PPC 2018: XII International Conference on Interconnections between Particle Physics and Cosmology

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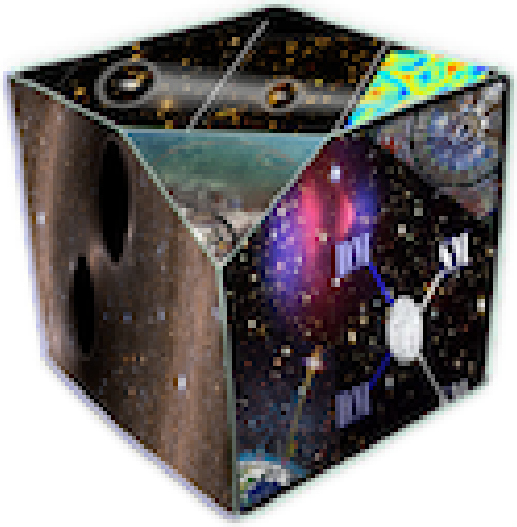
Zürich



Book of Abstracts

Contents

Short presentations & Poster session / **7**

Numerical Simulation of the Axion Field through the QCD Phase Transition

Authors: Malte Buschmann[1]; Benjamin Safdi[1]; Joshua Foster[1]

[1] *University of Michigan*

We perform a large scale (3+1)-dimensional numerical simulation of the axion field around the QCD epoch. Our aim is to fully resolve dynamical non-linear effects in the inhomogeneous axion field, collapsing domain walls and oscillons. These effects are important as they lead to large overdensities in the energy density at late times. Those overdensities will eventually collapse into axion minicluster, which have various phenomenological implications like microlensing events. It is therefore important to have a reliable estimate of the number of overdensities and their mass relation.

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Short presentations & Poster session / **11**

Neutrino mass via fermion kinetic mixing; Scotogenic model in the context of SU(7) GUT; Neutrino mass and $R_{(K*)}$ and $R_{(D*)}$ anomalies via R_2 and S_3 leptoquarks

Authors: Arnab Dasgupta[1]; Graham White[2]; Michael Schmidt[3]; Oleg Popov[4]; Sin Kyu Kang[5]

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[2] *Monash University*

[3] *The University of Sydney*

[4] *Seoul National University of Science and Technology*

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I will talk on 1 of the following:

1) Generating neutrino mass via fermion kinetic mixing. I this work we show how neutrino masses can be obtained from the radiative fermion mixing of 2 or more dark fermions and what kind of consequences and signatures this scenario can have compared to other similar models of neutrino mass.

2) I this work we demonstrate how Scotogenic neutrino mass generation can be embedded in $SU(7)$ GUT with different possible phenomenology and signatures. In this scenario we have a low energy Pati-Salam like,$SU(4)_c \times SU(2)_L \times U(1)_R$, symmetry. We also show how the $SU(7)$ symmetry and subsequent symmetries can be broken down to SM, as well as investigate possible dark symmetries needed for Scotogenic scenario.

3) Here we focus on explaining $R_{(K*)}$ and $R_{(D*)}$ anomalies via $R_2 \sim (3, 2, 7/6)$ and $S_3 \sim (\bar{3}, 3, 1/3)$ leptoquarks as well as simultaneously generating neutrino mass. We show that non of these leptoquarks can accommodate these anomalies alone and both are needed for simultaneous solution of

$R_{(K*)}$ and $R_{(D*)}$ anomalies and neutrino mass generation. We study constraints and signatures of this model.

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Short presentations & Poster session / **12**

Leptogenesis in Cosmological Relaxation with Particle Production

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Cosmological relaxation of the electroweak scale is improved by using particle production to trap the relaxion. We combine leptogenesis with such a relaxion model that has no extremely small parameters or large e-foldings. Scanning happens after inflation now allowed to be at a high scale over a sub-Planckian relaxion field range for an O(100) TeV cut-off scale of new physics. Particle production by the relaxion also reheats the universe and generates the baryonic matter-antimatter asymmetry. We propose a realisation in which out-of-equilibrium leptons, produced by the relaxion, scatter with the thermal bath through interactions that violate CP and lepton number via higher-dimensional operators. Such a minimal effective field theory setup, with no new physics below the cut-off, naturally decouples new physics while linking leptogenesis to relaxion particle production; the baryon asymmetry of the universe can thus be intrinsically tied to a weak scale hierarchy.

