The 4th Topics of Particle, Astro and Cosmo Frontiers (TOPAC 2026) 第 4 届粒子物理、天体物理和宇宙学前沿国际学术研讨会

Report of Contributions

https://indico-tdli.sjtu.edu.cn/e/4560

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

Composite Asymmetric Dark Matter from Primordial Black Holes

Monday, 20 April 2026 13:30 (15 minutes)

We investigate a cogenesis scenario for composite asymmetric dark matter framework: a dark sector has a similar strong dynamics to quantum chromodynamics in the standard model, and the dark-sector counterpart of baryons is the dark matter candidate. The Hawking evaporation of primordial black holes plays the role of a source of heavy scalar particles whose CP-violating decay into quarks and dark quarks provides particle–anti-particle asymmetries in baryons and dark matter, respectively. Primordial black holes should evaporate after the electroweak phase transition and before the big-bang nucleosynthesis for explaining the baryon asymmetry of the Universe and for consistent cosmology. We find that this scenario explains the observed values for both baryon and dark matter energy densities when the heavy scalar particles have a mass of 10^6-10^9 GeV and the primordial black holes have masses of 10^7-10^9 g.

Primary authors: KUWAHARA, Takumi (Peking U); UCHIDA, Yoshiki (South China Normal University)

Presenter: UCHIDA, Yoshiki (South China Normal University)

Session Classification: Parallel Theory-BSM: BSM Probes (Room 368, Chair Ke-Ping Xie)

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

Soliton mergers and radio transients —A new window on dark photon dark matter

Sunday, 19 April 2026 16:55 (15 minutes)

Ultralight dark photons can form stable, compact clumps that possess macroscopic coherence, called solitons. When two such solitons collide and merge, the merged object can suddenly convert its stored dark-sector energy into ordinary radio photons through a process called parametric resonance. The merger rate scales steeply with local soliton number density (merger rate $\propto$ density^2), so regions near supermassive black holes —where dark matter can form dense, spiky profiles —are especially important for producing detectable bursts.

We use the lack of such narrow, powerful radio transients in existing surveys to set concrete limits. For dark photon masses that correspond to radio frequencies (˜10^{-6}–10^{-4} eV), current nondetections imply that at most a few percent of dark matter can reside in these solitons. Alternatively, if a large fraction of dark matter were in solitons, the coupling that converts dark photons to ordinary photons must be extremely small. These bounds come from comparing predicted burst rates and energies with radio telescope exposure and nonobservation.

Primary authors: AMARAL, Dorian; SCHIAPPACASSE, Enrico; ZHANG, Hong-Yi

Presenter: ZHANG, Hong-Yi

Session Classification: Parallel Cosmology & Astrophysics: Cosmic Signals (Room 302, Chair Zhao-Feng Kang)

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

Self-similar inverse cascade from higher-form symmetry

Monday, 20 April 2026 11:40 (25 minutes)

In the conventional turbulence studies, it has been revealed that inverse cascades driven by conserved quantities integrated over the entire space, such as helicity in three spatial dimensions
On the other hand, in terms of the higher-from symmetry, we are getting to know that there are also conserved charges are defined by integration over subspaces.
In this talk, I will demonstrate a new mechanism where higher-form symmetries naturally induce a self-similar inverse cascade. Taking axion electrodynamics with non-linear topological interaction as a paradigmatic example, it is shown that the conserved charge associated with its 1-form symmetry drives the system toward large-scale coherent structures through a universal scaling behavior characterized by analytically determined scaling exponents.
Our findings suggest that higher-form symmetries can provide a fundamental organizing principle for understanding non-equilibrium phenomena and the emergence of coherent structures in turbulent systems.

Primary author: KAMADA, Kohei (HIAS UCAS)

Presenter: KAMADA, Kohei (HIAS UCAS)

Session Classification: Plenary Theory-Cosmology 13: Particle Cosmology (Room 567, Chair Yi-Fu Cai)

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

Probing Dark Shower Models at Colliders using Long-Lived Particle Searches

Sunday, 19 April 2026 16:55 (25 minutes)

TBD

Primary author: LIU, Wei (Nanjing University of Science and Technology)

Presenter: LIU, Wei (Nanjing University of Science and Technology)

Session Classification: BSM Highlight (Room 567, Chair Cheng-Cheng Han)

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

Domain Walls in Extended Higgs Sectors: Electric Charge Violation and Electroweak Symmetry Restoration

Sunday, 19 April 2026 17:40 (15 minutes)

Extended Higgs sectors such as the 2HDM and N2HDM provide new discrete symmetries, which, upon spontaneous symmetry breaking, can lead to the formation of topological defects called domain walls. In this talk, I discuss some consequences of these domain walls on the early universe, such as electroweak symmetry restoration necessary for Electroweak baryogenesis via domain walls, as well as the possibility of having electric charge breaking domain walls in the 2HDM, which lead to exotic effects such as the transformation of electrons into sterile neutrinos. This provides a new mechanism for the production of sterile neutrinos as dark matter.

Primary author: SASSI, Mohamed Younes (Tsung-Dao Lee Institute, Shanghai Jiao Tong University)

Presenter: SASSI, Mohamed Younes (Tsung-Dao Lee Institute, Shanghai Jiao Tong University)

Session Classification: Parallel Cosmology & Astrophysics: Cosmic Signals (Room 302, Chair Zhao-Feng Kang)

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

Strongly Coupled Dark Sectors from the Dark Matter–Baryon Coincidence

Monday, 20 April 2026 14:10 (15 minutes)

There are many reasons to believe in the existence of a strongly coupled dark sector. One of them is the observed similarity between the energy densities of dark matter and baryons, known as the dark matter–baryon coincidence problem. In this talk, I will explain why this comparability points toward an asymmetric strongly coupled dark sector at the QCD scale. I will further discuss model-building attempts to fully resolve the coincidence problem, highlighting the key features of the corresponding strongly coupled dark sectors, including their spectra and phenomenology.

Primary author: CHUNG, Yi (IBS, CTPU-PTC)

Presenter: CHUNG, Yi (IBS, CTPU-PTC)

Session Classification: Parallel Theory-Cosmology 2: Dark Cosmology (Room 302, Chair Sheng-Feng Yan)

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

High sensitivity magnetometry with ferromagnetic spins and its applications in fundamental physics

Friday, 17 April 2026 14:30 (25 minutes)

Due to their high spin density and low spin projection noise, ferromagnetic systems are expected to be powerful tools for high-precision metrology. This presentation will discuss our recent investigations into physics beyond the Standard Model, utilizing ferromagnetic spins as a platform."

Primary author: JI, Wei (Peking University)

Presenter: JI, Wei (Peking University)

Session Classification: Plenary Theory-Experiment Interplay 2: Precision Searches (Room 567, Chair Shao-Feng Ge)

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

Neutrino fog at CJPL

Sunday, 19 April 2026 17:20 (25 minutes)

The neutrino floor, a theoretical sensitivity limit for dark matter direct detections, is being redefined as the boundary of a dynamic "neutrino fog", where neutrino signals become inevitable, obscuring DM detection due to the statistical and systematic uncertainties. This study provides the first site-specific analysis of the neutrino floor at China Jinping Underground Laboratory (CJPL), leveraging its unique geographic and environmental characteristics. We quantify how CJPL's suppressed atmospheric neutrino flux (around 30% lower than Laboratori Nazionali del Gran Sasso) reshapes the neutrino floor, thereby enabling improved sensitivity to high-mass WIMPs (mass $> 10\mathrm{GeV}$). Using a gradient-based framework, we derive CJPL's neutrino floor and estimate the detection prospects for the PandaX-xT experiment. Our results demonstrate that a 500 tonne-year exposure with PandaX-xT could touch the floor, probing spin independent cross-section down to $\sigma_n \sim 3 \times 10^{-49}\mathrm{cm}^2$ at a DM mass of 70 GeV/c^2.

Primary author: LIU, Xuewen (Yantai University)

Presenter: LIU, Xuewen (Yantai University)

Session Classification: Parallel Dark Matter & Neutrinos (Room 368, chair Pei-Zhi Du)

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

Probing oscillation between visible photon and dark photon by optical time-domain reflectometry

Friday, 17 April 2026 18:05 (25 minutes)

Dark photons, which can kinetically mix with ordinary photons, represent the simplest extension to the standard model. Detecting their oscillations with visible photons could provide crucial insights into the nature of dark matter and fundamental interactions beyond the standard model. We propose a novel laboratory-based approach to detect dark photon oscillations using a laser in an Optical Time-domai Reflectometry (OTDR) setup. The laser light propagating through the optical fiber undergoes oscillations with the dark photon, leading to measurable changes in the power flow. These oscillations can be precisely measured, leveraging its high sensitivity and efficiency in detecting small variations in the optical signal. This approach could provide a new avenue for probing dark photon oscillations in the laboratory and greatly improve the current experimental sensitivity to dark photon in a wide mass range.

Primary author: WANG, Wenyu (Beijing University of Technology)

Presenter: WANG, Wenyu (Beijing University of Technology)

Session Classification: Astroparticle Highlight: Low-Energy Probes (Room 567, Chair Yong-Chao Zhang)

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

Spontaneous Leptogenesis in Type I Seesaw

Monday, 20 April 2026 08:15 (30 minutes)

Type-I seesaw models with a spontaneously broken B–L symmetry provide a natural framework for spontaneous leptogenesis driven by a Majoron. The kinetic background of the Majoron acts as a CP-violating source, generating a lepton asymmetry both through the decay of right-handed neutrinos and through equilibration via inverse-decay processes. We construct the Boltzmann equations in a fully consistent manner, incorporating both effects, to enable a quantitative analysis. When the neutrino Yukawa coupling is large enough to maintain B–L violating interactions in thermal equilibrium, the resulting asymmetry closely tracks its equilibrium value. In contrast, when this condition is not satisfied, a nontrivial interplay emerges between decay and inverse-decay dynamics, determined by the Yukawa coupling strength and the initial abundance of right-handed neutrinos.

Primary author: CHUN, EUNG JIN (Korea Institute for Advanced Study)

Presenter: CHUN, EUNG JIN (Korea Institute for Advanced Study)

Session Classification: Plenary Theory 11: Flavor/Neutrinos (Room 567, Chair Raymond Volkas)

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

Gravitational Wave Signature of Aspherical Bubbles Driven by Thermal Fluctuation

Friday, 17 April 2026 18:30 (15 minutes)

Cosmological first-order phase transitions are a well-motivated source of stochastic gravitational waves (GWs), but most predictions are made based on the highly idealized model of perfectly spherical vacuum bubbles, neglecting thermal fluctuations. In this work we use $(3+1)$-dimensional lattice simulations of a scalar model with thermal initial conditions to quantify how thermal fluctuations distort bubble profiles and modify the resulting GW spectrum. We find that thermal fluctuations can strongly break spherical symmetry at early times, allowing even an isolated bubble to emit GWs. In multi-bubble simulations, thermal fluctuations systematically reshape the spectrum, suppressing the infrared part while enhancing and broadening the high-k tail. We further provide an analytical estimate for the ultraviolet regime of the GW spectrum, which is in good agreement with our lattice results and suggests that this regime is dominated by thermal fluctuations. These effects could leave observable imprints in future GW searches.

Primary authors: Mr CHEN, GuangShang (Institute of Theoretical Physics); Ms WANG, HongXin (Shandong University); YANG, Jin Min (Henan Normal University); Prof. BIAN, Ligong (Chongqing University); Mr LI, Song (Henan Normal University); Mr XIAO, Yang (Henan Normal University); ZHANG, Yang (Henan Normal University)

Presenter: Mr XIAO, Yang (Henan Normal University)

Session Classification: Parallel Cosmology: Early Universe (Room 302, Chair Yong Tang)

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

Cosmological Collider Signals from Right-Handed Neutrino Loops

Monday, 20 April 2026 10:50 (25 minutes)

Cosmological Collider Signals from Right-Handed Neutrino Loops

Primary author: HAN, Chengcheng (Sun Yat-sen university)

Presenter: HAN, Chengcheng (Sun Yat-sen university)

Session Classification: Plenary Theory-Cosmology 13: Particle Cosmology (Room 567, Chair Yi-Fu Cai)

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

When inverse seesaw meets inverse electroweak phase transition: a novel path to leptogenesis

Sunday, 19 April 2026 16:30 (25 minutes)

Primary author: Prof. XIE, Ke-Pan (Beihang University)

Presenter: Prof. XIE, Ke-Pan (Beihang University)

Session Classification: BSM Highlight (Room 567, Chair Cheng-Cheng Han)

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

Probe exotic energy injection from dark sectors through cosmic reionization

Axions and primordial black holes (PBHs) are well-motivated dark matter candidates that can inject energy into the intergalactic medium (IGM) via decay or evaporation over cosmic history, leaving imprints on the cosmic microwave background (CMB). In recent work, we have derived a model-independent ionization history after recombination from CMB power spectra using a Gaussian process approach, allowing new physics to be constrained directly from the high-redshift optical depth. Applying this framework, we investigate the decay of multi-string axions and place the first constraints on the corresponding geometrical parameter space. We also compute the redshift-dependent energy injection from Hawking evaporation using BlackHawk, we obtain upper limits on the initial PBH abundance that are robust against reionization modeling uncertainties and systematically more conservative than existing bounds. Our results demonstrate the power of reionization observables as a precise probe of PBH evaporation and other late-time energy-injection scenarios.

Primary author: 尹, 孜文 (上海交通大学物理与天文学院（李政道研究所）)

Presenter: 尹, 孜文 (上海交通大学物理与天文学院（李政道研究所）)

Session Classification: Poster Session

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

Dark matter trio in classically conformal theories: WIMP, supercooling, and monopole

Beyond solving the hierarchy problem, classically conformal (CC) theories naturally accommodate dark matter (DM). In this work, we explore the CC $SU(2)_X$ gauge theory with a triplet dark scalar, uncovering three distinct DM scenarios: WIMP, supercooled DM, and monopole. The production mechanisms are strongly influenced by the CC model's unique first-order phase transition evolution history, which differs significantly from those in non-conformal models. We obtain the viable parameter space for each scenario and investigate the current constraints and future sensitivities at terrestrial experiments and gravitational wave observatories.

Primary authors: ZHAN, Cheng-Hao (Beihang Univ.); Prof. XIE, Ke-Pan (Beihang University)

Presenter: ZHAN, Cheng-Hao (Beihang Univ.)

Session Classification: Poster Session

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

Chiral gravitational wave background from axion-like fields

Friday, 17 April 2026 17:40 (25 minutes)

Axions and axion-like particles can be probed through gravitational waves indirectly, often referred to as "audible axions". The usual concept of audible axion relies on the coupling between the axions and the gauge fields. Here we consider an axion-like mechanism with coupling to the Nieh–Yan term. This interaction leads to the direct and efficient production of gravitational waves during the radiation-dominated era, originating from the tachyonic instability of the gravitational perturbations with the Nieh–Yan term. We calculate the energy spectral density of the chiral gravitational wave background and the comoving energy density of axion-like fields. Based on the numerical results, we explore the parameter space of axion masses and decay constants for detectable gravitational wave signals, either in pulsar timing arrays or space-based gravitational wave detections.

Primary author: ZHANG, Yun-Long (NAOC)

Presenter: ZHANG, Yun-Long (NAOC)

Session Classification: Parallel Cosmology: Early Universe (Room 302, Chair Yong Tang)

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

Confinement and Chiral Phase Transitions: The Role of Polyakov Loop Kinetics Terms

Sunday, 19 April 2026 17:25 (15 minutes)

We studied a crucial but often oversimplified ingredient in predicting gravitational-wave signals from QCD-type phase transitions: the kinetic term of the Polyakov loop. For the first time, we derive this term from first principles in finite-temperature pure SU(3) Yang-Mills theory, incorporating a field-dependent renormalization factor—a calculation we also extend to theories with more colors. Employing this derived kinetic term alongside three commonly-used effective potentials (the Haar-measure, polynomial, and quasi-particle models), we demonstrate that it substantially modifies the predicted GW energy spectrum from confinement transitions by 1-2 orders of magnitude. Based on this, we provide the first complete analysis of the chiral transition within the Polyakov–Nambu–Jona-Lasinio (PNJL) framework, described by the quark condensate. Our results reveal a clear dichotomy: while the Polyakov-loop kinetic term critically shapes GWs from confinement transitions, it has a negligible impact on the dynamics of the chiral transition, which is dominated by fermion condensation effects.

