SPCS 2026: 70th Anniversary of the Discovery of Parity Nonconservation and Prospects in Frontier Physics & SPCS 2026 Summer School

Report of Contributions

Contribution ID: **1** Type: **Parallel Session**

Featured X-ray signal from axion conversion at neutron stars

Tuesday, 23 June 2026 14:10 (20 minutes)

Neutron stars (NS's) with their strong magnetic fields and hot dense cores could be powerful probes of axions, a classic benchmark of feebly-coupled new particles, through abundant production of axions with the axion-nucleon coupling and subsequent conversion into X-rays due to the axion-photon coupling. In this article, we point out that the pulsation structures in both the intensity and polarization of X-rays from NS's could provide us additional information about axions and their couplings. We develop new analytical formalisms of pulsation-polarization structure applicable to a wide range of NS's in the axion scenario and argue that they hold in complicated astrophysical environments. As a case study, we apply our formalism to a representative X-ray Dim Isolated Neutron Star, RX J1856.6-3754, with an unexpected hard X-ray excess which might be axion-induced. We show with an updated fit that the axion explanation is compatible with both the intensity and pulsation data available, and combining the pulsation data does not shift the posterior by more than $1\,\sigma$. Yet, the preferred parameter space is close to being excluded by other astrophysical constraints. With a 75\% reduction of the uncertainties in the pulsation data, we could potentially draw a definite conclusion on the axion-induced X-rays at more than $3\,\sigma$ level.

Primary author: LI, Lingfeng

Presenter: LI, Lingfeng

Session Classification: Parallel session 2

Contribution ID: **2** Type: **Parallel Session**

Glueball Dark Matter： From Gravitational Waves to Direct Detection

Tuesday, 23 June 2026 15:30 (20 minutes)

This talk presents a unified view of glueball dark matter and related composite states in confining dark Yang–Mills sectors. I first review lattice-informed effective descriptions of dark confinement and chiral dynamics, and show how the resulting phase transitions can generate potentially observable gravitational-wave signals, especially in fermionic and near-conformal regimes. I then discuss the non-perturbative thermal evolution of the dark gluon–glueball system, which leads to a controlled prediction for the relic abundance of scalar glueball dark matter. Building on this framework, I introduce composite glueball axion-like particles generated by a θ term and heavy fermion portals, yielding novel visible-sector couplings. Finally, I present recent progress on direct detection, where UV portal operators are matched to non-perturbative glueball amplitudes through a tensor-Pomeron-inspired EFT, opening a quantitative route to recoil searches and collider-consistent light-portal scenarios. Overall, this framework provides a coherent link between dark confinement, cosmological evolution, and experimental probes of strongly coupled dark sectors.

Primary author: WANG, Zhi-Wei (UESTC)

Presenter: WANG, Zhi-Wei (UESTC)

Session Classification: Parallel session 2

Contribution ID: **3** Type: **Parallel Session**

New Perspectives on Precision Nucleon Tomography

Tuesday, 23 June 2026 14:10 (20 minutes)

This talk presents new perspectives on precision nucleon tomography using high-order QCD calculations and jet substructure. We discuss the winner-take-all axis for extending qT subtraction to jet processes, enabling NNNLO predictions for SIDIS and hadron production in DIS. Novel observables such as one-point energy correlators access the nucleon transversity distribution. Furthermore, we explore quantum decoherence in collider events via effective field theory, linking it to renormalization group evolution. These advances sharpen our understanding of the nucleon tomograph and strong interaction.

Primary author: SHAO, Dingyu

Presenter: SHAO, Dingyu

Session Classification: Parallel Session 1

Contribution ID: **4** Type: **Parallel Session**

Baryogenesis from primordial magnetic fields

Tuesday, 23 June 2026 13:30 (20 minutes)

In this talk, I will report our progress on baryogenesis and phase transition.

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

Presenter: Prof. BIAN, Ligong (Chongqing University)

Session Classification: Parallel session 2

Contribution ID: **5** Type: **Parallel Session**

Decoding Weak Phase Amplitudes in Charmed Baryon Decays

Tuesday, 23 June 2026 14:50 (20 minutes)

In this Letter, we present a strategy to decode decay amplitudes with different weak phases in two-body charmed baryon decays, addressing a long-standing challenge to understanding CP violation in this sector.
Using SU(3) flavor symmetry, we disentangle the amplitudes defined through $M = \lambda_s A_s + \lambda_b A_b$ ($\lambda_i = V_{ui}V_{ci}^*$), enabling a data-driven determination of their relative hierarchy across Cabibbo-favored, singly, and doubly Cabibbo-suppressed modes.
Applying this framework to current data, we find that the ratio
A_b/A_s is approximately 100 times larger than expectation of $\mathcal{O}(1)$ at 2.1σ level.
This unexpected pattern may be accommodated by SU(3) breaking effects, but it can also point to new physics.
We further show that the Lee-Yang parameters provide an independent and complementary probe.
To resolve this ambiguity in the origin of the enhancement, we propose a decisive discriminator using decay modes insensitive to large SU(3) breaking, in particular $\Xi_c^0 \to pK^-$ and $\Xi_c^0 \to \Sigma^+\pi^-$ as golden channels.
Measurements of these modes will distinguish between symmetry breaking effects and new physics, establishing a clean pathway to probe CP violation in the charm baryon sector.

