

# **Israeli Joint Particle Physics Meetings 2020-2021**

## **Report of Contributions**

Contribution ID: 1

Type: **not specified**

## TBA

*Wednesday, October 28, 2020 11:00 AM (1 hour)*

The talks will be given remotely:

Topic: Israeli joint seminar - Balkin/Caputo

Time: Oct 28, 2020 11:00 AM Jerusalem

Join Zoom Meeting

<https://technion.zoom.us/j/98260375922?pwd=dDJqdHBSa3pmY3Z5WEs3NEU0aENKZz09>

Meeting ID: 982 6037 5922

Passcode: HEP\_joint

Reuven will talk about:

Landscape instabilities from finite density effects

Abstract:

We consider finite density effects in models with a metastable ground state. We find that sufficiently dense objects, such as neutron stars, can destabilise the metastable minimum, allowing for classical formation of bubbles of a new vacuum. As we show, these bubbles are not necessarily confined to the dense region, but can escape to infinity. This leads to a phase transition in the universe after the formation of stars, and therefore has significant impact on e.g. solutions to the electroweak hierarchy problem based on dynamical selection of the electroweak vacuum. We work out the phenomenological consequences of such density triggered late phase transitions and put new constraints on the parameter space of some benchmark relaxation models.

Andrea will talk about:

Beyond the Standard Model with CMB and 21 cm data

I will introduce some well motivated Beyond The Standard Model (BSM) candidates and explain their effects on cosmological/astrophysical observables such as 21 cm and CMB data. In particular, I will first focus on Photon/ Dark Photon conversion in our inhomogeneous universe and its effect on the CMB spectrum. Then, I will add an axion-like particle to the model, which can play the role of dark matter, and investigate the effect of this extra energy injection onto the measured global 21-cm signal.

**Presenters:** CAPUTO, Andrea (University of Valencia); BALKIN, Reuven (Technical University of Munich)

Contribution ID: 2

Type: **not specified**

## TBA

*Wednesday, November 4, 2020 11:00 AM (1 hour)*

The talk will be given remotely:

Topic: Israeli joint seminar - Madge/Gouttenorie

Time: Nov 4, 2020 11:00 AM Jerusalem

Join Zoom Meeting

<https://technion.zoom.us/j/91033490160?pwd=OXJXUWVObWJYNWRRVVpxbTB1OGpCdz09>

Meeting ID: 910 3349 0160

Passcode: Hep\_joint

Eric will talk about

Constraining Secluded Hidden Sectors with Gravitational Waves

Abstract:

Thermal hidden sectors with particles at sub-MeV scales are subject to constraints from the effective number of neutrino species, which require these sectors to decouple from the Standard Model and to be colder than the photon bath around and after the epoch of Big Bang Nucleosynthesis. We discuss how this affects cosmological first-order phase transitions and the corresponding stochastic gravitational wave background in such a hidden sector. We demonstrate that is possible to construct models that comply with the constraints and still produce a gravitational wave signal that is detectable via future pulsar timing experiments.

Yann will talk about

Heavy Dark Matter: Models and Methods of Detection beyond the Standard Paradigm

Abstract:

Thermal Dark Matter much heavier than about 100 TeV is constrained by the unitarity bound on the annihilation cross-section. However, this can be evaded in presence of entropy injection which dilutes the DM abundance. In my talk, I discuss two possible sources of entropy injection.

First, the entropy injection following reheating after an early matter era, when a heavy spectator field, dominating the energy density of the universe, decays into radiation.

Second, the entropy injection following reheating after an early stage of vacuum domination generated by a supercooled confining first-order phase transition. Considering the scenario where DM is a bound-state of a new confining force, I show that a variety of new effects, string fragmentation and deep-inelastic-scattering, play an important role for setting the final DM abundance.

Such scenarios involve non standard cosmologies (either matter era or inflationary era inside the radiation era) and can be probed using the would-be imprints on the Gravitational-Waves (GW) spectrum from Cosmic Strings if observed with future GW detectors.

