9th SYMPOSIUM ON LARGE TPCs FOR LOW-ENERGY RARE EVENT DETECTION

Wednesday, 12 December 2018 - Friday, 14 December 2018

Diderot University

Book of Abstracts

Contents

1

Study and mitigation of spurious electron emission from cathodic wires in noble liquid time projection chambers

Author: Alfredo Tomas Alquezar[1]

Co-authors: Henrique Araujo [1]; Adam Bailey [2]; Timothy Sumner [1]; Brais Lopez Paredes [1]; Adrian Bayer ; Eunice Chen

[1] *Imperial College London*

[2] *Univ. of Valencia and CSIC (ES)*

Corresponding Authors: t.sumner@imperial.ac.uk, adam.bailey@cern.ch, a.tomas@imperial.ac.uk, h.araujo@imperial.ac.uk

Noble liquid radiation detectors have long been afflicted by spurious electron emission from their cathodic electrodes. This phenomenon must be understood and mitigated in the next generation of liquid xenon (LXe) experiments searching for WIMP dark matter or neutrinoless double beta decay, and in the large liquid argon (LAr) detectors for the long-baseline neutrino programmes. We present a systematic study of this spurious emission involving a series of slow voltage-ramping tests on fine metal wires immersed in a two-phase xenon time projection chamber with single electron sensitivity. Emission currents as low as 10^{-18} A can thus be detected by electron counting, a vast improvement over previous dedicated measurements. Emission episodes were recorded and observed to have complex emission patterns with outbreaks as high as $\sim 10^6$ c/s for some wires and also fainter, less variable type of emission. We find no evidence for an intrinsic threshold particular to the metal-LXe interface which might have limited previous experiments up to fields of at least 160 kV/cm and we confirmed that the choice of wider wires to reduce the field do not help to mitigate the emission. The general phenomenology is not consistent with enhanced field emission from microscopic filaments, but it appears instead to be related to the quality of the wire surface in terms of corrosion and the nature of its oxide layer. This study concludes that some surface treatments, in particular nitric acid cleaning applied to stainless steel wires, can bring about at least order-of-magnitude improvements in overall electron emission rates; this strategy has been undertaken for the production of the grids of the LUX-ZEPLIN detector grids.

2

Registration

3

Welcome and Introduction

Corresponding Author: kouchner@apc.univ-paris7.fr

4

Review on neutrino physics

Corresponding Author: petcov@sissa.it

5

R2D2 a novel double beta decay experiment

Corresponding Author: anselmo.meregaglia@cern.ch

6

Status of the NEXT project

Corresponding Author: lior.arazi@cern.ch

7

DBD2

8

PANDA-X TPC DBD

9

NE-Long base1

10

Topology of neutrino-less double beta decay on the PandaX-III experiment

Corresponding Author: javier.galan.lacarra@cern.ch

11

Future accelerators for neutrino physics

Corresponding Author: alain.blondel@cern.ch

12

Ne-long base2

13

Ne-long base3

14

QPix: Pixel-scale Signal Capture For Kiloton Liquid Argon TPC Detectors: Charge-Quantized Waveform Capture, Free-running Clocks, Dynamic Networks

Corresponding Author: yuan.mei@gmail.com

15

Upgrade of the T2K ND280 TPC

Corresponding Author: collazuol@fi.infn.it

16

Status of the LZ experiment

Corresponding Author: aldenfan@stanford.edu

17

Proportional Scintillation in Single Phase LXe TPCs

Corresponding Author: kgiboni@sjtu.edu.cn

18

Progress of the Picosec Micromegas concept towards a robust particle detector with segmented readout

Corresponding Author: lukas.sohl@cern.ch

19

Sphere1

20

Sphere2

21

The nEXO double-beta decay experiment

Corresponding Author: gratta@hep.stanford.edu

22

Dark Matter or Vivid Force

Authors: Gh Saleh[1]; Mohammad Javad Faraji[1]; Reza Alizadeh[1]; Asghar Dalili[1]

