UCLA Dark Matter 2018

Report of Contributions

https://indico.cern.ch/e/653314

Contribution ID: **5** Type: **Talk**

James Bullock (UCI): Structure formation simulations

Wednesday, 21 February 2018 08:00 (30 minutes)

Presenter: Prof. BULLOCK, James (UCI)

Session Classification: Session 1

Contribution ID: **6** Type: **Talk**

Edward Wright (UCLA): Cosmic Backgrounds

Wednesday, 21 February 2018 08:30 (30 minutes)

The Cosmic Microwave Background has been our most profilic source of precision cosmology data. The monopole spectrum of the CMB is the dominant radiation field at 1 mm at 1 AU from the Sun. The anisotropy of the CMB is 10,000 times smaller, but still easily measurable over the galactic foreground. But the polarization anisotropy of the CMB is another order of magnitude smaller, and the B-mode polarization is one or more orders of magnitude smaller still. Controlling the dust foreground to this level will be very challenging. At shorter wavelengths the Cosmic Infrared Background contains the integrated luminous history of the Universe, but controlling the solar system dust foreground is another challenge.

Presenter: Prof. WRIGHT, Edward (UCLA)

Session Classification: Session 1

Contribution ID: **7** Type: **Talk**

Tommaso Treu (UCLA): Probing dark matter with strong gravitational lensing

Wednesday, 21 February 2018 09:30 (30 minutes)

Strong gravitational lensing is a powerful and unique probe of the nature of dark matter. Relying only on dark matter's gravitational interaction, strong lensing can test dark matter models that range from primordial black holes to warm, cold, and self-interacting. After a brief introduction to strong lensing as a probe of dark matter I will review some of the most exciting recent results and discuss future prospects.

Presenter: Prof. TREU, Tommaso (UCLA)

Session Classification: Session 1

Contribution ID: **8** Type: **Talk**

Elisabeth Krause (Caltech): Dark energy

Wednesday, 21 February 2018 09:00 (30 minutes)

The accelerated expansion of the Universe is the most surprising cosmological discovery in decades. It has inspired a new generation ambitious surveys to determine the fundamental nature of this acceleration. This talk will introduce the different measurement techniques used by these surveys, and describe the landscape of current and near future cosmological sky surveys. This talk will highlight recent cosmology constraints from a combined analysis of galaxy clustering and weak gravitational lensing from the first year of the Dark Energy Survey. The analysis combines (i) the cosmic shear correlation function of 26 million source galaxies in four redshift bins, (ii) the galaxy angular autocorrelation function of 650,000 luminous red galaxies in five redshift bins, and (iii) the galaxy-shear cross-correlation of luminous red galaxy positions and source galaxy shears. These three measurements yield consistent cosmological results, and provide constraints on the amplitude of density fluctuations and dark energy equation of state that are competitive with those from cosmic microwave background measurements.

Presenter: Dr KRAUSE, Elisabeth (Caltech)

Session Classification: Session 1

Contribution ID: **9** Type: **Talk**

Simona Murgia (UCI): Dark Matter indirect detection with gamma rays.

Wednesday, 21 February 2018 10:30 (30 minutes)

Presenter: MURGIA, Simona (University of California, Irvine)

Session Classification: Session 2

Contribution ID: **10** Type: **Talk**

Carsten Rott (Sungkyunkwan University (SKKU), Korea): Indirect Searches for Dark Matter with Neutrinos

Wednesday, 21 February 2018 11:00 (30 minutes)

Dark Matter could be detected indirectly through the observation of neutrinos produced in self-annihilations or decays. Searches for such neutrino signals have resulted in some of the most stringent constraints on the lifetime of heavy dark matter and world best limits on spin-dependent scattering with matter. Searches have made significant progress in sensitivity through new search methodologies, detection channels, and through the availability of rich datasets, foremost from the IceCube Neutrino Telescope. In this talk, I will review latest results from dark matter searches with neutrinos and discuss discovery prospects at present and next-generation detectors. A particular focus will be put on the search for dark matter in the Sun and how a dark matter annihilation signal.

Presenter: ROTT, Carsten (Sungkyunkwan University)

Session Classification: Session 2

Contribution ID: **11** Type: **Talk**

James Buckley (Washington U in St Louis): Search for dark matter with ACT's

Wednesday, 21 February 2018 11:30 (30 minutes)

Annihilation of WIMPs into gamma-rays could provide an observable signal in future ground-based gamma-ray experiments like CTA over most of the natural parameter space for a thermal relic. High energy gamma-ray observations provide key constraints on WIMP DM, and together with complimentary direct detection and collider-based searches comprise a comprehensive program for
either confirming or ruling out the thermal WIMP hypothesis. In the event of a detection of WIMPs, the universal gamma-ray spectrum could determine the mass of the DM particle and provide particle identification through the imprint of
various annihilation channels on the detailed spectrum. Together with astrophysical measurements of galactic dynamics, gamma-ray measurements could go beyond detecting dark matter in the laboratory to determining the detailed distribution of dark matter in galactic halos and the role of DM in structure formation. Current searches with imaging atmospheric Cherenkov telescopes like
VERITAS, MAGIC and HESS already provide important constraints on high mass WIMPs, complementing Fermi constraints on lower mass models. CTA observations of the Galactic Center could constrain most of the remaining
natural parameter space for WIMP DM. Ground-based gamma-ray measurements can also provide constraints on non-WIMP dark matter including Axion-Like-Particles
(ALPs), where the oscillations between photons (in an astrophysical plasma) and Axions can result in a lower apparent attenuation of gamma-rays, evading pair
creation off of the extragalactic background light or high magnetic fields. Effectively, TeV gamma-ray measurements of AGNs, GRBs, or Pulsars can provide
the astrophysical equivalent of light-through-wall experiments. I will summarize results on DM searches from the current generation of IACTs, expected results for CTA or a larger ground-based instrument and the prospects for future space-based experiments.

Presenter: BUCKLEY, James (Washington U. Saint Louis)

Session Classification: Session 2

Contribution ID: **12** Type: **Talk**

Christoph Weniger (GRAPPA, Amsterdam): Indirect dark matter searches with charged cosmic rays and sub-GeV photons

Wednesday, 21 February 2018 12:00 (30 minutes)

Presenter: WENIGER, Christoph (University of Amsterdam)

Session Classification: Session 2

Contribution ID: **13** Type: **Talk**

Tim Tait (UCI): Dark Messages from Accelerators

Wednesday, 21 February 2018 16:00 (30 minutes)

I will review the current status of searches for dark matter at the Large Hadron Collider, with particular attention to the interplay with other kinds of searches and the theoretical constructions used to interpret them.

Presenter: TAIT, Tim M.P. (University of California, Irvine)

Session Classification: Session 4

Contribution ID: **14** Type: **Talk**

Bernard Sadoulet (UC Berkeley): Direct detection without noble gases and the low mass dark matter search frontier

Wednesday, 21 February 2018 14:00 (30 minutes)

Presenter: SADOULET, Bernard (University of California, Berkeley)

Session Classification: Session 3

Contribution ID: **15** Type: **Talk**

Cristiano Galbiati (Princeton): Direct dark matter detection with noble gases

Wednesday, 21 February 2018 14:30 (30 minutes)

Presenter: GALBIATI, Cristiano (Princeton University)

Session Classification: Session 3

Contribution ID: **16** Type: **Talk**

Elena Aprile (Columbia): The XENON Dark Matter Search Program: Status and Prospects

Wednesday, 21 February 2018 15:00 (30 minutes)

Presenter: APRILE, Elena (Columbia)

Session Classification: Session 3

Contribution ID: **17** Type: **Talk**

Kalliopi Petraki (Nikhef/LPTHE, Paris): Dark matter particle candidates

Wednesday, 21 February 2018 16:30 (30 minutes)

Presenter: PETRAKI, Kalliopi (University of Melbourne)

Session Classification: Session 4

Contribution ID: **18** Type: **Talk**

Anne Green (Nottingham): Primordial Black Holes as dark matter

Wednesday, 21 February 2018 17:00 (30 minutes)

Presenter: GREEN, Anne

Session Classification: Session 4

Contribution ID: **19** Type: **Talk**

Tien-Tien Yu (CERN): New Ideas for sub-GeV Dark Matter Direct Detection

Wednesday, 21 February 2018 13:30 (30 minutes)

The lack of any unambiguous signature of traditional WIMP dark matter, with masses of order 100 GeV, in direct detection searches has prompted a great deal of interest in new techniques, both theoretical and experimental, to probe dark matter candidates below a GeV in mass. In this talk, I will provide a brief survey of some of the recent proposals for the direct detection of meV-GeV mass dark matter candidates. In particular, I will highlight the status of the various proposed experiments, as well as their targeted reach for various dark matter candidates.

Presenter: YU, Tien-Tien (CERN)

Session Classification: Session 3

Contribution ID: **20** Type: **Talk**

Peter Graham (Stanford): Experimental searches of axions and axion-like particles

Wednesday, 21 February 2018 17:30 (30 minutes)

Presenter: GRAHAM, Peter

Session Classification: Session 4

Contribution ID: **104** Type: **Talk**

Kevork Abazajian (UCI): Dark matter sterile neutrinos

Wednesday, 21 February 2018 18:00 (30 minutes)

Presenter: N. ABAZAJIAN, Kevork

Session Classification: Session 4

Contribution ID: **105** Type: **Talk**

Kaixuan Ni (UCSD): Analyzing the XENON1T Dark Matter Search Data

Friday, 23 February 2018 08:00 (15 minutes)

XENON1T is the largest running liquid xenon detector for searching dark matter at Gran Sasso underground laboratory. The detector has been running in a stable condition for about one year and is delivering record-breaking exposure for dark matter direct detection. In this talk, I will present the details on the data reconstruction, selection, calibration and background analyses, leading towards the most sensitive dark matter search results up-to-date.

Presenter: NI, Kaixuan

Session Classification: Session 12

Contribution ID: **106** Type: **Talk**

Jianglai Liu (Shanghai Jiao Tong U.): PandaX status and prospects

Friday, 23 February 2018 08:15 (15 minutes)

The Particle and Astrophysical Xenon (PandaX) is a series of xenon-based ultra-low background experiments in the China Jinping underground Laboratory, aiming to search for Weakly-interacting massive particles (WIMPs) and to study neutrino properties. PandaX-II, with a 580-kg liquid xenon TPC currently under operation, is one of the leading WIMP direct detection experiment. In this talk, I shall present an overview of the project, discuss recent results from PandaX-II, and give an outlook into the future.

Presenter: LIU, Jianglai (Shanghai Jiao Tong University)

Session Classification: Session 12

Contribution ID: **107** Type: **Talk**

Bernhard Siebenborn (Karlsruhe Inst. of Technology (KIT)): Results from the EDELWEISS-III Dark Matter search, prospects for EDELWEISS-LT and beyond

Friday, 23 February 2018 09:30 (15 minutes)

EDELWEISS is a phased direct Dark Matter search program looking for WIMPs in the GeV-TeV mass range with cryogenic Ge mono-crystals. The simultaneous measurement of heat via thermal sensors (NTDs) and ionization signals allows for discrimination of nuclear against electron recoils. We present our results of the first stage of EDELWEISS-III and discuss the currently ongoing R&D approaches and measurements to further improve the experiment's sensitivity to smaller WIMP masses by utilizing the Neganov-Trofimov-Luke effect in EDELWEISS-LT. The timeline and the anticipated sensitivity will be presented together with an outlook beyond EDELWEISS-LT.

Presenter: SIEBENBORN, Bernhard (Karlsruhe Institute of Technology (KIT))

Session Classification: Session 12

Contribution ID: **108** Type: **Talk**

Peter Meyers (Princeton U): Darkside Latest Results

Friday, 23 February 2018 09:00 (15 minutes)

DarkSide uses a dual-phase Liquid Argon Time Projection Chambers to search for WIMP dark matter. The talk will present the latest result from the current experiment, DarkSide-50, running since mid 2015 a 50-kg-active-mass TPC, filled with argon from an underground source measured to contain lower Ar-39, the largest source of background, than atmospheric argon by a factor of >1000.

Presenter: MEYERS, Peter (Princeton University)

Session Classification: Session 12

Contribution ID: **109** Type: **Talk**

Holger Kluck (HEPHY, Vienna): Search for low-mass dark matter with the CRESST-III experiment

Friday, 23 February 2018 09:45 (15 minutes)

The third stage of the *Cryogenic Rare Event Search with Superconducting Thermometers* (CRESST-III) searches directly for interactions of dark matter with ordinary matter
at the *Laboratori Nazionali del Gran Sasso* (LNGS) in Italy. The detector targets of CRESST-III are CaWO_4 crystals which are operated as cryogenic calorimeters at O(10)mK. The main event signature for a potential dark matter interaction would be a nuclear recoil inside one of the targets. The simultaneous readout of both a phonon and a scintillation light signal is used to discriminate backgrounds.

Starting with the CRESST-II results in 2014, CRESST is leading the field below 1.7 GeV/cˆ2: The global exclusion limits for spin-independent dark matter-nucleus scattering were extended by CRESST down to the O(100)MeV scale for the first time.

In this contribution we will report the status of the current stage of the experiment, CRESST-III phase 1, discuss the latest results, and give an outlook to future stages of CRESST.

Presenter: KLUCK, Holger (HEPHY)

Session Classification: Session 12

Contribution ID: **110** Type: **Talk**

Vincenzo Caracciolo (LNGS, INFN): Dark Matter Investigation by DAMA/LIBRA

Friday, 23 February 2018 09:15 (15 minutes)

The DAMA/LIBRA set-up (about 250 kg highly radiopure NaI(Tl)) is currently in data taking at the Gran Sasso National Laboratory of the I.N.F.N. in its phase2. This experiment is dedicated to the investigation of Dark Matter (DM) particles in the galactic halo mainly by exploiting the model independent Dark Matter annual modulation signature. DAMA/LIBRA collected in its rst phase data over 7 annual cycles corresponding to an exposure of 1.04 ton x yr (DAMA/LIBRA-phase1). The DAMA/LIBRA-phase1 and the former DAMA/NaI data (cumulative exposure 1.33 ton x yr, corresponding to 14 annual cycles) give evidence at 9.3 sigma C.L. for the presence of Dark Matter particles in the galactic halo on the basis of the model independent DM annual modulation signature in highly radio-pure NaI(Tl) target. In this talk the results will be introduced and some of the most recent analyses will be presented as well as perspectives of the presently running phase-2. Possible future perspectives will also be addressed.