Primary author: SUN, Jin (IBS-CTPU-PTC)

Presenter: SUN, Jin (IBS-CTPU-PTC)

Session Classification: Parallel Session 1

Contribution ID: **6** Type: **Parallel Session**

Revisiting μ-econversion in R-parity violating SUSY

Tuesday, 23 June 2026 14:30 (20 minutes)

The μ-e conversion process is one of the most powerful ways to test lepton-flavor-violating (LFV) interactions involving charged leptons. The standard model with massive neutrinos predicts an extremely low rate for μ-e conversion, making this process an excellent probe for testing LFV arising from new physics. Among many theoretical models that can induce LFV, the Supersymmetric model with R-parity violating interactions is one of the most studied for μ-e conversion. In this work, we revisit trilinear R-parity violating interactions for μ-e conversion, considering renormalization group (RG) running effects from high to low energy scales. The μ-e conversion, $\mu \to e\gamma$, and $\mu \to eee$ experimental data are compared to give upper limits on the relevant 15 combinations of the trilinear λ' couplings and 6 combinations of the λ couplings, certain of which are underexplored in previous studies. We find that RG running effects influence the limits by no more than 30\% in most cases, but can improve constraints by $\sim$80\% in certain combinations, which cannot be neglected. In the near future, COMET and Mu2e are expected to begin data-taking and aim to provide the most stringent constraints on μ-e conversion. These next-generation μ-e experiments have the ability to give much more comprehensive examinations on most trilinear coupling combinations than the $\mu \to e\gamma$ and $\mu \to 3e$ decay experiments. The μ-e experiments will not only deepen our understanding of LFV but also provide a crucial way to examine the underlying new physics contributions.

Primary author: XIAO, Yu-Qi (Central China Normal University)

Presenter: XIAO, Yu-Qi (Central China Normal University)

Session Classification: Parallel Session 1

Contribution ID: **7** Type: **Parallel Session**

Spin-flavor entanglement in $\Lambda_b \to \Lambda D$ and weak phase extraction

Tuesday, 23 June 2026 15:50 (20 minutes)

We identify a new spin–flavor entanglement structure in $\Lambda_b \to \Lambda D$ decays, formed by the correlation between the Λ spin and the neutral-D flavor states ($D = D^0, \overline{D}^0, D_1, D_2$). The entanglement information is encoded in the decay rates and Lee-Yang parameters of the four neutral-D modes. We then show that the same spin-flavor structure provides a new method to determine the weak phase γ, a key angle of the Cabibbo-Kobayashi-Maskawa unitarity triangle. We find that the experimental uncertainty scales as $\sigma_\gamma \propto 1/calC$, where $calC$ is the Wootters concurrence, thereby quantitatively relating the precision of the weak-phase extraction to the amount of spin-flavor entanglement.

Primary authors: GENG, Chao-Qiang (Hangzhou Institute for Advanced Study, UCAS); Mr LIU, Sheng-Lin (HIAS,UCAS); HE, Xiao-Gang; DU, Yong (IMP CAS); LIU, chiawei

Presenter: LIU, chiawei

Session Classification: Parallel Session 1

Contribution ID: **8** Type: **Parallel Session**

Predictions for CP violation in anti-triplet beauty baryon to charmonium decays

Tuesday, 23 June 2026 15:30 (20 minutes)

Motivated by the recent 3.9σ evidence for CP violation from the LHCb collaboration in decays of an anti-triplet beauty baryon to a charmonium, an octet baryon, and a pseudoscalar meson, we perform, for the first time, a systematic analysis of this class of decays within the framework of flavor $SU(3)$ symmetry.
Several predictions for branching ratios and CP violating relations which can be tested in future experiments are found, in particular $\Delta A_{CP} = A_{CP}(\Lambda_b^0 \to p\pi^- J/\psi) - A_{CP}(\Lambda_b^0 \to pK^- J/\psi) = A_{CP}(\Lambda_b^0 \to n\pi^0 J/\psi) - A_{CP}(\Lambda_b^0 \to (nK_S, nK_L)J/\psi)$. Our results provide guidance to test the availability of $SU(3)$ symmetry and search for possible CP violation effects in this class of decays.

Primary authors: Dr SUN, Jin (IBS); Prof. HE, XiaoGang (TDLI); XING, zhi-peng (Nanjing Normal University)

Presenter: XING, zhi-peng (Nanjing Normal University)

Session Classification: Parallel Session 1

Contribution ID: **9** Type: **Parallel Session**

Chiral gravitational wave background from axion-like fields in the early universe

Tuesday, 23 June 2026 14:30 (20 minutes)

The chiral gravitational wave background (GWB) can be generated by axion-like fields in the early universe. The conventional notion of an audible axion relies on couplings between axions and gauge fields. Here we consider an axion-like mechanism coupled to the gravitational topological term, which enables direct and efficient production of gravitational waves during the radiation-dominated era of the early Universe. We compute the energy spectral density of the chiral gravitational wave background and the comoving energy density of axion-like fields. Using our numerical results, we explore the parameter space of axion masses and decay constants that yield detectable gravitational wave signals for both pulsar timing arrays and space-based gravitational wave detectors.[2604.08141 & 2412.18420].

