2025 Winter Postdoc Mini-Symposium

Report of Contributions

https://indico-tdli.sjtu.edu.cn/e/4612

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

Domain Walls in Extended Higgs Models

Friday, 26 December 2025 15:30 (20 minutes)

Extended Higgs models provide the possibility of new discrete symmetries, which can be spontaneously broken leading to the possibility of creating topological defects such as domain walls in the early universe. In this talk, I discuss some types of domain walls arising in extended Higgs models such as the Two-Higgs-Doublet-Model (2HDM) and the Next-to-Two-Higgs-Doublet-Model (N2HDM) and show how these domain walls can influence the early universe via electric charge breaking scalar field configurations, electroweak symmetry restoration inside the wall, and electroweak vacuum decay.

Primary author: Dr SASSI, Mohamed Younes (Tsung-Dao Lee Institute)

Presenter: Dr SASSI, Mohamed Younes (Tsung-Dao Lee Institute)

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

Exploring chirality structure in nucleon decay

Friday, 26 December 2025 16:10 (20 minutes)

Baryon number is an accidental symmetry in the Standard Model, but its violation is theoretically anticipated, making the search for such processes a promising avenue for discovering new physics. We explore how measurements of different nucleon decay channels can reveal the structure of the underlying theory. We investigate the chirality structure of baryon-number violating interactions through lifetime measurements of strangeness-conserving nucleon-decay channels. By employing an effective field theory approach, we demonstrate that the ratio of partial decay widths of proton decay channels, $\Gamma(p \to \eta l+)/\Gamma(p \to \pi 0 l+)$, where $l+$ denotes a positron or anti-muon, is sensitive to this chirality structure. Furthermore, we find that in certain new physics models, both anti-lepton and anti-neutrino channels provide valuable insights into the model's structure. Our results highlight the importance of searching for various decay channels in upcoming nucleon decay experiments.

Primary authors: HAMAGUCHI, Koichi; HOR, Shihwen (TDLI); NAGATA, Natsumi; TAKAHASHI, Hiroki

Presenter: HOR, Shihwen (TDLI)

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

Revisit cLFV in SUSY model with trilinear R-parity violation

Friday, 26 December 2025 13:50 (20 minutes)

TBD

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

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

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

Direct Constraints on Strongly Interacting Dark Matter from the James Webb Space Telescope

Friday, 26 December 2025 13:10 (20 minutes)

Direct-detection searches for dark matter are insensitive to dark matter particles that have large interactions with ordinary matter, which are stopped in the atmosphere or the Earth ' s crust before reaching terrestrial detectors. We use "dark" calibration images taken with the HgCdTe detectors in the near-infrared spectrograph (NIRSpec) on the James Webb Space Telescope (JWST) to derive novel constraints on sub-GeV dark matter candidates that scatter off electrons. We supplement the JWST analysis pipeline with additional masks to remove pixels with high-energy background events. For a 0.4% subcomponent of dark matter that interacts with an ultralight dark photon, we disfavor all previously allowed parameter space at high cross sections, and constrain some parameter regions for subcomponent fractions as low as ~0.01%.

Primary authors: Dr RAUSCHER, Bernard (NASA); XU, Hailin (Tsung-Dao Lee Institute); Dr DU, Peizhi (USTC); Prof. ESSIG, Rouven (Stony Brook University)

Presenter: XU, Hailin (Tsung-Dao Lee Institute)

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

From Higgs Precision to BSM Signatures and Electroweak Baryogenesis

Friday, 26 December 2025 14:30 (20 minutes)

My research explores the limitations of the Standard Model on three fronts. First, improving the theoretical precision for Higgsstrahlung at future electron-positron colliders to enable sensitive probes for new physics. Second, collaborating with ATLAS to search for BSM signatures in multi-lepton and b-jet events at the LHC, employing the GAMBIT framework for global statistical analysis and flavor physics. Third, connecting electroweak baryogenesis to flavor physics and explaining the baryon asymmetry of the universe, constraining CP-violation from electric dipole moments. Together, my work connects collider precision, direct searches, and cosmological theory to explore fundamental physics.