Presenter: CARACCIOLO, Vincenzo (INFN - National Institute for Nuclear Physics)

Session Classification: Session 12

Contribution ID: **111** Type: **Talk**

Christina Ignarra (SLAC): Overview and New Results from the LUX Experiment

Friday, 23 February 2018 08:30 (15 minutes)

The Large Underground Xenon (LUX) detector was a dual-phase xenon TPC with an active mass of 250 kg searching for Weakly Interacting Massive Particle (WIMP) dark matter via direct detection. It operated at the Sanford Underground Research Facility (SURF) in Lead, South Dakota from 2012-2016. This talk will report results from several new analyses: an effective field theory approach to explore a more general set of possible nuclear responses from WIMP-nucleon scattering, searches for annual and diurnal rate modulations in the data, and a search for the solar neutrino magnetic moment. New studies of calibrations, pulse-shape discrimination, and event reconstruction techniques will also be discussed.

Presenter: IGNARRA, Christina (SLAC)

Session Classification: Session 12

Contribution ID: **112** Type: **Talk**

Jingke Xu (LLNL): A search for annual and diurnal rate modulations in the LUX experiment

Friday, 23 February 2018 08:45 (15 minutes)

We will report a search for annual and diurnal rate modulations using over 20 months of LUX data acquired between 2013 and 2016. This study focuses on electron recoil events at low energies. We obtained a low and stable event rate by using the innermost volume of the LUX detector and by developing robust cuts and corrections to address the observed time-dependence of the detector performance. A remarkable stability was demonstrated with the event rates outside the energy region of interest after all cuts. In this talk, we will present the analysis strategy, the correction algorithms, and the findings of the modulation search.

Presenter: XU, Jingke

Session Classification: Session 12

Contribution ID: **115** Type: **Talk**

Burkhant Suerfu (Princeton U.): Status of the SABRE NaI(Tl) Dark Matter Experiment

Friday, 23 February 2018 12:15 (15 minutes)

SABRE is an experiment that is being developed to search for dark matter with an array of NaI(Tl) scintillating crystals. A primary goal is to test the DAMA-LIBRA modulation signal claimed to be evidence for dark matter. The experiment will employ NaI(Tl) crystals with low levels of internal radioactivity in an active shield of liquid scintillator and water. In the past two years SABRE has produced large NaI(Tl) crystals with radio-purity levels comparable to that of DAMA-LIBRA, and research toward higher radio-purity is ongoing. One detector will be deployed in the LNGS underground laboratory in Italy. A second detector will be located in Australia in the Stawell Underground Physics Laboratory, 240 km west of Melbourne. An overview of the detector design will be presented, together with reports on development of low radioactivity NaI(Tl) crystals, SABRE DAQ systems, and status of commissioning the North detector.

Presenter: SUERFU, Burkhant (Princeton University)

Session Classification: Session 13

Contribution ID: **116** Type: **Talk**

Alvaro Chavarria (U. of Washington): First results from the full CCD array of DAMIC at SNOLAB

Friday, 23 February 2018 11:30 (15 minutes)

Millimeter-thick charge-coupled devices (CCDs) are outstanding particle detectors. Although initially developed for near-infrared astronomy, the low pixel noise also makes them the most sensitive detectors to signals from ionizing radiation. By virtue of their very low energy threshold (<100 eV of ionizing energy) and their unique capabilities for background characterization based on their high spatial resolution, CCDs are poised to become the leading technology in the search for a wide variety of dark matter candidates with masses in the range 1 eV–10 GeV. I will present the first results from the completed seven-CCD array of DAMIC at SNOLAB. Sensitivity to WIMP-nucleus elastic scattering has been significantly improved thanks to the increased exposure, lower noise and lower radioactive backgrounds of the final detector configuration. I will also discuss the recent progress toward DAMIC-1K, a lower-background 1-kg CCD dark matter detector with an ionization threshold of 2 electrons.

Presenter: Prof. CHAVARRIA, Alvaro (University of Washington)

Session Classification: Session 13

Contribution ID: **117** Type: **Talk**

Ken Clark (SNOLAB): The PICO Experiment

Friday, 23 February 2018 10:45 (15 minutes)

The PICO collaboration uses bubble chambers to search for dark matter with results leading the world in sensitivity to the direct detection of WIMPs with spin-dependent coupling to protons. PICO recently operated a 32 litre bubble chamber (PICO-60) at the SNOLAB underground laboratory and currently has a 40 litre detector under construction. This new device (PICO-40L) will demonstrate the viability of the new design and prove the viability of scaling up to the next ton-scale experiment (PICO-500). A discussion of the technology, recent results, and future plans will be presented.

Presenter: CLARK, Ken (SNOLAB)

Session Classification: Session 13

Contribution ID: **118** Type: **Talk**

Reina Maruyama (Yale U.): COSINE-100

Friday, 23 February 2018 11:45 (15 minutes)

Astrophysical observations give overwhelming evidence for the existence of dark matter. While the DAMA collaboration asserts that they observe a dark matter-induced annual modulation signal in their NaI(Tl)-based detectors, their signal has not been confirmed. DAMA's observations are inconsistent with those from other direct detection dark matter experiments under most assumptions of dark matter. COSINE-100 has been taking physics data since September 2016 at Yangyang Underground Laboratory. I will describe the COSINE-100 experiment, the current status and prospect for low-background NaI(Tl)-based dark matter experiments, and our strategy for resolving the current stalemate in the field.

Presenter: MARUYAMA, Reina

Session Classification: Session 13

Contribution ID: **119** Type: **Talk**

Marisa Sarsa (U. of Zaragoza, Spain): Testing DAMA/LIBRA result with ANAIS-112 experiment

Friday, 23 February 2018 12:00 (15 minutes)

Detecting the elusive WIMPs (Weakly Interacting Massive Particles) proposed to explain the dark matter has shown to be a very challenging effort. The study of distinctive features in the WIMP signal allowing disentangling it from other backgrounds is an important asset in this search. The motion of the Earth around the Sun will produce a modulation in the dark matter interaction rate along the year, because of the change in relative velocity between WIMPs and target nuclei. Such a modulation, having all the features expected for WIMPs distributed in an isotropic and spherical halo, has been observed by DAMA/LIBRA experiment, in the Laboratory of Gran Sasso, Italy, with a high statistical significance. Neither considered systematics are able to explain such a modulation, nor are other very sensitive experiments using other target nuclei compatible with this result in most of the considered dark matter scenarios. The ANAIS (Annual modulation with NaI(Tl) Scintillators) experiment aims at the confirmation or refutation of the DAMA/LIBRA signal using the same target and technique at the Canfranc Underground Laboratory (LSC), Spain. Several 12.5 kg NaI(Tl) modules produced by Alpha Spectra Inc. have been operated in Canfranc during the last years in various set-ups. An outstanding light collection at the level of 15 photoelectrons per keV, which allows triggering at 1 keV of visible energy, has been measured for all of them and a complete characterization of their background has been achieved. The full ANAIS-112 set-up consisting of nine detectors in a 3x3 matrix configuration with a total mass of 112.5 kg has been commissioned at LSC in the first semester of 2017, starting the dark matter run on August, the 3rd. We will present and discuss the present status of the experiment, experimental planning, and sensitivity prospects in the search for the annual modulation of dark matter.

Presenter: Prof. SARSA, Marisa (University of Zaragoza)

Session Classification: Session 13

Contribution ID: **120** Type: **Talk**

Christian Regenfus (ETH Zurich): Status Report of The ArDM Project

Friday, 23 February 2018 11:15 (15 minutes)

The ArDM experiment, installed in the Canfranc underground laboratory LSC in Spain, is the first tonne-scale dual phase Liquid Argon detector designed for direct Dark Matter detection. Due to its size it represents an important milestone in the world wide effort for the development of large LAr Dark Matter detectors. The results from a commissioning run in the single phase operational mode were essential for the upgrade of the experimental setup and the transition to dual phase operation. Recently the main detector vessel was filled with about a tonne of Liquid Argon and commissioning in the dual phase operational mode has started. In the talk we will review the most important results from the single phase commissioning run and will present a status and first result from dual phase operation. We will also give an outlook on the mid term experimental program of ArDM comprising developments at LSC for next generation detectors in the framework of depleted argon research (DART) within DS20k.

Presenter: REGENFUS, Christian (Eidgenoessische Technische Hochschule Zuerich (ETHZ) (CH))

Session Classification: Session 13

Contribution ID: **121** Type: **Talk**

Status of the DEAP-3600 Dark Matter Search

Friday, 23 February 2018 11:00 (15 minutes)

DEAP-3600 is a single phase dark matter detector filled with 3.3 tonnes of liquid argon (LAr). The active volume is viewed by an array of 255 PMTs, separated from the LAr by 50 cm of acrylic. The whole detector is submerged in a large cylindrical water Cherenkov detector, which acts as a muon veto. DEAP-3600 began operations in May 2016, and has been running stably since November 2016. Analysis of the data taken so far has demonstrated the power of pulse shape discrimination to reject electron-recoiling backgrounds and has produced the most sensitive WIMP search to date using a LAr target. Results from the current analysis and future plans will be presented.

Presenter: WESTERDALE, Shawn (Carleton University)

Session Classification: Session 13

Contribution ID: **122** Type: **Talk**

Robert Calkins (SMU): Sub-GeV mass dark matter with the SuperCDMS experiment

Friday, 23 February 2018 10:30 (15 minutes)

Improvements in detector technologies have allowed direct detection experiments access to lower detection thresholds. In the case of the SuperCDMS Soudan experiment, this additional reach has been facilitated by applying strong electric potentials across each detector and taking advantage of the Neganov-Trofimov-Luke (NTL) effect to amplify ionization signals. For dark matter models with electron recoil signatures, the NTL effect is enhanced because of the higher fraction of ionization energy relative to a nuclear recoil of the same recoil phonon energy. The SuperCDMS SNOLAB experiment will start collecting data in 2020 with advanced NTL detectors that have much lower thresholds and improved energy resolution. In this talk, I will discuss analysis efforts to search for sub-GeV mass dark matter particles with existing data and implications for the future SuperCDMS SNOLAB experiment.

Presenter: CALKINS, Robert (Southern Methodist University)

Session Classification: Session 13

Contribution ID: **123** Type: **Talk**

Peter F. Smith (UCLA): The HUNTER experiment: proposed detection of keV-range sterile neutrinos by energy-momentum reconstruction of atomic K-capture

Friday, 23 February 2018 13:30 (15 minutes)

Right-handed or sterile neutrinos in the keV mass range have been proposed as an explanation of the galactic dark matter. Although direct detection of these is not feasible at the present time, the existence of such neutrinos could be demonstrated in the laboratory as rare events in atomic K-capture, emitting a neutrino together with atomic recoil, the K-vacancy then filled from a higher shell, emitting an X-ray, with further atomic rearrangement releasing several Auger electrons. By precise measurement of all decay products, including the recoil atom, the mass of the unseen neutrino can be calculated by four-momentum reconstruction –usually a value close to zero corresponding to standard neutrino mass eigenstates, but on rare occasions in the keV mass range corresponding to a sterile neutrino. The HUNTER experiment would utilize a large population of Cs-131 atoms suspended in high vacuum in a magneto-optical trap, measuring the vector momentum of all decay products to reconstruct individual sterile neutrino events in the mass range 5 – 350 keV. The method offers the possibility of improvement to progressively lower values of sterile neutrino coupling. A first phase of this experiment has been funded by the Keck Foundation as a collaboration between Temple, Houston, and UCLA groups.

Presenter: SMITH, PETER F (UCLA)

Session Classification: Session 14

Contribution ID: **124** Type: **Talk**

Philippe Gros (Queen's U., Kingston, Canada): NEWS-G: search for low-mass WIMPS with Spherical Proportional Counters

Friday, 23 February 2018 13:45 (15 minutes)

NEWS-G (New Experiments With Spheres-Gas) is a direct dark matter detection experiment using Spherical Proportional Counters (SPCs). It uses light noble gases to search for Weakly Interacting Massive Particles (WIMPs) down to the sub-GeV/c^2 mass region. The NEWS-G project builds on the experience gathered with the SEDINE detector, a 60cm SPC which has been operating for several years at the Laboratoire Souterrain de Modane (France). The NEWS-G collaboration is currently building a 140cm diameter SPC using low activity materials, that will be deployed at SNOLAB (Canada).

In this presentation, I will introduce the concept of SPC.
I will report the excellent results obtained with the SEDINE prototype with Ne as target nuclei, which exclude at 90\% confidence level (C.L.) cross-sections above 4.4×10^{-37}cm^2 for a 0.5GeV/c^2 WIMP.
I will finally describe the NEWS-G detector whose construction is ongoing for a deployment at SNOLAB planned in the summer of 2018.

Presenter: GROS, Philippe (Queen's University, Kingston, Canada)

Session Classification: Session 14

Contribution ID: **125** Type: **Talk**

Joshua Berger (U. of Wisconsin-Madison): Searching for Boosted Dark Dark Matter in Large Volume Neutrino Detectors

Friday, 23 February 2018 14:15 (15 minutes)

We study novel scenarios where thermal dark matter (DM) can be efficiently captured in the Sun and annihilate into boosted dark matter. We study scenarios which can yield viable thermal relic DM with masses O(1)-O(100) GeV. Taking advantage of the energetic deposits that arise when the boosted DM scatters off matter, we propose a detection strategy which uses large volume neutrino detectors. In particular, we focus on the prospects for observing such dark matter in liquid argon detectors, including current experiments such as MicroBooNE and future ones such as DUNE. The tools required to simulate and analyze events in these experiments are presented. We then determine the sensitivity to the parameter space of boosted dark matter models.

Presenter: BERGER, Joshua (University of Wisconsin-Madison)

Session Classification: Session 14

Contribution ID: **126** Type: **Talk**

Gulden Othman (U. of North Carolina-Chapel HIll): Low-Mass WIMP Search Using the MAJORANA DEMONSTRATOR

Friday, 23 February 2018 14:30 (15 minutes)

The MAJORANA DEMONSTRATOR is currently searching for neutrinoless double-beta decays in germanium-76 with the aim of demonstrating the feasibility to deploy a tonne-scale experiment in a phased and modular fashion. It consists of two modular arrays of natural and ^{76}Ge-enriched germanium detectors totaling 44.1 kg, of which 29.7 kg is enriched, operating at the 4850' level of the Sanford Underground Research Facility in Lead, South Dakota, USA. The low-backgrounds and low thresholds (< 1 keV) achieved by the DEMONSTRATOR enable additional rare-event searches at low-energies. Taking advantage of low detector thresholds and accumulated exposure allows for the opportunity to search for light-WIMPs ($\sim$10 GeV/c^2). In this work, we will focus on the prospect of a light-WIMP search using the MAJORANA DEMONSTRATOR, as well as efforts to extend the search to WIMP masses below 10 GeV/c^2.

