超越标准模型前沿交叉研讨会

Report of Contributions

https://indico-tdli.sjtu.edu.cn/e/4530

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

Constraining long-lived particles from Higgs boson decays at the LHC with displaced vertices and jets

Saturday, 22 November 2025 17:25 (25 minutes)

Long-lived particles (LLPs) originating from decays of Standard-Model-like or beyond-the-Standard-Model Higgs bosons are often featured with signatures of displaced vertices (DVs) and jets at colliders. In this work, we show that a recent ATLAS search for DVs plus jets, with its recast implementation, can efficiently place bounds on such hadronically or semileptonically decaying LLPs. In particular, we find the search is uniquely sensitive to LLP proper decay lengths of about 1-100 mm, probing complementary regions in the parameter space of the relevant models compared to other prompt and LLP searches.

Primary author: WANG (王), Zeren Simon (泽人) (Hefei University of Technology)

Presenter: WANG (王), Zeren Simon (泽人) (Hefei University of Technology)

Session Classification: Session 7

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

The Future of Muon Sources in China: Opportunities for New Physics Searches

Saturday, 22 November 2025 14:00 (25 minutes)

This talk will present the status and plans of Chinese muon facilities, and possible new physics search programs proposed.

Primary author: Dr PAN, Ziwen (USTC)

Presenter: Dr PAN, Ziwen (USTC)

Session Classification: Session 4

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

Loop-level lepton flavor violation in the left-right symmetric model

Sunday, 23 November 2025 11:10 (25 minutes)

We consider the lepton flavor violation (LFV) processes generated at loop-level in the left-right symmetric model (LRSM). We pay special attention to the parameter space in which a light exotic CP-even scalar is produced in beam dump experiments or astrophysical processes. When the light scalar behaves as a long-lived particle, various current searches and prospects for future facilities can apply constraints to the relevant parameter space. We show our preliminary results and discuss their physical implications.

Primary authors: WU, Peiwen (Southeast University); Ms QIANG, Shufang (Southeast University); Prof. ZHANG, Yongchao (Southeast University)

Presenter: WU, Peiwen (Southeast University)

Session Classification: Session 11

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

Leptophilic axionlike particles at forward detectors

Sunday, 23 November 2025 10:45 (25 minutes)

Leptophilic axion-like particles (ALPs) exhibit rich phenomenology, focusing exclusively on interactions between an ALP and Standard Model (SM) leptons. Through integration by parts, it is shown that both the three-point interaction, $a\bar{\ell}\ell$, and the four-point interaction, $a\ell^{-}\nu W^{+}$, play significant roles, making the flavor portal particularly compelling. For ALPs with masses ranging from $\mathcal{O}(1)$ MeV to $\mathcal{O}(1)$ GeV, they can contribute to exotic hadron decays. Suppressed couplings naturally extend the ALP lifetime, presenting opportunities for detection at forward detectors. In this study, we explore ALPs with both electrophilic and muonphilic scenarios. We propose an inclusive search for various hadrons that undergo exotic decays at the Large Hadron Collider (LHC). In the electrophilic scenario, long-lived ALPs are searched in the Forward Search Experiment (FASER) and its upgrading phase, FASER II. In the muonphilic scenario, where the ALP lifetime is significantly reduced due to its coupling to muons, we further investigate its detection potential at LHCb and its high-luminosity upgrade. Several benchmarks are analyzed, including electroweak-preserving, electroweak-violating and left-right softly asymmetric models, to demonstrate possible experimental constraints.

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

Co-author: Dr JIANG, Xu-Hui (Institute of High Energy Physics)

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

Session Classification: Session 10

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

Sterile Neutrino Oscillations with a Crossing-width Term

Saturday, 22 November 2025 15:15 (25 minutes)

We developed an algorithm to compute the oscillation and decay of a sterile neutrino generated at a collider in the case that a crossing-width term exist. We also looked into the hidden structure of the S-matrix to extract the oscillating informations.

Primary author: TANG, Yi-Lei (中山大学)

Presenter: TANG, Yi-Lei (中山大学)

Session Classification: Session 5

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

Leptogenesis via a new LNV effect

Sunday, 23 November 2025 08:35 (25 minutes)

In this talk I will present a new mechanism that can gives rise to the successful baryogensis via Leptogenesis.

