

DMUK meeting at Birmingham



Report of Contributions

Contribution ID: 1

Type: **not specified**

Searching for dilaton fields in the Ly α forest

Thursday 5 May 2022 13:35 (15 minutes)

Dilatons (and moduli) couple to the masses and coupling constants of ordinary matter, and these quantities are fixed by the local value of the dilaton field. If, in addition, the dilaton with mass m_ϕ contributes to the cosmic dark matter density, then such quantities oscillate in time at the dilaton Compton frequency. We show how these oscillations lead to broadening and shifting of the Voigt profile of the Ly α forest, in a manner that is correlated with the local dark matter density. We further show how tomographic methods allow the effect to be reconstructed by observing the Ly α forest spectrum of distant quasars. We then simulate a large number of quasar lines of sight using the lognormal density field, and forecast the ability of future astronomical surveys to measure this effect. We find that in the ultra low mass range $10^{-32} \text{ eV} \leq m_\phi \leq 10^{-28} \text{ eV}$ upcoming observations can improve over existing limits to the dilaton electron mass and fine structure constant couplings set by fifth force searches by up to five orders of magnitude. Our projected limits apply assuming that the ultralight dilaton makes up a few percent of the dark matter density, consistent with upper limits set by the cosmic microwave background anisotropies

Presenter: HAMAIDE, Louis**Session Classification:** Session 1

Contribution ID: 2

Type: **not specified**

Muon-induced background in a next-generation dark matter experiment based on liquid xenon

Thursday 5 May 2022 10:50 (20 minutes)

Muon-induced neutrons can lead to potentially irreducible backgrounds in rare event search experiments. We have investigated the implication of laboratory depth on the muon induced background in a future dark matter experiment capable of reaching the so-called neutrino floor. Our simulation study focuses on a xenon-based detector with 70 tonnes of active mass, surrounded by additional veto systems plus a water shield. Two locations at the Boulby Underground Laboratory (UK) were analysed as examples: an experimental cavern in salt at a depth of 2850 m w. e. (similar to the location of the existing laboratory), and a deeper laboratory located in polyhalite rock at a depth of 3575 m w. e. Our results show that no cosmogenic background events are likely to survive standard analysis cuts for 10 years of operation at either location. The largest background component that we identified comes from delayed neutron emission from N-17 which is produced from F-19 in the fluoropolymer components of the experiment. Our results confirm that a dark matter search with sensitivity to the neutrino floor is viable (from the point of view of cosmogenic backgrounds) in underground laboratories at these levels of rock overburden

Presenter: KUDRYAVTSEV, Vitaly

Session Classification: Session 1

Contribution ID: 3

Type: **not specified**

FlameNEST: Explicit Profile Likelihoods with the Noble Element Simulation Technique

Thursday 5 May 2022 13:00 (20 minutes)

We present FlameNEST, a framework providing explicit likelihood evaluations in noble element particle detectors using data-driven models from the Noble Element Simulation Technique. FlameNEST provides a way to perform statistical analyses on real data with no dependence on large, computationally expensive Monte Carlo simulations by evaluating the likelihood on an event-by-event basis using analytic probability elements convolved together in a single TensorFlow multiplication. Furthermore, this robust framework creates opportunities for simple inter-collaborative analyses which will be fundamental for the future of experimental dark matter physics

Presenter: JAMES, Robert (UCL)

Session Classification: Session 1

Contribution ID: 4

Type: **not specified**

Design of a compact SiPM array for the Xenia detector

Thursday 5 May 2022 11:30 (15 minutes)

Liquid xenon time projection chambers (LXe-TPCs) have set leading limits on dark matter scattering over the past two decades. These have so far employed low-background photomultiplier tubes to detect the xenon VUV luminescence. With SiPMs now yielding competitive photon detection performance in the VUV, the possibility of using this technology in the next generation of experiments is becoming more realistic, at least in some parts of the experiment. An outline of the design of a prototype array of sensors for the Xenia LXe-TPC being built at Imperial is discussed. The design is driven in particular by the requirements to achieve high spatial resolution and potential for ultra-low radioactive backgrounds, and will provide a test-bed for the development of end-to-end signal chains. Our more immediate aim is to explore possibilities for track-topology resolution in liquid xenon, in particular in conjunction with hydrogen-doping, which may help decrease gamma-ray backgrounds in neutrinoless double-beta decay searches in Xe-136

Presenter: STEVENS, Andrew (Imperial College London)

Session Classification: Session 1

Contribution ID: 5

Type: **not specified**

Status and Plans for Dark Matter work at Boulby underground Laboratory.