Primary author: Dr ZHU, Jiang (TDLi institution)

Co-author: Dr HUA, banghui (Huazhong university of science and technology)

Presenter: Dr ZHU, Jiang (TDLi institution)

Session Classification: Parallel Cosmology & Astrophysics: Cosmic Signals (Room 302, Chair Zhao-Feng Kang)

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

Large Neutrino "Collider"

Sunday, 19 April 2026 19:55 (25 minutes)

We propose using current and future large-volume neutrino telescopes as "Large Neutrino Colliders" (LνCs) to explore TeV-scale physics beyond the Standard Model. Cosmic neutrinos with energies above 100 PeV colliding with nucleons in the detector reach center-of-mass energies beyond the 14 TeV limit of the Large Hadron Collider (LHC). Using recently predicted and measured high-energy and ultra-high-energy neutrino fluxes from IceCube and KM3NeT, we estimate mass-scale sensitivities for representative new physics scenarios at 1-30 km^3 LνCs. Our results demonstrate that LνCs provide a novel avenue to probe multi-TeV particles with sensitivities comparable to, or even surpassing, those of the LHC.

Primary author: 谢 (XIE), 可平 (Keping) (李政道研究所)

Presenter: 谢 (XIE), 可平 (Keping) (李政道研究所)

Session Classification: Special Evening Plenary Session 2 (Room 567, Chair Si-Chun Sun)

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

Probing Dark Matter annihilation in the Galactic Centre with TRIDENT

We determine the future sensitivity of the TRIDENT neutrino telescope to dark matter annihilation in the Galactic Centre. By applying the full detector design we show that TRIDENT will probe annihilation rates down to $\langle \sigma v \rangle \approx 5 \times 10^{-27}\,\mathrm{cm}^3\,\mathrm{s}^{-1}$ for a $10\,\mathrm{TeV}$ dark matter, which is below the thermal freeze-out benchmark. The analysis is carried out with all-flavour neutrino interactions, where we demonstrate that cascade events, primarily due to $\nu_{e,\tau}$, show greater sensitivity to a dark matter signal compared to the more commonly studied track events. Furthermore, we highlight the impact of a previously overlooked background, Galactic neutrinos produced from interactions between hadronic cosmic rays and interstellar gas. We find dark matter sensitivities are more strongly degraded in the high energy region above $\sim 10\,\mathrm{TeV}$, with a maximal weakening of approximately a factor of ~ 2. This effect remains smaller than the uncertainty associated with the dark matter density profile but can nonetheless mimic a positive annihilation signal. We contextualize these results with a concrete particle model and show that TRIDENT will be able to probe the most interesting untested parts of parameter space.

Primary authors: CHEEK, Andrew (TDLI, SJTU); Prof. XU, Donglian (T D Lee Institute); ZHANG, Fuyudi; GIACINTI, Gwenael (TDLI & SJTU); MORTON-BLAKE, Iwan (Tsung-Dao Lee Institute / Shanghai Jiao Tong University); CHANG, Qichao; KACI, Samy (TDLI & SJTU); XIANG, Xin; CHU, Xin-Hui (TDLI, SJTU); WANG, Yingwei

Presenter: CHU, Xin-Hui (TDLI, SJTU)

Session Classification: Poster Session

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

Di-Higgs Recent Highlights and Summary

Friday, 17 April 2026 14:55 (25 minutes)

The talk will present the latest highlights and summary of di-Higgs studies from ATLAS and CMS experiments at the LHC.

Primary author: LIU(刘), Yanlin(彦麟)

Presenter: LIU(刘), Yanlin(彦麟)

Session Classification: Plenary Theory-Experiment Interplay 2: Precision Searches (Room 567, Chair Shao-Feng Ge)

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

SN1987A constraints on Hadronically Interacting Sub-GeV Dark Matter

We clarify the plasma effects on the couplings of dark photon and $U(1)_{B-L}$ gauge boson in medium and calculate the production rate of these two models in SN1987A via nucleon bremsstrahlung in detail, along with some secondary production channels. From the stellar cooling argument, we obtain the constraints on dark photon and $U(1)_{B-L}$ gauge boson. A new excluded region arises from the longitudinal component of $U(1)_{B-L}$ gauge boson, and we update the excluded region for dark photon.

Primary authors: 王, 尊 (东南大学); 张, 永超

Presenter: 王, 尊 (东南大学)

Session Classification: Poster Session

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

Direct Detection of Composite Asymmetric Dark Matter

Monday, 20 April 2026 13:45 (15 minutes)

We investigate the direct detection constraint on the composite asymmetric dark matter (ADM), where the confining gauge dynamics realized in the dark sector. The dark baryonic matter is the dark matter candidate, in particular it is similar to our baryons when we assume the SU(3) dark QCD in the dark sector. In addition, the dark sector is connected to the standard model sector through the dark photon portal to alleviate several cosmological problems, and we can probe the dark sector through the same dark photon. As for the direct detection, through the dark photon, the dark baryons can scatter off our baryons and leptons. When the dark baryons are charged under the U(1)_D (called dark proton), ordinary matter couples to the dark matter through the current interaction. Meanwhile, when the dark baryons are neutral under the U(1)_D (called dark neutron), ordinary matter couples to the dark matter through dipole interaction. In this talk, I will discuss the current constraints on and the future sensitivities to the composite ADM from the direct detection experiments.

Primary author: KUWAHARA, Takumi (Peking U)

Presenter: KUWAHARA, Takumi (Peking U)

Session Classification: Parallel Theory-BSM: BSM Probes (Room 368, Chair Ke-Ping Xie)

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

Cosmic birefringence and p-form fields

Sunday, 19 April 2026 21:05 (15 minutes)

A tantalizing hint of beyond Standard Model (SM) physics lies in the polarization structure of the CMB. Joint analysis of WMAP, Planck, and ACT data suggests that the linear polarization plane of CMB photons has, since the surface of last scattering, rotated by an angle $\beta \tilde{} 0.3$ degrees at over 4.5 σ significance. This is a parity violating phenomenon that can't be described using SM degrees of freedom. An axion-like coupling to the Chern-Simons term predicts a nonzero β, but it is not the only explanation. In this talk, we will overview the essential physics of cosmic birefringence and the role an axion may play. Then, we will explore two alternatives, namely, the possible explanation of cosmic birefringence coming from 2-form dark matter or 3-form dark energy.

Primary author: MANTON, Tucker (HIAS UCAS)

Co-author: KAMADA, Kohei (HIAS UCAS)

Presenter: MANTON, Tucker (HIAS UCAS)

Session Classification: Special Evening Plenary Session 3 (Room 567, Chair Ke-Pan Xie)

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

Two Higgs doublet models with a new U(1) gauge symmetry

Sunday, 19 April 2026 18:05 (20 minutes)

In this talk, we discuss two Higgs doublet models in which a new U(1) gauge symmetry is introduced. We investigate if these models are allowed by current phenomenological data without introducing a scalar field except for two Higgs doublet ones. We find they are excluded by constraints from scalar boson decays associated with new gauge boson Z'. Then a dark vector-like fermion is introduced to modify branching ratio of Z' and we searched for allowed parameter region taking all the phenomenological constraints into account. Finally we show allowed region that can avoid all the constraints.

Primary authors: NOMURA, Takaaki (Sichuan University); Prof. YAGYU, Kei (Tokyo University of Science)

Presenter: NOMURA, Takaaki (Sichuan University)

Session Classification: BSM Highlight (Room 567, Chair Cheng-Cheng Han)

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

Exploring Inelastic Self-Interacting Dark Matter with Linear Cosmology

Monday, 20 April 2026 13:55 (15 minutes)

Inelastic self-interacting dark matter (iSIDM) provides a well-motivated extension of the cold dark matter paradigm, featuring multiple internal states connected by inelastic conversion processes. In this presentation, I will present a linear-cosmology framework for iSIDM, starting from a model-independent microphysical parameterization of the inelastic cross section and deriving the corresponding background and perturbation equations in an effective Boltzmann-code description. I will then discuss the resulting cosmological evolution, including the homogeneous chemical evolution and thermal history of the dark sector, demonstrating how these dynamics imprint characteristic signatures on the growth of density perturbations and the linear matter power spectrum. Finally, I will illustrate how the linear-theory predictions of iSIDM can be connected to existing data by translating the modified transfer function into two commonly used phenomenological constraints—those derived from the Lyman-α forest and high-redshift UV luminosity functions—thereby obtaining a preliminary mapping of the viable parameter space.

Primary author: 段, 欣辰 (中国科学院紫金山天文台)

Co-authors: Prof. 王, 子威 (鹏城实验室); Prof. 蔡, 岳霖 (中国科学院紫金山天文台)

Presenter: 段, 欣辰 (中国科学院紫金山天文台)

Session Classification: Parallel Theory-Cosmology 2: Dark Cosmology (Room 302, Chair Sheng-Feng Yan)

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

Scattering of non-relativistic finite-size particles and puffy dark matter direct detection

Monday, 20 April 2026 14:00 (15 minutes)

In this work we consider the scattering between non-relativistic particles with different finite sizes. We first calculate their interaction potential and apply the partial wave method to obtain their scattering cross section. Our findings show that the particle size can significantly affect the scattering between non-relativistic particles. Then we apply such a study to direct detection of puffy dark matter. We find that the finite size of the target nucleus may introduce non-perturbative effects that differ from the scenario of point-like dark matter. For large-size dark matter particles, this non-perturbative regime in the dark matter–nucleus scattering cross section effectively disappears; while for small values of the size-to-range ratio in the scattering process, a significant non-perturbative regime can maintain. Finally, for the direct detection of nugget-type puffy dark matter with a small number of constituent particles, we find that the stability conditions for the formation of bound-state dark matter can provide constraints on the dark matter–nucleus scattering cross section.

Primary author: 武龙, 许

Presenter: 武龙, 许

Session Classification: Parallel Theory-BSM: BSM Probes (Room 368, Chair Ke-Ping Xie)

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

A Comprehensive Effective Field Theory Framework for Coherent Elastic Neutrino-Nucleus Scattering

Monday, 20 April 2026 13:30 (25 minutes)

Coherent elastic neutrino-nucleus scattering (CEνNS) is critical for testing the Standard Model electroweak sector, exploring neutrino properties, and searching for new physics (NP), with recent experiments (e.g., COHERENT, CONUS+, PandaX-4T, XENONnT) highlighting the need for a systematic theoretical framework. We have constructed a comprehensive end-to-end effective field theory (EFT) framework for CEνNS, covering the full energy scale hierarchy from the ultraviolet (UV) to the nuclear sector. It includes low-energy EFT (LEFT) operators up to dimension 8 (with QCD renormalization group running), spurion-method matching to the chiral Lagrangian, full power counting analysis for nuclear response functions (accounting for nucleon number enhancement), and matching of relevant LEFT operators to Standard Model EFT operators (with tree-level UV completions). Using CEνNS experimental data, this framework enables combined analysis to constrain EFT operator scales and neutrino non-standard interaction parameters.

Primary author: LI, Gang (Sun Yat-sen University)

Presenter: LI, Gang (Sun Yat-sen University)

Session Classification: Theory-Cosmology Highlight 1: Cosmological Signals (Room 567, Chair Ning-Qiang Song)

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

How large are curvature perturbations from slow first-order phase transitions?

Monday, 20 April 2026 13:30 (25 minutes)

When strongly supercooled cosmological first-order phase transitions (FOPTs) are sufficiently slow, super-horizon inhomogeneities can be generated. We compute these super-horizon curvature perturbations by employing a gauge-invariant, multi-fluid formalism. By resolving the gauge ambiguities inherent in conventional separate-universe simulations, we demonstrate that Primordial Black Holes are unlikely to be produced by these super-horizon inhomogeneities. We also derive a fitting formula for the resulting curvature perturbations and discuss potential observational constraints on FOPTs imposed by limits on primordial curvature perturbations and associated scalar-induced gravitational waves.

Primary author: 田, 驰 (安徽大学)

Presenter: 田, 驰 (安徽大学)

Session Classification: Parallel Theory-Cosmology 2: Dark Cosmology (Room 302, Chair Sheng-Feng Yan)

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

Enhanced Cosmic-Ray Cooling in AGN from Dark Matter Deep Inelastic Scattering

The diffusion of high-energy cosmic rays (CRs) through the dark matter (DM) spikes of active galactic nuclei entails significant energy loss via interactions with DM. While previous studies of sub-GeV DM have focused on elastic scattering, this process becomes insufficient at higher proton energies and DM masses. In this work, we investigate the CR-DM deep inelastic scattering (DIS) as mediated by a vector portal. We calculate the DIS contribution to the CR energy loss rate and derive stringent exclusion limits on the CR-DM scattering cross-section for DM masses between 10^{-6} GeV and 1 GeV. For higher CR energies and mediator masses, the resulting CR cooling timescales are reduced by orders of magnitude after involving the DIS contribution, producing stringent constraints that surpass most of current experimental limits.

Primary authors: Dr LU, Chih-Ting (Nanjing Normal University); WU, Lei (Nanjing Normal Univeristy); Dr SU, Liangliang (Karlsruhe Institute of Technology); Ms LI, Linjie (Nanjing Normal University); Dr MISHRA, Arvind Kumar (Nanjing Normal University)

Presenter: Dr LU, Chih-Ting (Nanjing Normal University)

Session Classification: Special Evening Plenary Session 1: Frontier Probes (Room 567, Chair Huai-Ke Guo)

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

Hypergeometric function representation of Feynman integral

Friday, 17 April 2026 18:05 (25 minutes)

Embed in Grassmannians, we can obtain the analytical hypergeometric function representation of multi-loop Feynman integrals with masses. We can make the classification among those hypergeometric function solutions by geometric configurations, and generalize Gauss relations among the hypergeometric functions to complete analytic continuation of the solutions. This method can be applicable to the high-order corrections of physical quantities.

Primary authors: Prof. FENG, Tai-Fu (Hebei University); Prof. ZHANG, Hai-Bin (Hebei University)

Presenter: Prof. ZHANG, Hai-Bin (Hebei University)

Session Classification: Formal Theory (Room 352, Chair Teng Fei)

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

Complex τ Electric Dipole Moment from GeV-Scale New Physics

Among the charged leptons, the τ electric dipole moment (dτ) is the least constrained. We show that the Im[dτ] imposes strong constraints on new physics that have yet to be discussed. Motivated in particular by the Super Tau-Charm Facility (STCF), which will provide a uniquely clean environment for precision τ-physics, we study the momentum-transfer dependence of dτ(q2) and compare the projected sensitivities of STCF and Belle II. Our analysis shows that an axion- like coupling of the τ lepton can induce sizable real and imaginary components of the EDM. The predicted EDM values may approach the present experimental sensitivities, making them accessible to future measurements at Belle II and the STCF.

Primary authors: Prof. HE, Xiao-Gang (TDLI); DU, Xinyu (SJTU)

Presenter: DU, Xinyu (SJTU)

Session Classification: Poster Session

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

Intertwining Axion and gravitational waves, generations and detection.

Monday, 20 April 2026 16:50 (25 minutes)

Firstly, we briefly discuss how the hypothetical beyond-the-Standard-Model particle, the axion, can produce gravitational waves through several mechanisms. Then we present some of our recent proposals for detecting axions/gravitational waves, including cryogenic quantum transport technology, traditional spin systems, and specially engineered artificial magnetoelectric materials. We demonstrate that room-sized detectors have promising sensitivity to axions with masses from kHz to GHz, and that a similar device can also be used for high-frequency gravitational wave detection over the same frequency range.