Presenter: OTHMAN, Gulden (University Of North Carolina)

Session Classification: Session 14

Contribution ID: **127** Type: **Talk**

Tien-Tien Yu (CERN): Exploring the sub-GeV Dark Matter Frontier with SENSEI

Friday, 23 February 2018 14:00 (15 minutes)

SENSEI is a small-scale silicon CCD detector designed to search for sub-GeV dark matter. The Skipper readout technology employed by SENSEI has sensitivity to single-electron signals, thus giving SENSEI one of the lowest thresholds ever demonstrated in DM direct detection. This low threshold will allow for unprecedented sensitivity to the largely unexplored, but theoretically well-motivated, area of sub-GeV dark matter models. In this talk, I will introduce SENSEI, describing the collaboration and experimental setup, as well as discuss some of the current science results.

Presenter: YU, Tien-Tien (CERN)

Session Classification: Session 14

Contribution ID: **128** Type: **Talk**

Hugh Lippincott (Fermilab): Status of the LZ construction project

Friday, 23 February 2018 15:15 (15 minutes)

The LUX-ZEPLIN (LZ) detector is a next generation dark matter detector that will use a 7 active tonne liquid xenon time projection chamber (LXe-TPC) to search for dark matter particles, among other rare phenomena. The LZ project was approved in 2014 to continue toward fabrication and is now in the construction phase. In this talk, I will give an update on the current status and schedule of the LZ construction project.

Presenter: LIPPINCOTT, Hugh (Fermilab)

Session Classification: Session 15

Contribution ID: **129** Type: **Talk**

Sally Shaw (UCSB): The LZ Outer Detector

Friday, 23 February 2018 15:30 (15 minutes)

The LUX-ZEPLIN (LZ) dark matter experiment will consist of 7 active tonnes of liquid xenon sensitive to the nuclear recoils induced by impinging weakly interacting massive particles (WIMPs). Backgrounds to a WIMP signal tend to populate the boundaries of the LZ sensitive volume, where gamma-rays and neutrons from nearby material can enter, scatter once, and exit. The Outer Detector (OD) of LZ consists of 17 tonnes of gadolinium-loaded liquid scintillator, surrounding the LZ liquid xenon, and is capable of efficiently tagging both gamma-rays and neutrons which have scattered in the liquid xenon. The OD provides a substantial increase in the background-free liquid xenon mass of LZ, expanding the volume available for WIMP search. We will report on the design studies, radioactive background requirements and results, and expected performance of the LZ Outer Detector.

Presenter: Dr SHAW, Sally (UCSB)

Session Classification: Session 15

Contribution ID: **130** Type: **Talk**

Juijen (Ryan) Wang (U of New Mexico): Triplet Lifetime Measurement in Gaseous Argon using MiniCLEAN Detector

Friday, 23 February 2018 16:45 (15 minutes)

The MiniCLEAN (Cryogenic Low-Energy Astrophysics with Noble liquid) dark matter experiment will exploit a single-phase liquid argon detector instrumented with 92 photomultiplier tubes placed in the cryogen with 4-π coverage of a 500 kg (150 kg) target (fiducial) mass. The detector design strategy emphasizes scalability to target masses of order 10 tons or more. During the initial cooling phase, impurities within the cold gas ($\leq$140 K) were monitored by measuring the scintillation light triplet lifetime, and ultimately a triplet lifetime of 3.48 $\pm$ 0.01 μs was obtained, indicating ultra-pure argon. This is the longest argon triplet time constant ever reported. The latest status of MiniCLEAN detector will be also presented in the talk.

Presenter: Dr WANG, Juijen (Ryan) (University of New Mexico)

Session Classification: Session 16

Contribution ID: **131** Type: **Talk**

Alessandro Razeto (LNGS, INFN, Italy): SiPM at cryogenic temperature for dark matter

Friday, 23 February 2018 15:00 (15 minutes)

DarkSide-20k is a 20 tonne fiducial mass liquid argon TPC that will perform an instrumental background-free search for WIMP dark matter. The TPC will be outfitted with more than 125,000 silicon photomultipliers (SiPM) grouped into 5210 single-channel, 25 cm^2 photosensors that are sensitive to single photoelectrons. We will present the performance of the photosensor and associated low-noise electronics at liquid argon temperature and discuss the strategy for scaling up production for DarkSide-20k.

Presenter: Dr RAZETO, Alessandro (LNGS, INFN, Italy)

Session Classification: Session 15

Contribution ID: **132** Type: **Talk**

Grzegorz Zuzel (Jagiellonian U. in Krakow): Low-background techniques in direct dark matter searches

Friday, 23 February 2018 15:45 (15 minutes)

In many experiments searching for rare nuclear processes, like direct interactions of cold dark matter particles, an extremely low radioactive contamination level of the detector target and the surrounding materials has to be achieved. This is only possible after implementation of an extensive R&D program and careful material screening with appropriate devices. Selected ultra-sensitive instruments and the most relevant experimental techniques allowing for searches and development of ultra-radio pure materials will be discussed. This include ICP-MS studies, gamma-ray spectroscopy, large-surface alpha spectroscopy, counting of Rn-222 and Rn-220 down to single atoms, purification of gases and studies of surface cleaning procedures. Application of the mentioned (complementary) techniques makes it possible to study the entire decay chains what is important for samples which in the production process undergo some chemical treatments resulting in disequilibrium in the chain (enrichment/depletion of some elements). For example, in the U-238 chain ICP-MS allows to study the long-lived U/Th isotopes, gamma-ray spectroscopy (or Rn-222 emanation) provides information about Ra-226 and the short lived Rn-222 daughters, and the large-surface alpha spectroscopy may be applied to investigate the bottom part of the chain, namely Po-210 (and indirectly Pb-210). Po-210 is of special interest since as an alpha emitter it may be a direct (e.g. degraded alphas) or indirect source of background (neutrons produced in the alpha-n reactions). Application of the outlined methods and results, with emphasis on high-sensitivity Rn emanation studies, on the development of etching methods effectively removing surface Po-210 contamination and on the first measurements of Po-210 content in the (oxygen-free) copper, stainless steel and titanium samples, will be presented.

Presenter: ZUZEL, Grzegorz (Jagiellonian University in Krakow)

Session Classification: Session 15

Contribution ID: **140** Type: **Talk**

Kelsey Oliver-Mallory (LBNL): Determination of Backgrounds for the LUX Experiment

Friday, 23 February 2018 17:00 (15 minutes)

LUX (Large Underground Xenon) is a retired 250 kg liquid xenon dark matter direct detection experiment. Determination of radiogenic backgrounds is essential for accurate extraction of signals and optimization of detector sensitivity. In this talk, we present analyses of backgrounds in the LUX detector, extending the energy scale beyond what is documented in previous publications. This work enables us to perform physics searches beyond the signal range of the spin independent WIMP (weakly interacting massive particle) interaction, and further refines our determination of contamination intrinsic to the xenon and originating from the detector's materials. The impact of the revised backgrounds on the detector sensitivity will be discussed.

Presenter: OLIVER-MALLORY, Kelsey (Lawrence Berkeley National Laboratory)

Session Classification: Session 16

Contribution ID: **141** Type: **Talk**

Paolo Agnes (Houston U): Measurement of liquid argon response to nuclear and electronic recoils with the ARIS experiment

Friday, 23 February 2018 16:30 (15 minutes)

The Argon Response to Ionization and Scintillation (ARIS) experiment utilized monoenergetic fixed-angle neutron and gamma scatters to characterize liquid argon response to nuclear and electronic recoils for support of direct dark matter detection experiments with a liquid argon target. The relative scintillation efficiency for low energy single-scatter nuclear recoils and the recombination probability of electron-ion pairs for single-scatter electronic recoils were measured for both zero field and a range of applied electric fields. The gamma-tagged events were also analyzed to extract the linearity of the light yield for electronic recoil events at zero field. The ARIS results and their application in the calibration of liquid argon response simulation models will be presented.

Presenter: AGNES, paolo (University of Houston)

Session Classification: Session 16

Contribution ID: **142** Type: **Talk**

Lucie Tvrznikova (Yale/LBNL): Characterization of high voltage behavior in noble liquids with XeBrA

Friday, 23 February 2018 17:15 (15 minutes)

The Xenon Breakdown Apparatus (XeBrA) is a 5-liter detector designed to study high voltage behavior in noble liquids, located at Lawrence Berkeley National Laboratory. XeBrA is designed to characterize the dependence of electric field breakdown on electrode properties in both liquid argon and liquid xenon. Electrodes may be tested up to 30 cm^2 in area, while varying cathode-anode separation from 0 to 10 mm, with cathode voltages up to -75 kV. Experimental evidence suggests a correlation between breakdown field and electrode area in liquid argon, and XeBrA' s design will determine whether such a correlation exists in liquid xenon and allow for a direct comparison between measurements in liquid xenon and liquid argon. This talk will present the motivation for XeBrA and its first results.

Presenter: TVRZNIKOVA, Lucie (Yale/LBNL)

Session Classification: Session 16

Contribution ID: **143** Type: **Talk**

Jim Dobson (CERN): Projected WIMP sensitivity of the LUX-ZEPLIN dark matter experiment

Friday, 23 February 2018 17:45 (15 minutes)

The LUX-ZEPLIN (LZ) experiment is a Generation 2 multi-tonne dark matter direct detection experiment that will operate 4850 feet underground at the Sanford Underground Research Facility in Lead, South Dakota. It will use a liquid xenon TPC with an active mass of 7 tonnes to search for the low energy signatures from interactions with WIMP dark matter in our galactic halo and other rare physics processes. LZ builds upon the demonstrated response to keV nuclear recoils and the excellent self-shielding properties of liquid xenon and scales the TPC design beyond all existing experiments. In addition, an optically separated and instrumented xenon skin layer (between the inner TPC and the walls of the cryostat) and a surrounding external liquid scintillator detector provide powerful rejection of gamma-rays and neutrons from internal sources. Materials screening and in-house purification of the liquid xenon then ensure that LZ meets the strict radioactivity constraints needed to achieve world leading WIMP search sensitivity. In this talk I will give an overview of LZ and present the latest projected WIMP sensitivity based on updated background estimates and both an updated TPC optical model and veto detector response.

Presenter: DOBSON, James Edward Young

Session Classification: Session 17

Contribution ID: **144** Type: **Talk**

Giuliana Fiorillo (U. di Napoli, INFN): Darkside-20k and the future Liquid Argon Dark Matter program

Friday, 23 February 2018 17:30 (15 minutes)

The next stage of the Darkside program for direct dark matter searches will involve a global collaboration from all the current Argon based experiments. DarkSide-20k has been recently approved and is based on a 20-tonne fiducial mass TPC with SiPM based photosensors and filled with Argon from an underground source. It is designed to have a background well below that from coherent scattering of solar and atmospheric neutrinos. Like its predecessor DarkSide-20k will be housed at the Gran Sasso (LNGS) underground laboratory, and it is expected to attain a WIMP-nucleon cross section of 10-47 cm2 for a WIMP mass of 1TeV/c2 in a 5 yr run. Plans for a further step towards a larger mass
detector capable of exploring the Dark Matter parameter space to the neutrino floor will be reviewed.

Presenter: FIORILLO, Giuliana (Universita e sezione INFN di Napoli (IT))

Session Classification: Session 17

Contribution ID: **148** Type: **Talk**

Anna Nierenberg (UCI): The nature of dark matter with narrow-line lensing

Thursday, 22 February 2018 07:30 (20 minutes)

Strong gravitational lensing provides a means of measuring the halo mass function into regimes below which baryons are reliable tracers of structure. In this low mass regime (M_vir<10ˆ9 M_sun), the microscopic characteristics of dark matter affect the abundance of dark matter halos.Strong gravitational lensing has been limited by the small number of systems which can be used to detect dark matter substructure. I will discuss the narrow-line lensing technique, which enables a significant increase in the number of systems which can be used to measure the subhalo mass function, and will provide a stringent new constraint on the free-streaming length of dark matter with currently known lenses alone. I will also discuss the promising future for this method in the era of LSST, JWST and 30 meter class telescopes.

Presenter: Dr NIERENBERG, Anna (UCI)

Session Classification: Session 5

Contribution ID: **149** Type: **Talk**

Marcel Pawlowski (UCI): Phase-space structures in satellite galaxy systems

Thursday, 22 February 2018 07:50 (20 minutes)

Our ever-increasing observational knowledge of satellite galaxy systems now allows us to identify structures in the phase-space distribution of satellites belonging to a common host, by studying their distribution and motion. This can potentially reveal connections in the formation and evolution history of different satellite galaxies, but can also be used to test cosmological models. One example of a recently discovered type of structure is that satellite galaxy systems around pairs of host galaxies are lopsided towards their partner host, a phenomenon that appears consistent with cosmological simulations based on the ΛCDM paradigm. A different type of structure are kinematically correlated Planes of Satellite Galaxies. Observations of the distribution and motion of satellites around the Milky Way and the Andromeda Galaxy have revealed the existence of such satellite galaxy planes, and evidence for similar structures beyond the Local Group is accumulating. Correlations as extreme as the observed ones are very rare in cosmological simulations based on the ΛCDM model. In contrast to other small-scale problems, current cosmological simulations provide no evidence that modeling baryonic physics or different types of dark matter alleviates this problem, because they do not substantially enhanced phase-space correlations among satellite galaxy systems. Unless a solution is found, the mismatch between the observed satellite galaxy planes and model expectations thus poses problems not just for the specific cold dark matter model, but potentially for the dark matter hypothesis in general.

Presenter: PAWLOWSKI, Marcel (University of California Irvine)

Session Classification: Session 5

Contribution ID: **150** Type: **Talk**

Simeon Bird (UC Riverside): Did LIGO Detect Dark Matter?

Thursday, 22 February 2018 08:10 (20 minutes)

I will discuss the possibility that the black-hole binary detected by LIGO may be a signature of primordial black hole dark matter. If two BHs in a galactic halo pass sufficiently close, they radiate enough energy in gravitational waves to become gravitationally bound. Curiously, the expected merger rate from these objects overlaps with that predicted by LIGO. Although a PBH dark matter fraction of unity is now ruled out, a smaller fraction is still plausible.

Presenter: BIRD, Simeon (UC Riverside)

Session Classification: Session 5

Contribution ID: **151** Type: **Talk**

Michael Boylan-Kolchin (U of Texas, Austin): Testing Dark Matter Models with Dwarf Galaxies

Thursday, 22 February 2018 08:30 (20 minutes)

Dwarf galaxies are among the best laboratories for exploring the nature of dark matter: their high dark matter content, coupled with the large number of dwarfs in close proximity to us, enable a variety of tests that are not possible with other astrophysical systems. I will discuss our efforts to understand unique signatures of both standard cold dark matter and various alternatives (including warm, self-interacting, and ultra-light axion dark matter) with high-resolution cosmological simulations of dwarf galaxies.

