

# **KEK-THEORY Workshop 2024**

## **Report of Contributions**

Contribution ID: 1

Type: **not specified**

# Tensor renormalization group and application to elementary particle physics

*Wednesday, December 11, 2024 9:30 AM (1 hour)*

Tensor network is a powerful numerical tool to compute the wave function of quantum many-body systems and to directly evaluate the path integrals in quantum field theory. In this talk, I mainly explain the latter case in detail. After introducing the basics of the tensor network, I give an overview of its recent progress especially in elementary particle physics. As specific examples, I explain how to compute the entanglement entropy, spectroscopy using tensor network, and recent developments of the tensor network coarse-graining algorithms. Finally I mention future perspective towards lattice QCD.

**Presenter:** Prof. TAKEDA, Shinji

**Session Classification:** Plenary Session

Contribution ID: 2

Type: **not specified**

## **Recent progress in tensor network approaches for condensed matter physics**

*Wednesday, December 11, 2024 10:45 AM (1 hour)*

**Presenter:** Dr OKUBO, Tsuyoshi

**Session Classification:** Plenary Session

Contribution ID: 3

Type: **not specified**

## **Bosonization revisited: application to the sign problem and lattice chiral fermion**

*Wednesday, December 11, 2024 1:30 PM (1 hour)*

**Presenter:** Dr OHATA, Hiroki

**Session Classification:** Plenary Session

Contribution ID: 4

Type: **not specified**

# Partially fault-tolerant quantum computing architecture

*Thursday, December 12, 2024 9:30 AM (1 hour)*

**Presenter:** Dr AKAHOSHI, Yutaro

**Session Classification:** Plenary Session

Contribution ID: 5

Type: **not specified**

# Quantum Error Correction and Holography

*Thursday, December 12, 2024 10:45 AM (1 hour)*

**Presenter:** Prof. NISHIOKA, Tatsuma

**Session Classification:** Plenary Session

Contribution ID: 6

Type: **not specified**

## Decoding quantum information from chaos: beyond the standard situation

*Thursday, December 12, 2024 1:30 PM (1 hour)*

A central challenge in large-scale quantum information processing is managing noise in quantum systems. Quantum error correction (QEC) addresses this by encoding quantum states into quantum error correction codes (QECCs) before noise occurs and decoding them afterward. Recently, QEC has attracted significant attention in theoretical physics due to its potential connections to quantum chaos and quantum gravity. As interest in QEC becomes broader, the decoding problem –how to decode a general QECC– is increasingly important. A few were known so far, but we recently proposed two approaches: one extends decoders for the standard class of QECCs based on stabilizers [1], and the other generalizes the Yoshida-Kitaev decoder [2], originally used to explore the black hole information paradox. In this talk, we present an overview of these approaches.

- 1) “Decoding general error correcting codes and the role of complementarity”, YN, T. Matsuura, and M. Koashi, arXiv:2210.06661 (2022).
- 2) “Explicit decoders using fixed-point amplitude amplification based on QSVT”, T. Utsumi, and YN, arXiv:2405.06051 (2024).

**Presenter:** Prof. NAKATA, Yoshifumi

**Session Classification:** Plenary Session

Contribution ID: 7

Type: **not specified**

# Tensor Networks as Conceptual and Computational Tools for Statistical Physics

*Friday, December 13, 2024 9:00 AM (1 hour)*

**Presenter:** Prof. OSHIKAWA, Masaki

**Session Classification:** Plenary Session



Contribution ID: 8

Type: **not specified**

# Advancements in Numerical Methods: Synergy of Tensor Networks and Quantum Algorithms

*Friday, December 13, 2024 10:15 AM (1 hour)*

**Presenter:** Prof. UEDA, Hiroshi

**Session Classification:** Plenary Session

Contribution ID: 9

Type: **not specified**

## **Some rigorous and numerical results for renormalization groups of tensor networks**

*Friday, December 13, 2024 11:30 AM (1 hour)*

**Presenter:** Prof. RYCHKOV, Slava

**Session Classification:** Plenary Session

Contribution ID: 10

Type: **not specified**

**Tensor renormalization group study of  
(1+1)-dimensional U(1) gauge-Higgs model at  $\theta = \pi$   
with Luescher's admissibility condition**

*Wednesday, December 11, 2024 2:50 PM (25 minutes)*

**Presenter:** Dr AKIYAMA, Shin-ichiro

**Session Classification:** Parallel Session

Contribution ID: 11

Type: **not specified**

## **Tensor renormalization group study of 3D Yang-Mills theories with the reduced tensor network formulation**

*Wednesday, December 11, 2024 3:15 PM (25 minutes)*

**Presenter:** Dr YOSPRAKOB, Atis

**Session Classification:** Parallel Session

Contribution ID: 12

Type: **not specified**

## **Grassmann bond-weighted tensor renormalization group approach to 1+1D two-color QCD with staggered fermions at finite density**