[1] *Saleh Research Centre*

Corresponding Author: postmaster@saleh-theory.com

We must know that everything we can't see or feel, we cannot say that it does not exist. And everything we see or feel, we can't always tell what or how it is made.
The mass, by definition, is a measure of resistance of an object to acceleration when a force is applied.
And, in principle, the mass occupies space and it is there where the force takes effect. Given what has been said, Dark Matter does not meet the definition of mass. Because it is everywhere but we can't find it. Indeed, what is called Dark Matter is an illusionary definition that must be corrected. Actually there is no Dark Matter, but rather a Vivid Force whose effect holds the structure of galaxies. According to the current theory the Dark Matter effect exists everywhere but it cannot be seen, so it is a force and not a mass. It is called Dark because the science has no knowledge about its nature; the one that we are going to explain and that we can call the Vivid Force. This force is originally created by the difference of a speed at the edge of the Universe and the speed inside the universe. A difference that generates a force toward the center like a vortex. This definition is better suited for galaxy consistency.
The enormous difference between the speed at the edges of the Universe and the speed at the supposed center of the Universe causes a vortex force. This same force creates a rotation and a force inward; like a vortex that turns and pushes everything in the center of the rotation. So what is called Dark Matter is only a Vivid Force that is generated from the difference in the speed of rotation of celestial objects at the edge of the Universe and those that rotate near its supposed center.

23

Dark atom solution for puzzles of direct dark matter searches

Author: Maxim Khlopov[1]

[1] *APC/MEPHI*

Corresponding Author: khlopov@apc.univ-paris7.fr

The puzzles of direct dark matter searches can find solution in the model of dark atoms, containing stable -2 charged lepton-like heavy particle bound by ordinary Coulomb interaction with primordial helium 4 nuclei. Specific properties of this nuclear interacting dark matter can explain positive results of DAMA/NaI and DAMA/LIBRA experiments and negative results in cryogenic and heavy nuclei (like xenon) detectors. Open questions of dark atom nuclear inetraction with matter are discussed.

24

Status of the NEXT project

Author: Lior Arazi[1]

[1] *Weizmann Institute of Science*

Corresponding Author: lior.arazi@weizmann.ac.il

We will discuss the status of the NEXT project including a summary of the recent results obtained with the NEW demonstrator and an overview of the plans for NEXT-100 and beyond.

25

Review on directional dark matter detection

Corresponding Author: daniel.santos@lpsc.in2p3.fr

26

Muon Tomography with Micromegas: Archaeology, Nuclear Safety and new developments for Geotechnics

Corresponding Author: hector.gomez@cern.ch

27

DarkSide: the quest for dark matter with liquid argon

Corresponding Author: claudio.giganti@cern.ch

28

Optical readout of GEM-based TPCs: ultra-fast optical readout and transparent readout anodes

Author: Florian Maximilian Brunbauer[1]

Co-authors: Dorothea Pfeiffer [2]; Eraldo Oliveri [2]; Francisco Ignacio Garcia Fuentes [3]; Leszek Ropelewski [2]; Michael Lupberger [2]; Miranda Van Stenis [2]; Patrik Thuiner [2]

[1] *CERN, Vienna University of Technology (AT)*

[2] *CERN*

[3] *Helsinki Institute of Physics (FI)*

Corresponding Authors: michael.lupberger@cern.ch, leszek.ropelewski@cern.ch, florian.maximilian.brunbauer@cern.ch, francisco.garcia@cern.ch, dorothea.pfeiffer@cern.ch, eraldo.oliveri@cern.ch, patrik.thuiner@cern.ch, miranda.van.stenis@cern.ch