Primary author: ZHANG, Yun-Long (NAOC)

Presenter: ZHANG, Yun-Long (NAOC)

Session Classification: Parallel session 2

Contribution ID: **10** Type: **Parallel Session**

Robustness of the δ_{CP} measurement at future long-baseline experiments

Tuesday, 23 June 2026 15:10 (20 minutes)

The precision determination of the leptonic CP-violating phase δ_{CP} is one of the main goals of the upcoming long-baseline experiments DUNE and Hyper-Kamiokande. Within the standard three-flavor framework and the usual assumptions on neutrino cross sections – namely lepton universality and accurate nuclear modeling – both experiments are projected to reach high sensitivity to δ_{CP}.

In this talk I examine how robust this picture really is. First, I show that a model-agnostic, data-driven treatment of current cross-section data allows smooth deformations of σ_{ν_e} that degrade the CP sensitivity by 3–4σ at maximal CP violation, exposing how much of the projected reach is rooted in theoretical assumptions rather than in measurements. Second, I show that even if these assumptions hold, any unmodeled new physics in neutrino propagation – illustrated by the NSI solutions to the present NOνA–T2K tension – affects DUNE and Hyper-Kamiokande differently due to their distinct matter effects, generating an artificial tension at the $\sim 3\sigma$ level between their inferred parameters. Taken together, these results suggest that, in the precision era, tensions between long-baseline experiments may themselves serve as a diagnostic tool, pointing either to hidden systematics or to physics beyond the Standard Model.

Primary author: PINHEIRO, Joao Paulo (TDLI)

Presenter: PINHEIRO, Joao Paulo (TDLI)

Session Classification: Parallel Session 1

Contribution ID: **11** Type: **Parallel Session**

Search for ultralight scalar dark matter with quadratic interactions

Tuesday, 23 June 2026 15:10 (20 minutes)

In this talk, I will discuss about my recent work on the searches for the ultralight scalar dark matter with quadratic interactions with SM fields. This will lead to the effective interactions between the ultralight dark matter and the nucleon fields phiˆ2 N N/f below the QCD confinement scale, which can be thought as potential barrier for the dark matter wind in the presence of ordinary matter. When the potential barrier is large enough compared with the kinetic energy of the dark matter, the dark matter flux will bounce back from the ordinary object, as a result inducing a pressure force on the object. After taking into the constraints from Supernova cooling, BBN and gravitational inverse square law test, there exists parameter spaces in our model which can be searched for by utilizing this force effect on the experiment for the test of the weak equivalence principle.

Primary author: LIU, Da (Shandong University)

Presenter: LIU, Da (Shandong University)

Session Classification: Parallel session 2

Contribution ID: **12** Type: **Parallel Session**

Specially Embedding a Composite Axion Model

Tuesday, 23 June 2026 14:50 (20 minutes)

We present a novel framework of the post-inflationary composite axion to address the strong CP problem without the cosmological domain wall problem. Conventional composite axion models lead to the domain wall number greater than one, producing stable axion domain walls that overclose the Universe. We show that by considering a special embedding of the confining gauge group responsible for the composite axion as well as QCD into a larger product gauge group, the domain wall number is essentially set to unity in the ultraviolet (UV) theory. In this setup, small instanton effects associated with the UV gauge dynamics induce a controlled explicit breaking of the residual discrete symmetry, providing a bias term in the axion potential. As a result, the domain walls become unstable and decay sufficiently quickly, while the axion solution to the strong CP problem remains intact. We construct an explicit realization of this framework, identify a viable parameter region and analyze the axion dark matter abundance. Decays of exotic hadrons from the composite dynamics are also investigated. Our special-embedding UV completion renders the domain wall problem in composite axion models cosmologically harmless.

Primary author: HOR, Shihwen (T. D. Lee Institute)

Presenter: HOR, Shihwen (T. D. Lee Institute)

Session Classification: Parallel session 2

Contribution ID: **13** Type: **Parallel Session**

Recent flavor physics from ATLAS and CMS including CPV

Tuesday, 23 June 2026 13:30 (20 minutes)

I will talk about some recent flavor physics results from ATLAS and CMS, including the tetraquark search, excited Bc meson search, B meson lifetime measurements and time-dependent CPV measurements. These results deepen our understanding of particle physics in the flavor sector.

Primary author: Prof. CHEN, Xin (Tsinghua Univ.)

Presenter: Prof. CHEN, Xin (Tsinghua Univ.)

Session Classification: Parallel Session 1

Contribution ID: **14** Type: **Parallel Session**

Deep-learning boosted hadronic Higgs precise measurements at future e+e− Higgs factories

Tuesday, 23 June 2026 13:50 (20 minutes)

Precise measurements of Higgs decays into quarks and gluons are essential
for probing the Yukawa couplings of the Higgs boson and testing the flavor structure of the Standard Model. We investigate the process e+e− ⟶ ZH at √s = 240 GeV at a future e+e− Higgs factory, taking the CEPC design as a benchmark. Jet flavor is identified using state-of-the-art particle-level deep neural network taggers, whose per-jet outputs are combined with global event observables in a two-stage analysis to separate the Higgs hadronic decay modes from the backgrounds. Assuming an integrated luminosity of 20 ab−1, we present a quantitative sensitivity estimation corresponding to a statistical significance of about 1.3σ for H ⟶ s¯s. These results highlight the potential of deep-learning-based jet flavor tagging for precision studies of Higgs decays at future e+e− Higgs factories.