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Short presentations & Poster session / **13**

Cosmological implications of ultra-light axion-like particles

Author: Vivian Poulin[1]

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In this poster, I review how the CMB (in particular its temperature and polarization anisotropies) can be used to look for ultra light axion-like particles (ULAs).
Such ULAs are numerous in the axiverse scenario and can play many role in cosmology, from Dark Matter to Dark Energy. Moreover, they have been invoked to solve several recent cosmological tensions. In particular, ULAs can potentially be used to solve the tension between the LCDM prediction of H0 extracted from Planck data and that deduced by direct observations of cepheids and SNIa at low-redshift. They have also been suggested as an explanation of the EDGES anomaly — the observation of a puzzling absorption feature in the global 21cm signal. While the standard axion potential leads to ULA behaving like DM when their mass is large enough, a simple generalization of this potential leads to ULAs diluting with arbitrary rate (i.e. they can be chosen to dilute like matter, radiation or at even faster rate).
I will explain why such ULAs are phenomenologically very interesting and describe how such generic ULAs can be accurately modeled on cosmological scales thanks to a newly derived fluid approximation that generalizes former work. Finally, I will discuss constraints arising from Planck data on these models, as well as the implications of these constraints for the puzzling cosmological tensions.

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Short presentations & Poster session / **14**

Are Dark Matter - Dark Radiation Interactions Favoured by Cosmological Data?

Author: Deanna C Hooper[1]

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The standard Dark Matter paradigm, in which Dark Matter is cold, collisionless, and only interacts significantly gravitationally, boasts remarkable success on large scales. However, possible tensions in H0 and S8 measurements have reinvigorated interest in beyond-LCDM models, such as interactions between all or a fraction of Dark Matter and Dark Radiation. Here I present recent constraints on these interactions, and discuss the potential of these models to alleviate cosmological tensions.

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Short presentations & Poster session / 15

The path to a neutrino mass sum measurement from cosmology

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Co-authors: Maria Archidiacono ; Sebastien Clesse ; Deanna C Hooper ; Julien Lesgourgues [2]; Tim Sprenger [1]

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Cosmology presents the best hope of measuring the sum of neutrino masses in the future. The CMB has already been a treasure trove of information and will continue to provide ever more precise information with upcoming or proposed CMB experiments, such as LiteBird, CMB-S4, CORE, and PICO. These missions will have great synergy with other branches of cosmology. In particular, massive neutrinos leave a distinct imprint on the matter distribution of the universe, which upcoming large-scale structure surveys Euclid and the SKA will observe with unprecedented levels of precision. The uncertainty in modelling of non-linear structure formation is often neglected in other forecasts, or scales corresponding to this regime are entirely removed. In this work, we take into account that our understanding of non-linear modelling is imperfect. We show that a neutrino mass sum measurement is all but guaranteed from cosmology in the next decade and that this statement is robust to choice of cosmological model or modelling of non-linear effects.

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Short presentations & Poster session / 16

Boosting the Annihilation Rate with Ultracompact Minihalos

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Cosmological inflation generates primordial density perturbations which are scale-free on observable scales but that may be considerably larger on smaller scales. The boosted power spectrum at small scales leads to increased formation of dense, small-scale structure at early times, enhancing the present-day annihilation rate of annihilating dark matter. In this work, we show how to compute the impact of a power spectrum predicted by an inflationary model on WIMP indirect detection, leading to constraints on the WIMP-inflation parameter space within the context of axion inflation and establishing a procedure for similar future inquiries.