Primary author: Prof. SUN, Sichun (Beijing Institute of Technology)

Presenter: Prof. SUN, Sichun (Beijing Institute of Technology)

Session Classification: Plenary Theory 15: Gravitational Waves (Room 567, Chair Ye-Ling Zhou)

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

Poster：Improving the detection sensitivity to primordial stochastic gravitational waves with reduced astrophysical foregrounds: Subthreshold binary neutron stars

Stochastic gravitational waves (GWs) consist of a primordial component from early Universe processes and an astrophysical component from compact binary mergers. To detect the primordial stochastic GW background (SGWB), the astrophysical foregrounds must be reduced to high precision, which is achievable for third-generation (3G) ground based GW detectors. Previous studies have shown that the foreground from individually detectable merger events can be reduced with fractional residual energy density below 10^{-3}, and the residual foreground from subthreshold binary neutron stars (BNSs) will be the bottleneck if not well cleaned. In this work, we propose that the foreground energy density of subthreshold BNSs $\Omega_{\rm sub}$ can be estimated via a population based approach from the individually detectable BNSs utilizing the isotropic orbital orientations of all BNSs, i.e., uniform distribution in $\cos\iota$, where ι is the BNS inclination angle with respect to the line of sight. Using this approach, we find $\Omega_{\rm sub}$ can be measured with percent-level uncertainty, assuming $O(10^5)$ individually detected BNSs in our simulations. This method represents a promising approach to tackling the foreground cleaning problem.

Primary authors: YU, Jiming; LI, MIngzheng (Shanghai Jiao Tong University); PAN, Zhen (TDLI)

Presenter: LI, MIngzheng (Shanghai Jiao Tong University)

Session Classification: Poster Session

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

From microphysics to Gravitational Waves for cosmological phase transitions

Monday, 20 April 2026 16:20 (30 minutes)

The possibility that future gravitational-wave detectors could observe the relic background from a cosmological phase transition has triggered intense progress in the theoretical description of these events. A detection of such a signal would probe energy scales far beyond those accessible to particle colliders, providing insight into fundamental questions about the early Universe, including the origin of the baryon asymmetry, the nature of dark matter, and the possible existence of exotic relics such as primordial black holes or cosmic strings.

If the transition is first order, it proceeds through the nucleation and expansion of bubbles of the new phase. The resulting gravitational-wave signal is therefore directly determined by microscopic properties of the transition, including the bubble nucleation rate, fluctuation determinants, and the velocity of the expanding bubble walls. Making reliable predictions therefore requires a precise treatment of thermal field theory, out-of-equilibrium dynamics, and the interaction of the bubble wall with the primordial plasma.

To enable systematic studies of models beyond the Standard Model, connecting microphysics to observable signals must be implemented in reliable and automated computational tools. Recent and forthcoming programs for determining bubble fluctuation determinants and bubble-wall velocities represent important steps in this direction. In this talk, I will review recent advances in modelling phase-transition dynamics, discuss the challenges that remain, and outline how improved automation will sharpen gravitational-wave predictions for upcoming experiments.

Primary author: SCHICHO, Philipp (University of Geneva)

Presenter: SCHICHO, Philipp (University of Geneva)

Session Classification: Plenary Theory 15: Gravitational Waves (Room 567, Chair Ye-Ling Zhou)

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

Flavor dependence of chiral symmetry breaking and the conformal window

We investigate the phase structure of Quantum Chromodynamics (QCD) in the vacuum as a function of quark flavor number N_f within the chiral limit. By self-consistently solving the coupled DSEs for the quark and gluon propagators in a minimal QCD scheme, we elucidate the nonperturbative dynamics governing dynamical chiral symmetry breaking. Our calculations determin a critical flavor number of $N_f^c = 6.81$ which marks the chiral symmetry restoration of quarks. Further analysis reveals the critical exponents of the chiral condensate as $-\langle\bar{\psi}\psi\rangle \sim |N_f - N_f^c|^{0.53(9)}$, characterized the second order feature of this phase transition of chiral symmetry. Additionally, we discuss the implications for the walking regime towards the conformal window at larger flavor.

Primary authors: GAO, Fei (Beijing Institute of Technology); LU, Yi (Peking University); CHEN, Yi-huai (Beijing Institute of Technology); LIU, Yu-xin (Peking University); WANG, Zhi-wei (The University of Electronic Science and Technology of China)

Presenter: CHEN, Yi-huai (Beijing Institute of Technology)

Session Classification: Poster Session

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

The Supersymmetric Pati–Salam Model Consisting of Only Small Representations: Theory and Phenomenology

Sunday, 19 April 2026 18:25 (15 minutes)

In this talk, we will present a supersymmetric Pati-Salam model with only small representations as a potential candidate for physics beyond the Standard Model. The model features a Higgs sector with bifundamental fields $H_R + \bar{H}_R = (4,1,2) + (\bar{4},1,2)$, $H_L + \bar{H}_L = (4,2,1) + (\bar{4},2,1)$ as well as a pair of bi-doublet fields $h_a = (1,2,2)$ where $a = 1,2$, with three families of fermions accommodated in $(4,2,1)+(\bar{4},1,2)$ as usual. The matter spectrum is augmented with three copies of neutral singlets that mix with ordinary neutrinos to realize the seesaw mechanism. The model introduces supersymmetric R-symmetry and a global discrete $\mathbb{Z}_n$ symmetry ($n > 2$) that prevents disastrous superpotential couplings, while its spontaneous breaking implies the existence of domain walls. We will discuss theoretical and phenomenological aspects of this model, including potential UV completion from string theory, its near-conformal RG running of gauge couplings, domain walls, proton decays, inflationary scenario, and gravitational waves as a potential probe of this model.

Primary author: OUYANG, Ruiwen (HIAS, UCAS)

Presenter: OUYANG, Ruiwen (HIAS, UCAS)

Session Classification: BSM Highlight (Room 567, Chair Cheng-Cheng Han)

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

Full positivity bounds for anomalous quartic gauge couplings in SMEFT

Electroweak boson scattering at the LHC provides a crucial avenue for probing physics beyond the Standard Model, particularly regarding deviations in quartic gauge couplings. We derive the complete set of positivity bounds for the 22 dimension-8 anomalous quartic gauge coupling (aQGC) coefficients within the Standard Model Effective Field Theory (SMEFT). Moving beyond previous studies limited to transverse vector bosons, our analysis incorporates all electroweak boson modes, explicitly constructing the extremal rays (ERs) of the positivity cone through a group theoretic framework. We utilize two independent methods–direct construction and Casimir operator analysis–to determine these rays, addressing complexities such as parity-violating operators and continuous parameter degeneracies. Our results indicate that the positivity bounds impose severe constraints, restricting the physically viable parameter space to approximately 0.0313% of the naive total space. Furthermore, we derive linear analytical bounds for various operator combinations and provide an easy-to-use Python package, {\tt SMEFTaQGC}, which implements algorithms to numerically verify positivity and compute the optimized positivity bounds for general aQGC configurations.

Primary authors: CHANG, Fu-Ming (University of Science and Technology of China); ZHOU, Shuang-Yong (University of Science and Technology of China); Mr 陈, 卓言 (中国科学技术大学)

Presenter: CHANG, Fu-Ming (University of Science and Technology of China)

Session Classification: Poster Session

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

Equivalence Principle Violation from Dark Matter Coherent Scattering

Monday, 20 April 2026 14:25 (15 minutes)

We discuss how coherent scattering of dark matter with macroscopic targets can generate observable forces and lead to signals of equivalence principle violation. For dark matter masses around the eV scale, coherent enhancement in homogeneous or random materials opens new possibilities for torsion-balance experiments and related searches.

Primary author: Dr XING, Chuan-Yang (China University of Petroleum (East China))

Presenter: Dr XING, Chuan-Yang (China University of Petroleum (East China))

Session Classification: Parallel Theory-Cosmology 2: Dark Cosmology (Room 302, Chair Sheng-Feng Yan)

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

Frontier of multi-loop multi-leg Feynman integrals

Sunday, 19 April 2026 11:00 (30 minutes)

With the development on differential equations and computational algebraic geometry methods, the era of analytic computation of multi-loop multi-leg Feynman integrals is coming. We analytically computed all 2loop 6point and 3loop 5point planar massless Feynman integrals. This is a mile stone of analytic feynman integral computation. Furthermore, based on analytic Feynman integrals, we present a new bootstrap method to obtained 2-loop 6-point amplitudes in QCD.

Primary author: ZHANG, Yang (University of Science and Technology of China)

Presenter: ZHANG, Yang (University of Science and Technology of China)

Session Classification: Plenary Theory 7: New QFT Methods (Room 567, Chair Hong-Jian He)

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

Isocurvature Induced Gravitational Waves at Pulsar Timing Arrays

Monday, 20 April 2026 17:15 (25 minutes)

The standard cosmological model (ΛCDM model) assumes adiabatic initial conditions for primordial density perturbations. However, many new physics scenarios can deviate from this assumption and predict isocurvature perturbations across a large range of scales. In this talk, I will discuss interesting features of gravitational waves induced by isocurvature perturbations. I will also show that observations from pulsar timing arrays can place stringent limits on isocurvature at around 10^6/Mpc.

Primary authors: Prof. CAI, Yifu (University of Science and Technology of China); DU, Peizhi (University of Science and Technology of China); ZHONG, Jiahang (University of Science and Technology of China)

Presenter: DU, Peizhi (University of Science and Technology of China)

Session Classification: Plenary Theory 15: Gravitational Waves (Room 567, Chair Ye-Ling Zhou)

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

Prospects of Light Scalar and U(1)_{B-L} gauge boson at FASER(2)

Monday, 20 April 2026 14:15 (15 minutes)

We did a full simulation of sensitivity reach of $U(1)_{B-L}$ gauge boson with the contribution of a light scalar. We consider a minimal extension of the standard model with a $U(1)_{B-L}$ gauge group.

Primary authors: ZHANG, Yongchao (Southeast University); GUO, Zihao (School of physics, Southeast University)

Presenter: GUO, Zihao (School of physics, Southeast University)

Session Classification: Parallel Theory-BSM: BSM Probes (Room 368, Chair Ke-Ping Xie)

Contribution ID: **43** Type: **not specified**

The Fate of Chiral gauge theory

Sunday, 19 April 2026 17:45 (20 minutes)

The infrared structure of gauge theories with chiral fermions remains largely unexplored. In this work we investigate the Bars–Yankielowicz class using the functional renormalisation group, building on recent developments in gauge–fermion systems that provide clear criteria for confinement and dynamical symmetry breaking.
We show that two distinct phases arise: one exhibiting both confinement and symmetry breaking at small numbers of colours, and another characterised by confinement without symmetry breaking in the large-colour limit. The latter realises a novel regime, opening the possibility of exotic spectra and phenomena that can now be studied within a systematic framework.

Primary author: LI, Haolin (Sun Yat-Sen University)

Presenter: LI, Haolin (Sun Yat-Sen University)

Session Classification: BSM Highlight (Room 567, Chair Cheng-Cheng Han)

Contribution ID: **44** Type: **not specified**

Δ(96)⊠H_CP 与 tri-direct CP 方法：中微子混合与质量的预言

基于 Δ(96)⊠H_CP 对称和 tri-direct CP 方法，系统分析最小跷跷板模型的对称破缺模式。精准预测中微子混合角、CP 破缺相位及质量谱，为下一代中微子实验提供理论参考。

Primary author: 闫, 丽娜 (西北大学)

Presenter: 闫, 丽娜 (西北大学)

Session Classification: Poster Session

Contribution ID: **45** Type: **not specified**

有限模群 Δ(96) 对称性下的中微子 Littlest Modular Seesaw 模型及其对轻子混合与中微子质量的新预言

基于模对称，我们系统分析了在双右手中微子 Littlest Modular Seesaw 机制中，模量场 τ 稳定在模对称固定点处的对称破缺模式。考虑有限模群 Δ(96)，我们求出了所有最低与次低权重的三维矢量值模形式，全面扫描了模形式在固定点处的可能排列，筛选出符合最新中微子振荡整体拟合的可行模型。此类模型的轻中微子质量矩阵仅依赖于三个实参数，且最轻中微子质量为零，预言性极强。我们给出了由模对称性固定的新的混合矩阵第一列结构。结合 JUNO 首批结果以及 T2HK、DUNE 的未来探测精度，讨论了这些模最小跷跷板模型的现象学意义。

Primary author: 郝, 海志 (西北大学)

Presenter: 郝, 海志 (西北大学)

Session Classification: Poster Session

Contribution ID: **46** Type: **not specified**

Non-Projective Bounds in Gravity and Negativity

We develop a primal bootstrap framework for gravitational effective field theories based on fully crossing-symmetric dispersion relations, using finite-resolution sampling instead of smearing. This approach has several key advantages: it allows direct control over the number of subtractions, makes it possible to impose linearized unitarity beyond positivity, and gives direct access to extremal spectra. We uncover new non-projective bounds that fix the overall scale of EFT couplings, including upper bounds of the form
M
MPlanck ⪅ 7.8 in D = 5, implying that the EFT cutoff M cannot be arbitrarily larger than the Planck scale. At extremal points saturating these bounds, we find stable spectra with sharp and unexpected quadratic trajectories.

Primary author: XU, Yongjun (HIAS)

Presenter: XU, Yongjun (HIAS)

Session Classification: Poster Session

Contribution ID: **47** Type: **not specified**

RELICS: A liquid xenon time projection chamber for reactor CEvNS

Sunday, 19 April 2026 18:05 (15 minutes)

Exhibiting the largest cross-section of all interaction channels for MeV neutrinos, coherent elastic neutrino-nucleus scattering (CEvNS) offers a compelling pathway for the remote monitoring of nuclear reactors. Liquid xenon time projection chambers (LXeTPCs) have emerged as an ideal technology for CEvNS detection, primarily due to their low backgrounds and energy thresholds. The RELICS (REactor neutrino LIquid xenon Coherent Scattering) experiment leverages this technology to target reactor CEvNS. RELICS is designed to perform precise measurements of the CEvNS cross-section, thereby advancing our understanding of fundamental neutrino properties and facilitating the search for physics beyond the Standard Model. This talk will introduce the status of the RELICS experiment and discuss its physics potential.

Primary author: WANG, Jun (Westlake University)

Presenter: WANG, Jun (Westlake University)

Session Classification: Parallel Dark Matter & Neutrinos (Room 368, chair Pei-Zhi Du)

Contribution ID: **48** Type: **not specified**

Muon-Induced Background Mitigation in the RELICS Experiment

Poster Abstruct

Precise measurement of Coherent elastic neutrino-nucleus scattering (CEvNS) is crucial for constraining the Standard Model and probing neutrino non-standard interactions. The Liquid Xenon Time Projection Chamber (LXeTPC) achieves enhanced signal amplification and lower energy thresholds, making it an ideal technology for CEvNS detection. The RELICS experiment in Taizhou, China, utilizes the LXeTPC technology to detect neutrinos from a nuclear reactor. One of the key challenges in this new scenario is suppressing the dominant delayed-electron background from cosmic muons. This poster will present the main background mitigation strategy and the latest progress of the RELICS experiment.

Primary author: Dr YANG, Jijun (西湖大学)

Presenter: Dr YANG, Jijun (西湖大学)

Session Classification: Poster Session

Contribution ID: **49** Type: **not specified**

Probing Neutrino-philic Scalars in Muon and Double Beta Decay

Friday, 17 April 2026 17:40 (15 minutes)

Self-interacting neutrinos are well-motivated particles in order to solve problems such as Hubble tension in cosmology. Neutrino-philic scalars, such as flavons and Majorons, can be solutions to BSM puzzles, such as lepton number and lepton flavour violations. New muon decay channels (e.g. $\mu \longrightarrow e\phi$, $\mu \longrightarrow e\phi\phi$) will be introduced by neurtino-scalar couplings and $\mu \longrightarrow e\nu\nu$ will have additional contribution from scalar one-loop effect. Scalar-facilitated neutrino self-interaction can also contribute to two-neutrino double beta decay, the shape of the two-electron spectrum in double beta decay experiments can therefore be modified. The interference between SM and scalar facilitated diagrams will enhance the sensitivity to new physics when the final state particles are the same as SM process. These new channels and enhancements will lead to a wider neurtino-scalar coupling parameter space that can be tested in future experiments.