Primary author: Dr ZHU, Yifan (TDLI, SJTU)

Presenter: Dr ZHU, Yifan (TDLI, SJTU)

Session Classification: Parallel Session 1

Contribution ID: **15** Type: **Parallel Session**

Supernova constraints on the interactions of dark matter

Tuesday, 23 June 2026 13:50 (20 minutes)

Assuming the dark matter (DM) particle has hadronic interactions, we estimate the SN1987A limits on the effective hadronic DM couplings in the framework of dim-5 and dim-6 operators. The cross sections for the effective DM-nucleon couplings can be excluded up to $\sim 10^{-52}\,\mathrm{cm}^2$ for DM mass down to the MeV scale, depending largely on the interaction type. We also update the supernova constraints on the absorptive DM operators.

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

Presenter: ZHANG, Yongchao (Southeast University)

Session Classification: Parallel session 2

Contribution ID: **17** Type: **Plenary Talk**

Analogue of Chern-Simons invariant in non-metricity gravity and axion cosmology

Tuesday, 23 June 2026 09:30 (30 minutes)

This talk is mainly based on the paper 2504.09218, a joint study with Sergei D. Odintsov.
We consider a pseudo-scalar quantity analogous to the Chern-Simons invariant within the framework of non-metric gravity.
By taking into account the coupling between this pseudoscalar and the axion, we present a scenario that may solve the axion misalignment problem, the S8 problem, and issues concerning the onset of inflation. When a phase transition occurs due to the spontaneous breaking of gauge symmetries in electroweak theories or Grand Unified Theories (GUTs), the pseudo-scalar quantity takes on a non-trivial value, which induces an axion field misalignment and leads to the creation of axion particles. If the gradient of the potential is small enough, the S8 problem may also be solved. Furthermore, we propose a mechanism whereby inflation is induced by the misalignment of the axion field generated by the phase transition in the GUTs.

Primary author: NOJIRI, Shin'ichi (Nagoya University/KEK)

Presenter: NOJIRI, Shin'ichi (Nagoya University/KEK)

Session Classification: Session I (Day 2)

Contribution ID: **18** Type: **Plenary Talk**

Charmed baryon decays at BESIII

Monday, 22 June 2026 17:20 (30 minutes)

BESIII has accumulated 4.5fb-1 of e+e- collision data in the 4.6 and 4.7 GeV energy range, which provide the largest dataset of LcLc pairs in the world. We will present a novel way for exploring CP violation using the LcLc threshold data and the first observation of the transverse polarization of in the reaction e+e- -> LcLc. Furthermore, Our presentation will also include the observation of a rare beta decay of the charmed baryon Lc->nenv with a Graph Neural Network, recent results of the partial wave analysis, as well as the recent branching fraction measurements.

Primary author: LI, Pei-Rong (LanZhou University)

Presenter: LI, Pei-Rong (LanZhou University)

Session Classification: Session IV

Contribution ID: **19** Type: **Plenary Talk**

The battle of symmetry vs asymmetry

Monday, 22 June 2026 09:40 (40 minutes)

The discovery of parity violation introduced asymmetry directly into our most fundamental laws. I will discuss how the conflict between symmetry and asymmetry has shaped where we are in fundamental physics and where we are going. Along the way we will check in on the discrete symmetries, the arrow of time and causality, work by T. D. Lee and G.C. Wick, Starobinsky inflation, etc..

Primary author: DONOGHUE, John (University of Massachusetts, Amherst)

Presenter: DONOGHUE, John (University of Massachusetts, Amherst)

Session Classification: Session I

Contribution ID: **20** Type: **Plenary Talk**

Direct CP violation in charmed meson decays

Monday, 22 June 2026 15:50 (30 minutes)

In November of 2011 LHCb announced the first evidence of CP violation in the charm sector. A nonzero value for the difference of CP asymmetries in the decays $D^0 \to K^+K^-$ and $D^0 \to \pi^+\pi^-$, $\Delta A_{CP} = (-0.82 \pm 0.21 \pm 0.11)\%$
was reported. This had triggered a flurry of studies exploring whether this CP violation in the charm sector implies new physics. Direct CP violation (DCPV) requires nontrivial strong and weak phase differences in two different subprocesses. The topological diagrammatic approach (TDA) is suitable for this purpose. DCPV in $D_s^+ \to K^+\eta$ induced from tree diagrams is estimated in TDA to be at the per mille level.
For CPV in the difference between $D^0 \to K^+K^-$ and $D^0 \to \pi^+\pi^-$, it is necessary to take penguin contributions into account and consider the interference between tree and penguin amplitudes.
Cheng-Wei Chiang and I found in 2012 that the short-distance penguin effect is too small. We conjectured that the long-distance (LD) penguin through the final-state rescattering is of the same order as the W-exchange topology. Since W-exchange can be extracted from the global fit to the data, we found two solutions: $\Delta A_{CP} = (-0.139 \pm 0.004)\%$ and $(-0.151 \pm 0.004)\%$. In the meantime, the original evidence of CP asymmetry difference was gone in 2013 and 2014 when LHCb started to use the muon tag to identify the D^0. In 2019, LHCb finally reported the first observation of
CP asymmetry in the charm system with the result
$\Delta A_{CP} = (-1.54 \pm 0.29) \times 10^{-3}$. Our predictions in 2012 are amazingly in excellent agreement with the LHCb observation of CP violation in 2019. Many mechanisms proposed in the literature for the penguin failed to give enough penguin enhancement. In this talk, we will also comment on the new measurement of CPV in $D^0 \to K^+K^-$ which leads to U-spin symmetry breaking and my indicate a signal of new physics.

