GNU-IBS Workshop on Particle Physics and Cosmology

Report of Contributions

https://indico.ibs.re.kr/e/gnu2025

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

Opening

Thursday, 25 September 2025 14:00 (10 minutes)

Presenter: Prof. CHOI, Kiwoon (IBS)

Session Classification: Session 1

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

Weakly model-independent determination of total expansion during inflation

Thursday, 25 September 2025 14:55 (45 minutes)

Presenter: Prof. GONG, Jinn-Ouk (Ewha Woman's University)

Session Classification: Session 1

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

Viability of Error Correction in Quantum Computer and Z(2) Lattice Gauge Theory

Saturday, 27 September 2025 10:05 (45 minutes)

Presenter: Prof. KIM, Seyong (Sejong University)

Session Classification: Session 3

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

Quantum Sensing Radiative Decays of Neutrinos and Dark Matter Particles

Saturday, 27 September 2025 11:10 (45 minutes)

Presenter: Prof. PARK, Myeonghun (Seoul National University of Science and Technology)

Session Classification: Session 3

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

Neutrino physics at forward experiments

Saturday, 27 September 2025 09:20 (45 minutes)

Presenter: Prof. JEONG, Yu Seon (Sungkyunkwan Univsersity)

Session Classification: Session 3

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

Physics of SHiP / SND@LHC

Thursday, 25 September 2025 14:10 (45 minutes)

Presenter: Prof. KIM, Yeong Gyun (Gwangju National University of Education)

Session Classification: Session 1

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

Neutrino experiments with Nuclear Emulsion

Friday, 26 September 2025 10:00 (50 minutes)

Presenter: Prof. YOON, Chun Sil (GNU)

Session Classification: Session 2

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

Probing the 3+1 neutrino model in the SHiP experiment

Friday, 26 September 2025 11:10 (40 minutes)

Presenter: Mr YOO, Seong Moon (Sungkyunkwan Univsersity)

Session Classification: Session 2

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

Toward Precision Antideuteron Spectra from Dark Matter: Percent-Level Uncertainty Control

Thursday, 25 September 2025 16:30 (40 minutes)

The detection of cosmic antideuterons ($\overline{\mathrm{D}}$) at kinetic energies below a few GeV/n could provide a smoking gun signature for dark matter (DM). However, the theoretical uncertainties of coalescence models have represented so far one of the main limiting factors for precise predictions of the $\overline{\mathrm{D}}$ flux. In this talk, I will present a novel calculation of the $\overline{\mathrm{D}}$ source spectra, based on the Wigner formalism, for which the Argonne v_{18} antideuteron wavefunction is implemented. The advantage of this approach is that this wave function does not have any free parameters related to the coalescence process. I show that the Argonne/Wigner model excellently reproduces the $\overline{\mathrm{D}}$ multiplicity measured by ALEPH at the Z-boson pole, which is usually adopted to tune the coalescence models based on different approaches. With this Monte Carlo approach, I show that the current theoretical uncertainty on the prediction of the $\overline{\mathrm{D}}$ source spectra to a few percent, for $\overline{\mathrm{D}}$ kinetic energies relevant to DM searches with GAPS and AMS, and for DM masses above a few tens of GeV. This result implies that the theoretical uncertainties due to the coalescence process are no longer the main limiting factor in the predictions.

Talk is based on:
https://arxiv.org/abs/2411.04815 (accepted for publication in PRL)
https://arxiv.org/abs/2312.01153
Discussion about QCD modeling is based on:
https://arxiv.org/abs/2303.11363
https://arxiv.org/abs/2202.11546
Dataset and code repo:
https://github.com/ajueid/CosmiXs.git

Presenter: Dr JUEID, Adil (IBS-CTPU-PTC)

Session Classification: Session 1

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

Testing Neutrino Mass Origins with Supernova Neutrinos

Friday, 26 September 2025 09:20 (40 minutes)

The origin of non-zero neutrino mass remains unknown. Currently, there are many possibilities for generating a neutrino mass. We divide them into two categories, the vacuum neutrino mass and the dark neutrino mass. Both the vacuum mass and the dark mass can fit the current oscillation data. For the vacuum mass, the value is only a constant. However, the dark mass is proportional to the DM number density and therefore varies on the galactic scale. This difference leads to different neutrino group velocities and the arrival time delay of core-collapse supernovae (SN) neutrinos. We find that this time delay can be used to distinguish the vacuum and dark neutrino masses.

Presenter: Dr KONG, Chiu-Fan (IBS-CTPU-PTC)

Session Classification: Session 2

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

Quantum advantage pursued by Hamiltonian simulation

Saturday, 27 September 2025 11:55 (40 minutes)

Quantum advantage refers to a computational benefit that quantum processors can achieve, which is unattainable by their classical counterparts. While numerous quantum algorithms have been proposed to demonstrate such an advantage, whether it has truly been achieved remains a subject of ongoing debate. This talk will introduce a Hamiltonian simulation of (1+1)D abelian lattice gauge theory on quantum processors as an alternative yet promising approach toward the quantum advantage. In particular, focusing on two key examples—ground state preparation and excited state spectroscopy—this talk will highlight how challenging physical problems can be addressed through quantum algorithms implemented on quantum hardware.

Presenter: Dr GHIM, Dongwook (IBS-CTPU-PTC)

Session Classification: Session 3

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

Gravitational Waves from a First-order Phase Transition of the Inflation

Session Classification: Session 1

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

A Review on Physics-Specific Foundation Models: from Particles to Cosmic Surveys

Friday, 26 September 2025 11:50 (40 minutes)

Foundation models - large, pretrained architectures adaptable across domains - are being explored in physics, from particle events to astrophysical data, though current evidence for their benefits and scope is mixed. This talk surveys emerging use cases, distinguishing what is empirically established from what remains speculative, with attention to embedding physical structure and constraints, and to open issues in uncertainty quantification, evaluation, and reproducibility. A particular focus is whether these models internalize world-model structure or rely primarily on task-specific heuristics and pattern matching.

Presenter: Dr CHO, Won Sang (IBS-CTPU-PTC)

Session Classification: Session 2

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

Searches for Power-Law Warped Extra Dimensions

Thursday, 25 September 2025 15:50 (40 minutes)

Presenter: Prof. IM, Sang Hui (Center for Theoretical Physics of the Universe, Institute for Basic Science, Korea)

Session Classification: Session 1