The Fourth International Conference on Axion Physics and Experiment (Axion 2025)

Report of Contributions

https://indico.itp.ac.cn/e/316

Contribution ID : **1** Type : **In person**

The Superconducting Heterodyne Approach to Axion Detection

Tuesday, 29 July 2025 14:25 (25)

Though most axion dark matter experiments use static background fields, the axion also induces transitions between oscillating modes of an excited cavity. This “heterodyne” detection approach benefits from the very high quality factors available in superconducting cavities, and has a parametrically enhanced signal power at low axion masses. I will review recent experimental progress on this concept, which is currently being pursued by a number of groups, with a particular focus on new results from SLAC.

Primary author(s) : Mr ZHOU, Kevin (UC Berkeley)

Presenter(s) : Mr ZHOU, Kevin (UC Berkeley)

Session Classification : Afternoon Session

Contribution ID : **2** Type : **In person**

Gravitational Wave Birefringence in Fuzzy Dark Matter and Symmetron Cosmology

Monday, 28 July 2025 11:30 (30)

Gravitational wave (GW) birefringence is a remarkable phenomenon which provides a window to test partiy violation in gravity. In this talk, I would discuss our recent studies on the GW birefringence in the FDM and symmetron models. In particular, inspired by the complicated distributions of the Fuzzy dark matter (FDM) and the symmetron field in our Galaxy, we are led to considering the GW propagation over the light scalar profile of general spacetime dependence. We apply the well-known eikonal approximation to solve this technical problem. In the FDM case, it is shown that GWs exhibit the amplitude birefringence with the dominant contribution only depending on the GW frequency. More importantly, the birefringence factor shows a periodic time modulation with its period reflecting the FDM mass, which is the smoking gun to test this FDM-induced mechanism. In the symmetron model, we introduce a new Z_2-symmetric Chern-Simons-like coupling, which can also generate the amplitude birefringence. However, unlike the FDM case, the birefringence induced by the galactic symmetron field is suppressed due to its screening mechanism. Thus, the GW birefringence is dominantly generated by the extra-galactic symmetron distribution, which can be further used to place a reasonable constraint on this parity-violating coupling in the symmetron model.

Primary author(s) : HUANG, Da (National Astronomical Observatories, Chinese Academy of Sciences); Mr XIONG, Ze-Xuan (Hangzhou Institute for Advanced Study)

Presenter(s) : HUANG, Da (National Astronomical Observatories, Chinese Academy of Sciences)

Session Classification : Morning Session

Contribution ID : **3** Type : **In person**

Searching for Solar and Reactor Axions with XENONnT and RELICS

Monday, 28 July 2025 10:30 (30)

Searching for Solar and Reactor Axions with XENONnT and RELICS

Axions can be produced in the Sun through processes such as inverse Compton scattering, the Primakoff effect, and the Fe57 deexcitation, and detected in noble liquid experiments via the inverse Primakoff effect and the axio-electric effect. Liquid xenon experiments, with their large exposure, low background, and low-energy thresholds, offer competitive sensitivities to axions. XENONnT, a dark matter liquid xenon experiment designed primarily for dark matter searches, has set competitive limits on axion-electron and axion-photon couplings. Additionally, axions can be produced in nuclear reactors via similar mechanisms. The RELICS experiment, currently under construction, will also employ liquid xenon to search for reactor-produced axions. In this talk, I will discuss the complementary approaches of solar and reactor axion searches, highlighting the synergies between XENONnT and RELICS in the quest for axions.

Primary author(s) : YE, Jingqiang (The Chinese University of Hong Kong, Shenzhen)

Presenter(s) : YE, Jingqiang (The Chinese University of Hong Kong, Shenzhen)

Session Classification : Morning Session

Contribution ID : **4** Type : **In person**

Black hole superradiance as a source of high-energy cosmic rays

Tuesday, 29 July 2025 16:25 (25)

Ultralight charged bosons can extract energy, angular momentum, and charge from a Kerr–Newman black hole (BH) due to superradiant instability, resulting in the formation of a BH–condensate system. In this work, we focus on a scalar field with a minicharge and numerically investigate in detail the evolution of this system. We find that even a tiny initial mass asymmetry between the positively and negatively charged components of the condensate can induce continuous charge accumulation in an initially neutral BH. BHs can accumulate charges large enough to induce the Schwinger effect, which leads to a copious production of electron–positron pairs. The particles carrying the charge opposite to that of the BH are emitted with electrical potential energies up to $\sim 10^{21}$ eV, suggesting that BH superradiance may serve as a source of high-energy cosmic rays.