The high signal amplification factors achievable by multi-layer amplification stages of Gaseous Electron Multipliers (GEMs) and the possibility to record scintillation light emitted during avalanche multiplication with high-granularity imaging sensors makes optical readout of GEM-based detectors an attractive technology for Time Projection Chambers (TPCs). Optically read out GEM-based TPCs have been shown to allow three dimensional (3D) track reconstruction of alpha particles and

are used in nuclear physics studies as well as rare-event applications.
Previously, this readout concept relied on auxiliary photon detectors such as PhotoMultiplier Tubes (PMTs) to provide timing information needed to augment 2D particle track images with depth information to achieve full 3D track reconstruction. Thus, this reconstruction approach was limited to straight trajectories such as alpha particle tracks. To overcome this limitation, we have studied two novel readout approaches allowing 3D track reconstruction: combined optical and electronic readout as well as ultra-fast optical readout.
Combining optical and electronic readout by using a segmented, optically transparent anode below a triple-GEM stack at the endcap of a TPC, 3D reconstruction of intricate particle tracks was achieved without the need for a PMT as auxiliary photon detector. An ITO-based strip anode plane was manufacture by direct laser lithography and etching techniques. Electronic signals were read out from this anode with an APV25 ASIC. The arrival time of electronic signals provided depth of interaction information. Detailed integrated 2D images corresponding to the XY-projections of particle tracks were recorded optically by a camera located below the triple-GEM stack. The visible scintillation light emitted in an Ar/CF₄ gas mixture during electron avalanche multiplication was passing through the ITO-based anode before being recorded by the camera. By combining the 2D information provided by the recorded images with Z-coordinate information extracted from signal arrival times obtained with electronic readout, complex trajectories could be reconstructed in 3D.
While the low frame rate of imaging sensors has previously been a limiting factor for optical readout, modern ultra-high-speed CMOS cameras permit imaging at up to one million frames per second at reduced resolution. Corresponding to microsecond-scale inter-frame time intervals, this permits recording a sequence of images for a single event in a TPC with a low drift velocity. Track segments at different depths are recorded in different frames and together with a known charge carrier drift velocity, the inter-frame interval can be used to determine relative depth information of particle track segments. We have demonstrated that ultra-fast CMOS cameras can be used for 3D track reconstruction of alpha particle tracks. This provides an unprecedented readout modality for TPCs and may allow the reconstruction of intricate events without the need for auxiliary timing detectors or complex reconstruction algorithms. In addition, this readout approach may be especially attractive for negative ion TPCs due to the lower drift velocities.

29

A new neutrinoless double beta decay experiment: R2D2

Corresponding Author: anselmo.meregaglia@cern.ch

30

Study and mitigation of spurious electron emission from cathodic wires in noble liquid time projection chambers

Corresponding Author: a.tomas@imperial.ac.uk

31

Results from the 1 tonne*year Dark Matter Search with XENON1T

Authors: Carla Macolino[1]; on behalf of the XENON collaboration[None]

[1] *LAL - Orsay*

Corresponding Author: macolino@lal.in2p3.fr

XENON1T is the world's largest and most sensitive detector for direct dark matter search in the form of Weakly Interacting Massive Particles (WIMPs). The detection principle is based on a double-phase

TPC (Time Projection Chamber), using about 2 tonnes of Xenon.
In this talk the latest results from the experiment, after collecting an exposure of 1.0 tonne x year, are discussed. The data are consistent with the expected background and correspond to the most stringent limit on spin-independent interactions of WIMPs with ordinary matter for a WIMP mass higher than 6 GeV/c^2.

33

The sparkless read-out of the NEWS-G spherical detector

Corresponding Author: ioannis.katsioulas@cern.ch

34

Results from the 1 tonne*year Dark Matter Search with XENON1T

Corresponding Author: macolino@lal.in2p3.fr

35

Optical readout of GEM-based TPCs: ultra-fast optical readout and transparent readout anodes