Primary author: CHAO, Wei (BNU)

Presenter: CHAO, Wei (BNU)

Session Classification: Session 8

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

Asymptotic GUT in extra dimension

Saturday, 22 November 2025 10:20 (25 minutes)

Asymptotic unification, distinct from the conventional concept of unification, suggests that couplings unify at a fixed point in the deep ultraviolet (UV) limit. 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)

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

Session Classification: Session 2

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

Relaxing BBN constraints on Heavy Neutral Leptons with Axion-like Particles

Sunday, 23 November 2025 09:25 (25 minutes)

Heavy neutral leptons (HNLs) are constrained by requirements of Big Bang Nucleosynthesis (BBN) as their decays significantly impact the formation of the primordial elements. We propose here a model where the primary decay channel for the HNLs is to an axion-like particle (ALP) and a neutrino. Consequently, HNLs can decay earlier and evade the BBN bound for lower masses, provided the ALPs themselves decay considerably later. Further cosmological and astrophysical constraints limit severely the range of validity of the ALP properties. We find that a new parameter region opens up for HNLs with masses between 1 MeV and 1 GeV, and active-sterile neutrino mixing strengths between 10^{-9} and 10^{-6} that is consistent with constraints and can be probed in future searches. In such a scenario, current bounds as well as sensitivities of future direct HNL searches such as at NA62 and DUNE will be affected.

Primary authors: MAJUMDAR, Chayan (IMP, CAS); DEPPISCH, Frank (University College London); GONZALO, Tomas E. (KIT); ZHANG, Zhong (UCL)

Presenter: MAJUMDAR, Chayan (IMP, CAS)

Session Classification: Session 9

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

Neutrinoless double beta decay within LRSM

Saturday, 22 November 2025 10:45 (25 minutes)

TBD

Primary author: Prof. 房, 栋梁 (中国科学院近代物理研究所)

Presenter: Prof. 房, 栋梁 (中国科学院近代物理研究所)

Session Classification: Session 2

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

Search for the heavy photophobic axion-like particles at the LHC

Sunday, 23 November 2025 10:20 (25 minutes)

TBD

Primary author: 王（WANG）, 科臣（Kechen）(武汉理工大学（Wuhan University of Technology）)

Presenter: 王（WANG）, 科臣（Kechen）(武汉理工大学（Wuhan University of Technology）)

Session Classification: Session 10

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

Searches for dark sector particles at Belle and Belle II

Saturday, 22 November 2025 16:35 (25 minutes)

TBD

Primary author: Dr JIA, Sen (Southeast University)

Presenter: Dr JIA, Sen (Southeast University)

Session Classification: Session 6

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

Dark Shower Searches using ML

Saturday, 22 November 2025 17:00 (25 minutes)

TBD

Primary author: LIU, Bingxuan (Shenzhen Campus of Sun Yat-sen University)

Presenter: LIU, Bingxuan (Shenzhen Campus of Sun Yat-sen University)

Session Classification: Session 7

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

Probing Axions and Millicharged Particles in Supernovae

Saturday, 22 November 2025 09:25 (25 minutes)

TBD

Primary author: LIU, Zuowei

Presenter: LIU, Zuowei

Session Classification: Session 1

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

Measuring Phase Transition Gravitational Waves and Higgs Self-couplings

Sunday, 23 November 2025 09:00 (25 minutes)

I will discuss how to measure the gravitational wave spectrum from cosmological first order phase transitions, in particular the Electroweak phase transitions, and how to then predict observables which are important but difficult to measure by other experiments, like the Higgs self-couplings.

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

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

Session Classification: Session 9

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

CP Violation Beyond SM: Dark Photon and Goldstone boson Frameworks

Sunday, 23 November 2025 11:35 (25 minutes)

This talk explores CP violation (CPV) in theories beyond the Standard Model (BSM). It addresses the long-standing puzzle that known CPV sources within the SM are insufficient to explain the observed matter-antimatter asymmetry of the universe, necessitating the identification of new CPV mechanisms. We present a systematic study of CPV mediated by two distinct BSM carriers: the dark photon and the Goldstone boson. The analysis demonstrates how their unique coupling structures generate observable CPV signals. By comparing their implications for electric dipole moments (EDMs), flavor-changing neutral currents (FCNCs), dark matter (DM), electroweak fits, and the resulting baryon asymmetry, we delineate the viable parameter space in light of current experimental constraints. Our findings underscore BSM CPV as an indispensable gateway to new physics at both the energy and precision frontiers.