**Presenters:** Mr MADGE, Eric (Johannes Gutenberg University Mainz); GOUTTENOIRE, Yann (Deutsches Elektronen-Synchrotron DESY)

Contribution ID: 3

Type: **not specified**

## Selection rules of scattering amplitudes in EFTs/Fast-rolling relaxion

*Wednesday, November 11, 2020 11:00 AM (1 hour)*

The talks will be given remotely:

Topic: Israeli joint seminar - Minyuan/Shoji

Time: Nov 11, 2020 11:00 AM Jerusalem

Join Zoom Meeting

<https://technion.zoom.us/j/96420929350?pwd=cVROS014dWFOcHI4OUV1SVh0MUxXQT09>

Meeting ID: 964 2092 9350

Passcode: Hep\_joint

Minyuan will talk about

Selection rules of scattering amplitudes in EFTs

Abstract:

I will discuss about the selection rules in helicity amplitudes in generic EFTs, at both tree and loop level. I will firstly review the well-known “non-interference” and “non-renormalization” theorems in the literature. Then I will present the new selection rules we obtained from angular momentum conservation, which gives new restriction of the anomalous dimension matrix of effective operators and the way how effective operators contribute to some  $2 \rightarrow N$  amplitudes at the loop level.

Yutaro will talk about

Fast-rolling relaxion

Abstract:

The negative results at the Large Hadron Collider imply that the scale of new physics is much higher than the electroweak scale, and the hierarchy between them should be explained in a natural way. The relaxion mechanism is a recently-proposed solution to the hierarchy problem and the electroweak scale is tuned dynamically by a scalar field. We point out that the tunneling phase of the original mechanism requires a huge number of e-folds of inflation and could cause fine-tuning problems in the inflation sector. We found a new mechanism within the original model, which overcomes the problem, is realized in a generic setup, and enhances the testability at colliders.

**Presenters:** MINYUAN, Jiang (Weizmann Institute of Science ); SHOJI, Yutaro (KMI, Nagoya University)

Contribution ID: 4

Type: **not specified**

## Signals of Axion Strings in the Sky

*Wednesday, November 18, 2020 11:00 AM (1 hour)*

The talk will be given remotely:

Topic: Israeli joint seminar - Agrawal

Time: Nov 18, 2020 11:00 AM Jerusalem

Join Zoom Meeting

<https://technion.zoom.us/j/96664637589?pwd=UCtQWFYwR0Mwb3VwTDlwMHNtSzM4Zz09>

Meeting ID: 966 6463 7589

Passcode: HEP\_joint

**Presenter:** AGRAWAL, Prateek (University of Oxford)

Contribution ID: 5

Type: **not specified**

## Positivity Bounds in Standard Model Effective Field Theory

*Wednesday, December 2, 2020 11:00 AM (1 hour)*

Dimension-8 Wilson coefficients in the Standard Model Effective Field Theory (SMEFT) are subject to the so-called “positivity bounds”. They are derived from the axiomatic principles of quantum field theory. In the parameter space spanned by Wilson coefficients, these bounds carve out various kinds of convex bodies and cones. As a result, several concepts and tools from convex geometry are useful for understanding these positive structures. I will discuss some recent studies on this topic, with a focus on the connection between the convex structure of the parameter space and the UV physics behind the SMEFT.

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<https://technion.zoom.us/j/91981479093?pwd=UXYyVU9MVnZrSnlnbnZTUFRnK3Jxdz09>

Meeting ID: 919 8147 9093

Passcode: HEP\_joint

**Presenter:** ZHANG, Cen (Institute of High Energy Physics, Chinese Academy Sciences)

Contribution ID: 6

Type: **not specified**

## Searches for new physics using levitated optomechanics

*Wednesday, December 16, 2020 11:00 AM (1 hour)*

In an attempt to provide further insight into one of the major questions of physics beyond the standard model, new, highly sensitive, optomechanical sensors are employed utilizing techniques synchronous with those of the atomic physics community. These sensors are table-top experimental tools offering exquisite control of mechanical and electrical degrees of freedom and isolation from the environment. They enable unprecedented acceleration sensitivities for  $\sim$ ng objects, while still maintaining the access needed to probe short-ranged dynamics.

