Crossroads between Theory and Phenomenology

Report of Contributions

https://indico.cern.ch/e/1334507

Contribution ID: **1** Type: **not specified**

Shining axions through astrophysical walls

Monday 10 June 2024 10:00 (45 minutes)

Presenter: SAFDI, Benjamin

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

More Axion Stars from Strings

Monday 10 June 2024 11:30 (45 minutes)

We show that if dark matter consists of QCD axions in the post-inflationary scenario more than ten percent of it efficiently collapses into Bose stars at matter-radiation equality. Such a result is mostly independent of the present uncertainties on the axion mass. This large population of solitons, with asteroid masses and Earth-Moon distance sizes, might plausibly survive until today, with potentially interesting implications for phenomenology and experimental searches.

Presenter: GORGHETTO, Marco (DESY)

Contribution ID: **3** Type: **not specified**

Welcome

Monday 10 June 2024 09:45 (5 minutes)

Presenter: MCCULLOUGH, Matthew Philip (CERN)

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

Gravitational Wave-Induced Freeze-In of Fermionic Dark Matter

Tuesday 11 June 2024 10:00 (45 minutes)

Presenter: MALEKNEJAD, Azadeh

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

Where to Look and How to Look for High-Frequency Gravitational Waves

Tuesday 11 June 2024 11:30 (45 minutes)

Abstract: Stochastic backgrounds of gravitational waves can potentially open a window on extremely high energies, giving us information on phase transitions at the GUT scale and many other BSM phenomena. In this talk I will discuss simple heuristic arguments that allow to establish the smallest detectable energy density in a primordial gravitational wave background. I will focus mainly on what is achievable with realistic detectors, and comment on the potential of advanced quantum sensing techniques. In the foreseeable future, it is not feasible to go beyond the BBN bound for frequencies above 100 kHz.

Presenter: D'AGNOLO, Raffaele (CEA IPhT Saclay)

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

Stability of Superconducting Strings

Tuesday 11 June 2024 15:00 (45 minutes)

Presenter: XUE, Wei (University of Florida (US))

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

Simulating Stochastic Gravitational Waves from Early Structure Formation

Wednesday 12 June 2024 10:00 (45 minutes)

Gravitational wave detectors provide a chance to observe the state of the very early universe and have important sensitivities for studies of early universe cosmology and searches for physics beyond the Standard Model. In this talk, I will discuss the production of potentially detectable stochastic gravitational wave backgrounds in early matter dominated eras in the linear and non-linear regimes of structure formation.

Presenter: FOSTER, Joshua (Massachusetts Institute of Technology)

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

The Strong CP Problem in String Theory (Cosmo+Swampland meeting)

Wednesday 12 June 2024 11:30 (45 minutes)

Presenter: MORITZ, Jakob Ulrich

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

Thinking Outside the Hypercube: RS and its Implications - TH colloquium

Wednesday 26 June 2024 14:00 (1 hour)

Presenter: RANDALL, lisa (harvard)

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

QCD axion strings or seeds?

Thursday 13 June 2024 10:00 (45 minutes)

Presenter: Dr BLASI, Simone (DESY)

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

Dynamical Generation of the Baryon Asymmetry from a Scale Hierarchy

Thursday 13 June 2024 11:30 (45 minutes)

Abstract: We propose a novel baryogenesis scenario where the baryon asymmetry originates directly from a hierarchy between two fundamental mass scales: the electroweak scale and the Planck scale. Our model is based on the neutrino-portal Affleck-Dine (AD) mechanism, which generates the asymmetry of the AD sector during the radiation-dominated era and subsequently transfers it to the baryon number before the electroweak phase transition. The observed baryon asymmetry is then a natural outcome of this scenario. The model is testable as it predicts the existence of a Majoron with a keV mass and an electroweak scale decay constant. The impact of the relic Majoron on ΔNeff can be measured through near-future CMB observations.

Presenter: CHANG, Jae Hyeok (Fermilab and UIC)

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

Cosmological Production of ROMP Dark Matter

Thursday 13 June 2024 15:00 (45 minutes)

Rapidly Oscillating Massive Particles (ROMPs) arise in quantum systems with non-diagonal interaction mass matrices. This misalignment between flavor and mass eigenstates leads to oscillations such as those between electron and muon neutrinos in the Standard Model, or between active and sterile neutrinos in Beyond the Standard Model frameworks to name just a few examples. In this talk, I will discuss the general framework for dark matter production via oscillations. I will focus on ROMP systems where one flavor state, chi, is weakly coupled to the Standard Model (and hence a good dark matter candidate) and the second flavor state, psi, is strongly coupled to the Standard Model such that psi oscillations to chi in the early universe can efficiently produce chi as the dark matter. I will discuss how oscillations, scatterings, thermal masses, and resonances all play a role to give ROMPs a rich cosmology.

Presenter: DUNSKY, David

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

Axion dark matter from kinetic misalignment

Friday 14 June 2024 10:00 (45 minutes)

Kinetic misalignment enables axion DM at low axion axion decay constant, which is particularly relevant for the whole experimental programme af axion searches. I'll discuss its distinctive features such as axion fragmentation and its signatures, as well as
UV implementations of rotating axions.