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Short presentations & Poster session / **19**

NA64 searching for hidden sectors at the CERN SPS

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NA64 is a fixed target experiment at the CERN SPS to search for hidden sectors. In this poster, we will present our latest results on the search for a new sub-GeV vector gauge boson (A′) mediated dark matter (χ) production. The A′, called dark photon, could be generated in the reaction e−Z→e−ZA′ of 100 GeV electrons dumped against an active target which is followed by the prompt invisible decay A′→χχ. The experimental signature of this process would be a clean event with an isolated electron and large missing energy in the detector. This allows us to set new limits on the γ−A′ mixing strength and constrain models with light thermal dark matter or light scalar, Majorana or pseudo-Dirac thermal dark matter. Preliminary results on the search for the X→e+e− decay of a new light X boson which could explain a recently observed anomaly in the 8Be transitions will be also discussed.

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Short presentations & Poster session / **20**

The GBAR experiment: Gravitational behaviour of antihydrogen at rest and a measurement of the antihydrogen Lamb shift

Authors: Gianluca Janka[1]; Balint Radics[1]; Christian Regenfus[1]; Andre Rubbia[1]; Paolo Crivelli[1]; GBAR collaboration[None]

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Antihydrogen is a blossoming field of research which studies aim to shed light on the observed baryon/antibaryon asymmetry in the Universe. The GBAR project (Gravitational Behaviour of Antihydrogen at Rest) at CERN aims to measure the free fall acceleration of ultracold neutral antihydrogen atoms in the terrestrial gravitational field. The experiment consists of preparing antihydrogen ions in a two-step charge exchange reaction and sympathetically cooling them with Be+ ions to less than 10 μK. The ultracold ions will then be photo-ionized just above threshold and the free fall time over a known distance, in a first phase at a level of 1%, measured. The antihydrogen atoms produced as a byproduct of the charge exchange reaction will be parasitically used to measure the Lamb shift of antihydrogen at a precision of 100 ppm and determining for a first time the antiproton charge radius at a level of 10%. The experimental setups and the current status will be presented.

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Short presentations & Poster session / 21

$f(R,T) = f(R) + \lambda T$ gravity models as alternatives to cosmic acceleration

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This article presents cosmological models that arise in a subclass of $f(R,T) = f(R) + f(T)$ gravity models, with different $f(R)$ functions and fixed T-dependence. That is, the gravitational lagrangian is considered as $f(R,T) = f(R) + \lambda T$, with constant λ. Here R and T represent the Ricci scalar and trace of the stress-energy tensor, respectively. The modified gravitational field equations are obtained through the metric formalism for the Friedmann-Lema\^itre-Robertson-Walker metric with signature $(+,-,-,-)$. We work with $f(R) = R + \alpha R^2 - \frac{\mu^4}{R}$, $f(R) = R + k\ln(\gamma R)$ and $f(R) = R + me^{[-nR]}$, with $\alpha, \mu, k, \gamma, m$ and n all free parameters, which lead to three different cosmological models for our Universe. For the choice of $\lambda = 0$, this reduces to widely discussed $f(R)$ gravity models. This manuscript clearly describes the effects of adding the trace of the energy-momentum tensor in the $f(R)$ lagrangian. The exact solution of the modified field equations are obtained under the hybrid expansion law. Also we present the Om diagnostic analysis for the discussed models.

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Short presentations & Poster session / **22**

First search for invisible decays of ortho-positronium confined in a vacuum cavity

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The experimental setup and results of the first search for invisible decays of ortho-positronium (o-Ps) confined in a vacuum cavity are reported. No evidence of invisible decays at a level Br $(\text{o-Ps} \to \text{invisible}) < 5.9 \cdot 10^{-4}$ (90 % C. L.) was found. This decay channel is predicted in Hidden Sector models such as the Mirror Matter (MM), which could be a candidate for Dark Matter. Analyzed within the MM context, this result provides an upper limit on the kinetic mixing strength between ordinary and mirror photons of $\varepsilon < 3.1 \cdot 10^{-7}$ (90 % C. L.). This limit was obtained for the first time in vacuum free of systematic effects due to collisions with matter. An upgraded confinement cavity and an improvement to the triggering system are also presented, which will improve the sensitivity to $\varepsilon \simeq 10^{-9}$.This is more than one order of magnitude below the current Big Bang Nucleosynthesis limit and in a region of parameter space of great theoretical and
phenomenological interest.