Primary author(s) : ZHANG, Hong (Shandong University -Qingdao); Mr XU, Qi-Xuan (Instituto Superior Tecnic, Universidade de Lisb); BAO, Shou-shan (Shandong University); Mr GUO, Yinda (Shandong University)

Presenter(s) : Mr GUO, Yinda (Shandong University)

Session Classification : Afternoon Session

Contribution ID : **5** Type : **In person**

Photon Proliferation Effect from N-body ultralight DM annihilation

I will demonstrate a general photon proliferation effect from N-body ultralight dark matter (DM) annihilation in the early Universe, which can induce a drastic photon-temperature shift after neutrino decoupling. For pseudoscalar DM mass below the eV scale, I will show that the photon proliferation effect becomes significant as the mass approaches the ultralight end, presenting the leading constraints on the DM-photon coupling, DM self-interaction, and DM-electron coupling.

Primary author(s) : LI, Shaoping (Osaka University)

Presenter(s) : LI, Shaoping (Osaka University)

Session Classification : Afternoon Session

Contribution ID : **6** Type : **In person**

Simulations of Fuzzy Dark Matter

Tuesday, 29 July 2025 16:50 (25)

As an alternative theory to cold dark matter (CDM), fuzzy dark matter (FDM) has recently attracted widespread attention. FDM consists of ultra-light bosons with masses around 10^{-22} eV. At typical galactic velocities, their de Broglie wavelength can reach kiloparsec (kpc) scales, thereby exhibiting unique wave-like behavior on galactic scales. This leads to complex evolutionary dynamics and observational effects, which may help address several small-scale challenges the CDM paradigm faces. Unlike other dark matter models, FDM is described by a wavefunction that follows the Schrödinger equation. In this presentation, I will introduce some of our recent work on FDM simulations, including: the construction of wavefunction initial conditions, the removal of initial velocity in FDM halo wavefunctions, self-consistent simulations of FDM and stellar systems, and tidal simulations of FDM subhalos.

Primary author(s) : Mr YANG, Yu-Ming (IHEP)

Co-author(s) : Mr BI, Xiao-Jun (IHEP); Mr YIN, Peng-Fei (IHEP); Mr ZHANG, Zhao-Chen (IHEP)

Presenter(s) : Mr YANG, Yu-Ming (IHEP)

Session Classification : Afternoon Session

Contribution ID : **7** Type : **In person**

Superradiant dark matter production from primordial black holes

Monday, 28 July 2025 17:15 (25)

Rotating primordial black holes (PBHs) in the early universe can emit particles through superradiance, a process particularly efficient when the particle's Compton wavelength is comparable to the PBH's gravitational radius. Superradiance leads to an exponential growth of particle occupation numbers in gravitationally bound states. We present an analysis of heavy bosonic dark matter (DM) production through three gravitational mechanisms: Hawking radiation, superradiant instabilities, and ultraviolet (UV) freeze-in. We consider PBHs that evaporate before Big Bang Nucleosynthesis (BBN). For both scalar and vector DM, our analysis incorporates the evolution of a second superradiant mode. We demonstrate that the growth of a second superradiant mode causes the decay of the first mode, and thus the second mode cannot further enhance the DM abundance beyond that already achieved by the first mode. Our study also reveals that while superradiance generally enhances DM production, gravitational wave (GW) emission from the superradiant cloud may significantly modify this picture. For scalar DM, GW emission reduces the parameter space where superradiance effectively augments relic abundance. For vector DM, rapid GW emission from the superradiant cloud may yield relic abundances below those achieved through Hawking radiation alone. These findings demonstrate that multiple-mode effect and GW emission play critical roles in modeling DM production from PBHs in the early universe.

