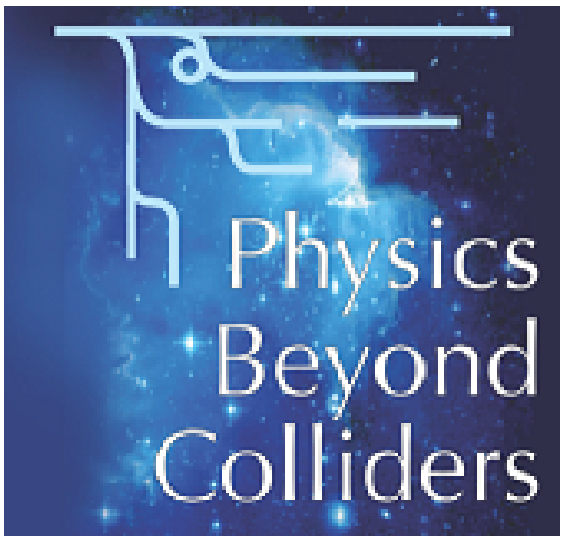
Physics Beyond Colliders Annual Workshop



Report of Contributions

https://indico.cern.ch/e/644287

Contribution ID: **2** Type: **not specified**

Light Dark Matter Searches with Carbon Nanotubes

Wednesday 22 November 2017 14:00 (15 minutes)

Directional detection of Dark Matter particles in the MeV mass range could be accomplished by studying electron recoils in large arrays of parallel carbon nanotubes. In a scattering process with a lattice electron, a DM particle might transfer sufficient energy to eject it from the nanotube surface. An external electric field is added to drive the electron towards the open ends of the array, where it is eventually detected. The anisotropic response of this detection scheme, as a function of the orientation of the target with respect to the DM wind, is calculated, and it is concluded that no direct measurement of the electron ejection angle is needed to explore significant regions of the light DM exclusion plot. A standard compact photomultiplier, in which the photocathode element is substituted with a dense array of parallel carbon nanotubes, could serve as the basic detection unit. For DM particles in the GeV mass range, ion channeling phenomena in carbon nanotubes can be exploited.

Authors: POLOSA, Antonio (Sapienza Universita‘ di Roma); CAVOTO, Gianluca (Sapienza Universita e INFN, Roma I (IT))

Presenter: POLOSA, Antonio (Sapienza Universita‘ di Roma)

Session Classification: New ideas

Contribution ID: **4** Type: **not specified**

A new experiment for axion-like particle search

Wednesday 22 November 2017 14:15 (15 minutes)

In Particle Physics, axions appear in very well motivated extensions of the Standard Model including the Peccei-Quinn mechanism proposed to solve the long-standing strong-CP problem. Together with the weakly interacting massive particles of supersymmetric theories, axions are also a favored candidate for resolving the Dark Matter issue.
I propose a new detection scheme for the search of axion-like particles based on a Light-Shining-Through-Wall (LSW) experiment in a photon frequency domain never explored before, at very low energy and with extremely intense photon sources.
The aim of the project is the design of a different and innovative experiment, based on the implementation of a new single-photon detector working in the sub-THz region, and exploiting nanotechnology devices at energy and temperature ranges never used in Particle Physics before.
The ultimate goal is to answer one of the most pressing questions in Particle Physics with an unusual approach, based on state-of-the-art, and beyond, nano- and quantum-technology: using leading edge nano- tech detectors to investigate fundamental issues of Particle Physics.
With radiation sources below the THz, thanks to the use of high luminosity klystrons or gyrations, present laboratory exclusion limits on axion-like particles might be improved by few orders of magnitude.The underlying idea of this proposal has been recently published in a paper in the Physics of the Dark Universe journal (see pays. Dark Univ. 12, 37 (2016) for details).

Author: SPAGNOLO, Paolo (INFN Sezione di Pisa, Universita' e Scuola Normale Superiore, P)

Presenter: SPAGNOLO, Paolo (INFN Sezione di Pisa, Universita' e Scuola Normale Superiore, P)

Session Classification: New ideas

Contribution ID: **5** Type: **not specified**

Overview of the BSM landscape

Tuesday 21 November 2017 09:30 (30 minutes)

Where we stand, possibilities, comparative reach

Presenter: JAECKEL, Joerg (ITP Heidelberg)

Session Classification: BSM

Contribution ID: **6** Type: **not specified**

SHiP

Tuesday 21 November 2017 10:00 (20 minutes)

Presenter: JACOBSSON, Richard (CERN)