Presenter: BOYLAN-KOLCHIN, Mike (U. of Texas at Austin)

Session Classification: Session 5

Contribution ID: **152** Type: **Talk**

Katherine Freese (U Michigan): Dark Stars

Thursday, 22 February 2018 08:50 (14 minutes)

The first phase of stellar evolution in the history of the Universe may be Dark Stars (DS), powered by dark matter heating rather than by nuclear fusion. Weakly Interacting Massive Particles which are their own antipartners can collect inside the first stars and annihilate to produce a heat source that powers the stars. A new stellar phase results, a Dark Star, which lasts as long as there is dark matter fuel, with lifetimes from millions to billions of years. Dark Stars, while made primarily of hydrogen and helium, are powered by dark matter. They are very bright diffuse puffy objects and grow to be very massive. In fact, they can grow up to ten million solar masses with up to ten billion solar luminosities. Such objects can be seen in James Webb Space Telescope; their signatures will be discussed. Once the dark matter fuel is exhausted, the DS becomes a heavy main sequence star. These stars eventually collapse to form massive black holes that may provide seeds for supermassive black holes observed at early times as well as in galaxies today. The black holes could still have dark matter spikes around them so that gamma-rays and positrons from annihilation could be seen in a variety of experiments.

Presenter: FREESE, Katherine (University of Michigan)

Session Classification: Session 5

Contribution ID: **154** Type: **Talk**

Daniele Gaggero (GRAPPA, Amsterdam): Primordial black holes as Dark Matter candidates?

Thursday, 22 February 2018 09:04 (14 minutes)

The idea that primordial black holes (PBHs) of O(10) solar mass can account for all the dark matter has been recently reconsidered after the discovery of a gravitational wave signal. We present a robust bound on this scenario based on a novel approach: We model in a conservative way the accretion of gas and the subsequent radio and X-ray emission originating by a population of PBHs in our Galaxy, exploiting well established empirical relations confirmed by current astronomical observations. We find a more reliable bound compared to the ones based on CMB spectrum and anisotropies, competitive with the dynamical ones. We discuss in detail future developments of our study, aimed at searching either a subdominant population of PBHs that contribute to a fraction of the DM, or a population of astrophysical black holes, and the role of the forthcoming radio facilities data in this context

Presenter: GAGGERO, Daniele

Session Classification: Session 5

Contribution ID: **155** Type: **Talk**

Tim Linden (Ohio State): Rise of the Leptons: Pulsar Emission Dominates the TeV Gamma-Ray Sky

Thursday, 22 February 2018 09:38 (17 minutes)

Recent HAWC observations have found extended TeV emission coincident with the Geminga and Monogem pulsars. In this talk, I will show that these detections have significant implications for our understanding of the TeV gamma-ray sky. First, the spectrum and intensity of these TeV Halos indicates that a large fraction of the pulsar spindown energy is efficiently converted into electron-positron pairs. This provides observational evidence supporting pulsar interpretations of the rising positron fraction observed by PAMELA and AMS-02. Second, the isotropic nature of this emission provides a new avenue for detecting nearby pulsars with radio beams that are not oriented towards Earth. Lastly, I will show that the total emission from all unresolved pulsars produces the majority of the TeV gamma-ray flux observed from the Milky Way, allowing us to set strong constraints on TeV dark matter models.

Presenter: LINDEN, Tim (U)

Session Classification: Session 6

Contribution ID: **156** Type: **Talk**

Dan Hooper (Fermilab): Pulsars and the Galactic Center Gamma-Ray Excess

Thursday, 22 February 2018 09:18 (20 minutes)

I will summarize the evidence in support of, and in opposition to, pulsars as the source of the gamma-ray excess observed from the Inner Milky Way. The evidence in favor of a pulsar origin includes the observed small scale power in the gamma-ray emission from this region, and possible correlations between this emission and the distribution of stars. In opposition to this conclusion are the lack of bright pulsar-like gamma-ray sources and bright low-mass X-ray binaries in this direction of the sky. I will also comment on the implications of HAWC's TeV-halos for pulsar interpretations of this excess.

Presenter: HOOPER, dan

Session Classification: Session 6

Contribution ID: **157** Type: **Talk**

Wim de Boer (Karlsruhe Inst. of Technology): The FERMI excess investigated over the whole gamma-ray sky

Thursday, 22 February 2018 10:25 (14 minutes)

The so-called Fermi-excess in the diffuse Galactic gamma-ray sky is observed as a shift of the maximum in the Eˆ2 weighted gamma-ray spectrum from 0.7 GeV to around 2 GeV. Such a shift can be explained by the contribution of a new source with a spectrum peaking at 2 GeV. Three sources have been proposed: a dark matter (DM) annihilation signal, a signal from millisecond pulsars (MSPs), a signal from molecular clouds (MCs). All three have Eˆ2 weighted spectra peaking around 2 GeV, but the slightly different shapes yield different goodness of fits. In addition, DM is expected to show a smooth spatial distribution, while MSPs and MCs are expected to show spatial fluctuations („speckling“) because of the discrete nature of the sources. Furthermore, the excess is maximal towards the Galactic center with a steeply falling intensity into the halo, which is true for all hypothesized sources.
We study the three hypothesis by investigating the spectral shapes, the spatial morphology and the speckling of the excess by fitting the spectral templates of all gamma-ray contributions in all sky directions. Such a spectral template fit based on data driven templates allows to simultaneously measure the excess and the background in all sky directions including the Galactic disk without the need for using propagation models with their large uncertainties. We find that the MC explanation best describes the data: it yields a chi2/dof close to unity over the entire sky (see 1707.08653) and moreover exhibits a strong correlation of the morphology and speckling with the all-sky CO maps from the Planck satellite, which traces MCs.

Presenter: DE BOER, Wim (KIT - Karlsruhe Institute of Technology (DE))

Session Classification: Session 6

Contribution ID: **158** Type: **Talk**

Martin Winkler (NORDITA): Hunting for WIMPs with Charged Cosmic Rays

Thursday, 22 February 2018 10:39 (14 minutes)

Weakly Interacting Massive Particles (WIMPs) have been the target of cosmic ray experiments for decades. AMS-02 is the first experiment which can realistically probe WIMP annihilation signals in the antiproton channel. Due to the tiny experimental errors, uncertainties in the astrophysical background have become the most limiting factor for dark matter detection. I will use the combination of antiproton, boron to carbon and positron data in order to systematically reduce uncertainties related to the propagation of charged cosmic rays. In addition, I will use a wide collection of accelerator data to improve the calculation of the astrophysical antiproton source term. Finally, I will present a spectral search for dark annihilation in the AMS-02 antiproton data.

Presenter: WINKLER, Martin (Nordita)

Session Classification: Session 6

Contribution ID: **159** Type: **Talk**

Tsuguo Aramaki (SLAC): GAPS - Hunting for Dark Matter with Cosmic-ray Antimatter

Thursday, 22 February 2018 10:53 (14 minutes)

GAPS (General Antiparticle Spectrometer) is a balloon-based indirect dark matter search experiment that focuses on low-energy antiprotons and antideuterons produced by dark matter annihilation and decay in the Galactic halo. The predicted antideuteron flux from well-motivated dark matter models can be more than two orders of magnitude larger than the one produced by the cosmic-ray interaction at low-energy. Therefore, the GAPS antideuteron measurement is considered as a background-free rare signal dark matter search experiment while solely and complementarily probing a broad number of dark matter models with direct detection, collider and other indirect searches. GAPS could also investigate the DM models put forward to explain the recent results from Fermi, AMS-02 and PAMELA observations. The detection concept and the detector performance have been validated through the accelerator beam test and the engineering flight. We are now moving forward with the first science flight scheduled by NASA from Antarctica in late 2020. In this talk, I will present the overview and the recent status of the GAPS mission.

Presenter: ARAMAKI, Tsuguo (SLAC)

Session Classification: Session 6

Contribution ID: **160** Type: **Talk**

Howard Baer (U. of Oklahoma): Prospects for WIMP and axion detection in SUSY with radiatively-driven naturalness

Thursday, 22 February 2018 11:23 (14 minutes)

SUSY with radiatively driven naturalness combines solutions to the gauge hierarchy problem, the strong CP problem, the SUSY mu problem and the Little Hierarchy problem. Dark matter is expected to be a higgsino-like WIMP plus SUSY DFSZ axion admixture where axions typically dominate the dark matter abundance. Nonetheless, prospects are better for WIMP detection than for axion detection. If WIMPs are not seen at ton-scale WIMP detectors, then this simple and compelling scenario would likely be ruled out.

Presenter: BAER, Howard (University of Oklahoma)

Session Classification: Session 7

Contribution ID: **161** Type: **Talk**

Peiwen Wu (Korea Inst. for Advanced Study): Heavy Quark Flavored Scalar Dark Matter

Thursday, 22 February 2018 11:37 (14 minutes)

The absence of confirmed signal in dark matter (DM) direct detection (DD) may suggest a weak coupling between DM and the first generation quarks. In this work we consider a real scalar dark matter S which has new Yukawa interactions with charm c and top quark t via a vector-like fermion mediator ψ. By setting the Higgs portal to be negligible, we focus on the new Yukawa interactions. Since there is no valence c, t quark in nucleons, DM-gluon scattering at loop level becomes important. We found that renormalization group equation (RGE) effects are crucial in calculating the DM-nucleon scattering rate at $\mu_{had} \sim 1\,\mathrm{GeV}$ if one constructs the effective theory at $\mu_{EFT} \sim m_Z$. For the perturbative benchmark couplings we choose, combined results from relic abundance requirement $\Omega h^2 = 0.12$, direct/indirect detection constraints, 13 TeV LHC data have excluded a thermal relic DM with $m_S < m_t/2$ in this model. FCNC processes of top quark can be generated at both tree level $t \to \psi^{(*)} S \to cSS$ and loop level $t \to c + \gamma/g/Z$, of which the branching fractions are usually below 10^{-9} after passing the other constraints, which are still safe from the current top quark width measurements.

Presenter: WU, Peiwen (Korea Institute for Advanced Study (KIAS))

Session Classification: Session 7

Contribution ID: **162** Type: **Talk**

Paolo Gondolo (University of Utah): The halo-independent approach as a problem of moments

Thursday, 22 February 2018 12:05 (14 minutes)

Halo-independent methods in the analysis of WIMP detection data have up to now provided separate constraints for specific integrals of the WIMP velocity distribution, and have assumed separate velocity distributions for the modulated and unmodulated rates. This has hindered the statistical interpretation of the results and has restricted the analysis to the comparison of experiments. I have recast the halo-independent approach as a moment problem, thus obtaining a proper statistical interpretation, including a profile likelihood with a continuum of nuisance parameters. This has extended the scope of the method to questions beyond the mere comparison of experiments. As a first example of the new method, I show a halo-independent estimate of the unmodulated signal corresponding to the DAMA annual modulation, including proper confidence levels, for spin-independent interactions under the assumption of a velocity distribution that is isotropic in the galactic reference frame.

Presenter: GONDOLO, Paolo (University of Utah)

Session Classification: Session 7

Contribution ID: **163** Type: **Talk**

Sebastian Baum (Stockholm U. and Oskar Klein Centre, Sweden): Thermal dark matter and the Higgs

Thursday, 22 February 2018 18:42 (14 minutes)

We analyze a low energy effective model of Dark Matter in which the thermal relic density is provided by a singlet Majorana fermion which interacts with the Higgs fields via higher dimensional operators. Direct detection signatures may be reduced if so-called blind spot solutions exist, which naturally appear in models with extended Higgs sectors. Explicit mass terms for the Majorana fermion can be forbidden by a Z 3 symmetry, which in addition leads to a reduction of the number of higher dimensional operators. Moreoever, a weak scale mass for the Majorana fermion is naturally obtained from the vacuum expectation value of a scalar singlet field and the proper relic density may be obtained by the s-channel interchange of Higgs and gauge bosons, with the longitudinal mode of the Z boson (the neutral Goldstone mode) playing a relevant role in the annihilation process. This model shares many properties with the Next-to-Minimal-Supersymmetric extension of the Standard Model with light singlinos and heavy scalar superpartners. The latter serves us as an explicit computational basis to study the properties of these kind of models, and allows to compare the predictions of the low energy with the ones of the ultraviolet complete one.

Presenter: BAUM, Sebastian (Stockholm University and Oskar Klein Centre)

Session Classification: Session 10

Contribution ID: **164** Type: **Talk**

Riccardo Catena (Chalmers U. of Technology, Sweden): Determining dark matter particle properties with direct detection experiments

Thursday, 22 February 2018 17:46 (14 minutes)

Direct detection experiments search for nuclear recoil events induced by the non-relativistic scattering of Milky Way dark matter (DM) particles in low-background detectors. Current strategies for the experimental analysis and theoretical interpretation of direct detection experiments focus on two parameters: the DM particle mass, and the cross-section for DM-nucleon scattering computed under the assumption of spin-independent or spin-dependent DM-nucleon interactions. In this framework, the DM particle spin remains unconstrained. In my talk, I introduce two new analysis strategies relying on the most general classification of single mediator models for DM-quark interaction. A first strategy potentially allows to extract the DM particle spin in the presence of a signal at direct detection experiments with directional sensitivity. A second strategy shows that a signal at XENONnT together with the detection, or lack of detection, of a mono-jet signal at the LHC Run 3 would significantly narrow the range of possible DM interactions and spins.

Presenter: CATENA, Riccardo (SISSA)

Session Classification: Session 10

Contribution ID: **165** Type: **Talk**

Alexander Dolgov (NSU and ITEP, Moscow): Massive Primordial Black Holes and Dark Matter

Thursday, 22 February 2018 11:09 (14 minutes)

Recent astronomical observations, indicating that the universe at high redshfts, z=5 -10, is unexpectedly densely populated by bright galaxies, supermassive black holes (quasars), gamma-bursters, supernovae and is very dusty, are reviewed. It is argued that the origin of these early formed objects is at odds with the conventional theory of their formations. Moreover, similar and probably related phenomena or objects are abundant in the contemporary universe. The origin of the observed MACHO's, supermassive black holes in every large galaxy and even SMBHs in practically empty space remains mysterious.

All these puzzles are simply and naturally solved in our model of 1993 of massive black hole formation in the early universe. The model predicted log-normal mass distribution of the primordial black holes (PBHs), which became popular in the recent year or two. It explains the puzzling properties of the LIGO-observed gravitational waves and allows for dark matter to be made mostly or solely by PBHs.

Presenter: DOLGOV, Alexander (NSU)

Session Classification: Session 7

Contribution ID: **166** Type: **Talk**

Matteo Cremonesi (Fermilab): Dark matter searches at the LHC

Thursday, 22 February 2018 13:35 (20 minutes)

Presenter: CREMONESI, Matteo (Fermi National Accelerator Lab. (US))

Session Classification: Session 8

Contribution ID: **167** Type: **Talk**

Peter Lewis (University of Hawaii): Dark Sector Physics with Belle II

Thursday, 22 February 2018 13:55 (17 minutes)

The next-generation B-factory experiment Belle II at the upgraded KEKB accelerator, SuperKEKB, will start physics data taking in 2018. It is an asymmetric e+e- collider that will operate with 40x the instantaneous luminosity of KEKB/Belle and aims to collect 50 times more data in total.

