YITP Annual Report

Yukawa Institute For Theoretical Physics Kyoto University

2022

Foreword

We present here an annual report of the scientific activities of Yukawa Institute for Theoretical Physics during the academic year 2022.

From the year 2007 we started our new project “Yukawa International program of Quark-Hadron Sciences (YIPQS)” funded by Japan Ministry of Education, Culture, Sports, Science and Technology. In this project we select a few research topics each year for long-term workshops and invite leading experts from abroad to stimulate discussion and to foster collaborations among workshop participants. In the year 2022, we successfully held two long-term work-shops “Mean-field and Cluster Dynamics in Nuclear Systems 2022” and “Novel Quantum States in Condensed Matter 2022” even under the COVID-19 pandemic. In order to enhance face-to-face communications among scientists even under the COVID-19 pandemic, we have promoted the domestic molecule workshop, which is similar to but more flexible than the international molecule workshop. We have held one international molecule-type program and four domestic molecule-type workshops in the year 2022, which turned out to be very successful.

Not only has our institute pushed forward various researches in contemporary theoretical physics, but also we encourage activities in creating new interdisciplinary fields of researches involving the forefront of modern physics. In April 2016, we newly established a research organization “Center for Gravitational Physics (CGP)”, and has developed collaborative researches among particle physics, astrophysics and cosmology, which continued until March 2022. In January 2018, we newly established a quantum information theory group as our 5th main research group in YITP, in addition to high energy physics, nuclear physics, astrophysics and cosmology, and condensed matter groups. In April 2020, we started to operate “International Research Unit of Quantum Information” in collaboration with 10 research organizations in Kyoto University. In April 2022, combining these activities, we have established “Center for Gravitational Physics and Quantum Information (CGPQI)", as the first research center for interdisciplinary studies through physics and quantum information.

Since its foundation in 1953, our institute has played a role of international hub for the researchers in theoretical physics. I hope that this report makes our activities more accessible to researchers in the world, and helps them to visit us in the future.

Finally I hope that we will enhance our activities in research after (or with) the COVID-19 pandemic in 2023 and later.

Director
Sinya Aoki

Contents

Chapter 1

Members

1.1 Regular Staff, Visiting Professors and International Research Unit of Quantum Information Researchers (2022 April – 2023 March)

Regular Staff

Sinya Aoki
Professor (E)

Tadashi Takayanagi
Professor (E)

Hisao Hayakawa
Professor (C)

Akira Ohnishi
Professor (N)

Masaru Shibata
Professor (A)

Shigeki Sugimoto
Professor (E) [–2022.5.31]

Shinji Mukohyama
Professor (A)

Masatoshi Sato
Professor (C)

Kunihito Ioka
Professor (A)

Masatoshi Murase
Associate Professor (C) [–2023.3.31]

Hiroshi Kunitomo
Associate Professor (E)

Naoki Sasakura
Associate Professor (E)

Keisuke Totsuka
Associate Professor (C)

Fumihiro Takayama
Associate Professor (E)

Atsushi Taruya
Associate Professor (A)

Antonio De Felice
Associate Professor (A)

Tomoyuki Morimae
Associate Professor (Q)

Yasuaki Hikida
Associate Professor (E)

Takahiro Nishimichi
Associate Professor (A) [–2023.3.31]

Yoshifumi Nakata
Associate Professor (Q) [2022.8.1–]

Yuko Fujita
Senior Lecturer (Project Manager)

Masakiyo Kitazawa
Senior Lecturer (N) [2022.8.1–]

Yoko Oya
Senior Lecturer (A) [2022.10.1–]

Seiji Terashima
Assistant Professor (E)

Ken Shiozaki
Assistant Professor (C)

Masazumi Honda
Assistant Professor (E)

Yuya Tanizaki
Assistant Professor (N)

Atsushi Naruko
Assistant Professor (A)

Nobuyuki Okuma
Assistant Professor (C) [–2023.3.31]

Katsuki Aoki
Assistant Professor (A) [2022.7.1–]

Rina Tazai
Assistant Professor (C) [2022.10.1–]

Ryo Hanai
Assistant Professor (C) [2022.10.16–]

Sotaro Sugishita
Assistant Professor (E) [2023.1.1–]

In this list, the symbols A, C, E, N and Q in the parenthesis are the following abbreviations of research fields:

A: Astrophysics and Cosmology
C: Condensed Matter and Statistical Physics
E: Elementary Particle Theory
N: Nuclear Physics Theory
Q: Quantum Information

Visiting Professors

Prof. Gianluca COLÒ
(University of Milano)
[2022.11.28 – 2023.3.3]
Exotic structure of neutron-rich nuclei

Prof. José María MARTÍN SENOVILLA
(University of Basque Country)
[2022.8.16 – 2023.1.15]
Mathematical Aspects of Gravitational Waves in Accelerating Universe

Prof. Frédéric van WIJLAND
(Université Paris Cité)
[2022.12.17 – 2023.3.31]
Active particles can helpequilibrium glasses

International Research Unit of Quantum Information

Michele DALL'ARNO
Program-Specific Assistant Professor
[2020.4.1 – 2023.3.31]

Prof. János BALOG
Visiting Fellow
(Wigner Research Centre for Physics)
[2022.10.1 – 2022.11.30]

1.2 Hakubi Researchers, PRESTO Researchers, Research Fellows and Graduate Students (2022 April – 2023 March)

Hakubi Researchers

Tomonori Ugajin
Hakubi Project Assistant Professor (E) [2020.4.1–]

PRESTO Researchers

Andrew Darmawan
PRESTO Assistant Professor (E) [2020.4.1–2023.3.31]

Research Fellows

Atsushi Watanabe (Program Coordinator) [2016.4.1 –]

Hamid Hamidani (A) [2018.4.1 – 2022.9.30]

Katsuki Aoki (A) [2019.4.1 – 2022.6.30]

Wataru Ishizaki (A) [2019.4.1 –]

Hidehiko Shimada (E) [2020.4.1 –]

Satoshi Tanaka (A) [2020.4.1 –]

Hiroki Matsui (A) [2021.4.1 –]

Ryota Mizuno (C) [2021.4.1 – 2023.3.31]

Koichi Murase (N) [2021.4.1 –]

Ken Osato (A) [2021.4.1 – 2022.6.15]

Kenta Suzuki (E) [2021.4.1 – 2022.8.31]

Kazufumi Takahashi (A) [2021.4.1 –]

Takashi Yoshida (Program Coordinator) [2021.4.1 –]

Saikat Das (A) [2021.10.1 –]

Norita Kawanaka (A) [2021.10.1 – 2023.3.31]

Bing Zhang (A) [2021.10.16 –]

Ibrahim Akal (E) [2021.11.1 – 2022.9.30]

Ben Quinn Baragiola (Q) [2021.11.1 – 2022.9.30]

Osmin Derius Lacombe (A) [2021.11.1 – 2022.11.30]

Shanming Ruan (E) [2021.11.1 –]

Amit Kumar Chatterjee (C) [2021.11.16 –]

Mohammad Ali Gorji (A) [2021.11.27 – 2022.10.18]

Kanato Goto (E) [2022.4.1 –]

Yui Hayashi (N) [2022.4.1 –]

Hector Bjoljahn Hougaard (Q) [2022.4.1 –]

Shogo Ishikawa (A) [2022.4.1 –]

Akihiro Miyata (E) [2022.4.1 – 2022.9.30]

Kazumasa Okabayashi (A) [2022.4.1 –]

Yoshiki Sato (E) [2022.4.1 – 2022.9.30]

Deheng Song (A) [2022.4.1 –]

Masataka Watanabe (E) [2022.4.1 –]

Chen Hsuan Hsu (C) [2022.5.1 – 2022.7.31]

Tomohiro Oishi (N) [2022.5.1 –]

Mohammad Reza Akhond (E) [2022.7.1 – 2022.11.29]

Jonathan Edward Harper (E) [2022.7.16 –]

Ali Mollabashi (E) [2022.7.16 –]

Dongwook Ghim (E) [2022.9.1 –]

Pratik Nandy (E) [2022.9.1 –]

Hiromasa Watanabe (N) [2022.9.1 –]

Kengo Shimada (E) [2022.10.1 –]

Ryo Takakura (Q) [2022.11.1 –]

Hirokazu Maruoka (C) [2023.1.1 –]

Graduate Students

Yukihisa Imamura (C) [2014.4.1 – 2022.9.30]

Chen Hua (E) [2015.10.16 –]

Haruki Kasuya (N) [2017.4.1 –]

Pradipto (C) [2017.10.1 – 2022.9.30]

Kota Hayashi (A) [2018.4.1 – 2023.3.31]

Daisuke Ishima (C) [2018.4.1 – 2023.3.31]

Kazutaka Kimura (A) [2018.4.1 – 2023.3.31]

Riku Masui (C) [2018.4.1 –]

Taisuke Matsuda (A) [2018.4.1 – 2023.3.31]

Kotaro Murakami (E) [2018.4.1 – 2023.3.31]

Masahiro Ogura (C) [2018.4.1 – 2023.3.31]

Zixia Wei (E) [2018.4.1 –]
Kenshiro Hara (E) [2019.4.1 – 2023.3.31]
Ryu Hayakawa (Q) [2019.4.1 –]
Hayato Kanno (E) [2019.4.1 –]
Daichi Nakamura (C) [2019.4.1 –]
Hiroki Ohata (N) [2019.4.1 –]
Shuhei Oyama (C) [2019.4.1 –]
Dennis Obster (E) [2019.10.1 – 2022.9.30]
Masaya Amo (A) [2020.4.1 –]
Taiga Hiroka (Q) [2020.4.1 –]
Masashi Kawahira (E) [2020.4.1 –]
Keiichiro Kubota (A) [2020.4.1 –]
Yusuke Nakai (C) [2020.4.1 –]
Hiroto Oka (C) [2020.4.1 –]
Yusuke Taki (E) [2020.4.1 –]
Paul Jeroen Laureis Martens (A) [2020.10.1 –]
Kenya Ikeda (E) [2021.4.1 –]
Kazuya Inaka (C) [2021.4.1 – 2023.3.31]
Takumi Kagitani (Q) [2021.4.1 – 2023.3.31]
Takafumi Kakehi (A) [2021.4.1 –]
Taishi Kawamoto (E) [2021.4.1 –]
Taiichi Nakanishi (E) [2021.4.1 –]
Naoki Ogawa (E) [2021.4.1 –]
Yuki Suzuki (E) [2021.4.1 –]
Syuhei Toba (A) [2021.4.1 –]
Takashi Tsuda (E) [2021.4.1 –]
Takahiro Waki (A) [2021.4.1 –]
Kazuki Doi (E) [2021.10.1 –]
Takamasa Ando (C) [2022.4.1 –]
Hiroki Kanda (E) [2022.4.1 –]
Hajime Kobayashi (A) [2022.4.1 –]
Keigo Masaki (Q) [2022.4.1 –]
Yuri Michinobu (A) [2022.4.1 –]
Urei Miura (C) [2022.4.1 –]
Bartosz Pyszkowski (E) [2022.4.1 –]
Masahide Sato (E) [2022.4.1 –]
Kenji Shimomura (C) [2022.4.1 –]
Yuki Shirakawa (Q) [2022.4.1 –]
Takahiro Tanaka (E) [2022.4.1 –]
Takeru Utsumi (Q) [2022.4.1 –]

Ph.D Awarded

Kota Hayashi
Black Hole-Neutron Star Mergers –Universal Evolution Picture Obtained by Seconds-long Numerical-Relativistic Neutrino-Radiation Magnetohydrodynamics Simulation– (A)
(Masaru Shibata)

Yukihisa Imamura
Systematic construction methods of exactly analyzable models in low dimensions (C)
(Keisuke Totsuka)

Daisuke Ishima
Eigenvalue analysis of amorphous solids consisting of frictional grains under athermal quasistatic shear (C)
(Hisao Hayakawa)

Kotaro Murakami
Lattice QCD studies on baryon resonances and pentaquarks from meson-baryon scatterings (E)
(Sinya Aoki)

Dennis Obster
Matrices and algebras in the canonical tensor model (E)
(Naokii Sasakura)

Masahiro Ogura
Geometric Method for Solvable Lattice Spin Systems (C)
(Masatoshi Sato)

Pradipto
Dynamics of dense non-Brownian suspensions under impact (C)
(Hisao Hayakawa)

Zixia Wei
Quantum Gravity Beyond the End of the World (E)
(Tadashi Takayanagi)

1.3 Affiliate Professors and Affiliate Associate Professors (2022 April – 2023 March)

Affiliate Professors

Nathalie DERUELLE
Professor Emeritus, Astroparticule et Cosmologie - Université Paris Diderot

Hideo KODAMA
Professor Emeritus, Kyoto University

Takahiro TANAKA
Professor, Graduate School of Science, Kyoto University

Yshai AVISHAI
Professor, Department of Physics, Ben Gurion University

Misao SASAKI
Deputy director, Kavli Institute for the Physics and Mathematics of the Universe, The University of Tokyo

Taichi KUGO
Professor Emeritus, Kyoto University

Masaki SHIGEMORI
Professor, Graduate School of Science, Nagoya University

Keiichi MAEDA
Professor Emeritus, Waseda University

Shinji HIRANO
Professor, Hunzhou University

Affiliate Associate Professors

Kohta MURASE
Associate Professor, Department of Physics, The Pennsylvania State University

Kenta KIUCHI
Group Leader, Max Planck Institute for Gravitational Physics (Albert Einstein Institute)

Yudai SUWA
Associate Professor, The University of Tokyo, Graduate School of Arts and Sciences

Takashi YAMAKAWA
NTT Corporation

Chapter 2

Research Activities

2.1 Research Summary

Astrophysics and Cosmology Group

Inflation and Early Universe

In our universe physical phenomena at various scales occur constantly, having mutual influence on each other. We consider it necessary for physics at the largest scales, i.e. cosmology, to be connected with physics at the shortest scales. For this reason we have been working on the early universe cosmology, where microscopic physics is essential, from various viewpoints by using every possible means such as general relativity, statistical physics, particle physics and superstring theory. For example, Martens, Matsui, Mukohyama and Naruko studied one of the three major boundary conditions in quantum cosmology, called the DeWitt boundary condition, and showed that in many gravitational theories including general relativity, the DeWitt wavefunction leads to unsuppressed anisotropies and inhomogeneities near the classical singularity and that Hořava-Lifshitz gravity, a renormalizable theory of quantum gravity, provides a solution to this problem.

Theory of Gravity

Massive gravity, the possibility that the graviton may have a non-vanishing mass, has a long history since Fierz and Pauli proposed a linear theory in 1939. It has nonetheless been rather difficult to establish a stable cosmological solution in the context of massive gravity. The minimal theory of massive gravity (MTMG) that De Felice and Mukohyama proposed in 2015 evades such difficulties and provides a fully stable nonlinear completion of the self-accelerating cosmological solution in massive gravity. De Felice, Mukohyama and Pookkillath extended the MTMG to a wide class of fully stable massive gravity theories with rich phenomenologies that can be probed by various observations. Recently the effective field theory (EFT) approach has been popular as a universal description of gravity on a given background and has been useful to interpret observational data in cosmology. Mukohyama and Yingcharoenrat for the first time formulated the EFT that can describe all scalar-tensor theories with timelike scalar profile in arbitrary backgrounds. Along with Takahashi, they then applied the EFT to derive the generalized Regge-Wheeler equation that describes odd-parity perturbations around a spherically symmetric black hole (BH) background. Aoki, Gorji, Mukohyama, and Takahashi formulated the EFT with a different symmetry-breaking pattern that describes the universe filled with a continuum such as fluids and solids. Aoki and his collaborators then found a duality between cosmological EFTs with different symmetry-breaking patterns. These EFTs are expected to act as the bridge between theories and observations. De Felice and collaborators studied the bounds of the integrated Sachs-Wolfe CMB and galaxy cross-correlations on three models of dark energy. They found that negative cross-correlations degraded the fit for the Galileon Ghost Condensate and Generalized Cubic Covariant Galileon models.

Recently, gravitational theories with higher derivative terms of a scalar field have been attracting great interest among researchers in the field. Naruko and collaborators found that the dangerous ghosty mode associated with those higher derivatives will show up in general once the matter coupling is taken into account.

Observational Cosmology

In cosmology, dark matter and dark energy are the greatest mysteries, and their properties and fundamental hypotheses in the current cosmological model need to be deeply studied. Okumura and Taruya reported the first constraints on the growth rate of the universe, $f\sigma_8$, with intrinsic alignments of galaxies from Sloan Digital Sky Survey. Combining further with galaxy clustering statistics, they obtained tighter constraints on the growth rate, in good agreement with the prediction of general relativity. Furthermore, an international team of the Subaru Hyper Suprime-Cam survey, including Nishimichi, has announced the third-year data release and reported tight constraints on a specific combination of cosmological parameters, $S_8 \equiv \sigma_8\sqrt{\Omega_\mathrm{m}/0.3}$, showing a mild tension with the Planck ΛCDM model by $\sim 2\sigma$ level. On the other hand, aiming at future precision observational studies, Nishimichi and his collaborators have made advancements in their numerical code, GINKAKU. They also developed an AI-assisted software, emulator, capable of generating fast predictions for different cosmological probes and hence of enabling efficient statistical inference. Toward the observational clarification of the nature of dark matter, Enomoto, Nishimichi and Taruya analyzed particles trajectories in N-body simulations to reveal the multi-stream nature of cold dark matter halos, finding that the radial density profile for each stream is described in a universal manner by a double power-law function. Further, Taruya and Saga studied analytically the central structure of halos in ultra-light dark matter models. The results suggest that the core-halo mass relations generically yield a non power-law behavior, as opposed to previous claims.

Numerical relativity

Numerical relativity is a crucial tool to predict gravitational waveforms and electromagnetic (EM) signals of relativistic phenomena and to interpret observational results for gravitational waves (GWs) and their EM counterparts. Hayashi, Kiuchi, Shibata and their collaborators performed seconds-long neutrino-radiation-magnetohydrodynamics simulations for black hole-neutron star (BH-NS) and binary neutron star (BNS) mergers, which self-consistently follow the NS mergers, subsequent mass ejection and disk formation, magneto-hydrodynamical evolution of the disk and resulting post-merger mass ejection, and collimated Poynting flux generation along the rotation axis of the remnant BH. Fujibayashi, Kiuchi, Shibata, and their collaborators also performed a long-term simulation for the post-merger evolution of BNSs paying attention to the r-process nucleosynthesis. They clarified that for BNS mergers leading to a BH and disk in $\sim 20\,\mathrm{ms}$ after the merger, the nucleosynthesis pattern is similar to the solar-abundance pattern. In addition, Fujibayashi, Shibata, and their collaborators performed a simulation for the stellar core collapse of massive and rapidly rotating progenitor stars to a BH and disk, which can subsequently explode due to the viscous and shock heating around the inner region of the disk. For very rapidly rotating progenitors, the explosion energy can be $\sim 10^{52}$ erg and can be a model for an energetic supernova. Lam, Shibata, and Kiuchi developed a numerical-relativity implementation for exploring tidal disruption of white dwarfs by relatively low-mass supermassive BH. Shibata and Traykova also performed a simulation for oscillating NSs in a scalar-tensor theory of gravity with kinetic screening and showed that the presence of the kinetic screening suppresses the emission of scalar-type GWs.

Multimessenger astronomy

Modeling EM counterparts of GW sources is a necessary task in multimessenger astronomy. Kawaguchi, Fujibayashi, Shibata with collaborators explored EM counterparts of GWs from strongly-magnetized merger-remnant NSs using a radiation transfer simulation and showed that the brightness of kilonovae and kilonova afterglow is significantly enhanced in the presence of the strong magnetic field in the merger remnant. Kiuchi and Shibata with collaborators in Israel showed that the remnant of a BNS leading to a BH and a torus, which is obtained by a long-term numerical-relativity simulation, satisfies the condition for launching relativistic jets.

While a detection of stochastic gravitational waves is promised to open up multimessenger cosmology, one serious concern is the correlated noise arising from Earth's global electromagnetic fields. Based on the Fisher matrix analysis, Himemoto, Nishizawa and Taruya showed that a proper modeling of the correlated noise allows us to detect the stochastic gravitational waves without serious parameter degeneracy, enabling minimal degradation of parameter constraints during the detection.

High Energy Astrophysics

Multi-messenger astrophysics and transient surveys are revealing new aspects of the high-energy universe. It is very exciting to theoretically explore the mechanisms behind high-energy particles and relativistic jets produced by strong-gravity objects such as black holes and neutron stars, as well as newly discovered mysteries like fast radio bursts (FRBs). Takahashi, Ioka, and their collaborators demonstrate that gamma-ray burst (GRB) afterglows, which serve as electromagnetic (EM) counterparts to gravitational waves (GWs), are ideal targets for observing the evolution of particle acceleration from relativistic to non-relativistic collisionless shocks. Wada and Ioka classify the expanding fireball evolution in neutron star magnetic fields and show that a magnetar burst can accelerate an outflow with sufficient energy to power FRBs. Hamidani and Ioka find that only 0.5-5 percent of the cocoon mass escapes the ejecta of a neutron star merger, whereas it is approximately 100 percent in collapsars. This has an impact on the EM counterparts to GWs from the cocoon (jet-heated ejecta). Shirasaki, Ioka, and their collaborators clarify the information available from cosmic dispersion measures of FRBs through cross-correlation analyses of foreground dark matter haloes.

Star and Planetary System Formation

The formation of stars and planetary systems is one of the most fundamental structural formation processes in the universe, which is directly related to the origin of the solar system. During the low-mass protostellar evolution, the understanding of the formation process of protoplanetary disks, which are the birth place of planetary systems, has remained as a missing-link. Recent radio observations with a high spatial-resolution and a high sensitivity allow us to reveal the gas distribution and its kinematics within a few hundreds or even a few tens au scale around young protostars, where protostellar disks are being formed. It is essential to characterize the complex physical structure around a protostar consisting of a infalling envelope, a rotationally-supported disk, and an outflow. Oya and her collaborators developed a general-purpose computer code to generate image data cubes of disk/envelope systems. The modeled data cubes were directly compared with the actual observational data with the Atacama Large Millimeter/submillimeter Array, and the essential physical parameters of protostellar sources, such as their protostellar masses and the angular momenta of the gas, were constrained. The modeled data can also be used as the mock data for machine/deep learnings; the kinematic structures of the observed molecular lines were classified into the ballistic motion and the Keplerian motion, to which the gas dynamics around young protostars are often approximated, by the support vector classification and the three-dimensional convolutional neural network.

Condensed Matter and Statistical Dynamics Group

Condensed Matter Physics

Non-Hermitian topological phenomena

The past decades have witnessed an explosion of interest in topological materials, and a lot of mathematical concepts have been introduced in condensed matter physics. Among them, the bulk-boundary correspondence is the central topic in topological physics, which has inspired researchers to focus on boundary physics. Recently, the concepts of topological phases have been extended to non-Hermitian Hamiltonians, whose eigenvalues can be complex. Besides the topology, non-Hermiticity can also cause a boundary phenomenon called the non-Hermitian skin effect, which is an extreme sensitivity of the spectrum to the boundary condition. Our group members including Sato and Okuma provide new insights of boundary phenomena in non-Hermitian systems from the view point of non-Hermitian topological phases.

Topological nature of parameter families of quantum spin systems

Inspired by Kitaev's Ω-spectrum proposal for unique gapped ground states, Shiozaki studied the adiabatic cycles in gapped quantum spin systems. The adiabatic cycles, one-parameter families of gapped states, have a topological nature that transcends conventional topological phases, the classification of which is based on path-connected components. The topological invariants characterizing the adiabatic cycles were investigated using exactly solvable group cohomology models and matrix product state representations. Here, the Bockstein isomorphism played a crucial role. From the perspective of physical signatures, it was demonstrated that the spatial and temporal texture of the adiabatic Hamiltonian confines a symmetry-protected topological phase to a lower dimension.

Strongly-correlated fermion systems with high symmetries

Recently, strongly-correlated fermion systems that have symmetries higher than spin-SU(2) have been discussed in various contexts. For instance, SU($N \leq 10$) magnetism has been reported in controlled cold-gas settings and an SU(8) Kondo-lattice model has been proposed to describe physics of the magic-angle twisted bilayer graphene. Totsuka considered the one-dimensional SU(N) Kondo lattice model when the Kondo interaction between the itinerant fermions and the local SU(N) moments is large and rigorously showed that the ground state is ferromagnetic for some fillings.

Lecheminant and Totsuka investigated the same model when the Kondo coupling is small using the consistency between the lattice (Lieb-Schultz-Mattis) index and global anomalies in the low-energy effective field theories, and mapped out the ground-state phases including an interesting topological phase with broken inversion symmetry.

Super-symmetric lattice fermion models

Supersymmetric quantum systems have remarkable spectral properties that have been fascinating physicists for many years. Motivated by recent progresses in supersymmetric lattice models, Miura and Totsuka introduced a supersymmetric model of lattice spinless fermions that contains a paring term as well as interactions. Using variational arguments and numerical simulations, they investigated the ground-state properties and spectral properties.

Advanced Statistical Dynamics

The subjects of advanced statistical dynamics are nonequilibrium statistical mechanics, nonlinear sciences and biological physics. The main goal in this field is to understand how dynamical nonequilibrium structures are sustained in nature based on tools of statistical physics. Thus, the research areas are spreaded in variety of fields in biology, chemistry, engineering, mathematics and physics. The current research activities of our group are quantum thermodynamics, non-reciprocal systems, granular physics, nonlinear rheology in glassy materials, biomechanics, and system biology.

Response of jammed amorphous solids

Hayakawa and Michio Otsuki of Osaka University used a 3-particle model to numerically and theoretically study two-dimensional frictional granular materials under oscillatory shear. They aimed to understand the characteristic behavior of storage and loss modulii. The storage modulus is the slope of the loading curve, which is analogous to Young's modulus in a tensile testing experiment. It measures how much energy must be put into the sample to store it. The loss modulus in viscoelastic materials measures the energy dissipated as heat, representing the viscous portion. If grains are monodispersed and form a crystal structure, exact expressions of the 3-body model for the storage and loss modulii give precise expressions of the modulii for many-body systems.

Hayakawa, Daisuke Ishima (one of his students), Kuniyasu Saitoh and Michi Otsuki present an eigenvalue analysis of a two-dimensional frictional granular system under step strains. They developed the analysis for both linear response regime and nonlinear response regime. They confirmed that the stress-strain curve can be reproduced even if the system contains avalanches once we know the configuration of grains. They also clarify the characteristic behavior of the density of states if friction between grains exists. Daisuke Ishima earned his PhD and won the Student Presentation Award of the Physical Society of Japan at 2023 Spring Meeting accordingly.

Rheology of dense suspensions

Hayakawa and Pradipto developed a theoretical analysis of impact-induced hardening in suspensions after an impact of a hard sphere as well as the LBM-DEM simulation. They clarified the origin of elasticity of the suspensions even in the absence of percolating force chains of suspended particles. As an application of the impact-induced hardening, they proposed a foot-spring-body system on a dense suspension. Due to the spring force of the system and the stiffness of the suspension, the foot undergoes multiple bounces. They submitted a preprint on this subject. Pradipto earned his PhD and was appointed as an assistant professor for five years.

Hayakawa, Satoshi Takada and Kazuhiro Hara of Tokyo University of Agriculture and Technology collaborated on kinetic theory and hydrodynamic simulations called LF-DEM of a mixture of inertial suspensions with soft-core particles. Surprisingly, they found discontinuous shear thickening (DST) even for frictionless grains, which is almost independent of the density. Above the DST, the suspensions exhibit shear thinning. They submitted two preprints on this subject.

Exactly solvable non-equilibrium lattice model

Hayakawa together with Amit Kumar Chatterjee who is a postdoc in this group have developed the theory of an exactly solvable nonequilibrium model on lattice. They obtain an exact matrix product steady state for a class of multi species asymmetric simple exclusion process with impurities, under periodic boundary condition. Alongside the usual hopping dynamics, an additional flip dynamics is activated only in the presence of impurities. They also analyze the cluster formation in a non-ergodic stochastic system as a result of counter-flow, with the aid of an exactly solvable model. To illustrate the clustering, a two species asymmetric simple exclusion process with impurities on a periodic lattice is considered, where the impurity can activate flips between the two non-conserved species. Exact analytical results, supported by Monte Carlo simulations, show two distinct phases, free flowing phase and clustering phase. The clustering phase is characterized by constant density and vanishing current of the non-conserved species, whereas the free flowing phase is identified with non-monotonic density and non-monotonic finite current of the same. The n-point spatial correlation between n consecutive vacancies grows with increasing n in the clustering phase, indicating the formation of two macroscopic clusters in this phase, one of the vacancies and the other consisting of all the particles. We define a rearrangement parameter that permutes the ordering of particles in the initial configuration, keeping all the input parameters fixed. This rearrangement parameter reveals the significant effect of non-ergodicity on the onset of clustering. For a special choice of the microscopic dynamics, we connect the present model to a system of run and tumble particles used to model active matter, where the two species having opposite net bias manifest the two possible run directions of the run and tumble particles, and the impurities act as tumbling reagents that enable the tumbling process. They have published two papers on this subject in Sci. Post. Phys. and PRE.

Theory of geometrical quantum thermodynamics in Thouless pumping process

Hayakawa together with Yoshii developed the theory of an entropy production and a work extracted from a system connected to two reservoirs by periodic modulations of chemical potentials of the reservoirs and one parameter in the system Hamiltonian under an isothermal condition. They find that the modulation of parameters can drive a geometrical state, which is away from a nonequilibrium steady state. With the aid of this property, they construct a geometric demon in which the relative entropy increases with time and we can extract the work, if they begin with the nonequilibrium steady state without modulations of parameters. They employ the Anderson model to demonstrate that the relative entropy can increase with time. Their paper has been accepted for the publication in Physical Review Research.

Stationary distribution of chemical reaction network

Hanai together with Yuji Hirono at APCTP (currently at Kyoto University) has developed a theory that analytically gives the exact stationary distributions for a certain type of stochastic chemical reaction network. The theorem due to Anderson, Craciun, and Kurtz states that the stationary distribution of zero deficiency and weakly reversible chemical reaction network is given by the Poisson distribution. They have developed a transformation of this network inspired by techniques developed in quantum optics that allowed them to analytically compute a stationary distribution of a certain class of non-zero deficiency network. They have published a preprint which is published in April 2023.

Non-reciprocal frustration physics

Hanai has established a direct analogy between geometrically frustrated systems and non-reciprocally interacting systems. Based on the established analogy, he has pointed out that non-reciprocal interacting systems may exhibit exotic phenomena similar to those known in geometrically frustrated systems, such as order-by-disorder phenomena and spin glasses. He has published a preprint.

Nuclear Theory Group

Nuclear theory group studies various aspects of the systems interacting via "strong interaction", covering three layers of the scale hierarchy. The relevant degrees of freedom in each layer are quarks and gluons also known as partons, hadrons such as mesons and nucleons, and nuclei composed of nucleons and hyperons. Study on diverse faces of nuclear physics revealing themselves in the different layers requires various theoretical knowledge and techniques in physics—quantum mechanics, relativity, field theories, and many-body theories. Main subjects discussed in nuclear theory group at present include the structure and dynamics of hadrons, hadronic and quark matter under extreme conditions, and the vacuum properties of quantum chromodynamics (QCD). These are closely related to particle physics, astrophysical phenomena, condensed matter theories as well as to recent accelerator experiments in the world.

Quark-Hadron Sciences

Quarks and gluons are strongly-interacting fundamental particles, but they are confined inside hadrons in vacuum. Nuclear theory group in YITP studies the quark and hadron dynamics in nuclear physics, putting emphases on quark-gluon structure of hadrons, hadron resonances, hadron-hadron interactions, and the QCD matter properties under extreme conditions where the quark and gluons are liberated from hadrons.

Heavy-Ion Collisions and QCD matter

At high temperatures and/or densities in heavy-ion collision reactions and neutron star cores, new forms of matter consisting of quarks and gluons are expected to be realized.

The formation of the quark-gluon plasma (QGP) in high-energy heavy-ion collisions are supported by accumulated experimental data at the Relativistic Heavy-Ion Collider (RHIC) and the Large Hadron Collider (LHC). For the precise determination of the properties of the created QGP, it is important to develop a quantitative dynamical model. It is also important to identify the experimental signals for important physics such as the QCD critical point, the first-order phase transition, and color superconductivity. For signals of color superconductivity and the critical point, Kitazawa, Nishimura, and a collaborator calculated the dilepton production rate and found that the rate is significantly enhanced in the low energy-momentum region, which can be signals of the phase transitions. The anomalous enhancement of the transport coefficients has also been found in the same formalism. Murase and collaborators investigated the effect of nontrivial fireball shapes in the phase space and critical fluctuations on the yield ratio of the light nuclei, which was suggested for a signal of the critical point. Murase and collaborators investigated the effect of hydrodynamic fluctuations in ultra-central Pb+Pb collisions at the collision energy $\sqrt{s_{\rm NN}} = 2.7$ TeV based on a dynamical model and showed that the situation of ultra-central flow puzzle is improved. Kitazawa, Murase, Touroux, and a collaborator developed a new numerical scheme for relativistic hydrodynamics with an implicit Runge-Kutta method, which is more efficient than the explicit Runge-Kutta methods of the same order.

The hyperon puzzle known for neutron stars is the problem that the existence of observed massive neutron stars cannot be explained because of the admixture of hyperons, such as the Λ baryons, in the neutron star matter. Murase, Ohnishi, and collaborators attempted to constrain the Λ potential, which plays an important role in the hyperon puzzle, using data from different measurements and experiments. The Λ potential from the chiral effective field was shown to be consistent with the directed flow v_1 observed in heavy-ion collisions and the Λ binding energies from the hypernuclear spectroscopy.

The interactions between hadrons are the current subjects extensively studied both from experiments and theories. Ohnishi and collaborators studied the $S = -2$ baryon-baryon (BB) interactions, ΞN-$\Lambda\Lambda$, using the $p\Xi^-$ and $\Lambda\Lambda$ correlation functions from high-energy nuclear collisions. By using the coupled-channel $S = -2$ BB interactions from the lattice QCD, the correlation functions are calculated and are found to explain the recently observed data well. The analysis was also extended to the channels including charm quarks.

Lattice QCD numerical simulations and related topics

In understanding the properties of strongly-interacting matter, the first principle numerical simulations based on lattice QCD plays crucial roles.

Namekawa, Ohnishi and collaborators applied the path optimization method to gauge theories having a sign problem. They tested the gauge-covariant neural network and an approximation of the Jacobian in the two-dimensional U(1) gauge theory with the complex gauge-coupling constant. They found that the path optimization can enhance the average phase factor.