Corresponding Author: florian.maximilian.brunbauer@cern.ch

36

Lunch

37

Dark atom solution for puzzles of direct dark matter searches

Corresponding Author: khlopov@apc.univ-paris7.fr

38

Review on axions as dark matter

39

Low energy muon reconstruction in micro-BooNE

40

Status of protoDUNE single phase

Corresponding Author: maura.spanu@cern.ch

41

Status of protoDUNE double phase

Corresponding Author: jdawson@in2p3.fr

42

T2K TPC performance

Corresponding Author: emilio.radicioni@cern.ch

43

Beam test of ARIADNE, a liquid argon TPC with optical read-out

Corresponding Author: k.mavrokoridis@cern.ch

44

Low BG TPC for direction-sensitive dark matter search

Corresponding Author: miuchi@phys.sci.kobe-u.ac.jp

45

Gamma ray polametry in astrophysics

Corresponding Author: denis.bernard@in2p3.fr

46

Status of Baby-IAXO to search for solar axions

Corresponding Author: theopisti.dafni@cern.ch

47

Review of NEWS-G Dark Matter searches and related projects

Corresponding Author: squirrelgui@gmail.com

48

Recent developments on the NEWS-G spherical proportional counter sensors

Corresponding Author: ioannis.katsioulas@cern.ch

49

Global analysis of oscillation parameters

Corresponding Author: antonio.marrone@ba.infn.it

50

CYGNO: directional Dark Matter search with optical readout

Author: Elisabetta Baracchini[1]

[1] *Gran Sasso Science Institute*

Corresponding Author: elisabetta.baracchini@lnf.infn.it

We are going to present the project for CYGNO, a 1kg gaseous TPC Dark Matter directional experiment, to be hosted at Laboratori Nazionali del Gran Sasso. CYGNO (a CYGNus TPC with Optical readout) fits into the context of the wider CYGNUS collaboration, for the development of a Galactic Nuclear Recoil Observatory at the ton scale with directional sensitivity. The most innovative CYGNO's features will be the exploitation of sCMOS cameras and PMTs, coupled to GEMs amplification of an He:CF4 gas mixture at atmospheric pressure. Compared to other optical approaches, these choices provide an improved signal/noise ratio, thanks to the 1-2 e-/pixel noise of sCMOS and high GEMs gains, combined with full 3D reconstruction, including head-tail, exploiting the large PMT signals. We will discuss the results of the Italian R&Ds with a 10 L detector prototype, demonstrating 3D tracking and background discrimination capabilities for O(100) keV nuclear and electron recoils, with O(100) um spatial resolution over 20 cm drift distance. We will conclude with the foreseen CYGNO-1kg experiment performances and preliminary sensitivity.

51

Short baseline neutrino experiments at FNAL

Corresponding Author: antonio.ereditato@cern.ch

52

A low-background Micromegas detector for IAXO and BabyIAXO

Corresponding Author: elisa.ruiz.choliz@cern.ch

53

Status of low mass WIMP detector TREX-DM

Corresponding Author: h.mirallas@cern.ch

55

Gas properties characterization for the NEWS-G detector

Corresponding Author: philippe.gros@gmail.com

56

Gas and copper purity investigations for the NEWS-G detector

Corresponding Author: prk313@student.bham.ac.uk

57

Progress on barium tagging for NEXT

Corresponding Author: ben.jones@uta.edu

58

Developments for spherical single phase LXe TPCs

Author: Hiroyuki Sekiya[1]

[1] *University of Tokyo*

Corresponding Author: sekiya@icrr.u-tokyo.ac.jp

Until today, the most established detector which uses noble liquid gases is the two phase TPC, however, at the early stages of the study, several groups had been testing of both direct (S1) and proportional (S2) scintillation in liquid xenon. Recently, considering to make much larger detectors for dark matter, supernova neutrino, and 0▯▯▯, the single phase TPC has been revived.
As a LXe spherical scintillator, XMASS is existing with us and GXe spherical TPCs also exist and are successfully operated, we are aiming to convert XMASS to spherical LXe TPC. For the first step we focus on getting S2 signal in a small LXe setup. We tested 10▯m tungsten wire in LXe and successfully observed stable S2 signal in keV range and confirmed the threshold of the electric field for S2 signal. Accordingly, we are designing a spherical electrode which makes enough high electric field over the threshold for the spherical detector.