Session Classification: BSM

Contribution ID: **7** Type: **not specified**

NA62++

Tuesday 21 November 2017 10:20 (20 minutes)

Presenter: SPADARO, Tommaso (INFN e Laboratori Nazionali di Frascati (IT))

Session Classification: BSM

Contribution ID: **8** Type: **not specified**

KLEVER

Tuesday 21 November 2017 11:10 (20 minutes)

Presenter: LAZZERONI, Cristina (University of Birmingham (GB))

Session Classification: BSM

Contribution ID: **9** Type: **not specified**

IAXO

Tuesday 21 November 2017 12:30 (20 minutes)

Presenter: GARCIA IRASTORZA, Igor (Universidad de Zaragoza (ES))

Session Classification: BSM

Contribution ID: **10** Type: **not specified**

LSW

Tuesday 21 November 2017 11:50 (20 minutes)

Presenter: LINDNER, Axel (DESY)

Session Classification: BSM

Contribution ID: **11** Type: **not specified**

EDM

Tuesday 21 November 2017 12:10 (20 minutes)

Presenter: SEMERTZIDIS, Yannis (CAPP/IBS and KAIST in South Korea)

Session Classification: BSM

Contribution ID: **12** Type: **not specified**

Overview of the QCD landscape

Tuesday 21 November 2017 14:00 (30 minutes)

Landscape, where we stand, possibilities, comparative reach

Presenters: SCHNELL, Gunar; PAWLOWSKI, Jan M. (University of Heidelberg); DIEHL, Markus

Session Classification: QCD

Contribution ID: **13** Type: **not specified**

COMPASS

Tuesday 21 November 2017 17:15 (15 minutes)

Presenter: DENISOV, Oleg (INFN, sezione di Torino)

Session Classification: QCD

Contribution ID: **14** Type: **not specified**

MUonE

Tuesday 21 November 2017 17:00 (15 minutes)

Presenter: VENANZONI, Graziano (INFN e Laboratori Nazionali di Frascati (IT))

Session Classification: QCD

Contribution ID: **15** Type: **not specified**

LHCb fixed target - SMOG

Tuesday 21 November 2017 14:30 (15 minutes)

Presenter: GRAZIANI, Giacomo (INFN, Sezione di Firenze (IT))

Session Classification: QCD

Contribution ID: **16** Type: **not specified**

ALICE fixed target

Tuesday 21 November 2017 15:00 (15 minutes)

Presenter: MASSACRIER, Laure Marie (Université Paris-Saclay (FR))

Session Classification: QCD

Contribution ID: **17** Type: **not specified**

AFTER

Tuesday 21 November 2017 15:15 (15 minutes)

Presenter: LANSBERG, Jean-Philippe (IPN Orsay, Paris Sud U. / IN2P3-CNRS)

Session Classification: QCD

Contribution ID: **18** Type: **not specified**

Crystal based experiments

Tuesday 21 November 2017 16:00 (15 minutes)

Presenter: STOCCHI, Achille (Universite de Paris-Sud 11 (FR))

Session Classification: QCD

Contribution ID: **19** Type: **not specified**

DIRAC++

Tuesday 21 November 2017 16:45 (15 minutes)

Presenter: NEMENOV, Leonid (Joint Institute for Nuclear Research (RU))

Session Classification: QCD

Contribution ID: **20** Type: **not specified**

NA60++

Tuesday 21 November 2017 16:15 (15 minutes)

Presenter: USAI, Gianluca (Universita e INFN, Cagliari (IT))

Session Classification: QCD

Contribution ID: **21** Type: **not specified**

NA61++

Tuesday 21 November 2017 16:30 (15 minutes)

Presenter: GAZDZICKI, Marek (Johann-Wolfgang-Goethe Univ. (DE))

Session Classification: QCD

Contribution ID: **22** Type: **not specified**

Accelerator side: introduction

Wednesday 22 November 2017 09:00 (15 minutes)

Presenter: LAMONT, Mike (CERN)

Session Classification: Accelerator

Contribution ID: **23** Type: **not specified**

Beam Dump Facility

Wednesday 22 November 2017 11:00 (20 minutes)

Presenter: LAMONT, Mike (CERN)

Session Classification: Accelerator

Contribution ID: **24** Type: **not specified**

Gamma factory

Wednesday 22 November 2017 09:50 (20 minutes)

Presenter: KRASNY, Mieczyslaw (Centre National de la Recherche Scientifique (FR))

Session Classification: Accelerator

Contribution ID: **25** Type: **not specified**

Conventional beams

Wednesday 22 November 2017 09:30 (20 minutes)