Watanabe and a collaborator investigated the real-time dynamics of the Caldeira-Leggett model by the Monte Carlo simulation. To overcome the sign problem, they used the techniques of the Lefschetz Thimble method. They discussed that the behaviors predicted by the decoherence can be reproduced numerically.

Ashikawa, Kitazawa and collaborators investigated the phase structure of QCD in heavy-quark region. They studied the finite-size scaling of the Binder cumulant around the critical point in heavy-quark QCD on the lattice. The efficient algorithm based on the hopping-parameter expansion allowed them to carry out a high-precision analysis. Various features of the critical point, such as its location and critical exponents have been revealed.

Ito and Kitazawa studied quantum effects on distribution of energy-momentum tensor (EMT) in the 2d system motivated by the numerical result of lattice simulations on the EMT distribution in static-quark systems. The EMT distribution has been calculated in the ϕ^4 and sine-Gordon models at the one-loop order. After a proper regularization, finite results that are consistent with the conservation laws are obtained.

Watanabe and collaborators discussed the existence of an intermediate phase in the confined/deconfined transition of 4d SU(3) QCD at finite temperature, which is expected by the analysis in the large N limit. It turns out that the discrepancy from the SU(3) Haar randomness plays a key role in characterizing the phase, by analyzing the $N_f = 2+1$ full lattice QCD configurations.

Nonperturbative aspects of field theories

Nonperturbative quantum field theory (QFT) is a branch of theoretical physics that explores the dynamics of quantum fields beyond the realm of perturbation theory. The development of nonperturbative methods is important to get accurate descriptions of strongly interacting phenomena, such as confinement in QCD.

Dynamics of strongly-coupled gauge theories

Tanizaki and collaborators developed a semiclassical description of 4d gauge theories by considering the T^2 compactification of the spacetime with the 't Hooft flux. The asymptotic freedom of 4d gauge theories allows one to perform the weak-coupling analysis in this setup, and the astonishing fact is that this weak-coupling regime gives the qualitative description of the strongly-coupled confinement phenomena. The 't Hooft flux describes a background magnetic field inside the compactified direction, and its presence plays a pivotal role to maintain the nontrivial anomaly of 4d Yang-Mills theory in the 2d effective theory. Furthermore, this technique is extended to the case with dynamical quarks, and the chiral effective Lagrangian is derived in a controllable semiclassical computation of QCD.

They also apply this semiclassical method to other gauge theories, QCD with two-index quarks. These theories are toy models of QCD, where quarks obey other representations of the gauge group. A notable feature of this QCD-like theory is that it provides an unconventional type of large-N limit of QCD without suppression of quantum anomaly, and its study is expected to give a better understanding of the contribution of dynamical quarks while the usual large-N limit highlights the gluon dynamics only. The novel semiclassical method clarifies their vacuum structure giving strong evidence for the validity of the large-N equivalence to the supersymmetric Yang-Mills theory.

Generalization of global symmetries

Symmetry often provides the guiding principle in the analysis of strongly-interacting field theories. Recently, a generalized notion of global symmetries is developing in the formal analysis of QFTs explaining the unconventional selection rules that go beyond the conventional symmetry.

Hayashi and Tanizaki found the new symmetry in a four-dimensional model of confining gauge theories, called the Cardy-Rabinovici model. The dynamics of this model is expected to have electromagnetic duality, which exchanges the Higgs phase, confinement phase, and oblique confinement phases. The newly found symmetry promoted this duality to the generalized symmetry in QFTs, and they apply it to find the low-energy effective actions of these various phases.

Tanizaki and collaborators also found generalized symmetry in classifying the stability of topological solitons. It has been believed for more than five decades that the solitons and their stability are classified by the homotopy group. They found that there are subtle and intricate examples, where this longstanding expectation is violated: In the four-dimensional $\mathbb{C}P^1$ sigma model, the topological solitons seem to be protected by the $U(1)$ symmetry unless monopoles are absent, while the soliton is transformed to the anti-soliton when it collides with the monopole. They show the presence of the noninvertible symmetry describing the correct selection rule.

Nuclear structure and dynamics

Nuclei are composites made of nucleons and have various structures and excitation schemes as quantum mechanical many-body systems. The primary goal of this area is to elucidate and predict the evolution of nuclear properties as functions of proton and neutron numbers — nuclear shape, density, and mass of the ground and excited states, and the structure of the excited spectrum. Especially, novel structures of neutron-rich and proton-rich nuclei are of particular interest.

Relativistic solution of one-proton emission

Proton emission determines the limit of existing nuclei on the proton-rich side. A proper description of one-proton emissions of various nuclei has been one goal of the multinucleon theories. For this purpose, as one archetype, relativistic energy-density functional (REDF) theory has been developed and utilized. The proton-emitting radioactivity can provide a suitable reference to further improve the predicting ability of REDF especially on the proton-drip line. Note that the quantum tunneling effect plays an essential role in nucleon-emitting radioactive processes.

T. Oishi recently developed the time-dependent Dirac-equation solver to describe the one-proton emission within the REDF framework. This solver naturally includes the quantum-tunneling effect. Benchmark calculations for the ^{37}Sc and ^{39}Sc nuclei concluded the one-proton emission energies and lifetimes, which are not in contradiction against the experimental data available. T. Oishi also demonstrated that this time-dependent Dirac equation provides results, which can be consistent with the other theoretical calculations. The present method is expected as applicable widely to proton-rich nuclides to improve the REDF theory.

Particle Physics Group

Particle physics is a branch of physics studying the origin of matter and space-time as well as their interactions, the most fundamental problems in Nature. Its final goal is to reveal the underlying physical laws and components of the nature. A lot of important mysteries are remaining unanswered, and this group has research activities in various directions to reach this goal. Here is a summary of main works of the members of the particle physics group in the academic year 2022.

Particle Phenomenology

In particle phenomenology, the current experimental results are considered to be very accurately described by the Standard Model (SM) with $SU(3) \times SU(2) \times U(1)$ gauge group. However, this model cannot be the final theory for the following reasons; it contains too many tunable parameters which can only be determined by experiments, it suffers from the hierarchy problem, and it does not contain the dark matter, neutrino masses. Thus particle physics beyond the SM is investigated by members of this group. Under the recent significant development of cosmological and astrophysical observations, seeking the fundamental solution to the dark matter and dark energy problem has become one of the leading topics.

Lattice QCD

Quantum Chromodynamics (QCD) is a non-Abelian gauge theory coupled with matter fields. This theory describes the hadronic systems, and has various applications in particle phenomenology as well as in astrophysics. Because of its strong interactions, understanding its properties requires non-perturbative approaches to quantum field theories. Lattice QCD gives a practical and powerful numerical method to analyze the non-perturbative aspects of QCD, and thus investigated by our group members.

In YITP, hadron interactions are investigated in lattice QCD, by using the HAL QCD potential method. We investigated optimized two-baryon operators in lattice QCD, which are shown to provide effective energies of the ground and excited states separately stable as a function of the Euclidean time. We also investigated a doubly-bottomed tetraquark state T_{bb} ($bb\bar{y}\bar{d}$) with quantum number $I(J^P) = 0(1^+)$ in (2+1)-flavor lattice QCD. The binding energy of T_{bb} is given by $E = 83(10)$ MeV at the physical point.

Quantum Gravity

It is yet unknown how to incorporate the principle of quantum mechanics into gravity or the general relativity. The application of the standard quantization procedure to the general relativity has serious problems, including uncontrollable UV divergences. A consistent theory of quantum gravity seems to require a new notion of space-time, which replaces the classical space-time notion described by a continuous smooth manifold. There exists various proposals including non-commutative space-times, which actually appear in certain limits in string theory. Other than this, a few members of this group study a tensor model in the canonical formalism, which describes spacetimes in terms of tensors. A central idea of this model is to describe spacetimes in terms of tensors: Spacetimes do not exist at the basis of the model, and they are expected to emerge as a notion for effective description.

String theory

String theory is a theory of one-dimensionally extended objects like string. The superstring theory is its extension with supersymmetry associating bosons and fermions, and has intensively been studied as a promising candidate of theories unifying all the interactions and matters. As a result, remarkably, now it is believed that the five known superstring theories, and also the eleven-dimensional supergravity theory as low-energy effective theory, are merely looking at different aspects of one hypothetical theory, the M-theory. It is important to clarify what the M-theory is, which is actively investigated by the group members. Meanwhile, it is also important issue to study quantum phenomena in very strong gravitational field like Black hole by means of the superstring theory as a consistent theory of quantum gravity. Since such phenomena cannot be handled by perturbations, however, a non-perturbative formulation of the superstring theory is required. The superstring field theory is a strong candidate of such a non-perturbative formulation, and also studied by the group members.

AdS/CFT Correspondence

The gauge/gravity correspondence, where gravitational theories are equivalent to non-gravitational theories which describe various matter systems, was first discovered by Juan Maldacena in 1997. The correspondence may play a key role to connect different fields in modern theoretical physics.

Intriguing connections between gauge/gravity correspondence and quantum information theory have been studied from the viewpoint of quantum entanglement and computational complexity. A few years ago, we found that the area of a minimal surface in Euclidean time-dependent asymptotically AdS space is equal to a quantity which call pseudo entropy. Pseudo entropy is a generalization of entanglement entropy and depends on both the initial and final state. In this year, we found an interesting application of pseudo entropy to a generalization of entanglement entropy to time-like subsystems, called time-like entanglement entropy. This quantity is dual to the time-like geodesic in AdS geometries and suggest that the time coordinate can emerge from the imaginary part of the pseudo entropy. We also examined the pseudo entropy for holography in de Sitter spaces and confirmed a similar relation. We also studied holographic duality on a flat space in the light of celestial holography. We computed the central charge of dual CFTs via the analysis of holographic entanglement entropy and showed that it takes imaginary values and gets divergent.

A simplified version of gauge/gravity correspondence can be constructed with higher spin gravity, which is expected to describe the tensionless limit of superstring theory. Applying the simplified version, our group members have investigated the quantum effects of three dimensional higher spin gravity from corresponding two dimensional conformal field theory (CFT).

One can use AdS/CFT correspondence to study quantum dynamics of black holes. Hawking found from analysis using the quantum theory of black holes that black holes emit a nearly thermal radiation called Hawking radiation. However, this result is known to be in conflict with the unitarity of quantum theory, and is referred to as the black hole information loss problem. In recent years, the island formula, which follows from the AdS/CFT correspondence combined with quantum information theory, has been proposed to accurately calculate the entropy of Hawking radiation, offering a significant advancement towards resolving the information loss problem. According to this formula, the information about the spacetime structure inside the black hole is completely encoded within the Hawking radiation. It is then natural to ask can how we actually extract the spacetime structure inside the black hole from the information of Hawking radiation. Recently, it has been discovered that the interior of a black hole is contain Hawking radiation as a quantum error correction code, which are essential for building actual quantum computers. We have been studying properties of this quantum error correction code embedded in the Hawking radiation from various perspectives (brane worlds, the SYK model, JT gravity). We also studied an analogous structure for de Sitter space.

The AdS-Rindler reconstruction was studied by our member and it was shown that the mode expansion of the Rindler patch is sensitive to the UV limit of the theory, that is, quantum gravity.

Quantum Field Theory

Historically the development of particle physics came hand in hand with that of field theory, which is not only a common language of particle physics but also a central tool in modern theoretical physics.

We performed numerical simulation of two-dimensional quantum electrodynamics, known as the Schwinger model. It is known that the conventional approach by the Monte Carlo method becomes challenging when considering situations in this theory where the topological term is not small. This is due to the so-called sign problem, which makes numerical simulation of various important quantum field theories difficult. Therefore, we utilized the method of the density matrix renormalization group for our simulations, and by calculating energy and correlation functions, we reproduced theoretical relation derived from the ’t Hooft anomaly.

We constructed new quantum field theories related to quasi-particles known as fractons, and analyzed their properties. Fractons are quasi-particles whose mobility is restricted in certain spatial directions, and were originally discovered in models proposed in the context of quantum error correction. Since the specific method of reproducing fractons is not yet well understood, by constructing various models, it is expected that clues for their experimental reproduction can be obtained. In particular we investigated vacuum structures, ’t Hooft anomalies and dualities in the quantum field theories.

Quantum Information Group

Quantum supremacy

Quantum computing is expected to be faster than classical one, but its theoretical understanding is still not complete. Especially, all quantum supremacy results need some computational assumptions, and it is an open problem to demonstrate quantum supremacy with weaker assumptions. Morimae and Yamakawa showed that inefficiently verifiable quantum supremacy can be constructed with only the existence of one-way functions which is weaker and standard assumptions in cryptography. They also constructed efficiently-verifiable quantum supremacy from trapdoor premutations.

Quantum cryptography without one-way functions

The existence of one-way functions is one of the most essencial assumptions in (classical) cryptography. In fact, almost all cryptographi primitives imply one-way functions, and cryptographic primitives in minicrypto, such as commitments, signatures, and pseudorandom generators, are equivalent to one-way functions. Morimae and Yamakawa showed that, on the other hand, in quantum cryptography, one-way function is not necessarily essential. They constructed commitments and signatures based on pseudorandom states generators whose existence can be shown to be possible even if all post-quantum classical cryptographic primitives (including one-way functions) are broken. They also show several new relations between cryptographic primitives weaker than one-way functions, such as pseudorandom states generators, one-way states generators, and EFI.

Data-driven inference of quantum devices

In recent years, a protocol has been introduced for the inference of quantum devices only based on the correlations such devices can generate in experiments. Such a protocol is therefore referred to as data-driven inference of quantum devices. In particular, and in contrast to quantum tomographic reconstruction, data-driven inference is agnostic to the way in which the data has been generated. Data-driven inference is based upon a minimality principle, reminiscent of Jaynes' MAXENT principle, according to which the result of the inference is the least committal device, that is, the device that is compatible with the data and as little else as possible.

While the problem of the data-driven inference of single-qubit systems had already been conclusively settled, in the fiscal year 2022 Dall'Arno carried on further research addressing the problem of the data-driven inference of quantum states and measurements for arbitrary-dimensional quantum systems. Through an outer approximation of the state space and the application of results in differential geometry by Fritz (1948), Dall'Arno derived the closed-form expression for the output of the data-driven inference of arbitrary-dimensional quantum measurements. These results provide the basis for the implementation of multi-qubit data-driven inference as a routine for the calibration of quantum computers.

Guesswork of a quantum ensemble

The guesswork quantifies the minimum number of queries needed to correctly guess the value of an unknown classical random variable, when a single value can be queried at a time, in the presence of side information. The problem has been extensively studied in the case of classical side information, but only recently tackled in the case of quantum side information.

In the fiscal year 2022, Dall'Arno showed that, when the side information is encoded in a single qubit system, the guesswork corresponds to a combinatorial problem known as the quadratic assignment problem, that can be computed exactly in time that is at worst factorial in the number of values the random variable can attain. This result allowed for the exact computation of the guesswork for the class of qubit ensembles whose Gram matrix is benevolent, which includes regular polygons, symmetric informationally complete ensembles, and mutually unbiased basis.

Overcoming noise in quantum computers

The concept of a scalable quantum computer that can solve problems out of reach of classical computers has intrigued physicists for decades. Yet despite significant breakthroughs, many obstacles remain in the practical realization of quantum computers. The biggest hurdle that quantum computers must overcome is that the units of quantum information, the qubits, are noisy and prone to error. A method of protecting qubits from noise is called quantum error correction (QEC), however, realizing quantum error correction requires a large number additional qubits and also requires that the noise strength on these qubits is below a certain threshold value, which up to now has been challenging to reach.

This year Andrew Darmawan and colleagues studied a scheme for quantum error correction in which information is encoded using random low depth circuits. Using tensor-network decoding methods, the authors showed how such encodings have an exceptionally high threshold to stochastic errors. This scheme could represent a new way to perform error correction which is practical due to its low depth, locality in 1D and high threshold to stochastic errors.

In another work, currently in preparation for submission, Andrew Darmawan and collaborators illustrated a new approach to simulating quantum error correction using tensor networks. An important advantage of this approach is that it can take into account various types of leakage processes in which a physical qubit is excited to higher levels outside of the qubit subspace. Using this method, they studied various ways in which the effect of leakage can be mitigated, shedding new light on how this problem may be solved in real-world quantum computers.

Yukawa International Program for Quark-Hadron Sciences

From the beginning of the academic year of 2007, Yukawa Institute for Theoretical Physics launched a new five-year project, “Yukawa International Program for Quark-Hadron Sciences (YIPQS)", sponsored by “Ministry of Education, Culture, Sports, Science and Technology, JAPAN (MEXT)". At the end of the academic year of 2010, the government approved to convert the YIPQS project budget into a more stable normal budget, and now we can run the program from a longer term point of view.

Aim of the program

By the end of 1970’s, the final understanding was reached that Quantum Chromodynamics (QCD) is the fundamental theory of the strong interaction which was originally discovered by Hideki Yukawa. Still, nevertheless, only little has been established from QCD on various possible forms of hadrons or quarks. For example, while scaling behaviors of the lepton-nucleon cross section in the deep-inelastic scattering region and some properties of ground state hadrons have been precisely understood in perturbative and lattice QCD calculations, respectively, we have not yet reached the stage to understand properties of excited hadrons above the threshold including the exotic hadrons, binding mechanism of nuclei with more than two nucleons, nuclear matter equation of state, and the vacuum structures at extremely high temperature in the Early Universe and at extremely high density in compact stars, from the fundamental theory, namely QCD. In other words, there is still a vast area of research interest which is to be explored. To advance our exploration, it is necessary not only to make full use of existing theoretical techniques but also to develop new theories and to establish new frameworks. The expected achievement would cast a strong impact on our understanding of various forms of matter at various levels in nature. One may face a situation that one should restructure the current understanding about possible forms of matter.

The primary purpose of the YIPQS is to establish a new area of research fields; the quark-hadron sciences. For this purpose, with cooperating with present and near-future experimental activities, Yukawa Institute for Theoretical Physics will advance theoretical research not only in quark-hadron physics but also in related areas, as listed below, which constitute indispensable building blocks for the quark-hadron sciences.

Examples of related areas include; quark-gluon plasma, hadron physics, lattice QCD, dark energy, dark matter, baryogenesis, CP violation, strongly-correlated systems, phase transition of internal degrees of freedom of matter, physics of the Early Universe, matter at extreme conditions, structure of unstable nuclei and nucleosynthesis, compact star physics, optical lattice, (super)string theory, AdS/CFT correspondence, non-perturbative and/or non-equilibrium dynamics, gravitational waves from compact star mergers, quantum information, etc.

International collaboration program

As a core activity of the YIPQS, long-stay programs are organized on research topics ranging over quark-hadron physics and related fields of theoretical physics. The proposal of the program is open for the community, with a requirement that the organizing committee should include a member of Yukawa Institute. Yukawa Institute calls for the proposals of the long-stay programs annually. The theme of the long-stay program is selected and endorsed by the YIPQS executive committee with taking account of comments and opinions from the international advisory committee. The program is to be endorsed by the steering/advisory committee of the Yukawa Institute. The proposed program plan is also to be examined by the user’s committee of the Yukawa Institute.

Two to three long-stay programs will be held annually; the duration of each program is one to three months. World-leading scientists are invited for each theme, and the Yukawa Institute provides participants with relaxed and at-home atmosphere so that there may be active discussions and fruitful collaborations, which we hope that will ultimately lead to Nobel-prize class results. To publicize the aim of creating and advancing the field of quark-hadron sciences, the activities and outcomes of the YIPQS will be announced regularly on the website.

Long-stay programs

In this academic year, the following two long-stay programs were held in the hybrid form under the spread of the coronavirus (COVID-19);

1. May 9 – June 17, 2022,
   “Mean-field and Cluster Dynamics in Nuclear Systems 2022 (MCD2022)"
   Chairman : Nobuyuki Itagaki (OMU) and Hitoshi Nakada (Chiba)
   http://www2.yukawa.kyoto-u.ac.jp/~mcd2022/index.php

2. October 31 – December 2, 2022,
   “Novel Quantum States in Condensed Matter 2022 (NQS2022)"
   Chairman : Takami Tohyama (TUS)
   http://www2.yukawa.kyoto-u.ac.jp/~nqs2022/

Molecule-type workshops

Smaller-size collaboration programs are also organized to cope with the rapid development of the research in this field. The program is named a “molecule-type” program.

It is expected that the group discussion in this small program will evolve to form a research collaboration. The proposal has been received anytime within the budget limit. This program should involve at least one core participant from abroad, and should be long for two weeks or more. The selection of this program is also made by the executive committee and the board member of the user's committee, and the selected program is examined by the user's committee of the Yukawa Institute.

Because of the outbreak of the coronavirus (COVID-19), it has been still difficult for core participants from abroad to join the international programs in this fiscal year. There was a program of this molecule-type below;

1. March 20 – March 31, 2023,
   "Quantum Error Correction"
   Core members : Andrew Darwaman, Ben Baragiola, Tomoyuki Morimae, Yoshifumi Nakata

From the fiscal year of 2021, we have called and accepted molecule-type workshops without core participants from abroad (domestic molecule-type workshops). This program continued in this fiscal year. There were four workshops of domestic molecule-type as listed below.

1. April 11 – April 15, 2022,
   "Cosmology with Weak Lensing: Beyond the Two-point Statistics"
   Core members : Ken Osato, Jia Liu, Masato Shirasaki, Masahiro Takada, Atsushi Taruya, Takahiro Nishimichi
2. August 22 – August 26, 2022,
   "Quantum Dynamics in Few-body Systems"
   Core members : Yukinao Akamatsu, Shimpei Endo, Hidetoshi Taya, Masaru Hongo, Keisuke Fujii
3. December 7 – December 20, 2022,
   "Fundamentals in density functional theory"
   Core members : Ryosuke Akashi, Gianluca Colò, Tomoya Naito, Takeru Yokota, Kenichi Yoshida
4. March 13 – March 30, 2023,
   "Non-linear nature of cosmological perturbations and its observational consequences"
   Core members : Maresuke Shiraishi, Teruaki Suyama, Jason Kristiano, Ryo Saito, Atsushi Taruya, Takahiro Nishimichi, Atsushi Naruko

Organization

The executive committee was organized in the Yukawa Institute to run the whole program. The committee members in the fiscal year of 2022 are:
Akira Ohnishi (chair), Sinya Aoki, Hisao Hayakawa, Yasuaki Hikida, Masakiyo Kitazawa, Tomoyuki Morimae, Shinji Mukohyama, Takahiro Nishimichi, Masatoshi Sato, Shigeki Sugimoto, Takahiro Tanaka, Yuya Tanizaki.

The website of the program is;
http://www2.yukawa.kyoto-u.ac.jp/~yipqs/index_e.html.

Center for Gravitational Physics and Quantum Information

On 1st April, 2022, Yukawa Institute for Theoretical Physics established a new research organization, named the “Center for Gravitational Physics and Quantum Information (CGPQI)”.

Purpose of this center

In physics, theoretical research activities have mainly been divided vertically into four groups: elementary particles, nuclear physics, cosmology, and condensed matter physics. Recently, however, “quantum information,” which is the basis of quantum technology, has emerged as a new paradigm for understanding the natural world. It has become clear that it is the key to solving difficult problems in important research targets in physics, such as “creation of the universe" and “quantum matter," by making the four theories cross-functional. At the same time, the cutting edge of theoretical physics provides a perspective that leads to new developments in quantum information and its applications in quantum technology. Thus, by introducing a new perspective of quantum information in physics, we expect that particle physics and cosmology, i.e. the basis of gravitational physics, will be deeply connected with nuclear and condensed matter theory, which study quantum matter. In this way a great interdisciplinary fusion will be realized involving the four fields of physics and quantum information that constitute our institute. The center aims to realize the fusion of different fields of quantum information theory and theoretical physics, and to build an international center of exchange by bringing together researchers from different fields with a wide range of domestic and international research institutions.

Primary research topics

This center has the following five sections. The research topics for each of them are as follows:

Quantum Information and Quantum Technology:

Quantum physics provides many surprising phenomena that do not appear in classical physics. One goal of quantum information is to apply these new phenomena for information processing. In particular, we will be able to realize super-fast computers or new cryptographic systems with various new and strong securities. The quantum information group mainly studies quantum complexity theory, quantum algorithm, and quantum cryptography. For quantum complexity theory, we are interested in theoretically showing quantum speedups based on some complexity assumptions, which is often called quantum supremacy. It is known that several tasks such as sampling and search problems can be solved faster than classical computers based on several complexity assumptions. For quantum algorithm, we are interested in fast quantum algorithm for topological data analysis, etc. Finally, for quantum cryptography, we study foundations of quantum cryptography such as constructing quantum cryptographic primitives based on weaker assumptions than the existence of one-way functions, etc. We also construct several new quantum cryptographic primitives such as certified deletion where the deletion of data can be verified by some certificate.

Quantum Gravity and Gauge/Gravity:

Gauge/Gravity duality provides us a remarkable method that equivalently connects gravity (superstring theory, general relativity) with quantum matter (quantum field theories, quantum many-body systems). This enables us to reduce complicated analysis of strongly interacting quantum system to much simpler classical calculations in gravity. At the same time, we can convert difficult problems in quantum gravity into simpler ones

Moreover, quantum information theoretic analysis has lead to the conjecture that the spacetimes in gravity may be regarded as the networks of quantum entanglement, which may be modeled by tensor networks in condensed matter physics. Such a surprising connection between quantum information theory and quantum gravity offers a promising approach to understand how the spacetimes described by quantum gravity look like. In our center, we are exploring basic problems in quantum gravity, such as understandings of black hole information problem and mechanisms of creation of the universe, in the light of Gauge/Gravity duality, quantum information theory and other related ideas.

Gravitational Waves and Cosmology:

Cosmology has been rapidly developing, based on precision observational data. It is fair to say that many parameters describing our universe have been determined, or at least are in the process of being determined, with good precision. Nonetheless, three great mysteries, i.e. dark energy, dark matter and inflation, are standing in the way of cosmology. In our center we tackle those mysteries by using every possible means such as general relativity, statistical physics, particle physics and superstring theory. In 2015, US gravitational wave detectors, advanced LIGO, achieved the first direct detection of gravitational waves. Japanese gravitational wave detector, named KAGRA, also started the observational run in 2020. The gravitational-wave astronomy has just begun and now is the exciting era. In our center we study the strong self-gravitating phenomena, the high-energy astrophysics and the test of general relativity by means of gravitational waves. We also make predictions of electromagnetic signals and develop efficient data-analysis methods.

Quantum Matter:

The ultimate goal of condensed-matter theory is to understand a variety of complex behaviors of matter with a combination of relatively simple models and fundamental principles of physics and to predict new phenomena on the basis of the knowledge gained there. One of the great advances in recent years is the understanding of the so-called “topological materials”. Whereas physics had already used topological idea (homotopy) successfully in classifying excitations and defects in (classical) ordered materials, topological materials focus on non-trivial topological properties of “quantum-mechanical wave functions”. Moreover, the research area of topological states of matter keeps expanding to include open systems or even systems that are apparently unrelated to quantum mechanics, which are commonly described by non-Hermitian Hamiltonians. As the topological states of matter had been defying the characterization with “local order parameters”, the concept of “quantum entanglement” born in the field of quantum information is useful to distinguish genuine topological phases. In our project, we study new phenomena in topological phases and related condensed matter/statistical physics and explore new applications of quantum gravity and quantum information to quantum matter.

<u>Strongly Coupled Quantum Systems and (Quantum)</u>:

Matter composed of quarks and gluons (quark-gluon plasma, QGP) underwent the last vacuum phase transition in the early universe, creating the present universe composed of protons, neutrons, and electrons. Around the phase transition temperature, QGP is almost a perfect fluid with an extremely low viscosity. Since QGP is a strongly coupled system, we need a non-perturbative theoretical framework for its direct analysis. The most standard framework to analyze such strongly coupled systems is the lattice QCD. However, the Monte Carlo method, which has been mainly used in numerical simulations of lattice QCD, is not a panacea, and in situations where there is a problem called the sign problem, the computational complexity increases explosively, and in principle, Recently, quantum computer-based approaches have been attracting attention as a way to overcome this situation In our center, we are exploring a new framework to study strongly coupled systems made from gluons and quarks, by combining quantum computing with conventional methods.

Achievements in the academic year 2022

Since the research of the members of the center are summarized in the other parts of this annual report, we only show some typical numbers that reflect the research activities and achievements of the center here.

We published 174 papers and four books. The number of workshops and schools organized by us and held at YITP was 23 (15 of them were international and 8 were domestic), including two long term workshops “Mean-field and Cluster Dynamics in Nuclear Systems 2022” and “Novel Quantum States in Condensed Matter 2022”, which were held for 5 weeks and the number of participants were 147 and 258, respectively. The total number of participants of these workshops was 3,238. We were invited to give talks in various workshops. The total number of the invited talks given by our members was 129 (84 of them were international and 45 were domestic).

Home page

The home page of the center is
https://www2.yukawa.kyoto-u.ac.jp/~cgpqi/en/.
The current members and research achievements are shown in this page.

International Research Unit of Quantum Information

Overview

The International Research Unit of Quantum Information was established on 2020 in collaboration of 10 Kyoto University research organizations and is operated by the Yukawa Institute for Theoretical Physics (YITP). The unit leader is Sinya Aoki, and the unit sub leaders are Tadashi Takayanagi and Tomoyuki Morimae. Michele Dall'Arno and Andres Ducuara at YITP join the unit as long-term visiting researchers (assistant professors).

Its aim is to enhance collaborations of quantum information science among different departments and institutes of Kyoto University, and create new research disciplines. The current research subjects are, for example, quantum computing, quantum cryptography, foundations of quantum physics, string theory and quantum information, quantum error correction, quantum simulation of field theory, and related subjects such as game theory, mathematics, supercomputing, physics, optics, and computer science.

Activities

1. Seminar by Dr. Ryuji Takagi (Nanyang Technological University Singapore), Fundamental limits of quantum error migration, 2022/7/22

2. Third Kyoto Workshop on Quantum Information, Computation, and Foundation, 2022/10/17-21

3. Seminar by Prof. Arthur jackob PARZYGNAT (Nagoya University), Retrodiction: time-reversal symmetry for quantum channels, 2022/12/19

4. Seminar by Prof. Martin Kliesch (The Hamburg University of Technology), Estimating Pauli noise in quantum error correction, 2022/12/22

5. International Molecule-type Workshop "Quantum Error Correction", 2023/3/20-31

2.2 Publications

2.2.1 YITP reports (January – December 2022)

22-1 Yan Lyu, Hui Tong, Takuya Sugiura, Sinya Aoki, Takumi Doi, Tetsuo Hatsuda, Jie Meng, Takaya Miyamoto
Optimized Two-Baryon Operators in Lattice QCD
arXiv:2201.02782 [hep-lat] Phys. Rev. D 105, 074512 (2022) (January).

22-2 Alexandre Belin, Robert C. Myers, Shan-Ming Ruan, Gábor Sárosi, Antony J. Speranza
Does Complexity Equal Anything?
arXiv:2111.02429 [hep-th] Phys. Rev. Lett. 128, 081602 (2022) (January).

22-3 Sinya Aoki, Tetsuya Onogi
Conserved non-Noether charge in general relativity: Physical definition vs. Noether's 2nd theorem
arXiv:2201.09557 [hep-th] Int. J. Mod. Phys. A 37, 2250129 (2022) (January).

22-4 Yuya Tanizaki, Mithat Ünsal
Center vortex and confinement in Yang-Mills theory and QCD with anomaly-preserving compactifications
arXiv:2201.06166 [hep-th] PTEP 1 04A108 (2022) (January).

22-5 Kenji Fukushima, Takuya Shimazaki, Yuya Tanizaki
Exploring the θ-vacuum structure in the functional renormalization group approach
arXiv:2202.00375 [hep-th] JHEP04(2022)040 (January).

22-6 Masato Minamitsuji, Kazufumi Takahashi, Shinji Tsujikawa
Linear stability of black holes in shift-symmetric Horndeski theories with a time-independent scalar field
arXiv:2201.09687 [gr-qc] Phys. Rev. D 105,104001(2022) (January).

22-7 Constance Mahony, Andrej Dvornik, Alexander Mead, Catherine Heymans, Marika Asgari, Hendrik Hildebrandt, Hironao Miyatake, Takahiro Nishimichi, Robert Reischke
The halo model with beyond-linear halo bias: unbiasing cosmological constraints from galaxy-galaxy lensing and clustering
arXiv:2202.01790 [astro-ph.CO] Mon. Not. R. Astron. Soc. 515, 2612-2623 (2022) (January).

22-8 Mitsutoshi Fujita, Yoshitaka Hatta, Shigeki Sugimoto, Takahiro Ueda
Nucleon D-term in holographic QCD
arXiv:2206.06578 [hep-th] PTEP 9 093B06 (2022) (February).

22-9 Oren Bergman, Shinji Hirano
The holography of duality in $\mathcal{N} = 4$ Super-Yang-Mills theory
arXiv:2208.09396 [hep-th] JHEP 11 (2022) 69 (February).

22-10 Taichiro Kugo, Ryuichi Nakayama, Nobuyoshi Ohta
Covariant BRST Quantization of Unimodular Gravity I – Formulation with antisymmetric tensor ghosts –
arXiv:2202.03626 [hep-th] Phys. Rev. D 105, 086006 (2022) (February).

22-11 Giulio Bonelli, Fran Globlek, Naotaka Kubo, Tomoki Nosaka, Alessandro Tanzini
M2-branes and q*-Painlevé equations*
arXiv:2202.10654 [hep-th] Lett Math Phys 112, 109 (2022) (February).

22-12 Yui Hayashi, Yuya Tanizaki
Non-invertible self-duality defects of Cardy-Rabinovici model and mixed gravitational anomaly
arXiv:2204.07440 [hep-th] JHEP 08 (2022) 036 (February).

22-13 Keisuke Nakashi, Masashi Kimura, Hayato Motohashi, Kazufumi Takahashi
Black hole perturbations in higher-order scalar-tensor theories: initial value problem and dynamical stability
arXiv:2204.05054 [gr-qc] Class. Quant. Grav. 39 (2022) no.17, 175003 (February).

22-14 Kenta Suzuki, Tadashi Takayanagi
BCFT and Islands in Two Dimensions
arXiv:2202.08462 [hep-th] JHEP 06 (2022) 95 (February).

22-15 Eivind Jørstad, Robert C. Myers, Shan-Ming Ruan
Holographic Complexity in dS_{d+1}
arXiv:2202.10684 [hep-th] JHEP 05 (2022) 119 (February).