59

Status and results from protoDUNE Single Phase

Author: Maura Ninuccia Spanu[1]

[1] *Brookhaven National Laboratory (US)*

Corresponding Author: maura.spanu@cern.ch

The Deep Underground Neutrino Experiment (DUNE) is an international long-baseline neutrino experiment that will build an intense neutrino beam from Fermi National Accelerator Laboratory in Batavia, Illinois, to a far detector consisting of four Liquid Argon Time Projection Chambers (LAr-TPC) holding in total around 80 ktons, at the Sanford Underground Research Laboratory in South Dakota at 1300 kilometers downstream of the source.
ProtoDUNE-SP is the Single-Phase DUNE Far Detector prototype built at the Cern Neutrino Platform facility with the aim to better define the production and installation procedures for DUNE FD as well as accumulate test-beam data at CERN in order to calibrate the response of the detector to different particles species.
With a total liquid argon (LAr) mass of 0.77 kt, it represents the largest monolithic single-phase LAr-TPC detector.

60

Status of the LZ experiment

Author: Alden Fan[1]

[1] *SLAC/Stanford*

Corresponding Author: aldenfan@stanford.edu

LUX-ZEPLIN (LZ) is a next generation direct dark matter detection experiment located at Sanford Underground Research Facility in Lead, SD. The detector consists of a dual-phase xenon Time Projection Chamber with an active volume of 7 tonnes (5.6 tonne fiducial), shielded by an instrumented liquid xenon skin region, a Gd-loaded liquid scintillator veto, and an ultrapure water veto. LZ is expected to start data taking in April 2020 and is projected to achieve a sensitivity for the spin independent WIMP-nucleon cross section of 1.6e-48 cmˆ2 at 40 GeV after 1000 live-days of exposure. An overview and the current status of the LZ experiment will be presented.

61

The MicroBooNE continuous readout stream for detection of supernova neutrinos

Author: José I. Crespo-Anadón[1]

[1] *Columbia University*

Corresponding Author: jcrespo@nevis.columbia.edu

Since the original detection of core-collapse supernova neutrinos in 1987, all large neutrino experiments seek to detect the neutrinos from the next nearby supernova. Among them, liquid argon time projection chambers (LArTPCs) offer a unique sensitivity to the electron neutrino flux. However, the low energy of the events (scale of MeVs), and the fact that all large (multi-tonne) LArTPCs operating at the moment are located near the surface, and therefore subject to an intense cosmic ray

flux, makes triggering on the supernova neutrinos very challenging. Instead, MicroBooNE has pioneered a novel approach for detecting supernova neutrinos based on a continuous readout stream and a delayed trigger generated by other neutrino detectors (the Supernova Early Warning System, or SNEWS). MicroBooNE's data is stored temporarily for a few days, awaiting an SNEWS alert to be permanently saved. In order to cope with the large data rates produced by the continuous readout of the TPC and the PMT systems, FPGA-based zero-suppression algorithms have been developed. This talk will describe the continuous readout stream of MicroBooNE and discuss its applications.

62

Low BG TPC for direction-sensitive dark matter search

Author: Kentaro Miuchi[1]

[1] *Kobe University*

Corresponding Author: miuchi@phys.sci.kobe-u.ac.jp

Low BG TPC is a powerful tool for direction-sensitive dark matter search.
I will present our R&D of negative ion TPC, TPC with resistive sheet, and latest NEWAGE results.
I'll also cover an international collaborative activity "CYGNUS".