Presenter: GATIGNON, Lau (CERN)

Session Classification: Accelerator

Contribution ID: **26** Type: **not specified**

LHC fixed target

Wednesday 22 November 2017 11:20 (20 minutes)

Presenter: FERRO-LUZZI, Massimiliano (CERN)

Session Classification: Accelerator

Contribution ID: **27** Type: **not specified**

Complex performance post LIU

Wednesday 22 November 2017 09:15 (15 minutes)

Presenter: KOUKOVINI PLATIA, Eirini (CERN)

Session Classification: Accelerator

Contribution ID: **28** Type: **not specified**

AWAKE++

Wednesday 22 November 2017 11:40 (15 minutes)

Presenters: GSCHWENDTNER, Edda (CERN); WING, Matthew (University College London)

Session Classification: Accelerator

Contribution ID: **29** Type: **not specified**

nuSTORM

Wednesday 22 November 2017 11:55 (15 minutes)

Presenter: LONG, Kenneth Richard (Imperial College (GB))

Session Classification: Accelerator

Contribution ID: **30** Type: **not specified**

Technology

Wednesday 22 November 2017 12:10 (20 minutes)

Presenters: SIEMKO, Andrzej (CERN); DOBRICH, Babette (CERN)

Session Classification: Accelerator

Contribution ID: **31** Type: **not specified**

Other new ideas

Session Classification: New ideas

Contribution ID: **32** Type: **not specified**

NA64++

Tuesday 21 November 2017 11:30 (20 minutes)

Presenter: GNINENKO, Sergei (Russian Academy of Sciences (RU))

Session Classification: BSM

Contribution ID: **33** Type: **not specified**

EDM

Wednesday 22 November 2017 10:10 (20 minutes)

Presenter: PRETZ, Jorg (Rheinisch Westfaelische Tech. Hoch. (DE))

Session Classification: Accelerator

Contribution ID: **34** Type: **not specified**

New ideas - abstracts received

Session Classification: New ideas

Contribution ID: **36** Type: **not specified**

Precision measurements in nuclear beta decay in the LHC era

I will discuss what kind of new phenomena can be probed through precision measurements in nuclear and neutron beta decays. Several of these experiments were carried out (or are planned/ongoing) at ISOLDE at CERN, a world-leading facility In the field of nuclear physics. Using a model-independent description I will review the interplay between the different experiments and which ones are the most sensitive and promising. I will discuss the synergy with searches at high-energy colliders, such as the LHC, and with other electroweak precision observables.

Author: GONZALEZ-ALONSO, Martin (CERN)

Presenter: GONZALEZ-ALONSO, Martin (CERN)

Session Classification: New ideas

Contribution ID: **39** Type: **not specified**

Polarized fixed target at LHC

Tuesday 21 November 2017 14:45 (15 minutes)

Presenter: DI NEZZA, Pasquale (INFN e Laboratori Nazionali di Frascati (IT))

Session Classification: QCD

Contribution ID: **41** Type: **not specified**

Measuring vacuum magnetic birefringence with static high-field superconducting magnets

Wednesday 22 November 2017 14:30 (15 minutes)

For many years the PVLAS collaboration has been working on trying to measure vacuum magnetic birefringence using optical techniques. That electrodynamics in vacuum is non-linear was predicted in 1935 [H. Euler and B. Kockel, Naturwiss, 23, 246 (1935)] and the first experimental proposal to detect the leading nonlinear effect, namely vacuum magnetic birefringence closely related to light-by-light elastic scattering, dates back to the early eighties at CERN following an idea by E. Iacopini and E. Zavattini [Phys. Lett. B, 85, 151 (1979)]. A lot of progress has been made since but the goal still needs to be reached. Recently Turolla et al. [Monthly Notices of the Royal Astronomical Society, Volume 465, Issue 1, 11 February 2017, Pages 492–500] have indirectly inferred evidence of vacuum magnetic birefringence from the observation of a neutron star and ATLAS has directly observed $\gamma - \gamma$ interactions at high energies [Nature Physics 13, 852–858 (2017)]. A direct observation at low energies is still lacking.

At present the PVLAS collaboration has reached an experimental value for the relevant parameter $\frac{\Delta n}{3B^2}$ to be compared with A_e describing the non linear behaviour of electrodynamics in vacuum of $\frac{\Delta n^{(\mathrm{PVLAS})}}{3B^2} = (6 \pm 9) \times 10^{-24}$ T^{-2} to be compared with the theoretical predicted value of $A_e = 1.32 \times 10^{-24}$ T^{-2}. Although the measured value is approaching the goal it was obtained with an integration of 5×10^6 s and is at present limited by wideband noise and not systematic effects. Further integration does not seem to be the best approach.