In my talk I will present the experimental setup and show results from two recent searches, one looking for small recoils from passing DM particles and the other for slight deviations from charge neutrality, opening a window into an exploration of dark matter particles bound to matter that may carry tiny electric charge. In both searches our results are complementary to much large-scale experiments.

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<https://technion.zoom.us/j/98348235450?pwd=SktiOFNhVS8waFU3bzBISjlkV2lqZz09>

Meeting ID: 983 4823 5450

Passcode: HEP\_joint

**Presenter:** AFEK, Gadi (Yale )

Contribution ID: 7

Type: **not specified**

## New Pathways to the Relic Abundance of Vector-Portal Dark Matter

*Wednesday, December 9, 2020 4:00 PM (1 hour)*

In the conventional weakly-interacting massive particle (WIMP) paradigm the late-time density of dark matter (DM) is set by the rate of two-body annihilations, but there has been considerable recent interest in exploring alternative DM scenarios where other interactions control the final abundance. I will show that by fully exploring the parameter space of a simple, weakly-coupled dark sector, we can find a rich set of novel pathways which lead to the observed relic density of DM. In particular, we can identify and characterize a general class of mechanisms in which the DM relic abundance is determined by processes controlling the thermal coupling of the DM and Standard Model (dubbed the KINetically DEcoupling Relic – KINDER), generalizing previously-studied special cases of this behavior.

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<https://technion.zoom.us/j/97499474494?pwd=WFA3OGIxS00zV01Kck02K3IxeFUyUT09>

Meeting ID: 974 9947 4494

Passcode: HEP\_joint

**Presenter:** FITZPATRICK, Patrick (Massachusetts Institute of Technology)



Contribution ID: 10

Type: **not specified**

## Stellar Basins of Gravitationally Bound Particles

*Wednesday, November 25, 2020 4:00 PM (1 hour)*

I will describe and explore the consequences of a newly identified physical phenomenon: volumetric stellar emission into gravitationally bound orbits of weakly coupled particles such as axions, moduli, hidden photons, and fermions. While only a tiny fraction of the instantaneous luminosity of a star (the vast majority of the emission is into relativistic modes), the continual injection of these particles into a small part of phase space causes them to accumulate over astrophysically long time scales, forming what I call a “stellar basin”, in analogy with the geologic kind. The energy density of the Solar basin can surpass that of the relativistic Solar flux at Earth’s location after only a million years, for a sufficiently long-lived particle produced through an emission process whose matrix elements are unsuppressed at low momentum. This observation has immediate and striking consequences for direct detection experiments—including new limits on axion and hidden-photon parameter space independent of dark matter assumptions. I will also discuss ongoing N-body simulations of the Solar basin, and the prospects for indirect detection of basin particles around stars.

Meeting ID: 986 0080 9266

Password: HEP\_joint

Time: Nov 25, 2020 04:00 PM Jerusalem

Join from PC, Mac, Linux, iOS or Android: <https://weizmann.zoom.us/j/98600809266?pwd=NW9DZk5meGNTYStH3NFNU>

**Presenter:** VAN TILBURG, Ken (Santa Barbara, KITP)

Contribution ID: 12

Type: **not specified**

## **Primordial black holes as dark matter: The good, the bad and the ugly**

*Wednesday, January 13, 2021 11:00 AM (1 hour)*

In this seminar, I will consider the possibility that the totality of dark matter consists of atomic-size black holes of primordial origin. I will review the basics of this proposal, and I will discuss some key questions yet unsolved.