Thursday 5 May 2022 10:10 (20 minutes)

Update on work underway and planned at Boulby underground Laboratory. In particular Dark Matter related studies

Presenter: PALING, Sean

Session Classification: Session 1

Contribution ID: 6

Type: **not specified**

Quantum-enhanced interferometry for axion searches

Thursday 5 May 2022 16:30 (15 minutes)

We will discuss an experiment for searching axions and axion-like-particles in the galactic halo using quantum-enhanced interferometry. This setup will search for axions in the mass range from 10–16 eV up to 10–12 eV using an optical cavity. The sensitivity will be enhanced using squeezed states of light similar to the gravitational-wave detectors. The proposed experiment has the potential to be further scaled up to a multi-km long detector. I will discuss the current status and future plans of the experiment.

Presenter: MARTYNOV, Denis (University of Birmingham)

Session Classification: Session 1

Contribution ID: 7

Type: **not specified**

When the Evaporation of Primordial Black Holes Messes Up with Dark Matter Production

Thursday 5 May 2022 11:10 (20 minutes)

In this talk, I will present the phenomenology of dark-matter production in the case where it is both produced by thermal processes and by the evaporation of primordial black holes. I will show how the evaporation of primordial black holes may dramatically affect the production of dark-matter particles as well as its phase-space distribution. I will also show that the population of DM particles produced by evaporation may be warm enough to re-thermalize with the pre-existing DM relic abundance, leading to non-trivial imprints on the value of the relic abundance at a later time.

Presenter: HEURTIER, Lucien (IPPP, Durham, England)

Session Classification: Session 1

Contribution ID: **8**

Type: **not specified**

Status of the DarkSide-20k experiment

Thursday 5 May 2022 15:30 (20 minutes)

Presenter: SANTONE, Daria (Royal Holloway, University of London)

Session Classification: Session 1

Contribution ID: 9

Type: **not specified**

Status of the LZ experiment

Thursday 5 May 2022 16:10 (20 minutes)

Presenter: SHAW, Sally (UCSB)

Session Classification: Session 1

Contribution ID: **10**

Type: **not specified**

Status of the NEWS-G experiment

Thursday 5 May 2022 15:50 (20 minutes)

Presenter: KNIGHTS, Patrick Ryan (University of Birmingham (GB))

Session Classification: Session 1

Contribution ID: **11**

Type: **not specified**

Status of the MIGDAL experiment

Thursday 5 May 2022 14:10 (20 minutes)

Presenter: NEEP, Tom (University of Birmingham (GB))

Session Classification: Session 1

Contribution ID: 12

Type: **not specified**

Introduction

Thursday 5 May 2022 10:00 (10 minutes)

Presenter: MCCABE, Christopher (King's College London)

Session Classification: Session 1

Contribution ID: 13

Type: **not specified**

Neutron spectroscopy with Spherical Proportional Counters in Boulby

Thursday 5 May 2022 10:30 (20 minutes)

Presenters: MANTHOS, Ioannis (Aristotle University of Thessaloniki); MANTHOS, Ioannis; MANTHOS, Ioannis (University of Birmingham (GB))

Session Classification: Session 1

Contribution ID: 14

Type: **not specified**

QSNET project: A network of clocks for measuring the stability of fundamental constants

Thursday 5 May 2022 16:45 (15 minutes)

The QSNET consortium is building a UK network of next-generation atomic and molecular clocks that will achieve unprecedented sensitivity in testing variations of the fine structure constant, α , and the electron-to-proton mass ratio, μ . In the range of parameters probed, either we will discover new physics, or we will impose new constraints on violations of fundamental symmetries and a range of theories beyond the Standard Model, including dark matter and dark energy models.

Presenter: PROKHOROV, Leonid (University of Birmingham)

Session Classification: Session 1

Contribution ID: 15

Type: **not specified**

SAMBA: A cross-platform DAQ software for rare-event searches

Thursday 5 May 2022 13:20 (15 minutes)

Presenter: SLATER, Mark William (University of Birmingham (GB))

Session Classification: Session 1

Contribution ID: 16

Type: **not specified**

Intergalactic Dark Matter

Thursday 5 May 2022 11:45 (15 minutes)

We discuss PBHs as dark matter, including not only in galaxies and clusters of galaxies but extremely massive PBHs which may allow the total entropy to reach the maximum holographic value

Presenter: FRAMPON, Paul (University of Salento)

Session Classification: Session 1

Contribution ID: 17

Type: **not specified**

Progress report on the QSHS hidden sector dark matter project

Thursday 5 May 2022 14:30 (20 minutes)

We report on the first 15 months of the QSHS project, an STFC funded collaboration building a UK based apparatus searching for wave-like dark matter in our galactic halo.

Presenter: BAILEY, Ian (Lancaster University / Cockcroft Institute of Accelerator Science and Technology)

Session Classification: Session 1

Contribution ID: **18**

Type: **not specified**

DM searches in colliders

Thursday 5 May 2022 13:50 (20 minutes)

Presenter: FROST, James (University of Oxford (GB))

Session Classification: Session 1