22-16 Taichiro Kugo, Ryuichi Nakayama, Nobuyoshi Ohta
Covariant BRST Quantization of Unimodular Gravity II – Formulation with a vector antighost –
arXiv:2202.10740 [hep-th] Phys. Rev. D 105, 106006 (2022) (February).

22-17 Jibril Ben Achour, Etera R. Livine, Shinji Mukohyama, Jean-Philippe Uzan
Hidden symmetry of the static response of black holes: Applications to Love numbers
arXiv:2202.12828 [gr-qc] (February).

22-18 Justin C. Feng, Shinji Mukohyama, Sante Carloni
Junction conditions and sharp gradients in generalized coupling theories
arXiv:2203.00011 [gr-qc] Physical Review D 105, 104036 (2022) (February).

22-19 Shakib Daryanoosh, Alexei Gilchrist, Ben Q. Baragiola
Collisional-model quantum trajectories for entangled qubit environments
arXiv:2202.13271 [quant-ph] Phys. Rev. A 106, 022202 (2022) (February).

22-20 Yasuaki Hikida, Tatsuma Nishioka, Tadashi Takayanagi, Yusuke Taki
CFT duals of three-dimensional de Sitter gravity
arXiv:2203.02852 [hep-th] JHEP 05 (2022) 129 (March).

22-21 Taishi Kawamoto, Takato Mori, Yu-ki Suzuki, Tadashi Takayanagi, Tomonori Ugajin
Holographic Local Operator Quenches in BCFTs
arXiv:2203.03851 [hep-th] JHEP05(2022)060 (March).

22-22 Francesco Di Filippo, Raúl Carballo-Rubio, Stefano Liberati, Costantino Pacilio, Matt Visser
On the inner horizon instability of non-singular black holes
arXiv:2203.14516 [gr-qc] (March).

22-23 Dennis Obster
Tensors and Algebras: An algebraic spacetime interpretation for tensor models
arXiv:2203.03633 [gr-qc] (March).

22-24 Hidefumi Matsuda, Teiji Kunihiro, Akira Ohnishi, Toru T. Takahashi
Entropy production in longitudinally expanding Yang-Mills field with use of Husimi function−semiclassical approximation
arXiv:2203.02859 [hep-ph] (March).

22-25 Antonio De Felice, Shinji Mukohyama, Kazufumi Takahashi
Built-in scordatura in U-DHOST
arXiv:2204.02032 [gr-qc] Phys. Rev. Lett. 129, 031103 (2022) (March).

22-26 Yuki Kamiya, Tetsuo Hyodo, Akira Ohnishi
Femtoscopic study on DD^* and $D\bar{D}^*$ interactions for T_{cc} and $X(3872)$
arXiv:2203.13814 [hep-ph] Eur. Phys. J. A 58, 131 (2022) (March).

22-27 Shinji Mukohyama, Vicharit Yingcharoenrat
Effective Field Theory of Black Hole Perturbations with Timelike Scalar Profile: Formulation
arXiv:2204.00228 [hep-th] JCAP 09 (2022) 010 (March).

22-28 Osmin Lacombe, Shinji Mukohyama
Self-tuning of the cosmological constant in braneworlds with $P(X,\varphi)$
arXiv:2203.16322 [hep-th] (March).

22-29 Masato Minamitsuji, Antonio De Felice, Shinji Mukohyama, Michele Oliosi
Static and spherically symmetric general relativity solutions in Minimal Theory of Bigravity
arXiv:2204.08217 [gr-qc] Phys. Rev. D 105, 123026 (2022) (March).

22-30 Masazumi Honda, Takuya Yoda
String theory, $\mathcal{N}=4$ SYM and Riemann hypothesis
arXiv:2203.17091 [hep-th] (March).

22-31 Naoki Sasakura
Emergence of classical spacetimes in canonical tensor model
arXiv:2203.16022 [hep-th] (March).

22-32 Hiroshi Kunitomo
Open-closed homotopy algebra in superstring field theory
arXiv:2204.01249 [hep-th] (March).

22-33 Tomonori Inoue, Makoto Sakamoto, Masatoshi Sato, Inori Ueba
Correspondence of topological classification between quantum graph extra dimension and topological matter
arXiv:2204.03834 [hep-th] Phys. Rev. D 106 (2022) 8, 085006 (April).

22-34 Sinya Aoki, Janos Balog, Tetsuya Onogi, Shuichi Yokoyama
Bulk reconstruction from a scalar CFT at the boundary by the smearing with the flow equation
arXiv:2204.01989 [hep-th] (April).

22-35 Mohammad Ali Gorji, Taisuke Matsuda, Shinji Mukohyama
Cosmological memory effect in scalar-tensor theories
arXiv:2204.09182 [gr-qc] Phys. Rev. D 106, 024013 (2022) (April).

22-36 Sinya Aoki, Janos Balog, Tetsuya Onogi, Shuichi Yokoyama

Special flow equation and GKP-Witten relation
arXiv:2204.06855 [hep-th] (April).

22-37 Heng-Yu Chen, Yasuaki Hikida
Three-dimensional de Sitter holography and bulk correlators at late time
arXiv:2204.04871 [hep-th] Phys. Rev. Lett. 129, 061601 (2022) (April).

22-38 Katsuki Aoki, Mohammad Ali Gorji, Shinji Mukohyama, Kazufumi Takahashi
Effective Field Theory of Gravitating Continuum: Solids, Fluids, and Aether Unified
arXiv:2204.06672 [hep-th] JCAP 08 (2022) 072 (April).

22-39 Antonio De Felice, Kei-ichi Maeda, Shinji Mukohyama, Masroor C. Pookkillath
VCDM and Cuscuton
arXiv:2204.08294 [gr-qc] Phys. Rev. D 106 (2022) 2, 024028 (April).

22-40 Toru Nishimura, Masakiyo Kitazawa, Teiji Kunihiro
Anomalous enhancement of dilepton production as a precursor of color superconductivity
arXiv:2201.01963 [hep-ph] (April).

22-41 Masato Minamitsuji, Kazufumi Takahashi, Shinji Tsujikawa
Linear stability of black holes with static scalar hair in full Horndeski theories: generic instabilities and surviving models
arXiv:2204.13837 [gr-qc] Phys. Rev. D 106, 044003 (2022) (April).

22-42 Ibrahim Akal, Taishi Kawamoto, Shan-Ming Ruan, Tadashi Takayanagi, Zixia Wei
Zoo of holographic moving mirrors
arXiv:2205.02663 [hep-th] JHEP 08 (2022) 296 (April).

22-43 Shuhei Ohyama, Ken Shiozaki, Masatoshi Sato
Generalized Thouless Pumps in 1+1-dimensional Interacting Fermionic Systems
arXiv:2206.01110 [cond-mat.str-el] Phys. Rev. B 106, 165115(2022) (May).

22-44 Yuta Hamada, Teppei Kitahara, Yoshiki Sato
Monopole-fermion scattering and varying Fock space
arXiv:2208.01052 [hep-th] JHEP 11 (2022) 116 (May).

22-45 Yuya Tanizaki, Mithat Ünsal
Semiclassics with 't Hooft flux background for QCD with 2-index quarks
arXiv:2205.11339 [hep-th] JHEP 08 (2022) 038 (May).

22-46 Emanuele Berti, Vitor Cardoso, Mark Ho-Yeuk Cheung, Francesco Di Filippo, Francisco Duque, Paul Martens, Shinji Mukohyama
Stability of the fundamental quasinormal mode in time-domain observations against small perturbations
arXiv:2205.08547 [gr-qc] Phys. Rev. D 106, 084036 (2022) (May).

22-47 Pisin Chen, Misao Sasaki, Dong-han Yeom, Junggi Yoon
Resolving information loss paradox with Euclidean path integral
arXiv:2205.08320 [gr-qc] Int. J. Mod. Phys. D 31, 2242001 (2022) (May).

22-48 Yi-Fu Cai, Xiao-Han Ma, Misao Sasaki, Dong-Gang Wang, Zihan Zhou
Highly non-Gaussian tails and primordial black holes from single-field inflation
arXiv:2207.11910 [astro-ph.CO] JCAP 12 (2022), 034 (May).

22-49 Ryo Terasawa, Ryuichi Takahashi, Takahiro Nishimichi, Masahiro Takada
Separate universe approach to evaluate nonlinear matter power spectrum for non-flat ΛCDM model
arXiv:2205.10339 [astro-ph.CO] Phys. Rev. D 106, 083504 (2022) (May).

22-50 Yu-ki Suzuki, Seiji Terashima
On the Dynamics in the AdS/BCFT Correspondence
arXiv:2205.10600 [hep-th] JHEP 09 (2022) 103 (May).

22-51 Paul Martens, Shinji Mukohyama, Ryo Namba
Reheating after relaxation of large cosmological constant
arXiv:2205.11754 [hep-th] JCAP 11 (2022) 047 (May).

22-52 Paul Martens, Hiroki Matsui, Shinji Mukohyama
DeWitt wave function in Hořava-Lifshitz cosmology with tensor perturbation
arXiv:2205.11746 [gr-qc] JCAP 11 (2022) 031 (May).

22-53 Raúl Carballo-Rubio, Francesco Di Filippo, Stefano Liberati, Costantino Pacilio, Matt Visser
Regular black holes without mass inflation instability
arXiv:2205.13556 [gr-qc] JHEP 09 (2022) 118 (May).

22-54 Raúl Carballo-Rubio, Francesco Di Filippo, Stefano Liberati, Matt Visser
*Constraints on horizonless objects after the EHT observation of Sagittarius A**
arXiv:2205.13555 [astro-ph.HE] JCAP 08 (2022) 08, 055 (May).

22-55 Sugumi Kanno, Misao Sasaki
Graviton non-gaussianity in α-vacuum
arXiv:2206.03667 [hep-th] JHEP 08 (2022) 210 (May).

22-56 Keisuke Izumi, Tetsuya Shiromizu, Kenta Suzuki, Tadashi Takayanagi, Norihiro Tanahashi
Brane Dynamics of Holographic BCFTs
arXiv:2205.15500 [hep-th] JHEP 10 (2022) 50 (May).

22-57 Shanjin Wu, Koichi Murase, Shian Tang, Huichao Song
Examination of background effects on light-nuclei yield ratio in relativistic heavy-ion collisions
arXiv:2205.14302 [nucl-th] Phys. Rev. C 106, 034905 (2022) (May).

22-58 Sinya Aoki
Noether's 1st theorem with local symmetries
arXiv:2206.00283 [hep-th] PTEP 2022, No.12 (2022) 123A02 (June).

22-59 Antonio De Felice, Shinji Mukohyama, Masroor C. Pookkillath
Extended minimal theories of massive gravity
arXiv:2206.03338 [gr-qc] Phys. Rev. D 106, 084050 (2022) (June).

22-60 Oliver H. E. Philcox, Mikhail M. Ivanov, Giovanni Cabass, Marko Simonović, Matias Zaldarriaga, Takahiro Nishimichi
Cosmology with the Redshift-Space Galaxy Bispectrum Monopole at One-Loop Order
arXiv:2206.02800 [astro-ph.CO] Phys. Rev. D 106, 043530 (2022) (June).

22-61 Ken Osato, Teppei Okumura
Clustering of emission line galaxies with IllustrisTNG I.: fundamental properties and halo occupation distribution
arXiv:2206.08678 [astro-ph.GA] Mon. Not. R. Astron. Soc, 519, 1771-1791 (2023) (June).

22-62 Seishiro Ono, Ken Shiozaki, Haruki Watanabe
Classification of time-reversal symmetric topological superconducting phases for conventional pairing symmetries
arXiv:2206.02489 [cond-mat.supr-con] (June).

22-63 Giacomo Pantaleoni, Ben Q. Baragiola, Nicolas C. Menicucci
The Zak transform: a framework for quantum computation with the Gottesman-Kitaev-Preskill code
arXiv:2210.09494 [quant-ph] (June).

22-64 Tomohiro Oishi, Ante Ravlic, Nils Paar
Symmetry breaking of Gamow-Teller and magnetic-dipole transitions and its restoration in calcium isotopes
arXiv:2201.00834 [nucl-th] Phys. Rev. C 105, 064309 (2022) (June).

22-65 Pisin Chen, Misao Sasaki, Dong-han Yeom, Junggi Yoon
Tunneling between multiple histories as a solution to the information loss paradox
arXiv:2206.10251 [gr-qc] (June).

22-66 Naoki Sasakura
Splitting-merging transitions in tensor-vectors systems in exact large-N limits
arXiv:2206.12017 [hep-th] Phys. Rev. D 106, 126016 (2022) (June).

22-67 Katsuki Aoki, Masato Minamitsuji
Resolving the pathologies of self-interacting Proca fields: A case study of Proca stars
arXiv:2206.14320 [gr-qc] (June).

22-68 Mendel Nguyen, Yuya Tanizaki, Mithat Ünsal
Winding theta and destructive interference of instantons
arXiv:2207.03008 [hep-th] (June).

22-69 Shohei Saga, Teppei Okumura, Atsushi Taruya, Takuya Inoue
Relativistic distortions in galaxy density-ellipticity correlations: gravitational redshift and peculiar velocity effects
arXiv:2207.03454 [astro-ph.CO] Mon. Not. R. Astron. Soc. 518, 4976-4990 (2022) (July).

22-70 Sotaro Sugishita, Seiji Terashima
Rindler Bulk Reconstruction and Subregion Duality in AdS/CFT
arXiv:2207.06455 [hep-th] JHEP 11 (2022) 41 (July).

22-71 Naoki Ogawa, Tadashi Takayanagi, Takashi Tsuda, Takahiro Waki
Wedge Holography in Flat Space and Celestial Holography
arXiv:2207.06735 [hep-th] Phys. Rev. D 107, 026001 (2023) (July).

22-72 Sevag Gharibian, Ryu Hayakawa, François Le Gall, Tomoyuki Morimae
Improved Hardness Results for the Guided Local Hamiltonian Problem
arXiv:2207.10250 [quant-ph] (July).

22-73 Taiga Hiroka, Tomoyuki Morimae, Ryo Nishimaki, Takashi Yamakawa
Certified Everlasting Functional Encryption
arXiv:2207.13878 [cs.CR] (July).

22-74 Ibra Akal
Breakdown of quantum mechanics in gravitational holography
arXiv:2208.01019 [hep-th] (July).

22-75 Masaya Amo, Keisuke Izumi, Yoshimune Tomikawa, Hirotaka Yoshino, Tetsuya Shiromizu

Asymptotic behavior of null geodesics near future null infinity. III. Photons towards inward directions
arXiv:2208.00822 [gr-qc] Phys. Rev. D 106, 084007 (2022) (July).

22-76 Hiroki Ohata, Hideo Suganuma
Remnants of quark model in lattice QCD simulation in the Coulomb gauge
arXiv:2207.13299 [hep-lat] (July).

22-77 A. Sakai, K. Murase, H. Fujii, T. Hirano
Space-time Evolution of Critical Fluctuations in an Expanding System
https://doi.org/10.5506/APhysPolBSupp.16.1-A155 Acta Phys. Pol. B Proc. Suppl. 16, 1 (2023) (July).

22-78 Shinji Mukohyama, Kazufumi Takahashi, Vicharit Yingcharoenrat
Generalized Regge-Wheeler Equation from Effective Field Theory of Black Hole Perturbations with a Timelike Scalar Profile
arXiv:2208.02943 [gr-qc] JCAP 10 (2022) 050 (July).

22-79 Saikat Das, Nayantara Gupta, Soebur Razzaque
Implications of multiwavelength spectrum on cosmic-ray acceleration in blazar TXS 0506+056
arXiv:2208.00838 [astro-ph.HE] Astron. Astrophys. 668, A146 (2022) (August).

22-80 Zhenyuan Wang, Donghui Jeong, Atsushi Taruya, Takahiro Nishimichi, Ken Osato
Perturbation Theory Remixed: Improved Nonlinearity Modeling beyond Standard Perturbation Theory
arXiv:2209.00033 [astro-ph.CO] (August).

22-81 Yasushi Nara, Asanosuke Jinno, Koichi Murase, Akira Ohnishi
Directed flow of Λ in high-energy heavy-ion collisions and Λ potential in dense nuclear matter
arXiv:2208.01297 [nucl-th] Phys. Rev. C106 (2022)4,044902 (August).

22-82 Atsushi Taruya, Shohei Saga
Analytical approach to core-halo structure of fuzzy dark matter
arXiv:2208.06562 [astro-ph.CO] Phys. Rev. D 106, 103532 (2022) (August).

22-83 Takahiko Matsubara, Misao Sasaki
Non-Gaussianity effects on the primordial black hole abundance for sharply-peaked primordial spectrum
arXiv:2208.02941 [astro-ph.CO] JCAP 10 (2022) 094 (August).

22-84 Atsuhisa Ota, Misao Sasaki, Yi Wang
Scale-invariant enhancement of gravitational waves during inflation
arXiv:2209.02272 [astro-ph.CO] (August).

22-85 Naoki Sasakura
Signed distributions of real tensor eigenvectors of Gaussian tensor model via a four-fermi theory
arXiv:2208.08837 [hep-th] Physics Letters B 836, 137618 (2023) (August).

22-86 Satoshi Yamaguchi
$SL(2,\mathbb{Z})$ action on quantum field theories with U(1) subsystem symmetry
arXiv:2208.13193 [hep-th] (August).

22-87 Tomoyuki Morimae, Takashi Yamakawa
Proofs of Quantumness from Trapdoor Permutations
arXiv:2208.12390 [quant-ph] ITCS 2023 (August).

22-88 Sinya Aoki
Do we know how to define energy in general relativity?
arXiv:2208.13558 [gr-qc] (August).

22-89 Kazufumi Takahashi, Masato Minamitsuji, Hayato Motohashi
Generalized disformal Horndeski theories: cosmological perturbations and consistent matter coupling
arXiv:2209.02176 [gr-qc] PTEP 2023, 013E01 (2023) (August).

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Free Fermion Cyclic/Symmetric Orbifold CFTs and Entanglement Entropy
arXiv:2209.00206 [hep-th] JHEP 12 (2022) 4 (August).

22-92 Kei-ichiro Kubota, Shun Arai, Shinji Mukohyama
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arXiv:2209.00795 [gr-qc] Phys. Rev. D 107 (2023) 6, 064002 (August).

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Super-horizon resonant magnetogenesis during inflation
arXiv:2210.07050 [astro-ph.CO] Phys. Rev. D 107, 083517 (2023) (September).

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arXiv:2209.04970 [astro-ph.CO] (September).

22-96 Stefano Antonini, Gregory Bentsen, ChunJun Cao, Jonathan Harper, Shao-Kai Jian, Brian Swingle
Holographic measurement and bulk teleportation
arXiv:2209.12903 [hep-th] JHEP 12 (2022) 124 (September).

22-97 Yusuke Namekawa, Kouji Kashiwa, Hidefumi Matsuda, Akira Ohnishi, Hayato Takase
Improving efficiency of the path optimization method for a gauge theory
arXiv:2210.05402 [hep-lat] Phys. Rev. D 107, 034509 (2023) (September).

22-98 Naoki Sasakura
Real tensor eigenvalue/vector distributions of the Gaussian tensor model via a four-fermi theory
arXiv:2209.07032 [hep-th] (September).

22-99 Heng-Yu Chen, Shi Chen, Yasuaki Hikida
Late-time correlation functions in dS_3/CFT_2 correspondence
arXiv:2210.01415 [hep-th] JHEP 02 (2023) 38 (September).

22-100 Masazumi Honda, Etsuko Itou, Yuya Tanizaki
DMRG study of the higher-charge Schwinger model and its 't Hooft anomaly
arXiv:2210.04237 [hep-lat] JHEP 11 (2022) 141 (September).

22-101 Alexandre Belin, Robert C. Myers, Shan-Ming Ruan, Gábor Sárosi, Antony J. Speranza
Complexity Equals Anything II
arXiv:2210.09647 [hep-th] JHEP 01 (2023) 154 (September).

22-102 Sinya Aoki
Colliding gravitational waves and singularities
arXiv:2209.11357 [gr-qc] (September).

22-103 Stratos Pateloudis, Georg Bergner, Masanori Hanada, Enrico Rinaldi, Andreas Schäfer, Pavlos Vranas, Hiromasa Watanabe, Norbert Bodendorfer
Precision test of gauge/gravity duality in D0-brane matrix model at low temperature
arXiv:2210.04881 [hep-th] JHEP 03 (2023) 71 (September).

22-104 José M. M. Senovilla
Ultra-massive spacetimes
arXiv:2209.14585 [gr-qc] (September).

22-105 Toru Nishimura, Masakiyo Kitazawa, Teiji Kunihiro
Anomalous enhancement of dilepton production due to soft modes in dense quark matter
arXiv:2210.00774 [hep-ph] EPJ Web Conf. 276, 01003 (2023) (September).

22-106 Budhaditya Bhattacharjee, Pratik Nandy, Tanay Pathak
Krylov complexity in large-q and double-scaled SYK model
arXiv:2210.02474 [hep-th] (October).

22-107 Masakiyo Kitazawa
From lattice to observables: Real and virtual experiments for exploring hot and dense QCD
arXiv:2210.00739 [nucl-th] EPJ Web Conf. 276, 01024 (2023) (October).

22-108 Yuya Kusuki, Zixia Wei
AdS/BCFT from Conformal Bootstrap: Construction of Gravity with Branes and Particles
arXiv:2210.03107 [hep-th] JHEP 01 (2023) 108 (October).

22-109 Minki Hhan, Tomoyuki Morimae, Takashi Yamakawa
From the Hardness of Detecting Superpositions to Cryptography: Quantum Public Key Encryption and Commitments
arXiv:2210.05978 [quant-ph] Eurocrypt 2023 (October).

22-110 Tomoki Wada, Kunihito Ioka
Expanding Fireball in Magnetar Bursts and Fast Radio Bursts
arXiv:2208.14320 [astro-ph.HE] Mon. Not. R. Astron. Soc. 519, 4094-4109 (2023) (October).

22-111 Hamid Hamidani, Kunihito Ioka
Cocoon breakout and escape from the ejecta of neutron star mergers
arXiv:2210.00814 [astro-ph.HE] Mon. Not. R. Astron. Soc. 520, 1111-1127 (2023) (October).

22-112 Hamid Hamidani, Kunihito Ioka
Cocoon emission in neutron star mergers
arXiv:2210.02255 [astro-ph.HE] (October).

22-113 Kotaro Murakami, Yutaro Akahoshi, Sinya Aoki, Takumi Doi, Kenji Sasaki
Lattice QCD studies on decuplet baryons as meson-baryon bound states in the HAL QCD method
arXiv:2210.05395 [hep-lat] (October).

22-114 Dennis Obster
The tensor of the exact circle: Reconstructing geometry
arXiv:2211.15344 [gr-qc] (October).

22-115 Sinya Aoki, Kiyoharu Kawana
Entropy and its conservation in expanding Universe
arXiv:2210.03323 [hep-th] (October).

22-116 Tomoyuki Morimae, Takashi Yamakawa
One-Wayness in Quantum Cryptography
arXiv:2210.03394 [quant-ph] (October).

22-117 Takafumi Aoki, Sinya Aoki, Takashi Inoue
Lattice study on a tetra-quark state T_{bb} in the HAL

QCD method
arXiv:2306.03565 [hep-lat] (October).

22-118 Masanori Hanada, Hiromasa Watanabe
Partial deconfinement: a brief overview
arXiv:2210.11216 [hep-th] Eur. Phys. J. Spec. Top. 232, 333-337 (2022) (October).

22-119 Daiki Suenaga, Masakiyo Kitazawa
Effective model for pure Yang-Mills theory on $\mathbb{T}^2 \times \mathbb{R}^2$ *with Polyakov loops*
arXiv:2210.09363 [hep-ph] Phys. Rev. D 107 (2023) 7, 074502 (October).

22-120 Yoshifumi Nakata, Takaya Matsuura, Masato Koashi
Constructing quantum decoders based on complementarity principle
arXiv:2210.06661 [quant-ph] (October).

22-121 Kazuki Doi, Jonathan Harper, Ali Mollabashi, Tadashi Takayanagi, Yusuke Taki
Pseudo Entropy in dS/CFT and Time-like Entanglement Entropy
arXiv:2210.09457 [hep-th] Phys. Rev. Lett. 130, 031601 (2023) (October).

22-122 Akira Ohnishi, Asanosuke Jinno, Koichi Murase, Yasushi Nara
Directed flow of Λ *from heavy-ion collisions and hyperon puzzle of neutron stars*
arXiv:2210.17202 [nucl-th] EPJ Web Conf. 271, 08006 (2022) (October).

22-123 Naoki Sasakura
Exact analytic expressions of real tensor eigenvalue distributions of Gaussian tensor model for small N
arXiv:2210.15129 [hep-th] (October).

22-124 Yutaro Akahoshi, Sinya Aoki
Interaction potentials for two-particle states with non-zero total momenta in lattice QCD
arXiv:2301.06038 [hep-lat] (October).

22-125 Yugo Abe, Takeo Inami, Keisuke Izumi
High-energy properties of the graviton scattering in quadratic gravity
arXiv:2210.13666 [hep-th] JHEP 03 (2023) 213 (October).

22-126 Shi Chen, Yuya Tanizaki
Solitonic symmetry beyond homotopy: invertibility from bordism and non-invertibility from TQFT
arXiv:2210.13780 [hep-th] (October).

22-127 Daiki Suenaga, Kotaro Murakami, Etsuko Itou, Kei Iida
Probing the hadron mass spectrum in dense two-color QCD with the linear sigma model
arXiv:2211.01789 [hep-ph] Phys. Rev. D 107, 054001 (2023) (October).

22-128 Saikat Das, Soebur Razzaque
Ultrahigh-energy cosmic-ray signature in GRB 221009A
arXiv:2210.13349 [astro-ph.HE] Astron. Astrophys. 670, L12 (2023) (October).

22-129 Michele Dall'Arno
The signaling dimension of physical systems
arXiv:2210.15210 [quant-ph] Quantum Views 6, 66 (2022) (October).

22-130 Saswato Sen, Christof Wetterich, Masatoshi Yamada
Scaling solutions for asymptotically free quantum gravity
arXiv:2211.05508 [hep-th] JHEP 02 (2023) 54 (October).

22-131 Kazuyuki Kanaya, Ryo Ashikawa, Shinji Ejiri, Masakiyo Kitazawa, Hiroshi Suzuki, Naoki Wakabayashi
Phase structure and critical point in heavy-quark QCD at finite temperature
arXiv:2211.08631 [hep-lat] (October).

22-132 Yuhma Asano, Goro Ishiki, Takaki Matsumoto, Shinji Shimasaki, Hiromasa Watanabe
On the existence of the NS5-brane limit of the plane wave matrix model
arXiv:2211.13716 [hep-th] PTEP 2023 (2023) 4, 043B01 (November).

22-133 Hiroki Matsui, Shinji Mukohyama, Atsushi Naruko
No Smooth Spacetime in Lorentzian Quantum Cosmology and Trans-Planckian Physics
arXiv:2211.05306 [gr-qc] Phys. Rev. D 107, 043511 (2023) (November).

22-134 Kazufumi Takahashi, Rampei Kimura, Hayato Motohashi
Consistency of matter coupling in modified gravity
arXiv:2212.13391 [gr-qc] Phys. Rev. D 107, 044018 (2023) (November).

22-135 Masazumi Honda, Taiichi Nakanishi
Scalar, fermionic and supersymmetric field theories with subsystem symmetries in d+1 dimensions
arXiv:2212.13006 [hep-th] JHEP 03 (2023) 188 (November).

22-136 Yoshimasa Hidaka, Satoshi Iso, Kengo Shimada
Entanglement Generation and Decoherence in a Two-Qubit System Mediated by Relativistic Quantum Field
arXiv:2211.09441 [quant-ph] Phys. Rev. D 107, 085003 (2023) (November).

22-137 Raúl Carballo-Rubio, Francesco Di Filippo, Stefano Liberati, Matt Visser

A connection between regular black holes and horizonless ultracompact stars
arXiv:2211.05817 [gr-qc] (November).

22-138 Zixia Wei, Yasushi Yoneta
Counting atypical black hole microstates from entanglement wedges
arXiv:2211.11787 [hep-th] (November).

22-139 Sebastian Franco, Dongwook Ghim, Rak-Kyeong Seong
Brane Brick Models for the Sasaki-Einstein 7-Manifolds $Y^{p,k}(\mathbb{CP}^1 \times \mathbb{CP}^1)$ and $Y^{p,k}(\mathbb{CP}^2)$
arXiv:2212.02523 [hep-th] JHEP 03 (2023) 050 (November).

22-140 Toru Nishimura, Masakiyo Kitazawa, Teiji Kunihiro
Critical fluctuations of QCD phase transitions and their related observables
https://doi.org/10.1051/epjconf/202227405009 EPJ Web Conf. 274, 05009 (2022) (November).

22-141 Ken-ichi Nakao, Kazumasa Okabayashi, Tomohiro Harada
Radiative gravastar with thermal spectrum; Sudden vacuum condensation without gravitational collapse
arXiv:2211.13477 [gr-qc] Phys. Rev. D 107, 084036 (2023) (November).

22-142 Antonio De Felice, Kei-ichi Maeda, Shinji Mukohyama, Masroor C. Pookkillath
Gravitational collapse and formation of a black hole in a type II minimally modified gravity theory
arXiv:2211.14760 [gr-qc] JCAP 03 (2023) 030 (November).

22-143 Tomohiro Harada, Kazunori Kohri, Misao Sasaki, Takahiro Terada, Chul-Moon Yoo
Threshold of Primordial Black Hole Formation against Velocity Dispersion in Matter-Dominated Era
arXiv:2211.13950 [astro-ph.CO] JCAP 02 (2023) 038 (November).

22-144 Shi Pi, Misao Sasaki
Logarithmic Duality of the Curvature Perturbation
arXiv:2211.13932 [astro-ph.CO] (November).

22-145 Atsuhisa Ota, Misao Sasaki, Yi Wang
One-loop tensor power spectrum from an excited scalar field during inflation
arXiv:2211.12766 [astro-ph.CO] (November).

22-146 Kotaro Murakami, Daiki Suenaga, Kei Iida, Etsuko Itou
Measurement of hadron masses in 2-color finite density QCD
arXiv:2211.13472 [hep-lat] (November).

22-147 Blayney W. Walshe, Ben Q. Baragiola, Rafael N. Alexander, Nicolas C. Menicucci
Equivalent Noise Properties of Two-Mode Macronode-based Cluster States
arXiv:2305.11630 [quant-ph] (November).

22-148 Sinya Aoki, Takafumi Aoki
Lattice study on a tetraquark state T_{bb} in the HAL QCD method
arXiv:2212.00202 [hep-lat] (November).

22-149 Kohei Sato, Hiromasa Watanabe, Takeshi Yamazaki
Calculation of the pion charge radius from an improved model-independent method
arXiv:2212.00207 [hep-lat] (November).

22-150 Yusuke Manita, Katsuki Aoki, Tomohiro Fujita, Shinji Mukohyama
Spin-2 dark matter from anisotropic Universe in bigravity
arXiv:2211.15873 [gr-qc] Phys. Rev. D 107, 104007 (2023) (November).

22-151 Andrew S. Darmawan, Yoshifumi Nakata, Shiro Tamiya, Hayata Yamasaki
Low-depth random Clifford circuits for quantum coding against Pauli noise using a tensor-network decoder
arXiv:2212.05071 [quant-ph] (December).

22-152 Budhaditya Bhattacharjee, Xiangyu Cao, Pratik Nandy, Tanay Pathak
Operator growth in open quantum systems: lessons from the dissipative SYK
arXiv:2212.06180 [quant-ph] JHEP 03 (2023) 054 (December).

22-153 Katsuki Aoki
Unitarity and unstable-particle scattering amplitudes
arXiv:2212.05670 [hep-th] Phys. Rev. D 107, 065017 (2023) (December).

22-154 Raúl Carballo-Rubio, Francesco Di Filippo, Stefano Liberati, Costantino Pacilio, Matt Visser
Comment on "Stability properties of Regular Black Holes"
arXiv:2212.07458 [gr-qc] (December).

22-155 Katsuki Aoki, Masato Minamitsuji
Highly compact Proca stars with quartic self-interactions
arXiv:2212.07659 [gr-qc] Phys. Rev. D 107, 044045 (2023) (December).

22-156 Kenta Suzuki, Yu-ki Suzuki, Takashi Tsuda, Masataka Watanabe
Information metric on the boundary
arXiv:2212.10899 [hep-th] JHEP 05 (2023) 013 (December).

22-157 Masato Minamitsuji, Antonio De Felice, Shinji Mukohyama, Michele Oliosi
Gravitational collapse and odd-parity black hole perturbations in Minimal Theory of Bigravity
arXiv:2301.00498 [gr-qc] Phys. Rev. D 107, 064070 (2023) (December).

22-158 Katsuki Aoki, Jose Beltrán Jiménez, David Figueruelo
Some disquisitions on cosmological 2-form dualities
arXiv:2212.12427 [gr-qc] JCAP 04 (2023) 059 (December).

22-159 Hiroki Ohata, Hideo Suganuma
Study of Hadron Masses with Faddeev-Popov Eigenmode Projection in the Coulomb Gauge
arXiv:2212.12109 [hep-lat] EPJ Web Conf. 274, 02007 (2022) (December).

22-160 Alexander Ganz, Paul Martens, Shinji Mukohyama, Ryo Namba
Bouncing Cosmology in VCDM
arXiv:2212.13561 [gr-qc] JCAP 04 (2023) 060 (December).

22-161 Antonio De Felice, Shinji Mukohyama, Kazufumi Takahashi
Approximately stealth black hole in higher-order scalar-tensor theories
arXiv:2212.13031 [gr-qc] JCAP 03 (2023) 050 (December).

22-162 Masaki Shigemori
Superstrata on Orbifolded Backgrounds
arXiv:2212.13388 [hep-th] JHEP 02 (2023) 099 (December).

22-163 Yohsuke Enomoto, Takahiro Nishimichi, Atsushi Taruya
Universal multi-stream radial structures of cold dark matter halos
arXiv:2302.01531 [astro-ph.CO] (December).

22-164 Yoshiaki Himemoto, Atsushi Nishizawa, Atsushi Taruya
Distinguishing a stochastic gravitational-wave signal from correlated noise with joint parameter estimation: Fisher analysis for ground-based detectors
arXiv:2302.03336 [gr-qc] Phys. Rev. D 107, 064055 (2023) (December).

22-165 Kazuya Takahashi, Kunihito Ioka, Yutaka Ohira, Hendrik J. van Eerten
Probing particle acceleration at trans-relativistic shocks with off-axis gamma-ray burst afterglows
arXiv:2208.06274 [astro-ph.HE] Mon. Not. R. Astron. Soc. 517, 5541-5559 (2022) (January).