Primary author: ZHANG, Zhong (Southeast University)

Presenter: ZHANG, Zhong (Southeast University)

Session Classification: Parallel Astroparticle: Dark Probes (Room 368, Chair Xiang Xiao)

Contribution ID: **50** Type: **not specified**

Parton Evolution Effects in Cosmic-Ray Boosted Dark Matter

Friday, 17 April 2026 17:55 (15 minutes)

In this talk, I discuss parton evolution effects in the framework of cosmic-ray boosted dark matter. When dark matter particles are accelerated by high-energy cosmic rays, the large hierarchy between the scattering scale and the dark-sector masses can induce a dark parton shower. At high-threshold detectors, a similar hierarchy in the DM–electron scattering process leads to collinear splittings that can be described by introducing a dark matter parton distribution function (DM PDF). I will show that both types of parton evolution lead to a suppression of the electron recoil rate at neutrino detectors.

Primary author: Dr ZHANG(张), Cong(聪) (中国科学院理论物理研究所)

Presenter: Dr ZHANG(张), Cong(聪) (中国科学院理论物理研究所)

Session Classification: Parallel Astroparticle: Dark Probes (Room 368, Chair Xiang Xiao)

Contribution ID: **51** Type: **not specified**

Cosmological Collider Searches beyond the Hubble Scale with Planck Data

Monday, 20 April 2026 14:30 (15 minutes)

Searches for primordial non-Gaussianity (NG) has the potential to not only reveal the physics of cosmic inflation, but also the structure of fundamental interactions at the highest energies. The cosmological collider (CC) physics program exemplifies this possibility and demonstrates how searches for oscillatory NG can lead to mass-spin spectroscopy of extremely heavy states. Adopting an effective field theory approach, we find the class of Feynman diagrams that can give the largest NG mediated by a heavy scalar particle with mass $M \sim H$, the inflationary Hubble scale. We compute the full shape of the NG and perform the first search for this shape using Planck data, finding no evidence for NG. This search loses its sensitivity as $M \gg H$ since quantum vacuum fluctuations cannot efficiently produce such heavier particles. We then focus on a mechanism where a chemical potential excites on-shell scalar particles with mass $M \gg H$. Computing the full shapes, we perform the first CC search for particles parametrically heavier than H using Planck data. For a range of chemical potential ω and M satisfying $\omega - M \simeq 3H$, we find a global 1.7σ evidence for non-zero NG, after taking into account the look-elsewhere effect.

Primary authors: Ms LU, Qianshu (Institute for Advanced Study, Princeton); Mr KUMAR, Soubhik (Tufts University); ZHANG, Yisong (Tsinghua University); XIANYU, Zhong-Zhi (Tsinghua University)

Presenter: ZHANG, Yisong (Tsinghua University)

Session Classification: Parallel Theory-BSM: BSM Probes (Room 368, Chair Ke-Ping Xie)

Contribution ID: **52** Type: **not specified**

Probing 5.5 MeV solar axion at the PandaX experiment

Friday, 17 April 2026 18:10 (15 minutes)

We focus on the detection of 5.5 MeV solar axions from the pp-chain via electron-positron pair production at the PandaX experiment. Previous work established the relation between axion and photon cross sections for massless axions. We verify this relation numerically in the massless limit. Then we compute the cross section for finite axion mass (< 1 MeV) and derive the corresponding mass correction. Our results show that the cross section increases with axion mass, modifying the original relation.

Additionally, we point out that the cross section scales as Z^2, giving high-Z targets like xenon a significant advantage. By combining this Z-enhancement with finite-mass corrections, this work provides a more complete theoretical basis for solar axion searches in high-Z detectors such as PandaX. Furthermore, we estimate the sensitivity for PandaX-4T and show that future PandaX-nT can achieve a sensitivity comparable to Borexino.

Primary authors: FENG, Ruofei (Southeast University); Prof. GE, Shao-Feng (TDLI-SJTU); Dr TITOV, Oleg (TDLI-SJTU); ZHANG, Yongchao (Southeast University)

Presenter: FENG, Ruofei (Southeast University)

Session Classification: Parallel Astroparticle: Dark Probes (Room 368, Chair Xiang Xiao)

Contribution ID: **53** Type: **not specified**

Looking for lights from the darkness: Signals from MeV-scale solar axion-like particles

Sunday, 19 April 2026 14:00 (30 minutes)

We investigate the photons from the decay of axion-like particles, produced in the solar activity. The nontrivial geometry indicates a wide angular distribution of these photons, which can even come from directions which deviate significantly from the direction of the sun. We consider some detection setups including space and terrestrial experiments in the pole region. There is a critical height for the terrestrial searches, below which there is no flux at all for some regions of the parameter space. One can explore the coupling of axion-like particle to photons up to 10^{-13} GeV^{-1}, if the flux of MeV-scale photons can reach the order of 10^{-15} erg cm^{-2} s^{-1} in future experiments.

Primary authors: Dr QIU, Yu-Cheng (City University of Hong Kong); ZHANG, Yongchao (Southeast University)

Presenter: ZHANG, Yongchao (Southeast University)

Session Classification: Plenary Theory 9: Dark Signals (Room 567, Chair Hai-Bo Yu)

Contribution ID: **54** Type: **not specified**

Gauge-Independent Gravitational Waves from Supercooled Phase Transitions in a Minimal Dark U(1) Sector

Friday, 17 April 2026 19:30 (25 minutes)

First-order phase transitions in hidden gauge sectors can generate stochastic gravitational wave backgrounds and provide a powerful new probe of dark sector physics. In this talk, I will present a gauge-independent analysis of gravitational waves from a minimal dark U(1) sector containing a dark Higgs and a dark photon, with the option of an additional vectorlike dark fermion as a viable dark matter candidate. By combining the Nielsen identity with a controlled derivative expansion and power-counting framework, one can construct a gauge-independent effective action in both the high-temperature and supercooled low-temperature regimes, thereby obtaining robust predictions for bubble nucleation and the resulting gravitational wave signals. I will discuss how the microscopic model parameters map onto detector-facing observables ranges relevant to pulsar timing arrays and future space-based interferometers. The results show that supercooled phase transitions generally lead to stronger and more readily detectable signals than parametrically high-temperature transitions, while also highlighting the complementarity between gravitational wave observations and dark matter phenomenology in this minimal dark-sector setup. Our results provide the most reliable and concrete predictions to date for a minimal gauged dark sector.

Primary author: FENG, Wan-Zhe (Tianjin University)

Presenter: FENG, Wan-Zhe (Tianjin University)

Session Classification: Special Evening Plenary Session 1: Frontier Probes (Room 567, Chair Huai-Ke Guo)

Contribution ID: **55** Type: **not specified**

Dispersive Bootstrap in Cosmological Collider Physics

It is widely believed that during inflation heavy particles ($m \tilde{} H$ up to 10^13 GeV) beyond the Standard Model can be produced and they can leave imprints on large cosmic scales. This mechanism provides a unique window to explore physics at extremely high energy scales—a paradigm known as cosmological collider (CC) physics. The central observables in CC physics are inflation correlators with massive exchanges, which are difficult to compute due to many technical challenges. In recent work, we proposed a new program to bootstrap inflation correlators using dispersion relations on the complex momentum plane, conceptually analogous to the famous dispersion relations in flat spacetime. We developed two distinct types of dispersion relations, the vertex and line dispersion relations. The framework allows us to extract the full analytic expressions for massive correlators solely from their oscillatory signals, thereby drastically simplifying the computational process. Furthermore, we demonstrated that these dispersion relations are highly effective at the loop level and give rise to "irreducible results" which are free of UV divergence and independent of renormalization schemes. By applying the line dispersion relation to several one-loop correlators which are difficult to compute using other techniques, we obtained new analytical expressions that are much simpler than existing results.

Primary authors: LIU, Haoyuan (Tsinghua University); ZHANG, Hongyu; WU, Jiayi (Tsinghua University); QIN, Zhehan (Tsinghua University); XIANYU, Zhong-Zhi (Tsinghua University)

Presenter: LIU, Haoyuan (Tsinghua University)

Session Classification: Poster Session

Contribution ID: **56** Type: **not specified**

Two-Step Cosmological Selection: Electroweak Scale and Its Unifying Legacy

Monday, 20 April 2026 13:55 (25 minutes)

The hierarchy problem between the electroweak (EW) scale and the Planck scale remains a central puzzle in modern physics. A promising approach is the cosmological selection via volume-weighted dynamics in a multiverse landscape, where the EW scale is dynamically selected as the configuration that maximizes the vacuum energy. We propose a two-step cosmological selection (TCS) mechanism. By minimally extending the Standard Model with a complex scalar singlet χ and $U(1)$ symmetry, the origin of the EW scale is explained elegantly by the TCS mechanism. The mechanism also has the potential to account for the neutrino masses generation. Once the $U(1)$ symmetry is broken explicitly by the soft breaking terms, the framework predicts a viable dark matter candidate. Its abundance can be produced via ultra-relativistic freeze-out during reheating and correlates directly with the reheating temperature.

Primary author: YANG, jinlei (Hebei University)

Co-author: Prof. DEPPISCH, Frank F (University College London)

Presenter: YANG, jinlei (Hebei University)

Session Classification: Parallel Formal Theory 2: Formal Cosmology (Room 352, Chair Teng Ma)

Contribution ID: **57** Type: **not specified**

Shockwaves and Time Delays in Einstein-Maxwell Effective Field Theory

Monday, 20 April 2026 13:30 (25 minutes)

We derive the shockwave metric in four-dimensional Einstein–Maxwell effective field theory (EFT) by performing an ultra-relativistic boost of the charged black hole solution accompanied by a rescaling of its mass and charge, including leading order EFT corrections. In contrast to the neutral (Schwarzschild) case, where higher derivative operators leave the shockwave geometry unchanged, we show that electrically charged shockwaves receive non-trivial EFT corrections. We then compute the time delay experienced by a probe photon traversing the resulting charged shockwave. We find that two EFT contributions, the correction to the shockwave geometry and the backreaction induced by the probe photon, are both essential for obtaining a physical time delay that is invariant under field redefinitions of the metric.

Primary authors: Prof. GROJEAN, Christophe (DESY); Dr JIANG, Minyuan (Nanjing Normal University); Dr VUONG, Pham Ngoc Hoa (DESY)

Presenter: Dr JIANG, Minyuan (Nanjing Normal University)

Session Classification: Parallel Formal Theory 2: Formal Cosmology (Room 352, Chair Teng Ma)

Contribution ID: **58** Type: **not specified**

Primordial black hole as cosmic accelerator of light dark matter

Current multiton dark matter (DM) detectors are largely incapable of detecting light dark matter from the Galactic halo due to the energy threshold limitations of their recoil measurements. However, primordial black holes (PBHs) can evaporate via Hawking radiation to particles whose energies are set by the black hole temperature. Consequently, weakly interacting light dark matter (or dark radiation) particles produced in this manner can reach the Earth with sufficient flux and kinetic energy above the experimental thresholds. This opens up a novel avenue to probe the light dark sector in terrestrial experiments. In this work, we explore this possibility by considering fermionic DM produced through PBH evaporation and investigate its electron recoil signatures in direct detection experiments. We analyze both energy independent (constant) and energy dependent (scalar and vector mediated) DM-electron interactions, highlighting the strong dependence of the recoil spectra on the underlying Lorentz structure of the interaction. In addition, we also account for the attenuation effects due to loss of kinetic energy while DM traverses through Earth ' s crust, which can significantly modify the incoming DM flux. Incorporating these effects carefully, we place constraints on light DM using the electron recoil data from XENONnT, LZ, and PandaX-4T.

Primary author: -, Sk Jeesun (Tsung Dao Lee Institute)

Presenter: -, Sk Jeesun (Tsung Dao Lee Institute)

Session Classification: Parallel Dark Matter & Neutrinos (Room 368, chair Pei-Zhi Du)

Contribution ID: **59** Type: **not specified**

Determining the Nature of Dark Matter with Astronomical Observations: Dwarf Galaxies and Small-Scale Structure

Friday, 17 April 2026 13:30 (30 minutes)

Despite decades of intensive direct detection searches across different dark matter candidates, no conclusive particle signal has been identified. This motivates complementary constraints on dark matter properties model independently from astronomical observations. In this talk, we focus on wave-like ultralight dark matter (ULDM) and its dynamical impact on dwarf galaxies. We will show that some observations favor a wave like dark matter and how the wave dark matter can remain consistent with existing limits.

Primary author: 毕, 效军 (中科院高能所)

Presenter: 毕, 效军 (中科院高能所)

Session Classification: Plenary Theory-Experiment Interplay 2: Precision Searches (Room 567, Chair Shao-Feng Ge)

Contribution ID: **60** Type: **not specified**

PKMu 缪子散射探测及新物理探索

Sunday, 19 April 2026 16:30 (25 minutes)

本报告将介绍了基于缪子散射的科学研究项目 PKMu (Probing and Knocking with Muons) 及其近期进展, 该项目旨在利用缪子探索超越标准模型的潜在物理现象. 在缪子散射探测暗物质研究中, 项目利用阻性板气体室等高精度缪子径迹探测器, 建立宇宙射线缪子散射实验平台, 开展了为期 63 天直接探测实验, 通过详细的宇宙射线散射模拟与实测对比, 揭示了宇宙射线多组分对散射信号的贡献, 对缪子和低速暗物质的散射截面给出实测限制; 在缪子散射对暗玻色子与带电轻子味破坏的研究中, 结合高原子序数靶材和缪子-电子散射的实验设计, 模拟结果展现出在亚 GeV 质量区间及独立参数空间探索中的独特优势. 此外, 对缪子-电子散射中的量子纠缠与 Bell 不等式进行了模拟分析, 模拟结果显示在 GeV 能区具备良好的观测条件. 未来, 也将在国内国际缪子源上进行更深入的缪子散射研究. 总体而言, PKMu 研究项目不仅提出了新一系列缪子散射实验构想, 还结合模拟与实验验证提供了系统的可行性分析, 为暗物质搜寻、暗玻色子探索及量子力学基础问题研究开辟了新的途径.

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Primary authors: LI, Qite (Peking University); ZHOU, Chen (Peking University); LI, Qiang (Peking University)

Presenter: LI, Qite (Peking University)

Session Classification: Collider Physics (Room 352, Chair Yan-Lin Liu)

Contribution ID: **61** Type: **not specified**

Hunting Dark Matter with Gravitational Wave detectors

Monday, 20 April 2026 10:00 (25 minutes)

This talk will focus on how gravitational-wave experiments can help probe dark matter candidates. The first part will demonstrate how data from the LIGO-Virgo-KAGRA Collaboration can be leveraged to distinguish between annihilating weakly interacting massive particles and a population of millisecond pulsars as the source of the long-standing GeV gamma-ray excess at the Galactic Center. I will then show how these same detectors enable the direct detection of ultralight dark matter candidates, including dark photons, axions, and dilatons.

Primary author: ZHAO, Yue (HKUST)

Presenter: ZHAO, Yue (HKUST)

Session Classification: Plenary Theory 12: Novel Probes and EFT (Room 567, Chair Wen-Yuan Ai)

Contribution ID: **62** Type: **not specified**

Constructing Massive Vector Amplitudes from Consistency Conditions

Friday, 17 April 2026 17:40 (25 minutes)

Based on the general principles of Lorentz symmetry and unitarity, we introduce two consistency conditions – on-shell gauge symmetry and strong massive-massless continuation – in constructing amplitudes of massive gauge theory with elementary particles. In particular we argue that on-shell gauge symmetry can be understood as a consequence of Lorentz symmetry, unitarity and massive-massless continuation. Based on these two conditions, combined with the little group transformation and consistent factorization, we construct 3-point and 4-point vector-boson/scalar amplitudes that correspond to renormalizable interactions, then analyze the underlying theories and models. Given the particle masses, almost all possible vertices, including those involving Goldstone modes, are uniquely fixed. The only exceptions are triple and quartic scalar self-couplings. In addition, all particle masses must have the same physical origin. If the number of vector bosons is smaller than 3, the underlying theories for the amplitudes are either massive gauge theories with spontaneous symmetry breaking (S.S.B.) or Stueckelberg theory. The necessary condition for the latter is that the scalars have equal masses. We also discuss different models depending on the number of scalars involved. If the number of vector bosons is larger than 3, the underlying theory must be Yang-Mills theory with S.S.B. In both Abelian and non-Abelian cases, the specific shape of the Higgs potential cannot be determined, which explains the fact that scalar self-couplings are undetermined, and the relations between the masses are generally nonlinear.

