Kobayashi-Maskawa Institute
for the Origin of Particles and the Universe
Nagoya University

Annual Report

April 2023 – March 2023

Foreword

I (Junji Hisano) was reappointed to the second term as director of KMI in April 2022. During the first term, the KMI activities were subject to various restrictions due to the spread of the new type of coronavirus infection. Although the spread of coronavirus infection has not yet subsided, we have regained the activities we had before the coronavirus infection spread. We are costumed to be with coronavirus. In 2022, we dispatched many people overseas. In addition to it, the 4th KMI International School, " Statistical Data Analysis and Anomalies in Particle Physics and Astrophysics" was held face-to-face in December 2022. The core-to-core program "DMNet" held an international symposium at the Max Planck Institute for Nuclear Physics in Heidelberg, Germany, in September 2022. We also held workshops in hybrid ways. Research activities using Internet technology, which did not exist before the spread of coronavirus infection, are expanding.

At the end of 2022, we received good news. Nagoya University has Tau-lepton Physics Research Center under the Graduate School of Science, and the deadline for its establishment will come in March 2023. In conjunction with this, the International Research Center for Flavor Physics will be established under the KMI in April 2023. This will help to revitalize international research and education in flavor physics. For this establishment, we have submitted a budget request to the Ministry of Education, Culture, Sports, Science and Technology (MEXT), which was approved. This will enable KMI to grow its activities in the future.

In this report, the experimental and theoretical highlights at KMI are reported in Sect. 3, where other activities spanning through all scientific missions at KMI are also summarized. Research-related activities, such as regular seminars and colloquia, conferences and meetings, are summarized in Sect.4. Publications and presentations through these activities are listed in Sect. 5.

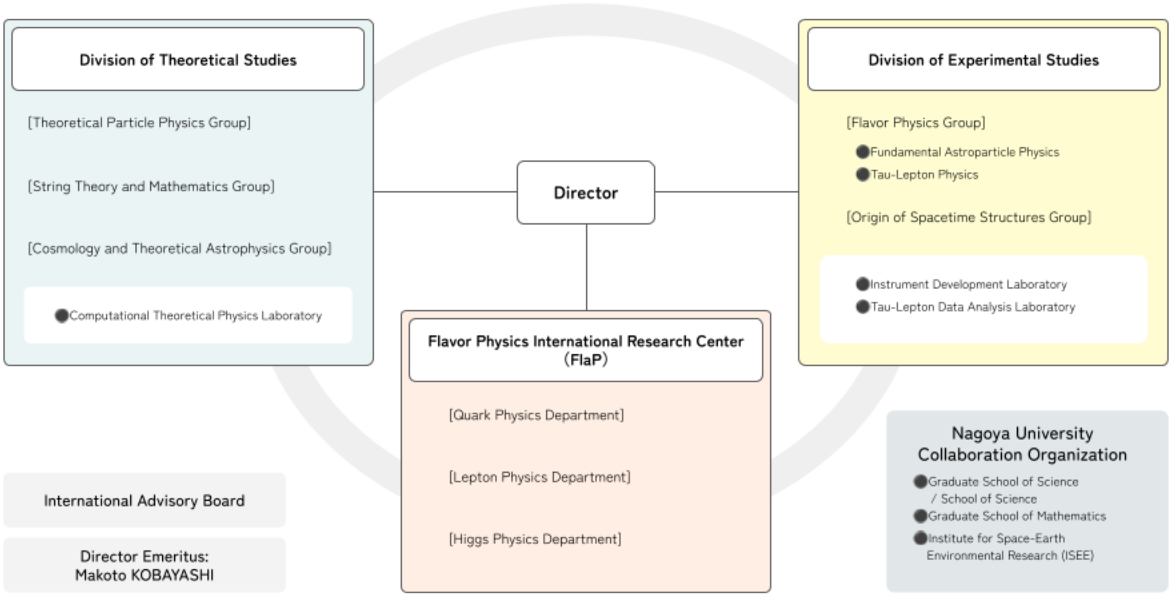
Junji Hisano

Contents

Chapter 1

Organization

1.1 Organization



1.2 Staff List

Director : HISANO Junji

Director Emeritus: MASKAWA Toshihide, KOBAYASHI Makoto

Division of Theoretical Studies (Chair, NOJIRI Shin'ichi)