Belle II offers the possibility to search for a large variety of dark sector particles in the GeV mass range complementary to LHC and dedicated low energy experiments. These searches will profit both from the very large dataset that will be acquired by the Belle II experiment, and from specifically designed triggers for the early running of Belle II. This talk will review planned dark sector searches with a focus on the discovery potential of the first data.

Presenter: LEWIS, Peter (University of Hawaii)

Session Classification: Session 8

Contribution ID: **168** Type: **Talk**

Daniel Snowden-Iff (Occidental College): BDX-DRIFT: A low-energy, low-background, directional search for light dark matter at accelerators

Thursday, 22 February 2018 14:12 (14 minutes)

Electron beam dump experiments have been shown to have high sensitivity to light dark matter at accelerators (LDMA). In these experiments high-intensity, multi-GeV electron beams directed at fixed targets can produce, because of couplings to charge, light dark matter particles. With their weak couplings these light dark matter particles easily pass through the beam dump plus, typically, large amounts of shielding, where they can interact with target nuclei in a detector. With its unique directional and background rejection capabilities, the Directional Recoil Identification From Tracks (DRIFT) technology is ideally suited to search for elastic nuclear recoils from LDMA. We propose to search for directional low-energy LDMA-induced recoils utilizing the negative-ion TPC technology developed for DRIFT. Preliminary work, including a test run at SLAC, suggests that a DRIFT detector would have sensitivity rivaling the best limits on LDMA and provide a smoking-gun directional signature in the event of discovery.

Presenter: SNOWDEN-IFFT, Daniel

Session Classification: Session 8

Contribution ID: **169** Type: **Talk**

Andrew Spray (CTPU, Inst. for Basic Science, Korea): Prospective Searches for Electroweak Dark Matter at CLIC

Thursday, 22 February 2018 14:26 (14 minutes)

Electroweak multiplets are an archetypal candidate for the WIMP paradigm of thermal dark matter. Examples include the Wino and Higgsino of supersymmetry, as well as the fermion quintet of Minimal Dark Matter. We discuss the prospective limits and discovery reach at the proposed future lepton collider CLIC on these and similar models. When the components of the multiplet are approximately degenerate, search strategies are sensitive to the lifetime of the lightest charged state, or equivalently the mass splitting. We combine signals including disappearing tracks, long-lived charged particles and mono-photons to cover different regions of parameter space. Additionally, for mass splittings of a few GeV, we show how searches based on a single hard lepton offer the greatest sensitivity by allowing the reconstruction of the soft decay products. Finally we discuss the implications of these limits and the relic density in more general models.

Presenter: SPRAY, Andrew (CoEPP, University of Melbourne)

Session Classification: Session 8

Contribution ID: **170** Type: **Talk**

Christian Boutan (Pacific Northwest National Laboratory): The Axion Dark Matter Experiment (ADMX): Overview & Recent Results

Thursday, 22 February 2018 14:42 (20 minutes)

The Axion Dark Matter eXperiment (ADMX) is a DOE "Generation 2" direct-detection dark matter project searching for μeV axions. Exploiting the inverse primakoff effect where $a \rightarrow \gamma^*\gamma$, the experiment utilizes a tunable, high-Q cavity, submerged in a 8 Tesla magnetic field and looks for the resonant conversion of axions into microwave photons. Over the last decade the ADMX has undergone multiple upgrades and is now operating with unprecedented sensitivity, able to discover or rule out even the most pessimistically coupled DFSZ QCD axions. I will present an overview of the ADMX experiment and discuss preliminary results from our 2017 data run.

Presenter: BOUTAN, Christian (Pacific Northwest National Laboratory)

Session Classification: Session 9

Contribution ID: **171** Type: **Talk**

Jonghee Yoo (KAIST): Axion Dark Matter Search

Thursday, 22 February 2018 15:02 (20 minutes)

It has now been proven that the Universe is mostly filled with what we cannot see; dark matter. The presence of dark matter had profound consequences on the evolution of the Universe. The Standard Model does not accommodate a suitable dark matter candidate. Therefore the existence of dark matter is a crucial phenomenological evidence for physics Beyond the Standard Model. The pressing goal of current and future dark matter experiments is to answer the question of whether dark matter interacts with normal matter other than gravity; i.e. if dark matter is detectable. Among the plethora of dark matter candidate particles, the Weakly Interacting Massive Particles (WIMPs) and the Axions are the most outstanding contender. In this talk, I will discuss the dark matter axion search projects.

Presenter: Prof. YOO, JONGHEE (KAIST)

Session Classification: Session 9

Contribution ID: **172** Type: **Talk**

Alexander Millar (MPI Munich): Dielectric haloscopes: a new way to search for axion dark matter

Thursday, 22 February 2018 15:22 (15 minutes)

We propose a new strategy to search for dark matter axions in the mass range of 40–400μeV by introducing dielectric haloscopes, which consist of dielectric disks placed in a magnetic field. When an interface between different dielectric media is inside a magnetic field, the oscillating axion field acts as a source of electromagnetic waves, which emerge in both directions perpendicular to the surface. The emission rate can be boosted by multiple layers judiciously placed to achieve constructive interference and by a large transverse area. A sensitivity to QCD axion models is conceivable with 80 disks of 1 mˆ2 area contained in a 10 Tesla field. This concept is being pursued by the new MADMAX Collaboration.

Presenter: MILLAR, Alexander (Max Planck Institute for Phyiscs)

Session Classification: Session 9

Contribution ID: **173** Type: **Talk**

Luca Visinelli (Stockholm University and Nordita): Axions in cosmology and astrophysics

Thursday, 22 February 2018 15:37 (14 minutes)

The axion is a well-motivated hypothetical particle which candidates to constitute the observed cold dark matter budget. In this talk, I first revise the properties of the axion in light of current bounds from astrophysics and cosmology, and give some prospects for future searches. I then discuss some mechanisms to relax such bounds. I conclude by presenting a possible detection challenge, namely axion stars.

Presenter: Dr VISINELLI, Luca (Stockholm University and Nordita)

Session Classification: Session 9

Contribution ID: **174** Type: **Talk**

Enrico Schiappacasse (Institute of Cosmology - Tufts University): Axion Dark Matter Clump

Thursday, 22 February 2018 16:20 (14 minutes)

Recently there has been much interest in the spatial distribution of light scalar dark matter, especially axions, throughout the universe. When the local gravitational interactions between the scalar modes are sufficiently rapid, it can cause the field to re-organize into a Bose-Einstein condensate of gravitationally bound clumps. These clumps are stable when only gravitation is included, but the picture becomes more complicated when the presence of the axion's attractive self interactions is considered. We perform a detailed stability analysis to determine under what conditions the clumps are stable. We focus on spherical configurations, leaving aspherical configurations for future work. We identify branches of clump solutions of the axion-gravity-self-interacting system and study their stability properties. We find that clumps that are (spatially) large are stable, while clumps that are (spatially) small are unstable and may collapse. In both cases, there is a maximum number of particles which can be in a clump. The stable branch is mainly ruled by gravity and could comprise a significant component of dark matter in the galaxy. The unstable branch connects to a relativistic branch, which is quasi-stable because of the emission of relativistic axions. We clarify how a recent claim in the literature of a new ultra-dense branch of stable solutions rests on an invalid use of the non-relativistic approximation. We also consider repulsive self-interactions that may arise from a generic scalar dark matter candidate, finding a single stable branch that extends to arbitrary particle number. This may have interesting astrophysical consequences.

Presenter: Mr SCHIAPPACASSE, Enrico (Institute of Cosmology - Tufts University)

Session Classification: Session 9

Contribution ID: **175** Type: **Talk**

Ariel Zhitnitsky (University of British Columbia): Cosmological axion field and quark nugget dark matter model

Thursday, 22 February 2018 16:34 (14 minutes)

I overview the dark matter model offering a very natural explanation of two (naively unrelated) problems in cosmology: the observed relation $\Omega_{\rm DM} \sim \Omega_{\rm visible}$ and the observed asymmetry between matter and antimatter in the Universe, known as the "baryogenesis" problem. In this framework, both types of matter (dark and visible) have the same QCD origin, form at the same QCD epoch, and both proportional to one and the same dimensional parameter of the system, $\Lambda_{\rm QCD}$, which explains how these two, naively distinct, problems could be intimately related, and could be solved simultaneously within the same framework. I specifically want to review two recent papers:
1. long standing puzzle on the solar extreme UV radiation and quark nugget dark matter (JCAP 1710 (2017) no.10, 050, arxiv 1707. 03400)
2. CP odd axion field and the formation of the dark matter nuggets (Phys.Rev. D96 (2017) no.6, 063514, arxiv 1702.04354)

Presenter: ZHITNITSKY, Ariel (University of British Columbia)

Session Classification: Session 9

Contribution ID: **176** Type: **not specified**

Miguel Daal (UCSB): Light Bosonic Dark Dark Matter Search Using Microwave Kinetic Inductance Detectors (MKIDs)

Thursday, 22 February 2018 16:48 (14 minutes)

We describe a proposed small-scale direct detection experiment to search for dark matter in the form of vector bosons in the mass range 0.1 to 10 eV/c^2, i.e. dark photons. The experiment is designed so that dark photon absorption onto electrons would create quasi-particles in 2500 superconducting aluminum absorbers, which would all fit on a 4 inch wafer. The quasi-particles would be trapped and concentrated into MKIDs, allowing us to determine event energy, location and time. We will present estimates of the backgrounds and sensitivity for our sea-level experiment. We expect that the scientific reach is orders of magnitude below existing indirect constraints.

Presenter: DAAL, Miguel (UCSB)

Session Classification: Session 9

Contribution ID: **177** Type: **Talk**

Yevgeny Stadnik (Johannes Gutenberg University of Mainz): New Laboratory and Astrophysical Probes for Low-Mass Dark Matter and Dark Bosons

Thursday, 22 February 2018 17:02 (14 minutes)

Low-mass bosonic dark matter particles produced after the Big Bang may form an oscillating classical field, which can be sought for in a variety of low-energy laboratory experiments based on spectroscopic, interferometric and magnetometric techniques, as well as in various astrophysical phenomena. Dark bosons can also mediate anomalous fifth forces between ordinary-matter particles that can be sought for in laboratory experiments. Recent measurements in atoms and astrophysical phenomena have already allowed us to improve on existing constraints on various non-gravitational interactions between dark bosons and ordinary-matter particles by many orders of magnitude.

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[9] V. A. Dzuba, V. V. Flambaum, and Y. V. Stadnik, arXiv:1709.10009; Phys. Rev. Lett. (In press).

Presenter: STADNIK, Yevgeny (University of New South Wales)

Session Classification: Session 9

Contribution ID: **178** Type: **Talk**

Arran Phipps (Stanford University): Dark Matter Radio

Thursday, 22 February 2018 17:16 (14 minutes)

The Dark Matter Radio (DM Radio) is a sensitive search for sub-eV axion and hidden photon dark matter over a wide mass range. While Weakly Interacting Massive Particles (WIMPs) have been the primary focus of direct detection for several decades, there has been growing interest in searching for ultra-light-field candidates such as the hidden photon (spin 1 boson) and axion (spin 0 boson). DM Radio uses a superconducting, tunable lumped-element LC resonator with SQUID-based readout. I will discuss the motivation, detection strategy, status, and prospects for the DM Radio experiment and show the dark matter phase space that DM Radio will search over the next several years.

Presenter: PHIPPS, arran (Stanford University)

Session Classification: Session 9

Contribution ID: **180** Type: **Talk**

Dmitri Nanopoulos (TAMU): Starobinsky-like inflation, supercosmology and neutrini masses in no-scale flipped SU(5)

Thursday, 22 February 2018 12:19 (14 minutes)

Flipped SU(5) is embedded in a no-scale supergravity framework and discuss its predictions for cosmic microwave background observables which are Starobinsky-like, with a possible variation in the ratio r of the tensor to scalar perturbations. I'll discuss the model's predictions for neutrino masses,and show their dependence on the inflaton mass,thus correlating the heavy right-handed neutrino mass to the inflaton/inflatino one. Strong reheating is favored that leads,through supercosmology, to a GUT phase transition without excessive entropy production which could dilute the generated baryon asymmetry.

Presenter: NANOPOULOS, Dimitri (University of Texas (US))

Session Classification: Session 7

Contribution ID: **181** Type: **Talk**

Lina Necib (Caltech): Empirical Determination of the Dark Matter Velocity Distribution

Thursday, 22 February 2018 17:32 (14 minutes)

Using the hydrodynamic simulation Eris, we found that the kinematics of dark matter follows closely the kinematics of old metal poor stars, present in the Milky Way's stellar halo. We use this correspondence to obtain the first empirical measurement of the local velocity distribution of dark matter, by analyzing the Gaia data and computing the velocity distribution of metal poor stars. We find that this velocity distribution is peaked at lower velocities than the generally assumed Maxwell Boltzmann distribution, leading to a weakening of direct detection limits at dark matter masses less than 10 GeV by almost a factor of two. We also found a few kinematic outliers in the stellar data that might be hints of dark matter substructure.

Presenter: NECIB, Lina (MIT)

Session Classification: Session 10

Contribution ID: **182** Type: **Talk**

Tanja Rindler-Daller (U of Vienna): Growth of perturbations in a Universe with complex scalar-field dark matter

Thursday, 22 February 2018 18:28 (14 minutes)

There is great interest in scalar-field dark matter (SFDM) comprised of ultralight bosons, in which structure formation is supposed to be like standard CDM on large scales but suppressed on small scales by quantum effects. We study the case of complex SFDM, with a global U(1)-symmetry, for which the comoving boson number density is conserved after reheating when SFDM emerged. In addition, we include a repulsive boson self-interaction. In this scenario, SFDM can dominate the Universe before BBN, enhancing the expansion rate before and during radiation-domination, compared to LCDM. We will present our results on the growth of perturbations in such modified cosmology, with implications for the allowed parameter space of complex SFDM models.