Presenter: SERVANT, Geraldine (Deutsches Elektronen-Synchrotron (DE))

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

Probing the dark sector with Large Scale Structure

Friday 14 June 2024 11:30 (45 minutes)

Presenter: SALVIONI, Ennio (University of Sussex (GB))

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

Shadow Matter

Monday 17 June 2024 11:30 (45 minutes)

I will argue that there are quantum states of the field theories of general relativity and electromagnetism that we typically ignore, but have interesting phenomenological effects. These states amount to loosening the constraint equations known as the Hamiltonian and momentum constraints in GR and Gauss'law in EM. Turning off the Hamiltonian constraint sources non-dynamical parts of the metric which mimic a pressureless dust, and thus these effects may be the explanation as to why we have inferred the existence of dark matter, both locally and cosmologically. Turning off the momentum constraints add additional velocity-dependent source terms to this effective dust, but these effects are not conserved and redshift quickly outside the horizon. Turning off the Gauss'law constraint mimics a charge density that does not respond to electric forces, but follows geodesics, thus adding a charged component to the dust. If this new structure in the gravitational and electric fields explain dark matter, it forbids an early period of inflation and therefore requires a different explanation for density perturbations.

Presenter: KAPLAN, David

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

Continuous-Spin Particles, On Shell

Monday 17 June 2024 15:00 (45 minutes)

Presenter: BELLAZZINI, Brando

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

n-shell relations between effective field theories of gluons

Tuesday 18 June 2024 10:00 (45 minutes)

It is known that universal algebraic structures govern the scattering amplitudes of a large web of theories, whose boundaries are however not well understood. In this talk, I will comment on effective field theory deformations of this web. Focussing on tree-level dynamics, I will explain that the scattering amplitudes of gluons minimally coupled to adjoint scalars contain all of the information required to construct those of a tower of gluon EFTs. For instance, I will present closed-form expressions for all-multiplicity scattering amplitudes in the (CP-even) EFT of gluons at mass dimension six, and for a specific choice of Wilson coefficients at dimension eight —all constructed through a systematic and explicit recycling of dimension-four data. I will also mention how one can recursively turn spacetime dimensions into operator dimensions. The technique behind those results is our extension of the so-called covariant color-kinematics duality introduced by Cheung and Mangan.

Primary author: BONNEFOY, Quentin (DESY)

Presenter: BONNEFOY, Quentin (DESY)

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

Vignettes from Strongly-Coupled Dark Sectors

Tuesday 18 June 2024 11:30 (45 minutes)

I'll discuss three recent developments related to dark glueball, dark meson, and dark baryon theory and phenomenology. Along the way we'll see the continued importance of prompt and long-lived searches at LHC, as well as a surprising symmetry impacting dark baryon direct detection that appears in a broad class of strongly-coupled dark sectors.

Primary author: KRIBS, Graham

Presenter: KRIBS, Graham

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

Learning new tricks with the Higgs?

Tuesday 18 June 2024 15:00 (45 minutes)

Primary authors: ENGLERT, Christoph; ENGLERT, Christoph Peter (University of Glasgow (GB))

Presenters: ENGLERT, Christoph; ENGLERT, Christoph Peter (University of Glasgow (GB))

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

A different view on colliders

Wednesday 19 June 2024 10:00 (45 minutes)

Energy correlators do live at the crossroads between theory and phenomenology. I will briefly review developments on both fronts that explain the resurgence of interest on these old observables. Then, I present how to compute high point correlators from recursion relations, what can be learned from low point ones, and how to go beyond energies.

Primary author: Mr RIEMBAU, Marc (CERN)

Presenter: Mr RIEMBAU, Marc (CERN)

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

Higgs Shift-Symmetries

Wednesday 19 June 2024 11:30 (45 minutes)

Primary author: SERRA, Javi (IFT)

Presenter: SERRA, Javi (IFT)

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

New physics on the run from precision tests - TH colloquium

Wednesday 19 June 2024 14:00 (1 hour)

Primary author: RENNER, Sophie Alice (University of Glasgow (GB))

Presenter: RENNER, Sophie Alice (University of Glasgow (GB))

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

Non-decoupling new particles

Thursday 20 June 2024 10:00 (45 minutes)

Primary author: SUTHERLAND, David

Presenter: SUTHERLAND, David

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

Probing ultralight dark matter with gravity wave detectors

Thursday 20 June 2024 11:30 (45 minutes)

Primary author: KIM, Hyungjin

Presenter: KIM, Hyungjin

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

Matching EFT to LHC

Thursday 20 June 2024 15:00 (45 minutes)

Primary author: LUTY, Markus (University of California Davis)

Presenter: LUTY, Markus (University of California Davis)

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

Non-invertible Naturalness and Quantum Flavodynamics

Friday 21 June 2024 10:00 (45 minutes)

Presenter: KOREN, Seth (University of Notre Dame)

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

Strong gauge dynamics and BSM model building tools

Friday 21 June 2024 11:30 (45 minutes)

Many attractive ideas on BSM physics involve strong gauge dynamics we do not understand well. I present recent attempts to gain better understanding of strong gauge dynamics using supersymmetry and anomaly mediation of supersymmetry breaking. Then I speculate on areas of BSM model building that they may open up.