Primary author(s) : Mr JIA, Nayun (Northeastern University); Prof. BAO, Shou-Shan (Shandong University); Prof. ZHANG, Chen (Northeastern University); Prof. ZHANG, Hong (Shandong University); Prof. ZHANG, Xin (Northeastern University)

Presenter(s) : Mr JIA, Nayun (Northeastern University)

Session Classification : Afternoon Session

Contribution ID : **8** Type : **In person**

The cosmological consequences of preferred axion models

Monday, 28 July 2025 16:25 (25)

The preferred axion models are a set of minimal QCD axion models that abide by standard cosmological constraints in the post-inflationary PQ breaking scenario. It turns out that some of these models predict a period of early matter domination, driven by the additional particle content. I will discuss how this leads to a greater number of models with consistent cosmologies and alters the axion dark matter mass range. On the other hand, the decay products of the new heavy particles may contribute to the number of relativistic degrees of freedom during recombination. This allows us to make concrete predictions and distinguish against preferred axion models, even in scenarios where early matter domination doesn't occur. I will also discuss the potential for gravitational wave astronomy to probe these models.

Primary author(s) : CHEEK, Andrew (TDLI, SJTU)

Presenter(s) : CHEEK, Andrew (TDLI, SJTU)

Session Classification : Afternoon Session

Contribution ID : **9** Type : **In person**

Laser-assisted search for axion-like particle or dark photon in strong-field QED

Wednesday, 30 July 2025 10:00 (30)

In this talk I propose a laser-assisted method for the search of light dark particles such as axion-like particle and dark photon. I will first introduce strong-field QED framework and laser-assisted Compton scattering. Then I will discuss the laser-induced Compton scattering to dark particles and show the prospect of detection.

Primary author(s) : Prof. LI, Tong (Nankai University)

Co-author(s) : Prof. MA, Kai (Xi'an University of Architecture and Technology)

Presenter(s) : Prof. LI, Tong (Nankai University)

Session Classification : Morning Session

Contribution ID : **10** Type : **Online**

Search for Axion Dark Matter with the TASEH experiment

Wednesday, 30 July 2025 09:00 (30)

Haloscoope experiment, with the assumption that the Dark Matter is completely made of Axions, provides the highest Axion search sensitivity. The TASEH experiment is a Haloscope experiment with a copper coated stainless steel cavity inside a 9T magnet in a Dilution Refrigerator operating at 50 mK base temperature. An amplification chain with a self-developed Josephson Parametric Amplifier has been implemented and successfully achieved a noise level corresponding to 1.2 photon around 2.1 GHz. Data taking around this frequency is ongoing. Preliminary analysis indicates that a sensitivity of 1.5 times the benchmark KSVZ model of QCD Axion can be achieved. The contribution reports the latest progress of the TASEH experiment and the plans for the near future.

Primary author(s) : Prof. CHANG, Yuan-Hann

Presenter(s) : Prof. CHANG, Yuan-Hann

Session Classification : Morning Session

Contribution ID : **11** Type : **In person**

Small Instantons and the Post-Inflationary QCD Axion in a Special Product GUT

Monday, 28 July 2025 14:00 (30)

We present a new framework of grand unification that is equipped with an axion solution to the strong CP problem without a domain wall problem when the Peccei–Quinn (PQ) symmetry is spontaneously broken after inflation. Our grand unified theory (GUT) is based on a symmetry breaking pattern, SU(10) × SU(5)1 ⟶ SU(5)V ⊃ SU(3)C × SU(2)L × U(1)Y, where SU(5)1 and a special embedding of SU(5)2 ⊂ SU(10) are broken to a diagonal subgroup SU(5)V. The model contains a vector-like pair of PQ-charged fermions that transform as (anti-)fundamental representations under SU(10), so that the domain wall number is one. However, after the GUT symmetry breaking, the number of vector-like pairs of PQ-charged colored fermions is larger than one, which seems to encounter the domain wall problem. This apparent inconsistency is resolved by small instanton effects on the axion potential which operate as a PQ-violating bias term and allow the decay of domain walls. We propose a domain-wall-free UV completion for an IR model where the domain wall number appears larger than one. The model gives a prediction for a dark matter axion window, which is different from that of the ordinary post-inflationary QCD axion with domain wall number one.