The sensitivity of the PVLAS apparatus is far from being shot-noise limited with a wideband contribution which still needs to be understood and is under investigation. Past and present experiments using the same, or a similar, approach also suffer from a similar problem. As can be seen in the attached figure the birefringence noise of our and other experiments seems to lay on a power curve and diminishes with frequency.

So the two main ingredients are for an experiment aiming at measuring directly vacuum magnetic birefringence using light are: high modulation frequency of the signal and a high value for the integral $\int B^2 dl$. Typical values today are $\int B^2 dl \approx 10 - 20$ T^{2}m at frequencies of the order of tens of Hertz.

Very high values of $\int B^2 dl \approx 1000 - 5000$ T^{2}m can be obtained with accelerator superconducting magnets like the HERA magnets and the ones in LHC. The problem is to modulate the effect at a reasonably high frequency. In the past, rotating the polarisation of the light entering the polarimeter has been proposed by OSQAR but difficulties have been encountered, e.g. mirror birefringence. A new possible technique, published in 2016 [Eur. Phys. J. C (2016) 76:294] and still to be tested, proposes the insertion of two synchronously rotating half-wave plates inside the Fabry-Perot cavity (with therefore a relatively low finesse of $\approx 10^3$) each one on either side of the magnetic field so as to have a rotating polarisation $only$ in the static magnetic field but not on the mirrors of the cavity.

This idea, with its possible drawbacks, will be presented thinking on the lines of using an LHC magnet at CERN.
[Experimental birefringence sensitivities of experiments designed to measure vacuum magnetic birefringence. The continuous line is a fit resulting in a power law $S_{\Delta n} = f^k$ with $k = -0.78$]. 1

Author: ZAVATTINI, Guido (Università di Ferrara)

Co-authors: DELLA VALLE, Federico (University of Siena); EJLLI, Aldo (University of Ferrara); GASTALDI, Ugo (Universita di Ferrara & INFN (IT)); Prof. MILOTTI, Edoardo (INFN - National Institute for Nuclear Physics); PENGO, Ruggero (Universita e INFN, Legnaro (IT)); RUOSO, Giuseppe (INFN, Legnaro (IT))

Presenter: ZAVATTINI, Guido (Università di Ferrara)

Session Classification: New ideas

Contribution ID: **44** Type: **not specified**

REDTOP: Rare Eta Decays with a TPC for Optical Photons

Wednesday 22 November 2017 16:40 (15 minutes)

Presenter: CAROSI, Roberto (INFN - National Institute for Nuclear Physics)

Session Classification: New ideas II

Contribution ID: **45** Type: **not specified**

Exploring Hidden Sector Physics with an electron beam facility

Session Classification: New ideas II

Contribution ID: **46** Type: **not specified**

A possible implementation of an electron beam facility at CERN

Wednesday 22 November 2017 16:20 (20 minutes)

Presenter: STAPNES, Steinar (CERN)

Session Classification: New ideas II

Contribution ID: **47** Type: **not specified**

Exploring Hidden Sector Physics with an electron beam facility

Tuesday 21 November 2017 09:00 (30 minutes)

Presenter: SCHUSTER, Philip (Perimeter Institute for Theoretical Physics)

Contribution ID: **48** Type: **not specified**

Precision measurements in nuclear beta decay at ISOLDE

Wednesday 22 November 2017 14:45 (25 minutes)

Presenters: GONZALEZ-ALONSO, Martin (CERN); MALBRUNOT, Stephan (CERN)

Session Classification: New ideas

Contribution ID: **49** Type: **not specified**

Search for new physics via EDM of heavy and strange baryons at the LHC

Wednesday 22 November 2017 15:10 (20 minutes)

Presenter: MARTINEZ VIDAL, Fernando (IFIC - University of Valencia and CSIC (ES))

Session Classification: New ideas

Contribution ID: **50** Type: **not specified**

Probing QED in the strong-field limit with the XFEL at DESY

Wednesday 22 November 2017 16:00 (20 minutes)

Presenter: WING, Matthew (University College London)

Session Classification: New ideas II

Contribution ID: **51** Type: **not specified**

Introduction

Tuesday 21 November 2017 08:30 (20 minutes)

Presenter: VALLEE, Claude (Centre de Physique des Particules de Marseille)

Session Classification: Introduction