*Wednesday, December 11, 2024 3:40 PM (25 minutes)*

**Presenter:** Mr KWOK, Ho Pai

**Session Classification:** Parallel Session

Contribution ID: 13

Type: **not specified**

## **Tensor renormalization group analysis of entanglement entropy in (1+1)-dimensional XY model**

*Wednesday, December 11, 2024 4:05 PM (25 minutes)*

**Presenter:** Dr TANAKA, Gota

**Session Classification:** Parallel Session

Contribution ID: 14

Type: **not specified**

## Quantum Black Brane in the 4d Standard Model

*Wednesday, December 11, 2024 3:40 PM (25 minutes)*

**Presenter:** Mr KIMURA, Hayate

**Session Classification:** Parallel Session

Contribution ID: 15

Type: **not specified**

## **Non-supersymmetric heterotic strings**

*Wednesday, December 11, 2024 3:15 PM (25 minutes)*

**Presenter:** Mr ISHIGE, Arata

**Session Classification:** Parallel Session



Contribution ID: 16

Type: **not specified**

## **deSitter from M-Theory**

*Wednesday, December 11, 2024 2:50 PM (25 minutes)*

**Presenter:** Dr LOGES, Gregory

**Session Classification:** Parallel Session

Contribution ID: 17

Type: **not specified**

## **Species scale in one-loop correction**

*Wednesday, December 11, 2024 4:05 PM (25 minutes)*

**Presenter:** Mr MICHINOBU, Yuri

**Session Classification:** Parallel Session

Contribution ID: **18**

Type: **not specified**

## **Non-Lagrangian approach to GKP-Witten relation by conformal smearing**

*Wednesday, December 11, 2024 5:00 PM (25 minutes)*

**Presenter:** Prof. AOKI, Sinya

**Session Classification:** Parallel Session

Contribution ID: 19

Type: **not specified**

## Quantum tunneling, decoherence and the beginning of the Universe from Lefschetz thimble real-time simulations

*Wednesday, December 11, 2024 5:25 PM (25 minutes)*

Monte Carlo simulations of quantum time-evolution based on the real-time path integral have been thought to be extremely difficult since it involves a phase factor  $\exp(iS)$  in the integrand, which causes a severe sign problem. We apply the Lefschetz thimble method with various new techniques to such systems. In this talk, I would like to discuss a new understanding of quantum tunneling and quantum decoherence that arises as complex saddle point configurations. I would also like to discuss how one can apply this method to investigate the beginning of the universe based on quantum gravity.