Primary author(s) : Prof. NAKAI, Yuichiro

Presenter(s) : Prof. NAKAI, Yuichiro

Session Classification : Afternoon Session

Contribution ID : **12** Type : **Online**

Composite dark matter axion-like particles: Glueball-ALPs

Tuesday, 29 July 2025 17:40 (25)

I will present a composite dark matter framework based on the confinement dynamics of a dark SU(N) Yang-Mills sector. This theory gives rise to composite bound states, glueballs, that in the absence of fermions serve as dark matter candidates. I will review recent developments in understanding glueball production in the early Universe and delineate the parameter space where they can account for the entirety of dark matter. A particular focus will be placed on a novel class of states: pseudoscalar glueballs with axion-like properties, dubbed Glueball-ALPs (GALPs), bridging the phenomenology of glueballs and axion-like particles, opening new directions for modelling axion-like dark matter.

Primary author(s) : Dr CARENZA, Pierluca

Presenter(s) : Dr CARENZA, Pierluca

Session Classification : Afternoon Session

Contribution ID : **13** Type : **Online**

Probing Heavy Axion-like Particles from Massive Stars with X-rays and Gamma Rays

Monday, 28 July 2025 15:00 (30)

The hot interiors of massive stars in the later stages of their evolution provide an ideal place for the production of heavy axion-like particles (ALPs) with mass up to O(100 keV) range. We show that a fraction of these ALPs could stream out of the stellar photosphere and subsequently decay into two photons that can be potentially detected on or near the Earth. In particular, we estimate the photon flux originating from the spontaneous decay of heavy ALPs produced inside Horizontal Branch and Wolf-Rayet stars, and assess its detectability by current and future X-ray and gamma-ray telescopes.

Primary author(s) : Prof. DEV, P. S. Bhupal

Presenter(s) : Prof. DEV, P. S. Bhupal

Session Classification : Afternoon Session

Contribution ID : **14** Type : **In person**

PQ-quality and scale hierarchy of extra-dimensional axions

Monday, 28 July 2025 08:30 (30)

We discuss the PQ-quality and the possible hierarchical patterns of axion scales (and couplings) for extra-dimensional axions that originate from higher-dimensional p-form gauge fields. As a concrete example, we consider a 5-dim model on Z2-orbifold involving 1-form and 3-form gauge fields, and examine how the warped geometry and fixed-point interactions affect the PQ-quality and axion scale hierarchy.

Primary author(s) : Prof. CHOI , Kiwoon

Presenter(s) : Prof. CHOI , Kiwoon

Session Classification : Morning Session

Contribution ID : **16** Type : **In person**

Are axion solutions to the CP problem fine-tuned?

Tuesday, 29 July 2025 09:00 (30)

TBA

Primary author(s) : Prof. FOWLIE, Andrew

Presenter(s) : Prof. FOWLIE, Andrew

Session Classification : Morning Session

Contribution ID : **17** Type : **In person**

QCD axion dark matter with Peccei-Quinn symmetry breaking by a light scalar field

Tuesday, 29 July 2025 14:50 (25)

QCD axion can explain the strong CP problem and dark matter (DM) simultaneously. If the Peccei-Quinn (PQ) symmetry is spontaneously broken after inflation, string-wall network would dominate the energy density in the Universe. In this talk, we consider a mixing coupling of the PQ scalar with a light scalar field which induces an extra axion potential. When the PQ scalar is mixed nonlinearly, the axion oscillation around the extra potential triggers the formation of stable domain wall. However, the system collapses due to the QCD effect as a bias, resulting in a large amount of dark matter. In addition, by estimating the misalignment production modified by the extra potential, we clarify the total abundance of axion dark matter.