The experimental setup will also allow us to measure the o-Ps decay rate. Currently, the experimental uncertainty of the o-Ps decay rate is at 140 ppm precision; this exceeds the theoretical accuracy (1 ppm level) by two orders of magnitude. We propose a method that relies on the o-Ps confinement cavity and the granularity of the surrounding calorimeter to subtract the time dependent pick-off annihilation rate of the fast backscattered positronium from the o-Ps decay rate prior to fitting the distribution. Therefore, this measurement will be free from the systematic errors present in the previous experiments and thus could reach the ultimate accuracy of a few ppm level to confirm or confront directly the higher order QED corrections.

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Gravitational waves / **23**

Seeing and Hearing the Violent Universe: the astrophysics of compact object mergers

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Gravitational waves / **24**

The long vision of gravitational wave astronomy

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Recent gravitational wave (GW) detections with LIGO/Virgo opened a new window on the Universe, unveiling the most violent catastrophic events in the cosmos. GW astronomy is just in its infancy, the Laser Interferometer Space Antenna (LISA) and Pulsar Timing Arrays (PTAs) will offer a complementary view of the GW universe in a much more extended range of frequencies, from mHz down to nHz. I will briefly discuss the status of LIGO/Virgo, LISA and PTA, their targeted sources and the science they will enable in the future decades.

Affiliation:

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Academic position:

Gravitational waves / **25**

Probing nuclear physics with gravitational waves

The gravitational waves from a neutron star binary inspiral carry unique information about fundamental physics in extreme conditions. I will discuss the imprints of the properties of neutron star matter on the gravitational waves, what we have learned from the neutron star binary inspiral event GW170817, and outline future prospects and challenges.

Affiliation:

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Academic position:

Gravitational waves / **26**

Direct gravitational wave detection and its implications for fundamental physics, astrophysics, and cosmology

The ability to directly detect gravitational waves from merging binary black holes gave us our first-ever access to the genuinely strong-field dynamics of gravity. In 2017 a binary neutron star coalescence was also observed, accompanied by a short gamma ray burst, thus corroborating the link between the two. The discovery of an afterglow gave a glimpse of the putative formation mechanism for a large fraction of heavy elements in the Universe. In addition, gravitational wave observations provided us with a way to directly probe the behavior of bulk nuclear matter, about which much is still unknown. Finally, gravitational wave observations of both binary black hole and binary neutron star

coalescences yield a new type of distance marker which bypasses the "cosmic distance ladder". After this I will discuss what other discoveries can be expected in the near term, and what will be the new opportunities arising from future new detectors on the ground and in space.

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Low energy precision experiments / **27**

Dark sectors at the precision/intensity frontier

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Empirical motivations for new physics, e.g. the need to explain dark matter and neutrino mass, arguably point to a hidden/dark sector, weakly coupled to the Standard Model. I'll discuss the impact of low energy precision and high-intensity experiments in testing this theoretical paradigm.

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Academic position:

Low energy precision experiments / **28**

Searching for dark matter using ultra cold neutrons

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The existence of dark matter DM is well established from cosmological observations. While large scale structure formation, rotation curves of galaxies and gravitational lensing all clearly indicate the presence of DM in the Universe, the microscopic particles responsible for these observation still hide from laboratory discovery. A viable class of hypothetical particles which could make up DM are Axions and Axion like particles. Originally the Axion was motivated by the absence of a signal for an electric dipole moment of the neutron (nEDM) ($dn < 3.0 \times 10^{-26} ecm$ [J.M. Pendlebury et al.,PRD92(2015)092003]) generated by the vacuum polarisation term of quantum chromo dynamics. The same spectrometers using ultra cold neutrons which are used for searching for an nEDM can also be used to search for ultra-light axionic dark matter [C. Abel et al., PRX7(2017)041034].
In this talk I will give an overview of possible DM searches using ultra cold neutrons with a particular focus on our experiments using spin precession.