22-166 Ataru Tanikawa, Kohei Hattori, Norita Kawanaka, Tomoya Kinugawa, Minori Shikauchi, Daichi Tsuna
Search for a Black Hole Binary in Gaia DR3 Astrometric Binary Stars with Spectroscopic Data
arXiv:2209.05632 [astro-ph.SR] ApJ 946, 79 (2023) (January).

2.2.2 Publications and Talks by Regular Staff and Unit of Quantum Information Researchers (April 2022 — March 2023)

Katsuki Aoki

Journal Papers

1. K. Aoki, J. B. Jiménez, & D. Figueruelo, "Some disquisitions on cosmological 2-form dualities", JCAP, **04** (2023) 059, YITP-22-158, arXiv:2212.12427 [gr-qc].
2. K. Aoki & M. Minamitsuji, "Highly compact Proca stars with quartic self-interactions", Phys. Rev. D, **107** (2023) 044045, YITP-22-155, arXiv:2212.07659 [gr-qc].
3. K. Aoki, "Unitarity and unstable-particle scattering amplitudes", Phys. Rev. D, **107** (2023) 065017, YITP-22-153, arXiv:2212.05670 [hep-th].
4. Y. Manita, K. Aoki, T. Fujita & S. Mukohyama, "Spin-2 dark matter from an anisotropic universe in bigravity", Phys. Rev. D **107** (2023) 104007. YITP-22-150, arXiv:2211.15873 [gr-qc].
5. K. Aoki & M. Minamitsuji, "Resolving the pathologies of self-interacting Proca fields: A case study of Proca stars", Phys. Rev. D, **106** (2022) 084022, YITP-22-67, arXiv:2206.14320 [gr-qc].
6. K. Aoki, M. A. Gorji, S. Mukohyama, & K. Takahashi, "Effective field theory of gravitating continuum: solids, fluids, and aether unified", JCAP, **08** (2022), 072, YITP-22-38, arXiv:2204.06672 [hep-th].

Talks at International Conferences

1. "Towards global S-matrix constraints on dark matter physics", in FY2022 " What is dark matter? - Comprehensive study of the huge discovery space in dark matter " , Kavli IPMU, The University of Tokyo, March 2023.
2. "Positivity beyond tree level", Invited, in 2023 Winter-I NRF-JSPS Workshop in particle physics, cosmology, and gravitation, Hokkaido University, January 2023.
3. "The Effective Field Theory of Vector–Tensor Theories", Invited, in 9th Korea-Japan Workshop on Dark Energy, Yonsei University (online), Republic of Korea, November 2022.
4. "The Effective Field Theory of Vector–Tensor Theories", in JGRG31, RESCEU, The University of Tokyo, October 2022.

Invited Seminars (Overseas)

1. "Massive graviton as dark matter", Central China Normal University (online), China, March 2023.

Invited Seminars (in Japan)

1. "Towards S-matrix theory of unstable particles", RIKEN, Japan, March 2023.
2. "Gravitational positivity bounds", Resceu, The University of Tokyo, Japan, February 2023.
3. "Gravitational positivity bounds", The University of Tokyo, Komaba, Japan, April 2022 (in Japanese).

Sinya Aoki

Journal Papers

1. Y. Lyu, H. Tong, T. Sugiura, S. Aoki, T. Doi, T. Hatsuda, J. Meng, & T. Miyamoto,

"Optimized two-baryon operators in lattice QCD",
Phys. Rev. D, **105** (2022) 074512, YITP-22-01, arXiv:2201.02782 [hep-lat].

2. S. Aoki & T. Onogi,
"Conserved non-Noether charge in general relativity: Physical definition versus Noether's second theorem",
International Journal of Modern Physics A, **37** (2022) 2250129, YITP-22-03, arXiv:2201.09557 [hep-th].

3. S. Aoki,
"Noether's 1st theorem with local symmetries",
PTEP, **2022** (2022) 12, 123A02, YITP-22-58, arXiv:2206.00283 [hep-th].

4. S. Aoki, J. Balog, T. Onogi, & S. Yokoyama,
"Special flow equation and the GKP-Witten relation",
PTEP, **2023** (2023) 1, 013B03, YITP-22-36, arXiv:2204.06855 [hep-th].

5. S. Aoki & J. Balog,
"Extension of the HKLL bulk reconstruction for small Δ,"
JHEP **05** (2023), 034, YITP-23-24, arXiv:2302.11854 [hep-th].

Books and Proceedings

1. S. Aoki & T. Aoki,
"Lattice study on a tetraquark state T_{bb} in the HAL QCD method,"
PoS **LATTICE2022** (2023), 049, YITP-22-148, arXiv:2212.00202 [hep-lat].

2. S. Aoki, Y. Aoki, H. Fukaya, J. Goswami, S. Hashimoto, I. Kanamori, T. Kaneko & Y. Zhang,
"Thermodynamics with Möbius domain wall fermions near physical point II,"
PoS **LATTICE2022** (2023), 176, arXiv:2303.05884 [hep-lat].

Talks at International Conferences

1. "Lattice study on a tetra-quark state T_{bb} in the HAL QCD method",
The 39th International Symposium on Lattice Field Theory (Lattice 2023), University of Bonn, Bonn, Germany,
August 8-13, 2022.

2. "Recent results in HAL QCD method", Invited,
Bethe Forum "Multihadron Dynamics in a Box - A.D. 2022", BCTP, Bonn, Germany,
August 15-19, 2022.

3. "Is energy conserved in general relativity ? – The latest collaboration with Tetsuya –", Invited,
Non-perturbative Analysis of Quantum Field Theory and its Application", Osaka University Hall, Osaka University, Toyonaka, Japan,
September 22, 2022.

4. "Colliding gravitational waves and singularities",
The 13th RESCEU International Symposium "JGRG31", Koshiba- Hall, The University of Tokyo, Tokyo, Japan,
October 24-28, 2022.

5. "Baryon-Baryon interactions in lattice QCD", invited, On-line
Baryon 2022, Sevilla, Spain/Zoom,
November 7-11, 2022.

6. "Entropy and its conservation in expanding Universe", On-line,
KEK Theory Workshop 2022,
December 7-9, 2022.

7. "Entropy and its conservation in expanding Universe", invited,
2022 NTU-Kyoto high energy physics workshop/Kawai Fest, Department of Physics, National Taiwan University, Taipei, Taiwan,
December 17-20, 2022.

8. "Lattice study on a tetra-quark state T_{bb} in the HAL QCD method", invited,
Workshop on "Physics of heavy quarks and exotic hadrons 2023", Tokai Campus, KEK, Japan,
January 30-31, 2023.

9. "Recent results in HAL QCD method", invited,
   "Challenges and opportunities in Lattice QCD simulations and related fields", RIKEN R-CCS, Kobe, Japan,
   February 15 - 17, 2023.

10. "Recent results in HAL QCD method - charmed tetra-quark state T_{cc} - " , nvited,
    "Precision Physics from the Lattice and the Continuum Limit", IRIS Building, Humboldt University, Berlin, Germany,
    March 30-31, 2023.

Invited Seminars (Overseas)

1. "Conserved non-Noether charge in general relativity: Physical definition vs. Noether's 2nd theorem", On-line,
   April 1, 2022, BNL, Upton, NY, USA.

2. "Lattice study on a tetra-quark state T_{bb} in the HAL QCD method",
   July 29, 2022, Seminar, TU, Munich, Germany.

3. "Lattice QCD: Introduction, results and challenges", On-line,
   One world IAMP mathematical physics seminar, December 12, 2022.

4. "Energy (non-)conservation and an alternative conserved charge in a curved spacetime (general relativity)",
   March 28, 2023, Albert Einstein Institute, MPI for Gravitational Physics, Potsdam, Germany.

5. "Energy (non-)conservation and an alternative conserved charge in a curved spacetime (general relativity)",
   March 29, 2023, IRIS, Humboldt University, Berlin, Germany.

Invited Seminars (in Japan)

1. "Conserved non-Noether charge in general relativity: Physical definition vs. Noether's 2nd theorem",
   April 11, 2022, Seminar, Nagoya University, Nagoya, Japan.

2. "Noether's 1st theorem with local symmetries",
   June 3, 2022,Department of Physics, University of Tokyo, Tokyo, Japan.

Michele Dall'Arno

Journal Papers

1. M. Dall'Arno, "The signaling dimension of physical systems", Quantum Views **6**, 66 (2022).

2. M. Dall'Arno, F. Buscemi, and T. Koshiba, "Guesswork of a quantum ensemble", IEEE Trans. Inform. Theory **68**, 3193 (2022).

Talks at International Conferences

1. "Guesswork of quantum ensembles," Invited,
   in "XIII Symposium KCIK-ICTQT on Quantum Information," Sopot, Poland, online,
   May 2022.

2. "Data-driven inference of quantum measurements," Invited,
   in "Quantum Information, Computation, and Foundation," Kyoto, Japan, online,
   October 2022.

Invited Seminars (in Japan)

1. "Information storage of an n-level quantum system,"
   Graduate School of Informatics, Univ. of Nagoya, December 2022.

Andrew Darmawan

Journal Papers

1. S. Singh, A. S. Darmawan, B. J. Brown, and S. Puri,
   "High-fidelity magic-state preparation with a biased-noise architecture,"
   Phys. Rev. **A 105** (2022), 052410 (10 pages), YITP-21-86, arXiv:2109.02677 [quant-ph].

Invited Seminars (Overseas)

1. “Low-depth random Clifford circuits for quantum coding against Pauli noise using a tensor-network decoder,”
   Coogee’23 - Sydney Quantum Information Theory Workshop, Australia, February 2023.

Invited Seminars (in Japan)

1. “Applications of tensor networks to quantum error correction,”
   Koashi Lab, Univ. of Tokyo, July 2022 (online).

Antonio De Felice

Journal Papers

1. M. Minamitsuji, A. De Felice, S. Mukohyama, & M. Oliosi,
   “Gravitational collapse and odd-parity black hole perturbations in minimal theory of bigravity",
   Phys. Rev. D, **107** (2023) 064070, YITP-22-157, arXiv:2301.00498 [gr-qc].
2. A. De Felice, S. Mukohyama, & K. Takahashi,
   “Approximately stealth black hole in higher-order scalar-tensor theories",
   JCAP, **2023** (2023) 3, 050, YITP-22-161, arXiv:2212.13031 [gr-qc].
3. A. De Felice, K. Maeda, S. Mukohyama, & M. C. Pookkillath,
   “Gravitational collapse and formation of a black hole in a type II minimally modified gravity theory",
   JCAP, **2023** (2023) 3, 030, YITP-22-142, arXiv:2211.14760 [gr-qc].
4. A. De Felice, S. Mukohyama, & M. C. Pookkillath,
   “Extended minimal theories of massive gravity",
   Phys. Rev. D, **106** (2022) 084050, YITP-22-59, arXiv:2206.03338 [gr-qc].
5. J. A. Kable, G. Benevento, N. Frusciante, A. De Felice, & S. Tsujikawa,
   “Probing modified gravity with integrated Sachs-Wolfe CMB and galaxy cross-correlations",
   JCAP, **2022** (2022) 9, 002, YITP-21-138, arXiv:2111.10432 [astro-ph.CO].
6. A. De Felice, S. Mukohyama, & K. Takahashi,
   “Avoidance of Strong Coupling in General Relativity Solutions with a Timelike Scalar Profile in a Class of Ghost-Free Scalar-Tensor Theories",
   Phys. Rev. Lett., **129** (2022) 031103, YITP-22-25, arXiv:2204.02032 [gr-qc].
7. A. De Felice, K. Maeda, S. Mukohyama, & M. C. Pookkillath,
   “Comparison of two theories of Type-IIa minimally modified gravity",
   Phys. Rev. D, **106** (2022) 024028, YITP-22-39, arXiv:2204.08294 [gr-qc].
8. M. Minamitsuji, A. De Felice, S. Mukohyama, & M. Oliosi,
   “Static and spherically symmetric general relativity solutions in minimal theory of bigravity",
   Phys. Rev. D, **105** (2022) 123026, YITP-22-29, arXiv:2204.08217 [gr-qc].
9. A. De Felice, S. Mukohyama, & M. C. Pookkillath,
   “Static, spherically symmetric objects in type-II minimally modified gravity",
   Phys. Rev. D, **105** (2022) 104013, YITP-21-127, arXiv:2110.14496 [gr-qc].

Talks at International Conferences

1. “How to address tensions in cosmology by modified gravity with 2 dof,” Invited,
   in “Tensions in Cosmology,” Corfu, Greece, September 2022.

Invited Seminars (Overseas)

1. “Minimal theories and modified gravity models,”
   NAS, Mahidol University, Nakhon Sawan, Thailand, August 2022.
2. “Minimal theories and modified gravity models,”
   IF, Naresuan University, Phitsanulok, Thailand, January 2023 (online).

Andres Ducuara

Talks at International Conferences

1. "Characterisation of quantum betting tasks in terms of Arimoto mutual information," Contributed,
   in "Quantum resources: from mathematical foundations to operational characterisation," Singapore,
   December 2022.

Invited Seminars (in Japan)

1. "Characterisation of Quantum Betting Tasks,"
   Nagoya University, July 2022 (Q-LEAP theory seminar).

Ryo Hanai

Books and Proceedings

1. R. Hanai,
   "Physics of non-reciprocal phase transitions,"
   Butsuri-Gakkai-shi, Vol. 77, No. 10, Physical Society of Japan, (2023) (9 pages).

Talks at International Conferences

1. "Non-reciprocal frustrations: time crystalline order-by-disorder phenomenon and a spin-glass-like state", Invited,
   in "Japan-France joint seminar "Physics of dense and active disordered materials"", Kyoto, Japan, March 2023.
2. "Non-reciprocal frustration induced order-by-disorder and spin-glass-like state",
   in "APS March Meeting 2023", Las Vegas, US, March 2023.
3. "Non-reciprocal frustration: time-crystalline order by disorder phenomena and glassy dynamics", Invited,
   in "Dynamical Days Asia Pacific 12 (DDAP12)", PCS-IBS, Daejeon, South Korea, November 2022.

Invited Seminars (Overseas)

1. " Non-reciprocal phase transitions and frustrations " Seminar at UCSB, Santa Barbara, USA, Aug. 2022.
2. " Non-reciprocal frustration: time-crystalline order by disorder phenomena and glassy dynamics " , Changwon National University, Changwon, South Korea, Nov. 2022.

Invited Seminars (in Japan)

1. " Non-reciprocal frustrations: time crystalline order-by-disorder phenomenon and a spin-glass-like state " , Japan-France seminar, March 2023.
2. "Physics of non-recprocal phase transitions", Graduate School of Human and Environmental Studies, Kyoto University, March 2023.
3. "Physics of non-recical phase transitions", CREST Tutorial Workshop, Online, March 2023.
4. "Non-reciprocal phase transition and frustration physics", 10th Statistical Physics Roundtable Meeting (10th), March 2023.
5. "Non-reciprocal phase transitions", Yagami Statistical Physics Seminar, Keio University, Zoom, Dec. 2022
6. "Non-reciprocal many-body physics: phase transitions and frustration physics " , YITP Seminar/2nd Regular Kakenhi Meeting "Theoretical studies of non-equilibrium driven-dissipative systems", YITP, Kyoto, Japan, Nov. 2022.

Hisao Hayakawa

Journal Papers

1. A. K. Chatterjee, and H. Hayakawa,
   "Multi species asymmetric simple exclusion process with impurity activated flips,"
   SciPost Phys. **14** (2023) 016 (40 pages).
2. D. Ishima, K. Saitoh, M. Otsuki and H. Hayakawa,
   "Eigenvalue analysis of stress-strain curve of two-dimensional amorphous solids of dispersed frictional grains with finite shear strain,"
   Phys. Rev. **E107** (2023) 034904 (17 pages).

3. D. Ishima, K. Saitoh, M. Otsuki and H. Hayakawa,
"Theory of rigidity and numerical analysis of density of states of two-dimensional amorphous solids with dispersed frictional grains in the linear response regime,"
Phys. Rev. **E107** (2023) 054902 (22 pages).

4. M. Otsuki and H. Hayakawa,
"An exact expression of three-body system for the complex shear modulus of frictional granular materials",
Soft Matter **19**, 2127 (2023) (11 pages).

5. A. K. Chatterjee, and H. Hayakawa,
"Counterflow-induced clustering: Exact results,"
Phys. Rev. E **107**, 054905 (2023) (18 pages).

Talks at International Conferences

1. "Demon driven by geometrical phase," Invited,
in "25th Anniversary Symposium of German-Japanese Joint Research Project on Nonequilibrium Statistical Physics Perspectives for Future Collaboration," YITP, Kyoto Univ.
October, 2022.

2. "Theory of Mpemba-like phenomena: a few example including quantum effect," Invited,
in Japan-France joint seminar "Physics of dense and active disordered materials", YITP, Kyoto Univ.
March 2023.

Invited Seminars (in Japan)

1. "How Japanese physics was born and was developed -from Kyuri-gaku to Yukawa-,"
IUPAP 100 years anniversary sympoisum,
October 2022 (in Japanese)

Yasuaki Hikida

Journal Papers

1. H.-Y. Chen, S. Chen, & Y. Hikida,
"Late-time correlation functions in dS_3/CFT_2 correspondence",
JHEP, **2023** (2023) 2, 38, YITP-22-99, arXiv:2210.01415 [hep-th].

2. H.-Y. Chen & Y. Hikida,
"Three-Dimensional de Sitter Holography and Bulk Correlators at Late Time",
Phys. Rev. Lett., **129** (2022) 061601, YITP-22-37, arXiv:2204.04871 [hep-th].

3. Y. Hikida, T. Nishioka, T. Takayanagi, & Y. Taki,
"Holography in de Sitter Space via Chern-Simons Gauge Theory",
Phys. Rev. Lett., **129** (2022) 041601, YITP-21-105, arXiv:2110.03197 [hep-th].

4. Y. Hikida, T. Nishioka, T. Takayanagi, & Y. Taki,
"CFT duals of three-dimensional de Sitter gravity",
JHEP, **2022** (2022) 5, 129, YITP-22-20, arXiv:2203.02852 [hep-th].

5. T. Creutzig & Y. Hikida,
"FZZ-triality and large N = 4 super Liouville theory",
Nuclear Physics B, **977** (2022) 115734, YITP-21-144, arXiv:2111.12845 [hep-th].

Talks at International Conferences

1. "Three-dimensional de Sitter holography" Invited,
in "Higher Spin Gravity and its Applications," APCTP, Korea,
October 2022.

2. "Late-time correlation functions in dS_3/CFT_2 correspondencec," Invited,
in "The 2nd International Conference on Holography and its Applications," Damghan University, Iran (online),
January 2023.

3. "Exploring 3d de Sitter gravity via holography," Invited,
in "6th International Conference on Holography, String Theory and Spacetime in DaNang," Duy Tan University, Vietnam,
February 2023.

Invited Seminars (Overseas)

1. "Symmetric orbifold from AdS_3 string theory,"
National Taiwan University, January 2023.

Invited Seminars (in Japan)

1. “dS_3/CFT_2 correspondence,”
Dept. of Phys., Tokyo Inst. of Tech. (online), April 2022.

Masazumi Honda

Journal Papers

1. M. Honda & T. Nakanishi,
“Scalar, fermionic and supersymmetric field theories with subsystem symmetries in d + 1 dimensions",
JHEP, **2023** (2023) 3, 188, YITP-22-135, arXiv:2212.13006 [hep-th].

2. M. Honda, E. Itou, & Y. Tanizaki,
“DMRG study of the higher-charge Schwinger model and its ’t Hooft anomaly",
JHEP, **2022** (2022) 11, 141, YITP-22-100, arXiv:2210.04237 [hep-lat].

Books and Proceedings

1. A. Matsumoto, K. Hatakeyama, M. Hirasawa, M. Honda, J. Nishimura and A. Yosprakob, “Numerical studies on the finite-temperature CP restoration in 4D SU(N) gauge theory at $\theta = \pi$,” PoS **LATTICE2022** (2023), 378, doi:10.22323/1.430.0378.

2. M. Honda, “Digital Quantum Simulation of the Schwinger model with Topological term,” doi:10.1142/9789811261633_0003.

Talks at International Conferences

1. Invited, "Digital Quantum Simulation of higher-charge Schwinger model with Topological term", Numerical Methods in Theoretical Physics 2022, APCTP, Korea, May 2022 (invited, zoom).

Invited Seminars (Overseas)

1. "Digital Quantum Simulation of higher-charge Schwinger model with Topological term", Ruhr university, Germany, March 2023.

2. "Digital Quantum Simulation of higher-charge Schwinger model with Topological term", IFT-Madrid, Spain, March 2023.

3. "Digital Quantum Simulation of higher-charge Schwinger model with Topological term", Cambridge University, UK, October 2022.

4. "Digital Quantum Simulation of higher-charge Schwinger model with Topological term", Durham University, UK, October 2022.

5. "Digital Quantum Simulation of higher-charge Schwinger model", National Taiwan University, Taiwan, April 2022.

Invited Seminars (in Japan)

1. "String theory, N=4 SYM and Riemann hypothesis", Tokyo Institute of Technology, May 2022.

2. "String theory, N=4 SYM and Riemann hypothesis", Nagoya University, June 2022.

3. "Applications of Quantum computation to Quantum field theory", The second Extreme Universe School, online, July 2022.

4. "Basics of quantum computation and adiabatic state preparation", New computational method in field theory 2022 -Summer school on quantum computation and tensor network, YITP, September 2022.

5. "String theory, N=4 SYM and Riemann hypothesis", RIKEN iTHEMS, February 2023.

6. "Quantum computation and matrix quantum mechanics", JSPS Spring meeting 2023 Symposium "Quantum computation and Particle Physics, online, March 2023.

Kunihito Ioka

Journal Papers

1. H. Hamidani & K. Ioka,
“Cocoon breakout and escape from the ejecta of neutron star mergers",
Mon. Not. R. Astron. Soc., **520** (2023) 1111-1127, YITP-22-111, arXiv:2210.00814 [astro-ph.HE].

2. T. Wada & K. Ioka,
"Expanding fireball in magnetar bursts and fast radio bursts",
Mon. Not. R. Astron. Soc., **519** (2023) 4094-4109, YITP-22-110, arXiv:2208.14320 [astro-ph.HE].

3. K. Takahashi, K. Ioka, Y. Ohira, & H. J. van Eerten,
"Probing particle acceleration at trans-relativistic shocks with off-axis gamma-ray burst afterglows",
Mon. Not. R. Astron. Soc., **517** (2022) 5541-5559, YITP-22-165, arXiv:2208.06274 [astro-ph.HE].

4. M. Shirasaki, R. Takahashi, K. Osato, & K. Ioka,
"Probing cosmology and gastrophysics with fast radio bursts: cross-correlations of dark matter haloes and cosmic dispersion measures",
Mon. Not. R. Astron. Soc., **512** (2022) 1730-1750, YITP-21-80, arXiv:2108.12205 [astro-ph.CO].

Talks at International Conferences

1. "Fireball in Fast Radio Bursts," Invited,
in "Fast Radio Bursts Symposium 2023," National Chung Hsing University, Taichung, Taiwan,
February 2023.

2. "Fireball in Fast Radio Bursts," Invited,
in "There is plenty of room at the bottom (FRBs)," Cornell University, USA,
October 2022.

3. "Panel discussion of jet launching mechanism, jet structure, shock breakout," Invited,
in "Gravitational Wave Physics and Astronomy Workshop (GWPAW) 2022," Sofitel Melbourne on Collins, Melbourne, Australia,
December 2022.

Invited Seminars (Overseas)

1. "Fireball in Fast Radio Bursts,"
Institute for Advanced Study Astrophysics Seminar, Zoom and Bloomberg Lecture Hall, USA, October 2022.

Masakiyo Kitazawa

Journal Papers

1. T. Nishimura, M. Kitazawa and T. Kunihiro,
"Enhancement of dilepton production rate and electric conductivity around the QCD critical point,",
PTEP **2023** (2023) no.5, 053D01 [arXiv:2302.03191 [hep-ph]].

2. D. Suenaga and M. Kitazawa,
"Effective model for pure Yang-Mills theory on $\mathbb{T}^2 \times \mathbb{R}^2$ with Polyakov loops,"
Phys. Rev. D **107** (2023) no.7, 074502 [arXiv:2210.09363 [hep-ph]].

3. G. Pihan, M. Bluhm, M. Kitazawa, T. Sami and M. Nahrgang,
"Critical net-baryon fluctuations in an expanding system,"
Phys. Rev. C **107** (2023) no.1, 014908 [arXiv:2205.12834 [nucl-th]].

4. M. Kitazawa, S. Esumi and T. Nonaka,
"Ratio of baryon and electric-charge cumulants at second order with acceptance corrections,"
Nucl. Phys. A **1030** (2023), 122591 [arXiv:2205.10030 [hep-ph]].

5. T. Nishimura, M. Kitazawa, & T. Kunihiro,
"Anomalous enhancement of dilepton production as a precursor of color superconductivity",
PTEP, **2022** (2022) 9, 093D02, arXiv:2201.01963 [hep-ph].

Books and Proceedings

1. M. Kitazawa and T. Kunihiro
"Quark matter under extreme conditions: Phyase transitions in the world of elementary particles," (Japanese Language)
Kyoritsu, Sep. 2022, ISBN:978-4320035492.

2. M. Kitazawa, S. Esumi and T. Nonaka,
"Baryon/Charge Cumulant Ratio at Second Order,"
Acta Phys. Polon. Supp. **16** (2023) no.1, 82.

3. K. Kanaya, R. Ashikawa, S. Ejiri, M. Kitazawa, H. Suzuki and N. Wakabayashi,
"Phase structure and critical point in heavy-quark QCD at finite temperature,"
PoS **LATTICE2022** (2023), 177 [arXiv:2211.08631 [hep-lat]].

4. M. Kitazawa,
"From lattice to observables: Real and virtual experiments for exploring hot and dense QCD,"
EPJ Web Conf. **276** (2023), 01024 [arXiv:2210.00739 [nucl-th]].

5. T. Nishimura, M. Kitazawa and T. Kunihiro,
"Anomalous enhancement of dilepton production due to soft modes in dense quark matter,"
EPJ Web Conf. **276** (2023), 01003 [arXiv:2210.00774 [hep-ph]].

6. T. Nishimura, T. Kunihiro and M. Kitazawa,
"Anomalous dilepton production as precursory phenomena of color superconductivity,"
PoS **PANIC2021** (2022), 237.

7. T. Nishimura, M. Kitazawa, & T. Kunihiro,
"Critical fluctuations of QCD phase transitions and their related observables",
European Physical Journal Web of Conferences, **274** (2022) 05009.

8. D. Suenaga & M. Kitazawa,
"Roles of Polyakov loops in Yang-Mills theory on $\mathbb{T}^2 \times \mathbb{R}^2$",
European Physical Journal Web of Conferences, **274** (2022) 02014.

9. K. Ozawa, K. Aoki, S. Esumi, T. Gunji, T. Hachiya, H. Harada, Y. Ichikawa, M. Kitazawa, et al.,
"The J-PARC heavy ion project",
European Physical Journal Web of Conferences, **271** (2022) 11004.

Talks at International Conferences

1. "Dilepton production as a signal to explore QCD phase diagram," Invited,
in "Infinite and Finite Nuclear Matter (INFINUM-2023)," online
Feb. 2023.

2. "Lattice study of the critical point in heavy-quark QCD,"
in "Workshop on Critical Point and Onset of Deconfinement (CPOD2022)," online Nov. 2022.

3. "Critical points in hot and dense QCD," Invited,
in "the 15th Asia Pacific Physics Conference (APPC15)," online
Aug. 2022.

4. "Lattice QCD and physics at nonzero temperature," Invited Lecture
in "Nuclear Physics School (NPS2022)," hybrid, Korea
June 2022.

5. "From lattice to observables: Real and virtual experiments for exploring hot and dense medium," Invited, Plenary
in "The 20th International Conference on Strangeness in Quark Matter (SQM 2022)", hybrid, Korea,
June 2022.

Invited Seminars (in Japan)

1. "Exploring Strongly-Interacting Systems with Energy-Momentum Tensor,"
YITP Colloquium, YITP, Kyoto University, Kyoto, January 2023.

2. "Energy-momentum tensor around the kink in 1+1d field theories,"
KEK, Tsukuba, Oct. 2022.

3. "Invitation to elementary particle physics," (Japanese Language)
Yashiro High School, Nagano, Nagano, Sep. 2022.

4. "Phase structure of hot and dense QCD and its experimental search,"
GPPU Seminar, Tohoku University, Sendai, Miyagi, June 2022.

Invited Seminars (in Japan)

1. "Open-closed homotopy algebra in superstring field theory"
(On-line) Dept. of Math., Nagoya Univ., 17th June 2022.

2. “Open-closed homotopy algebra in superstring field theory”
(On-line) Dept. of Phys., Hokkaido Univ., 15th July 2022.

3. “String field theory and homotopy algebra,” Intensive Lecture (On-line), Univ. of Tokyo, Komaba, 15th, 29th June, and 6th July 2022.

Hiroshi Kunitomo

Journal Papers

1. H. Kunitomo, “Open-closed homotopy algebra in superstring field theory,” PTEP **2022** (2022) no.9, 093B07 [arXiv:2204.01249 [hep-th]].

Invited Seminars (Overseas)

1. “Open-closed homotopy algebra in suprestring field theory,” Invited in “SFT journal club,” (On-line), 2nd June 2022.

Invited Seminars (in Japan)

1. “Open-closed homotopy algebra in superstring field theory”
(On-line) Dept. of Math., Nagoya Univ., 17th June 2022.

2. “Open-closed homotopy algebra in superstring field theory”
(On-line) Dept. of Phys., Hokkaido Univ., 15th July 2022.

3. “String field theory and homotopy algebra,” Intensive Lecture (On-line), Univ. of Tokyo, Komaba, 15th, 29th June, and 6th July 2022.

Tomoyuki Morimae

Journal Papers

1. Y. Takeuchi, Y. Takahashi, T. Morimae, & S. Tani,
“Divide-and-conquer verification method for noisy intermediate-scale quantum computation",
Quantum, **6** (2022) 758, YITP-21-107, arXiv:2109.14928 [quant-ph].

2. Y. Takeuchi, T. Morimae, & S. Tani,
“Sumcheck-based delegation of quantum computing to rational server",
Theor. Comput. Sci., **924** (2022) 46.

Books and Proceedings

1. T. Morimae and T. Yamakawa,
“Proofs of quantumness from trapdoor permutations,”
ITCS 2023, YITP-22-87, arXiv:2208.12390.

2. T. Morimae and T. Yamakawa,
“Quantum commitments and signatures without one-way functions,”
CRYPTO 2022, YITP-21-155, arXiv:2112.06369.

3. T. Hiroka, T. Morimae, R. Nishimaki and T. Yamakawa,
“Certified everlasting zero-knowledge proof for QMA,”
CRYPTO 2022, YITP-21-155, arXiv:2112.06369.

4. T. Morimae and T. Yamakawa,
“Classically verifiable NIZK for QMA with preprocessing,”
ASIACRYPT 2022, YITP-21-10, arXiv:2102.09149.

Talks at International Conferences

1. S. Gharibian, R. Hayakawa, F. Le Gall, T. Morimae,
“Improved Hardness Results for the Guided Local Hamiltonian Problem",
QIP2023.

2. M. Hhan, T. Morimae, T. Yamakawa,
“From the Hardness of Detecting Superpositions to Cryptography: Quantum Public Key Encryption and Commitments",
QCW 2022, QIP2023.

3. T. Morimae and T. Yamakawa,
“Proofs of quantumness from trapdoor permutations",
QCW 2022.

4. T. Hiroka, T. Morimae, R. Nishimaki, and T. Yamakawa,

“Certified everlasting zero-knowledge proof for QMA",
Qcrypt 2022.

5. T. Morimae and T. Yamakawa,
“Quantum commitments and signatures without one-way functions",
QCW 2022, QIP 2023.

6. T. Hiroka, T. Morimae, R. Nishimaki, and T. Yamakawa,
“Certified Deletion for Public Key Encryption, Zero-Knowledge, and More",
QIP 2022 (Short plenary talk).

Invited Seminars (Overseas)

1. T. Morimae,
“Quantum commitments and signatures without one-way functions",
Monash Cybersecurity Seminars, Monash University, Australia, December 13, 2022 (online).

2. T. Morimae,
“Quantum cryptography without one-way functions",
Quantum Innovation 2022, November 30, 2022 (online).

Shinji Mukohyama

Journal Papers

1. M. Minamitsuji, A. De Felice, S. Mukohyama, & M. Oliosi,
“Gravitational collapse and odd-parity black hole perturbations in minimal theory of bigravity",
Phys. Rev. D, **107** (2023) 064070, YITP-22-157, arXiv:2301.00498 [gr-qc].

2. K. Kubota, S. Arai, & S. Mukohyama,
“Propagation of scalar and tensor gravitational waves in Horndeski theory",
Phys. Rev. D, **107** (2023) 064002, YITP-22-92, arXiv:2209.00795 [gr-qc].

3. A. De Felice, S. Mukohyama, & K. Takahashi,
“Approximately stealth black hole in higher-order scalar-tensor theories",
JCAP, **2023** (2023) 3, 050, YITP-22-161, arXiv:2212.13031 [gr-qc].

4. A. De Felice, K. Maeda, S. Mukohyama, & M. C. Pookkillath,
“Gravitational collapse and formation of a black hole in a type II minimally modified gravity theory",
JCAP, **2023** (2023) 3, 030, YITP-22-142, arXiv:2211.14760 [gr-qc].

5. H. Matsui, S. Mukohyama, & A. Naruko,
“No smooth spacetime in Lorentzian quantum cosmology and trans-Planckian physics",
Phys. Rev. D, **107** (2023) 043511, YITP-22-133, arXiv:2211.05306 [gr-qc].

6. P. Martens, S. Mukohyama, & R. Namba,
“Reheating after relaxation of large cosmological constant",
JCAP, **2022** (2022) 11, 047, YITP-22-51, arXiv:2205.11754 [hep-th].

7. P. Martens, H. Matsui, & S. Mukohyama,
“DeWitt wave function in Hořava-Lifshitz cosmology with tensor perturbation",
JCAP, **2022** (2022) 11, 031, YITP-22-52, arXiv:2205.11746 [gr-qc].

8. A. De Felice, S. Mukohyama, & M. C. Pookkillath,
“Extended minimal theories of massive gravity",
Phys. Rev. D, **106** (2022) 084050, YITP-22-59, arXiv:2206.03338 [gr-qc].