Primary author(s) : Dr SUZUKI, Motoo; NAKAGAWA, Shota (Tsung-Dao Lee Institute); Ms HAO, Yu Xuan; NAKAI, Yuichiro

Presenter(s) : NAKAGAWA, Shota (Tsung-Dao Lee Institute)

Session Classification : Afternoon Session

Contribution ID : **18** Type : **In person**

Probe CP Structure of Axion-Like Particles at Future Lepton Collider

Monday, 28 July 2025 16:00 (25)

We study a charge-parity (CP) violating Axion-like particle (ALP) involved in both CP-even ($aF_{\mu\nu}\tilde{F}^{\mu\nu}$) and CP-odd ($aF_{\mu\nu}F^{\mu\nu}$) ALP-photon interaction at future lepton colliders. We examine the properties of the ALP and its CP structure by analyzing the $e^+e^- \to e^+e^-a \to e^+e^-\gamma\gamma$ channels. A CP-sensitive observable $\Delta\phi_{ee}$, is employed, signifying the azimuthal angular difference between the final state electrons. The constraints on the couplings of CP-violating ALPs at future lepton collider can reach $\mathcal{O}(10^{-3})$ TeV^{-1}, surpassing the sensitivity conducted in the electric dipole moment of electron (eEDM). Since the contributions originating from purely CP-even, purely CP-odd and CP-violating ALP-photon interactions exhibit distinct behaviors in the differential distribution of the observable $\Delta\phi_{ee}$, a binned likelihood analysis effectively discriminates the CP structure of the ALP. Specifically, if CP-even coupling constants are close to those of the CP-odd ALP-photon interaction under certain new symmetry assumptions, the presence of CP violation in the ALP sector can be tested upon the discovery of direct evidence for ALPs by future lepton colliders. For cases where the two coupling constants are not close to one another, an increased integral luminosity substantially enhances the sensitivity in probing CP-violating ALPs.

Primary author(s) : Dr SONG, Muyuan

Co-author(s) : Dr DING, Jiannan; Dr LIU, Yandong

Presenter(s) : Dr SONG, Muyuan

Session Classification : Afternoon Session

Contribution ID : **19** Type : **In person**

Recent Progress of DarkSHINE R&D

Monday, 28 July 2025 17:40 (25)

DarkSHINE is a fixed-target experiment initiative to search for light Dark Matter and mediators at SHINE (Shanghai high repetition rate XFEL and extreme light facility, being the 1st hard X-ray FEL in China) under construction targeting completion in 2025/2026. DarkSHINE aims to search for the new mediator, Dark Photon, bridging the Dark sector and the ordinary matter. In this contribution, we present the idea of this new project and 1st prospective study in search for Dark Photon decaying into light dark matter as well as the very recent technical R&D progresses. It also provides the opportunity to incorporate broader scope of BSM search ideas such as ALP / Anomalous Muonium / LLP / etc. and electron/photon/neutrino-nuclear interaction product measurements, utilizing the fixed-target experiment of this type. Also in the future, DarkSHINE experiment has the great potential to be upgraded into positron beam mode and search for Dark Photon via more production channels through s/t-channel annihilations. Last but not least, DarkSHINE will likely provide cross-reference experimental DATA together with future LDMX experiment, the continued NA64 experiment, etc. to become part of the global efforts for accelerator based Dark Matter searches.

Primary author(s) : Dr ALFANDA, Haidar (Tsung-Dao Lee Institute, Shanghai Jiao Tong University (CN)); LI, Shu (Tsung-Dao Lee Institute & Shanghai Jiao Tong University)

Presenter(s) : Dr ALFANDA, Haidar (Tsung-Dao Lee Institute, Shanghai Jiao Tong University (CN))

Session Classification : Afternoon Session

Contribution ID : **20** Type : **In person**

Laboratory enhanced searches for decaying axion dark matter

Tuesday, 29 July 2025 08:30 (30)

The axion is particularly well motivated candidate for the dark matter comprising most of the mass of our visible Universe, leading to worldwide experimental and observational efforts towards its discovery. A primary technique in this search is the cavity haloscope, which is used to enhance the rate that dark matter axions convert to photons in a background electromagnetic field. As we discuss, the same haloscope technique can also be used to enhance the rate at which axions decay to two photons, as a manifestation of the Purcell effect. We explore this possibility, and show that it offers a novel method to explore the axion parameter space that is competitive and complimentary to other approaches