Presenter: Dr RINDLER-DALLER, Tanja (Dept. of Physics, University of Michigan)

Session Classification: Session 10

Contribution ID: **183** Type: **Talk**

Paul Shapiro (U of Texas at Austin): Cosmology in a Universe with Complex Scalar-Field Dark Matter

Thursday, 22 February 2018 18:14 (14 minutes)

We consider an alternative to WIMP cold dark matter (CDM), ultralight bosonic dark matter (m ≥ 10ˆ(-22) eV) described by a complex scalar field (SFDM) with global U(1) symmetry, for which the comoving particle number density is conserved after particle production during standard reheating. We allow for a repulsive self-interaction. For complex SFDM, structure formation is CDM-like on large scales but suppressed on small-scales by quantum effects, just as in the case of a real scalar field. However, in the ΛSFDM universe, the background evolution of the complex field differs from that of the real field; complex SFDM starts relativistic, evolving from stiff (w=1) to radiationlike (w=1/3), before becoming nonrelativistic at late times (w=0). Thus, before the familiar radiation-dominated era, there is an earlier era of stiff-SFDM-domination, during which the expansion rate is higher than in ΛCDM. SFDM particle mass m and coupling strength λ, of a quartic self-interaction, are therefore constrained by cosmological observables, particularly N_eff, the effective number of neutrino species during BBN, and z_eq, the redshift of matter-radiation equality. Furthermore, since the stochastic gravitational-wave background (SGWB) from inflation is amplified during the stiff era, it can contribute a radiationlike component large enough to affect these observables by further boosting the expansion rate. Remarkably, this same amplification makes detection of the SGWB possible at high frequencies by current laser interferometer experiments, e.g., aLIGO/Virgo and LISA. For SFDM particle parameters that satisfy these cosmological constraints, the amplified SGWB is detectable by LIGO for a broad range of reheat temperatures T_reheat, for values of tensor-to-scalar ratio r currently allowed by CMB polarization measurements. The SGWB is maximally detectable if modes that reentered the horizon when reheating ended have frequencies today in the LIGO sensitive band. For r=0.01, if SFDM parameters are chosen which marginally satisfy the above constraints, the maximally detectable model for (λ/(mcˆ2)ˆ2, m)=(10ˆ(-18)eVˆ(-1)cmˆ3, 8×10ˆ(-20)eV) corresponds to T_reheat≈10ˆ4 GeV, for which we predict an aLIGO O1 run detection with SNR ˜ 10. Upper limits on the SGWB reported by aLIGO O1 already place a new kind of cosmological constraint on SFDM. A wider range of SFDM parameters and T_reheat should be accessible to aLIGO/Virgo O5. For r=0.01 and λ/(mcˆ2)ˆ2=10ˆ(-18)eVˆ(-1)cmˆ3, 3σ detection is predicted for 600 ≤ T_reheat(GeV) ≤ 10ˆ7 by O5.

Presenter: SHAPIRO, Paul (The University of Texas at Austin)

Session Classification: Session 10

Contribution ID: **184** Type: **Talk**

Patrick Stengel (Stockholm): Dark Matter and QCD-Charged Mediators in the Quasi-Degenerate Regim

Thursday, 22 February 2018 18:00 (14 minutes)

We study a scenario in which the only light new particles are a Majorana fermion dark matter candidate and one or more QCD-charged scalars, which couple to light quarks.This scenario has several interesting phenomenological features if the new particles are nearly degenerate in mass. In particular, LHC searches for the light scalars have reduced sensitivity, since the visible and invisible products tend to be softer. Moreover, dark matter-scalar co-annihilation can allow even relatively heavy dark matter candidates to be consistent thermal relics. Finally, the dark matter nucleon scattering cross section is enhanced in the quasi-degenerate limit, allowing direct detection experiments to use both spin-independent and spin-dependent scattering to probe regions of parameter space beyond those probed by the LHC. Although this scenario has broad application, we phrase this study in terms of the MSSM, in the limit where the only light sparticles are a bino-like dark matter candidate and light-flavored squarks.

Presenter: STENGEL, Patrick

Session Classification: Session 10

Contribution ID: **186** Type: **Talk**

Samuel Witte (U. of Valencia): Unified Halo-Independent Formalism for Direct Detection Experiments

Thursday, 22 February 2018 11:51 (14 minutes)

In this talk I will present a new halo-independent formalism for the analysis of direct dark matter detection experiments which proves that: either the dark matter speed distribution or the Galactic dark matter velocity distribution that maximizes any likelihood can always be expressed in terms of a small number of delta functions. The aforementioned proof, based on the Fenchel-Eggleston theorem for convex hulls, generalizes previously developed halo-independent analyses that, until recently, required the existence of an extended likelihood (i.e. unbinned data) and could only be applied to measurements of the unmodulated rate. Depending on if the best-fit halo function is unique, this result either allows for the construction of two-sided pointwise halo-independent confidence bands or a degeneracy band. Finally, I will show that enforcing isotropy in the Galactic frame leads to an unmodulated best-fit halo function that is piecewise linear, differing significantly from the unconstrained best-fit halo function.

Presenter: WITTE, Samuel (IFIC, University of Valencia)

Session Classification: Session 7

Contribution ID: **188** Type: **Talk**

Nigel Smith (Director, SNOLAB): Development of Deep Underground Facilities

Friday, 23 February 2018 19:30 (15 minutes)

Direct searches for dark matter candidates require deep underground research facilities and specialised low background infrastructure and associated capabilities. As the dark matter community develops ever more sensitive detectors, the requirements placed on deep underground facilities and these capabilities become even more stringent. This talk will review recent progress within deep underground facilities at providing these required research infrastructures, including the recent steps to provide greater coordination between the research facilities.

Presenter: SMITH, Nigel (SNOLab)

Session Classification: Session 18

Contribution ID: **189** Type: **Talk**

Andrew Renshaw (U. of Houston): URANIA and ARIA, Low radioactivity Argon for rare event searches

Friday, 23 February 2018 19:00 (15 minutes)

The DarkSide-50 two-phase liquid argon (LAr) detector has been searching for weakly interacting massive particle (WIMP) dark matter for more than three years, and during last two and a half years has been successfully operating the detector with argon that was extracted from underground CO_2 wells in Cortez, Colorado in the US. This source of argon has been long shielded from cosmic rays entering Earth's atmosphere, and thus has a lower concentration of the cosmogenically produced isotope of ^{39}Ar that beta decays with an endpoint energy that causes the beta spectrum to entirely cover the LAr WIMP search region. A 70-day exposure of the underground argon (UAr) inside DS-50 demonstrated that the UAr extracted from Colorado contains ^{39}Ar a factor >1000 less than atmospheric argon. This large reduction in ^{39}Ar opens the door for the construction of much larger LAr detectors that can be used for the direct detection of WIMP dark matter, as well as other rare-event searches. This talk will focus on the details of two new projects called Urania and Aria. Urania aims to extract 100 kg/day of UAr from the same source of gas as that used to extract the UAr for DS-50. Aria will then further purify the extracted UAr to produce >35 tonnes of detector grade UAr for use in a 20-tonne fiducial volume detector called DarkSide-20k, set to begin operations at the beginning of the next decade.

Presenter: RENSHAW, Andrew (U. of Houston)

Session Classification: Session 18

Contribution ID: **190** Type: **Talk**

Aldo Ianni (Director, Canfranc): Dark Matter program at the LSC and synergy between DULs

Friday, 23 February 2018 19:15 (15 minutes)

The activity on direct search for dark matter at the Laboratorio Subterraneo de Canfranc (LSC) is reviewed. At LSC, presently, ANAIS is in data taking to probe the DAMA/LIBRA longstanding result on annual modulation. The two-phase ton-scale liquid argon detector ArDM is in data taking. ArDM will turn into a crucial facility for DarkSide-20k by the end of 2018. More R&D activities are underway with TREX-DM, a high pressure gas TPC, and CLYC-N, an effort to characterize CLYC scintillators in the framework of dark matter direct search.
A discussion on synergy between Deep Underground Laboratory in the framework of LSC is presented.

Presenter: IANNI, Aldo (Canfranc)

Session Classification: Session 18

Contribution ID: **193** Type: **Talk**

Ben M Loer (PNNL): Prospects for Low Mass WIMP Searches with SuperCDMS

Friday, 23 February 2018 18:15 (15 minutes)

SuperCDMS is the premiere experimental search for low mass Weakly Interacting Massive Particle (WIMP) dark matter in the O(1 GeV) mass range. In this talk I will begin with a brief preview of new results on the way from the third and final run of high voltage detectors at Soudan laboratory. The majority of this talk will focus on the upcoming SuperCDMS SNOLAB and will describe the overall experiment design, improved detector technology for improved resolution and lower thresholds, current status and projected backgrounds and sensitivity.

Presenter: LOER, Ben (PNNL)

Session Classification: Session 17

Contribution ID: **194** Type: **Talk**

Luca Grandi (U. Chicago): XENONnT on the horizon

Friday, 23 February 2018 18:00 (15 minutes)

The XENON1T experiment is a search for dark matter, operating at Laboratori Nazionali del Gran Sasso since about one year and sensitive to possible rare interactions of dark matter particles with ordinary matter. The XENON1T experimental setup and infrastructure were designed to allow for a fast upgrade of its central detector, a two-phase xenon Time Projection Chamber (TPC). The XENONnT project, the next phase of the program, will feature a new TPC with an active target of ˜6 tonnes of xenon (4 tonne fiducial) and will implement a series of technological solutions aiming to further suppress the dominant background sources and boost the physics reach of the experiment. With all major infrastructures already commissioned and operated for its predecessor, XENONnT is expected to start the first physics run in the first half of 2019. I will guide you through the status of the proposed upgrade.

Presenter: GRANDI, Luca (The University of Chicago)

Session Classification: Session 17

Contribution ID: **198** Type: **Talk**

Manfred Lindner(MPI for Nuclear Phys. Heidelberg): DARWIN - towards the ultimate dark matter detector

Friday, 23 February 2018 18:30 (15 minutes)

The DARWIN project aims at a 50 ton ultimate liquid xenon dark matter detector and this talk will cover R&D efforts as well as the physics potential. DARWIN will search WIMPs in a wide mass-range until neutrino interactions become an irreducible background. It can search in addition for axions and for neutrinoless double-beta decay of 136-Xe. It can also measure the low-energy solar neutrino flux with high precision, observe coherent neutrino-nucleus interactions, and detect galactic supernovae.

Presenter: LINDNER, Manfred (Max Planck Institut fuer Kernphysik, Heidelberg, Germany)

Session Classification: Session 17

Contribution ID: **199** Type: **Talk**

Sven Vahsen (U. of Hawaii): Status of the CYGNUS Directional Dark Matter Detector Project

Friday, 23 February 2018 18:45 (15 minutes)

With WIMP-nucleon scattering limits approaching the neutrino floor, and coherent neutrino-nucleon scattering experimentally established, there is renewed interest in directional detectors as a means to penetrate the neutrino floor. The CYGNUS collaboration aims to deploy multiple gas Time Projection Chambers (TPCs) to accomplish this. I will review recent work carried out by the collaboration, including R&D on gas TPCs with negative ions drift and charge readout via micro pattern gaseous detectors, and a conceptual design study that compares the suitability of different technological approaches to a large-scale nuclear recoil observatory with sensitivity to both WIMP dark matter and neutrinos.

Presenter: VAHSEN, Sven (University of Hawaii (US))

Session Classification: Session 17

Contribution ID: **201** Type: **Poster**

Estella Barbosa de Souza (Yale U.): COSINE-100 simulation and background assessment

Wednesday, 21 February 2018 18:32 (1 minute)

The COSINE-100 experiment is a NaI(Tl) dark matter direct detection experiment, with the goal of testing DAMA's claim for dark matter detection by looking for an annual modulation signal. It has 8 NaI(Tl) crystals, adding to a total of 106 kg, and 2000 liters of a liquid scintillator veto. Located at the Yangyang Underground Laboratory, South Korea, COSINE-100 has been running since September 2016. The search for the annual modulation signal requires a complete understanding of the background signal and their time dependence. This can be achieved by conducting a complete simulation and modeling of detector's background, in addition to a study of the cosmogenic activation history of the crystals. In this poster, I will present details of the COSINE-100 simulation and background assessment, and the study of cosmogenic activated backgrounds.

Primary author: BARBOSA DE SOUZA, Estella (Yale U.)

Presenter: BARBOSA DE SOUZA, Estella (Yale U.)

Session Classification: Poster Session

Contribution ID: **203** Type: **Poster**

Irene Bolognino (INFN- Milano): Direct search of Dark Matter through the SABRE experiment

Wednesday, 21 February 2018 18:30 (1 minute)

The interaction rate of hypothesized dark matter particles in an Earth bound detector is expected to undergo an annual modulation due to the planet's orbital motion. The DAMA/LIBRA experiment has observed such a modulation with high significance in an array of scintillating NaI(Tl) crystals. This claim is still unverified inasmuch as the other experiments involved in this research use different dark matter targets and cannot be compared with DAMA/LIBRA in a model-independent way. The SABRE experiment seeks to provide a much-needed model-independent test of the DAMA/LIBRA modulation by developing highly pure NaI(Tl) crystal detectors with very low radioactivity and deploying them in an active veto detector that can reject key backgrounds in a dark-matter measurement. The final layout of SABRE will consist in a pair of twin detectors at LNGS (Laboratori Nazionali del Gran Sasso, Italy) and SUPL (Stawell Underground Physics Laboratory, Australia). The combined analysis of data sets from the two hemispheres will allow identifying any terrestrial contribution to the modulating signal. In this talk, the status report of the SABRE proof of principle activities at LNGS are presented together with the results of Monte Carlo simulations and the expected sensitivity.

Primary author: Dr BOLOGNINO, Irene (Dipartimento di Fisica Università degli Studi di Milano - INFN Sezione di Milano)

Presenter: Dr BOLOGNINO, Irene (Dipartimento di Fisica Università degli Studi di Milano - INFN Sezione di Milano)

Session Classification: Poster Session

Contribution ID: **204** Type: **Poster**

Jae Hyeok Chang (Stonybrook): Supernova 1987A Constraints on Low-Mass Dark Sectors

Wednesday, 21 February 2018 18:31 (1 minute)

Supernova 1987A provides strong constraints on dark-sector particles with masses below ˜100 MeV. If such particles are produced in sufficient quantity, they reduce the cooling time of the supernova, in conflict with observations. We consider the resulting constraints on dark photons, milli-charged particles, axions and sub-GeV dark matter coupled to dark photons. For the first time, we include the effects of finite temperature and density on the kinetic-mixing parameter, ε, in this environment. Furthermore, we estimate the systematic uncertainties on the cooling bounds by deriving constraints assuming one analytic and four different simulated temperature and density profiles of the proto-neutron star. Our constraints exclude novel parameter spaces for sub-GeV dark matter, and for dark photons and axions differs significantly from previous work in the literature.