Primary author: CHENG, Hai-Yang (Academia Sinica)

Co-author: Prof. CHIANG, Cheng-Wei (National Taiwan University)

Presenter: CHENG, Hai-Yang (Academia Sinica)

Session Classification: Session IV

Contribution ID: **21** Type: **Plenary Talk**

Muon g−2 and EDM: Precision Tests of Fundamental Symmetries and New Physics

Tuesday, 23 June 2026 10:50 (30 minutes)

The muon anomalous magnetic moment, aμ=(g−2)μ/2, is one of the most sensitive precision observables for testing the Standard Model and probing new physics. The successive Muon g−2 experiments at CERN, Brookhaven, and Fermilab were recognized with the 2026 Breakthrough Prize in Fundamental Physics, reflecting the long-standing impact of this experimental program on precision tests of fundamental interactions. The final result from the Fermilab Muon g−2 Experiment has reached a precision of 127 parts per billion, marking a major milestone for the storage-ring technique and providing the most precise measurement of the muon magnetic anomaly to date. At the same time, important questions remain concerning the Standard Model prediction, in particular the hadronic contributions, as well as the need for independent experimental cross-checks. Complementary to g−2, the muon electric dipole moment provides a highly sensitive probe of new sources of CP violation and charged-lepton-sector new physics. This talk will review the final Muon g−2 result and its physics implications, and discuss future prospects for EDM searches and next-generation g−2 concepts such as CANTON-μ as probes of fundamental symmetries and physics beyond the Standard Model.

Primary author: Prof. LI, Liang (Shanghai Jiao Tong University)

Presenter: Prof. LI, Liang (Shanghai Jiao Tong University)

Session Classification: Session II (Day 2)

Contribution ID: **23** Type: **Plenary Talk**

Paradigm changing studies of spin entangled hyperons and antihyperons at BESIII

Monday, 22 June 2026 11:20 (40 minutes)

This talk presents paradigm-changing studies of spin-entangled hyperons and antihyperons conducted at the BESIII experiment. Utilizing unique, high-statistics datasets of quantum-entangled pairs produced in electron-positron collisions, BESIII has established itself as a leading facility for precision hyperon physics. The core research focuses on the search for Charge-Parity (CP) violation in the decays of various hyperons, achieving unprecedented sensitivities at the level of 10ˆ-3, which is crucial for understanding the matter-antimatter asymmetry of the universe. A landmark achievement is the world's most precise measurement of the Lambda hyperon's electric dipole moment (EDM), improving the experimental upper limit by over two orders of magnitude and providing a new probe for physics beyond the Standard Model. Furthermore, the program encompasses detailed investigations into hyperon radiative decays, semileptonic decays, and spin-polarization dynamics. Collectively, these results leverage BESIII's unique capabilities at the charm energy region to advance fundamental knowledge of QCD, CP symmetry, and the search for new physics in the baryon sector.

Primary author: Prof. LI, Hai-Bo (IHEP)

Presenter: Prof. LI, Hai-Bo (IHEP)

Session Classification: Session II

Contribution ID: **24** Type: **Parallel Session**

Status and prospect of Trident

Tuesday, 23 June 2026 15:50 (20 minutes)

The tRopIcal DEep-sea Neutrino Telescope (TRIDENT) project aims to pioneer the development of a next-generation deep-sea neutrino observatory. Designed to detect high-energy astrophysical neutrinos, TRIDENT seeks to address the century-old puzzle of the origin of cosmic rays. Furthermore, it will enable precise measurements of the flavor ratio of astrophysical neutrinos, providing valuable insights into neutrino production mechanisms within cosmic sources and serving as a powerful probe for physics beyond the Standard Model.

TRIDENT will feature a large-scale deep-sea array deployed at a depth of 3,500 meters in the South China Sea. The full configuration will comprise approximately 1,000 strings instrumented with roughly 20,000 novel hybrid digital optical modules (hDOMs), monitoring a seawater volume of about 10 cubic kilometers. TRIDENT Phase-I, consisting of 10 detector strings, is currently underway and is scheduled for deployment in 2027. This talk will present the recent technical updates, project status, and future prospects of the TRIDENT experiment.

Primary author: Dr MEI, Hualin

Presenter: Dr MEI, Hualin

Session Classification: Parallel session 2

Contribution ID: **28** Type: **Plenary Talk**

Theoretical Predictions and the Little Red Dots in the Universe

Tuesday, 23 June 2026 10:00 (30 minutes)

James Webb Space Telescope (JWST) discovered remarkably numerous Little Red Dots (LRDs) in the Universe for a wide redshift z range from ˜2 to ˜7. Such LRDs, characterized by prominent V shaped continuum spectra with unusually broad Hα and Hβ lines (FWHM ˜10ˆ3 to ˜10ˆ4 km/s), are inferred to be extremely luminous, compact, massive, metal poor yet without detectable X-ray and radio emissions. We have been working on self-similar dynamic formation of black holes in a wide mass range within giant mass reservoirs containing normal and dark matters in general. In particular, we predicted the possibility of hypermassive black holes (HMBHs; ˜10ˆ{10} to 10ˆ{12} solar masses or even higher) and supermassive black holes (SMBHs; ˜10ˆ{6} to several 10ˆ{9} solar masses) in the Universe including the early Universe. We also suggested the progenitors of the LIGO/Virgo black holes in the forbidden mass zone, magnetars, and classes of supernovae, γ-ray bursts, X-ray bursts, fast radio bursts are likely to be magnetized massive stars. As a CUSPEA scholar of 1980, I also share anecdotes of Professor T. D. Lee.