Primary author: Prof. CHEN, Junmou (Jinan University)

Presenter: Prof. CHEN, Junmou (Jinan University)

Session Classification: Formal Theory (Room 352, Chair Teng Fei)

Contribution ID: **63** Type: **not specified**

Probing Dark Matter Spike with Gravitational Waves from Early EMRIs in the Milky Way Center

Friday, 17 April 2026 20:40 (15 minutes)

Cold dark matter may form dense structures around supermassive black holes (SMBHs), significantly influencing their local environments. These dense regions are ideal sites for the formation of extreme mass-ratio inspirals (EMRIs), in which stellar-mass compact objects gradually spiral into SMBH, emitting gravitational waves (GWs). Space-based gravitational-wave (GW) observatories, such as LISA and Taiji, will be sensitive to these signals, including early-stage EMRIs (E-EMRIs) that persist in the low-frequency band for extended periods. Here we investigate the impact of dark matter-induced dynamical friction on E-EMRIs in the Milky Way Center, model its effect on the trajectory, and calculate the resulting GW spectrum.

Primary authors: TANG, Yong (University of Chinese Academy of Sciences); FENG, chen (中国科学院大学)

Presenter: FENG, chen (中国科学院大学)

Session Classification: Poster Session

Contribution ID: **64** Type: **not specified**

ULDM-Induced Variations of Fundamental Constants in Space-Based Laser Interferometers

Ultralight dark matter (ULDM) coupled to the Standard Model can induce coherent oscillations of effective fundamental constants and thereby generate narrow-band signals in precision interferometric experiments. In this work, we investigate how such oscillations imprint signatures on space-based laser interferometers such as LISA and Taiji. Starting from the one-way inter-spacecraft link observables, we analyze several detector-level effects induced by ULDM, including composition-dependent acceleration of test masses, laser-frequency variations associated with cavity-length modulation, refractive-index effects, and clock-related contributions. We then propagate these signals through the standard calibration chain, including clock-noise suppression and time-delay interferometry (TDI). We show that the observability of a ULDM-induced effect is determined by the structure of its single-link response. In particular, the signal generated by ULDM-induced laser-frequency variation enters the raw link observable with the same operator structure as laser phase noise. As a consequence, it is strongly suppressed in realistic TDI combinations. By contrast, signals with explicit directional structure, such as Doppler responses induced by ULDM-driven test-mass motion, are not removed in the same way by TDI. We further construct the ξ observable, which isolates the differential motion between the test mass and the optical bench, and derive its sensitivity to the dilaton–gluon coupling for LISA, Taiji, and BBO. Our results identify a class of ULDM signatures to which TDI-based space interferometers are intrinsically insensitive, while clarifying which types of couplings can still leave measurable imprints in the final observables.

Primary authors: JIANG, Tingyuan (ICTP-AP, UCAS); TANG, Yong (University of Chinese Academy of Sciences)

Presenter: JIANG, Tingyuan (ICTP-AP, UCAS)

Session Classification: Poster Session

Contribution ID: **65** Type: **not specified**

Leptophilic Scalar Dark Matter: Evading direct detection and prospective neutron star heating

Sunday, 19 April 2026 16:30 (25 minutes)

Leptophilic dark matter offers a well-motivated framework in which conventional nuclear-recoil limits can be strongly suppressed, while viable parameter space remains testable through astrophysical observations. In this talk, I will present a study of scalar leptophilic dark matter in a gauged $\mathrm{U}(1)_{L_\mu - L_\tau}$ extension of the Standard Model, including secluded and pseudo-Nambu–Goldstone boson benchmark realizations. After imposing relic-density, direct- and indirect-detection, and neutrino-trident constraints, viable sub-TeV to TeV parameter regions remain. I will emphasize that neutron star heating provides a powerful complementary probe of these models: even when terrestrial direct-detection signals are suppressed, dark matter capture in neutron stars can still yield observable heating signatures. This complementarity makes old neutron stars a promising probe of thermal dark matter scenarios that evade strong constraints from conventional direct-detection searches.

Primary authors: CAI, Chengfeng (Sun Yat-sen University); ZHANG, Hong-Hao

Presenter: CAI, Chengfeng (Sun Yat-sen University)

Session Classification: Parallel Cosmology & Astrophysics: Cosmic Signals (Room 302, Chair Zhao-Feng Kang)

Contribution ID: **66** Type: **not specified**

Probing Collapsed Dark Matter Halos with Fast Radio Bursts

Sunday, 19 April 2026 18:20 (15 minutes)

The observations of ultra-dense substructures in strong lensing systems challenge the standard cosmology model at small scales. Self-interacting dark matter (SIDM), as one of the alternatives to the cold collisionless dark matter (CDM) of the standard cosmology model, provides a natural mechanism for forming such structures via gravothermal core-collapsing. We show that strong grav-
itational lensing of fast radio bursts (FRBs) provides a new way to effectively probe these structures and to understand dark matter self-interactions. Core-collapsed SIDM halos exhibit steeper central density profiles than CDM halos, enhancing the lensing cross section and producing longer time delays between FRB images. We model the SIDM core-collapsed halo with a power-law profile whose center is cored, and compute lensing properties for subhalo and host halo lensing, including maximal impact parameters and time-delay distributions. Future observatories, such as BURSTT, SKA2-Low, and SKA2-Mid, could detect 105–106 FRBs over a decade, yielding statistically significant time-delay distributions that can probe core-collapse parameters of SIDM halos including self-interaction cross section strengths to σ/m ⊠ min{18 cm2/g, 40λsub cm2/g}.

Primary authors: Prof. ZHANG, Chen (Tongji University); ZHONG, Yiming; Dr WANG, weiyang (University of Chinese Academy of Sciences); 何, 雨轩 (City University of Hong Kong)

Presenter: 何, 雨轩 (City University of Hong Kong)

Session Classification: Parallel Dark Matter & Neutrinos (Room 368, chair Pei-Zhi Du)

Contribution ID: **67** Type: **not specified**

An unexpected possible extraction of \alpha_s using EEC in the post-confinement region

Friday, 17 April 2026 19:55 (25 minutes)

We present precision predictions for the quantum scaling of the post-confinement plateau of the energy-energy correlator (EEC). The analysis follows the light-ray operator product expansion (OPE) description of the near-side EEC, in which the plateau is controlled by the leading $J = 5$ channel and its timelike anomalous dimension. We assess the impact of the plateau prediction on possible α_s extraction and find that the present experimental setup already supports a meaningful sensitivity study.

Primary author: LIU, Xiaohui (Beijing Normal University)

Presenter: LIU, Xiaohui (Beijing Normal University)

Session Classification: Special Evening Plenary Session 1: Frontier Probes (Room 567, Chair Huai-Ke Guo)

Contribution ID: **68** Type: **not specified**

Light and Heavy Scalar Resonances in the NMSSM with Correct Dark Matter Relic Abundance

Sunday, 19 April 2026 16:55 (25 minutes)

Recent CMS analyses report an excess in the diphoton-plus-b¯b channel, indicative of a heavy resonance around 650GeV decaying into a Standard Model (SM)-like Higgs boson and a lighter scalar near 95GeV. The case for a 95GeV state is further supported by diphoton excesses observed by both CMS and ATLAS, as well as a b¯b excess previously observed at the Large Electron-Position collider. This study presents a unified interpretation of these anomalies within the framework of the General Next-to-Minimal Supersymmetric Standard Model that naturally accommodates a light singlet-dominated CP-even scalar boson hs near 95 GeV and a heavier doublet-like scalar boson AH near 650 GeV. Through a comprehensive scan of the parameter space, we demonstrate that the model can explain these excesses at 2 σ level while satisfying constraints from the dark matter relic density, direct detection experiments, the properties of the 125GeV Higgs boson, B-physics observables, and searches for electroweakinos at the Large Hadron Collider (LHC). The interpretation features a Bino-dominated lightest neutralino as the dark matter candidate, whose relic abundance is achieved primarily via As funnel annihilation or coannihilation with S˜-like χ ˜02s into hsAH final states. Our findings provide clear predictions for testing this scenario at the high-luminosity LHC and future colliders.

Primary author: LIAN, Jingwei (Henan Institute of Science and Technology)

Co-authors: Mr 曹, 俊杰 (郑州大学); Mr 刘, 要北 (河南科技学院)

Presenter: LIAN, Jingwei (Henan Institute of Science and Technology)

Session Classification: Collider Physics (Room 352, Chair Yan-Lin Liu)

Contribution ID: **69** Type: **not specified**

Explaining the ACT Helium Abundance tension via Large Lepton Asymmetry from Axion Inflation

The generation of helical magnetic fields and associated chiral asymmetry via the chiral anomaly is a generic feature in pseudoscalar inflation models. In this talk, we explore a scenario where the inflaton ϕ is coupled to a gauged lepton flavor symmetry $U(1)_{L_\mu - L_\tau}$ through a Chern-Simons term $\frac{\alpha}{4f}\phi F\tilde{F}$.

The homogeneous evolution of the inflaton will case a tachyonic instability in one helicity mode of the gauge field, leading to the exponential production of helical magnetic fields. While this process naturally induces a lepton asymmetry, the resulting magnitude in standard setups is typically suppressed by the fermion production during inflation, causing it to be too small to yield observable consequences.

We demonstrate that this limitation can be overcome by implementing a specific mechanism to suppress fermion production during the inflationary era. This suppression allows for a much larger quantity of magnetic helicity. Focusing on the gauged $U(1)_{L_\mu - L_\tau}$ symmetry, we show that our mechanism can produce relatively large lepton asymmetry. Furthermore, to avoid baryon overproduction via Sphaleron process, we postpone the $U(1)_{L_\mu - L_\tau}$ symmetry breaking until after EWPT. This result provides a scenario for the Y_p tension recently hinted at by the ACT cosmic microwave background observations.

Primary authors: WU, Di (HIAS); HU, Yifan (HIAS); KAMADA, Kohei (HIAS)

Presenter: WU, Di (HIAS)

Session Classification: Poster Session

Contribution ID: **70** Type: **not specified**

Exploring muonphilic dark matter with the Z2-even mediator at muon colliders

Poster

Primary author: Ms CHEN, Wanyun (Nanjing Normal University)

Co-authors: Dr LU, Chih-Ting (Nanjing Normal University); Mr LI, Haoqi (Nanjing Normal University); Mr WANG, Qiulei (Nanjing Normal University)

Presenter: Ms CHEN, Wanyun (Nanjing Normal University)

Session Classification: Poster Session

Contribution ID: **71** Type: **not specified**

Gravitational waves and primordial black holes produced by dark meta stable vacuum decay

Sunday, 19 April 2026 18:10 (15 minutes)

Inspired by string theory and cosmological constant problem, it is plausible that the Universe's vacuum structure is characterized by a landscape of metastable vacua. If the dark vacuum is metastable, bubbles of lower-energy phases can nucleate at an approximately constant rate. Because the Hubble expansion rate is monotonically non-increasing with cosmic time, such nucleation can eventually lead to percolation and completion of a dark-sector phase transition. In this work, we investigate the phenomenological consequences of this transition, focusing on the resulting stochastic gravitational-wave background and the potential formation of primordial black holes.

Primary authors: Prof. AN, Haipeng (Tsinghua University); LI, Tingyu (Tsinghua University); Dr CHEN, Yang (Tsinghua University)

Presenter: LI, Tingyu (Tsinghua University)

Session Classification: Parallel Cosmology & Astrophysics: Cosmic Signals (Room 302, Chair Zhao-Feng Kang)

Contribution ID: **72** Type: **not specified**

Non-Abelian Domain walls: oreo and CP violation

Monday, 20 April 2026 14:20 (25 minutes)

The spontaneous breaking of an A_4 flavour symmetry can lead to the formation of domain walls. We study this phenomenon in the scenarios of real and complex A_4 symmetric scalar theories and discover new kinds of domain walls, which we denote as "oreo"-type composite domain walls and CP-violating domain walls.

Primary author: FU, Bowen (Northeastern University, Shenyang)

Presenter: FU, Bowen (Northeastern University, Shenyang)

Session Classification: Theory-Cosmology Highlight 1: Cosmological Signals (Room 567, Chair Ning-Qiang Song)

Contribution ID: **73** Type: **not specified**

Frictional effect and scaling properties in domain wall networks

Monday, 20 April 2026 14:20 (15 minutes)

Domain walls arise in various physical contexts, such as early universe phase transitions. Their interaction with the surrounding plasma determines their motion and the scaling behavior of the networks. We study the friction exerted by a thermal plasma on domain walls in the thin-wall regime using the ballistic approximation. The resulting friction, dependent on wall velocity and temperature, is incorporated into the wall's equations of motion to analyze its effect on network evolution. As an application, we explore implications for dark matter models and the associated gravitational wave signals.

Primary author: LU, Yi-Song

Presenter: LU, Yi-Song

Session Classification: Parallel Formal Theory 2: Formal Cosmology (Room 352, Chair Teng Ma)

Contribution ID: **74** Type: **not specified**

Ultra-Low Nucleation Phase Transitions: Super-Hubble Bubbles and Non-Standard Dynamics

Sunday, 19 April 2026 18:25 (15 minutes)

Supercooled phase transitions have attracted significant interest as potential sources of strong, low-frequency gravitational wave signals detectable by Pulsar Timing Arrays (PTAs). A nucleation temperature T_n is often used to characterize the onset of the transition, defined by a threshold on the nucleation rate. However, in the regime of ultra-low nucleation rates, T_n may not exist, but this does not necessarily imply that the transition cannot complete. We show that even when nucleation remains suppressed and bubble separations exceed the Hubble scale, early-time bubbles can grow and eventually collide at late times, leading to completion. This presentation focuses on the completion condition and the associated dynamics in the regime of ultra-low nucleation rates.

Primary author: CHEN, Haibin

Co-authors: Mr FAN, Qiqi (Sun Yat-sen University); JIANG, Yun

Presenter: CHEN, Haibin

Session Classification: Parallel Cosmology & Astrophysics: Cosmic Signals (Room 302, Chair Zhao-Feng Kang)

Contribution ID: **75** Type: **not specified**

Black hole induced false vacuum decay in a heat bath in (1+1) dimensions

Friday, 17 April 2026 18:30 (15 minutes)

The possibility that a black hole catalyzes vacuum decay is an interesting and important topic both phenomenologically and theoretically. One of the issues is the choice of the vacuum state. To address it, we consider a (1+1)-dimensional toy model of a scalar field with inverted Liouville potential in an external background of a dilaton black hole. We study the decay of a general out-of-equilibrium state describing the evaporating black hole immersed in the thermal bath with a different temperature. We analytically derive the exponential suppression factor of the tunneling rate and show how they interpolate between the results of the previous study on those for the Hartle-Hawking vacuum and Unruh vacuum. We also find the non-thermal sphaleron configuration analytically when there is no dilaton barrier and construct the semiclassical solution describing tunneling onto this sphaleron. Our study would be the first step to examine the vacuum decay around a black hole in our cosmic history.

Primary authors: HU, Bowen (中国科学院大学杭州高等研究院); KAMADA, Kohei (HIAS UCAS)

Presenter: HU, Bowen (中国科学院大学杭州高等研究院)

Session Classification: Formal Theory (Room 352, Chair Teng Fei)

Contribution ID: **76** Type: **not specified**

Modulus stabilization of modular flavor models in Jordan frame supergravity

Friday, 17 April 2026 17:05 (25 minutes)

We propose to discuss the modular flavor model and the stabilization of single modulus field in the Jordan frame supergravity with non-minimal scalar-curvature coupling of the form $\Phi(\tau,\bar{\tau})R$. Modular invariance and positivity of the scale factor constrain stringently the form of the frame function, consequently the Kahler potential. We discuss some general properties of scalar potentials after the scale transformation from the Jordan frame to the Einstein frame. We find that the shape of the resulting scalar potential in the Einstein frame is quite different from that of ordinary single modulus stabilization mechanism. The scalar potential could be stationary at the $i\infty$ fixed point, leading to a runaway type vacuum. We also discuss numerically the modulus stabilization for some simplified scenarios.