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Academic position:

Low energy precision experiments / **29**

Atomic physics tests of dark matter and dark energy

Atomic physicists have spent decades developing tools to gain complete quantum control of atoms and ions. These tools have used them to make ever increasing precision measurements - the most prominent example being atomic optical clocks which can now measure frequencies to 10^{-19} precision. Recently there has been increasing interest in leveraging these precision tools to look for small effects from various dark matter and dark energy models. In this talk I will discuss a couple examples. First I will discuss how precision force measurements using atom interferometry can be used to constrain various scalar field models proposed as candidates for dark energy and dark matter. Second I will discuss a new experiment using laser cooled radioactive cesium atoms to search for sterile neutrinos through total energy and momentum reconstruction.

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Academic position:

Early universe cosmology / **30**

Matter in the Universe as a Consequence of the Fermi Scale Epoch

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The Standard Model may be a valid effective field theory all the way up to the Planck scale, still it suffers from a number of theoretical and observational shortcomings. I will overview the theoretical, phenomenological and cosmological arguments for a possible existence of new particles with masses below the Fermi scale and discuss the experimental prospects to search for them.

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Academic position:

Early universe cosmology / **31**

Cosmology of Fibre Inflation Models

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I will describe several features of type IIB Fibre Inflation models like:
(i) how to construct a chiral global embedding into consistent Calabi-Yau orientifold compactifications;
(ii) the presence of an inflaton upper bound from the Kahler cone conditions;
(iii) the details of perturbative reheating and the associated production of dark radiation;
(iv) the generation of primordial black holes during inflation and their contribution to dark matter;
(v) open issues with light axionic spectator fields during inflation.

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Academic position:

Early universe cosmology / **32**

Exploring the Early Universe with the Cosmic Microwave Background

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Even though the Cosmic Microwave Background (CMB) is a photograph of the Universe when it was about 400000 years old and had a temperature of about 0.3eV, it contains information about a much earlier phase of the Universe, most notably inflation.
In my talk I shall describe the amplified quantum fluctuations which we observe in the CMB. I shall discuss what we already know and what we might learn from future observations. I also argue why we are convinced that a mechanism similar to inflation is at the origin of the observed spectrum of fluctuation.

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Academic position:

Dark matter / **37**

Cosmological Probes of Dark Matter Interactions

I will review cosmological probes of dark matter physics, focusing in particular on the most recent results relating to dark-matter–baryon elastic scattering.

Affiliation:

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Academic position:

Closing session/summary talks / **38**

Closing talk: theory

Closing session/summary talks / **39**

Closing talk: experiment

Affiliation:

Email address:

Academic position:

Modern tools in detection and data analysis in particle physics and astrophysics / **40**

Deep Learning and the challenges of High-Luminosity LHC

In this talk, I review some of the big challenges that will come with High-Luminosity LHC
and how Deep Learning could be used as a paradigm-shift solution to face such a challenge.
Reviewing existing proof-of-principle studies, I will discuss how the usage of Deep Learning solutions
could alleviate the task of collecting, processing, monitoring and analysing the large datasets
that the LHC will deliver.

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Academic position:

Modern tools in detection and data analysis in particle physics and astrophysics / **41**

Networked data-science for research, academic communities and beyond

In this talk, I'll focus on an exceptional way of doing data-driven research employing networked community. Many examples of collaboration with the data-science community within competitions organised on Kaggle or Coda Lab platforms usually get limited by restrictions on those platforms. Common metrics do not necessarily correspond to the goal of the original research. Constraints imposed by the problem statement typically look artificial for ML-community. Preparing a perfect competition takes a considerable amount of efforts. On the contrary research process requires a lot of flexibility and ability to look at the problem from different angles. I'll describe the alternative research collaboration process can bridge the gap between domain-specific research and data science community. Particularly, it can involve academic researchers, younger practitioners and all

enthusiasts who are willing to contribute. Such research process can be supported by an open computational platform that is will be described along with meaningful examples and discussed amongst the audience of the track.