References:
【01】Lian B., Lou Y.-Q., Relativistic self-similar dynamic collapses of black holes in general polytropic spherical clouds, MNRAS 438, 1242–1255 (2014); Advance Access publication 2013 December 20
【02】Lou Y.-Q., Jiang Y.-F., Supermassive black holes in galactic bulges, MNRAS Lett. 391, L44–L48 (2008)
【03】Lou Y.-Q., Wu Y., Intermediate-mass black holes in globular clusters, MNRAS Lett. 422, L28–L32 (2012)
【04】Lou Y.-Q., Ma J.-Z., Supermassi v e stars with random transverse magnetic fields, MNRAS 516, 1481–1500 (2022); Advance Access publication 2021 September 15 https://doi.org/10.1093/mnras/stab2631
【05】Hu R.-Y., Lou Y.-Q., Magnetized massive stars as magnetar progenitors,MNRAS 396, 878–886 (2009)

Primary author: LOU, YU QING (Tsinghua University)

Presenter: LOU, YU QING (Tsinghua University)

Session Classification: Session I (Day 2)

Contribution ID: **29** Type: **Plenary Talk**

A scenario for electroweak baryogenesis in 2HDM

Monday, 22 June 2026 13:30 (30 minutes)

We discuss a two Higgs doublet model with successful electroweak baryogenesis but without cancellations of electric dipole moments (EDMs). For the baryogenesis, additional scalar bosons are favored to couple mainly with the top quark with CP violations. However, if they also couple to light fermions of the Standard Model, the model is limited severely by EDMs, and additional CP phases irrelevant to the baryogenesis are often introduced to cancel the contributions to the EDMs.
We here discuss a scenario where the light-fermion couplings are suppressed to avoid the constraints. We show that our scenario is compatible with the current experimental bounds and is within the scope of future EDM experiments.

Primary author: KANEMURA, Shinya (Osaka University)

Presenter: KANEMURA, Shinya (Osaka University)

Session Classification: Session III

Contribution ID: **31** Type: **Plenary Talk**

Search for the QCD Critical Point and Strange Di-baryon in High Energy Nuclear Collisions

Monday, 22 June 2026 14:30 (30 minutes)

Understanding the properties of quark matter and its phase structure is crucial for advancing our knowledge of the universe's evolution and the composition of visible matter. Over the past two decades, numerous experimental observations have provided evidence for the existence of strongly interacting quark-gluon plasma (sQGP) in relativistic heavy-ion collisions. As a result, exploring the QCD phase structure at high baryon densities—such as mapping the first-order phase transition boundary and locating the QCD critical point—has become a primary objective in heavy-ion collision research. Between 2010 and 2021, the first and second phase of the Beam Energy Scan (BES-I) at RHIC wrere completed, with the STAR experiment collecting data from Au+Au collisions at energies ranging from 200 GeV to 3 GeV (Collider and Fixed-target mode). In this talk, I will present the latest experimental progress in searching for the QCD critical point and strange dibaryon in heavy-ion collisions at RHIC. I will also discuss new facilities designed for exploring the high baryon density region and outline future research plans.

Primary author: LUO, Xiaofeng (Central China Normal University)

Presenter: LUO, Xiaofeng (Central China Normal University)

Session Classification: Session III

Contribution ID: **32** Type: **Plenary Talk**

From Parity Violation to the Standard Model and Beyond

Monday, 22 June 2026 09:00 (40 minutes)

This talk reviews the historical path from the proposal of parity nonconservation to the establishment of the Standard Model. We trace the development from parity-violation experiments and the V–A theory through current algebra, flavor mixing, CP violation to the electroweak theory and beyond. This evolution illustrates how this brave challenge to a fundamental symmetry reshaped the field of particle physics.

Primary author: Prof. LUO, Ming-Xing (CSRC)

Presenter: Prof. LUO, Ming-Xing (CSRC)

Session Classification: Session I

Contribution ID: **33** Type: **Plenary Talk**

Recent results on B physics at Belle II

Monday, 22 June 2026 16:50 (30 minutes)

B physics plays a central role in the Belle and Belle II experimental programs, which operate at the (Super)KEKB asymmetric eˆ+ eˆ- collider. With a large recorded luminosity on the Y(4S) resonance, Belle and Belle II provide a clean environment for studying B meson decays, CP violation, and rare processes. In this talk, I show some recent results of B physics at Belle II including measurement of time-dependent CP violation, semi-leptonic decays, lepton-flavor-violating decays and hadronic decays.

