

# **Israeli Joint Particle Physics Meetings 2021-2022**

## **Report of Contributions**

Contribution ID: 1

Type: **not specified**

# Hunting Axions Using Astrophysical Observation and Quantum Metrology

*Wednesday 3 November 2021 11:00 (1 hour)*

Ultralight bosons behave like coherent waves when the occupation number is large enough. If they are coupled to the Standard Model sector of the particle physics, such an oscillating background can induce a tiny signal. Near a fast rotating black hole, axion within one order of the mass window can accumulate through superradiance, with a large density saturating the non-linear self-interaction. If linearly polarized radiation is emitted near the black hole, axion can contribute to birefringence effect that shifts the position angle periodically, making the polarimetric measurements of the Event Horizon Telescope a powerful way to look for ultra-light axions. On the other hand, quantum metrology can play huge roles in the measurements of fundamental physics. Among these, resonant detection of axion dark matter based on electromagnetic coupling is a popular direction attracting many ongoing experiments and proposals such as microwave cavity, LC circuit and superconducting radio-frequency cavity. A quantum network of resonators can strongly enhance the signal power and boost the search. A network of spin dependent sensors with long baseline can identify the microscopic nature of dark matter or other cosmological background and increase the spatial resolution for transient source like axion or dark photon wave as well.

**Presenter:** CHEN, Yifan (ITP-CAS)

Contribution ID: 2

Type: **not specified**

# Gegenbauer Goldstones

*Wednesday 17 November 2021 11:00 (1 hour)*

We investigate radiatively stable classes of pseudo-Nambu-Goldstone boson (pNGB) potentials for approximate spontaneously broken  $SO(N + 1) \rightarrow SO(N)$ . Using both the one-loop effective action and symmetry, it is shown that a Gegenbauer polynomial potential is radiatively stable, being effectively an eigenfunction' from a radiative perspective. In Gegenbauer pNGB models, one naturally and automatically obtains  $v \propto f/n$ , where  $n \in 2\mathbb{Z}$  is the order of the Gegenbauer polynomial. For a Gegenbauer Higgs boson, this breaks the usual correlation between Higgs coupling corrections and  $v/f$  tuning. Based on this, we argue that to conclusively determine whether or not the Higgs is a composite pNGB in scenarios with up to  $\mathcal{O}(10\%)$  fine-tuning will require going beyond both the Higgs coupling precision and heavy resonance mass reach of the High-Luminosity LHC.

**Presenter:** DURIEUX, Gauthier (CERN)

Contribution ID: 3

Type: **not specified**

## Expecting the Unexpected at the LHC and Beyond

*Wednesday 8 December 2021 16:00 (1 hour)*

Despite countless searches at the LHC, there is still no evidence for new physics. The overwhelming majority of these searches are highly model-specific, motivated by (and optimized for) top-down considerations such as SUSY, extra dimensions, etc. This leaves a vast phase space unexplored by current searches. Could it be that we're not looking in the right places? In recent years, there has been growing interest in model-agnostic searches for new physics at the LHC, driven by powerful advances in modern machine learning, and many new methods have been proposed. I will give an overview of some of the exciting recent progress in this direction.

**Author:** SHIH, David (Rutgers University)

**Presenter:** SHIH, David (Rutgers University)

Contribution ID: 6

Type: **not specified**

## Dark Matter from dark gauge theories

*Wednesday 15 December 2021 11:00 (1 hour)*

In this talk I will describe dark sectors made of non-abelian gauge theories with fermions neutral under the Standard Model. This leads to accidentally stable Dark Matter candidates that can be populated minimally through gravitational interactions. In the pure glue scenario DM is the lightest glueball while adding light fermions the lightest pion and baryon are the DM candidates. Despite the absence of SM interactions these scenarios are constrained by structure formation, Neff and limits on DM self-interactions.

**Presenter:** REDI, Michele (Universita e INFN, Firenze (IT))

Contribution ID: 7

Type: **not specified**

## Maximizing Direct Detection with HYPER Dark Matter

*Wednesday 15 December 2021 13:00 (1 hour)*

Faced with null results in the direct search of WIMP dark matter, there is growing motivation to explore dark matter candidates too light to be directly detected at current experiments. Indeed, there exists a vast array of proposals for direct detection experiments sensitive to sub-GeV dark matter coupled to nucleons. But can dark matter with a consistent cosmological history populate the regions of parameter space these proposals would be sensitive to? Furthermore, is there a maximum cross section for sub-GeV dark matter scattering off nucleons in light of present day constraints? In this talk, I will first estimate this maximum cross section. I will then introduce a novel dark matter candidate which realizes this cross section: Highly interactive Particle Relics (HYPERs). The HYPER relic abundance is set by UV freeze-in, after which a dark sector phase transition decreases the mass of the mediator which connects HYPERs to the visible sector. This increases the HYPER's direct detection cross section, but in such a way as to leave the HYPER's abundance unaffected. HYPERs present a benchmark for direct detection experiments that probe light dark matter.