Primary author: MURAYAMA, Hitoshi (University of California Berkeley (US))

Presenter: MURAYAMA, Hitoshi (University of California Berkeley (US))

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

On-shell techniques for the standard-model effective theory

Wednesday 26 June 2024 11:30 (45 minutes)

Presenter: DURIEUX, Gauthier (CP3 - UCLouvain)

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

Particle Physics meets Gravitational Wave Physics

Monday 24 June 2024 15:00 (45 minutes)

I will give an overview of how quantum field theory—the main tool of particle physics—is applied to the study of relativistic two-body problem, how it is relevant to precision measurements in future gravitational wave observatories, and how it connects to my research in this topic; the effects of spin in binary dynamics.

Presenter: Mr KIM, Jung-Wook

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

Talk

Monday 24 June 2024 11:30 (45 minutes)

Presenter: BRENNAN, T. Daniel

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

A holographic view of the QCD axion

Tuesday 25 June 2024 10:00 (45 minutes)

Presenter: GHERGHETTA, Tony

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

Axion couplings as UV probes

Tuesday 25 June 2024 11:30 (45 minutes)

Presenter: NEE, Michael (Harvard University)

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

Geometry of Scattering Amplitudes

Tuesday 25 June 2024 15:00 (45 minutes)

Presenter: HELSET, Andreas (CERN)

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

Hamiltonian Truncation and Effective Field Theory

Wednesday 26 June 2024 10:00 (45 minutes)

Presenter: FARNSWORTH, Kara Michelle (Universite de Geneve (CH))

Contribution ID: **35** Type: **not specified**

Gravitational waves from domain walls bounded by inflated cosmic strings

Thursday 27 June 2024 10:00 (45 minutes)

Presenter: WANG, Liantao

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

The quantum width of a causal diamond

Thursday 27 June 2024 11:30 (45 minutes)

Presenter: ZUREK, Kathryn (Caltech)

Contribution ID: **37** Type: **not specified**

Topological Portal to the Dark Sector: from EFT to UV

Thursday 27 June 2024 15:00 (45 minutes)

Presenter: DAVIGHI, Joseph Enea

Contribution ID: **38** Type: **not specified**

SU(N) and O(N) Representation Theory at non-integer N

Friday 28 June 2024 10:00 (45 minutes)

The standard representation theory for SU(N) and O(N) groups are defined at positive integer N. However, cases of non-integer N are often encountered, e.g. when studying dimensional regularization, evanescent operators, conformal bootstrap, etc. A natural continuation to non-integer N (such as N=3.99) is to take the one at infinitely large integer N. This contains representations with arbitrarily high ranks, which must appear ("specialize") as representations with valid ranks when N is taken to be an integer. This specialization map is complicated to work out for the O(N) group. In this talk, I will introduce a very efficient new algorithm through clipping the Young diagram. I also clarify that the Racah-Speiser algorithm in textbooks is for a completely different task, which cannot achieve what our new algorithm does.

Presenter: LU, Xiaochuan (University of California, San Diego)

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

Abelian Instantons and Monopole Scattering

Friday 28 June 2024 11:30 (45 minutes)

It is usually assumed that 4D instantons can only arise in non-Abelian theories. In our recent work arXiv:2406.13738, we re-examine this conventional wisdom by explicitly constructing instantons in an Abelian gauge theory: QED_4 with N_f flavors of Dirac fermions, in the background of a Dirac monopole. This is the low-energy effective field theory for fermions interacting with a 't Hooft-Polyakov monopole, in the limit where the monopole is infinitely heavy (hence pointlike) and static. This theory, whose non-topological sectors were studied by Rubakov and Callan, has a far richer structure than previously explored. We show how to calculate the topological instanton number, demonstrate the existence of 't Hooft zero modes localized around such instantons, and show how instantons in the path integral provide the underlying mechanism for the Callan-Rubakov process: monopole-catalyzed baryon decay with a cross-section that saturates the unitarity bound. Our computation relies on correctly identifying the relevant EFT for monopole catalysis as axial QED_2 in an effective AdS_2 metric.

Presenter: TELEM, Ofri (The Hebrew University of Jerusalem)

Contribution ID: **40** Type: **not specified**

TH colloquium by Krishna Rajagopal, ”Novel Probes of the Primordial Liquid”

Wednesday 12 June 2024 14:00 (1 hour)

Please check details on https://indico.cern.ch/event/1384507/

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

Welcome

Monday 17 June 2024 11:25 (5 minutes)

Presenter: MCCULLOUGH, Matthew Philip (CERN)

Contribution ID: **42** Type: **not specified**

Welcome

Monday 24 June 2024 11:25 (5 minutes)

Presenter: COHEN, Tim (CERN)