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Academic position:

Modern tools in detection and data analysis in particle physics and astrophysics / **42**

Machine Learning: From Industry to Science

New methods of big data analysis, data mining, data generations and data adaptation are widely used in many different areas of the modern society. This is mostly a result of fruitful cooperation between corresponding business experts and experts in relevant areas of the computing science. Natural sciences however, especially those frontiers like particle physics and cosmology at their extremes usually use different model: modern CS ideas are accommodated by specialists educated in the natural science, not by CS experts. In the presentation I will discuss pro and contra of this approach, give an overview which kind of problems may be better addressed using Machine Learning techniques. What may be expected when people apply ML to natural sciences, and which questions are still opened. We will also touch some ethical aspects related with increasing use of AI in modern world.

Affiliation:

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Academic position:

Model building / **43**

Recent developments in model building

Model building / **44**

Exotic DM models

Model building / **45**

Dark sectors

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Model building inspired by flavor physics

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Exotic searches at the LHC

In this talk, a brief description of the latest results in exotic searches using data collected in 2016 by the CMS and ATLAS experiments at the LHC. This talk focuses on searches using Lorentz-boosted hadronic objects which are enhanced by the current conditions of the LHC.

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Academic position:

Collider physics / **48**

SUSY searches at the LHC

Despite the absence of experimental evidence, weak scale supersymmetry remains one of the best motivated and studied Standard Model extensions. This talk gives an overview of the most recent SUSY searches at ATLAS and CMS experiments using 13 TeV Run2 data.

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Academic position:

Collider physics / **49**

Rare, Exotic, and Invisible Higgs boson at the LHC

ATLAS and CMS have rich programs to explore the BSM territories in Higgs physics. The latest LHC results on Higgs rare, exotic and invisible decays are briefly reviewed in this talk.

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Academic position:

Collider physics / **50**

Search for dark sectors and long-lived particles at the LHC

The search programmes for long-lived and dark sector particles have been gaining momentum at ATLAS and CMS as LHC Run 2 nears its end. These unconventional signatures are well motivated but were often not among the first targets of Run 2 due to requiring complex experimental techniques such as dedicated triggers, reconstruction, or calibration. New results will be highlighted from both experiments in this up-and-coming research area.

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Collider physics / **51**

Search for low and high mass resonances at the LHC

Affiliation:

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Academic position:

Collider physics / **52**

Tests of Lepton Flavor Universality at LHCb

The Lepton Flavour Universality (LFU) anomalies are currently one of the hottest topics in the particle physics community. LFU can be violated in models beyond the SM by new physics particles that couple preferentially to certain generations of leptons. A combination of recent results from LHCb, Belle and BaBar on the ratio of branching fractions of tree level b->clν processes have shown a discrepancy from the Standard Model (SM) prediction of ≈ 4 σ. Tensions with respect to SM predictions have also been observed in both branching fractions and angular observables of rare semileptonic b decays.
In the talk I will mainly review the latest lepton universality tests with both semileptonic and rare semileptonic decays of B mesons and I will give a short outlook for the near future.

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Dark matter / **53**

Accelerator-based Searches for Light DM

The origin and observed abundance of Dark Matter can be explained elegantly by the thermal freeze-out mechanism, leading to a preferred mass range for Dark Matter particles in the MeV-TeV region. The GeV-TeV mass range is being explored intensively by a variety of experiments searching for Weakly Interacting Massive Particles. The sub-GeV region, however, in which the masses of most of the building blocks of stable matter lie, is experimentally open territory. This mass range for particles and force carriers occurs naturally in Hidden Sector Dark Matter models. This talk gives an overview of accelerator-based experiments searching for MeV - GeV Dark Matter, targeting as a benchmark a model with a Dark Photon mixing kinetically with the SM photon. It will focus on searches for invisibly decaying Dark Photons.

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Academic position:

Dark matter / **54**

Accelerator-based light particle searches at NA62 experiment

The NA62 fixed target experiment, which operates on a very high intensity, 400 GeV/c primary proton beam supplied from the CERN SPS accelerator facility has a great potential to search for new particles at MeV-GeV scale. Very weak coupling with the SM sector is assumed. New Physics models such are heavy neutral leptons, axion-like particles, dark photons and scalars are being studied at NA62. In this talk results of the studies are presented.