9. E. Berti, V. Cardoso, M. H.-Y. Cheung, F. Di Filippo, F. Duque, P. Martens, & S. Mukohyama,
“Stability of the fundamental quasinormal mode in time-domain observations against small perturbations",
Phys. Rev. D, **106** (2022) 084011, YITP-22-46, arXiv:2205.08547 [gr-qc].

10. H. Matsui, S. Mukohyama, & A. Naruko,
“DeWitt boundary condition is consistent in Hořava-Lifshitz quantum gravity",
Physics Letters B, **833** (2022) 137340, YITP-21-128, arXiv:2111.00665 [gr-qc].

11. S. Mukohyama, K. Takahashi, & V. Yingcharoenrat,
“Generalized Regge-Wheeler equation from Effective Field Theory of black hole

perturbations with a timelike scalar profile", JCAP, **2022** (2022) 10, 050, YITP-22-78, arXiv:2208.02943 [gr-qc].

12. O. Lacombe & S. Mukohyama,
"Self-tuning of the cosmological constant in brane-worlds with P(X,ϕ)",
JCAP, **2022** (2022) 10, 014, arXiv:2203.16322 [hep-th].

13. S. Mukohyama & V. Yingcharoenrat,
"Effective field theory of black hole perturbations with timelike scalar profile: formulation",
JCAP, **2022** (2022) 9, 010, YITP-22-27, arXiv:2204.00228 [hep-th].

14. A. De Felice, S. Mukohyama, & K. Takahashi,
"Avoidance of Strong Coupling in General Relativity Solutions with a Timelike Scalar Profile in a Class of Ghost-Free Scalar-Tensor Theories",
Phys. Rev. Lett., **129** (2022) 031103, YITP-22-25, arXiv:2204.02032 [gr-qc].

15. A. De Felice, K. Maeda, S. Mukohyama, & M. C. Pookkillath,
"Comparison of two theories of Type-IIa minimally modified gravity",
Phys. Rev. D, **106** (2022) 024028, YITP-22-39, arXiv:2204.08294 [gr-qc].

16. M. A. Gorji, T. Matsuda, & S. Mukohyama,
"Cosmological memory effect in scalar-tensor theories",
Phys. Rev. D, **106** (2022) 024013, YITP-22-35, arXiv:2204.09182 [gr-qc].

17. J. B. Achour, E. R. Livine, S. Mukohyama, & J.-P. Uzan,
"Hidden symmetry of the static response of black holes: applications to Love numbers",
JHEP, **2022** (2022) 7, 112.

18. M. Minamitsuji, A. De Felice, S. Mukohyama, & M. Oliosi,
"Static and spherically symmetric general relativity solutions in minimal theory of bigravity",
Phys. Rev. D, **105** (2022) 123026, YITP-22-29, arXiv:2204.08217 [gr-qc].

19. J. C. Feng, S. Mukohyama, & S. Carloni,
"Junction conditions and sharp gradients in generalized coupling theories",
Phys. Rev. D, **105** (2022) 104036, YITP-22-18, arXiv:2203.00011 [gr-qc].

20. A. De Felice, S. Mukohyama, & M. C. Pookkillath,
"Static, spherically symmetric objects in type-II minimally modified gravity",
Phys. Rev. D, **105** (2022) 104013, YITP-21-127, arXiv:2110.14496 [gr-qc].

Talks at International Conferences

1. "EFT of scalar-tensor gravity with timelike scalar profile," Invited,
in "All Things EFT" (online),
June 2022.

2. "Dynamical approach to the cosmological constant problem revisited," Invited,
in "String theory, gravity and cosmology 2022" (online),
June 2022.

3. "Gravity beyond general relativity," Invited,
in "ICMSA2022" (online),
July 2022.

4. "Modified gravity with 2 d.o.f.as a tool to address tensions in cosmology," Invited,
in "Corfu2022," Corfu, Greece,
September 2022.

5. "EFT of scalar-tensor gravity with timelike scalar profile," Invited,
in "Quantum Effective Field Theory and Black Hole Tests of Einstein Gravity," Trieste, Italy,
September 2022.

6. "Dark energy, black holes and effective field theory," Invited,
in "Korea-Japan workshop on dark energy" (online),
November 2022.

7. "Dark energy, black holes and effective field theory," Invited,
in "Joint Canada Asia Pacific Conference on General Relativity and Relativistic Astrophysics",
November 2022.

8. "Dark energy, black holes and effective field theory", Invited,
   in "DSU2022," Sideny, Australia,
   December 6, 2022.

9. "Dynamical approach to the cosmological constant problem revisited," Invited,
   in "2022 Winter CAS-JSPS Workshop in Cosmology, Gravitation, and Particle Physics," Prague, Czech Republic,
   December 2022.

Invited Seminars (Overseas)

1. "Minimalism in modified gravity and implications to cosmology and gravitational waves,"
   ENS in Paris, France, September 2022.

2. "Some thoughts on the information loss paradox,"
   University of Tours, Tours, France, October 2022.

3. "EFT of scalar-tensor gravity with timelike scalar profile,"
   IJCLab, Orsay, France, October 2022.

4. "Dark energy, black holes and effective field theory,"
   IAP, Paris, France, October 2022.

5. "Effective field theory of black hole perturbations with timelike scalar profile,"
   DAMTP, Cambridge, UK, March 2023.

6. "Effective field theory of black hole perturbations with timelike scalar profile,"
   Kings College London, London, UK, March 2023.

7. "Effective field theory of black hole perturbations with timelike scalar profile,"
   CENTRA, Lisbon, Portugal, March 2023.

8. "Gravity and cosmology beyond general relativity,"
   ICG, Portsmouth, March 2023.

9. "Effective field theory of black hole perturbations with timelike scalar profile,"
   Imperial College London, London, UK, March 2023.

Invited Seminars (in Japan)

1. "Gravity and cosmology beyond general relativity,"
   Nagoya University, January 2023.

Masatoshi Murase

Books and Proceedings

1. Masatoshi Murase and Tomoko Murase,
   "Chapter 10: Transdisciplinary Study of How to Integrate Shattered World: The Self-nonself Circulation Principle of "Living" Wholeness," In: The Kyoto Post-COVID Manifesto For Global Economics: Confronting Our Shattered Society (Eds: Stephen Hill, Tadashi Yagi, Stomu Yamash'ta) Springer-Nature, pp.169-196, 2022.

2. Masatoshi Murase and Tomoko Murase,
   "Chapter 11: The Self-nonself Circulation Principle of "Living" Nature: How to Survive Shattered World," In: The Kyoto Post-COVID Manifesto For Global Economics: Confronting Our Shattered Society (Eds: Stephen Hill, Tadashi Yagi, Stomu Yamash'ta) Springer-Nature, pp. 197-212, 2022.

3. Tomoko Murase and Masatoshi Murase,
   "Chapter 12: A Case Study of the Self-nonself Circulation Principle in Action: Toward A New Synthesis Beyond Division between Inside and Outside World in Nursing," In:The Kyoto Post-COVID Manifesto For Global Economics: Confronting Our Shattered Society (Eds: Stephen Hill, Tadashi Yagi, Stomu Yamash'ta) Springer-Nature, pp.213-233, 2022.

Invited Seminars (in Japan)

1. "Integrated Life Science and Medicine,"
   Mie University, Graduate School of Medicine, July 18, 2022.

2. "Life Science and Biolgocal Physics,"
   Kyoto University Lectures, Institute for Riberal Arts and Science, Kyoto University, April-July, 2022.

3. "Advanced Future Studies,"
   Kyoto University Lectures, Institute for

Riberal Arts and Science, Kyoto University, April-July, 2022.

4. "Life Science and Biolgocal Physics," Kyoto University Lectures for Graduate Students, Institute for Riberal Arts and Science, Kyoto University, April-July, 2022.

5. "Origin and Evolution of Living Systems," Ritsumeikan University Advanced Lectures, at Ritsumeikan University, September 4, 2022.

6. "Integrated Biolgocal Physics 1," Japanese Red Cross Toyota College October-November, 2022.

Yoshifumi Nakata

Journal Papers

1. E. Wakakuwa and Y. Nakata, "One-Shot Triple-Resource Trade-Off in Quantum Channel Codin," IEEE Trans. Inf., vol. 69, no. 4, pp. 2400-2426 (2023) (47 pages), arXiv:2004.12593.

2. Y. Nakara, E. Wakakuwa and M. Koashi, "Black holes as clouded mirrors: the Hayden-Preskill toy model with symmetry," Quantum 7, 928 (2023) (35 pages), arXiv:2007.00895v8.

Talks at International Conferences

1. "Quantum error correction by low-depth random clifford circuits," Invited, in "Quantum Innovation 2022," Tokyo, Japan, online November 2022.

Invited Seminars (in Japan)

1. "Quantum Error Correction and Hayden-Preskill Thought Experiment," Graduate School of Science, Nagoya Univ., February 2023.

Atsushi Naruko

Journal Papers

1. H. Matsui, S. Mukohyama, & A. Naruko, "No smooth spacetime in Lorentzian quantum cosmology and trans-Planckian physics", Phys. Rev. D, **107** (2023) 043511, YITP-22-133, arXiv:2211.05306 [gr-qc].

2. A. Naruko, R. Saito, N. Tanahashi, & D. Yamauchi, "Ostrogradsky mode in scalar-tensor theories with higher-order derivative couplings to matter", PTEP **2023** (2023) 5, 053E02, YITP-22-94, arXiv:2209.02252 [gr-qc].

3. Y. Takamori, A. Naruko, Y. Sakurai, K. Takahashi, D. Yamauchi, & C.-M. Yoo, "Testing the non-circularity of the spacetime around Sagittarius A* with orbiting pulsars", Publ. Astron. Soc. Japan, **75** (2023) S217, YITP-21-48, arXiv:2108.13026 [gr-qc].

4. H. Matsui, S. Mukohyama, & A. Naruko, "DeWitt boundary condition is consistent in Hořava-Lifshitz quantum gravity", Physics Letters B, **833** (2022) 137340, YITP-21-128, arXiv:2111.00665 [gr-qc].

Talks at International Conferences

1. "Spatial gradient expansion approach for generic scalar-tensor theories," Invited, in "Workshop on Gravitation & Cosmology," Hotel alpha-one, Toyama, Japan, November 2022.

2. "Multi-messenger Study of Heavy Dark Matter: A02 Group Status Report," in "FY2022 "What is dark matter? - Comprehensive study of the huge discovery space in dark matter"," KIPMU, Chiba, Japan, March 2023.

3. "Spatial gradient expansion approach for generic scalar-tensor theories," in "Domestic Molecule-type Workshop "Non-linear Nature of Cosmological Perturbations and its Observational Consequences"," YITP, Kyoto, Japan, March 2023.

Invited Seminars (in Japan)

1. "インフレーション宇宙と原始ゆらぎとその評価法,"
   Dept. of Phys., Univ. of Toyama, June 2022.

Takahiro Nishimichi

Journal Papers

1. Y. Park, T. Sunayama, M. Takada, Y. Kobayashi, H. Miyatake, S. More, T. Nishimichi, S. Sugiyama,
   "Cluster cosmology with anisotropic boosts: validation of a novel forward modelling analysis and application on SDSS redMaPPer clusters,"
   Mon. Not. Roy. Astron. Soc. **518** (2023) 5171-5189, YITP-21-160, arXiv:2112.09059 [astro-ph.CO].

2. A. Amon, N. C. Robertson, H. Miyatake, C. Heymans, *et al.*,
   "Consistent lensing and clustering in a low-S8 Universe with BOSS, DES Year 3, HSC Year 1, and KiDS-1000,"
   Mon. Not. Roy. Astron. Soc. **518** (2023) 477-503, arXiv:2202.07440 [astro-ph.CO].

3. H. Miyatake, S. Sugiyama, M. Takada, T. Nishimichi, *et al.*,
   "Cosmological inference from an emulator based halo model. II. Joint analysis of galaxy-galaxy weak lensing and galaxy clustering from HSC-Y1 and SDSS,"
   Phys. Rev. D **106** (2022) 083520, YITP-21-125, arXiv:2111.02419 [astro-ph.CO].

4. H. Miyatake, Y. Kobayashi, M. Takada, T. Nishimichi, *et al.*,
   "Cosmological inference from an emulator based halo model. I. Validation tests with HSC and SDSS mock catalogs,"
   Phys. Rev. D **106** (2022) 083519, YITP-21-03, arXiv:2101.00113 [astro-ph.CO].

5. R. Terasawa, R. Takahashi, T. Nishimichi, M. Takada,
   "Separate universe approach to evaluate nonlinear matter power spectrum for nonflat ΛCDM model,"
   Phys. Rev. D **106** (2022) 083504, YITP-22-49, arXiv:2205.10339 [astro-ph.CO].

6. C. Mahony, A. Dvornik, A. Mead, C. Heymans, M. Asgari, *et al.*,
   "The halo model with beyond-linear halo bias: unbiasing cosmological constraints from galaxy-galaxy lensing and clustering,"
   Mon. Not. Roy. Astron. Soc. **515** (2022) 2612-2623, YITP-22-07, arXiv:2202.01790 [astro-ph.CO].

7. O. H. E. Philcox, M. M. Ivanov, G. Cabass, M. Simonović, M. Zaldarriaga, T. Nishimichi,
   "Cosmology with the redshift-space galaxy bispectrum monopole at one-loop order,"
   Phys. Rev. D **106** (2022) 043530, YITP-22-60, arXiv:2206.02800 [astro-ph.CO].

8. S. Sugiyama, M. Takada, H. Miyatake, T. Nishimichi, *et al.*,
   "HSC Year 1 cosmology results with the minimal bias method: HSC × BOSS galaxy-galaxy weak lensing and BOSS galaxy clustering,"
   Phys. Rev. D **105** (2022) 123537, YITP-21-126, arXiv:2111.10966 [astro-ph.CO].

9. A. Taruya, T. Nishimichi, D. Jeong,
   "Grid-based calculations of redshift-space matter fluctuations from perturbation theory: UV sensitivity and convergence at the field level,"
   Phys. Rev. D **105** (2022) 103507, YITP-21-95, arXiv:2109.06734 [astro-ph.CO].

10. Y. Kobayashi, T. Nishimichi, M. Takada, H. Miyatake,
    "Full-shape cosmology analysis of the SDSS-III BOSS galaxy power spectrum using an emulator-based halo model: A 5% determination of σ_8,"
    Phys. Rev. D **105** (2022) 083517, YITP-21-112, arXiv:2110.06969 [astro-ph.CO].

Talks at International Conferences

1. "The Dark Quest project for cosmological emulation," Invited,
   in "Challenges and Innovations in Computational Astrophysics IV (ChalCA-IV),"
   Online,
   November 2022.

2. “Dark Quest II project and halo shapes,” in “New Frontiers in Cosmology with the Intrinsic Alignments of Galaxies,” YITP, Kyoto University, Kyoto, Japan, December 2022.

3. “The Dark Quest project for cosmological emulation,” in “The 9th East Asian Numerical Astrophysics Meeting (EANAM9),” Tenbusu Naha, Okinawa, Japan, September 2022.

Invited Seminars (Overseas)

1. “Cosmological inference based on emulators,” IAU-IAA Astrostatistics and Astroinformatics seminars, Online, March 2023.

2. “Simulation-based large-scale structure cosmology: Emulation and beyond,” Academia Sinica Institute of Astronomy and Astrophysics, Taipei, Taiwan, February 2023.

Akira Ohnishi

Journal Papers

1. Y. Namekawa, K. Kashiwa, H. Matsuda, A. Ohnishi, & H. Takase, “Improving efficiency of the path optimization method for a gauge theory", Phys. Rev. D, **107** (2023) 034509, YITP-22-97, arXiv:2210.05402 [hep-lat].

2. Y. Nara, A. Jinno, K. Murase, & A. Ohnishi, “Directed flow of Λ in high-energy heavy-ion collisions and Λ potential in dense nuclear matter", Phys. Rev. C, **106** (2022) 044902, YITP-22-81, arXiv:2208.01297 [nucl-th].

3. H. Wolter, M. Colonna, D. Cozma, P. Danielewicz, C. M. Ko, R. Kumar, A. Ono, M.Y. B. Tsang, et al., “Transport model comparison studies of intermediate-energy heavy-ion collisions", Progress in Particle and Nuclear Physics, **125** (2022) 103962, arXiv:2202.06672 [nucl-th].

4. H. Matsuda, T. Kunihiro, A. Ohnishi, & T. T. Takahashi, “Entropy production in a longitudinally expanding Yang-Mills field with use of the Husimi function: semiclassical approximation", PTEP, **2022** (2022) 7, 073D02, arXiv:2203.02859 [hep-ph].

5. Y. Kamiya, T. Hyodo, & A. Ohnishi, “Femtoscopic study on D D^* and D D^* interactions for T_{cc} and X(3872)", European Physical Journal A, **58** (2022) 131, YITP-22-26, arXiv:2203.13814 [hep-ph].

Books and Proceedings

1. Y. Namekawa, K. Kashiwa, H. Matsuda, A. Ohnishi, & H. Takase, “Exploration of Efficient Neural Network for Path Optimization Method”, PoS LATTICE2022 (2023) 026.

2. A. Ohnishi, Y. Kamiya, & T. Hyodo, “Charmed Hadron Interactions and Correlation Functions”, Acta Phys. Polon. Supp. **16** (2023) 1, 86.

3. A. Ohnishi, A. Jinno, K. Murase, & Y. Nara, “Directed flow of Λ from heavy-ion collisions and hyperon puzzle of neutron stars", European Physical Journal Web of Conferences, **271** (2022) 08006, YITP-22-122, arXiv:2210.17202 [nucl-th].

4. A. Ohnishi, “Hadrons, Quark-Gluon Plasma, and Neutron Stars”, Handbook of Nuclear Physics (Springer), 2023.

Talks at International Conferences

1. “Femtoscopy for flavored hadron-hadron interactions,” in “The 59th International Winter Meeting on Nuclear Physics,” Bormio, Italy, January 2023.

2. “Femtoscopic study of flavored hadron interactions and ExHIC,” in “Exotics and Exotic Phenomena in

Heavy Ion Collisions," APCTP, Pohang, Korea/Online,
September 29 - October 1, 2022.

3. "Directed flow of Λ from heavy-ion collisions and hyperon puzzle of neutron stars," in "14th Conference on Hypernuclear and Strange Particle Physics," Prague, Czech Republic,
June 27 - July 1, 2022.

4. "Directed flow of Λ from heavy-ion collisions and hyperon puzzle of neutron stars," in YIQPS long-term workshop on "Mean-field and Cluster Dynamics in Nuclear Systems 2022", YITP, Kyoto, Japan,
May 9 - June 17, 2022.

5. "Charmed hadron interactions and correlation functions,"
in "Quark Matter 2022," Online/Krakow, Poland,
April 2022.

Invited Seminars (Overseas)

1. "Exploring hadron interactions and bound states with femtoscopy in heavy-ion collisions,"
in "On-line seminar series IV on "RHIC Beam Energy Scan": Theory and Experiment," Online,
June 2022.

Invited Seminars (in Japan)

1. "Femtoscopy for Hadron-Hadron Interaction,"
Heavy-Ion Pub #37, Osaka University, December 2022 (in Japanese).

Nobuyuki Okuma

Journal Papers

1. N. Okuma and T. Mizoguchi,
"Relationship between two-particle topology and fractional Chern insulator"
Phys. Rev. Research **5** (2023), 013112 (14 pages).

Talks at International Conferences

1. "Topological aspects of non-Hermitian skin effects", October 2022 ("Pan-Pacific Workshop on Topology and Correlation in Exotic Materials", French Polynesia).

Invited Seminars (in Japan)

1. "Topological aspects of non-Hermitian physics", Online, June 2022 (RIKEN iTHEMS Quantum Matter Seminar, Zoom).

2. "Topological aspects of non-Hermitian physics", March 2023 (Kawaguchi Group seminar, Nagoya).

Yoko Oya

Books and Proceedings

1. Y. Oya,
"A Few Tens au Scale Physical and Chemical Structures Around Young Low-Mass Protostars,"
Springer, ISBN: 978-981-19-1707-3 (2022)

Talks at International Conferences

1. "Chemical Differentiation and its Relation with the Physical Structures in Disk-Forming Regions: This and the Next Decade," Invited,
in "Symposium on Next Generation Astrochemistry," The University of Tokyo, Tokyo, Japan,
November 2022.

2. "Chemical Diagnostics for Tracing the Physical Structures in Disk-Forming Regions of Young Low-Mass Protostellar Sources," Invited,
in "East Asia ALMA Science Workshop 2023," The Great Roots Forestry Spa Resort, New Taipei City, Taiwan,
February 2023.

3. "ALMA Large Project FAUST (Fifty AU STudy of the chemistry in the disk/envelope system of Solar-like protostars)," Invited (review talk),
in "Astronomical Society of Japan Annual Meeting 2023a," Rikyo University, Tokyo, Japan,
March 2023 (in Japanese).

Invited Seminars (in Japan)

1. "Starry Sky Looking Up with Large Radio Telescopes: What is the Origin of the Solar System?,"
   Yukawa Institute for Theoretical Physics, Kyoto University, January 2023 (in Japanese).

Naoki Sasakura

Journal Papers

1. N. Sasakura,
   "Signed distributions of real tensor eigenvectors of Gaussian tensor model via a four-fermi theory",
   Physics Letters B, **836** (2023) 137618, YITP-22-85, arXiv:2208.08837 [hep-th].

2. N. Sasakura,
   "Real tensor eigenvalue/vector distributions of the Gaussian tensor model via a four-fermi theory",
   PTEP, **2023** (2023) 1, 013A02, arXiv:2209.07032 [hep-th].

3. N. Sasakura,
   "Splitting-merging transitions in tensor-vectors systems in exact large-N limits",
   Phys. Rev. D, **106** (2022) 126016, YITP-22-66, arXiv:2206.12017 [hep-th].

4. T. Kawano & N. Sasakura,
   "Emergence of Lie group symmetric classical spacetimes in the canonical tensor model",
   PTEP, **2022** (2022) 4, 043A01, YITP-21-99, arXiv:2109.09896 [hep-th].

Talks at International Conferences

1. "Splitting-merging transitions in a tensor-vectors system in exact large N limits,"
   in "The 34th International Colloquium on Group Theoretical Methods in Physics," Strasbourg, France,
   July 2022.

2. "Emergence of macroscopic spacetimes in a certain large-N limit of canonical tensor model," Invited,
   in "Quantum Gravity and Random Geometry," Institut Henri Poincare, Paris, France, January 2023.

Invited Seminars (in Japan)

1. "Tensor eigenvalue/vector distributions via field theoretical methods,"
   Tensor Journal Club, France, March 2023.

Masatoshi Sato

Journal Papers

1. T. Inoue, M. Sakamoto, M. Sato, I. Ueba, " Correspondence of topological classification between quantum graph extra dimension and topological matter, "
   Phys. Rev. D **106**, 085006 (2022).

2. N. Okuma, M. Sato, "Non-Hermitian topological phenomena: A review, "
   Annual Review of Condensed Matter Physics, **14**, 83 (2023).

3. S. Ohyama, K. Shiozaki, and M, Sato, "Generalized Thouless pumps in (1+1)-dimensional interacting fermionic systems, "
   Phys. Rev. B **106**, 165115 (2022).

Talks at International Conferences

1. " Bulk-boundary correspondence in point-gap topological phases, " Invited,
   in International Workshop " Condensed Matter Solitons (Virtual) " organized by the PCS IBS in Daejeon, South Korea,
   June 29 (2022).

2. " Majorana fermions and pairing symmetries in topological superconductors, " Invited,
   in 13th International Conference on Materials and Mechanism of Superconductivity and High-temperature Superconductors, Vancouver Conference Center, Canada,
   July 18 (2022).

3. " Majorana fermions and pairing symmetries in topological superconductors, " Plenary,
   in 29th International Conference on Low Temperature Physics, Sapporo, Japan,
   August 18, (2022).

4. “ Majorana fermions and pairing symmetries in topological superconductors, ” Invited,
in IBS-APCTP Conference on Advances in the Physics of Topological and Correlated Matter, Daejeon, South Korea,
September 19 (2022).

5. “ Extrinsic topology of Floquet anomalous boundary states in quantum walks,” Invited, in The 2022 Pan-Pacific Workshop on Topology and Correlations in Exotic Materials conference, Gump Station, Moorea, Tahiti,
Oct. 26 (2022).

6. “Dissipation induced topological superconductivity, ” Invited,
in JSPS-EPSRC-CNR/SPIN-IBS Core-To-Core Workshop OSS 2022, Unconventional transport in superconducting and magnetic systems with spin-orbit coupling. Vietri sul Mare, Italy,
Nov. 15 (2022).

7. “Topological Phases in Open Systems,” Invited,
in 60th Meeting of the Biophysical Society of Japan, Hakodate,
Sep. 28 (2022).

Invited Seminars (Overseas)

1. “ Topological Aspects of non-Hermitian skin effects (online), ” Invited
in Seminar at InQubator for Quantum Simulation at the University of Washington, Dec. 07 (2022).

2. “ Majorana fermions and pairing symmetries in topological superconductors (online), ” Invited
in Frontiers of Condensed Matter Physics, FCMP Columbia 2023 Spring online lectures by leading CMP-AMO researchers,
March 20 (2023).

Invited Seminars (in Japan)

1. “トポロジカル超伝導体入門(オンライン), ”in 物性若手夏の学校, August 3-5, 2022.

2. “ 新しいトポロジカル相：開放系トポロジカル相, ” in 第 426 回物性談話会, 名古屋大学大学院工学研究科, October 7, 2022.

3. “ トポロジカル超伝導,”in 物性研短期研究会「固体におけるエニオンと分数粒子研究の最前線」東京大学物性研究所, February 13, 2023.

Masaru Shibata

Journal Papers

1. K. Hayashi, S. Fujibayashi, K. Kiuchi, K. Kyutoku, Y. Sekiguchi, and M. Shibata, “General-relativistic neutrino-radiation magnetohydrodynamics simulation of seconds-long black hole-neutron star mergers” Phys. Rev. D **106** (2022) 023008 (26 pages).

2. K. Kawaguchi, S. Fujibayashi, K. Hotokezaka, M. Shibata, and S. Wanajo, “Electromagnetic counterparts of binary neutron star mergers leading to a strongly magnetized long-lived remnant neutron star” Astrophys. J. **933** (2022) 22 (18 pages).

3. R. Dudi, A. Adhikari, B. Bruegmann, T. Dietrich, K. Hayashi, K. Kawaguchi, K. Kiuchi, K. Kyutoku, M. Shibata, and W. Tichy, “Investigating GW190425 with numerical-relativity simulations” Phys. Rev. D **106** (2022) 084039 (11 pages).

4. E. Zhou, K. Kiuchi, M. Shibata, A. Tsokaros, and K. Uryu, “Evolution of equal mass binary bare quark stars in full general relativity: could a supramassive merger remnant experience prompt collapse?” Phys. Rev. D **106** (2022) 103030 (7 pages).

5. K. Kiuchi, L. E. Held, Y. Sekiguchi, and M. Shibata, “Implementation of advanced Riemann solvers in a neutrino-radiation magnetohydrodynamics code in numerical relativity and its application to a binary neutron star merger” Phys. Rev. D **106** (2022) 124041 (41 pages).

6. S. Fujibayashi, K. Kiuchi, S. Wanajo, K. Kyutoku, Y. Sekiguchi, and M. Shibata,

"Comprehensive study on the mass ejection and nucleosynthesis in the binary neutron star mergers leaving short-lived massive neutron stars" Astrophys. J. **942** (2023) 39 (20 pages).

7. K. Kawaguchi, S. Fujibayashi, and M. Shibata, "A Monte-Carlo based relativistic radiation hydrodynamics code with a higher-order scheme" Phys. Rev. D **107** (2023) 023026 (25 pages).

8. M. Shibata and D. Traykova, "Properties of scalar wave emission in a scalar-tensor theory of gravity with kinetic screening" Phys. Rev. D **107** (2023) 044068 (14 pages).

9. A. T.-L Lam, M. Shibata, and K. Kiuchi, "Numerical-relativity simulation for tidal disruption of white dwarfs by a supermassive black hole" Phys. Rev. D **107** (2023) 043033 (12 pages).

10. M. Pais, T. Piran, Y. Lyubarski, K. Kiuchi. and M. Shibata, "The collimation of relativistic jets in post-neutron star binary merger simulations" Astrophys. J. Lett. **946** (2023) L9 (9 pages).

Talks at International Conferences

1. "Neutron-star merger simulation: Our latest progress," Invited,
in "Binary neutron stars workshop," Univ of Rochester, USA (online),
June 6 2022.

2. "Predictive power of numerical relativity," Invited,
in "9th EANAM,", Okinawa (online), September 28 2022.

3. "Hydrodynamics modeling of neutron-star mergers" Invited,
in "GSI workshop: Remnants of neutron-star mergers", Darmstadt, Germany, October 17 2022.

4. "Modeling neutron-star mergers by long-term numerical-relativity simulation" Invited,
in "Workshop on kilonovae", Badhonnef, Germany, November 28 2022.

Invited Seminars (Overseas)

1. "Predictive power of numerical relativity," CENTRA, Lisboa, Portugal, May 26, 2022.

2. "Predictive power of numerical relativity," Leiden Obs., Leiden, Netherland, March 2, 2023.

Ken Shiozaki

Journal Papers

1. S. Ohyama, K. Shiozaki, & M. Sato,
"Generalized Thouless pumps in (1 +1)-dimensional interacting fermionic systems",
Phys. Rev. B, **106** (2022) 165115, YITP-22-43, arXiv:2206.01110 [cond-mat.str-el].

2. K. Shiozaki, M. Sato, & K. Gomi,
"Atiyah-Hirzebruch spectral sequence in band topology: General formalism and topological invariants for 230 space groups",
Phys. Rev. B, **106** (2022) 165103.

3. K. Shiozaki,
"Adiabatic cycles of quantum spin systems",
Phys. Rev. B, **106** (2022) 125108, YITP-21-121, arXiv:2110.10665 [cond-mat.str-el].

4. K. Kawabata, K. Shiozaki, & S. Ryu,
"Many-body topology of non-Hermitian systems",
Phys. Rev. B, **105** (2022) 165137, arXiv:2202.02548 [cond-mat.str-el].

Talks at International Conferences

1. "Adiabatic Cycles in Quantum Spin Systems," Invited,
in "Geometrical aspects of topological phases of matter: spatial symmetries, fractons and beyond," Stony Brook University, New York, US,
May 2022.

Shigeki Sugimoto

Journal Papers

1. M. Fujita, Y. Hatta, S. Sugimoto and T. Ueda,
"Nucleon D-term in holographic quantum chromodynamics,"
PTEP 2022 (2022) 9, 093B06 (33 pages), YITP-22-09, arXiv:2206.06578 [hep-th].

Talks at International Conferences

1. "Nuclear D-term in holographic QCD," Invited talk in APCTP focus program "QCD and gauge/gravity duality," Asia Pacific Center for Theoretical Physics, Pohang, Korea, November 2022.

Invited Seminars (Overseas)

1. "Anomaly and Superconnection,"
Crete Center for Theoretical Phycis, Greece, December 2022. (Online)

Invited Seminars (in Japan)

1. "Gravitational form factor for Baryons in holographic QCD,"
Department of Physics, Kyoto Univ, June 2022 (in Japanese).

2. "Nuclear D-term in holographic QCD,"
Reserach Center for Nuclear Physics, Osaka Univ, March 2023 (RCNP colloquium, in English).

Tadashi Takayanagi

Journal Papers

1. H. Kanda, M. Sato, Y. Suzuki, T. Takayanagi, & Z. Wei,
"AdS/BCFT with brane-localized scalar field",
JHEP, **2023** (2023) 3, 105, YITP-23-07, arXiv:2302.03895 [hep-th].

2. K. Doi, J. Harper, A. Mollabashi, T. Takayanagi, & Y. Taki,
"Pseudoentropy in dS /CFT and Timelike Entanglement Entropy",
Phys. Rev. Lett., **130** (2023) 031601, YITP-22-121, arXiv:2210.09457 [hep-th].

3. N. Ogawa, T. Takayanagi, T. Tsuda, & T. Waki,
"Wedge holography in flat space and celestial holography",
Phys. Rev. D, **107** (2023) 026001, YITP-22-71, arXiv:2207.06735 [hep-th].

4. T. Takayanagi & T. Tsuda,
"Free fermion cyclic/symmetric orbifold CFTs and entanglement entropy",
JHEP, **2022** (2022) 12, 4, YITP-22-91, arXiv:2209.00206 [hep-th].

5. K. Izumi, T. Shiromizu, K. Suzuki, T. Takayanagi, & N. Tanahashi,
"Brane dynamics of holographic BCFTs",
JHEP, **2022** (2022) 10, 50, YITP-22-56, arXiv:2205.15500 [hep-th].

6. I. Akal, T. Kawamoto, S.-M. Ruan, T. Takayanagi, & Z. Wei,
"Zoo of holographic moving mirrors",
JHEP, **2022** (2022) 8, 296, YITP-22-42, arXiv:2205.02663 [hep-th].

7. Y. Hikida, T. Nishioka, T. Takayanagi, & Y. Taki,
"Holography in de Sitter Space via Chern-Simons Gauge Theory",
Phys. Rev. Lett., **129** (2022) 041601, YITP-21-105, arXiv:2110.03197 [hep-th].

8. I. Akal, T. Kawamoto, S.-M. Ruan, T. Takayanagi, & Z. Wei,
"Page curve under final state projection",
Phys. Rev. D, **105** (2022) 126026, YITP-21-158, arXiv:2112.08433 [hep-th].

9. K. Suzuki & T. Takayanagi,
"BCFT and Islands in two dimensions",
JHEP, **2022** (2022) 6, 95, YITP-22-14, arXiv:2202.08462 [hep-th].

10. Y. Hikida, T. Nishioka, T. Takayanagi, & Y. Taki,
"CFT duals of three-dimensional de Sitter gravity",
JHEP, **2022** (2022) 5, 129, YITP-22-20, arXiv:2203.02852 [hep-th].

11. T. Kawamoto, T. Mori, Y. Suzuki, T. Takayanagi, & T. Ugajin,
"Holographic local operator quenches in BCFTs",
JHEP, **2022** (2022) 5, 60, YITP-22-21, arXiv:2203.03851 [hep-th].