Theoretical Particle Physics Group

TANABASHI Masaharu (Professor)
HISANO Junji (Professor)
TOBE Kazuhiro (Associate Professor)
MAEKAWA Nobuhiro (Associate Professor)
KANEKO Takashi* (Lecturer)
KITAHARA Teppei (Assistant Professor)
SUENAGA Daiki* (Assistant Professor; from January 1, 2024)

YAMANAKA Nodoka (Assistant Professor)

String Theory and Mathematics Group

KANNO Hiroaki (Professor)
SHIROMIZU Tetsuya (Professor)
SAKAI Tadakatsu (Associate Professor)
IZUMI Keisuke (Lecturer)

Cosmology and Theoretical Astrophysics Group

NOJIRI Shin'ichi (Chair, Professor)
ICHIKI Kiyotomo (Associate Professor)
MIYATAKE Hironao (Associate Professor)
YOKOYAMA Shuichiro (Assistant Professor)
SAGA Shohei (Assistant Professor)
ARAI Shun (Researcher)
KOBAYASHI Takeshi (Visiting Scientist)
NISHIZAWA Atsushi J. (Visiting Scientist)
SUNAYAMA Tomomi (Visiting Scientist)

Computational Theoretical Physics Laboratory (Chief, ICHIKI Kiyotomo)

TANABASHI Masaharu (Professor)
ICHIKI Kiyotomo (Chief, Associate Professor)
NONAKA Chiho (Visiting Scientist)

Division of Experimental Studies (Chair, IIJIMA Toru)

Flavor Physics Group

Tau-Lepton Physics

IIJIMA Toru (Professor)
KRIZAN Peter (Professor)
HORII Yasuyuki (Associate Professor)
YOSHIHARA Keisuke (Associate Professor; until April 30, 2023)
SUZUKI Kazuhito (Lecturer)
ZHOU Qidong (Assistant Professor; until April 30, 2023)
KOBAYASHI Masatoshi* (Assistant Professor; from April 1, 2023)
NAKAMURA Yuya* (Assistant Professor; from January 1, 2024)
TOMOTO Makoto (Visiting Scientist)
GAZ Alessandro (Visiting Scientist)
HAYASAKA Keiji* (Visiting Scientist; from April 1, 2023)
KATO Yuji (Visiting Scientist)
MATSUOKA Kodai (Visiting Scientist)
NAKAHAMA Yu (Visiting Scientist)

Fundamental Astroparticle Physics

ITOW Yoshitaka (Chair, Professor)
KITAGUCHI Masaaki (Associate Professor)
OKUMURA Akira (Junior Associate Professor)

NAKANO Toshiyuki (Lecturer)
KAZAMA Shingo (Assistant Professor)
NAKA Tatsuhiro (Visiting Scientist)

Origin of Spacetime Structures Group

Observational Astrophysics

NAKAZAWA Kazuhiro (Associate Professor)

Theoretical Spacetime Analysis

NAKAZAWA Kazuhiro (Associate Professor)
NAMBU Yasusada (Associate Professor)
KOBAYASHI Masahiko (Technical Assistant)

Instrument Development Laboratory

NAKAZAWA Kazuhiro (Chief, Associate Professor)

Tau-Lepton Data Analysis Laboratory

IIJIMA Toru (Chief, Professor)
TOMOTO Makoto (Visiting Scientist)
KATO Yuji (Visiting Scientist)

Flavor Physics International Research Center (FlaP; Chair, IIJIMA Toru)

Quark Physics

IIJIMA Toru (Professor)
HARADA Masayasu (Professor)
KITAGUCHI Masaaki (Associate Professor)
NAKAZAWA Yu (Assistant Professor; from January 1, 2024)*
YAMAGUCHI Yasuhiro (Assistant Professor)*

Lepton Physics

ITOW Yoshitaka (Professor)
INAMI Kenji (Associate Professor)
TOBE Kazuhiro (Associate Professor)
NAKANO Toshiyuki (Lecturer)

Higgs Physics

TANABASHI Masaharu (Professor)
HISANO Junji (Professor)
HORII Yasuyuki (Associate Professor)

Public Relations Office

MIYATAKE Hironao (Chief, Associate Professor)
KAZAMA Shingo (Associate Professor)
TAKAHASHI Shota (Assistant Professor)

Associate Members

SUGIYAMA Naoshi

KAWAMURA Seiji

SHIMIZU Hirohiko

TAJIMA Hiroyasu

ROKUJO Hiroki

SATO Osamu

MINAMIZAKI Azusa

(New members are indicated with * .)