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Dark matter / **55**

SHiP and its relation to DM and cosmology

Affiliation:

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Academic position:

Dark matter / **56**

Dark matter searches with ATLAS and CMS

This talk will give an overview of searches for WIMP Dark Matter exploiting signatures of large missing transverse energy (MET) at both ATLAS and CMS. The so-called MET+X searches are performed for various objects X and cover a broad range of DM scenarios. The talk will focus on recent results using 13 TeV data sets, new techniques that are employed and new models that are tested.

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Dark matter / **57**

Dark matter mediator searches with the LHC

This talk presents results from the ATLAS and CMS experiments on searches for dark matter mediator particles. First, searches targeting new vector bosons decaying into dijet final states are described. Techniques for studying low-mass resonances below the typical threshold for conventional dijet resonance searches are emphasized, including the use of data scouting, online bottom quark tagging, and boosted mediator production due to initial state radiation. Second, more complex models are discussed, including scalar mediators, leptonic decays, and SUSY. Finally, the LHC limits are compared to direct detection results in the context of the mediator simplified models.

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Late universe cosmology / **59**

From pixels to physics: the promise of large cosmological surveys

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We are entering a transformative period in observational cosmology. Surveys starting in 2019 promise to solve key problems in cosmology — but only if we develop new approaches for handling the volume and complexity of the data. Extracting robust cosmological information from these surveys is a major challenge that will require development and validation of analysis methods at each step of the chain from raw pixels to cosmology. I will comment on some of the experimental and methodological innovations that are needed to realise the promise of upcoming surveys. I will place particular emphasis on the need for accurate diagnosis of inconsistent results from different combinations of cosmological probes,
to ascertain whether such “tensions” indicate the need for new physics.

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Academic position:

Neutrinos / **62**

Neutrinos and cosmology

The presence of a cosmic background of relic neutrinos is a robust prediction of the standard cosmological model. A direct detection is extremely difficult and still lacking. Nevertheless cosmological observations are a powerful probe of neutrino properties, and cosmological bounds on neutrino masses and number are in agreement with both theoretical predictions and laboratory searches.
In this talk, I will briefly review the basics of neutrino cosmology. I will then focus on current cosmological limits on neutrino properties, and show the prospects from next-generation surveys.

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Academic position:

Neutrinos / **63**

Latest results from NOvA

The NOvA experiment is a two detector long baseline neutrino oscillation search. This talk will show the latest results from NOvA with both a neutrino and antineutrino beam. Implications for the future will also be discussed with a particular emphasis on leptonic CP violation.

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Academic position:

Dark matter / **64**

Axion Dark Matter Experiment (ADMX) Recent Results and Future Prospects

The Axion Dark Matter Experiment (ADMX) is currently taking data with sensitivity towards discovery of the axion that simultaneously solves the strong-CP problem of quantum chromodynamics (QCD) and accounts for the dark matter of the universe. Details will be given of the microwave cavity haloscope technique and recent published results demonstrating sensitivity in the axion coupling

to two photons below the canonical theoretical band that encompasses model uncertainty. The run plan and potential future efforts will also be described.

Affiliation:

Email address:

Academic position:

Late universe cosmology / **65**

An Analytic Approach to Cosmic Structures

The non-linear, late-time evolution of cosmic structures is notoriously hard to tackle with analytic methods. While numerical simulations are highly successful and lead to impressive results, there are fundamental as well as pragmatic reasons for an analytic understanding to be sought. Conventional methods based on the hydrodynamic equations are limited mainly by the shell-crossing problem. In this talk, I shall review a novel approach based on kinetic field theory. It structurally resembles a non-equilibrium statistical quantum field theory and avoids the shell-crossing problem by construction. Suitably approximating particle interactions allows the derivation of a closed, non-perturbative, parameter-free expression for the non-linear cosmic-density power spectrum which reproduces numerical results to better than 10% up wave numbers of k ~ 10 h/Mpc at redshift 0. The formalism can straightforwardly be generalised to mixtures of gas and dark matter, axionic dark matter, or modified gravity theories, for which I shall show first examples.