Primary author(s) : HOUSTON, Nick (▒▒▒▒▒▒)

Presenter(s) : HOUSTON, Nick (▒▒▒▒▒▒)

Session Classification : Morning Session

Contribution ID : **21** Type : **In person**

Distinguishing Light Scalars via CP: Dilaton and Axion at Belle II

Tuesday, 29 July 2025 14:00 (25)

We present a detailed phenomenological study of a light dilaton φ, arising from the spontaneous breaking of approximate scale invariance in a nearly conformal theory. Particular care is taken to account for the dilaton's enhanced coupling to photons, originating from loops of the conformal sector, which significantly shortens its lifetime and relaxes constraints from $K \to \pi + \text{inv.}$ searches at NA62 and cosmological constraints from the Big Bang Nucleosynthesis. New model-independent inclusive bounds from $b \to s\varphi$ transitions are obtained. Proceeding further, we consider the dilaton discovery prospect in a collider such as Belle II and outline how to distinguish it from an axion a having a similar final state signature without relying on how φ/a decays. The CP property can be used as it modifies the variation of the differential cross-section of $e^+e^- \to e^+e^-\varphi/a$ with the azimuthal angle between the outgoing leptons.

Primary author(s) : Dr GIRMOHANTA, Sudhakantha (Tsung-Dao Lee Institute); NAKAI, Yuichiro; Dr SHIGEKAMI, Yoshihiro (Henan Normal University); Prof. TOBIOKA, Kohsaku (Florida State University)

Presenter(s) : Dr GIRMOHANTA, Sudhakantha (Tsung-Dao Lee Institute)

Session Classification : Afternoon Session

Contribution ID : **22** Type : **In person**

Observation of quantum entanglement in $\Lambda\bar{\Lambda}$ pair production via electron-positron annihilation

Monday, 28 July 2025 14:30 (30)

We report the observation of quantum entanglement in $\Lambda\bar{\Lambda}$ pairs produced via electron-positron annihilation, specifically through the decay $J/\psi \to \Lambda\bar{\Lambda}$. By analyzing the angular correlations of the subsequent weak decays $\Lambda \to p\pi^-$ and $\bar{\Lambda} \to \bar{p}\pi^+$, we derive normalized observables $\mathcal{O}_i$ $(i = 0, 1, \ldots, 4)$ that distinguish entangled states from separable ones. Theoretical predictions for these observables are established, with violations of separable-state bounds serving as unambiguous signatures of entanglement. Experimental measurements at $\cos\theta_\Lambda = 0$ yield $\mathcal{O}_{1\text{min}}^{\text{Observed}} = -0.7374 \pm 0.0011 \pm 0.0016$, significantly exceeding the classical limit of -0.5 with a statistical significance of 124.9σ. For $|\cos\theta_\Lambda| < 0.4883$, the observed $\mathcal{O}_1^{\text{Observed}}$ consistently exhibits $\mathcal{O}_1^{\text{Observed}} < -\frac{1}{2}$ with a statistical significance of at least 5σ. Since 69.3% of the decay events involving $\Lambda \to p + \pi^-$ and $\bar{\Lambda} \to \bar{p} + \pi^+$ are spacelike-separated, our results confirming the persistence of quantum entanglement in the $\Lambda\bar{\Lambda}$ system provide strong support for the non-locality of quantum mechanics. The findings are consistent with theoretical expectations under decoherence-free conditions, highlighting the potential of hyperon pairs as probes for fundamental quantum phenomena.