Chapter 2

Management System

- Steering Committees

  - Steering Committee of KMI
    In this Committee, the following agenda items are discussed:

    1. Selection of Director General in KMI,
    2. Future plans and evaluation on the plans in KMI,
    3. Basic policies of managements and administrations in KMI,
    4. Personnel affairs in KMI,
    5. Budgets and facilities in KMI,
    6. Collaborations among the Division of Theoretical Studies, the Division of Experimental Studies, and Flavor Physics International Research Center,
    7. Anything else related with managements and administrations in KMI.

  - Steering Committee for each Laboratory in the following list is placed, where its managements and administrations are discussed:

    * Computational Theoretical Physics Laboratory
    * Instrument Development Laboratory
    * Tau-Lepton Data Analysis Laboratory

- Advisory Board

  By following the foundation of KMI, an international advisory board has started.

  The members of the advisory board are the followings (in alphabetical order):

  · ELLIS John (Professor at King's College London)

  · KAJITA Takaaki (Director, Institute for Cosmic Ray Research, The University of Tokyo)

  · ISO Satoshi (Professor, KEK)

  · MURAYAMA Hitoshi (Professor, University of California, Berkeley)

  · SASAKI Misao (Professor, Kavli Institute for the Physics and Mathematics of the Universe, The University of Tokyo)

  · SILK Joseph (Professor, Institut d'astrophysique de Paris)

  · YAMAUCHI Masanori (Director General of High Energy Accelerator Research Organization)

Chapter 3

Progress in Research

3.1 Division of Theoretical Studies

3.1.1 Theoretical Particle Physics Group (including FlaP)

This year I investigate the following topics: (1) Study of effcts of a_0 meson inside the neutron star based on the parity doublet model. (2) Construction of an effective model of octet baryons based on the parity doublet structure. (3) An analysis of hadron spectra using a chiral quark model. (4) Analysis of singly heavy baryons using a chiral effective model. (Masayasu Harada)

We scrutinize a radiatively generated QCD θ parameter at the two-loop level based on both full analytical loop functions with the Fock-Schwinger gauge method and the effective field theory approach, using simplified models. We observe that the radiatively generated θ parameters at the low energy scale precisely match between them. It provides validity to perturbative loop calculations of the QCD θ parameter with the Fock-Schwinger gauge method. Furthermore, it is also shown that the ordinary Fujikawa method for the radiative θ parameter by using $\theta =$ `arg detM_q^{loop} does not cover all contributions in the simplified models. But, we also find that when there is a scale hierarchy in CP-violating sector, evaluation of the Fujikawa method is numerically sufficient. As an application, we calculate the radiative θ parameter at the two-loop level in a slightly extended Nelson-Barr model, where the spontaneous CP violation occurs to solve the strong CP problem. It is found a part of the radiative θ parameters cannot be described by the Fujikawa method.(Junji Hisano, Teppei Kitahara)

We consider electrically neutral complex vector particles V below the GeV mass scale that, from a low energy perspective, couple to the photon via higher dimensional form factor interactions. We derive ensuing astrophysical constraints by considering the anomalous energy loss from the Sun, Horizontal Branch, and Red Giant stars as well as from SN1987A that arise from vector pair-production in these environments. Under the assumption that the dark states V constitute dark matter, the bounds are then complemented by direct and indirect detection as well as cosmological limits. The relic density from freeze-out and freeze-in mechanisms is also computed. On the basis of a UV-complete model that realizes the considered effective couplings, we also discuss the naturalness of the constrained parameter space, and provide an analysis of the zero mass limit of V. (Junji Hisano)

We study B meson semileptonic decays in lattice QCD. The Möbius domain-wall quark action is employed for all relevant quark flavors in order to control discretization errors and renormalization of the weak current on the lattice. For the $B \to \pi\ell\nu$ decay, we calculate the vector and scalar form factors. By a simultaneous fit to our lattice and experimental data by Belle and BaBar, we obtain $|V_{ub}|$ with a 10 % accuracy. For the $B \to D^*\ell\nu$ decay, we determine all four form factors as a function of the recoil parameter. These data in particular near zero recoil significantly stabilize the determination of $|V_{cb}|$ and, hence would be useful input to the future determination of $|V_{cb}|$. (Takashi Kaneko)