Primary author: WANG, Fei (Zhengzhou University)

Presenter: WANG, Fei (Zhengzhou University)

Session Classification: Plenary Theory 3 (GUT Special Session): Unification (Room 567, Chair Xin-Qiang Li)

Contribution ID: **77** Type: **not specified**

Asymptotic grand unification in SO(10)

Friday, 17 April 2026 16:40 (25 minutes)

Asymptotic unification, distinct from the conventional concept of unification, suggests that couplings unify at a non-trivial ultraviolet (UV) fixed point. Theory with an interacting UV fixed point is normally referred to as asymptotic safety to address the famous UV Landau pole problem. Alternative to a usual grand unified theory (GUT), an asymptotic GUT gradually unifies gauge couplings in the deep UV limit. Using an economical and realistic particle content setup, we demonstrate that asymptotic grand unification can be achieved in SO(10) with one extra dimension. One intermediate scale, the Pati-Salam symmetry breaking scale, is included below the compactification scale. The top, bottom and tau masses are split, and the smallness of the neutrino mass is explained via inverse seesaw. Due to the absence of large-dimensional Higgs representations, gauge couplings exhibit asymptotic safety and are thus asymptotically unified, regardless of their initial values. In contrast, Yukawa couplings can achieve asymptotic freedom if the negative gauge contributions dominate over the positive Yukawa terms.

Primary author: ZHOU, Ye-Ling (HIAS-UCAS)

Co-authors: FANG, Gao-Xiang (HIAS, UCAS, Hangzhou); WANG, Zhi-Wei (UESTC)

Presenter: ZHOU, Ye-Ling (HIAS-UCAS)

Session Classification: Plenary Theory 3 (GUT Special Session): Unification (Room 567, Chair Xin-Qiang Li)

Contribution ID: **78** Type: **not specified**

Model Parameter Reconstruction of Electroweak Phase Transition with TianQin and LISA: Insights from the Dimension-Six Model

Sunday, 19 April 2026 17:55 (15 minutes)

We investigate the capability of TianQin and LISA to reconstruct the model parameters in the Lagrangian of new physics scenarios that can generate an electroweak SFOPT. Taking the dimension-six Higgs operator extension of the Standard Model as a representative scenario for a broad class of new physics models, we establish the mapping between the model parameter Λ and the observable spectral features of the stochastic gravitational wave background. We begin by generating simulated data incorporating Time Delay Interferometry channel noise, astrophysical foregrounds, and signals from the dimensional-six model. The data are then compressed and optimized, followed by geometric parameter inference using both Fisher matrix analysis and Bayesian nested sampling with PolyChord, which efficiently handles high-dimensional, multimodal posterior distributions. Finally, machine learning techniques are employed to achieve precise reconstruction of the model parameter Λ. For benchmark points producing strong signals, parameter reconstruction with both TianQin and LISA yields relative uncertainties of approximately 20–30% in the signal amplitude and sub-percent precision in the model parameter Λ. TianQin's sensitivity is limited to stronger signals within its optimal frequency band, whereas LISA can reconstruct parameters across a broader range of signal strengths. Our results demonstrate that reconstruction precision depends on signal strength, astrophysical foregrounds, and instrumental noise characteristics.

Primary author: YANG, Aidi

Co-authors: IDEGAWA, Chikako (Sun Yat-sen University); HUANG, Fa Peng (Sun Yat-sen University)

Presenter: YANG, Aidi

Session Classification: Parallel Cosmology & Astrophysics: Cosmic Signals (Room 302, Chair Zhao-Feng Kang)

Contribution ID: **79** Type: **not specified**

Radiative corrections to inverse beta decay and neutron decay at low energies

Friday, 17 April 2026 17:40 (25 minutes)

We compute electromagnetic radiative corrections in the inverse beta decay at reactor antineutrino energies within the heavy baryon chiral perturbation theory, provide the most accurate cross-section predictions for this process, and present a complete error budget. For the first time, we consistently include quantum electrodynamics, chromodynamics, and electroweak contributions and present the positron energy spectrum accounting for radiative corrections. Our calculation also improves on previous evaluations by incorporating permille-level contributions. The results can be readily applied to normalize the reactor antineutrino flux, improve on the reconstruction of the antineutrino energy, make precise measurements of neutrino oscillation parameters at JUNO, and search for new physics at nuclear power plants. Additionally, we quantify the relation between the experimental value of the nucleon axial-vector charge and its evaluations within the lattice quantum chromodynamics.

Primary author: TOMALAK, Sasha (Institute of Theoretical Physics, Chinese Academy of Sciences)

Presenter: TOMALAK, Sasha (Institute of Theoretical Physics, Chinese Academy of Sciences)

Session Classification: Astroparticle Highlight: Low-Energy Probes (Room 567, Chair Yong-Chao Zhang)

Contribution ID: **80** Type: **not specified**

Complementary Probes of Neutrino Mass Ordering at Colliders

Sunday, 19 April 2026 17:20 (15 minutes)

The ordering of neutrino masses remains an open question in particle physics. While upcoming oscillation experiments aim to resolve this using low-energy probes, complementary approaches are needed to test neutrino mass generation more broadly. In this talk, I will show how high-energy collider experiments can provide such a probe within the minimal Type-I seesaw framework. Focusing on a scenario with two nearly degenerate heavy neutral leptons (HNLs), I will explain how the structure of light–heavy neutrino mixing is constrained by the observed neutrino masses, leading to flavor specific signatures for normal and inverted mass orderings. I will demonstrate that future high-luminosity Z-pole colliders, such as CEPC and FCC-ee, can probe these flavor patterns for very small mixing strengths and, in favorable cases, distinguish between the two orderings. This highlights collider searches for HNLs as a complementary tool to neutrino oscillation experiments in addressing the neutrino mass ordering problem.

Primary author: SENAPATI, Supriya (Nanjing University of Science and Technology)

Presenter: SENAPATI, Supriya (Nanjing University of Science and Technology)

Session Classification: Collider Physics (Room 352, Chair Yan-Lin Liu)

Contribution ID: **81** Type: **not specified**

Flavor Physics in the Precision Era: Rare Decays, Lepton Universality, and New-Physics Targets

Friday, 17 April 2026 09:40 (30 minutes)

With the steady running of the LHCb and Belle II experiments, as well as the precision achieved from Lattice QCD for non-perturbative hadronic parameters, we are entering the era of precision flavor physics. In this talk, I will introduce the role played by flavor physics in precisely testing the Standard Model and indirectly probing physics beyond it. Then, I will give some examples to illustrate how precision flavor physics helps us to achieve this goal. I will also discuss the lepton universality and its violation indicated by the R(D) and R(D*) anomalies, the b->s nu nu decays and their implications for the dark sector, as well as some deviations observed in non-leptonic B decays.

Primary author: LI, Xin-Qiang (Central China Normal Univerisy)

Presenter: LI, Xin-Qiang (Central China Normal Univerisy)

Session Classification: Plenary Theory 1: Flavor and CP Violation (Room 567, Chair Zhi-Wei Wang)

Contribution ID: **82** Type: **not specified**

Discrete flavour and CP symmetries in light of JUNO and neutrino global fit

Sunday, 19 April 2026 16:55 (25 minutes)

Working within the reference three-neutrino mixing framework, we confront the lepton mixing predictions derived using non-Abelian discrete flavour and CP symmetries with the first JUNO data on the solar neutrino mixing parameters $\sin^2\theta_{12}$
and with the results of the latest global neutrino data analysis. We focus on symmetry breaking patterns for which the lepton PMNS mixing matrix depends only on one or two free real parameters. Performing a comprehensive statistical analysis in each of the considered cases, we report the best fit values, the 3σ C.L. allowed ranges and the χ^2-distributions of the lepton mixing observables - the three mixing angles and the three CP-violation phases. We find that the JUNO measurements can disfavour or rule out a number of the mixing patterns associated with specific types of breaking of the discrete flavour and CP symmetries.
The synergy of JUNO, DUNE and T2HK data can provide an exhaustive test of the considered approach to lepton mixing based on non-Abelian discrete lepton flavour symmetries combined with the CP symmetry.

Primary author: LI, Cai-Chang (西北大学)

Presenter: LI, Cai-Chang (西北大学)

Session Classification: Parallel Dark Matter & Neutrinos (Room 368, chair Pei-Zhi Du)

Contribution ID: **83** Type: **not specified**

Impact of Cosmological Phase Transitions on FIMP Dark Matter

Friday, 17 April 2026 18:05 (25 minutes)

For feebly interacting massive dark matter particle (FIMP) dark matter, variations in particle mass during cosmological phase transitions can affect the dark matter production mechanism. Meanwhile, reheating, entropy injection, and phase coexistence during phase transitions, especially supercooled phase transitions, also influence the evolution of dark matter abundance to varying degrees. This talk will review their overall impacts on the relic density for different FIMP DM scenarios.

Primary author: 张, 阳 (河南师范大学)

Presenter: 张, 阳 (河南师范大学)

Session Classification: Parallel Cosmology: Early Universe (Room 302, Chair Yong Tang)

Contribution ID: **84** Type: **not specified**

Spacetime Symmetry dictates EFT Operators: from SMEFT to Dark Matter and Nuclear EFTs

Saturday, 18 April 2026 11:20 (30 minutes)

Presenter: YU, Jiang-Hao

Session Classification: Plenary Theory 4: QFT Frontiers and Strong Dynamics (Room 567, Chair Bo Feng)

Contribution ID: **85** Type: **not specified**

Truth and Beauty: Quantum Entanglement Theory and Its Generic Searches at the Colliders

Sunday, 19 April 2026 10:30 (30 minutes)

The quantum entangled state, which does not violate the Bell non-locality, can violate the Bell non-locality due to the super-activation. Thus, the quantum entanglement is indeed one of the most important properties of quantum mechanics, i.e., Truth of Nature. We shall propose the quantum entanglement theory from mathematical point of view, i.e., Beauty of Theory. For pure states, considering a general quantum system with N particles, we show that the quantum space (the total spin polarization parameter space) is complex projective space, and the classical space (the spin polarization parameter space for classical theory) is the cartesian product of the complex projective spaces. Thus, the classical space is the (generalized) Sagre variety in the quantum space, and the quantum entanglement space is the difference of these two spaces. For mixed states, the sufficient and necessary conditions for quantum entanglement can be given as a set of algebraic equations, which are simple and can be solved easily for physical systems. In addition, we propose a generic method to calculate the quantum range and classical range for the expectation value of any physics observable at the collider, and thus we can probe the quantum entanglement spaces which the previous ways cannot. However, there is a circular argument issue. Furthermore, we will briefly explain how to probe the quantum entanglement consistently in high energy physics by determining the spin analyzing powers and excluding the local hidden variable theory, i.e., evade the circular argument issue and solve the no-go theorem problem.

Presenter: LI, Tianjun (Henan Normal University)

Session Classification: Plenary Theory 7: New QFT Methods (Room 567, Chair Hong-Jian He)

Contribution ID: **87** Type: **not specified**

Asymptotic Grand Unified models

Friday, 17 April 2026 15:40 (30 minutes)

We present the idea of asymptotic grand unification, where the gauge couplings run to a unique fixed point in the ultraviolet, thanks to the presence of a compact extra dimension and to a specific choice group structure and multiplet content. We introduce a minimal model based on a SU(5) gauge theory but also discuss SO(10) and other generalisations, giving also few results on the expected phenomenology.

Presenter: DEANDREA, Aldo (University Lyon 1)

Session Classification: Plenary Theory 3 (GUT Special Session): Unification (Room 567, Chair Xin-Qiang Li)

Contribution ID: **88** Type: **not specified**

Supernova cooling from neutrino-devouring dark matter

Monday, 20 April 2026 11:15 (25 minutes)

Supernova cooling provides a powerful probe of physics beyond the Standard Model (SM), in particular for new, light states interacting feebly with SM particles. Unlike previous supernova studies focusing on annihilation or bremsstrahlung, we identify neutrino-initiated conversion as a dominant and previously unexplored production channel for fermionic dark matter (DM) via the neutrino-devouring process inside a core-collapse supernova, which contributes to the excessive cooling of the supernova. By incorporating state-of-the-art supernova simulation data and the full time evolution information, we derive stringent and robust limits on DM interactions.

Primary author: SONG, Ningqiang (Institute of Theoretical Physics, Chinese Academy of Sciences)

Presenter: SONG, Ningqiang (Institute of Theoretical Physics, Chinese Academy of Sciences)

Session Classification: Plenary Theory-Cosmology 13: Particle Cosmology (Room 567, Chair Yi-Fu Cai)

Contribution ID: **89** Type: **not specified**

Search Results for Physics Beyond the Standard Model with LIGO-Virgo-KAGRA's O1-O4a Observing Runs

Monday, 20 April 2026 15:55 (25 minutes)

I will discuss the recently released results on searches of physics beyond the standard model with LIGO-Virgo-KAGRA's most recent O1-O4a observing runs, including searches for cosmological first order phase transitions, cosmic strings, domain wall, primordial black holes, induced gravitational waves, and direct searches for dark matter, etc.

Primary author: GUO, Huaike (University of Chinese Academy of Sciences)

Presenter: GUO, Huaike (University of Chinese Academy of Sciences)

Session Classification: Plenary Theory 15: Gravitational Waves (Room 567, Chair Ye-Ling Zhou)

Contribution ID: **90** Type: **not specified**

VISHnu

Friday, 17 April 2026 08:40 (30 minutes)

I will describe the VISHnu model, which is a DFSZ axion-majoron model variant with the following features: (a) No cosmological domain wall problem, thus permitting a post-inflationary axion. (b) Identification of the Peccei-Quinn breaking scale with the type-I seesaw scale, thus explaining the tiny neutrino masses. (c) Baryogenesis via leptogenesis. (d) Successful inflation driven by a non-minimal coupling of the Peccei-Quinn scalar to the Ricci scalar. And, of course, (e) a solution to the strong CP problem.

Presenter: VOLKAS, Raymond (The University of Melbourne)

Session Classification: Plenary Theory 1: Flavor and CP Violation (Room 567, Chair Zhi-Wei Wang)

Contribution ID: **91** Type: **not specified**

Invariance of the Friedberg-Lee translation as a partial flavor symmetry

A neutrino would be the Goldstone-like (massless) fermion if it had a translational symmetry, as first pointed out by D.V.Volkov and V.P. Akulov in their pioneering paper about supersymmetry in 1973. But it was R. Friedberg and T.D. Lee who first applied such a working symmetry to constraining the pattern of lepton flavor mixing in 2006. My talk is intended to explain why the Friedberg-Lee translation may serve as a partial flavor symmetry for charged fermions and massive neutrinos, and especially why it is analogous to a broken mu-tau reflection symmetry in the active neutrino sector.

Presenter: XING, Zhi-zhong (Institute of High Energy Physics, Chinese Academy of Sciences)

Contribution ID: **92** Type: **not specified**

How a gravitational wave background affects particle processes

Monday, 20 April 2026 18:05 (25 minutes)

In one of his final papers, Steven Weinberg, together with Raphael Flauger, asked whether gravitational waves (GWs) can be attenuated through their interactions with matter. They argued that no attenuation occurs, owing to a cancellation between graviton absorption and stimulated emission, as inferred from leading-order soft-graviton arguments.

In this talk, I revisit this reasoning and show that it fails for the converse problem: the influence of a gravitational-wave background on matter. For unstable particles, real graviton emission and absorption appear to enhance decay rates. However, these apparent effects are a mirage, arising from an overreliance on leading-order perturbation theory.

To resolve this issue, we formulate a new version of Weinberg's soft graviton theorem that properly accounts for the presence of a graviton medium. We find that the mutual transparency of matter and gravitational radiation is preserved in general cases. However, we also identify an extreme regime where a new IR effect might emerge.

Primary author: AI, Wenyuan (Tsung-Dao Lee Institute, Shanghai Jiao Tong University)

Presenter: AI, Wenyuan (Tsung-Dao Lee Institute, Shanghai Jiao Tong University)

Session Classification: Plenary Theory 15: Gravitational Waves (Room 567, Chair Ye-Ling Zhou)

Contribution ID: **93** Type: **not specified**

Baryonic CP Violation in Theory

Friday, 17 April 2026 10:10 (30 minutes)

The first observation of CP violation in baryon decays in last year is a historic milestone for particle physics. This talk summarizes theoretical progress in the field, highlighting the accurate predictions preceding the discovery and discussing subsequent developments.