Zoom link: <https://us02web.zoom.us/j/87807850062>

**Presenter:** URBANO, Alfredo (Sapienza University of Rome)

Contribution ID: 13

Type: **not specified**

## Early Cannibal Domination and the Matter Power Spectrum

*Wednesday, January 20, 2021 4:00 PM (1 hour)*

Decoupled hidden sectors in the early universe can easily and generically result in departures from radiation domination prior to Big Bang Nucleosynthesis, leaving a potentially observable footprint in the distribution of dark matter on very small scales. I'll talk about the gravitational consequences of an era of early cannibal domination, which can happen when the lightest particle in a hidden sector has efficient number-changing interactions, giving it an equation of state intermediate between radiation and matter. An early cannibal-dominated era generates a peak in the dark matter power spectrum, the location and height of which are directly determined by the mass of the cannibal field, the strength of the cannibal interactions, and its lifetime. I'll discuss the map between the particle properties of the cannibal species and the features in the linear matter power spectrum, with an eye toward (futuristic) observability.

Zoom link: <https://us02web.zoom.us/j/82696603936>

**Presenter:** SHELTON, Jessie (UIUC)

Contribution ID: **14**

Type: **not specified**

**TBA**

*Wednesday, December 23, 2020 4:00 PM (1 hour)*

**Presenter:** Dr TELEM, Ofri (UC Berkeley)

Contribution ID: 15

Type: **not specified**

## Neutron stars as axion laboratories

*Wednesday, February 3, 2021 5:00 PM (1 hour)*

The QCD axion is a well-motivated dark matter candidate that may also solve the strong CP problem related to the absence of the neutron electric dipole moment. Multiple experimental efforts are currently racing to try to discover this particle in the laboratory. In this talk I will show that astrophysical observations are also a promising path towards detecting the axion and related axion-like-particles, which arise in some String Theory compactifications. I will focus in particular on neutron stars as laboratories for searching for axions, leveraging the strong magnetic fields in these systems. I will discuss two recent neutron star axion searches, one in the radio band and one in the X-ray band, that probe new regions of axion parameter space and perhaps even uncover hints of new physics.

Join Zoom Meeting

<https://technion.zoom.us/j/93107752292?pwd=V1dnZnRwODY3aDM3TFVYd2twYldGUT09>

Meeting ID: 931 0775 2292

Passcode: HEP\_joint

**Presenter:** SAFDI, Benjamin (massachusetts institute of technology)

Contribution ID: 16

Type: **not specified**

## **Black holes and axions: from gravitational waves to axionic beacons**

*Wednesday, February 17, 2021 4:00 PM (1 hour)*

I will discuss how black holes can become nature's laboratories for ultralight axions. When a boson's Compton wavelength is comparable to the horizon size of a black hole, energy and angular momentum from the black hole are converted into exponentially growing clouds of bosons, creating a gravitational atom in the sky. Previously open parameter space of axions can be constrained by observations of rapidly spinning black holes. Such black hole-axion 'gravitational atoms' can also source up to thousands of monochromatic gravitational wave signals visible in LIGO and VIRGO observatories. If the axions interact with one another, instead of gravitational waves, black holes populate the universe with axion waves that may be detectable in laboratory experiments designed for axion dark matter searches.

Zoom link:

<https://weizmann.zoom.us/j/97087622747?pwd=YUIySnVRNFEveXQyZzdEeWM4MU8vQT09>

**Presenter:** BARYAKHTAR, Masha (NYU)

Contribution ID: 17

Type: **not specified**

# Probing ultra-low-mass dark matter and macroscopic topological defects via varying fundamental constants

*Wednesday, February 10, 2021 11:00 AM (1 hour)*

## Abstract

Ultra-low-mass bosonic dark matter may form a coherently oscillating classical field. Scalar-type interactions of this field with ordinary matter induce apparent variations of the fundamental “constants”, including the fundamental interaction strengths and particle masses. I discuss how these varying constants can be sought with precision, low-energy (and often table-top-scale) experiments, including: spectroscopy (clocks), optical cavities, interferometry, and torsion pendula. Existing and new experimental data have allowed us to improve on previous bounds on scalar-field dark-matter interactions by up to 15 orders of magnitude. Ultra-low-mass bosons may also form macroscopic topological defects, such as domain walls. I discuss previously overlooked signatures in models of scalar-field topological defects, including an environmental dependence of and spatial variations of the fundamental constants in the vicinity of dense bodies such as Earth due to the formation of a “bubblelike” defect structure surrounding the dense body. These novel quasi-non-transient signatures have allowed us to significantly improve on previous bounds on models of scalar-field domain walls.

## References

- [1] Stadnik and Flambaum, Physical Review Letters 114, 161301 (2015).
- [2] Stadnik and Flambaum, Physical Review Letters 115, 201301 (2015).
- [3] Stadnik and Flambuum, Physical Review A 93, 063630 (2016).
- [4] Stadnik and Flambaum, Physical Review A 94, 022111 (2016).
- [5] Hees, Minnazzoli, Savalle, Stadnik and Wolf, Physical Review D 98, 064051 (2018).
- [6] Grote and Stadnik, Physical Review Research 1, 033187 (2019).
- [7] Stadnik, Physical Review D 102, 115016 (2020).

## Join Zoom Meeting

<https://technion.zoom.us/j/99982341831?pwd=YlpaSzA3NWJQN0lzakxLQ1Q0cEVFUT09>

Meeting ID: 999 8234 1831

Passcode: HEP\_joint

**Presenter:** Dr STADNIK, Yevgeny (Kavli IPMU, University of Tokyo)

Contribution ID: 18

Type: **not specified**

## $\nu$ Physics Searches with Neutrino Oscillation Experiments

*Wednesday, March 10, 2021 11:00 AM (1 hour)*

We will discuss several old and new searches for physics beyond the Standard Model in the neutrino sector. The first part of the talk will be devoted to the long-standing short-baseline oscillation anomalies, which we will attempt to explain both within the Standard Model and by going beyond. In the second part of the talk, we will give an overview of possible future searches for physics beyond the Standard Model using neutrino experiments, including searches for Fuzzy Dark Matter in neutrino oscillations, searches for new neutrino interactions using LHC neutrinos, and searches for light new particles in the Near Detectors at neutrino facilities.

Join Zoom Meeting

<https://technion.zoom.us/j/98345039651?pwd=ck5mdi9yUUdnTWhpYTY1bmI0QVdOUT09>

Meeting ID: 983 4503 9651

Passcode: HEP\_Joint

**Presenter:** KOPP, Joachim (CERN)



Contribution ID: 19

Type: **not specified**

## Detecting Muons in Neutron Stars with Neutrinos and Gravitational Waves

*Wednesday, March 3, 2021 11:00 AM (1 hour)*

A large abundance of stable muons is an inescapable consequence of high-mass neutron stars. In this talk I will firstly discuss the role of muon diffusion in neutron stars. This can lead to out-of-equilibrium muon decays yielding MeV-scale neutrinos as well as contribution to the neutron star cooling rate. In the second part I will turn to BSM scenarios in which muonic forces play a role in neutron star binaries and their subsequent mergers through gravitational wave measurements.

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<https://technion.zoom.us/j/98788397051?pwd=amgwVHZtNVU1cGtDU1ExQUIYcW1lZz09>

Meeting ID: 987 8839 7051

Passcode: HEP\_joint

**Presenter:** OPFERKUCH, Toby (CERN)

Contribution ID: 20

Type: **not specified**

## Dark Matter Interactions in Condensed Matter Systems

*Wednesday, April 7, 2021 4:00 PM (1 hour)*

As the gravitational evidence accumulates inexorably that dark matter comprises the vast majority of the mass of the universe, the particle nature of dark matter remains a mystery. New laboratory experiments are being commissioned to probe dark matter lighter than the proton mass, but the signature of dark matter in these detectors relies crucially on the condensed matter properties of the detector material. I will present several examples of a new approach, inspired by tools from condensed matter physics, to determine the sensitivity of a given experiment to dark matter which fully accounts for the collective modes and many-body effects present in any real material. This approach helps to identify the novel condensed matter systems with optimal material properties for dark matter detection, bridging high- and low-energy physics and ensuring that no stone is left unturned in the hunt for dark matter in the laboratory.