Primary author: SIERRA, Cristian (Tsung-Dao Lee Institute)

Presenter: SIERRA, Cristian (Tsung-Dao Lee Institute)

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

Constraining non-standard neutrino interactions with neutral current events at long-baseline oscillation experiments

Friday, 26 December 2025 15:10 (20 minutes)

We explore, for the first time, {\textit{neutral-current}} events at long-baseline experiments to constrain vector and axial-vector neutrino non-standard interactions (NSI) with quarks. We leverage the flavor dependence of NSIs to perform an oscillation analysis in the neutral-current channel. We first introduce a framework to parametrize the effect of NSI on the cross section. Then, as an example, we analyze NOvA neutral-current data which provides significantly improved constraints on the axial-vector NSI parameters εAμμ, εAττ and εAeμ. This is highly complementary to constraints from SNO data, which, differently from long-baseline neutral current data, is not sensitive to isospin conserving NSIs εAu=εAd. Additionally, we disfavor large values of the diagonal vectorial NSI εVμμ and
\varepsilon_{\tau\tau}^V$ which originate from the LMA-Dark solution. We also highlight the complementarity between NSI searches at oscillation experiments using charged current and neutral current channels.

Primary author: PINHEIRO, Joao Paulo (TDLI)

Presenter: PINHEIRO, Joao Paulo (TDLI)

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

In-situ Calibration Techniques at TRIDENT

Friday, 26 December 2025 13:30 (20 minutes)

Accurate reconstruction of neutrino–nucleus interaction events is essential for studies of the high-energy Universe and fundamental physics at TRIDENT. The TRIDENT detector will be deployed in the South China Sea, where the seawater environment introduces additional systematic uncertainties to neutrino detection. This talk presents a suite of in-situ calibration techniques developed to constrain detector systematics while minimising experimental downtime. By performing in-situ calibrations, these methods enable real-time monitoring of key parameters, including the water attenuation length and detector orientations, under dynamically changing conditions. The calibration strategies and the achieved measurement precisions are discussed.

Primary author: ZHU, Tailin

Presenter: ZHU, Tailin

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

Sub-keV dark photon search with S2-only data in PandaX4T

Friday, 26 December 2025 15:50 (20 minutes)

The PandaX-4T experiment has achieved significant progress in ultra-low energy regions. Here, we present the first search for dark photon signals in the 0.1 - 1 keV energy range, previously unexplored by PandaX-4T. Using Run0+Run1 S2-only data, we set competitive constraints on the kinetic mixing parameter for dark photon masses in the range of 0.1 - 1 keV. This analysis extends the detection sensitivity to sub-keV physics, complementing the existing results from the PandaX-4T experiment.

Primary author: 李, 帅杰 (Yalong Hydro)

Presenter: 李, 帅杰 (Yalong Hydro)

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

DarkSHINE: A fixed-target search for dark photon at the SHINE facility

Friday, 26 December 2025 14:10 (20 minutes)

DarkSHINE is a proposed fixed-target experiment at SHINE aimed at searching for sub-GeV dark-sector mediators and light dark matter.
Its baseline target is an invisibly decaying dark photon ($A' \to \chi\chi^-$) produced in high-intensity electron–nucleus interactions, observed through a missing-energy/momentum signature.
We present the experimental concept, baseline detector design, and a first prospective sensitivity study.
We also report recent R&D progress and discuss future extensions, including a positron-beam mode. DarkSHINE will be complementary to NA64 and LDMX experiments.

Primary author: MAS'UD ALFANDA, Haidar (TDLI, SJTU)

Presenter: MAS'UD ALFANDA, Haidar (TDLI, SJTU)

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

Studying dark sector imprints in cosmology

Friday, 26 December 2025 16:30 (20 minutes)

Relativistic degrees of freedom or N_eff is one of the crucial cosmological parameters and is sensitive to extra radiation energy density at the time of neutrino decoupling. The precise measurement of N_{eff} at the time of CMB formation by Planck 2018 can be used to understand fundamental interactions and to shed light on beyond standard model (BSM) scenarios. In this talk I will explain how N_eff can probe light (MeV) freeze in dark matter models which contain additional neutrino injection at late time. We propose a scenario where a long lived scalar decays to a dark matter and active neutrinos after BBN. Despite the feeble coupling of DM the parameter space can be probed via N_eff. I will also talk about how N_eff at CMB can constrain light Z' gauge boson realized in generic BSM U(1)_X scenarios.

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

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