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Late universe cosmology / **66**

The Hubble Constant: Implications for Cosmology

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Organizational / **67**

Conference Welcome

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Academic position:

Neutrinos / **68**

Latest results from T2K

Affiliation:

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Academic position:

Short presentations & Poster session / **69**

Fourier domain gravitational waveforms for precessing eccentric binaries

Authors: Antoine Klein[1]; Yannick Boetzel[2]; Philippe Jetzer[2]; Achamveedu Gopakumar[3]; Lorenzo De Vittori[None]

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We build two families of inspiral waveforms for precessing binaries on eccentric orbits in the Fourier domain. To achieve this, we use a small eccentricity expansion of the waveform amplitudes in order to separate the periastron precession timescale from the orbital timescale, and use a SUA transformation to compute the Fourier transform in the presence of spin-induced precession. We show that the resulting waveforms can yield a median faithfulness above 0.993 when compared to an equivalent time domain waveform with an initial eccentricity of e_0 0.3. Using a circular waveform can potentially lead to significant biases in the recovery of the parameters, even when the system has fully circularized. This is an effect of the residual eccentricity present when the objects forming the binary have non-vanishing spin components in the orbital plane.

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Short presentations & Poster session / **70**

The Mu3e Experiment

Author: Lukas Gerritzen[1]

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Mu3e is an experiment for the search for the charged lepton flavour violating decay $\mu \to \mathrm{eee}$ with a single event sensitivity of 10^{-16}, which is an improvement of 4 orders of magnitude over the current limit of $B < 10^{-12}$ (90% CL, SINDRUM, 1988).
This poster explains the general detector concept and lays focus on the scintillating fibre sub-detector. High muon stopping rates of up to $10^8 \mu/s$ call for precise timing measurements to suppress combinatorial backgrounds (*pileup*). The scintillating fibre sub-detector (in combination with a scintillating tile sub-detector) makes for combinatorial background suppression by two orders of magnitude.

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Dark matter / **71**

Sterile neutrino DM: status and overview

Dark matter / **72**

Dark matter searches with liquid xenon detectors

Affiliation:

Email address:

Academic position:

Dark matter / **73**

ArDM, DEAP, DarkSide review (LAr)

Dark matter / **74**

Searching for Low-Mass Dark Matter Particles: DAMIC, SuperCDMS and CRESST

Cosmological and astronomical observations indicate that the vast majority of the universe's matter content is made out of dark matter. We have to look beyond the Standard Model of particle physics to find candidates for dark matter in the form of weakly interacting massive particles. Over the past decades, we have largely focused on searching for dark matter within the 10 GeV-1 TeV mass range (WIMPs). The absence of a discovery has motivated us to broaden our experimental search program and to look for lighter dark matter particles in the sub-GeV mass range. In this talk, recent results and ongoing efforts in terms of detector technologies of the DAMIC, SuperCDMS and CRESST collaborations will be discussed.

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Academic position:

Late universe cosmology / **75**

Probing the nature of dark matter with astrophysical observations

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I will discuss different ways to constrain the nature of dark matter using gravitational probes from current and future astrophysical surveys. The focus will be on non-cold and interacting dark matter models.

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Late universe cosmology / **76**

Dark-energy constraints from forthcoming cluster and galaxy surveys

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Late universe cosmology / **77**

The Landscape of Modified Gravity

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Academic position:

Organizational / **85**

Registration

Organizational / **86**

PPC 2019: Welcome from the organizers

Affiliation:

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Academic position:

Short presentations & Poster session / **87**

Gravitational wave polarization from combined Earth-space detectors

Authors: Lionel Philippoz[1]; Adrian Boitier[1]; Philippe Jetzer[1]

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We investigate the sensitivity to additional gravitational wave polarization modes of future detectors. We study the correlation of the upcoming Einstein Telescope and its combination with existing or planned Earth-based detectors with a possible future space-borne detector like DECIGO. The cases of a gravitational wave background and point sources are considered.

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Organizational / **88**

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