Primary author: CHANG, Jae Hyeok (YITP, Stony Brook)

Presenter: CHANG, Jae Hyeok (YITP, Stony Brook)

Session Classification: Poster Session

Contribution ID: **205** Type: **Poster**

Seongjin In (Sungkyunkwan University, Korea): Solar Atmospheric Neutrino Searches with IceCube Neutrino Telescope

Wednesday, 21 February 2018 18:34 (1 minute)

Searches for dark matter annihilations in the Sun have resulted in some of the strongest bounds on the dark matter proton scattering cross section. Solar dark matter searches, however face an irreducible background from solar atmospheric neutrinos. We are presenting a search for solar atmospheric neutrinos conducted with the IceCube neutrino telescope to quantify this sensitivity floor. IceCube is the worlds largest neutrino telescope and optimized to detect high energy neutrinos. It is ideally suited to search for solar atmospheric neutrinos and flux might be observable with IceCube.Solar atmospheric neutrinos, generated when cosmic rays interact with the atmosphere, are expected to have distinguishable shape of energy spectrum with atmospheric neutrinos generated in the Earth. The difference originates from the lower atmospheric density on the Sun, which allows secondary particles to decay rather than interact with the medium and lose energy. As a result, the amount of the solar atmospheric neutrino can be larger than it of the atmospheric neutrinos at the Earth above TeV energy. In this presentation, the sensitivity to the solar atmospheric neutrino flux and a potential application to solar dark matter searches will be presented.

Primary author: IN, Seongjin (Sungkyunkwan University)

Presenter: IN, Seongjin (Sungkyunkwan University)

Session Classification: Poster Session

Contribution ID: **206** Type: **Poster**

Esteban Jimenez (Texas A&M U.): Dark Matter Relics and Scalar Tensor Theories

Wednesday, 21 February 2018 18:35 (1 minute)

The expansion rate of the universe had a strong influence on the origin of the dark matter abundance during the early stages of the universe's evolution, mainly prior to big-bang nucleosynthesis. Any departure of the expansion rate of the universe from the standard cosmological model during that time can modify the dark matter abundance. In this poster, I will show the role played by a scalar field on the modification of the expansion rate of the universe arising from scalar-tensor theories of gravity coupled both conformally and disformally to matter, and also, I will show how these variations to the expansion rate would modify the dark matter content of the Universe.

Primary author: JIMENEZ, Esteban (Texas A&M University)

Presenter: JIMENEZ, Esteban (Texas A&M University)

Session Classification: Poster Session

Contribution ID: **207** Type: **Poster**

Christopher Michael Karwin (UCI): Evidence for Extended Gamma-ray Emission Toward the Outer Halo of M31 from Fermi-LAT Observations

Wednesday, 21 February 2018 18:36 (1 minute)

The dark matter (DM) halo of M31 is predicted to extend to roughly 300 kpc from its center, and have a mass on the order of 10^{12} M_sun, which amounts to roughly 90% of the galaxy's total mass. The halo is also predicted to contain a large amount of substructure, a subset of which hosts M31's population of satellite dwarf galaxies. At a distance of about 785 kpc from the Milky Way (MW), the halo diameter covers over 30 degrees across the sky; however, there is significant uncertainty pertaining to the actual extent, geometry, and substructure content. To search for extended gamma-ray emission from M31's DM halo, we conduct an analysis of 91.4 months of Fermi-LAT observations of a 28^\circ\times28^\circ square region centered at M31, and we employ specialized GALPROP-based interstellar emission models to characterize the foreground gamma-ray emission from the MW. Significant excess emission is detected in the 3-20 GeV energy range, which extends outward to a projected radius of approximately 200 kpc from the center of M31. The spectral characteristics of the observed excess are roughly consistent with expectations for DM annihilation from M31. However, significant uncertainties remain, both observationally and in regards to modeling the DM halo. Our observations of M31 are presented.

Primary author: MICHAEL KARWIN, Christopher

Presenter: MICHAEL KARWIN, Christopher

Session Classification: Poster Session

Contribution ID: **209** Type: **Poster**

Jung-Tsung Li (UCSD): Neutrino Burst-Generated Gravitational Radiation From Collapsing Supermassive Stars

Wednesday, 21 February 2018 18:37 (1 minute)

We estimate the gravitational radiation signature of the electron/positron annihilation-driven neutrino burst accompanying the asymmetric collapse of an initially hydrostatic, radiation-dominated supermassive object suffering the Feynman-Chandrasekhar instability.
An object with a mass $5 \times 10^4 M_\odot < M < 5 \times 10^5 M_\odot$, with primordial metallicity, is an optimal case with respect to the fraction of its rest mass emitted in neutrinos as it collapses to a black hole: lower initial mass objects will be subject to scattering-induced neutrino trapping and consequently lower efficiency in gravitational radiation generation; while higher masses will not get hot enough to radiate significant neutrino energy before producing a black hole.
The optimal case collapse will radiate several percent of the star's rest mass in neutrinos and, with an assumed small asymmetry in temperature at peak neutrino production, produces a characteristic linear memory gravitational wave burst signature.
The timescale for this signature, depending on redshift, is ~ 1 s to 10 s, optimal for proposed gravitational wave observatories like DECIGO.
Using the response of that detector, and requiring a signal-to-noise ratio SNR > 5, we estimate that collapse of a $\sim 10^5 M_\odot$ supermassive star could produce a neutrino burst-generated gravitational radiation signature detectable to redshift z
$lesssim 3$.
With the envisioned ultimate DECIGO design sensitivity, we estimate that the linear memory signal from these events could be detectable with SNR > 5 to z
$lesssim 15$.

Primary author: LI, Jung-Tsung

Presenter: LI, Jung-Tsung

Session Classification: Poster Session

Contribution ID: **211** Type: **Poster**

Brandon Melcher (Syracuse): Concentrated Dark Matter: Enhanced Small-scale Structure from Co-Decaying Dark Matter.

Wednesday, 21 February 2018 18:38 (1 minute)

We study the cosmological consequences of co-decaying dark matter - a recently proposed mechanism for depleting the density of dark matter through the decay of nearly degenerate particles. A generic prediction of this framework is an early dark matter dominated phase in the history of the universe, that results in the enhanced growth of dark matter perturbations on small scales. We compute the duration of the early matter dominated phase and show that the perturbations are robust against washout from free-streaming. The enhanced small scale structure is expected to survive today in the form of compact micro-halos and can lead to significant boost factors for indirect detection experiments, such as FERMI, where dark matter would appear as point sources.

Primary author: MELCHER, Brandon

Presenter: MELCHER, Brandon

Session Classification: Poster Session

Contribution ID: **212** Type: **Poster**

Alissa Monte (UMass Amherst): Analysis of Alpha Events in DarkSide-50

Wednesday, 21 February 2018 18:39 (1 minute)

DarkSide-50 is the current phase of the DarkSide direct dark matter search program, operating underground at the Laboratori Nazionali del Gran Sasso in Italy. The
detector is a dual-phase argon Time Projection Chamber (TPC), designed for direct detection of Weakly Interacting Massive Particles, and housed within an active veto
system of liquid scintillator and water Cherenkov detectors. Since switching to a target of low radioactivity argon extracted from underground sources in April, 2015, the background is no longer dominated by naturally occurring Ar. However, alpha backgrounds from radon and its daughters remain, both from the liquid argon bulk and internal detector surfaces. I will present an analysis of alpha populations in the DarkSide-50 TPC, focusing on events from the uranium chain.

Primary author: MONTE, Alissa

Presenter: MONTE, Alissa

Session Classification: Poster Session

Contribution ID: **213** Type: **Poster**

Hee Jung Kim (KAIST): Self-heating dark matter via the semi-annihilation

Wednesday, 21 February 2018 18:40 (1 minute)

Although the freeze-out of the dark matter (DM) number density depends on the evolution of the DM temperature, their co-evolution remains largely unexplored; it is usually assumed that the DM and standard model (SM) sectors have the same temperature. On the other hand, when the DM particles pair-annihilate with one DM particle in the final state (semi-annihilate), there is no guarantee that the kinetic equilibrium between the DM and SM sectors is maintained. Assuming only the semi-annihilation and self-interaction of DM particles, I will illustrate the non-trivial co-evolution of DM temperature and number density, and give the possibility that the density fluctuations may be suppressed at the sub-galactic scales like keV-scale warm dark matter but with GeV-scale DM in this scenario.

Primary author: Mr KIM, Hee Jung (KAIST (Korea Advanced Institute of Science and Technology))

Presenter: Mr KIM, Hee Jung (KAIST (Korea Advanced Institute of Science and Technology))

Session Classification: Poster Session

Contribution ID: **214** Type: **Poster**

Quynh Lah Nguyen (Notre Dame): Constraints on Interacting Dark Matter from small scale structure

Wednesday, 21 February 2018 18:41 (1 minute)

The core-cusp problem remains as one of the unresolved challenges between observation and simulations in the standard ΛCDM model for the formation of galaxies. Basically, the problem is that ΛCDM simulations predict that the center of galactic dark matter halos contain a steep power- law mass density profile. However, observations of dwarf galaxies in the Local Group reveal a density profile consistent with a nearly flat distribution of dark matter near the center. A number of solutions to this dilemma have been proposed. We discuss the possibility that the dark matter particles themselves self interact and scatter. The scattering of dark matter particles then can smooth out their profile in high-density regions. We also summarize a theoretical model as to how self- interacting dark matter may arise. We implement this form in simulations of self-interacting dark matter in models for galaxy formation and evolution. Constraints on this form of self-interacting dark matter will be summarized.

Primary author: LAN NGUYEN, Quynh

Presenter: LAN NGUYEN, Quynh

Session Classification: Poster Session

Contribution ID: **216** Type: **Poster**

Kris Pardo (Princeton): Astrophysical and Cosmological Constraints on Dark Matter Emulators

Wednesday, 21 February 2018 18:42 (1 minute)

Several modified gravity theories have been proposed as attempts to explain dark matter. However, many of these dark matter emulators are unable to explain core phenomena of dark matter. We show that Verlinde's Emergent Gravity, a theory which reduces to MOND in the point mass limit, is unable to properly predict the rotation curves of isolated dwarf galaxies.
In addition, we use an analytic treatment to show that general dark matter emulators are unable to reproduce the observed baryonic acoustic oscillations.

Primary author: PARDO, Kris

Presenter: PARDO, Kris

Session Classification: Poster Session

Contribution ID: **217** Type: **Poster**

Tao Ren (UC Riverside): Diversity and Uniformity of Rotation Curves from Self-interacting Dark Matter Framework

Wednesday, 21 February 2018 18:43 (1 minute)

Rotation curves of galaxies have diverse behavior in the central regions, but they obey an organizing principle in that the rotation curves can be approximately described by a radial acceleration relation or the Modified Newtonian Dynamics (MOND) phenomenology. We show that both the diversity
and uniformity are naturally reproduced in a hierarchical structure formation model with the simple addition of self- interactions among dark matter particles. We explicitly demonstrate the presence of a radial acceleration relation in the SPARC sample of galaxies using the results of fits to rotation curves with the self-interacting dark matter (SIDM) model.
The inferred stellar mass-to-light ratios and the concentration-mass
relation of the outer halo are consistent with current constrains from
theoretical models and simulations.

Primary author: REN, Tao (UC Riverside)

Presenter: REN, Tao (UC Riverside)

Session Classification: Poster Session

Contribution ID: **218** Type: **Poster**

Ben Schlitzer (UC Davis): The Argon Response to Ionization and Scintillation Experiment

Wednesday, 21 February 2018 18:44 (1 minute)

The Argon Response to Ionization and Scintillation (ARIS) experiment was constructed to characterize the response of single-scatter nuclear and electronic recoils in liquid argon in support of experiments with a liquid argon target. A 0.5 kg active volume scintillation cell of liquid argon was exposed to the highly collimated and quasi-monoenergetic LICORNE neutron source at the Institute de Physique Nuclaire Orsay in Orsay, France. An array of liquid scintillator detectors was used to tag scattered neutrons and select nuclear recoil energies, with average energies between 7 and 118 keV measured. The relative scintillation efficiency of nuclear recoils was measured to high precision for both zero field and a range of applied electric fields. Results from the experiment will be presented.

Primary author: SCHLITZER, Ben

Presenter: SCHLITZER, Ben

Session Classification: Poster Session

Contribution ID: **219** Type: **Poster**

Gizem Sengor (Syracuse): An effective field theory approach to preheating

Wednesday, 21 February 2018 18:45 (1 minute)

reheating refers to the stage at the end of inflation where the inflation transfers its energy to other fields through resonance, as opposed to perturbative decays. We will demonstrate how these mechanisms can be captured in an EFT setting for the perturbations. While the form of the Lagrangian will resemble that of the EFT of quasi single field inflation, the behavior of the EFT functions during preheating are of course different then during inflation. Understanding the symmetries and scales of the preheating background and how they work into the EFT functions will lead us to ladder up the scales of certain interactions during preheating with respect to each other. This talk is based on work [hep-th]1701.01455.

Primary author: SEGNOR, Gizem

Presenter: SEGNOR, Gizem

Session Classification: Poster Session

Contribution ID: **220** Type: **Poster**

Mukul Sholapurkar (Stony Brook): Neutrino Backgrounds for the Direct-Detection of Sub-GeV Dark Matter

Wednesday, 21 February 2018 18:46 (1 minute)

The direct detection of sub-GeV dark matter has received increased interest in the last few years. Recent proposals for experimental ideas using dark matter electron scattering have opened up previously unexplored, but theoretically well-motivated, regions of parameter space. As these experiments increase their cross section reach and exposures, they will start to become sensitive to astrophysical neutrinos. The coherent scattering of neutrinos can mimic a dark matter signal, and for experiments without directional sensitivity, is indistinguishable from dark matter. We consider the effects of the coherent neutrino background in which the neutrino scatters off of the nucleus for dark matter-electron scattering experiments. In particular, we calculate the dark matter-electron scattering cross section sensitivities for silicon, germanium and xenon targets at exposures ranging from 1-1000 kg-years assuming a solar neutrino-only background. We find that the neutrino background is negligible in semiconductors for exposures less than 1 kg-year, but become important at higher exposures. These findings show that the neutrino background is not a concern for experiments like SENSEI or DAMIC, but will have contributions to SuperCDMS

Primary author: SHOLAPURKAR, Mukul (Stony Brook University)

Presenter: SHOLAPURKAR, Mukul (Stony Brook University)

Session Classification: Poster Session

Contribution ID: **222** Type: **Poster**

William Thompson (Yale): Monitoring System and Data Stability of COSINE-100

Wednesday, 21 February 2018 18:47 (1 minute)

COSINE-100 is a direct detection dark matter experiment consisting of 106 kg of low-background NaI(Tl) detectors located at the Yangyang Underground Laboratory in Korea. One of the primary physics goals of COSINE-100 is to search for a WIMP-induced annual modulation signal to confirm or refute DAMA/LIBRA's claim of dark matter discovery. The search for an annual modulation signal requires a thorough understanding of time-dependent environmental effects and data stability. To measure environmental effects over time, COSINE-100 has developed a monitoring system to keep track of operating conditions, such as temperature, radon levels, and muon rates. Here, I will present the COSINE-100 monitoring system and discuss the achieved stability of COSINE-100 data.