Primary author(s) : Dr PEI, Junle

Presenter(s) : Dr PEI, Junle

Session Classification : Afternoon Session

Contribution ID : **23** Type : **In person**

Search for Millicharged dark matter via Multimessenger Time-Delay Analysis of GRB GW170817A

Tuesday, 29 July 2025 11:00 (30)

We derive new constraints on millicharged dark matter from the multimessenger observation of GW170817. In the neutron star merger event GW170817, the first detection of a gamma-ray burst (GRB) delayed by approximately 1.7 seconds relative to the gravitational wave emission was observed. Utilizing this delay, we constrain the millicharge parameter of dark matter within the large-scale structure of the universe. For dark matter masses below 10−15 eV, the millicharge parameter is constrained to be less than 10−14, representing the most stringent limits achieved to date.

Primary author(s) : Dr ZHANG, Wenxing (Hebei University)

Presenter(s) : Dr ZHANG, Wenxing (Hebei University)

Session Classification : Morning Session

Contribution ID : **24** Type : **In person**

Dark photon dark matter search at the TASEH experiment

Monday, 28 July 2025 11:00 (30)

The dark photon is a well motivated candidate for the dark matter. A primary tool in this search is the cavity haloscope, which facilitates resonantly enhanced conversion to photons from dark photons. We re-examining the data taken by the Taiwan Axion Search Experiment with Haloscope (TASEH) experiment, and derive a world-leading constraint on the dark photon with mass in the 19.46 - 19.84 μeV mass range. The bound exceeds the naive 'rescaling limit' by roughly one order of magnitude. In this data, we also identify a tentative signal with a local significance of 4.7 σ, previously disregarded due to an axion-specific veto, corresponding to a dark photon with mass ~ 19.5 μeV.

Primary author(s) : Prof. LI, Jinmian

Presenter(s) : Prof. LI, Jinmian

Session Classification : Morning Session

Contribution ID : **25** Type : **In person**

Mesonic contributions to axion thermalization below the QCD crossover in the KSVZ axion model

Tuesday, 29 July 2025 15:15 (25)

Constraints on axions as hot dark matter (HDM) from $\Delta N_{\rm eff}$ provide an important and independent probe of axion properties. In hadronic axion models such as the KSVZ model, the axion thermalization rate below the QCD crossover temperature is typically estimated under two key assumptions: (1). thermal corrections to the reaction amplitudes are negligible at $T < M_{\rm th}/2$ with Mth the reaction threshold and (2). axion-pion interaction ($a\pi \leftrightarrow \pi\pi$) dominates unless specically suppressed.
In this talk, we critically reexamine these assumptions by systematically calculating the relevant corrections to the axion thermalization rate in the KSVZ axion model. Our analysis emphasizes the role of nonperturbative mesonic dynamics in the relevant processes. The results also have implications for meson-driven thermalization in other axion models.

Primary author(s) : WANG, Jinbao (□□□□)

Presenter(s) : WANG, Jinbao (□□□□)

Session Classification : Afternoon Session

Contribution ID : **26** Type : **In person**

Superconducting cavities as detectors of ultralight bosons and high frequency gravitational waves

Tuesday, 29 July 2025 17:15 (25)

Superconducting radio-frequency (SRF) cavities, renowned for their exceptionally high quality factors (~10^10), have emerged as powerful tools for probing fundamental physics beyond the Standard Model. In this talk, I will introduce the first-ever scan search for dark photon dark matter using a tunable SRF cavity, achieving unprecedented sensitivity to the kinetic mixing coefficient parameter ε . By mechanically adjusting the resonant frequency of a niobium cavity in a 2 K liquid helium environment, we scanned a 1.37 MHz range centered at 1.3 GHz, setting the world's tightest constraints on ε. Beyond terrestrial dark photon dark matter, we also demonstrate that SRF cavities can serve as sensitive detectors for galactic dark photon backgrounds, leveraging their directional sensitivity to probe potential anisotropic signals. Finally, we present a theoretical framework where an array of coupled electromagnetic detectors significantly enhances scan rates for ultralight dark matter and high-frequency gravitational waves.