63

A low energy muon neutrino event reconstruction for MicroBooNE

Author: Adrien Hourlier[1]

[1] *Massachusetts Institute of Technology*

Corresponding Author: hourlier@mit.edu

MicroBooNE is a Liquid Argon Time Projection Chamber (LArTPC) neutrino experiment on the Booster Neutrino Beamline at the Fermi National Accelerator Laboratory, with an 85-tonne active mass.
One of MicroBooNE's primary physics goals is to investigate the excess of electron neutrino events seen by MiniBooNE in the [200-600] MeV range.
MicroBooNE will constrain the intrinsic electron neutrino component of the beam by measuring the muon neutrino spectrum.
Several low-energy excess analyses are taking place in parallel, using independent reconstructions and selection schemes.
This talk will focus on a low-energy excess analysis that makes use of deep learning algorithms applied to the high-resolution images provided by the MicroBooNE LArTPC.
I will present a novel 3D event reconstruction based on computer vision tools and a stochastic search algorithm that aims to reconstruct low energy events with high resolution.
I will then present validation studies verifying the good agreement of our simulation to our muon neutrino data.

66

A low-background Micromegas detector for IAXO and BabyIAXO

Author: Elisa Ruiz Choliz[1]

[1] *Universidad de Zaragoza (ES)*

Corresponding Author: elisa.ruiz.choliz@cern.ch

The baseline detection technique for IAXO and BabyIAXO consist of an ultra-low background Time Projection Chamber (TPC) coupled to pixelated Micromegas readout. Microbulk Micromegas detectors show convenient features for solar axion searches because their performance is very stable, they present good energy resolution in the IAXO range of interest, they provide topological information of the detected events and also, very low background levels can be achieved. To prove the performance and the background levels of the IAXO and BabyIAXO detectors, a prototype called IAXOD0 has been commissioned at the University of Zaragoza. The characterization and the preliminary tests proved the detector to be stable and the first data taking campaign was performed during August. In parallel, a IAXOD0 background model simulation is being computed in order to fully understand the detector's background. REST is the software used for both the simulations and the analysis.

67

Developments for spherical single phase LXe TPCs

Corresponding Author: sekiya@icrr.u-tokyo.ac.jp

68

DARWIN: Towards the Ultimate Dark Matter Detector

Corresponding Author: galloway@physik.uzh.ch

69

The MicroBooNE continuous readout stream for detection of supernova neutrinos

Corresponding Author: jcrespo@nevis.columbia.edu

71

DARWIN: Towards the Ultimate Dark Matter Detector

Author: Michelle Galloway[None]

Corresponding Author: galloway@physik.uzh.ch

The DARWIN (DARk matter WImp search with liquid xenoN) project is planning for a 50-ton ultimate liquid xenon dark matter detector. The experiment will reach sensitivity to WIMP nuclear recoil cross sections within a wide mass range down to the level of the irreducible neutrino background. In addition to WIMPs, DARWIN will also be sensitive to the neutrinoless double beta decay of Xe-136, alternative dark matter candidates such as dark photons and super-WIMPs, and other interesting science channels, such as solar axions, solar neutrinos, and coherent neutrino-nucleus scattering. This talk will give an overview of the current detector design, inherent challenges, and ongoing R&D projects. Sensitivity projections for WIMPs and other prominent detection channels will be presented.

72

CYGNO: directional Dark Matter search with optical readout

Corresponding Author: elisabetta.baracchini@lnf.infn.it

73

Status of protoDUNE Dual Phase

Author: Jaime Victoria Dawson[1]

[1] *Universite de Paris VII (FR)*

Corresponding Author: jdawson@in2p3.fr

The Deep Underground Neutrino Experiment (DUNE) will use a large liquid argon (LAr) detector consisting of four modules each with a fiducial mass of 10 kt of LAr. One of the technology options for the far detector modules is a liquid-argon TPC working in dual phase mode.

ProtoDUNE Dual Phase is a large demonstrator of the double phase liquid argon Time Projection Chamber (TPC) with a 6×6×6˜m3 (300t) active volume. The TPC is built inside a tank based on industrial LNG technology. Electrons produced in the liquid argon are extracted in the gas phase. Here, a readout plane based on Large Electron Multiplier (LEM) detectors provides amplification before the charge collection onto an anode plane with strip readout. PMTs located on the bottom of the tank containing the liquid argon provide the readout of the scintillation light.