**Presenter:** ELOR, Gilly

Contribution ID: 13

Type: **not specified**

## Cosmological Relaxation through the Dark Axion Portal

*Wednesday 26 January 2022 11:00 (1 hour)*

The dark axion portal is a coupling of an axion-like particle to a dark photon kinetically mixed with the visible photon. I will demonstrate how this portal, when applied to the relaxion, can lead to cosmological relaxation of the weak scale using dark photon production. The key backreaction mechanism which triggers the trapping of the Higgs vev at the desired value involves the Schwinger effect: As long as electroweak symmetry is unbroken, Schwinger production of massless Standard Model fermions, which carry dark millicharges, suppresses the dark photon production. Once the electroweak symmetry is broken, the fermions acquire mass and the suppression is lifted. An enhanced dark photon dissipation then traps the relaxion at a naturally small weak scale. This model thus provides a novel link between the phenomenological dark axion portal, dark photons, and the hierarchy problem of the Higgs mass.

**Presenter:** DOMCKE, Valerie (CERN)

Contribution ID: 15

Type: **not specified**

## **Online seminar, Feb. 9, 11:00**

*Wednesday 9 February 2022 11:00 (1 hour)*



Contribution ID: 17

Type: **not specified**

## **Online seminar, Feb. 16, 11:00**

*Wednesday 16 February 2022 11:00 (1 hour)*

Contribution ID: **18**

Type: **not specified**

# Gearing up for high luminosity LHC - the quest to discover Physics beyond the Standard Model

*Tuesday 22 March 2022 10:30 (4h 10m)*

## Agenda

10:30 –11:00 Coffee

11:00 –11:15 Introduction - Shlomit Tarem, Technion

11:15 –11:40 Search for New Physics via Lepton Flavor Violation - Mattias Birman, Weizmann Institute

11:40 –12:00 Tagging charm jets in Higgs decays - Nilotpall Kakati, Weizmann Institute

12:00 –12:20 Search for the Higgs to charm couplings - Guy Koren, Tel Aviv University

12:20 –13:30 Lunch

13:30 –13:50 Search for muon-philic forces - Shlomit Tarem, Technion

13:50 –14:10 Search for Heavy Neutral Leptons - Avner Soffer, Tel Aviv University

14:10 –14:30 A Data Directed Paradigm for BSM searches - Shikma Bressler, Weizmann Institute

14:30 –14:40 RECFA visit to Israel, November 2022 - Eilam Gross, Weizmann Institute

**Presenters:** SOFFER, Avi (Tel Aviv University (IL)); GROSS, Eilam (Weizmann Institute of Science (IL)); KOREN, Guy (Tel Aviv University (IL)); BIRMAN, Mattias (Weizmann Institute of Science (IL)); KAKATI, Nilotpall (Weizmann Institute of Science (IL)); BRESSLER, Shikma (Weizmann Institute of Science (IL)); TAREM, Shlomit (Technion- Israel Institute of Technology (IL))

Contribution ID: 19

Type: **not specified**

## The next-generation High Intensity Kaon Experiment (HIKE)

*Wednesday 6 April 2022 11:00 (1 hour)*

Kaon physics has played a tremendous role in the history of flavor physics and CP violation. In the past few decades, the B meson program has taken over as the main driving force for advancements in the field. I will discuss recent theoretical developments that have inspired a novel proposal for a next generation experiment for the detection of neutral kaon decays into charged particles. The proposed experiment would enable testing the SM CKM structure in a unique and critical way, by comparing the current knowledge from B-physics with clean measurements in K-physics. Moreover, rare kaon decays are among the most sensitive probes of both heavy and light new physics. I will present our work on these topics as well as the current status of the proposal.

**Presenter:** DERY, Avital (Cornell)

Contribution ID: **20**

Type: **not specified**

**TBA**

*Wednesday 27 April 2022 11:00 (1 hour)*

**Presenters:** LEHMANN, Benjamin (UC Santa Cruz); GROSSMAN, Yuval (Cornell)

Contribution ID: **21**

Type: **not specified**

**TBA**

*Wednesday 25 May 2022 11:00 (20 minutes)*

**Presenters:** DAVIGI, Joe (Zurich); GELLER, Sarah (MIT)

Contribution ID: **22**

Type: **not specified**

**TBA**

*Wednesday 6 April 2022 13:00 (1 hour)*

**Presenter:** KAPLAN, David E.

Contribution ID: **23**

Type: **not specified**

**TBA**

*Wednesday 11 May 2022 11:00 (1 hour)*

**Presenter:** WATERBURY, Michael (University of California, Irvine)