T 23: Dark Matter I

Time: Tuesday 17:00–18:40 Location: H-HS I

Group Report T 23.1 Tue 17:00 H-HS I

The XENONnT Dark Matter Search Experiment — •Sebastian Lindemann for the XENON-Collaboration — University of Freiburg, Germany

XENON1T, the largest and most sensitive dark matter direct detection experiment, has set the most stringent upper limit on the spin-independent WIMP-nucleon cross section, with a minimum of 4.1×10^{-47} cm^2 for a 30 GeV/c^2 WIMP. The next step in the XENON program, XENONnT, is now under construction at LNGS. With this upgrade, the XENON collaboration aims to probe spin-independent WIMP-nucleon cross sections as low as 2×10^{-48} cm^2 with a 20 tonne-year exposure. This talk gives an overview of the experiments and presents the latest results.

T 23.2 Tue 17:20 H-HS I

Neutron background simulations for the DARWIN experiment — •Julia Dierle — Albert-Ludwigs-Universität Freiburg

The DARWIN (DARk matter WImp search with liquid xenoN) detector, a liquid xenon time projection chamber with a 40t target, will probe any signal from dark matter WIMPs above the irreducible neutrino floor for masses $> 5\,\text{GeV/c}^2$. Detailed background simulations are required to estimate DARWIN's sensitivity to WIMPs and other rare events. The investigation of nuclear recoil background events is particularly important since WIMPs are also expected to scatter elastically off xenon nuclei. We report on recent results on the simulations of radiogenic neutrons which are produced in (α,n) and spontaneous fission processes in the detector materials.

T 23.3 Tue 17:35 H-HS I

Update of XENONnT's Gd-loaded water Cherenkov neutron veto — •Daniel Wenz for the XENON-Collaboration — Institut für Physik & Exzellenzcluster PRISMA, J. Gutenberg-Universität Mainz, 55099 Mainz, Germany

In 2018 the XENON1T experiment set the most stringent limits for the WIMP-Nucleon coupling for masses above 6 GeV/c2 utilizing a liquid xenon time projection chamber. Following this success a new and larger liquid xenon time projection chamber called XENONnT is currently constructed at the Laboratori Nazionali del Gran Sasso in Italy. Its sensitivity will be increased by more than an order of magnitude.

To achieve this ambitious goal the detector intrinsic neutron background must be reduced as well. Neutrons are capable to mimic WIMP signal by performing single scatter interactions and escaping the detectors volume. To counter this, XENONnT will be equipped with a new neutron veto that is based on a gadolinium-loaded water Cherenkov detector with a neutron tagging efficiency up to 84 %.

In this talk we present the current status of the neutron veto including the Gd-procurement and the measurement of the Gd-loaded water transparency, as well as discussing novel techniques for the calibration of the neutron-tagging efficiency and background discrimination strategies.

T 23.4 Tue 17:50 H-HS I

Study of muon-induced neutron signatures for DARWIN observatory — •Jose Cuenca Garcia — Karlsruher Institut für Technologie, Karlsruhe, Deutschland, DARWIN collaboration

The goal of the DARWIN observatory is to become the most powerful dark matter detector using liquid Xenon as a target inside a sensitive time projection chamber (TPC). Although DM search experiments are underground, many background sources have to be understood and controlled. We present here some Geant4 simulations of a more detailed muon flux and how the interaction of the muons with the components of the detector can contribute to the background of the DM search.

Group Report T 23.5 Tue 18:05 H-HS I

Low-mass Dark Matter Search with CRESST-III — •Margarita Kaznacheeva for the CRESST-Collaboration — Physik-Department E15, Technische Universität München, D-85747 Garching, Germany

The CRESST-III (Cryogenic Rare Event Search with Superconducting Thermometers) experiment is dedicated to one of the most exciting open questions in modern astroparticle physics - revealing the nature of dark matter (DM). It uses scintillating single crystals operated as cryogenic calorimeters at mK temperatures and is equipped with transition-edge-sensors. In order to achieve the required ultra-low backgrounds, the detectors are surrounded by layers of radiopure shielding materials and installed at the deep underground facility of the Laboratori Nazionali del Gran Sasso. The light produced by particle interactions in scintillating crystals is measured by a separate cryogenic light detector, which enables particle discrimination between nuclear recoils (signal) and electron recoils (dominant background) on an event-by-event basis. With a new generation of CRESST detectors an ultra-low energy threshold of 30 eV has been achieved, which makes CRESST the leading experiment in sub-GeV DM searches. In this talk, I will give an overview of the experiment and present the latest DM data, which improved the sensitivity to spin-independent DM scattering down to masses of 160 MeV. Moreover, I will give an update on recent R&D efforts and conclude with the future perspectives of CRESST.

T 23.6 Tue 18:25 H-HS I

Super Cryogenic Dark Matter Search at SNOLAB — •Alexander Zaytsev for the SuperCDMS-Collaboration — Universität Hamburg, Hamburg, Germany

Convincing astrophysical observations point to the abundant existence of dark matter in the Universe. Many experiments have been using different techniques to detect dark matter directly. However, despite their efforts, dark matter particles remain to be observed to this day. The Super Cryogenic Dark Matter Search experiment (SuperCDMS) is making use of the low-background environment at the SNOLAB underground laboratory (Canada) to detect dark matter interactions with silicon and germanium crystal detectors operated at temperatures as low as 15 mK. The most popular particle dark matter candidates include Weakly Interacting Massive Particles (WIMPs) which recoil from crystal nuclei, producing a phonon signal in the detector. Moreover, the SuperCDMS experiment is capable of detecting electron recoil signals, which could be induced, for example, by Light Dark Matter, dark photons and Axion-Like Particles. SuperCDMS uses two types of detectors: iZIP detectors which measure both phonon and ionization signals and provide electron and nuclear recoil discrimination, and HV detectors which provide an extremely low energy threshold due to a very strong amplification of the ionization signal. The purpose of this talk is to provide an overview of the SuperCDMS experiment, discuss the detection mechanisms and the projected sensitivity to different dark matter channels.