ProtoDUNE will be operated at the CERN neutrino platform test beam facility. As well as being the engineering prototype of a Far Detector module, it will also demonstrate the concept of a very large dual-phase LAr TPC which will be calibrated with a charged particle test beam. The design of the TPC including the fabrication, testing, installation and commissioning of the various detector components will be briefly discussed.

74

Status of BabyIAXO to search for solar axions

Author: Theopisti Dafni[1]

[1] *Universidad de Zaragoza (ES)*

Corresponding Author: theopisti.dafni@cern.ch

The International Axion Observatory (IAXO) is the proposed fourth generation axion helioscope, aiming to improve the sensitivity of the currently most sensitive, third generation experiment (CAST) by more than one order of magnitude. This sensitivity is expected to come from an axion-physics dedicated magnet equipped with x-ray focusing devices that will be coupled to low-background detectors. A significant discovery potential is offered, as a substantial region of the axion (and ALP) parameter space, unexplored to date, will be probed. As a first step towards IAXO, Baby-IAXO will be built: a demonstrator of the IAXO magnet, with the prototype x-ray optics and the low-background detectors. Baby-IAXO will already have a higher sensitivity than CAST, and therefore will produce relevant physics results at an intermediate level. Here, we will report on the status of this project.

75

Gas properties characterization for the NEWS-G detector

Author: Philippe Gros[1]

[1] *Queen's University, Kingston, Canada*

Corresponding Author: philippe.gros@gmail.com

NEWS-G (New Experiments With Spheres-Gas) is a direct dark matter detection experiment using Spherical Proportional Counters (SPCs). Key advantages of SPCs for dark matter search and especially light mass DM particles are their low energy threshold -single ionisation electron- and the possibility to use various light target nuclei -Neon/Helium/CH4 gases-. Dark
matter limits were obtained in 2017 using Neon in the 60 cm prototype SEDINE at Laboratoire Souterrain de Modane (LSM).
R&D is ongoing within the collaboration to define the best operating conditions in a larger 140 cm detector at SNOLAB. For this, we use two main
calibration tools: a gaseous 37Ar source, providing two monoenergetic peaks
at 280 eV and 2.8 keV, and a 213 nm UV laser, extracting photoelectrons from
the inner surface of the sphere. The laser allows us to study the response
of the detector to single electrons, to measure the drift time and diusion
of electrons from the surface. On the other hand, the 37Ar source allows
to measure the energy resolution for events in the whole detector volume.
Finally, combining these two tools, we can extract the W-value of the gas
mixture from the single electron response and the position of monoenergetic
peaks.

76

Review of NEWS-G Dark Matter searches and related projects

Author: Guillaume Giroux[1]

[1] *Queen's University*

Corresponding Author: squirrelgui@gmail.com

The NEWS-G (New Experiments With Spheres –Gas) collaboration searches for light dark matter using spherical proportional counters (SPCs) located in deep underground laboratories. A choice of light gas targets (Ne, He, H) in conjunction with sub-KeV nuclear recoil thresholds allow for sensitivity to low-mass WIMPs (Weakly Interacting Massive Particles) down to 0.1 GeV/cˆ2. The recent results from SEDINE, a 60-cm diameter SPC located at LSM (Laboratoire Souterrain de Modane), set new constraints for WIMP masses lighter than 0.6 GeV/cˆ2 and will be presented. New gas quenching factor measurements obtained at the TUNL (Triangle Universities Nuclear Laboratory) facility and the status and outlook of the 1.4-metre diameter ultra-low background SPC project to be installed at SNOLAB will also be presented.

77

Software developments for gaseous TPC based on the GEANT4/Garfield integration

Corresponding Author: konstantinos.nikolopoulos@cern.ch

78

Cosmological constraints on neutrinos

Corresponding Author: licia.verde@cern.ch

79

An unlimited large TPC pixel detector plane

Corresponding Author: f.hartjes@nikhef.nl

80

Session chair : C. Volpe