Talks at International Conferences

1. "Holography with End-of-the-World Branes and Quantum Entanglement", Invited, in "Quantum Information, Dynamics and Ergodicity: From Many-Body Systems to Gravity", Colloquium talk, PCTS, Princeton, USA, February 2023.
2. "Emergent holographic spacetimes from quantum information", Invited, in 13th Conference on Physics of Particles and Fields, the Physics Society of Iran, Iran, February 2023.
3. "Wedge Holography in Flat Space and Celestial Holography", Invited, in Taiwan String Workshop 2022, NTU, Taiwan, December 2023.
4. "Pseudo Entropy and AdS(dS)/CFT", Invited, in 2022 Simons Collaboration on It from Qubit Annual Meeting, Simons Foundation, New York, USA, ,December, 2022.
5. "A New Generalization of Entanglement Entropy", Invited, in 2nd Symposium on Trans-scale Quantum Science, U. of Tokyo, November, 2022.
6. "CFT Dual of dS3 and Pseudo Entropy", Invited, in HirosiFest, Kavli IPMU, U. .of Tokyo, October, 2022.
7. "CFT Dual of De Sitter Space in Three Dimensions", Invited, in Quantum Information in QFT and AdS/CFT-III, online (IITGN, IITH), India, September, 2022.
8. "Wedge Holography in Flat Space and Celestial Holography", Invited, in Workshop on celestial amplitudes and flat space holography, Corfu (online), Greece, September, 2022.
9. "Holographic Moving Mirrors", Invited, in Fundamental aspects of gravity, Imperial College London, August, 2022.
10. "Moving Mirror and Page Curve", Invited, in Current challenges in black hole physics and cosmology, YITP, Kyoto, June, 2022.
11. "CFT Dual of De Sitter Gravity in Three Dimensions", Invited, in Informational Architecture of Spacetime Workshop, OIST, Okinawa, May, 2022.

Invited Seminars (Overseas)

1. "Holography with End-of-the-World Branes and Quantum Entanglement", Invited, in "Eastern Hemisphere Colloquium of Geometry and Physics", IBS-CGP, Korea March 2023.

Yuya Tanizaki

Journal Papers

1. M. Honda, E. Itou, & Y. Tanizaki, “DMRG study of the higher-charge Schwinger model and its ’t Hooft anomaly", JHEP, **2022** (2022) 11, 141, YITP-22-100, arXiv:2210.04237 [hep-lat].
2. Y. Tanizaki & M. Ünsal, “Semiclassics with ’t Hooft flux background for QCD with 2-index quarks", JHEP, **2022** (2022) 8, 38, YITP-22-45, arXiv:2205.11339 [hep-th].
3. Y. Hayashi & Y. Tanizaki, “Non-invertible self-duality defects of Cardy-Rabinovici model and mixed gravitational anomaly", JHEP, **2022** (2022) 8, 36, YITP-22-12, arXiv:2204.07440 [hep-th].
4. Y. Tanizaki & M. Ünsal, “Center vortex and confinement in Yang-Mills theory and QCD with anomaly-preserving compactifications", PTEP, **2022** (2022) 4, 04A108, YITP-22-04, arXiv:2201.06166 [hep-th].

5. K. Fukushima, T. Shimazaki, & Y. Tanizaki, "Exploring the θ-vacuum structure in the functional renormalization group approach",
JHEP, **2022** (2022) 4, 40, YITP-22-05, arXiv:2202.00375 [hep-th].

Books and Proceedings

1. Y. Hayashi & Y. Tanizaki,
"Non-invertible self-duality defects of Cardy-Rabinovici model and mixed gravitational anomaly",
European Physical Journal Web of Conferences, **274** (2022) 02010.
2. Y. Tanizaki,
"Generalization of global symmetry and its applications to QCD-related physics",
Handbook of Nuclear Physics (Springer), 2023.

Talks at International Conferences

1. "Noninvertible Solitonic Symmetry", Invited, in "Topological Phases of Matter: From Low to High Energy", Institute of Nuclear Theory (INT), University of Washington, USA, 6-10 March 2023.
2. "Nonperturbative Anomaly and Functional RG", Invinited, in "Functional Renormalization Group at RIKEN 2023: From condensed matter and particle physics to gravity", RIKEN, Saitama, Japan, 21-22 Jan. 2023.
3. "Symmetries in QFT and applications", Invinited, in "KEK Theory Workshop 2022", KEK (online), Japan, 6-9 Dec. 2022.
4. "Semiclassical description of confinement via center vortices and anomaly-preserving T^2 compactifications", Invited, in "15th Quark Confinement and Hadron Spectrum", University of Stavanger, Norway, 1-6 Aug. 2022.
5. "Semiclassical description of confinement via center vortices and anomaly-preserving T^2 compactifications", Invinited, in "Continuous Advances in QCD 2022", FTPI, University of Minnesota, MN, USA, 12-14 May 2022.
6. "Semiclassical analysis of 2-index QCD using 't Hooft flux", in "Paths to QFT 2022", Durham University, UK, 15-20 Aug. 2022.
7. "Generalization of global symmetries in QFTs", Invited, in "CREST tutorial workshop" (online), Japan, 27-29 Mar. 2023.

Invited Seminars (Overseas)

1. "Generalized symmetries in QFTs and algebraic structure of solitonic symmetry", Theory Group Meeting, Scuola Normale Superiore, Pisa, Italy (online), 24 Nov. 2022.
2. "Non-invertible self-duality symmetry of Cardy-Rabinovici model and the mixed gravitational anomaly", Department of Mathematical Sciences, Durham University, UK, 12 Aug. 2022.
3. "Semiclassical description of confinement via center vortices and anomaly-preserving T^2 compactifications", North Carolina State University, NC, USA, 19 May 2022.
4. "Semiclassical description of confinement via center vortices and anomaly-preserving T^2 compactifications", KIAS String Seminars, Korea Institute for Advanced Study (online), Korea, 4 Apr 2022.

Invited Seminars (in Japan)

1. "Noninvertible solitonic symmetry", Elementary Particle Theory Group, Kyushu University, Fukuoka, Japan, 17 Mar. 2023.
2. "Introduction to noinvertible symmetry in QFTs", Keio University, Kanagawa, Japan (online), 13 Jan. 2023.
3. "Semiclassics with 't Hooft flux and confinement of 4d gauge theories via center vortices", Elementary Particle Theory Group, Kyushu University, Fukuoka, Japan, 26 Dec. 2022.
4. "Generalized Symmetry in QFTs and its Applications", Niigata University, Niigata, Japan, 17 Nov. 2022.
5. "Generalized symmetries in QFTs", Colloquim at Shinshu Center for Mathematical Sciences, Shinshu University (online), Japan, 25 Oct. 2022.

6. “Semiclassics with ’t Hooft flux and confinement of 4d gauge theories via center vortices", CREST Research Seminar on "Theoretical studies of topological phases of matter" (online), Japan, 10 June 2022.

Atsushi Taruya

Journal Papers

1. Y. Himemoto, A. Nishizawa and A. Taruya,
   “Distinguishing a stochastic gravitational-wave signal from correlated noise with joint parameter estimation: Fisher analysis for ground-based detectors,”
   Phys. Rev. D **107** (2023) 064055 (17 pages), YITP-22-164, arXiv:2302.03336 [astro-ph.CO].

2. T. Okumura and A. Taruya,
   “First Constraints on Growth Rate from Redshift-space Ellipticity Correlations of SDSS Galaxies at $0.16 < z < 0.70$,”
   Astrophy. J. Lett. **945** (2023) L30 (7 pages), YITP-23-03, arXiv:2301.06273 [astro-ph.CO].

3. S. Saga, T. Okumura, A. Taruya and T. Inoue,
   “Relativistic distortions in galaxy density-ellipticity correlations: gravitational redshift and peculiar velocity effects,”
   Mon. Not. Royal. Astron. Soc. **518** (2023) p.4976-4990, YITP-22-69, arXiv:2207.03454 [astro-ph.CO].

4. A. Taruya and S. Saga,
   “Analytical approach to the core-halo structure of fuzzy dark matter,”
   Phys. Rev. D **106** (2022) 103532 (25 pages), YITP-22-82, arXiv:2208.06562 [astro-ph.CO].

5. T. Okumura and A. Taruya,
   “Tightening geometric and dynamical constraints on dark energy and gravity: Galaxy clustering, intrinsic alignment, and kinetic Sunyaev-Zel’dovich effect,”
   Phys. Rev. D **106** (2022) 043523 (24 pages), YITP-21-113, arXiv:2110.11127 [astro-ph.CO].

6. S. Saga, A. Taruya and S. Colombi,
   “Cold dark matter protohalo structure around collapse: Lagrangian cosmological perturbation theory versus Vlasov simulations,”
   Astron. Astrophys. **664** (2022) A3 (31 pages), YITP-21-93, arXiv:2111.08836 [astro-ph.CO].

7. A. Taruya, T. Nishimichi and D. Jeong,
   “Grid-based calculations of redshift-space matter fluctuations from perturbation theory: UV sensitivity and convergence at the field level,”
   Phys. Rev. D **105** (2022) 103507 (27 pages), YITP-21-95, arXiv:2109.06734 [astro-ph.CO].

8. Y. Rasera, M-A. Breton, P.-S. Corasaniti, J. Allingham, F. Roy, V. Reverdy, T. Pellegrin, S. Saga, A. Taruya, S. Agarwal and S. Anselmi,
   “The RayGalGroupSims cosmological simulation suite for the study of relativistic effects: An application to lensing-matter clustering statistics,”
   Astron. Astrophys. **661** (2022) A90 (24 pages), arXiv:2111.08745 [astro-ph.CO].

9. S. Saga, A. Taruya, Y. Rasera and M-A. Breton,
   “Detectability of the gravitational redshift effect from the asymmetric galaxy clustering,”
   Mon. Not. Royal. Astron. Soc. **511** (2022) p.2732-2754, YITP-21-93, arXiv:2109.06012 [astro-ph.CO].

Books and Proceedings

1. Y. Suto (Ed.), R. Uchiyama, T. Matsubara, J. Yokoyama, A. Taruya, K. Hotokezaka and M. Takada,
   “20th century science collection: The Birth of Modern Cosmology (in Japanese),”
   Iwanami Bunko (Blue 951-1) (268 pages), ISBN: 9784003395110.

Invited Seminars (Overseas)

1. “Precision cosmology beyond ΛCDM: analytical approach meets data-driven cosmology,” (online)

Academia Sinica Institute of Astronomy and Astrophysics, Taiwan, April 2022.

Invited Seminars (in Japan)

1. "The past, Present and Future of the Expanding Universe,"
   Terada-nishi elementary school, November 2022 (in Japanese, Hands-on Class to Tickle Children's Intellectual Curiosity by Kyoto prefecture).

2. "The past, Present and Future of the Expanding Universe,"
   Taga elementary school, December 2022 (in Japanese, Hands-on Class to Tickle Children's Intellectual Curiosity by Kyoto prefecture).

Rina Tazai

Journal Papers

1. R. Tazai, S. Matsubara, Y. Yamakawa, S. Onari, H. Kontani,
   "Rigorous formalism for unconventional symmetry breaking in Fermi liquid theory and its application to nematicity in FeSe,"
   Phys. Rev. B. **107** (2023) (16 pages), arXiv:2205.02280.

Talks at International Conferences

1. "Permanent Loop Current in Strongly Correlated Electron Systems based on fRG" Invited,
   in "FRG workshop at RIKEN" RIKEN, January 2023.

Seiji Terashima

Journal Papers

1. S. Sugishita & S. Terashima,
   "Rindler bulk reconstruction and subregion duality in AdS/CFT",
   JHEP, **2022** (2022) 11, 41, YITP-22-70, arXiv:2207.06455 [hep-th].

2. Y. Suzuki & S. Terashima,
   "On the dynamics in the AdS/BCFT correspondence",
   JHEP, **2022** (2022) 9, 103, YITP-22-50, arXiv:2205.10600 [hep-th].

Invited Seminars (in Japan)

1. "On the dynamics in the AdS/BCFT correspondence,"
   Dept. of Phys., Nagoya Univ., June 2022.

Keisuke Totsuka

Journal Papers

1. K. Totsuka,
   "Ferromagnetism in the SU(N) Kondo lattice model: SU(N) double exchange and supersymmetry",
   Phys. Rev. A, **107** (2023) 033317, arXiv:2208.05899 [cond-mat.str-el].

2. R. Masui & K. Totsuka,
   "Electric and magnetic properties of higher-spin Kondo-Heisenberg models at strong coupling",
   Phys. Rev. B, **106** (2022) 014411, arXiv:2202.03708 [cond-mat.str-el].

Books and Proceedings

1. K. Totsuka,
   "Majorana excitations in quantum spin liquids, (in Japanese)"
   Suuri Kagaku **4** (2022) 50 (8 pages).

Talks at International Conferences

1. "SU(N) Kondo lattice model ... ferromagnetism and supersymmetry," Invited,
   in "SU(N) physics in condensed matter and cold atoms," online,
   May 2022.

2.2.3 Publications and Talks by Hakubi Researchers, Research Fellows and Graduate Students (April 2022– March 2023)

Masaya Amo

Journal Papers

1. M. Amo, K. Izumi, Y. Tomikawa, H. Yoshino and T. Shiromizu,
   "Asymptotic behavior of null geodesics near future null infinity. III. Photons towards inward directions,"
   Phys.Rev.D **106** (2022) 8, 084007 (11 pages), Phys.Rev.D **107** (2023) 2, 029902 (erratum) (2 pages), YITP-22-75, arXiv:2208.00822 [gr-qc].

Books and Proceedings

1. M. Amo and T. Shiromizu,
   "ブラックホールと我々の宇宙　２つの地平の物語," in Japanese, translation of "A Tale of Two Horizons " by Edgar Shaghoulian,
   NIKKEI SCIENCE, issue of Dec. 2022.

Talks at International Conferences

1. "Generalization of the photon sphere referring to null infinity,"
   in "The 31st Workshop on General Relativity and Gravitation in Japan(JGRG31)," Tokyo, Japan,
   October 2022.

2. "Asymptotic behavior of null geodesics near future null infinity,"
   in "23rd International Conference on General Relativity and Gravitation (GR23)," Online,
   July 2022.

Invited Seminars (in Japan)

1. "null 測地線の無限遠近傍の漸近的振る舞い,"
   The Kobayashi-Maskawa Institute for the Origin of Particles and the Universe (KMI), Nagoya Univ., December 2022 (KMI 主催分野横断セミナー).

Amit Kumar Chatterjee

Journal Papers

1. A. K. Chatterjee and H. Hayakawa,
   "Multi species asymmetric simple exclusion process with impurity activated flips",
   SciPost Phys., **14** (2023) 016 (40 pages), arXiv:2205.03082 [cond-mat.stat-mech].

Talks at International Conferences

1. "Multi species asymmetric simple exclusion process with impurity activated flips,"
   Contributed,
   in "APS March Meeting," Las Vegas, Nevada, United States,
   March 2023.

2. "Multi species asymmetric simple exclusion process with impurity activated flips,"
   Contributed, Online,
   in "The 15th Asia Pacific Physics Conference," Korean Physical Society, Seoul, South Korea,
   August 2022.

Invited Seminars (Overseas)

1. "Multi species ASEP with impurities: matrix product state, negative mobility and clustering,"
   Indian Institute of Science, Bengaluru, India, February 2023.

Invited Seminars (in Japan)

1. "Multi species asymmetric simple exclusion process with impurity activated flips,"
   Online,
   Sasamoto lab, Condensed Matter Theory Group, Tokyo Institute of Technology, July 2022.

Dongwook Ghim

Journal Papers

1. S. Franco, D. Ghim and R.-K. , Seong "Brane Brick Models for the Sasaki-Einstein 7-manifolds $Y^{p,k}(\mathbb{CP}^1 \times \mathbb{CP}^1)$ and $Y^{p,k}(\mathbb{CP}^2)$,"
JHEP **03** (2023) 050 (37 pages), YITP-22-139, arXiv:2212.02523 [hep-th].

Mohammad Ali Gorji

Journal Papers

1. K. Aoki, M. A. Gorji, S. Mukohyama and K. Takahashi, "Effective field theory of gravitating continuum: solids, fluids, and aether unified," JCAP **08**, 072 (2022) doi:10.1088/1475-7516/2022/08/072 [arXiv:2204.06672 [hep-th]].
2. M. A. Gorji, T. Matsuda and S. Mukohyama, "Cosmological memory effect in scalar-tensor theories," Phys. Rev. D **106**, no.2, 024013 (2022) doi:10.1103/PhysRevD.106.024013 [arXiv:2204.09182 [gr-qc]].

Invited Seminars (Overseas)

1. "Small-scale cosmological perturbations: gravitational waves and dark matter,"
University of Barcelona, Spain, January 2023.

Invited Seminars (in Japan)

1. "EFT of Cosmological Perturbations: The role of vector fields,"
Waseda University, June 2022.
2. "EFT of Cosmological Perturbations: The role of vector fields,"
Summer CAS-JSPS Workshop in Cosmology, Gravitation, and Particle Physics, August 2022.

Hamid Hamidani

Journal Papers

1. H. Hamidani, and K. Ioka,
"Cocoon breakout and escape from the ejecta of neutron star mergers,"
Mon. Not. R. Astron. Soc. **520** (2023) 1111 (18 pages), arXiv: 2210.00814 [astro-ph.HE].

Talks at International Conferences

1. "The Cocoon Emission in GW170817-like Events,"
in "Symposium of the innovative area, Gravitational Wave Physics and Astronomy: Genesis," Kyoto University, Kyoto, Japan,
April 2022.

Invited Seminars (Overseas)

1. "Cocoon Emission in Neutron Star Mergers,"
Goethe University at Frankfurt, online, Germany, February 2023.

Invited Seminars (in Japan)

1. "The Cocoon Breakout & Emission In BNS Mergers,"
Dept. of Phys., Univ. of Hiroshima, online, June 2022.

Kota Hayashi

Journal Papers

1. K. Hayashi, S. Fujibayashi, K. Kiuchi, K. Kyutoku, Y. Sekiguchi, and M. Shibata,
"General-relativistic neutrino-radiation magnetohydrodynamic simulation of seconds-long black hole-neutron star mergers,"
Phys. Rev. D **106** (2022) 023008 (26 pages), arXiv:2111.04621 [astro-ph.HE].
2. R. Dudi, A. Adhikari, B. Brügmann, T. Dietrich, K. Hayashi, K. Kawaguchi, K. Kiuchi, K. Kyutoku, M., Shibata, and W. Tichy,
"Investigating GW190425 with numerical-relativity simulations,"
Phys. Rev. D **106** (2022) 084039 (11 pages), arXiv:2109.04063 [astro-ph.HE]

Talks at International Conferences

1. "Seconds-long simulation of black hole-neutron star mergers: Effects of magnetic field orientation, strength, and equatorial plane symmetry,"

in “The 9th East Asian Numerical Astrophysics Meeting (EANAM9),” Okinawa, Japan,
September 2022.

2. “General-relativistic neutrino-radiation magnetohydrodynamics simulations of black hole-neutron star mergers for seconds,”
in “Symposium on Gravitational wave physics and astronomy: Genesis,” Kyoto, Japan,
April 2022.

Invited Seminars (in Japan)

1. “Black Hole-Neutron Star Mergers - Universal Evolution Picture Obtained by Seconds-long Numerical-Relativistic Neutrino-Radiation Magnetohydrodynamics Simulation-,”
Astronomical Institute, Tohoku Univ., February 2023.

2. “General-relativistic neutrino-radiation magnetohydrodynamic simulation of seconds-long black hole-neutron star mergers,”
High Energy Astrophysics Group, Waseda Univ. (Online), October 2022.

3. “General-relativistic neutrino-radiation magnetohydrodynamic simulation of seconds-long black hole-neutron star mergers,”
Theoretical Astrophysics Group, Osaka Univ. (Online), July 2022.

Yui Hayashi

Journal Papers

1. Y. Hayashi & Y. Tanizaki,
“Non-invertible self-duality defects of Cardy-Rabinovici model and mixed gravitational anomaly",
JHEP, **2022** (2022) 8, 36, YITP-22-12, arXiv:2204.07440 [hep-th].

Books and Proceedings

1. Y. Hayashi & Y. Tanizaki,
“Non-invertible self-duality defects of Cardy-Rabinovici model and mixed gravitational anomaly",
European Physical Journal Web of Conferences, **274** (2022) 02010.

Talks at International Conferences

1. “Non-invertible self-duality defects of Cardy-Rabinovici model and mixed gravitational anomaly,”
15th Quark Confinement and the Hadron Spectrum, Stavanger, Norway, August 2022.

2. “ Non-invertible self-duality defects of Cardy-Rabinovici model and mixed gravitational anomaly ” ,
39th Lattice International Symposium on Lattice Field Theory, Bonn, Germany, August 2022.

Chen-Hsuan Hsu

Journal Papers

1. C.-H. Hsu, D. Loss and J. Klinovaja,
“General scatterings and electronic states in the quantum-wire network of moiré systems,”
(12 pages) arXiv:2303.00759 [cond-mat.mes-hall] (March).

Norita Kawanaka

Journal Papers

1. A. Tanikawa, K. Hattori, N. Kawanaka, T. Kinugawa, M. Shikauchi and D. Tsuna,
“Search for a Black Hole Binary in Gaia DR3 Astrometric Binary Stars with Spectroscopic Data”,
Astrophys. J. **946** (2023) 79 (11 pages), YITP-22-166, arXiv:2209.05632 [astro-ph.SR].

2. M. Shikauchi, D. Tsuna, A. Tanikawa and N. Kawanaka,
“Spatial and Binary Parameter Distributions of Black Hole Binaries in the Milky Way Detectable with Gaia”,
YITP-23-06, arXiv:2301.07207 [astro-ph.GA].

Invited Seminars (in Japan)

1. “Origin of Galactic Cosmic-Rays”, Kyoto University, October 2022 (Workshop “Civilization, Environment, Solar System, and Galaxy Connected by Cosmic-Rays”, in Japanese).

2. “Theoretical Model of a Hyper Accretion Flow”, Institute of Cosmic-Ray Research, University of Tokyo, November 2022 (Workshop “Diversity of the Universe Probed by High Energy Astrophysical Phenomena”, in Japanese).

Kazutaka Kimura

Journal Papers

1. K. Kimura, T. Hosokawa, K. Sugimura and H. Fukushima, “3D Radiation-Hydrodynamic Simulations Resolving Interior of Rapidly Accreting Primordial Protostar,” ApJ. in press, arXiv:2303.12100, [astro-ph].

Hiroki Matsui

Journal Papers

1. H. Matsui, S. Mukohyama, & A. Naruko, “No smooth spacetime in Lorentzian quantum cosmology and trans-Planckian physics", Phys. Rev. D, **107** (2023) 043511, YITP-22-133, arXiv:2211.05306 [gr-qc].

2. P. Martens, H. Matsui, & S. Mukohyama, “DeWitt wave function in Hořava-Lifshitz cosmology with tensor perturbation", JCAP, **2022** (2022) 11, 031, YITP-22-52, arXiv:2205.11746 [gr-qc].

3. H. Matsui, S. Mukohyama, & A. Naruko, “DeWitt boundary condition is consistent in Hořava-Lifshitz quantum gravity", Physics Letters B, **833** (2022) 137340, YITP-21-128, arXiv:2111.00665 [gr-qc].

4. H. Matsui, “Spacetime instability and quantum gravity as low energy effective field theory", General Relativity and Gravitation, **54** (2022) 123, arXiv:1901.08785 [hep-th].

Talks at International Conferences

1. “No Smooth Beginning for The Universe and Trans-Planckian Physics,” Plenary, in “KEK Theory Workshop 2022,” Tsukuba, Ibaraki, Japan, December 2022.

2. “DeWitt boundary condition is consistent in Hořava-Lifshitz quantum gravity,” Plenary, in “The 31th Workshop on General Relativity and Gravitation,” Online, Japan, October 2022.

Ryota Mizuno

Talks at International Conferences

1. “A novel impurity solver in dynamical mean field theory: Iterative perturbation theory combined with the parquet equations,” Poster, in “13th International Conference on Materials and Mechanisms of Superconductivity & High Temperature Superconductors,” Vancouver, Canada, July 2022.

2. “Development of efficient methods in dynamical mean field theory based on the characteristics of the frequency dependence of the local vertex ,” Poster, in “29th International Conference on LOW TEMPERATURE PHYSICS,” Sapporo, Japan, August 2022.

Ali Mollabashi

Journal Papers

1. K. Doi, J. Harper, A. Mollabashi, T. Takayanagi and Y. Taki, ‘Timelike entanglement entropy,” JHEP **05** (2023), 052 [arXiv:2302.11695 [hep-th]].

2. K. Doi, J. Harper, A. Mollabashi, T. Takayanagi, & Y. Taki, “Pseudoentropy in dS /CFT and Timelike Entanglement Entropy",

Phys. Rev. Lett., **130** (2023) 031601, YITP-22-121, arXiv:2210.09457 [hep-th].

3. K. Goto, A. Mollabashi, M. Nozaki, K. Tamaoka, & M. T. Tan,
"Information scrambling versus quantum revival through the lens of operator entanglement",
JHEP, **2022** (2022) 6, 100, YITP-21-147, arXiv:2112.00802 [hep-th].

4. M. R. M. Mozaffar & A. Mollabashi,
"Time scaling of entanglement in integrable scale-invariant theories",
Physical Review Research, **4** (2022) L022010, arXiv:2106.14700 [hep-th].

Talks at International Conferences

1. "Time scaling of entanglement in integrable scale-invariant theories," Frontiers of HolographicDuality-4, Steklov Mathematical Institute, Moscow, 14 Dec. 2022 (online).

Invited Seminars (Overseas)

1. "Time-like Entanglement Entropy", School of Physics, Institute for Research in Fundamental Sciences, Tehran, Feb. 28, 2023 (online, in Persian).

Invited Seminars (in Japan)

1. "Time scaling of entanglement in integrable scale-invariant theories", Yukawa Institute for Theoretical Physics, Kyoto Univ., Oct. 28, 2022.

Kotaro Murakami

Journal Papers

1. D. Suenaga, K. Murakami, E. Itou and K. Iida,
"Probing the hadron mass spectrum in dense two-color QCD with the linear sigma model,"
Phys. Rev. D **107**, no.5, 054001 (2023) (16 pages), YITP-22-127, arXiv:2211.01789 [hep-ph].

Books and Proceedings

1. K. Murakami, D. Suenaga, K. Iida and E. Itou,
"Measurement of hadron masses in 2-color finite density QCD,"
PoS **LATTICE2022**, 154 (2023) (9 pages), YITP-22-146 arXiv:2211.13472 [hep-lat].

Talks at International Conferences

1. "Studies on baryon resonances from lattice QCD," Invited,
in "Third International Workshop on the Extension Project for the J-PARC Hadron Experimental Facility (3rd J-PARC HEF-ex WS)", J-PARC, 14-16 March 2023.

2. "Studies on baryon resonances from meson-baryon scatterings in lattice QCD," Invited,
in "International workshop on Hadron physics with kaon beam and related topics", online, 3-4 October 2022 (Invited talk).

3. "Measurement of hadron masses in 2-color finite density QCD",
in "The 39th International Symposium on Lattice Field Theory (Lattice 2022)", Bonn, Germany, 8-13 August 2022.

Invited Seminars (in Japan)

1. "Lattice QCD studies on baryon resonances from meson-baryon scatterings,"
Dept. of Phys., Kyushu Univ., January 2023 (in Japanese).

2. "Lattice QCD studies on baryon resonances from meson-baryon scatterings,"
Dept. of Phys., Tokyo Institute of Technology, November 2022 (in Japanese).

3. "Lattice QCD studies on baryon resonances from meson-baryon scatterings,"
Institute for Theoretical Physics, Kanazawa Univ., November 2022 (in Japanese).

4. "Lattice QCD studies on baryon resonances from meson-baryon scatterings,"
Dept. of Phys., Nagoya Univ., November 2022.

Kengo Shimada

Journal Papers

1. Y. Hidaka, S. Iso & K. Shimada,
"Entanglement generation and decoherence in a two-qubit system mediated by relativistic quantum field",
Phys. Rev. D, **107** (2023) 8, 085003, arXiv:2211.09441 [quanta-ph].

Kazufumi Takahashi

Journal Papers

1. M. Minamitsuji, K. Takahashi, S. Tsujikawa,
"Linear stability of black holes in shift-symmetric Horndeski theories with a time-independent scalar field,"
Phys. Rev. D **105** (2022) 104001 (20 pages), YITP-22-06, arXiv:2201.09687 [gr-qc].

2. A. De Felice, S. Mukohyama, K. Takahashi,
"Avoidance of Strong Coupling in General Relativity Solutions with a Timelike Scalar Profile in a Class of Ghost-Free Scalar-Tensor Theories,"
Phys. Rev. Lett. **129** (2022) 031103 (6 pages), YITP-22-25, arXiv:2204.02032 [gr-qc].

3. K. Nakashi, M. Kimura, H. Motohashi, K. Takahashi,
"Black hole perturbations in higher-order scalar-tensor theories: initial value problem and dynamical stability,"
Class. Quant. Grav. **39** (2022) 175003 (44 pages), YITP-22-13, arXiv:2204.05054 [gr-qc].

4. K. Aoki, M. A. Gorji, S. Mukohyama, K. Takahashi,
"Effective Field Theory of Gravitating Continuum: Solids, Fluids, and Aether Unified,"
JCAP **08** (2022) 072 (48 pages), YITP-22-38, arXiv:2204.06672 [hep-th].

5. M. Minamitsuji, K. Takahashi, S. Tsujikawa,
"Linear stability of black holes with static scalar hair in full Horndeski theories: generic instabilities and surviving models,"
Phys. Rev. D **106** (2022) 044003 (27 pages), YITP-22-41, arXiv:2204.13837 [gr-qc].

6. S. Mukohyama, K. Takahashi, V. Yingcharoenrat,
"Generalized Regge-Wheeler Equation from Effective Field Theory of Black Hole Perturbations with a Timelike Scalar Profile,"
JCAP **10** (2022) 050 (23 pages), YITP-22-78, arXiv:2208.02943 [gr-qc].

7. K. Takahashi, M. Minamitsuji, H. Motohashi,
"Generalized disformal Horndeski theories: cosmological perturbations and consistent matter coupling,"
PTEP **2023** (2023) 013E01 (29 pages), YITP-22-89, arXiv:2209.02176 [gr-qc].

8. A. De Felice, S. Mukohyama, K. Takahashi,
"Approximately stealth black hole in higher-order scalar-tensor theories,"
JCAP **03** (2023) 050 (16 pages), YITP-22-161, arXiv:2212.13031 [gr-qc].

9. K. Takahashi, R. Kimura, H. Motohashi,
"Consistency of matter coupling in modified gravity,"
Phys. Rev. D **107** (2023) 044018 (10 pages), YITP-22-134, arXiv:2212.13391 [gr-qc].

Talks at International Conferences

1. "Built-in scordatura in U-DHOST,"
in "Gravity: Current challenges in black hole physics and cosmology," YITP, Kyoto University
June 2022.

2. "Generalized disformal Horndeski theories: cosmological perturbations and consistent matter coupling,"
in "The 31st Workshop on General Relativity and Gravitation in Japan," the University of Tokyo,
October 2022.

Invited Seminars (in Japan)

1. "Invertible disformal transformations with higher derivatives,"
Rikkyo University, May 2022.

2. "Invertible disformal transformations with higher derivatives,"
Tokyo Institute of Technology, June 2022.

Ryo Takakura

Talks at International Conferences

1. "Overviews of generalized probabilistic theories and specific results for regular polygon theories," Invited,
in "2022 Japan-China International Conference on matrix theory with applications"
Ritsumeikan University, Kusatsu, Japan
Dec. 2022.

Nathan Touroux

Invited Seminars(in Japan)

1. "An efficient implicit integrator for relativistic hydrodynamics,"
Dept. of Phys., Univ. of Osaka, July 2022 (Nuclear-Theory meetings).

2. "An efficient implicit integrator for relativistic hydrodynamics,"
Dept. of Phys., Univ. of Kyoto, November 2022 (Quark-Hadron seminar).

Hiromasa Watanabe

Journal Papers

1. Y. Asano, G. Ishiki, T. Matsumoto, S. Shimasaki, H. Watanabe,
"On the existence of the NS5-brane limit of the plane wave matrix model,"
PTEP **2023** (2023) 4, 043B01, YITP-22-103, arXiv:2211.13716 [hep-th].

2. M. Hanada, H. Watanabe,
"Partial deconfinement: a brief overview,"
Eur.Phys.J.ST **03** (2023) 184, YITP-22-118, arXiv:2210.11216 [hep-th].

3. S. Pateloudis, G. Bergner, M. Hanada, E. Rinaldi, A. Schäfer, P. Vranas, H. Watanabe, N. Bodendorfer,
"Precision test of gauge/gravity duality in D0-brane matrix model at low temperature,"
JHEP **03** (2023) 184, YITP-22-103, arXiv:2210.04881 [hep-th].

4. G. Bergner, N. Bodendorfer, M. Hanada, S. Pateloudis, E. Rinaldi, A. Schäfer, P. Vranas, H. Watanabe,
"Confinement/deconfinement transition in the D0-brane matrix model – A signature of M-theory?,"
JHEP **05** (2022) 096, arXiv:2110.01312 [hep-th].

Books and Proceedings

1. K. Sato, H. Watanabe and T. Yamazaki,
"Calculation of the pion charge radius from an improved model-independent method,"
PoS LATTICE2022, YITP-22-149, arXiv:2212.00207 [hep-lat].

Talks at International Conferences

1. "Partial deconfinement in gauge theory," Invited,
in "Kobe Workshop on Cosmology and Fundamental Physics 2023," Kobe University, Hyogo, Japan,
March 2023.

2. "Partial deconfinement in large N gauge theory," Invited,
in "NONPERTURBATIVE AND NUMERICAL APPROACHES TO QUANTUM GRAVITY, STRING THEORY AND HOLOGRAPHY," ICTS-TIFR (via online), India,
August 2022.

Invited Seminars (in Japan)

1. "Partial deconfinement in large N gauge theory,"
RCNP theory seminar, Research Center for Nuclear Physics, Osaka University, June 2022.

Takashi Yoshida

Journal Papers

1. K. Takahashi, T. Takiwaki, & T. Yoshida, “Monotonicity of the Cores of Massive Stars", Astrophys. J., **945** (2023) 19, arXiv:2302.03197 [astro-ph.SR].

2. C. Nagele, H. Umeda, K. Takahashi, T. Yoshida, & K. Sumiyoshi, “Stability analysis of supermassive primordial stars: a new mass range for general relativistic instability supernovae", Mon. Not. R. Astron. Soc., **517** (2022) 1584-1600, arXiv:2205.10493 [astro-ph.SR].