Presenter: YU, Fu-Sheng (Lanzhou University)

Session Classification: Plenary Theory 1: Flavor and CP Violation (Room 567, Chair Zhi-Wei Wang)

Contribution ID: **94** Type: **not specified**

Weak Gravity Conjecture in the sky: gravitational waves from preheating in Einstein-Maxwell-Scalar EFT

Monday, 20 April 2026 10:25 (25 minutes)

The effective field theory (EFT) concept provides a necessary tool for obtaining general predictions of low-energy theory valid below its unitarity-breaking scale (cutoff scale). Early Universe inflation and subsequent reheating could be a unique setup for testing potentially observable effects coming from the derivative expansion of the corresponding EFT around the flat space vacuum. In this work, we consider an EFT describing perturbative reheating dominated by the decay of inflaton to photons caused by the dimension-5 operator. We compute the graviton production during reheating and high frequency gravitational wave signal due to the bremsstrahlung effect in the presence of R F F operator. It may lead to the dominant contribution at high momenta if the EFT cutoff is lower than the Planck mass. Assuming the general consequences of the unitarity and causality constraints, which imply that all EFT operators should be present, and be suppressed by the scales following from the dimension analysis, we obtain the observational constraints (CMB bound for the dark radiation) on the mass of the inflaton and UV cutoff of gravity. We find that for the typical parameters of large field inflation models, the gravitational cutoff scale cannot be lower than 10ˆ15 GeV.

Presenter: TOKAREVA, Anna (Hangzhou Institute for Advanced Study)

Session Classification: Plenary Theory 12: Novel Probes and EFT (Room 567, Chair Wen-Yuan Ai)

Contribution ID: **95** Type: **not specified**

Quantum Sensing Frontiers for Dark Matter and New Physics

Sunday, 19 April 2026 19:30 (25 minutes)

Presenter: GAO, Christina

Session Classification: Special Evening Plenary Session 2 (Room 567, Chair Si-Chun Sun)

Contribution ID: **96** Type: **not specified**

dark matter signals at gravitational wave detectors

Sunday, 19 April 2026 14:30 (25 minutes)

Presenter: HUANG, Fa Peng (Sun Yat-sen University)

Session Classification: Plenary Theory 9: Dark Signals (Room 567, Chair Hai-Bo Yu)

Contribution ID: **97** Type: **not specified**

Integration & Reduction

Sunday, 19 April 2026 10:00 (30 minutes)

In various physical situations, we need to do various integration. In this talk I will present recent developments how to do these integrations efficiently.

Presenter: FENG, Bo (South China Normal University (SCNU))

Session Classification: Plenary Theory 7: New QFT Methods (Room 567, Chair Hong-Jian He)

Contribution ID: **98** Type: **not specified**

Semileptonic decay of heavy flavor meson

Monday, 20 April 2026 09:15 (30 minutes)

The study of semileptonic decay plays an important role in extracting the CKM matrix element, where the relevant form factor encodes the nontrivial strong interaction dynamics. We will overview the current achievements on the semileptonic decay, especially from the viewpoint from the relativistic quark model. The observables such as branching fraction, forward-backward asymmetry and polarization will be predicted, confronting with the experimental measurement.

Presenter: KANG, Xian-Wei (Beijing Normal University)

Session Classification: Plenary Theory 11: Flavor/Neutrinos (Room 567, Chair Raymond Volkas)

Contribution ID: **99** Type: **not specified**

Status of the Hai-Ling Project

Saturday, 18 April 2026 10:00 (30 minutes)

Presenter: Prof. XU, Donglian (T D Lee Institute)

Session Classification: Plenary Experiment 2: Astroparticle (Room 567, Chair Xiao-Gang He)

Contribution ID: **100** Type: **not specified**

Glueball Dark Matter under Precision Control: Relic Abundance, Portals, and Direct Detection

Saturday, 18 April 2026 11:50 (30 minutes)

Confining dark sectors offer a minimal and predictive route to composite dark matter (DM). I connect nonperturbative glueball physics to cosmological evolution and to laboratory searches. Using lattice-calibrated thermodynamics, we revisit the relic abundance of stable scalar glueballs and show that strong-coupling effects can shift standard abundance estimates by up to an order of magnitude, yielding a robust mapping between the confinement scale and the observed DM density (including its dependence on the dark-to-visible temperature ratio). We then show how heavy-fermion portals can naturally suppress electromagnetic couplings of composite states, opening broad viable parameter space for heavy glueball/axion-like DM. Finally, I present new results for C-odd vector glueball ("oddball") DM coupled to photons via light electrically charged vector-like fermions portal, namely, its coherent nuclear scattering dominated by two off-shell photons. Matching an EFT to nonperturbative glueball form factors predicts a steep scaling, $\sigma_{\rm SI} \propto \Lambda_D^{2.15} m_\psi^{-8}$, so current and next-generation xenon detectors probe a distinctive light-portal window with $\Lambda_D \sim$ sub-GeV - few GeV and $m_\psi \sim$ few - tens of GeV, compatible with collider and precision constraints.

Presenter: PASECHNIK, Roman (Lund University)

Session Classification: Plenary Theory 4: QFT Frontiers and Strong Dynamics (Room 567, Chair Bo Feng)

Contribution ID: **101** Type: **not specified**

Positivity Bounds in SMEFT

Sunday, 19 April 2026 14:55 (25 minutes)

Presenter: ZHOU, Shuang-Yong (University of Science and Technology of China)

Session Classification: Plenary Theory 10: BSM Constraints (Room 567, Chair Xu Feng)

Contribution ID: **103** Type: **not specified**

Probing Ultralight Dark Matter with Laser Interferometers in Space

Sunday, 19 April 2026 15:45 (25 minutes)

Presenter: TANG, Yong (University of Chinese Academy of Sciences)

Session Classification: Plenary Theory 10: BSM Constraints (Room 567, Chair Xu Feng)

Contribution ID: **104** Type: **not specified**

Axion Theory and Phenomenology

Saturday, 18 April 2026 13:30 (30 minutes)

Presenter: LIU, Jia (Peking University)

Session Classification: Plenary Theory-Experiment Interplay 5: Cross Frontiers (Room 567, Chair Tian-Jun Li)

Contribution ID: **105** Type: **not specified**

Learning from all Particles/Hits: AI usage at Collider/Cosmic-Ray Frontier

Saturday, 18 April 2026 14:30 (30 minutes)

Presenter: RUAN, Manqi (Institute of High Energy Physics, Beijing, China)

Session Classification: Plenary Theory-Experiment Interplay 5: Cross Frontiers (Room 567, Chair Tian-Jun Li)

Contribution ID: **106** Type: **not specified**

Origin of Mass and Scattering Amplitudes: from Higgs to Pauli, Kaluza-Klein, and Chern-Simons

Saturday, 18 April 2026 10:50 (30 minutes)

Presenter: HE, Hong-Jian (TDLI & SJTU)

Session Classification: Plenary Theory 4: QFT Frontiers and Strong Dynamics (Room 567, Chair Bo Feng)

Contribution ID: **108** Type: **not specified**

Self-Interacting Dark Matter and Dark Sectors: Small-Scale Structure as a Precision Probe

Sunday, 19 April 2026 08:15 (30 minutes)

Presenter: YU, Haibo (University of California, Riverside)

Session Classification: Plenary Theory 6: Fundamental Probes（Room 567, Chair Zong-Guo Si）

Contribution ID: **109** Type: **not specified**

Consistent high temperature symmetry non-restoration in 3+1 dimensions

Friday, 17 April 2026 16:10 (30 minutes)

The phenomenon of symmetry non-restoration goes back to Weinberg around 50 years ago: some systems may exhibit spontaneous symmetry breaking at large temperature. Only recently however this same behavour has been found in UV complete models, being previous examples only effective theories with a UV cutoff. I will describe such a UV complete model both at large and finite number of colours.

Presenter: BAJC, Borut

Session Classification: Plenary Theory 3 (GUT Special Session): Unification (Room 567, Chair Xin-Qiang Li)

Contribution ID: **110** Type: **not specified**

Morphology of the Galactic Center Gamma-Ray Excess

Sunday, 19 April 2026 15:20 (25 minutes)

The Galactic Center Gamma-Ray Excess (GCE) remains one of the most intriguing puzzles in astrophysics, with leading interpretations including dark matter annihilation and an unresolved population of millisecond pulsars. In this talk, I present two complementary studies on the GCE morphology. First, I show that the GCE morphology is robust against variations in point source and galactic disk masking, consistently favoring either a nearly spherical profile or a peanut-shaped profile, depends on the background diffuse emission models. Second, motivated by recent Galactic surveys including Gaia, I extend the analysis to generic triaxial and tilted dark matter halos, finding that while the GCE spectrum and inner cuspiness are robust against halo triaxiality and tilt, its morphology can discriminate between different triaxial halo configurations and is more compatible with a dark matter origin than a stellar one.

Presenter: ZHONG, Yiming

Session Classification: Plenary Theory 10: BSM Constraints (Room 567, Chair Xu Feng)

Contribution ID: **111** Type: **not specified**

希格斯与中微子：通向粒子物理未来的两个窗口

希格斯粒子发现以后，标准模型基本完成，粒子物理处于转折点。一方面，标准模型还不能回答许多根本问题，只是一个在目前能标下的有效理论；另一方面，实验上发现了一些超出标准模型的迹象和证据。因此，我们需要更多的实验发现来理解更高能量、更深层次的物理。希格斯和中微子就是两个最好的窗口。我将介绍国内在这两方面的努力：一是刚刚在去年 8 月份开始运行取数的江门中微子实验（JUNO），另一个是环形正负电子对撞机（CEPC）。

Presenter: Prof. WANG, Yi-Fang (IHEP)

Session Classification: Public Lecture by Yi-fang Wang （王贻芳院士）

Contribution ID: **112** Type: **not specified**

Constraining Higgs potential with multi-Higgs production

Sunday, 19 April 2026 13:30 (30 minutes)

Presenter: 司, 宗国 (山东大学物理学院)

Session Classification: Plenary Theory 9: Dark Signals (Room 567, Chair Hai-Bo Yu)

Contribution ID: **113** Type: **not specified**

Functional qcd meets cosmology

Sunday, 19 April 2026 12:00 (25 minutes)

Presenter: GAO, Fei

Session Classification: Plenary Theory 8: Strongly Coupled Theory Special Session (Room 567, Chair Xiao-Feng Luo)

Contribution ID: **114** Type: **not specified**

Electroweak Box Diagrams from Lattice QCD: γW and γZ Corrections for Precision Tests of the Standard Model

Sunday, 19 April 2026 08:45 (30 minutes)

Presenter: FENG, Xu

Session Classification: Plenary Theory 6: Fundamental Probes（Room 567, Chair Zong-Guo Si）

Contribution ID: **115** Type: **not specified**

Search for Ultralight Dark Matter and Gravitational Wave in the Geomagnetic Field

Friday, 17 April 2026 14:00 (30 minutes)

Presenter: WU, Lei (Nanjing Normal Univeristy)

Session Classification: Plenary Theory-Experiment Interplay 2: Precision Searches (Room 567, Chair Shao-Feng Ge)

Contribution ID: **117** Type: **not specified**

Vector Boson Scattering and Electroweak Symmetry Breaking: Status and Outlook

Friday, 17 April 2026 11:00 (30 minutes)

Presenter: YANG, Haijun (Shanghai Jiao Tong University (CN))

Session Classification: Plenary Experiment 1: Collider (Room 567, Chair Man-Qi Ruan)

Contribution ID: **119** Type: **not specified**

Emergent Hadron Mass in QCD: From the Gluon Mass to Observables

Sunday, 19 April 2026 11:30 (30 minutes)

Visible matter is characterised by a single mass scale; namely, the proton mass. The proton's existence and structure are supposed to be described by quantum chromodynamics (QCD), the strong interaction part of the Standard Model; yet, absent Higgs boson couplings, chromodynamics is scale-invariant. Thus, if the Standard Model is truly a part of the theory of Nature, then the proton mass is an emergent feature of QCD; and emergent hadron mass (EHM) must provide the basic link between theory and observation. This presentation will sketch recent progress in elucidating the character of EHM. Special emphasis will given to the three pillars of EHM namely, the momentum-dependent gluon mass, QCD's process-independent effective charge, and the running quark mass; their role in stabilising strong interaction theory; and their measurable expressions in a diverse array of observables.

Presenter: ROBERTS, Craig

Session Classification: Plenary Theory 8: Strongly Coupled Theory Special Session (Room 567, Chair Xiao-Feng Luo)

Contribution ID: **120** Type: **not specified**

Measurements and implications of Galactic cosmic ray spectra

Saturday, 18 April 2026 14:00 (30 minutes)

Precise measurements of energy spectra of cosmic rays are crucial to understanding the physics of cosmic rays. New progresses of measurements of the Galactic cosmic ray spectra by DAMPE and LHAASO will be introduced. The physical implications of these new measurements will be discussed.

Presenter: YUAN, Qiang (Purple Mountain Observatory)

Session Classification: Plenary Theory-Experiment Interplay 5: Cross Frontiers (Room 567, Chair Tian-Jun Li)

Contribution ID: **121** Type: **not specified**

Heavy axion in Composite Higgs model

Monday, 20 April 2026 15:30 (25 minutes)

We present a UV-complete extension of the Standard Model based on the gauge group \(SU(5)\times SU(3)*c*ˆ{*prime}*times Sp(2)*{TC}ˆ{\prime}\times SU(2)*L*times U(1)_Y\), which breaks in two steps to QCD and a technicolor sector. Three axions cancel the three \(*theta\)-terms. Small instantons from the confining \(SU(3)_cˆ{*prime}\) and \(Sp(2)*{TC}ˆ{\prime}\) sectors generate axion potentials, raising their masses to the eV range—well above the QCD axion. The model includes a composite Higgs (\(SU(4)/Sp(4)\)) yielding a 125 GeV Higgs. Anomaly cancellation is verified. This provides a concrete "hypercolored axion" realization with multiple heavy axions.

Primary author: MA, Teng

Presenter: MA, Teng

Session Classification: Plenary Theory 14 (Composite Higgs Special Session): Composite Higgs (Room 567, Chair Aldo Deandrea)

Contribution ID: **122** Type: **not specified**

Hidden Correlations of Reionization Optical Depth in Cosmology

Monday, 20 April 2026 13:55 (25 minutes)

The reionization optical depth $\tau_{\rm reio}$ has interesting connections to existing cosmological anomalies. As first studied in the context of the Hubble tension in our previous paper, a larger $\tau_{\rm reio}$, which could be achieved by removing the Planck low-ℓ polarization data, could boost H_0 slightly, resulting in a mild reduction of the tension between the early- and late-universe determinations of H_0. It has been shown later that a larger $\tau_{\rm reio}$ could also relieve other anomalies including: the tension between BAO and CMB data, the neutrino mass tension, and the latest DESI plus supernovae data's tension with the standard cosmological constant scenario. In this paper, we systematically analyze the correlations between $\tau_{\rm reio}$ and relevant cosmological parameters in the existing cosmic observation anomalies. In addition to Pearson correlation coefficients extracted directly from the covariance matrix, we also study partial correlation coefficients which measure intrinsic relationships between pairs of parameters removing the influence of other parameters. Introducing these methods of partial correlations to cosmology,
we show that $\tau_{\rm reio}$ has weak intrinsic correlations with the parameters responsible for the tensions and anomalies discussed. The large direct Pearson correlations that allow larger $\tau_{\rm reio}$ inferences to alleviate the cosmological tensions each arise from complicated networks through multiple parameters. As a result, the relationships between $\tau_{\rm reio}$ and each anomaly are not independent of other parameters. We also introduce causal inference methods to cosmological data analyses, computing correlations to clarify the impact of large scale polarization data and the effects of CMB observations from ACT and SPT.