Join Zoom Meeting

<https://technion.zoom.us/j/97817207513?pwd=a2VxM1A1YUloLzN5d0RXOGVySmQrZz09>

Meeting ID: 978 1720 7513

Passcode: HEP\_Joint

**Presenter:** KAHN, Yonatan (University of Illinois at Urbana-Champaign)

Contribution ID: 21

Type: **not specified**

## How big is your tabletop?

*Wednesday, June 9, 2021 11:00 AM (1 hour)*

We will discuss some recent results of laboratory searches for ultralight bosonic dark matter (including the recent results from a global network of atomic magnetometers GNOME) and “fifth forces,” and will conclude with a description of the Gamma Factory at CERN—an ambitious proposal of using the LHC as a source of gamma rays with unprecedented intensity and a precision ion trap at the same time, a 27 km-circumference fundamental-physics tool with a “table-top” flavor.

Join Zoom Meeting

<https://technion.zoom.us/j/95117284437?pwd=Zmt4NWRLUEF6dmc1b0F3bjVCTUZUQT09>

Meeting ID: 951 1728 4437

Passcode: HEP\_joint

**Presenter:** BUDKER, DMITRY (Helmholtz Institute Mainz and UC Berkeley)

Contribution ID: 22

Type: **not specified**

# Comagnetometers as Probes for Ultralight Dark Matter

*Wednesday, May 5, 2021 11:00 AM (1 hour)*

**Presenter:** BLOCH, Itay (TAU)

Contribution ID: 23

Type: **not specified**

## Searching for physics beyond the Standard Model at the LHCb experiment

*Wednesday, June 23, 2021 4:00 PM (1 hour)*

### Abstract:

The LHCb experiment at the Large Hadron Collider (LHC) at CERN has been the world's premier laboratory for studying processes in which the quark types (or flavors) change since 2011. Such processes are highly sensitive to quantum-mechanical contributions from as-yet-unknown particles, e.g. supersymmetric particles, even those that are too massive to produce at the LHC. I will discuss the status of these searches, including some intriguing anomalies. I will also present searches for the proposed dark matter analogs of the photon and the Higgs boson. Planned future upgrades and the resulting physics prospects will also be discussed, including our plans to process the full 5 terabytes per second of LHCb data in real time in the next LHC run.

### Join Zoom Meeting

<https://technion.zoom.us/j/95630474725?pwd=TWNIblpXdFovc0ZKUDhlMC9rU3ByZz09>

Meeting ID: 956 3047 4725

Passcode: HEP\_Joint

**Presenter:** WILLIAMS, J Michael (Massachusetts Inst. of Technology (US))

Contribution ID: 24

Type: **not specified**

## Looking forward to new physics: The FASER experiment at the CERN LHC

*Wednesday, July 21, 2021 11:00 AM (1 hour)*

The FASER experiment is a new small and inexpensive experiment that is being placed 480 meters downstream of the ATLAS experiment at the CERN LHC. The experiment will shed light on currently unexplored phenomena, having the potential to make a revolutionary discovery. FASER is designed to capture decays of exotic particles, produced in the very forward region, out of the ATLAS detector acceptance. FASERnu, a FASER sub-detector, is designed to detect collider neutrinos for the first time and study their properties. The experiment's initial installation in its final location was completed at the end of March and the experiment is now getting ready for the LHC Run-3 data-taking. This talk will present the physics prospects, the detector design, as well as the construction and commissioning progress of FASER. Prospects for the experiment beyond Run-3 will also be outlined.