Primary author: THOMPSON, William (Yale University)

Presenter: THOMPSON, William (Yale University)

Session Classification: Poster Session

Contribution ID: **223** Type: **Poster**

Thomas Thorpe (University of Hawaii): A Prototype Directional Dark Matter Detector

Wednesday, 21 February 2018 18:49 (1 minute)

As direct dark matter detectors become larger, and gain sensitivity, they will start detecting neutrinos via coherent scattering with their target nuclei. The most powerful way to discriminate neutrino from dark matter scattering, amongst other backgrounds, is to measure the direction of the nuclear recoils and use this information to reconstruct the source location, a so-called directional detector. As part of the CYGNUS collaboration, which is aimed at constructing large directional detectors, our group is operating a small prototype. The prototype is a Negative Ion Time Projection Chamber (NITPC) with GEM amplification and, eventually, HD pixel readout will be installed. Such a design would allow for 3-D tracking with powerful background suppression and could serve as "unit-cell"for a large, future, directional detector.

Primary author: THORPE, Thomas

Presenter: THORPE, Thomas

Session Classification: Poster Session

Contribution ID: **224** Type: **Poster**

Jennifer Rittenhouse West (UCI): The Cosmological Fate of SU(3)_C x U(1)_EM (based on https://arxiv.org/abs/1711.04534)

Wednesday, 21 February 2018 18:50 (1 minute)

An investigation into the signatures of breaking the symmetry of the current group structure of Nature in order to determine the fate of the strong and electromagnetic forces as the Universe expands and cools from 2.7 K to 0 K. A spontaneous symmetry breaking (SSB) is considered and constraints upon the scalar fields charged under SU(3)_C and U(1)_EM are discussed. For the usual Higgs mechanism, U(1)_EM is found to be a long range force for the rest of the lifetime of the Universe. The strong force is tested for complementarity but its fate is left open, although there are indications it will remain unbroken.

Primary author: WEST, Jennifer Rittenhouse

Presenter: WEST, Jennifer Rittenhouse

Session Classification: Poster Session

Contribution ID: **225** Type: **Poster**

Ziping Ye (University of Houston): Neutrino Detection in DarkSide-20k

Wednesday, 21 February 2018 18:51 (1 minute)

The core detector of the now planned DarkSide-20K experiment is a two-phase liquid argon time projection chamber (LAr TPC) with 20 tons fiducial mass. It is designed to register possible nuclear recoil events due to rare scattering of dark matter particles and atomic nuclei, and is located deep underground at Gran Sasso National Lab (LNGS) in Italy. DarkSide-20K can achieve background free rare event searches thanks to the following features: a cosmic ray muon veto, a neutron veto, low-radioactivity argon in the TPC, pulse shape discrimination between nuclear recoil and electron recoil, 3D coordinate reconstruction and silicon photomultiplier- based photodetectors. It is thus ideal for weakly interacting massive particle (WIMP) dark matter searches. As a bonus, it is also very promising for studying neutrinos. Neutrino-nucleus coherent scattering would produce nuclear recoils with energies similar to collisions from dark matter particles, however, its relatively large cross section allows a relatively small detector compared to normal neutrino detectors. Our studies show that DarkSide-20K could uniquely contribute to the detection of supernova burst neutrinos, diffuse supernova and stellar neutrinos, solar neutrinos, and other sources of neutrinos. Besides the importance of detecting these various types of neutrinos for study, detecting neutrinos in the DarkSide-20K defines the neutrino floor for WIMP dark matter searches.

Primary author: YE, Ziping

Presenter: YE, Ziping

Session Classification: Poster Session

Contribution ID: **226** Type: **Poster**

Jingqiang Ye (UC San Diego): XENON1T Dark Matter Search Experiment

Wednesday, 21 February 2018 18:52 (1 minute)

The XENON1T Experiment uses a liquid xenon Time Projection Chamber to search for Nuclear Recoils (NR) caused by hypothesized Weakly Interacting Massive Particles (WIMPs). The detector can get both scintillation signal and charge signal, and reject most Electronic Recoils background by utilizing the difference in the ratio of charge signal and scintillation signal. I will present the experimental setup, and dark matter search results obtained from the first 34.2 days of data. In addition, I will present the study of the position reconstruction and field distortion corrections that lead to an improved analysis for the new dark matter search data.

Primary author: YE, Jingqiang

Presenter: YE, Jingqiang

Session Classification: Poster Session

Contribution ID: **227** Type: **Poster**

Chiara Pancaldo Salemi (MIT): ABRACADABRA, A Search for Low-Mass Axion Dark Matter

Wednesday, 21 February 2018 18:53 (1 minute)

ABRACADABRA, A Broadband/Resonant Approach to Cosmic Axion Detection with an Amplifying B-field Ring Apparatus, is an experiment that searches for ultra-light axion and axion-like dark matter in the mass range $10^{-14} - 10^{-6}$ eV. It uses a toroidal magnet to source an oscillating effective electric current from interactions with the axion field. This current is then detected and amplified with a SQUID magnetometer. Axions' tiny electromagnetic coupling means that the experiment must be highly sensitive and have minimal background noise. This talk will present the current status of the first generation of the experiment, ABRACADABRA-10cm.

Primary author: SALEMI, Chiara (Massachusetts Institute of Technology)

Presenter: SALEMI, Chiara (Massachusetts Institute of Technology)

Session Classification: Poster Session

Contribution ID: **228** Type: **Poster**

Jagjit Singh Sidhu (CASE): Novel Macroscopic Dark Matter (Macro) Detection Schemes

Wednesday, 21 February 2018 18:54 (1 minute)

Macroscopic objects made of baryonic matter with sizable strangeness (i.e. many of the valence quarks are strange quarks, rather than the usual up and down quarks found in protons and neutrons) may be stable, and may have formed prior to nucleosynthesis [1][2] thus evading the principal constraint on baryonic dark matter. We have analyzed the expected signals that would be produced from the passage of macroscopic dark matter (macros) through the atmosphere and sedimentary rock. Fluorescence detectors (FD) such as those of Pierre Auger Observatory and JEM-EUSO could detect the light produced from the recombination of the resulting plasma in the atmosphere. This could involve hardware or software changes to the trigger. The tracks of metamorphic rock (fulgurites) that macros would leave in passing through sedimentary rock could be distinguished from the surrounding sedimentary rock. We present the regions of parameter space that could be probed from the expected atmospheric fluorescence and fulgurite tracks.

Primary author: SINGH SIDHU, Jagjit (CWRU)

Presenter: SINGH SIDHU, Jagjit (CWRU)

Session Classification: Poster Session

Contribution ID: **229** Type: **Poster**

Jamin Rager (UNC): An Update on the Bosonic Dark Matter Search with the MAJORANA DEMONSTRATOR

Wednesday, 21 February 2018 18:55 (1 minute)

The MAJORANA DEMONSTRATOR is a neutrinoless double-beta decay experiment operating at the 4850' level of the Sanford Underground Research Facility that uses modular arrays of enriched, 76Ge detectors in an ultra-low background environment. The DEMONSTRATOR has a low energy program that is capable of probing a variety of exotic keV-scale physics; it has recently produced limits on generic bosonic dark matter that come in two weakly coupling varieties, vector and pseudoscalar (axion-like). These particles would manifest as low energy peaks at their rest mass in the detector spectrum. I describe recent efforts in the MAJORANA DEMONSTRATOR's ongoing bosonic dark matter campaign, specifically improving the limits on the relevant coupling parameters.

Primary author: RAGER, Jamin (University of North Carolina - Chapel Hill)

Presenter: RAGER, Jamin (University of North Carolina - Chapel Hill)

Session Classification: Poster Session

Contribution ID: **230** Type: **Poster**

Field Rose Rogers (MIT): Searching for Antinucleon Signatures of Dark Matter in Cosmic Rays with GAPS

Wednesday, 21 February 2018 18:56 (1 minute)

GAPS is the first experiment optimized primarily to detect low-energy cosmic antideuterons and antiprotons. Any observation of low-energy antideuterons would indicate new physics because the expected flux of such particles from conventional astrophysics is extraordinarily small. Meanwhile, low-energy antiprotons can be used to probe cosmic-ray propagation models, and with sensitivity to both antiprotons and antideuterons, GAPS will be able to probe previously unexplored dark matter parameter space. The GAPS experimental program consists of several long-duration balloon flights from Antarctica, with the first flight scheduled by NASA for December 2020. The detector consists of layered planes of lithium-drifted Silicon (Si(Li)) detectors surrounded by a plastic scintillator time-of-flight, which are used for a novel particle identification technique based on exotic atom capture and decay, making GAPS sensitive to antinuclei in an unprecedentedly low energy range (<.25GeV/n). I present here the design and status/schedule of GAPS, in particular the Si(Li) detectors that lie at the heart of the experimental design.

Primary author: ROGERS, Field Rose (Yale University (US))

Presenter: ROGERS, Field Rose (Yale University (US))

Session Classification: Poster Session

Contribution ID: **231** Type: **Talk**

Omar Moreno (SLAC): First Results from the Heavy Photon Search

Friday, 23 February 2018 14:45 (15 minutes)

The Heavy Photon Search (HPS) experiment at Jefferson Lab is searching for a new U(1) vector boson (”heavy photon”, “dark photon” or A’) in the mass range of 20-500 MeV/c2. An A’ in this mass range is theoretically favorable and may also mediate dark matter interactions. The A’ couples to the ordinary photon through kinetic mixing, which induces its coupling to electric charge. Since heavy photons couple to electrons, they can be produced through a process analogous to bremsstrahlung, subsequently decaying to an e+e− pair, which can be observed as a narrow resonance above the large QED trident background. For suitably small couplings, heavy photons travel detectable distances before decaying, providing a second signature. Using the CEBAF electron beam at Jefferson Lab incident on a thin tungsten target, along with a compact, large acceptance forward spectrometer consisting of a silicon vertex tracker and lead tungstate electromagnetic calorimeter, HPS is accessing unexplored regions in the mass-coupling phase space.

The HPS engineering run took place in spring of 2015 using a 1.056 GeV, 50 nA beam and collected 1165 nb−1 (7.29 mC) of data. This talk will present the results of a resonance search for a heavy photon using the engineering run data.

Presenter: MORENO, Omar (SLAC National Accelerator Laboratory)

Session Classification: Session 14

Contribution ID: **232** Type: **Poster**

Omar Moreno (SLAC): The Light Dark Matter eXperiment

Wednesday, 21 February 2018 18:33 (1 minute)

The Light Dark Matter eXperiment (LDMX) proposes a high-statistics search for low- mass dark matter in fixed-target electron-nucleus collisions. Ultimately, LDMX will explore thermal relic dark matter over most of the viable sub-GeV mass range to a decisive level of sensitivity. To achieve this goal, LDMX employs the missing momentum technique, where electrons scattering in a thin target can produce dark matter via "dark bremsstrahlung"giving rise to significant missing momentum and energy in the detector. To identify these rare signal events, LDMX individually tags incoming beam-energy electrons, unambiguously associates them with low energy, moderate transverse-momentum recoils of the incoming electron, and establishes the absence of any additional forward-recoiling charged particles or neutral hadrons. LDMX will employ low mass tracking to tag incoming beam-energy electrons with high purity and cleanly reconstruct recoils. A high-speed, granular calorimeter with MIP sensitivity is used to reject the high rate of bremsstrahlung background at trigger level while working in tandem with a hadronic calorimeter to veto rare photonuclear reactions. This talk will summarize the small-scale detector concept for LDMX, ongoing performance studies, and near future prospects.

Presenter: MORENO, Omar (SLAC National Accelerator Laboratory)

Session Classification: Poster Session

Contribution ID: **233** Type: **Poster**

Xinran Li (Princeton): Study on CMOS imaging detector for the search of neutrinoless double β decay in ^{82}Se

Wednesday, 21 February 2018 18:48 (1 minute)

The observation of a neutrinoless double β decay branching ratio is the only known test if neutrinos are Majorana fermions. While one of the isotope, ^{82}Se, being a double β decay candidate, amorphous selenium have been used as X-ray detector for medical imaging for decades. In this work, a high-resolution solid state a-Se imaging detector based on CMOS technology is proposed, which presents great background rejection power and the feasibility to build large scale detector. Currently, experiments are being carried out to demonstrate that a-Se detector could reach the proposed performance, especially the average electron-hole pair production energy and the Fano factor from MeV β ionization under large biasing field.

Presenter: LI, Xinran (Princeton University)

Session Classification: Poster Session

Contribution ID: **234** Type: **Poster**

Daniel Gilman (UCLA): Probing dark matter with flux ratios from multiply imaged quasars

Wednesday, 21 February 2018 18:57 (1 minute)

The properties of the dark matter particle(s), including its mass and self interactions, affect the abundance and density profiles of dark matter substructure with viral masses below 10ˆ9 solar masses. When these halos impinge on the multiple images in strong gravitational lenses, they perturb image magnifications significantly. To connect this observable to populations of dark matter halos and subhalos, we present a statistical method that relies on forward modeling image magnifications in strong lenses to measure the subhalo mass function. We apply this technique to a warm dark matter scenario, in which free streaming suppresses the subhalo mass function below a characteristic scale that depends on the dark matter particle mass. With our method, we project 2 sigma lower bounds on the mass of thermal relic particles, and quantify the modeling and observation precision required to perform the measurement. A sample of 180 systems with 4% uncertainties on image fluxes constrains the thermal relic mass to > 4.5 keV for projected mass fractions in substructure at the Einstein radius of 0.4%. With a higher mass fraction of 2%, the bound on the free streaming scale improves to 6.5 keV with only 80 lenses. In the coming years, data from strong lenses will push tests of the fundamental predictions of cold dark matter to increasingly small scales.

Presenter: GILMAN, Daniel (UCLA)

Session Classification: Poster Session

Contribution ID: **235** Type: **Poster**

Christopher Kelso (U of North Florida): Directly detecting Isospin-Violating Dark Matter

Wednesday, 21 February 2018 18:58 (1 minute)

We consider the prospects for multiple dark matter direct detection experiments to determine if the interactions of a dark matter candidate are isospin-violating. We focus on theoretically well-motivated examples of isospin-violating dark matter (IVDM), including models in which dark matter interactions with nuclei are mediated by a dark photon, a Z, or a squark. We determine that the best prospects for distinguishing IVDM from the isospin-invariant scenario arise in the cases of dark photon- or Z-mediated interactions, and that the ideal experimental scenario would consist of large exposure xenon- and neon-based detectors. If such models currently just evade current direct detection limits, then one could distinguish such models from the standard isospin-invariant case with two detectors with of order 100 ton-year exposure.

Presenter: KELSO, Christopher (U of North Florida)

Session Classification: Poster Session