Primary author: SHEN, Chengping (Fudan University)

Presenter: SHEN, Chengping (Fudan University)

Session Classification: Session IV

Contribution ID: **34** Type: **Plenary Talk**

Experimental overview of hyperon weak radiative decays

Tuesday, 23 June 2026 11:20 (30 minutes)

Hyperon decays serve as important windows for searching for new sources of CP violation and as ideal probes for studying strong interactions at low energies. In addition to the well-known hadronic weak decays of hyperons, this report presents an experimental overview of the weak radiative decays of hyperons, alongside the less-studied neutron-involved hyperon decays. These studies provide precise experimental constraints for addressing long-standing questions in low-energy strong interaction, such as the DeltaI=1/2 rule and Hara's theorem, while also setting important limists on the new physics beyond the SM.

Primary author: Dr ZHOU, Xiaorong (USTC)

Presenter: Dr ZHOU, Xiaorong (USTC)

Session Classification: Session II (Day 2)

Contribution ID: **35** Type: **Plenary Talk**

Extra-Dimensional Axions: Axion Quality and Phenomenology

Tuesday, 23 June 2026 09:00 (30 minutes)

I discuss characteristic features of extra-dimensional axions arising from higher-dimensional gauge fields. Particular attention will be paid to the axion quality needed to solve the strong CP problem and to distinctive features of their low-energy couplings compared with conventional four-dimensional field-theoretic axions.

Primary author: Prof. CHOI, Kiwoon

Presenter: Prof. CHOI, Kiwoon

Session Classification: Session I (Day 2)

Contribution ID: **36** Type: **Plenary Talk**

Parity-Violation with Electrons: The Standard Model and Beyond

Monday, 22 June 2026 15:00 (30 minutes)

Measurements of parity-violating observables in electron scattering, atomic transitions, and electron-positron annihilation have played a decisive role in confirming and testing the Standard Model electroweak sector and in probing the strong interaction in the non-perturbative regime. After reviewing this story, I discuss the experimental frontier for parity-violation with electrons and the corresponding theoretical challenges.

Primary author: RAMSEY-MUSOLF, Michael (TDLI-SJTU)

Presenter: RAMSEY-MUSOLF, Michael (TDLI-SJTU)

Session Classification: Session III

Contribution ID: **37** Type: **Plenary Talk**

Study of CP violation with the LHCb at CERN

Monday, 22 June 2026 16:20 (30 minutes)

The LHCb experiment at CERN’s Large Hadron Collider is dedicated to heavy-flavour physics, focusing on the decays of beauty and charm hadrons, with CP violation measurements among its core objectives. Since its inception, LHCb has advanced the study of CP violation into a precision era, achieving precise determinations of CKM phases and reporting the first observations of CP violation in the Bs0, charm, and baryon sectors. In this talk, I will provide a brief overview of CP violation studies at LHCb.

Primary author: ZHANG, Yanxi (Peking university)

Presenter: ZHANG, Yanxi (Peking university)

Session Classification: Session IV

Contribution ID: **38** Type: **Plenary Talk**

Global polarization effect in relativistic heavy ion collisions

Monday, 22 June 2026 10:40 (40 minutes)

Parity non-conservation provides a practical way to measure hyperon polarizations in high energy reaction experiments and leads to the discovery of significant transverse polarization of hyperons in unpolarized hadron-hadron collisions and a series of other unexpected spin effects. These striking spin effects lead to an active direction in QCD –the QCD spin physics.
Global polarization of the quark gluon plasma (QGP) in relativistic heavy ion collisions has been proposed twenty years ago. It has been shown that the colliding system in non-central relativistic heavy ion collision possess a huge orbital angular momentum in the direction opposite to the normal of the reaction plan. Due to QCD spin orbit interaction such huge orbital angular momentum can be transferred partly to the spin polarization of QGP produced in the collision and leads to global polarization of QGP. The effect has been confirmed by experiments worldwide. It opens a new avenue in studying QGP properties in heavy ion collisions and QCD theory thus leads to a novel direction in QCD spin physics. This talk will briefly summarize the basic ideas and results of the global polarization and discuss recent developments and outlook.

Primary author: LIANG, Zuotang

Presenter: LIANG, Zuotang

Session Classification: Session II

Contribution ID: **39** Type: **Plenary Talk**

From the V-A theory of weak interaction to the uniqueness of the standard model and beyond

Parity conservation was first questioned along with some possible experimental tests suggested by TD Lee and CN Yang in 1956. In 1957, several experiments confirmed parity nonconservation in weak interaction. However, the theory of weak interaction: V-A theory was only established in 1958 by Marshak et al. The V-A chiral structure is encoded as the defining feature of the electroweak unified theory.
Through anomalies of chiral gauge fields in four-dimensional space, we show that the representations of quarks and leptons, as well as electric charges, in the SU(3)C x SU(2)L x U(1)Y gauge group of the Standard Model are rather unique. We also discuss some unresolved issues of the Standard Model, particularly the three generations of fermion families and the mass problem of fundamental particles, as well as potential new physics beyond.

Primary author: GENG, Chao-Qiang (Hangzhou Institute for Advanced Study, UCAS)

Presenter: GENG, Chao-Qiang (Hangzhou Institute for Advanced Study, UCAS)

Session Classification: Session III

Contribution ID: **40** Type: **Plenary Talk**

Precision probes of fundamental interactions at particle colliders

Tuesday, 23 June 2026 16:30 (40 minutes)

The discovery of parity violation marked a turning point in fundamental physics: it showed that nature distinguishes left from right, revealing the chiral structure of the weak interaction and paving the way to electroweak theory. This line of inquiry has continued through the discoveries of CP violation, electroweak unification, and the Higgs boson with its associated scalar interactions. Particle colliders have been central to this endeavour, exposing the symmetries, symmetry-breaking mechanisms, and quantum dynamics that govern the microscopic world. This talk will briefly trace the evolution of collider physics toward the modern energy and precision frontier, and discuss how future colliders can provide transformative tests of fundamental physics.