Join Zoom Meeting

<https://technion.zoom.us/j/99294613395?pwd=UHplVY9aZHh0bVB5UndpM0liTngyQT09>

Meeting ID: 992 9461 3395

Passcode: HEP\_Joint

**Presenter:** SFYRLA, Anna (Universite de Geneve (CH))

Contribution ID: 25

Type: **not specified**

## Is SMEFT Enough?

*Wednesday, May 19, 2021 4:00 PM (1 hour)*

There are two canonical approaches to treating the Standard Model as an effective field theory: the Standard Model EFT (SMEFT), respecting the full electroweak gauge symmetry, and the Higgs EFT (HEFT), respecting only electromagnetism. Of these, SMEFT has become the predominant approach, both as a framework for the interpretation of LHC Higgs data and as a laboratory for exploring the properties of effective field theory. This raises a number of questions: Is HEFT relevant in light of current data? What types of UV physics (if any) require HEFT, rather than SMEFT? Is SMEFT enough?

In this talk, I'll develop a geometric picture of SMEFT and HEFT that provides sharp criteria for determining the appropriate EFT for the Higgs sector, illuminating the physical scenarios that require HEFT and arguing that SMEFT is not enough. I'll draw further connections between this geometric picture, scattering amplitudes, and the scale of unitarity violation in the two EFTs, ultimately framing an interesting question for the LHC and future colliders: is electroweak symmetry linearly realized by the known particles?

Zoom link:

<https://weizmann.zoom.us/j/97087622747?pwd=YUIySnVRNFEveXQyZzdEeWM4MU8vQT09>

**Presenter:** CRAIG, Nathaniel (UC Santa Barbara)

Contribution ID: 26

Type: **not specified**

## The first results from the new g-2 experiment at Fermilab

*Wednesday, May 12, 2021 11:00 AM (1 hour)*

The muon g-2 experiment at Fermilab aims to measure the anomalous magnetic moment of the muon to the unprecedented precision of 140ppb. The current world's best measurement made at Brookhaven National Laboratory, with a precision of 540ppb, is at odds with the Standard Model theoretical prediction by 3.7 standard deviations. The new experiment is designed to discover whether this two decade old difference really is a sign of new physics. This talk will discuss how this offers a unique probe into beyond the standard model physics through the high precision that can be reached both in the theoretical prediction and experimental measurement. Data taking started in 2018 and here we will present the first, highly anticipated result from the first run, with a precision slightly better than the current world's best measurement.

Join Zoom Meeting

<https://technion.zoom.us/j/98630264970?pwd=TC95SVBDL3c5QjQwNXBWanJuN01rZz09>

Meeting ID: 986 3026 4970

Passcode: HEP\_Joint

**Presenter:** CHISLETT, Rebecca



Contribution ID: 27

Type: **not specified**

## On-shell bootstrap of a general spontaneously broken gauge theory

*Wednesday, May 26, 2021 11:00 AM (1 hour)*

It is well known that the most general renormalizable quantum field theory one can write down for a finite spectrum of spin-0, 1/2, and 1 particles is a gauge theory, with possible spontaneously broken symmetries. The existence of Lie group structures in such a theory is dictated by perturbative unitarity of the on-shell scattering amplitudes. Armed with new tools developed for scattering amplitudes, we demonstrate very explicitly how broken symmetries emerge from the constraints of tree unitarity. We review the on-shell spinor helicity formalism, using which we enumerate all possible 3-pt and 4-pt tree amplitudes of massive spin-0, 1/2 and 1 particles satisfying unitarity constraints. We show in these amplitudes how massive vectors and scalars need to be in the same representation of some Lie group, and how the longitudinal components of these massive vectors are equivalent to scalars in the high energy limit. We will also comment on an extended color-kinematics duality that can be hiding in such a general theory.

**Presenter:** YIN, Zhewei (Uppsala University)