Primary author: LI, Lingfeng

Presenter: LI, Lingfeng

Session Classification: Theory-Cosmology Highlight 1: Cosmological Signals (Room 567, Chair Ning-Qiang Song)

Contribution ID: **123** Type: **not specified**

On-shell Approaches for Gravitational Wave Physics: waveform and beyond

Monday, 20 April 2026 12:05 (25 minutes)

The detection of gravitational waves has created a pressing need for high-precision theoretical models for binary systems. In this talk, I will review recent progress in the analytic computation of physical observables for binary black hole and neutron star systems using modern on-shell methods. I will focus on how the on-shell methods, which focus directly on gauge-invariant observables, offer significant simplifications over traditional formalisms. Furthermore, they provide new insights into the structure of classical general relativity. As an illustration, I will present a newly identified violation of the peeling behavior in the asymptotic metric.

Primary author: TENG, Fei (Fudan University)

Presenter: TENG, Fei (Fudan University)

Session Classification: Plenary Theory-Cosmology 13: Particle Cosmology (Room 567, Chair Yi-Fu Cai)

Contribution ID: **124** Type: **not specified**

PandaX: Status and Prospects

Saturday, 18 April 2026 09:00 (30 minutes)

Presenter: LIU, Jianglai (Shanghai Jiao Tong University)

Session Classification: Plenary Experiment 2: Astroparticle (Room 567, Chair Xiao-Gang He)

Contribution ID: **125** Type: **not specified**

Cosmic Rays, SNRs and μ-Quasars in LHAASO's View

Saturday, 18 April 2026 08:30 (30 minutes)

Presenter: CAO, zhen (中国科学院高能物理研究所)

Session Classification: Plenary Experiment 2: Astroparticle (Room 567, Chair Xiao-Gang He)

Contribution ID: **126** Type: **not specified**

Composite Higgs, ALPs, and partially composite tops

Monday, 20 April 2026 15:00 (30 minutes)

We present a class of models of electro-weak symmetry breaking based on strongly coupled gauge theories. We discuss the requirements imposed by flavor and CP violation on the strong dynamics. All these models give rise to an ALP that is an interesting target for searches at the high luminosity run of LHC. We present its effective lagrangian and some of the current bounds.

Presenter: FERRETTI, Gabriele (Chalmers University)

Session Classification: Plenary Theory 14 (Composite Higgs Special Session): Composite Higgs (Room 567, Chair Aldo Deandrea)

Contribution ID: **127** Type: **not specified**

How Viable is Electroweak Baryogenesis?

Friday, 17 April 2026 09:10 (30 minutes)

Presenter: Prof. RAMSEY-MUSOLF, Michael

Session Classification: Plenary Theory 1: Flavor and CP Violation (Room 567, Chair Zhi-Wei Wang)

Contribution ID: **128** Type: **not specified**

Neutrinoless Double Beta Decay in the Multi-Isotope Era: From Discovery to Mechanism

Monday, 20 April 2026 08:45 (30 minutes)

Presenter: DEPPISCH, Frank (University College London)

Session Classification: Plenary Theory 11: Flavor/Neutrinos (Room 567, Chair Raymond Volkas)

Contribution ID: **129** Type: **not specified**

Geometric RG Flow：Holographic QCD

Presenter: HUANG, Mei (University of Chinese Academy of Sciences(UCAS))

Session Classification: Plenary Theory 4: QFT Frontiers and Strong Dynamics (Room 567, Chair Bo Feng)

Contribution ID: **130** Type: **not specified**

Search for the QCD critical point and Strange-Dibaryon at RHIC-STAR （QCD 相变临界点与奇异双重子态的实验寻找）

Friday, 17 April 2026 11:30 (30 minutes)

Presenter: LUO, Xiaofeng (Central China Normal University)

Session Classification: Plenary Experiment 1: Collider (Room 567, Chair Man-Qi Ruan)

Contribution ID: **132** Type: **not specified**

High-Frequency Gravitational Waves in Planetary Magnetospheres: New Detection Opportunities and Constraints

Sunday, 19 April 2026 09:15 (30 minutes)

Presenter: LIU, Tao (HKUST)

Session Classification: Plenary Theory 6: Fundamental Probes（Room 567, Chair Zong-Guo Si）

Contribution ID: **133** Type: **not specified**

Latest results from the LUX-ZEPLIN (LZ) dark matter experiment

Sunday, 19 April 2026 17:45 (20 minutes)

LUX-ZEPLIN (LZ) is a dark matter direct detection experiment, operating deep underground at the Sanford Underground Research Facility (SURF), USA. Utilizing a 7-tonne dual-phase xenon time projection chamber in conjunction with a robust veto system, LZ aims to primarily detect Weakly Interacting Massive Particles (WIMPs), one of the most promising dark matter candidates. Currently, LZ provides the most stringent constraints on WIMPs heavier than 5 GeV/c2. In this talk, I will review the current status of LZ and highlight our recent efforts in search for WIMPs, alongside explorations of other beyond the Standard Model phenomena.

Primary author: XU, YONGHENG

Presenter: XU, YONGHENG

Session Classification: Parallel Dark Matter & Neutrinos (Room 368, chair Pei-Zhi Du)

Contribution ID: **134** Type: **not specified**

First Oscillation Results and Future Prospects of JUNO

Saturday, 18 April 2026 09:30 (30 minutes)

Presenter: LI, Yufeng (Institute of High Energy Physics)

Session Classification: Plenary Experiment 2: Astroparticle (Room 567, Chair Xiao-Gang He)

Contribution ID: **135** Type: **not specified**

Probing Majorana Neutrinos and Dark Matter at MeV-scale with PandaX

Sunday, 19 April 2026 16:30 (25 minutes)

Liquid xenon experiments have advanced dark matter direct detection. While traditionally focused on keV-scale signals, the MeV region also offers rich information for studying neutrinos and dark matter. The PandaX-4T experiment at the China Jinping Underground laboratory uses 3.7 tons of natural xenon. We have developed a dedicated data analysis framework extending its energy range to the MeV scale, systematically characterized the detector response and background model, and searched for neutrinoless double beta decay, axion-like particles/dark photons, and more. This talk will highlight these achievements.

Presenter: XIAO, Xiang (Sun Yat-sen University)

Session Classification: Parallel Dark Matter & Neutrinos (Room 368, chair Pei-Zhi Du)

Contribution ID: **137** Type: **not specified**

Z3 对称下的跷跷板门户与超重暗物质

为了解开暗物质之谜以及中微子质量和问题，研究对跷跷板模型进行了一个简单扩展，在跷跷板机制中引入右手中微子，将暗区与中微子物理联系起来，不仅能够解释观测到的微小中微子质量问题，还能通过轻子生成过程解释宇宙的重子不对称性，构建“跷跷板通道”的暗物质模型。然而，在离散的Z_2 对称模型中，当暗标量ϕ 粒子的质量小于右手中微子 N 时，即质量排序为$m_N > m_\phi$ ，暗标量ϕ 会因为衰变宽度受到混合角及多体相空间的抑制而表现出长寿命，在大爆炸核合成时期后的衰变会破坏轻元素丰度的宇宙学图景，因此这种情况在Z_2 模型中会被大爆炸合成观测所排除。
为了规避这一严峻挑战，我们将暗对称性扩展至Z_3 对称性，暗区包含在Z_3 对称变换下的暗标量ϕ 和暗狄拉克费米子χ，其中χ 作为最轻的暗粒子，是稳定的暗物质。如此情况下，除了与右手中微子通道的相互作用$y_N \phi \chi N$ 外，Z_3 对称性还允许引入一个新的汤川耦合相互作用$y_\chi \phi \chi^c \chi$，使ϕ 获得了一个全新的衰变通道：$\phi \to \chi\chi$。这样即使耦合常数y_χ 非常微弱，该衰变道的存在也足以确保暗标量ϕ 的寿命远短于大爆炸核合成的时间尺度（约 1 秒）。因此，原本在Z_2 对称模型中被严格排除的质量排序$m_N > m_\phi$ ，在Z_3 对称模型中变得似乎可行，为暗标量提供了一幅无需精细调节就能符合宇宙学观测的物理图像。
对于这个模型的唯象研究进一步聚焦于超重暗物质粒子χ 的产生机制，其质量尺度高达10^{10}GeV 的量级，与通过轻子生成所要求的重右手中微子能标（通常高于10^9GeV）自然契合。暗物质χ 的丰度主要通过“冻结”机制产生，具体依赖于暗区粒子与右手中微子之间的质量排序。存在两种典型情形：A 型，$m_\phi > m_N$，暗物质χ 主要通过散射$\phi\chi \to h$ 过程产生，效率由中微子汤川耦合y_N 与再加热温度T_{RH} 控制。B 型，$m_N > m$，暗物质χ 主要来自右手中微子的衰变过程$N \to \phi\chi$，所需要的汤川耦合y_N 取决于质量比m_N/m_χ。在Z_3 对称模型中，由于$\phi \to \chi\chi$ 衰变道的存在，暗标量的转化效率更高，因此产生的暗物质遗迹丰度度通常高于Z_2 对称模型。通过对玻尔兹曼方程的详细求解，可以在参数空间中确定能满足观测的暗物质丰度区域。同时，再加热温度T_{RH} 是一个非常关键的参数，它直接决定了产生正确遗迹丰度所需要的汤川耦合y_N 的强度；而新引入的耦合y_χ 虽然对解决大爆炸核合成问题至关重要，但对y_N 的影响相对较小。总之，Z_3 对称的跷跷板通道模型为连接中微子质量、重子不对称性和超重暗物质这三大宇宙学谜题提供了一个能经受住宇宙学观测检验的理论框架。

Primary author: 杨, 彩霞 (济南大学)

Presenter: 杨, 彩霞 (济南大学)

Session Classification: Poster Session

Contribution ID: **138** Type: **not specified**

不同模型下 Z’通道暗物质的相关唯象学研究

暗物质是当今宇宙学与粒子物理学领域的核心未解难题，其粒子本质探索是理论物理研究的前沿热点。标准模型虽然是个比较完美的模型，但它不包含引力相互作用，无法解释暗物质本质是什么。所以，在标准模型的扩展规范对称性框架下，聚焦于“矢量玻色子 Z’ 通道”的暗物质产生与探测机制，围绕 U(1)*(L_μ-Lτ)* 和 *U(1)(B-L)* 两类典型模型，系统研究了暗物质的遗迹密度、产生机制、唯象学约束及实验探测前景等。论文旨在阐明 *Z’* 通道暗物质在不同规范扩展下的物理特性，并为未来暗物质探测提供理论支撑。在 *U(1)*(L_μ-Lτ) 模型中，引入狄拉克费米子 χ 作为暗物质候选者，分析轻暗物质（MeV-GeV 尺度）与重暗物质（TeV 尺度）下参数空间约束以及 Z’ 玻色子实验探测范围；在 U(1)(B-L) 模型中，引入双狄拉克暗费米子 χ1 与 χ2 ，通过质量混合项诱导耦合，重点研究共振与隔离场景下共散射、转换和共湮灭三种机制在不同参数空间的主导作用及其对遗迹密度演化的影响。

Primary author: 王, 振伟 (济南大学)

Presenter: 王, 振伟 (济南大学)

Session Classification: Poster Session

Contribution ID: **139** Type: **not specified**

A 2026 update of cosmological collider physics

There have been increasing activities recently in the studies of cosmological collider physics and cosmological correlators, attracting attentions from particle physics, observational cosmology, and amplitude communities alike. We will review some recent progress in this direction.

Presenter: XIANYU, Zhong-Zhi (Tsinghua University)

Session Classification: Plenary Theory-Cosmology 13: Particle Cosmology (Room 567, Chair Yi-Fu Cai)

Contribution ID: **140** Type: **not specified**

ATLAS Updates on Higgs-Top Yukawa Coupling and Probing CP Violation

Friday, 17 April 2026 12:00 (25 minutes)

Measurements of the Higgs boson production in association with top quarks provide a direct probe of the Higgs-top Yukawa coupling, a key parameter in the Standard Model. This talk presents the latest ATLAS results on ttH and tH production using the full Run 2 dataset of 140 fb^{-1} at $\sqrt{s}$ = 13 TeV, with a focus on the multi-lepton final state. The measured ttH signal strength is $\sigma\_ttH/\sigma\_SM = 0.63^{+0} \cdot {}^{20}{}_{-0} \cdot {}^{19}$, corresponding to an observed significance of 3.3σ. Furthermore, the CP structure of the top-Higgs Yukawa coupling is probed through a combined analysis of ttH and tH events. Values of the CP mixing angle $|\alpha| > 62°$ are excluded at 68% confidence level, setting important limits on possible CP-odd contributions to the Higgs-top interaction, which is closely connected to the CP violation required to explain the baryon asymmetry of the universe.

Presenter: LIU, Kun (TDLI / SJTU)

Session Classification: Plenary Experiment 1: Collider (Room 567, Chair Man-Qi Ruan)

Contribution ID: **146** Type: **not specified**

Probing the wave nature of light new physics

Sunday, 19 April 2026 17:10 (15 minutes)

Many well-motivated UV theories contain bonsonic light degrees of freedom, which can exhibit various wave-like behaviors at low energy. This leads to many new ideas and novel observables in recent years to probe new physics in astrophysical and laboratory setups alike. In this talk, I will briefly review a few examples in leveraging the wave-like features to test axions and ultralight dark matter. These include the axion-induced supernova remnant radio echo, the soliton-imprinted galaxy rotation curves, axion-induced neutron star X-ray signals. I will end with a new axion-photon resonant conversion mechanism induced by spatially varying magnetic field background and show its phenomenological consequences to the LSTW experiments and solar axion searches.

Presenter: SUN, Chen (ICTP, Trieste)

Session Classification: Parallel Cosmology & Astrophysics: Cosmic Signals (Room 302, Chair Zhao-Feng Kang)

Contribution ID: **147** Type: **not specified**

Multi-messenger probes of ultralight dark matter

Friday, 17 April 2026 18:30 (15 minutes)

Presenter: LI, Bohua (Guangxi University)

Session Classification: Astroparticle Highlight: Low-Energy Probes (Room 567, Chair Yong-Chao Zhang)

Contribution ID: **149** Type: **not specified**

Supercooled Phase Transitions with Radiative Symmetry Breaking (online)

Sunday, 19 April 2026 20:35 (30 minutes)

First-order phase transitions produce gravitational waves and primordial black holes. They always occur in field theories where symmetries are radiatively broken and masses are correspondingly generated. These theories predict a period of supercooling: phase transitions become effective at temperatures much smaller than the symmetry-breaking scale. I will discuss a model-independent approach to study phase transitions in this scenario, which can be adopted if supercooling is strong enough. Perturbative methods can be used to determine the effective action and such model-independent approach allows us to obtain ready-to-use formulas that can be applied to any specific model of this sort.

Presenter: Prof. SALVIO, Alberto (University of Rome and INFN Tor Vergata)

Session Classification: Special Evening Plenary Session 3 (Room 567, Chair Ke-Pan Xie)

Contribution ID: **151** Type: **not specified**

Supercooled Dark-Sector Phase Transitions and the PTA Gravitational-Wave Signal

Monday, 20 April 2026 17:40 (25 minutes)

Presenter: SCHWALLER, Pedro (Mainz University)

Session Classification: Plenary Theory 15: Gravitational Waves (Room 567, Chair Ye-Ling Zhou)

Contribution ID: **153** Type: **not specified**

Long-lived Particle searches

Sunday, 19 April 2026 17:20 (25 minutes)

In this work we study the prospect of detecting light scalars at the FASER. We develop the general formalism for the scalar production and decay from mesons at LHC, given modified couplings of the scalars to the SM particles, as well as summarizing the relevant GeV-scale experiment constraints. We then analyze the reaches of light scalars in the large $\tan\beta$ region of the Type-I 2HDM, in which a light scalar with relatively long life time could be accommodated. We also have studies in the framework of NMSSM.

Primary author: SU, Wei (SYSU)

Presenter: SU, Wei (SYSU)

Session Classification: BSM Highlight (Room 567, Chair Cheng-Cheng Han)

Contribution ID: **154** Type: **not specified**

Primordial black hole formation and multimessenger signals in a complex singlet extension of the standard model

Sunday, 19 April 2026 17:35 (20 minutes)

Presenter: IDEGAWA, Chikako (Sun Yat-sen University)

Session Classification: Collider Physics (Room 352, Chair Yan-Lin Liu)