2.2.4 Publications and Talks by Affiliate Professors and Affiliate Associate Professors (April 2022– March 2023)

Yshai Avishai

Journal Papers

1. Y. Avishai & Y. B. Band,
"Graphene bilayer and trilayer Moiré lattice with Rashba spin-orbit coupling,"
Phys. Rev. B **106** (2022) L041406, arXiv:2109.14308 [cond-mat.mes-hall].

Books and Proceedings

1. Y. Avishai & Y. B. Band,
"Aharonov-Bohm and Aharonov-Casher effects in condensed matter physics,"
in Encyclopedia of condensed matter physics 2nd Edition (2023).

Talks at International Conferences

1. "Graphene bilayer and trilayer Moiré lattice with Rashba spin-orbit coupling and an in-plane magnetic field," Invited,
in "Une conférence en l'honneur de Gilles Montambaux," LPS Orsay, France,
June 2022.

Shinji Hirano

Journal Papers

1. O. Bergman and S. Hirano,
"The holography of duality in $\mathcal{N} = 4$ Super-Yang-Mills theory,"
JHEP **11** (2022) 069 (30 pages), YITP-22-09, arXiv:2208.09396 [hep-th] (August).

Talks at International Conferences

1. "The holography of duality in $\mathcal{N} = 4$ Super-Yang-Mills theory," Invited (Online),
in "Integrability, Duality and Related Topic," Asia Pacific Center for Theoretical Physics, Pohang, South Korea,
November 2022.

Invited Seminars (in Japan)

1. "The holography of duality in $\mathcal{N} = 4$ Super-Yang-Mills theory," (Online)
Dept. of Phys., Kyoto Univ., October 2022 (in Japanese).

2. "The holography of duality in $\mathcal{N} = 4$ Super-Yang-Mills theory," (Online)
Dept. of Phys., Tokyo Institute of Technology, November 2022 (in English).

Kenta Kiuchi

Journal Papers

1. M. Pais, T. Piran, Y. Lyubarsky, K. Kiuchi, and M. Shibata,
"The collimation of relativistic jets in post-neutron star binary merger simulations,"
Astrophys. J., **946** (2023) L9

2. A. T. Lam, M. Shibata and K. Kiuchi,
"Numerical-relativity simulation for tidal disruption of white dwarfs by a supermassive black hole,"
Phys. Rev. D., **107** (2023) 043033

3. K. Kiuchi, L. E. Held, Y. Sekiguchi and M. Shibata,
"Implementation of advanced Riemann solvers in a neutrino-radiation magnetohydrodynamics code in numerical relativity and its application to a binary neutron star merger,"
Phys. Rev. D., **106** (2022) 124041

4. R. Dudi, A. Adhikari, B. Bruegmann, T. Dietrich, K. Hayashi, K. Kawaguchi, K. Kiuchi, K. Kyutoku, M. Shibata, and W. Tichy,
"Investigating GW190425 with numerical-relativity simulations,"
Phys. Rev. D., **106** (2022) 084039

5. K. Hayashi, S. Fujibayashi, K. Kiuchi, K. Kyutoku, Y. Sekiguchi, and M. Shibata,
"General-relativistic neutrino-radiation

magnetohydrodynamics simulation of seconds-long black hole-neutron star mergers,"
Phys. Rev. D., **106** (2022) 023008

6. E. Zhou, K. Kiuchi, M. Shibata, A. Tsokaros, and K. Uryu,
"Evolution of equal mass binary bare quark stars in full general relativity: could a supramassive merger remnant experience prompt collapse?,"
Phys. Rev. D., **106** (2022) 103030

Talks at International Conferences

1. "Self-consistent picture of the mass ejection from a one second-long binary neutron star merger leaving a short-lived remnant in general-relativistic neutrino-radiation magnetohydrodynamic simulation," Invited,
in "Unsolved Problems in Astrophysics and Cosmology," The Hebrew Univ. Jerusalem, Israel,
December 2022.

2. "Constrainig the Nuelcar Equation of State from Compact Binary Mergers," Invited,
in "CRC2022," Holderness, NH, USA,
August 2022.

3. "Waveform challenge and numerical Relativity," Invited panelist,
in "The 8th PAX Meeting," MIT, Boston, USA,
August 2022.

4. "Self-consitent modeling of compact binary mergers in numerical relativity," Invited,
in "Frontiers in Numerical Relativity," Jena Univ., Jena, Germany,
June 2022.

Hideo Kodama

Books and Proceedings

1. Hideo Kodama (edit, Japanese translation and explanation),
"Albert Einstein, General Relativity Theory" (in Japanese)
Iwanami bunko, 2023, 235 pages, ISBN978-4-00-339343-7.

Taichiro Kugo

Journal Papers

1. T. Kugo, R. Nakayama and N. Ohta, "Covariant BRST quantization of unimodular gravity. II. Formulation with a vector antighost," Phys. Rev. D **105** (2022) 106006 (13 pages), YITP-22-16, arXiv:2202.10740 [hep-th].

Kei-ichi Maeda

Journal Papers

1. K. Maeda, and S. Panpanich,
"Cuscuta-Galileon cosmology: Dynamics, gravitational constants, and the Hubble constant,"
DOI: 10.1103/PhysRevD.105.104022.
Phys. Rev. D **105** (2022) 104022 (25 pages), arXiv:2202.04908[gr-qc].

2. A. De Felice, K. Maeda, S. Mukohyama, and M.C. Pookkillath,
"Comparison of two theories of Type-IIa minimally modified gravity,"
DOI: 10.1103/PhysRevD.106.024028.
Phys. Rev. D **106** (2022) 024028 (20 pages), arXiv:2204.08294 [gr-qc].

3. K. Kohri, and K. Maeda,
"A possible solution to the helium anomaly of EMPRESS VIII by cuscuton gravity theory,"
DOI: 10.1093/ptep/ptac114.
PTEP **091** (2022) E01 (7pages), arXiv:2206.11257 [gr-qc].

4. S. Panpanich, and K. Maeda,
"Cosmological dynamics of Cuscuta-Galileon gravity,"
DOI: 10.1140/epjc/s10052-023-11356-7
Eur. Phys. J. C **83** (2023) 240 (11 pages), arXiv:2109.12288[gr-qc].

5. A. De Felice, K. Maeda, S. Mukohyama, and M.C. Pookkillath,
"Gravitational collapse and formation of a black hole in a type II minimally modified gravity theory,"
DOI: 10.1088/1475-7516/2023/03/030.

JCAP **03** (2023) 030 (22 pages), arXiv:2211.14760[gr-qc].

6. K. Maeda, P. Gupta, and H. Okawa, "Dynamics of Binary System around Supermassive Black Hole," Phys. Rev. D (2023, to be published) (34 pages), arXiv:2303.16553 [gr-qc].

Books and Proceedings

1. Kei-ichi Maeda and Makoto Tanabe "Special Theory of Relativity studied by Exercises,"(in Japanese) ISBN978-4-7819-1541-8 (SAIENSU-SHA Co.,Ltd., 2022) (168 pages).

Invited Seminars (Overseas)

1. "Relativistic Dynamical System and Gravitational Waves," Albert Einstein Institute, Potsdam, Germany, October 2022.
2. "Relativistic Dynamical System and Gravitational Waves," Astroparticle and Cosmology Laborator, Paris, France, November 2022.
3. "Relativistic Dynamical System and Gravitational Waves," Center for Astrophysics and Gravitation/ Instituto Superior Técnico, Lisbon, Portugal, November 2022.

Misao Sasaki

Journal Papers

1. T. Harada, K. Kohri, M. Sasaki, T. Terada and C. M. Yoo, "Threshold of primordial black hole formation against velocity dispersion in matter-dominated era," JCAP **02**, 038 (2023) [arXiv:2211.13950 [astro-ph.CO]].
2. T. Matsubara and M. Sasaki, "Non-Gaussianity effects on the primordial black hole abundance for sharply-peaked primordial spectrum," JCAP **10**, 094 (2022) [arXiv:2208.02941 [astro-ph.CO]].
3. Y. F. Cai, X. H. Ma, M. Sasaki, D. G. Wang and Z. Zhou, "Highly non-Gaussian tails and primordial black holes from single-field inflation," JCAP **12**, 034 (2022) [arXiv:2207.11910 [astro-ph.CO]].
4. S. Kanno and M. Sasaki, "Graviton non-gaussianity in α-vacuum," JHEP **08**, 210 (2022) [arXiv:2206.03667 [hep-th]].
5. P. Chen, M. Sasaki, D. h. Yeom and J. Yoon, "Resolving information loss paradox with Euclidean path integral," Int. J. Mod. Phys. D **31**, no.14, 2242001 (2022) [arXiv:2205.08320 [gr-qc]].
6. Y. F. Cai, X. H. Ma, M. Sasaki, D. G. Wang and Z. Zhou, "One small step for an inflaton, one giant leap for inflation: A novel non-Gaussian tail and primordial black holes," Phys. Lett. B **834**, 137461 (2022) [arXiv:2112.13836 [astro-ph.CO]].
7. C. M. Yoo, T. Harada, S. Hirano, H. Okawa and M. Sasaki, "Primordial black hole formation from massless scalar isocurvature," Phys. Rev. D **105**, no.10, 103538 (2022) [arXiv:2112.12335 [gr-qc]].
8. M. Sasaki, V. Takhistov, V. Vardanyan and Y. l. Zhang, "Establishing the Nonprimordial Origin of Black Hole–Neutron Star Mergers," Astrophys. J. **931**, no.1, 2 (2022) [arXiv:2110.09509 [astro-ph.CO]].
9. S. Passaglia and M. Sasaki, "Primordial black holes from CDM isocurvature perturbations," Phys. Rev. D **105**, no.10, 103530 (2022) [arXiv:2109.12824 [astro-ph.CO]].

Talks at International Conferences

1. "Primordial Black Holes from Inflation," Invited, in "Symposium on Gravitational wave physics and astronomy: Genesis," Kyoto (online), April 2022

2. “Resolving information loss paradox with Euclidean path integral approach,”Invited,
in “String Theory, Gravity and Cosmology (SGC 2022)” Seoul, Korea (online), June 2022

3. “Primordial Black Holes from Inflation,”Invited,
in “Gravity: Current challenges in black hole physics and cosmology,” Kyoto (online), June 2022

4. “Inflation and cosmological perturbations,” Invited lectures,
in “V institute of space sciences summer school: Modified gravities, inflation and primordial perturbations: theory and computing” Barcelona, Spain (online), July 2022

5. “Primordial Black Holes from Inflation,”Invited,
in “31st Texas Symposium on Relativistic Astrophysics,” Prague, Chechia, September 2022

6. “Primordial Black Holes from Inflation,”Invited,
in “9th Korea-Japan workshop on dark energy,” Seoul, Korea (online), Novemver 2022

7. “Primordial Black Holes from Inflation,”Invited,
in “Messengers of the very early universe: Gravitational Waves and Primordial Black Holes,” Padova, Italy, December 2022

8. “Primoridal Black Holes from Non-Perturbative Non-Gaussian Tails,”Invited,
in “Testing Gravity 2023”, Vancouver, Canada, January 2023

9. “Inflation and Gravitational Wave Cosmology,”Invited,
in “Interdisciplinary Science Conference in Okinawa (ISCO 2023) - Physics and Mathematics meet Medical Science -,” Okinawa, February 2023

Invited Seminars (Overseas)

1. “Primordial Black Holes from Inflation,""
USTC colloquium, Hefei, Chian (online), May 2022

2. “Primordial Black Holes from Inflation,”
APC seminar, Paris, France (online), September 2022

3. “Inflation Breeds Primordial Black Holes,”
ULB Solvay Colloquium, Brussels, Belgium (online), September 2022

4. “Inflation as a farm to grow primordial black holes,”
Higgs Centre Colloquium,” Edinburgh, UK (online), October 2022

5. “Cosmology - the quest for the birth and evolution of the Universe,”
Tongji University Lecture,” Shanghai, China (online), November 2022

6. “Primordial Black Holes from Inflation,”
LMU ASC seminar, Munich, Germany, December 2022

7. “Primordial Black Holes may be Dark Matter of the Universe,”
Padova University Physics Colloquium, Padova, Italy, December 2022

8. “Primordial Black Holes from Inflation,”
LeCosPA seminar, Taipei, Taiwan, March 2023

9. “Primordial Black Holes from Inflation,”
KIAS seminar, Seoul, Korea, March 2023

Invited Seminars (in Japan)

1. “Multiple classical histories as a solution to the black hole information loss paradox,”
KEK seminar, Tsukuba (online), July 2022

Masaki Shigemori

Journal Papers

1. M. Shigemori,
“Superstrata on Orbifolded Backgrounds,”
JHEP **2023** (2023) 099 (35 pages), YITP-22-162, arXiv:2212.13388 [hep-th].

Talks at International Conferences

1. “Fractional modes and superstrata”, Invited, in “Quantum extreme universe from quantum information”, Yukawa Institute for Theoretical Physics, Kyoto, Japan, September 2022.

Yudai Suwa

Journal Papers

1. K. Kashiyama, R. Sawada, and Y. Suwa, “X-Raying the Birth of Binary Neutron Stars and Neutron Star-Black Hole Binaries,” Astrophys. J. **935** (2022) 86, arXiv:2204.08851 [astro-ph.HE].
2. Y. Suwa, A. Harada, M. Harada, Y. Koshio, M. Mori, F. Nakanishi, K. Nakazato, K. Sumiyoshi, and R. A. Wendell, “Observing Supernova Neutrino Light Curves with Super-Kamiokande. III. Extraction of Mass and Radius of Neutron Stars from Synthetic Data,” Astrophys. J. **934** (2022) 15, arXiv:2204.08363 [astro-ph.HE].
3. A. Tanikawa, G. Chiaki, T. Kinugawa, Y. Suwa, and N. Tominaga, “Can Population III stars be major origins of both merging binary black holes and extremely metal poor stars?,” PASJ **74** (2022) 521, arXiv:2202.00230 [astro-ph.HE].

Talks at International Conferences

1. “Probing mass and radius of neutron stars with supernova neutrinos,” in “Symposium on Gravitational wave physics and astronomy: Genesis,” Online, April 2022.
2. “Unraveling the Supernova Interior with Super-Kamiokande,” Invited, in “Unraveling the History of the Universe and Matter Evolution with Underground Physics,” Tokyo University of Science, Japan, June 2022.

Invited Seminars (in Japan)

1. “Supernova and nuclear physics,” Dept. of Phys., Tohoku University, October 2022 (11th SNP School 2022).

Takashi Yamakawa

Books and Proceedings

1. T. Morimae and T. Yamakawa, “Proofs of quantumness from trapdoor permutations,” ITCS 2023, YITP-22-87, arXiv:2208.12390.
2. T. Morimae and T. Yamakawa, “Quantum commitments and signatures without one-way functions,” CRYPTO 2022, YITP-21-155, arXiv:2112.06369.
3. T. Hiroka, T. Morimae, R. Nishimaki and T. Yamakawa, “Certified everlasting zero-knowledge proof for QMA,” CRYPTO 2022, YITP-21-155, arXiv:2112.06369.
4. T. Morimae and T. Yamakawa, “Classically verifiable NIZK for QMA with preprocessing,” ASIACRYPT 2022, YITP-21-10, arXiv:2102.09149.

Talks at International Conferences

1. M. Hhan, T. Morimae, T. Yamakawa, “From the Hardness of Detecting Superpositions to Cryptography: Quantum Public Key Encryption and Commitments", QCW 2022, QIP2023
2. T. Morimae and T. Yamakawa, “Proofs of quantumness from trapdoor permutations", QCW 2022
3. T. Hiroka, T. Morimae, R. Nishimaki, and T. Yamakawa, “Certified everlasting zero-knowledge proof for QMA", Qcrypt 2022

4. T. Morimae and T. Yamakawa,
   “Quantum commitments and signatures without one-way functions",
   QCW 2022, QIP 2023
5. T. Hiroka, T. Morimae, R. Nishimaki, and T. Yamakawa,
   “Certified Deletion for Public Key Encryption, Zero-Knowledge, and More",
   QIP 2022 (Short plenary talk)

2.3 Seminars, Colloquia and Lectures

▷ 2022.4.1 — 2023.3.31

4.7 Rui Luo (CSIRO Space and Astronomy and Australia Telescope National Facility), Understanding Fast Radio Bursts statistically and observationally

4.15 Warit Asavanant and Hironari Nagayoshi (University of Tokyo), Practical optical quantum computation on continuous-variable programmable measurement-based quantum computing platform

4.21 Smaranika Banerjee (Tohoku University), Early kilonova from neutron star mergers

4.22 Yui Hayashi (YITP, Kyoto University), Complex singularities of Landau gauge Yang-Mills propagators and their general properties

4.22 Akihiro Miyata (YITP, Kyoto University), A Partially Fine-grained Description of an Evaporating Black Hole with Baby Universes and its Application

4.28 Hirosi Ooguri (California Institute for Technology and Kavli IPMU), Symmetry in QFT and Gravity

5.6 Kanato Goto (YITP, Kyoto University), Dissolving wormholes in the SYK model

5.12 Sho Fujibayashi (Max Planck Institute for Gravitational Physics (Albert-Einstein Institute)), Mass ejection and nucleosynthesis in binary neutron star mergers leaving short-lived massive neutron stars

5.17 Giacomo Pantaleoni (University of Sydney), The Gottesman-Kitaev-Preskill code and the Zak transform

5.19 Ruoyu Liu (School of Astronomy and Space Science, Nanjing University), A multi-zone view of blazar's emission

5.19 Chen-Hsuan Hsu (YITP, Kyoto University), Majorana zero modes in proximitized higher-order topological insulators

5.27 Yoshiki Sato (YITP, Kyoto University), Interpreting the Final State of Monopole-Fermion Scattering

5.27 Yasir Iqbal (Indian Institute of Technology Madras), Quantum Spin Liquid Physics on a novel shuriken lattice based material

6.3 Daiki Suenaga (RIKEN Nishina Center), Heavy-quark spin polarization induced by the Kondo effect in a magnetic field

6.3 Masataka Watanabe (YITP, Kyoto University), Stability analysis of a non-Unitary CFT

6.9 Takahiro Sudoh (Ohio State University), Where are the Galactic PeVatrons?

6.9 Mirian Tsulaia (OIST), Models with interacting massless and massive Higher Spin Fields

6.10-6.14 Naoto Shiraishi (The University of Tokyo), Lecture series: YITP Intensive Lecture ２ "stochastic thermodynamics"

6.13 Naoto Shiraishi (The University of Tokyo), Some recent results on the response and the relaxation in small stochastic systems

6.16 Sébastien Renaux-Petel (Institut Astrophysique de Paris), Cosmological bootstrap in slow motion and the low speed collider

6.17 Yoshiki Uchida (Kyushu University), Geometric Interpretation of Nonlinear Sigma Models and Extension to Systems with Fermions

6.24 Toru Kojo (Tohoku University), Stiffening of matter in quark-hadron continuity

6.24 Satoshi Yamaguchi (Osaka University), Anomaly of subsystem symmetry and anomaly inflow

6.27 Laura Herold (Max-Planck Institute for Astrophysics), Early Dark Energy: a status update and a new constraint using the profile likelihood

7.1 Noriyuki Sogabe (Institute of Modern Physics, Chinese Academy of Sciences), Exploring the criticality of QCD with effective field theory for fluctuating hydrodynamics

7.1 Yui Hayashi (YITP, Kyoto University), Non-invertible self-duality defects of Cardy-Rabinovici model and mixed gravitational anomaly

7.4 Pradipto (YITP, Kyoto University), Dynamics of dense non-Brownian suspensions under impact

7.5 Mainak Mukhopadhyay (Arizona State University), Quantum fields in time and space dependent backgrounds

7.7 Masato Shirasaki (National Astronomical Observatory of Japan), Large-scale structure of the universe probed with weak-lensing effect and deep learing

7.14 Nanae Domoto (Tohoku University), Understanding spectral features of kilonova toward identification of r-process elements

7.15 Ryo Yokokura (KEK), Higher-group global symmetries in axion electrodynamics

7.19-7.22 Kazuya Koyama (Institute of Cosmology and Gravitation, University of Portsmouth), Lecture series: Cosmological tests of gravity

7.21 Kazuya Koyama (Institute of Cosmology and Gravitation, University of Portsmouth), Cosmological tests of gravity

7.22 Yohsuke Takamori (National Institute of Technology, Wakayama College), On bound orbits in non-Schwarzschild potential due to dark matter distribution

7.22 Ryuji Takagi (Nanyang Technological University Singapore), Fundamental limits of quantum error mitigation

7.27 Takeshi Kobayashi (SISSA), Monopoles and Cosmological Magnetic Fields

7.29 Yuya Kusuki (Caltech), Semiclassical Gravity from Averaged Boundaries in two-dimensional BCFTs

8.10 Beni Yoshida (Perimeter Institute), Quantum information theory of holographic scattering

8.18 Noemie Globus (University of California, Santa Cruz (USA)), Powehi, ergomagnetosphere, ejection disc and jet

8.24 Russell Neilson (Drexel University), Dark Matter and Neutrino Physics with Scintillating Bubble Chambers

8.25 Naoko Kurahashi Neilson (Drexel University), Neutrino Astronomy at the Earth's South Pole

9.6 Alexander Vikman (CEICO, Institute of Physics of the Czech Academy of Sciences), Dark Matter via Inverse Phase Transition: going beyond freeze-in with observable Gravitational Waves

9.6 Leonardo Trombetta (CEICO, Institute of Physics of the Czech Academy of Sciences), Constraints on hairy black-holes in shift-symmetric theories

9.7 Evgeni Grishin (Monash University), Dynamical origins of wide binary collisions: from the Solar system to galaxy mergers

9.8 Ryo Terasawa (Kavli IPMU, The University of Tokyo), Fast estimation of power spectrum response to long-wavelength density fluctuation and its applications

9.9 ZELJKA MARIJA BOSNJAK (University of Zagreb), GRB prompt emission modelling and the low-luminosity events

9.16 Haruki Emori (Hokkaido University), Correspondence of weak value and correlation function

9.20 Viraj Nistane (University of Geneva), Cosmological constraints using 21cm Intensity Mapping with HIRAX

10.4-10.6 Yasuyuki Kawahigashi (The Graduate School of Mathematical Sciences, The University of Tokyo), Lecture series: Categorical symmetries of anyons and operator algebras

10.7 Heng-Yu Chen (National Taiwan University), Explicit Late Time Correlation Functions in de Sitter from CFT

10.12 Koji Inui (The University of Tokyo), Inverse design of Hamiltonian with desired properties by using automatic differentiation

10.14 Mohammad Akhond (YITP, Kyoto University), Mass deformations of 3d and 5d long quivers

10.18 Rina Tazai (YITP, Kyoto University), Microscopic origin of quantum phase transitions in kagome metal AV_3Sb_5

10.20 Ricardo Landim (Technical University of Munich), Ruling out Interacting Holographic Dark Energy with Hubble scale cutoff + New constraints on Interacting dark energy

10.21 Dongwook Ghim (YITP, Kyoto University), How to Train Gauge Theories with 2 Supercharges

10.28 Ali Mollabashi (YITP, Kyoto University), Time scaling of entanglement in integrable scale-invariant theories

11.1 Ryo Hanai (YITP, Kyoto University/APCTP), Non-reciprocal many-body physics: phase transitions and frustration physics

11.4 Kenji Kadota (Hangzhou Institute for Advanced Study at University of Chinese Academy of Sciences), Exploration for the dark matter (PBHs, axions) beyond WIMP

11.4 Kengo Shimada (YITP, Kyoto University), Decoherence and complementarity in relativistic quantum measurements

11.7 Justin Feng (University of Lisbon), The Weiss variation in gravitation theory

11.7 Mairi Sakellariadou (King's College London), Hunting for the gravitational-wave background: detection methods and implications for astrophysics, high energy physics and the early Universe

11.8-11.10 Vincent Vennin (ENS Paris), Lecture series: Stochastic methods in inflationary cosmology

11.10 Vincent Vennin (ENS Paris), Quantum diffusion during cosmic inflation

11.10 Alessandra Silvestri (University Leiden), Reconstructed Gravity from Cosmological data

11.11 Stephen Angus (Asia Pacific Center for Theoretical Physics), Perturbations in O(D,D) cosmology

11.11 Pratik Nandy (YITP, Kyoto University), Operator growth in dissipative open quantum systems

11.14 Md Arif Shaikh (Seoul National University), Defining eccentricity for gravitational wave astronomy

11.14 Toshinori Hayashi (The University of Tokyo), Orbital parameter dependence of disruption timescales for hierarchical triple systems

11.16 Takayoshi Sano (Institute of Laser Engineering, Osaka University), Relativistic wave-particle interaction under a strong magnetic field: Similarities between laboratory laser plasmas and astrophysical phenomena Circumstellar Medium

11.18 Akihiko Monnai (Osaka Institute of Technology), Phenomenological aspects of QCD equation of state in nuclear collisions

11.18 Jonathan Edward Harper (YITP, Kyoto University), Perfect Tensor Hyperthreads

11.25 Budhaditya Bhattacharjee (Indian Institute of Science), HKLL for the non-normalisable mode

11.28 Joshua E. Barnes (Institute for Astronomy, University of Hawaii), Mixing in Smooth and N-Body Potentials

12.2 Hiromasa Watanabe (YITP, Kyoto University), Numerical studies of quantum decoherence based on the Lefschetz thimble method

12.16 Motokazu Abe (Kyushu University), Formulation of fractional topological charge in lattice gauge theory

12.19 Arthur jackob PARZYGNAT (Nagoya University), Retrodiction: time-reversal symmetry for quantum channels

12.19-12.19 Joshua E. Barnes (University of Hawaii at Manoa), Lecture series：One-day lecture course on N-body methods

12.20 Alexander Ganz (Jagiellonian University), Minimally Modified Gravity and its Phenomenological Properties

12.23 Yuta Hamada (KEK), Compactness of brane moduli and Swampland

12.27 Shigeo Kimura (Frontier Research Institute for Interdisciplinary Sciences and Astronomical Institute, Tohoku University), Exploring the plasma loading mechanism of radio jets launched from black holes

1.4 José Senovilla (Basque Country University UPV/EHU / YITP, Kyoto University), YITP Colloquium：A very singular theorem, 2020 Physics Nobel prize!

1.6 Shinji Ejiri (Niigata University), Gradient flow, confinement and magnetic monopole in U(1) lattice gauge theory

1.10 Masakiyo Kitazawa (YITP, Kyoto University), YITP Colloquium：Exploring strongly-interacting systems with energy-momentum tensor

1.11 Daisuke Ishima (YITP, Kyoto University), Eigenvalue analysis of amorphous solids consisting of frictional grains under athermal quasistatic shear

1.12 George Zahariade (Institut de Física d'Altes Energies (IFAE), Universitat Autònoma de Barcelona), Quantum formation of topological defects

1.12 Mainak Mukhopadhyay (Pennsylvania State University), Kink-antikink scattering in a quantum vacuum

1.13 Gianluca Colò (Università degli Studi di Milano / YITP, Kyoto University), The nuclear equation of state from the low-energy perspective and the link with nuclear collective motion

1.13 Sussane Reffert (University of Bern), The large charge expansion

1.23 Martin Kliesch (The Hamburg University of Technology), Estimating Pauli noise in quantum error correction

1.23 Chunshan Lin (Jagiellonian University), Sound Speed Resonance: A Novel Mechanism of Matter-Graviton Conversation

2.2 Yu-tin Huang (National Taiwan University), Bounds from bootstrapping quantum gravity

2.7 Koki Nakata (The Japan Atomic Energy Agency Advanced Science Reserach Center), Non-Hermitian Casimir Effect from Magnon Quantum Fields

2.8 Federico Ghimenti (Universite Paris Cite), Speed-up sampling with nonreciprocal interactions : a theoretical, quantitative evaluation

2.9 Alireza Talebian (Institute for Research in fundamental Sciences (IPM)), Pseudo-Scalar Fields in Early Universe

2.10 Nobuyuki Ishibashi (University of Tsukuba), The Fokker-Planck formalism for closed bosonic strings

2.14 Seishi Enomoto (Sun Yat-sen University), Matter-antimatter asymmetric production during preheating

2.14 Masato Yamanaka (Yokohama National University), Reformulation of Lepton Flavor Violating Deep Inelastic Scattering

2.16 Frédéric van Wijland (Université Paris Cité / YITP, Kyoto University), YITP Colloquium：Active matter, or the macroscopic consequences of breaking the arrow of time at the microscopic scale

2.16 Yen-Ting Lin (Academia Sinica Institute of Astronomy and Astrophysics), Recent progress on galaxy-halo connection

2.17 Samuel Begg (Asia Pacific Center for Theoretical Physics (APCTP)), Liouvillian Skin Effect in an Interacting System

2.20-2.22 Masaki Oshikawa (Institute for Solid State Physics, The University of Tokyo), Lecture series: Introductory course on Symmetry Protected Topological Phases

2.21 Mohammad Ali Gorji (Barcelona University), Primary tensor-induced stochastic gravitational waves

2.21 Raul Carballo-Rubio (Southern Denmark University), Towards the notion of a semiclassical relativistic star

2.24 Mikhail Volkov (Institut Denis Poisson, University of Tours), Magnetic monopoles in the electroweak theory and their black hole counterparts

2.27 Rajan Gupta (Los Alamos National Laboratory (LANL)), YITP Colloquium：The nucleon structure and contributions of novel CP violating interactions to the neutron electric dipole moment

2.28 Vicharit Yingcharoenrat (The University of Tokyo), Super-horizon Resonant Magnetogenesis during Inflation

3.7 S. R. Kulkarni (California Institute of Technology), The Far Ultraviolet diffuse background

3.8 Ryohei Seto (Wenzhou Institute, University of Chinese Academy of Sciences), Nonuniform flows of dense suspensions

3.16 Charles Robson (Tampere University), A topological path to the Hawking temperature: astrophysical black holes and analogues

3.20 Gilbert Weinstein (Ariel University), Gravitational Solitons and Complete Ricci Flat Riemannian Manifolds of Infinite Topological Type

2.4 Visitors (April 2022 – March 2023)

Atom-type Visitors

Kamijima, Shoma (A)
The University of Tokyo
2022-05-09 – 2022-07-29
Terasawa, Ryo (A)
The University of Tokyo, Kavli IPMU
2022-08-29 – 2022-09-09
O'Connell, David (E)
Okinawa Institute of Science and Technology
2022-11-07 – 2022-12-07

Visitors

Takada, Masahiro (A)
Kavli IPMU, the University of Tokyo
2022-04-01 – 2022-04-15
Riegler, Robert Max (E)
Harvard Uiversity
2022-04-07 – 2022-04-22
Liu, Jia (A)
Kavli IPMU, the University of Tokyo
2022-04-11 – 2022-04-15
Shirasaki, Masato (A)
NAOJ
2022-04-11 – 2022-04-15
Asavanant, Warit (Q)
University of Tokyo
2022-04-13 – 2022-04-15
Nagayoshi, Hironari (Q)
University of Tokyo
2022-04-13 – 2022-04-15
Chen, Shi (N)
The University of Tokyo
2022-04-13 – 2022-04-20
Banerjee, Smaranika (A)
Tohoku University
2022-04-20 – 2022-04-29
Fujibayashi, Sho (A)
Max Planck Institute for Gravitational Physics (Albert-Einstein Institute)
2022-04-26 – 2022-05-28
Ooguri, Hirosi (E)
California Institute for Technology and Kavli IPMU
2022-04-28 – 2022-04-28
Hiroshima, Nagisa (A)
University of Toyama
2022-05-09 – 2022-05-09
Murase, Kohta (A)
The Pennsylvania State University
2022-05-02 – 2022-09-03
Yamaguchi, Satoshi (E)
Osaka University
2022-05-09 – 2022-08-31
Balog, Janos (E)
Wigner Research Centre for Physics
2022-05-12 – 2022-06-12
Maeda, Kei'ichi (A)
Waseda University
2022-05-16 – 2022-07-15
Pantaleoni, Giacomo (Q)
University of Sydney
2022-05-17 – 2022-05-27
Kumar, Pawan (A)
The University of Texas at Austin
2022-05-25 – 2022-06-20
Iqbal, Yasir (C)
Indian Institute of Technology Madras
2022-05-26 – 2022-05-29
Suenaga, Daiki (N)
RIKEN Nishina Center
2022-06-03 – 2022-06-03
Takahashi, Ryuichi (A)
Hirosaki University
2022-06-05 – 2022-06-07
Tsulaia, Mirian (E)
OIST
2022-06-05 – 2022-06-11
Ono, Seishiro (C)
Univ. of Tokyo
2022-06-06 – 2022-06-17
Ben Achour, Jibril (A)
Arnold Sommerfeld Center for Theoretical Physics - LMU, Munich
2022-06-06 – 2022-06-23
Shimada, Kengo (E)
KEK
2022-06-07 – 2022-06-09
Sudoh, Takahiro (A)
Ohio State University
2022-06-09 – 2022-06-09
Shiraishi, Naoto (C)
The University of Tokyo
2022-06-09 – 2022-06-14
Kawakami, Hiroki (E)
Osaka University
2022-06-10 – 2022-06-10
Takeuchi, Shingo (E)
Duy Tan University
2022-06-10 – 2022-07-18
Tsuna, Daichi (A)
Univ. of Tokyo