Primary author: SUN, Jin (韩国基础研究院)

Presenter: SUN, Jin (韩国基础研究院)

Session Classification: Session 11

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

Cosmological signatures of neutrino seesaw mechanism

Saturday, 22 November 2025 11:35 (25 minutes)

The tiny neutrino masses are most naturally explained by seesaw mechanism through singlet right-handed neutrinos, which can further explain the matter-antimatter asymmetry in the Universe. In this work, we propose a new approach to study cosmological signatures of neutrino seesaw through the interaction between inflaton and right-handed neutrinos, which respects the shift symmetry. In our framework, after inflation the inflaton predominantly decays into right-handed neutrinos and its decay rate is modulated by the fluctuations of the Higgs field, which act as the source of curvature perturbations. This gives a new realization of Higgs modulated reheating, and it produces primordial non-Gaussian signatures that can be measured by the forthcoming large-scale structure surveys. We demonstrate, for the first time, that the measurements of non-Gaussianity by these surveys can probe the neutrino seesaw scale and have the potential to constrain a large portion of the seesaw parameter space, opening up a new window for directly testing the high-scale seesaw mechanism.

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

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

Session Classification: Session 3

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

Probing lepton flavor mixing at colliders and in low-energy experiments

Saturday, 22 November 2025 14:50 (25 minutes)

I will talk about several proposals, which aim to uncover lepton flavor mixing in the right-handed sector through processes at various colliders and in low-energy experiments.

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

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

Session Classification: Session 5

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

Cosmological phase transitions with low nucleation rates: recent progress and implications

Saturday, 22 November 2025 11:10 (25 minutes)

We study cosmological phase transitions in the low-nucleation-rate regime, where standard bubble percolation fails. Two distinct mechanisms emerge: (i) a bubble-free transition, in which a higher-energy vacuum within domain walls classically decays into the true vacuum, and (ii) super-Hubble separated bubbles, leading to ultra-supercooled or reheated transitions. These scenarios reveal unconventional dynamical pathways with significant implications for early-Universe evolution and gravitational-wave phenomenology.

Primary author: JIANG, Yun

Presenter: JIANG, Yun

Session Classification: Session 3

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

Distinguishing Dirac from Majorana Heavy Neutrino at Future Lepton Colliders

Saturday, 22 November 2025 16:10 (25 minutes)

TBD

Primary author: LIU, Yandong (Beijing Normal University)

Presenter: LIU, Yandong (Beijing Normal University)

Session Classification: Session 6

Contribution ID: **24** Type: **not specified**

Probe Neutrino & Dark Matter with Cosmic Gravitational Focusing

Saturday, 22 November 2025 09:00 (25 minutes)

TBD

Primary author: Prof. GE, Shao-Feng (TDLI-SJTU)

Presenter: Prof. GE, Shao-Feng (TDLI-SJTU)

Session Classification: Session 1

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

Probing New Physics with Double Beta Decay

Saturday, 22 November 2025 08:35 (25 minutes)

Primary author: DEPPISCH, Frank (University College London)

Presenter: DEPPISCH, Frank (University College London)

Session Classification: Session 1

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

物理学院党委书记发言

Saturday, 22 November 2025 08:20 (15 minutes)

Presenter: 李, 鸿涛

Session Classification: Opening Remarks 开幕式

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

Elegant Scotogenic Neutrino Mass and Asymmetry

Sunday, 23 November 2025 08:10 (25 minutes)

Presenter: KANG, Zhaofeng

Session Classification: Session 8

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

Search for neutrinoless double beta decay based on cryogenic bolometer

Saturday, 22 November 2025 14:25 (25 minutes)

TBD

Presenter: 谢, 芳 (复旦大学)

Session Classification: Session 4