [2]Walther-Meißner-Institut für Tieftemperaturforschung, D-85748 Garching, Germany — [3]INFN, Laboratori Nazionali del Gran Sasso, I-67100 Assergi, Italy

A precise measurement of the radio-purity levels of the $CaWO_4$ crystals used for Dark Matter search with the CRESST experiment and CEvNS measurements with the NUCLEUS experiment is fundamental for a better background understanding. The sensitivity of HPGe detectors is not sufficient to measure the excellent radio-purity levels of the $CaWO_4$ crystals produced in-house at the Technische Universität München (TUM). I report on a cryogenic alpha-screening facility developed at TUM, which is currently being commissioned, and will provide a method to determine the radiopurity of our $CaWO_4$ crystals by measuring the alpha-decays with high precision in the unique experimental environment of the shallow underground laboratory (UGL) at TUM. The research was supported by the DFG through the Excellence Cluster ORIGINS, the SFB1258 and the BMBF: 05A17WO4 and 05A17VTA.

T 104.6 Thu 17:35 T-H36

Development of a new generation of beaker modules for CRESST — •Fiona Hamilton[1], Gode Angloher[2], Antonio Bento[2], Anna Bertolini[2], Lucia Canonica[2], Nahuel Ferreiro[2], Dominik Fuchs[2], Abhijit Garai[2], Dieter Hauff[1,2,3], Margarita Kaznacheeva[1], Angelina Kinast[1], Alexander Langenkämper[1], Michele Mancuso[2], Athoy Nilima[2], Tobias Ortmann[1], Luca Pattavina[1], Federica Petricca[2], Walter Potzel[1], Franz Pröbst[2], Francesca Pucci[2], Johannes Rothe[1], Karoline Schaeffner[2], Stefan Schönert[1], Martin Stahlberg[2], Leo Stodolsky[2], Raimund Strauss[1], and Vanessa Zema[2] — [1]Technische Universität München, Physik Department Lehrstuhl E15, James-Franck-Straße 1, D-85748 Garching — [2]Max-Planck-Institut für Physik, Föhringer Ring 6, D-80805 München — [3]Universität Tübingen, Physikalisches Institut, Auf der Morgen- stelle 14, D-72076 Tübingen

The CRESST experiment is leading the direct search for nuclear recoils induced by light dark matter. The CRESST "beaker modules", using a silicon beaker as a light detector, provide a complete surface anticoincidence veto. For the next generation of beaker modules, the target and beaker sizes were scaled down in order to further improve energy resolution, allowing background suppression down to energy thresholds below 100 eV. A status update on the research and development of the new generation of beaker modules at TUM is presented. The research was supported by the DFG through the Excellence Cluster ORIGINS and the SFB1258, and the BMBF: 05A17WO4 and 05A17VTA.

T 104.7 Thu 17:50 T-H36

Investigation of Production Techniques for Sputtered Tung-

sten Thin Films — •Tobias Ortmann[1], Andreas Erhart[1], Margarita Kaznacheeva[1], Angelina Kinast[1], Alexander Langenkämper[1], Luca Pattavina[1], Walter Potzel[1], Johann Riesch[2], Johannes Rothe[1], Nicole Schermer[1], Stefan Schönert[1], Raimund Strauss[1], Victoria Wagner[1], and Alexander Wex[1] — [1]Technische Universität München, Physik Department Lehrstuhl E15, James-Franck-Straße 1, D-85748 Garching — [2]Max-Planck-Institut für Plasmaphysik, Boltzmannstraße 2, D-85748 Garching bei München

Cryogenic rare event searches like the CRESST and the NUCLEUS experiments use TES (Transition Edge Sensors) as phonon sensors to read out their target crystals. This type of sensors utilizes the superconducting phase transition of tungsten to measure the energy deposited in the absorbers. The most established method of production for these films is electron beam physical vapor deposition. For future large scale production the application of argon DC-magnetron sputtering is investigated in terms of film quality and reproducibility. The most recent results of these investigations are presented. The research was supported by the DFG through the Excellence Cluster ORIGINS and the SFB1258, and the BMBF: 05A17WO4 and 05A17VTA.