2022-06-13 – 2022-06-17
Hasegawa, Atsuya (Q)
University of Tokyo
2022-06-13 – 2022-06-17
Firouzjahi, Hassan (A)
Institute for Research in Fundamental Sciences
2022-06-13 – 2022-07-04
Furuya, Keiichiro (E)
Purdue University
2022-06-13 – 2022-07-15
Heinsdorf, Niclas (C)
Max Planck Institute for Solid State Research
2022-06-15 – 2022-06-20
Fujita, Tomohiro (A)
Waseda University
2022-06-20 – 2022-06-22
Minamitsuji, Masato (A)
Instituto Superior Tecnico, Universidade de Lisboa
2022-06-20 – 2022-07-13
Kojo, Toru (N)
Tohoku University
2022-06-24 – 2022-06-24
Herold, Laura (A)
Max-Planck Institute for Astrphysics
2022-06-24 – 2022-06-27
Nakao, Ken-ichi (A)
Osaka Metropolitan University
2022-06-30 – 2022-06-30
Sogabe, Noriyuki (N)
Institute of Modern Physics, Chinese Academy of Sciences
2022-07-01 – 2022-07-02
Hayasaki, Kimitake (A)
Chungbuk National University
2022-07-01 – 2022-07-23
Kobayashi, Ryohei (C)
University of Maryland
2022-07-03 – 2022-07-30
Ganz, Alexander (A)
Jagiellonian University
2022-07-04 – 2022-12-21
Hiramatsu, Takashi (A)
Rikkyo University
2022-07-09 – 2022-07-12
Horiuchi Shunsaku (A)
Virginia Polytechnic Institute and State University
2022-07-11 – 2022-07-13
Kamada Ayuki (A)
University of Warsaw
2022-07-11 – 2022-07-13
Yin, Wen (A)
Tohoku University
2022-07-11 – 2022-07-13
Yamanaka Masato (A)
YOKOHAMA National University
2022-07-11 – 2022-07-13
Bartusek, James (Q)
University of California, Berkeley
2022-07-11 – 2022-07-15
Domoto, Nanae (A)
Tohoku University
2022-07-11 – 2022-07-15
Ono, Seishiro (C)
The University of Tokyo
2022-07-11 – 2022-07-17
Niebel, Gabiel (E)
Universite de Bourgogne
2022-07-11 – 2022-09-12
Yokokura, Ryo (E)
KEK
2022-07-14 – 2022-07-16
Takamori, Yohsuke (A)
National Institute of Technology, Wakayama College
2022-07-21 – 2022-07-22
Takagi, Ryuji (Q)
Nanyang Technological University Singapore
2022-07-22 – 2022-07-22
Kobayashi, Takeshi (A)
International School for Advanced Studies (SISSA)
2022-07-24 – 2022-07-29
Yokokura, Ryo (N)
KEK
2022-07-25 – 2022-07-28
Nonaka, Chiho (N)
Hiroshima University
2022-08-01 – 2022-08-03
Oshima, Kazuki (N)
Nagoya University
2022-08-01 – 2022-08-05
Akitsu, Kazuyuki (A)
Institute for Advanced Study
2022-08-08 – 2022-08-13
Yamazaki, Masahito (A)
Kavli IPMU
2022-08-09 – 2022-08-12
Ashwinkumar, Meer (A)
Kavli IPMU
2022-08-10 – 2022-08-12
Noumi, Toshifumi (A)
Kobe University
2022-08-10 – 2022-08-12
Saito, Ryo (A)
Yamaguchi University
2022-08-10 – 2022-08-12
Shirai, Satoshi (A)
Kavli IPMU
2022-08-10 – 2022-08-12
Yoshida, Beni (E)
Perimeter Institute
2022-08-17 – 2022-08-17
Hiramatsu, Takashi (A)
Rikkyo University
2022-08-19 – 2022-08-26

Yokokura, Ryo (N)
KEK
2022-08-19 – 2022-09-05
Akitsu, Kazuyuki (A)
Institute for Advanced Study
2022-08-21 – 2022-08-28
Himemoto, Yoshiaki (A)
Nihon University
2022-08-22 – 2022-08-24
Akamatsu, Yukinao (N)
Osaka University
2022-08-22 – 2022-08-26
Endo, Shimpei (N)
Tohoku University
2022-08-22 – 2022-08-26
Fujii, Keisuke (N)
Ruprecht-Karls-Universität Heidelberg
2022-08-22 – 2022-08-26
Hongo, Masaru (N)
Niigata University
2022-08-22 – 2022-08-26
Nishizawa, Atsushi (A)
University of Tokyo
2022-08-22 – 2022-08-26
Taya, Hidetoshi (N)
RIKEN, iTHEMS
2022-08-22 – 2022-08-26
Ito, Hiroaki (N)
Osaka University
2022-08-22 – 2022-09-15
Nishimura, Toru (N)
Osaka University
2022-08-22 – 2022-09-30
Namba, Ryo (A)
RIKEN
2022-08-23 – 2022-08-25
Kurahashi Neilson, Naoko (A)
Drexel University
2022-08-24 – 2022-08-26
Neilson, Russell (A)
Drexel University
2022-08-24 – 2022-08-26
Crew, Samuel (E)
University of Bath
2022-08-26 – 2022-08-30
Bosnjak, Zeljka Marija (A)
University of Zagreb
2022-09-01 – 2022-09-28
Vikman, Alexander (A)
CEICO, Institute of Physics of the Czech Academy of Sciences
2022-09-03 – 2022-09-07
Trenkler, Georg (A)
CEICO, Institute of Physics of the Czech Academy of Sciences
2022-09-03 – 2022-09-07
Trombetta, Leonardo (A)
CEICO, Institute of Physics of the Czech Academy of Sciences
2022-09-03 – 2022-09-07
Kawana, Kiyoharu (E)
no affiliation
2022-09-03 – 2022-10-03
Takahashi, Ryuichi (A)
Hirosaki University
2022-09-05 – 2022-09-06
Grishin, Evgeni (A)
Monash University
2022-09-07 – 2022-09-07
Caputa, Pawel Piotr (E)
University of Warsaw
2022-09-12 – 2022-09-28
Barnes, Joshua (A)
Institute for Astronomy, University of Hawaii at Manoa
2022-09-14 – 2022-12-20
Emori Haruki (C)
Hokkaido University
2022-09-16 – 2022-09-16
Nistane, Viraj (A)
University of Geneva
2022-09-20 – 2022-09-22
Chen, Heng-Yu (E)
National Taiwan University
2022-10-01 – 2022-10-10
Colombi, Stéphane (A)
Institut d'Astrophysique de Paris
2022-10-01 – 2022-10-17
Balog, János (E)
Wigner Research Centre for Physics
2022-10-01 – 2022-11-30
Kawahigashi, Yasuyuki (0)
The Graduate School of Mathematical Sciences, The University of Tokyo
2022-10-04 – 2022-10-06
Kawana, Kiyoharu (E)
no affiliation
2022-10-04 – 2022-10-31
Inui, Koji (C)
Department of Applied Physics, The University of Tokyo
2022-10-11 – 2022-10-13
Yamada, Masatoshi (E)
Univertsität Heidelberg
2022-10-11 – 2022-10-28
Maharana, Jnanadeva (E)
Institute of Physics, Bhubaneswar, and National Institute of Science Education and Reseach Bhubaneswar, India
2022-10-14 – 2022-10-28
Landim, Ricardo (A)
Technical University of Munich
2022-10-19 – 2022-10-21
Fujii, Ryota (E)

Ibaraki University
2022-10-19 – 2022-11-18
Osato, Ken (A)
Chiba University
2022-10-24 – 2022-10-28
Kadota, Kenji (A)
Hangzhou Institute for Advanced Study at University of Chinese Academy of Sciences
2022-10-26 – 2022-12-14
Pi, Shi (A)
Institute of Theoretical Physics, Chinese Academy of Sciences
2022-10-30 – 2022-11-14
Pradipto (C)
Tokyo University of Agriculture and Technology
2022-10-31 – 2022-11-01
Takada, Satoshi (C)
Tokyo University of Agriculture and Technology
2022-10-31 – 2022-11-01
Maruoka, Hirokazu (C)
JAMSTEC
2022-10-31 – 2022-11-02
Yoneta, Yasushi (E)
Univ. of Tokyo
2022-10-31 – 2022-11-07
Feng, Justin Christopher (A)
University of Lisbon
2022-10-31 – 2022-12-30
Yoshii, Ryosuke (C)
Sanyo-Onoda City University
2022-11-01 – 2022-11-02
Vennin, Vincent (A)
ENS Paris
2022-11-03 – 2022-11-13
Sakellariadou, Mairi (A)
King's College London
2022-11-05 – 2022-11-08
Angus, Stephen (A)
Asia Pacific Center for Theoretical Physics
2022-11-06 – 2022-11-19
He, Minxi (A)
High Energy Accelerator Research Organization
2022-11-08 – 2022-11-10
Inui, Ryoto (A)
Nagoya University Cosmology Group
2022-11-08 – 2022-11-10
Mizuguchi, Yurino (A)
Nagoya University Cosmology Group
2022-11-08 – 2022-11-10
Tada, Yuichiro (A)
Nagoya University Institute for Advanced Research
2022-11-08 – 2022-11-10
Shaikh, Md Arif (A)
Seoul National University
2022-11-13 – 2022-11-15
Colombi, Stéphane (A)
Institut d'Astrophysique de Paris
2022-11-14 – 2022-11-15
Hayashi, Toshinori (A)
The University of Tokyo
2022-11-14 – 2022-11-16
Suto, Yasushi (A)
The University of Tokyo
2022-11-14 – 2022-11-16
Takayoshi Sano (A)
Institute of Laser Engineering, Osaka University
2022-11-16 – 2022-11-18
Monnai, Akihiko (N)
Osaka Institute of Technology
2022-11-18 – 2022-11-18
Wu, Yantao (E)
RIKEN
2022-11-28 – 2022-12-06
Nakatsukasa, Takashi (N)
University of Tsukuba
2022-12-07 – 2022-12-13
Amano, Tomohito (N)
the University of Tokyo
2022-12-07 – 2022-12-16
Sagawa, Hiroyuki (N)
University of Aizu
2022-12-07 – 2022-12-16
Hinohara, Nobuo (N)
Center for Computational Sciences, University of Tsukuba
2022-12-07 – 2022-12-20
Naito, Tomoya (N)
RIKEN iTHEMS
2022-12-07 – 2022-12-20
Yokota, Takeru (N)
iTHEMS, RIKEN
2022-12-07 – 2022-12-20
Yoshida, Kenichi (N)
Kyoto University
2022-12-07 – 2022-12-20
Sugino, Osamu (N)
The Instutute for Solid State Physics, The University of Tokyo
2022-12-08 – 2022-12-13
Tanimura, Yusuke (N)
Tohoku University
2022-12-08 – 2022-12-13
Sato, Takeshi (N)
the University of Tokyo
2022-12-08 – 2022-12-20
Sato, Shunsuke (N)
Center for Computational Sciences, University of Tsukuba
2022-12-09 – 2022-12-16
Murase, Kohta (A)
The Pennsylvania State University
2022-12-10 – 2023-01-16
Fukuda, Masahiro (N)
ISSP, University of Tokyo

2022-12-12 – 2022-12-16
Washiyama, Kouhei (N)
Center for Computational Sciences, University of Tsukuba
2022-12-12 – 2022-12-16
Akashi, Ryosuke (N)
National Institutes for Quantum Science and Technology
2022-12-12 – 2022-12-20
Parzygnat, Arthur (E)
Graduate School of Informatics, Nagoya University
2022-12-12 – 2022-12-23
Abe, Motokazu (E)
Kyushu University
2022-12-16 – 2022-12-17
Fujibayashi, Sho (A)
Max Planck Institute for Gravitational Physics (Albert-Einstein Institute)
2022-12-19 – 2022-12-19
Maruoka, Hirokazu (C)
JAMSTEC
2022-12-22 – 2022-12-22
Hamada, Yuta (E)
KEK
2022-12-23 – 2022-12-24
Talebian, Alireza (A)
Institute for Research in fundamental Sciences (IPM)
2022-12-25 – 2023-02-28
Himemoto, Yoshioaki (A)
Nihon University
2022-12-26 – 2022-12-27
Nishizawa, Atsushi (A)
Research Center for the Early Universe, The Univesity of Tokyo
2022-12-26 – 2022-12-28
Hiramatsu, Takashi (A)
Rikkyo University
2022-12-26 – 2022-12-29
Pi, Shi (A)
Institute of Theoretical Physics, Chinese Academy of Sciences
2022-12-26 – 2023-01-06
Kimura, Shigeo (A)
Frontier Research Institute for Interdisciplinary Sciences and Astronomical Institute, Tohoku University
2022-12-27 – 2022-12-28
Yamada, Masatoshi (E)
Jilin University
2023-01-04 – 2023-01-19
Inoue, Takuya (A)
Institute of Astronomy and Astrophysics, Academia Sinica, ASIAA
2023-01-05 – 2023-01-05
Ejiri, Shinji (N)
Niigata University
2023-01-05 – 2023-01-07
Zahariade, George (A)
Institut de Física d'Altes Energies (IFAE), Universitat Autònoma de Barcelona
2023-01-05 – 2023-01-17
Kiuchi, Kenta (A)
Max Planck Institute for Gravitational Physics
2023-01-05 – 2023-01-27
Mukhopadhyay, Mainak (A)
Pennsylvania State University
2023-01-07 – 2023-01-17
Watanabe, Ryotaro (E)
no affiliation
2023-01-09 – 2023-02-28
Fujibayashi, Sho (A)
Max Planck Institute for Gravitational Physics (Albert-Einstein Institute)
2023-01-10 – 2023-01-12
Reffert, Sussane (E)
University of Bern
2023-01-12 – 2023-01-14
Saito, Ryo (A)
Graduate School of Sciences and Technology for Innovation, Yamaguchi University
2023-01-12 – 2023-01-16
Wu, Yantao (E)
Insutitute of Physical and Chemical Research
2023-01-12 – 2023-01-19
Minami, Kazuhiko (C)
Nagoya University
2023-01-13 – 2023-01-13
Ghimenti, Federico (C)
Université Paris Cité
2023-01-15 – 2023-03-15
Nozaki, Masahiro (E)
Kavli Institute for Theoretical Sciences, UCAS
2023-01-16 – 2023-02-14
Masada, Yohei (A)
Fukuoka University
2023-01-17 – 2023-01-18
Enomoto, Seishi (A)
Sun Yat-sen University
2023-01-18 – 2023-02-03
Yamanaka, Masato (A)
Yokohama National University
2023-01-19 – 2023-02-01
Kliesch, Martin (Q)
The Hamburg University of Technology
2023-01-23 – 2023-01-24
Lin, Chunshan (A)
Jagiellonian University
2023-01-23 – 2023-01-25
Fujii, Ryota (E)
Ibaraki University
2023-01-23 – 2023-01-26
Huang Yu-tin (A)
National Taiwan University
2023-01-25 – 2023-02-16

Begg, Samuel Ewan (C)
Asia Pacific Center for Theoretical Physics
2023-01-25 – 2023-03-01
Noumi, Toshifumi (A)
Kobe University
2023-01-30 – 2023-01-30
Shirai, Satoshi (A)
The University of Tokyo
2023-01-30 – 2023-01-31
Sato, Sota (A)
Kobe University
2023-01-30 – 2023-02-02
Riegler, Robert Max (E)
TU Wien
2023-01-30 – 2023-02-10
Yu, Chengpeng (N)
the University of Tokyo
2023-01-30 – 2023-02-10
Yamada, Masatoshi (E)
Jilin University
2023-01-30 – 2023-02-15
Mukhopadhyay, Mainak (A)
Pennsylvania State University
2023-01-30 – 2023-02-17
Yamazaki, Masahito (A)
The University of Tokyo
2023-01-31 – 2023-01-31
Chandhanapparambil Pookkillath, Masroor (A)
Mahidol University
2023-02-05 – 2023-02-25
Tomikawa, Keitaro (A)
Rikkyo University
2023-02-06 – 2023-02-10
Volkov, Mikhail (A)
University of Tours
2023-02-06 – 2023-03-06
Nakata, Koki (C)
Advanced Science Research Center, Japan Atomic Energy Agency
2023-02-07 – 2023-02-07
Matsumoto, Moemi (N)
Tohoku University
2023-02-08 – 2023-02-17
Kimura, Masashi (A)
Daiichi Institute of Technology
2023-02-09 – 2023-02-17
Ishibashi, Nobuyuki (E)
University of Tsukuba
2023-02-10 – 2023-02-10
Tanimura, Yusuke (N)
Tohoku University
2023-02-10 – 2023-02-15
Hirano, Shinji (E)
Huzhou University
2023-02-12 – 2023-02-24
Yamanaka, Masato (A)
Yokohama National University
2023-02-13 – 2023-02-14
Ikeda, Takuto (A)
Rikkyo University
2023-02-13 – 2023-02-16
Parzygnat, Arthur (E)
Graduate School of Informatics, Nagoya University
2023-02-13 – 2023-02-24
Hiramatsu, Takashi (A)
Rikkyo University
2023-02-16 – 2023-02-23
Carballo-Rubio, Raul (A)
Southern Denmark University
2023-02-16 – 2023-03-01
Gorji, Mohammad Ali (A)
Universitat de Barcelona
2023-02-19 – 2023-03-04
Shirai, Satoshi (A)
University of Tokyo
2023-02-20 – 2023-02-21
Hayasaki, Kimitake (A)
Chungbuk National University
2023-02-20 – 2023-02-22
Oshikawa, Masaki (E)
The Institute for Solid State Physics, The University of Tokyo
2023-02-20 – 2023-02-22
Hayashi, Toshinori (A)
the University of Tokyo
2023-02-20 – 2023-02-24
Sato, Sota (A)
Kobe University
2023-02-20 – 2023-02-24
Takada, Satoshi (C)
Tokyo University of Agriculture and Technology
2023-02-23 – 2023-02-24
Iizuka, Shunsuke (C)
Tokyo University of Agriculture and Technology
2023-02-23 – 2023-02-24
Gupta, Rajan (E)
Los Alamos National Laboratory
2023-02-25 – 2023-03-01
Yingcharoenrat, Vicharit (A)
University of Tokyo
2023-02-26 – 2023-03-04
Mori, Ryuhei (Q)
Tokyo Institute of Technology.
2023-02-27 – 2023-03-01
Osaki, Shuhei (Q)
Tokyo Institute of Technology.
2023-02-27 – 2023-03-01
Ogata, Yusuke (Q)
Tokyo Institute of Technology.
2023-02-27 – 2023-03-01
Saito, Kazuori (Q)
Tokyo Institute of Technology.
2023-02-27 – 2023-03-01
Tsunoda, Michiaki (Q)

Tokyo Institute of Technology.
2023-02-27 – 2023-03-01
Watanabe,Akihito (Q)
Tokyo Institute of Technology.
2023-02-27 – 2023-03-01
Kamijima, Shoma (A)
The University of Tokyo
2023-02-27 – 2023-03-03
Tomikawa, Keitaro (A)
Rikkyo University
2023-02-27 – 2023-03-03
Fujii, Ryota (E)
Ibaraki University
2023-03-05 – 2023-03-10
Kulkarni, S. R. (A)
California Institute of Technology
2023-03-07 – 2023-03-08
Seto, Ryohei (C)
Wenzhou Institute, University of Chinese Academy of Sciences
2023-03-08 – 2023-03-08
Okunishi, Kouichi (E)
Niigata University
2023-03-13 – 2023-03-14
Shiraishi, Maresuke (A)
Suwa University of Science
2023-03-13 – 2023-03-15
Suyama, Teruaki (A)
Tokyo Institute of Technology
2023-03-13 – 2023-03-17
Parzygnat, Arthur (E)
Graduate School of Informatics, Nagoya University
2023-03-13 – 2023-03-24
Robson, Charles (A)
Tampere University
2023-03-15 – 2023-03-17
Kristiano, Jason (A)
the University of Tokyo
2023-03-15 – 2023-03-30
Baragiola, Ben (Q)
RMIT University
2023-03-16 – 2023-03-31
Weinstein, Gilbert (A)
Ariel University
2023-03-20 – 2023-03-20
Saito, Ryo (A)
Yamaguchi University
2023-03-22 – 2023-03-30
Himemoto, Yoshiaki (A)
College of Industrial Technology, Nihon University
2023-03-23 – 2023-03-24
Fujii, Ryota (E)
Ibaraki University
2023-03-26 – 2023-03-31
Suyama, Teruaki (A)
Tokyo Institute of Technology
2023-03-27 – 2023-03-30

2.5 Highlighted Papers

1. Quantum Journal
   "Quantum algorithm for persistent Betti numbers and topological data analysis"
   Mr. Ryu Hayakawa (2nd-year Ph.D. student)
   (https://quantum-journal.org/views/qv-2023-01-26-70/)

2.6 Awards

1. Mr. Taiga Hiroka received the Student Presentation Award at the 45th Quantum Information Technology symposium.

2. Dr. Kenta Suzuki and Dr. Hiroaki Matsunaga won Particle Physics Medal: Young Scientist Award in Theoretical Particle Physics

3. Mr. Taishi Kawamoto and Mr. Masaya Amo received the Student Presentation Award of the Physical Society of Japan (2022 Autumn Meeting).

4. Mr. Zixia Wei, Dr. Masataka Watanabe, Prof. Nobuyuki Okuma, Prof. Ryo Hanai, Dr. Yuki Kamiya, and Prof. Kyohei Kawaguchi won the Young Scientist Award of the Physical Society of Japan 2023.

5. Mr. Masaya Amo and Mr. Paul Martens in our institute won Presentation Award of The 31st Workshop on General Relativity and Gravitation in Japan.

Chapter 3

Workshops and Conferences

3.1 International Workshops and Conferences

Since 1978, a series of international physics workshops, called *Yukawa International Seminar (YKIS)* are held annually or bi-annually. *The Nishinomiya Yukawa Memorial Project* was initiated by Nishinomiya city where the late Prof. Hideki Yukawa lived when he wrote his famous papers on the meson theory. As one of the major programs of this project, an international symposium open to public was held every year in Nishinomiya city, and its post/pre-workshop held at YITP. In recent years both the Nishinomiya Yukawa Symposium and its post/pre-workshops are held at YITP, Kyoto.

As of the academic year 2007, Yukawa Institute for Theoretical Physics launched a new five-year project, "*Yukawa International Program for Quark-Hadron Sciences* (YIPQS)." A few research topics are selected each year and a long-term workshop focused on each topic, extending over a period of a few months, is organized by inviting leading experts from the world. Emphasis is laid on fostering fruitful collaboration among the workshop participants.

For the academic year 2022, the following two coferences were held in hybrid form due to the COVID-19 pandemic.

Yukawa International Seminar (YKIS2022)

Yukawa International Seminar 2022b "Developments of Physics of Unstable Nuclei"

May 23 - May 27. 2022, Chaired by Naoyuki Itagaki and Hitoshi Nakada, 87 participants (31 from abroad)

For details, see https://www2.yukawa.kyoto-u.ac.jp/~mcd2022/programYKIS.php

Nishinomiya-Yukawa Symposium 2022

YIPQS Long-term and Nishinomiya-Yukawa Memorial Workshop "Novel Quantum States in Condensed Matter 2022"

October 31 - December 2, 2022, Chaired by Takami Tohyama, 242 participants (70 from abroad)

For details, see https://www2.yukawa.kyoto-u.ac.jp/~nqs2022/index.php

3.2 YITP Workshops

YITP workshops are one of the main activities of Yukawa Institute. The aim of them is to open new research fields and stimulate nationwide collaborations. Workshop plans can be proposed by any researcher and are approved by the Committee on Research Projects of the Institute. Small workshops, summer schools and regional schools to educate young researchers are positively supported.

In the past 5 years, more than 20 workshops are held each year with 1500 strong participants visiting YITP. The list of the workshops together with the number of participants for the last academic year is given below.

▷ 2022.4.1 — 2023.3.31

In this list, the symbols W, T, X after "YITP-" are as follows:

W: YITP Workshop
T : YIPQS Workshop
X: Workshop Organized by the Staff Members

YITP-W-22-01
Gravity: Current challenges in black hole physics and cosmology, Jun.20 - Jul.1,
K. Aoki, A. De Felice, F. Di Filippo, M. A. Gorji, S. Mukohyama, M. C. Pookkillath, *440-participants.*

YITP-W-22-02
Lattice and continuum field theories 2022, Jul.19 - Jul.22,
M. Hongo, Y. Tanizaki, T. Misumi, T. Doi, Y. Goto, *179-participants.*

YITP-W-22-03
Japan-France joint seminar "Physics of dense and active disordered materials", Mar.13 - Mar.16,
H. Hayakawa, M. Kobayashi, K. Miyazaki, H. Yoshino , K. A. Takeuchi, L. F. Cugliandolo, M. Picco, *63-participants.*

YITP-W-22-04 (postponed)
Frontiers in nonequilibrium physics: active matter, topology and beyond,
K. Kawaguchi, D. Nishiguchi, K. Shiozaki, T. Ozawa.

YITP-W-22-05
67th Condensed Matter Physics Summer School, Aug.2 - Aug.5,
M. Amano, K. Gennyu, H. Oshima, S. Toyama, E. Imada, S. Hamanaka, K. Morimoto, S. Murakami, H. Yoshida, A. Miyamoto, T. Chida, T. Sakaii, H. Saito, T. Imazu, M. Kado, R. Ishikawa, H. Yoshida, H. Saito, T. Morita, I. Kobayashi, T. Joya, Y. Ihara, *415-participants.*

YITP-W-22-06 (postponed)
YITP-YSF Symposium: Perspectives on Non-Equilibrium Statistical Mechanics: The 45th Anniversary Symposium of Yamada Science Foundation
,
H. Hayakawa, K. Saito, S. Sasa, M. Sano, K. A. Takeuchi, H. Tasaki, T. Deguchi.

YITP-W-22-07
The 68th YONUPA Summer School, Aug.6 - Aug.9,
Y. Toda, S. Aoki, S. Murayama, Y. Ando, R. Ikarashi, H. Niinobe, I. Koga, Y. Okubo, L. Hoiki, *345-participants.*

YITP-W-22-08
Thermal Quantum Field Theory and Their Applications, Sep.20 - Sep.22,
I. Ichinose, T. Inagaki, S. Ejiri, A. Ohnishi, T. Oka, K. Kashiwa, M. Kitazawa, Y. Sekiguchi, E. Senaha, H. Tajima, M. Tachibana, Y. Tanizaki, E. Nakano, S. Nakamura, C. Nonaka, Y. Hidaka, *123-participants.*

YITP-W-22-09
Strings and Fields 2022, Aug.19 - Aug.23,
K. Omori, H. Kunitomo, T. Sakai, Y. Sakatani, M. Sakamoto, S. Sugimoto, T. Takayanagi, K. Tamaoka, Y. Tachikawa, K. Nii, T. Nishinaka, T. Noumi, K. Hashimoto, M. Hamanaka, Y. Hikida, M. Honda, K. Maruyoshi, T. Morita, S. Yamaguchi, K. Yoshida, *259-participants.*

YITP-W-22-10
The 52nd Summer School on Astronomy and Astrophysics, Aug.23 - Aug.26,
S. Ogawa, K. Uno, M. Abe, T. Oka, Y. Asada, M. Ogawa, K. Kobayashi, R. Uematsu, R. Kobashi, Y. Tampo, D. Inoue, T. Takahashi, T. Waki, S. Ogio, K. Setoguchi, *236-participants.*

YITP-W-22-11
Progress in Particles Physics 2022, Aug.29 - Sep.2,
T. Abe, H. Ishida, H. Ohki, Y. Omura, K. Kamada, T. Kitahara, F. Takayama, N. Nagata, T. Higaki, K. Yagyu, *143-participants.*

YITP-W-22-12
The 62nd Summer School of Young Researchers Society for Biophysics, Aug.30 - Sep.2,
M. Sugiura, T. Takahashi, S. Iwata, K. Inutsuka, T. Itoh, E. Meguro, K. Shin, Y. Yamashita, Y. Sugiura, Y. Mizuno, T. Nishiyama, S. Iida, Y. Ichikawa, A. Okuyama, S. Kato, M. Aoyama, Y. Sekine, S. Ohashi, S. Inukai, K. Ishikawa, T. Sugimoto, K. Watanabe, *192-participants.*

YITP-W-22-13
YITP Summer School: A novel numerical approach to quantum field theories, Sep.12 - Sep.16,
M. Honda, E. Itou, T. Nishioka, *79-participants.*

YITP-W-22-14
Quantum Extreme Universe From Quantum Information, Sep.26 - Sep.30,
A. Ishibashi, K. Okunishi, T. Takayanagi, N. Tanahashi, M. Tezuka, Y. Nakata, M. Hotta, T. Morimae, T. Ugajin, *575-participants.*

YITP-W-22-15
25th Anniversary Symposium of German-Japanese Joint Research Project on Nonequilibrium Statistical Physics Perspectives for Future Collaboration, Oct.12 - Oct.14,
M. Tanaka, R. Yamamoto, M. Sano, H. Loewen, H. Brand, H. Hayakawa, *72-participants.*

YITP-W-22-16
New frontiers in cosmology with the intrinsic alignments of galaxies, Dec.5 - Dec.9,
J. Blazek, J. Lee, A. Naruko, T. Nishimichi, T. Okumura, U. Pen, J. Shi, M. Takada, A. Taruya, *71-participants.*

YITP-W-22-17
New Trends in Superconducting Phenomena emerging in Non-trivial Electronic States, Dec.21 - Dec.23,
H. Ikeda, R. Arita, Y. Ono, H. Kontani, M. Sato, T. Tohyama, Y. Matsuda, Y. Yanase, K. Kuroki, *114-participants.*

YITP-W-22-18
Fast Radio Bursts and Cosmic Transients, Jun.6 - Jun.7,
K.Ioka, M.Shibata, N.Kawanaka, H.Hamidani, W.Ishizaki, B.T.Zhang, S.Das, *77-participants.*

YITP-T-22-01
Long-term Workshop on "Mean-field and Cluster Dynamics in Nuclear Systems 2022", May 9 - Jun.17,
not listed, *-participants.*

YITP-T-22-02
YIPQS long-term and Nishinomiya-Yukawa memorial workshop "Novel Quantum States in Condensed Matter 2022", Oct.31 - Dec.2,
A. Furusaki, S. Miyashita, S. Murakami, M. Ogata, T. Oka, N. Okuma, T. Ozawa, S. Ryu, M. Sato, A. Schnyder, K. Shiozaki, R. Tazai, T. Tohyama, K. Totsuka, *-participants.*

YITP-T-22-03
Domestic Molecule-type Workshop "Cosmology with Weak Lensing :Beyond the Two-point Statistics", Apr.11 - Apr.15,
K.Osato, T.Nishimichi, A.Taruya, *106-participants.*

YITP-T-22-04
Domestic Molecule Type Workshop "Quantum Dynamics in Few-body Systems", Aug.22 - Aug.26,
Y. Akamatsu, S. Endo, H. Taya, M. Hongo, K. Fujii, *45-participants.*

YITP-T-22-05
Domestic Molecule Type Workshop "Fundamentals in density functional theory", Dec.7 - Dec.20,
R. Akashi, G. Colò, T. Naito, T. Yokota, K. Yoshida, A. Ohnishi, *73-participants.*

YITP-T-22-06
International Molecule-type Program "Quantum Error Correction", Mar.20 - Mar.31,
A. Darmawan, B. Baragiola, *31-participants.*

YITP-T-22-07
Domestic Molecule Type Workshop "Non-linear nature of cosmological perturbations and its observational consequences", Mar.13 - Mar.30,
A. Naruko, T. Nishimichi, A. Taruya, *19-participants.*

YITP-X-22-01 not used

YITP-X-22-02
Lecture for YITP Computer system Yukawa-21, May 30,
YITP Computer Room, *39-participants.*

YITP-X-22-03
2nd workshop: Multimessenger Study of Heavy Dark Matter, Jul.11 - Jul.12,
T.Fujii, N.Hiroshima, K.Murase,A.Yamanaka, *18-participants.*

YITP-X-22-04
Heavy Ion Pub #36, Aug.3 - Aug.3,
M. Asakawa, M. Kitazawa, K. Shigaki, M. Shimomura, C. Nonaka, M. Harada, *64-participants.*

YITP-X-22-05
Third Kyoto Workshop on Quantum Information, Computation, and Foundation, Oct.17 - Oct.21,
T. Morimae, M. Dall'Arno, A. F. Ducuara Garcia, *142-participants.*

YITP-X-22-06
2nd Regular Kakenhi Meeting "Theoretical stud-

ies of non-equilibrium driven-dissipative systems", Nov.1 - Nov.1,
H. Hayakawa, *94-participants.*

YITP-X-22-07
Civic Lecture "Present from Dr. Yukawa" (Special Event of the series 3), Jan.14 - Jan.14,
F. Sato, Y. Yanase, K. Hagino, H. Kunitomo, K. Hashimoto, H. Hayakawa, Y. Kusaba, Y. Yamaoka, M. Bando, T. Okada, Y. Egami, H. Wada, *73-participants.*

3.3 Regional Schools supported by YITP

▷ 2022.4.1—2023.3.31

Here is the list of the Regional Schools with the dates, the place, the name(s) of the main invited Lecturer(s) and the participating Universities.

YITP-S-22-01
The 49th Workshop of Hokuriku-Shinetsu Soryushi-ron Group, Jul. 8, 10, 23,
N. Ohta (National Cetnral University, Taiwan), S. Mishima (KEK).
Nara Women's Univ., OIST, Hiroshima Univ., Tsukuba Univ., Kyoto Univ. and others

YITP-S-22-02
Chubu Summer School 2022, Aug. 8 - Aug.10,
Yuta Hamada(KEK).
Tokai Univ., Shinshu Univ., Shizuoka Univ.

Chapter 4

Public Lectures and Outreach

4.1 Public lecture series

As an outreach activity, we are holding public lecture series co-hosted with Division of Physics and Astronomy (DPA), Graduate School of Science, Kyoto University. All lectures are free and open to the public. This has been held every year in the autumn, and taken over those held as an activity of the 21st Century COE Program, “Center for Diversity and Universality in Physics” (2003 - 2007), and the Global COE Program, “The Next Generation of Physics, Spun from Universality and Emergence” (2008 - 2012). Every time, three professors of Division of Physics and Astronomy and Yukawa Institute for Theoretical Physics explain their research for general audience at Kyoto University Clock Tower Centennial Hall. From the academic year 2020, this public lecture series is held online due to the COVID-19 pandemic.

In this academic year, we held

Kyoto University 125th Anniversary Public Lecture Series "Physics & Astrophysics"

June 11, 2022
Kunihito Ioka (YITP)
“The Strongest Explosive Cosmic Transients” [1]

July 18, 2022
Koji Hashimoto (DPA)
“From Formulas Govering the Universe to Superstring Theory” [1]

4.2 Other outreach activities

September 9, 2022
Prof. Tomoyuki Morimae gave a lecture entitled "Quantum Computing and Quantum Cryptography" at the 123rd Kyoto University Marunouchi Seminar.

September 22, 2022
Prof. Tadashi Takayanagi appeared on the NHK-BS Premium TV program "Cosmic Front".

November 4, 2022
Prof. Atsushi Taruya gave a talk at Terada-nishi elementary school in Joyo city.

November 26, 2022
Prof. Tomoyuki Morimae gave a lecture entitled "Quantum Information: Quantum Computing and Quantum Cryptography" and Prof. Tadashi Takayanagi gave a lecture entitled "From Quantum Information to Extreme Universe: Universe emerging from Qubits" at Public Lecture in Grant-in-Aid for Transformative Research Areas (A) "Extreme Universe".

December 14, 2022
Students of Naragakuen Junior Hight School/High School visited YITP.

December 20, 2022
Prof. Atsushi Taruya gave a talk at Taga elementary school in Ide town.

January 11, 2023
Prof. Masaru Shibata gave a lecture in the 20th Chushiro Hayashi Memorial Lecture.

[1] The original titles of these lectures are given in Japanese. They are translated in English by our responsibility.