**Presenter:** Prof. NISHIMURA, Jun

**Session Classification:** Parallel Session

Contribution ID: 20

Type: **not specified**

## **Complex Langevin Lattice QCD for Color-Superconductivity at Extremely High Density**

*Wednesday, December 11, 2024 5:50 PM (25 minutes)*

**Presenter:** MIURA, Kohtaroh (KEK IPNS)

**Session Classification:** Parallel Session

Contribution ID: 21

Type: **not specified**

## 't Hooft line in 4D U(1) lattice gauge theory, and microscopic descriptions of dyon's statistics

*Wednesday, December 11, 2024 5:00 PM (25 minutes)*

**Presenter:** Mr ONODA, Soma

**Session Classification:** Parallel Session

Contribution ID: 22

Type: **not specified**

## **Proper Effective Temperature and Order Parameters in Relativistic Non-Equilibrium Steady States**

*Wednesday, December 11, 2024 5:25 PM (25 minutes)*

**Presenter:** Prof. NAKAMURA, Shin

**Session Classification:** Parallel Session

Contribution ID: 23

Type: **not specified**

## **A scaling relation in large-N gauge theories at finite temperature**

*Wednesday, December 11, 2024 5:50 PM (25 minutes)*

**Presenter:** Prof. MORITA, Takeshi

**Session Classification:** Parallel Session



Contribution ID: 24

Type: **not specified**

## **Narain CFT from error-correcting code via integers of cyclotomic field**

*Thursday, December 12, 2024 3:15 PM (25 minutes)*

**Presenter:** Mr OIKAWA, Takumi

**Session Classification:** Parallel Session

Contribution ID: 25

Type: **not specified**

# Universal structure of islands in evaporating black holes

*Thursday, December 12, 2024 2:50 PM (25 minutes)*

**Presenter:** Dr MATSUO, Yoshinori

**Session Classification:** Parallel Session

Contribution ID: 26

Type: **not specified**

## **Entanglement R'enyi entropy and boson-fermion duality in the massless Thirring model**

*Thursday, December 12, 2024 3:40 PM (25 minutes)*

**Presenter:** Mr FUJIMURA, Harunobu

**Session Classification:** Parallel Session

Contribution ID: 27

Type: **not specified**

## **Selection rules of topological solitons from non-invertible symmetries in axion electrodynamics**

*Thursday, December 12, 2024 2:50 PM (25 minutes)*

**Presenter:** Dr YOKOKURA, Ryo

**Session Classification:** Parallel Session

Contribution ID: 28

Type: **not specified**

## **Anyon condensation in mixed-state topological order #93**

*Thursday, December 12, 2024 3:15 PM (25 minutes)*

**Presenter:** Dr KIKUCHI, Ken

**Session Classification:** Parallel Session

Contribution ID: 29

Type: **not specified**

## **Bridging two semiclassical confinement mechanisms: monopole and center vortex**

*Thursday, December 12, 2024 3:40 PM (25 minutes)*

**Presenter:** Dr HAYASHI, Yui

**Session Classification:** Parallel Session

Contribution ID: 30

Type: **not specified**

## **Numerical studies of the type IIB matrix model with the gauge-fixed Lorentz symmetry**

*Thursday, December 12, 2024 5:15 PM (25 minutes)*

**Presenter:** Mr TRIPATHI, Ashutosh

**Session Classification:** Parallel Session

Contribution ID: 31

Type: **not specified**

## **Defining IKKT matrix model by gauge fixing Lorentz symmetry**

*Thursday, December 12, 2024 4:50 PM (25 minutes)*

**Presenter:** Mr PIENSUK, Worapat

**Session Classification:** Parallel Session



Contribution ID: 32

Type: **not specified**

## **Complex Langevin simulation of the IKKT matrix model with or without "gauge-fixing" the Lorentz symmetry**

*Thursday, December 12, 2024 5:40 PM (25 minutes)*

**Presenter:** Mr YAMAMORI, Naoyuki

**Session Classification:** Parallel Session

Contribution ID: **33**

Type: **not specified**

**TBA**

*Thursday, December 12, 2024 6:05 PM (25 minutes)*

**Presenter:** Dr HATAKEYAMA, Kohta

**Session Classification:** Parallel Session

Contribution ID: 34

Type: **not specified**

## Unitarity of string geometry theory

*Thursday, December 12, 2024 4:50 PM (25 minutes)*

**Presenter:** Prof. SATO, Matsuo

**Session Classification:** Parallel Session

Contribution ID: 35

Type: **not specified**

## **K27 as a symmetry of closed bosonic strings and branes**

*Thursday, December 12, 2024 5:15 PM (25 minutes)*

**Presenter:** Dr GLENNON, Keith

**Session Classification:** Parallel Session

Contribution ID: 36

Type: **not specified**

## **Localized RG flows on composite defects and C-theorem**

*Thursday, December 12, 2024 4:05 PM (25 minutes)*

**Presenter:** Dr GE, Dongsheng

**Session Classification:** Parallel Session

Contribution ID: 37

Type: **not specified**

# Thermal Area Law in Long-Range Interacting Systems

*Thursday, December 12, 2024 4:05 PM (25 minutes)*

**Presenter:** Dr KIM, Donghoon

**Session Classification:** Parallel Session

Contribution ID: 38

Type: **not specified**

## Revisiting Hawking Radiation via Generalized Uncertainty Principle

*Thursday, December 12, 2024 5:40 PM (25 minutes)*

The generalized uncertainty relation is expected to be an essential element in a theory of quantum gravity. We examine its effect on the Hawking radiation of a Schwarzschild black hole formed from collapse by incorporating a minimal uncertainty length scale into the radial coordinate of the background. This is implemented in both the ingoing Vaidya coordinates and a family of freely falling coordinates. We find that, regardless of the choice of the coordinate system, Hawking radiation is turned off at around the scrambling time. Interestingly, this phenomenon occurs while the Hawking temperature remains largely unmodified.

**Presenter:** Mr CHAU, Tin-Long

**Session Classification:** Parallel Session

Contribution ID: 39

Type: **not specified**

## UV Origin of Late-time Hawking Radiation

*Thursday, December 12, 2024 6:05 PM (25 minutes)*

We reexamined the connection between the Hawking radiation of a Schwarzschild black hole formed from collapse and ultraviolet(UV) physics with the local Lorentz symmetry violation or the existence of a minimal length. Significant modifications are reported after the scrambling time in both cases, which reflects the UV sensitivity of Hawking radiation. Depending on the physics at the singularity, Hawking radiation with the modified dispersion relation may be largely suppressed with a striking tunneling phenomenon behind. The Hawking wavepacket may exceed the size of the black hole under the generalized uncertainty principle that it longer employs the near horizon Unruh vacuum with a diminishing Hawking radiation amplitude. While a turned-off effect is shared in these two implementations, the Hawking temperature remains the same or only perturbatively corrected.

**Presenter:** Mr WANG, Cheng-Tsung**Session Classification:** Parallel Session