Primary author: Prof. HOECKER, Andreas (CERN)

Presenter: Prof. HOECKER, Andreas (CERN)

Session Classification: Session IV(Day2)

Contribution ID: **41** Type: **Plenary Talk**

Par(i)ty Tricks!

Tuesday, 23 June 2026 17:10 (40 minutes)

After reviewing the familiar definition of parity transformations and why they are explicitly broken in the standard model, I will discuss three ways that parity can be upgraded to being either a spontaneously broken or an exact symmetry. The resulting theories remain as interesting, aesthetically-driven speculations for physics beyond the standard model that can be searched for experimentally and/or observationally. One of them – mirror matter – was actually briefly discussed by T.D. Lee and C.N. Yang at the end of their Nobel-prize-winning paper on parity violation.

Primary author: Prof. VOLKAS, Raymond (The University of Melbourne)

Presenter: Prof. VOLKAS, Raymond (The University of Melbourne)

Session Classification: Session IV(Day2)

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

Experimental physics at e+e- collider

Thursday, 25 June 2026 09:00 (1h 15m)

Presenter: ZHOU, Xiaorong (USTC)

Session Classification: Lecture and Discussion

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

Experimental physics at e+e- collider

Thursday, 25 June 2026 10:45 (1h 15m)

Presenter: ZHOU, Xiaorong (USTC)

Session Classification: Lecture and Discussion

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

Collider Phenomenology

Thursday, 25 June 2026 14:00 (1h 15m)

Presenter: XIE, Keping (Tsung-Dao Lee Institute, Shanghai Jiao Tong University)

Session Classification: Lecture and Discussion

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

Experimental physics at e+e- collider

Thursday, 25 June 2026 15:45 (1h 15m)

Presenter: ZHOU, Xiaorong (USTC)

Session Classification: Lecture and Discussion

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

Future High Energy Collider Physics

Wednesday, 24 June 2026 09:00 (1h 15m)

Presenter: CHEN, Mingshui (IHEP)

Session Classification: Lecture and Discussion

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

Future High Energy Collider Physics

Wednesday, 24 June 2026 10:45 (1h 15m)

Primary author: CHEN, Mingshui (IHEP)

Presenter: CHEN, Mingshui (IHEP)

Session Classification: Lecture and Discussion

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

Collider Phenomenology

Wednesday, 24 June 2026 14:00 (1h 15m)

Primary author: XIE, Keping (Tsung-Dao Lee Institute, Shanghai Jiao Tong University)

Presenter: XIE, Keping (Tsung-Dao Lee Institute, Shanghai Jiao Tong University)

Session Classification: Lecture and Discussion

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

Future High Energy Collider Physics

Wednesday, 24 June 2026 15:45 (1h 15m)

Primary author: CHEN, Mingshui (IHEP)

Presenter: CHEN, Mingshui (IHEP)

Session Classification: Lecture and Discussion

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

Apparatus, AI, and state of Art: the 3A measurement of interactions at TeV

Friday, 26 June 2026 09:00 (1h 15m)

Presenter: WU, Yusheng (University of Science and Technology of China (CN))

Session Classification: Lecture and Discussion

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

Apparatus, AI, and state of Art: the 3A measurement of interactions at TeV

Friday, 26 June 2026 10:45 (1h 15m)

Presenter: WU, Yusheng (University of Science and Technology of China (CN))

Session Classification: Lecture and Discussion

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

Collider Phenomenology

Friday, 26 June 2026 14:00 (1h 15m)

Presenter: XIE, Keping (Tsung-Dao Lee Institute, Shanghai Jiao Tong University)

Session Classification: Lecture and Discussion

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

Apparatus, AI, and state of Art: the 3A measurement of interactions at TeV

Friday, 26 June 2026 15:45 (1h 15m)

Presenter: WU, Yusheng (University of Science and Technology of China (CN))

Session Classification: Lecture and Discussion

Contribution ID: **55** Type: **Plenary Talk**

TBD

Primary author: WU, Yue-Liang (UCAS)

Presenter: WU, Yue-Liang (UCAS)

Session Classification: Session IV(Day2)

Contribution ID: **56** Type: **Plenary Talk**

Overview of recent progress in PandaX experiment

Monday, 22 June 2026 14:00 (30 minutes)

PandaX (Particle and Astrophysical Xenon experiment), a large-scale liquid xenon dark matter detection project located at the China Jinping Underground Laboratory, has provided a high-sensitivity experimental platform for dark matter searches through the iterative development of three generations of detectors since its launch in 2009. It adopts the two-phase xenon time projection chamber technology, using xenon atoms as the detection target, and achieves detection by capturing the scintillation light and ionization signals generated by the collision between dark matter particles and xenon atoms. This report focuses on the recent progress in dark matter and neutrino physics searches with the PandaX-4T experiment as well as the development of the next-generation 20-ton liquid xenon experiment.

Presenter: ZHOU, Ning (Shanghai Jiao Tong University)

Session Classification: Session III