Primary author(s) : ZENG, Yanjie (ITP, CAS)

Presenter(s) : ZENG, Yanjie (ITP, CAS)

Session Classification : Afternoon Session

Contribution ID : **27** Type : **In person**

Model of the quintessence axion

Monday, 28 July 2025 09:00 (30)

We construct a model of the quintessence axion based on a gauged chiral U(1) symmetry and an additional flat fifth dimension. The required high qualities are guaranteed by the brane separation. The observed cosmological constant (i.e., the potential energy of the quintessence axion) is determined by the size of the extra dimension and the axion decay constant F_a is fixed almost at F_a ⊠ 10^17 GeV, which is sufficiently large for the stability of the axion field near the hilltop of its potential. Furthermore, the movement of the axion can also easily explain the recently reported isotropic cosmic birefringence of the cosmic microwave background photon.

Primary author(s) : Prof. WANG, Jinwei (UESTC)

Presenter(s) : Prof. WANG, Jinwei (UESTC)

Session Classification : Morning Session

Contribution ID : **28** Type : **In person**

Current status of the Muon g-2 and EDM

Tuesday, 29 July 2025 11:30 (30)

In this talk, I will present the latest results from the Fermilab Muon g-2 experiment and the current status of the PSI muEDM experiment. I will also discuss how these muon storage experiments can be used to search for new particles, such as axions.

Primary author(s) : KHAW, Kim Siang (SJTU)

Presenter(s) : KHAW, Kim Siang (SJTU)

Session Classification : Morning Session

Contribution ID : **30** Type : **In person**

Axion from topological defects

Monday, 28 July 2025 09:30 (30)

TBA

Primary author(s) : Prof. BIAN, Ligong (Chongqing University)

Presenter(s) : Prof. BIAN, Ligong (Chongqing University)

Session Classification : Morning Session

Contribution ID : **31** Type : **In person**

Finite temperature effective theory for Electroweak phase transition

Tuesday, 29 July 2025 16:00 (25)

TBA

Primary author(s) : QIN, Renhui (Chongqing University)

Presenter(s) : QIN, Renhui (Chongqing University)

Session Classification : Afternoon Session

Contribution ID : **32** Type : **In person**

Recent Dark “Matter/Photon/Higgs” search results from ATLAS

Monday, 28 July 2025 16:50 (25)

Primary author(s) : VU, Ngoc Khanh

Presenter(s) : VU, Ngoc Khanh

Session Classification : Afternoon Session

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

Reconciling Neutrino Mass Bounds with Strongly Self-Interacting Dark Radiation

Tuesday, 29 July 2025 09:30 (30)

Primary author(s) : GAO, Christina (SUSTech)

Presenter(s) : GAO, Christina (SUSTech)

Session Classification : Morning Session

Contribution ID : **34** Type : **In person**

Introduction of the Axion 2026 Conference

Tuesday, 29 July 2025 18:05 (10)

Primary author(s) : ZHANG, Hong

Presenter(s) : ZHANG, Hong

Session Classification : Afternoon Session

Contribution ID : **35** Type : **Online**

The EDM inverse problem: identifying the sources of CP violation and PQ breaking with EDMs

Wednesday, 30 July 2025 09:30 (30)

Primary author(s) : IM, Sang Hui

Presenter(s) : IM, Sang Hui

Session Classification : Morning Session

Contribution ID : **36** Type : **Online**

Searching for dark matter with high-energy galactic observations

Monday, 28 July 2025 18:05 (25)

Primary author(s) : BALAJI, Shyam

Presenter(s) : BALAJI, Shyam

Session Classification : Afternoon Session

Contribution ID : **37** Type : **In person**

Dynamics of multi-vacuum from stochastic axion frangmentation

Tuesday, 29 July 2025 10:30 (30)

Presenter(s) : JIANG, Yun (Sun Yat-sen University)

Session Classification : Morning Session

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

opening

Session Classification : Morning Session

Contribution ID : **39** Type : **In person**

Generation of Axions and Axion-Like Particles through Mass Parametric Resonance induced by Scalar Perturbations in the Early Universe

Tuesday, 29 July 2025 12:00 (30)

We show that scalar perturbations in the early universe could produce a significant amount of these particles primarily through mass parametric resonance effects. Notably, this mechanism does not generate additional isocurvature perturbations.

Presenter(s) : Prof. YANG, Qiaoli (Jinan University)

Session Classification : Morning Session