The rare flavor changing top quark decay $t \to cZ$ is a clear sign of new physics and experimentally very interesting due to the huge number of top quarks produced at the LHC. However, there are few viable models which can generate a sizable branching ratio for $t \to cZ$. In fact, vector-like quark models seem to be the only realistic option. We investigate all three representations (under the Standard Model gauge group) of vector-like quarks that can generate a sizable branching ratio for $t \to cZ$ without violating bounds from B physics. Importantly, these are exactly the three vector-like quarks which can lead to a sizable positive shift in the prediction for W mass, via the couplings to the top quark also needed for a sizable $\mathrm{Br}(t \to cZ)$. Calculating and using the one-loop matching of vector-like quarks on the Standard Model Effective Field Theory (SMEFT), we find that $\mathrm{Br}(t \to cZ)$ can be of the order of 10^{-4}–10^{-6} depending on the vector-like quark representations and that the large W mass measurement can be accommodated. (Teppei Kitahara)

Recently, the CMS collaboration has reported a di-tau excess with a local significance of 2.6–3.1σ where the invariant mass is $m_{\tau\tau} = 95$–$100\,\mathrm{GeV}$. This excess can be interpreted as a light scalar boson that couples to the third generation fermions, particularly top and τ. Based on the simplest model that can account for the CMS di-tau excess, we evaluate experimental sensitivities to the additional light resonance, using the results reported by the ATLAS collaboration. We see that a search for the top-quark associated production of the SM Higgs boson that decays into $\tau^+\tau^-$ sets a strong model-independent limit. We also find that the CP-even scalar interpretation of the light resonance is excluded by the ATLAS results, while the CP-odd interpretation is not. (Teppei Kitahara)

The magnetic monopole is an important theoretical construct which probes non-perturbative properties or global structures of quantum field theories. It is known that a massless fermion scattering off a Dirac monopole provides a peculiar final state. For example, when the flavor number of the massless Dirac fermion is 1, a non-trivial fermion helicity flip occurs in the scattering. We propose a four-dimensional interpretation of the outgoing state of the scattering of a massless fermion off a Dirac monopole. It has been known that such a state has fractional fermion numbers and is necessarily outside the Fock space on top of ordinary perturbative vacuum, when more than two flavors of charged Dirac fermions are considered. We point out that the Fock space of the fermions depends on the rotor degree of freedom of the monopole and changes by a monopole-fermion s-wave scattering. By uplifting the fermion-rotor system introduced by Polchinski, from two to four dimensions, we argue that the outgoing state can be understood as a state in a different Fock space. (Teppei Kitahara)

Fundamental physical constants are determined from a collection of precision measurements of elementary particles, atoms and molecules. This is usually done under the assumption of the SM of particle physics. Allowing for light NP beyond the SM modifies the extraction of fundamental physical constants. Consequently, setting NP bounds using these data, and at the same time assuming the CODATA recommended values for the fundamental physical constants, is not reliable. We formulate a method that both SM and NP parameters can be simultaneously determined in a consistent way from a global fit. For light vectors with QED-like couplings, such as the dark photon, we provide a prescription that recovers the degeneracy with the photon in the massless limit. At present, the data show tensions partially related to the proton charge radius determination. We show that these can be alleviated by including contributions from a light scalar with flavor non-universal couplings. (Teppei Kitahara)

Here's the English translation:

In 2020, the NANOGrav experimental group conducting pulsar timing array experiments announced observational results that could be interpreted as gravitational waves. It was pointed out that these gravitational waves could be interpreted as cosmic strings associated with symmetry breaking at around 10^14 GeV. This 10^14 GeV scale is predicted in natural grand unified theories where

$SU(2)_R \times U(1)_{B-L}$ breaks down to $U(1)_Y$. However, it is clear that this breaking does not form topological strings, and if strings are formed, they must be non-topological strings. For these reasons, while investigating the classical stability of non-topological strings, it was found that the previously known stability of non-topological strings due to electroweak symmetry breaking holds true even in supersymmetrized models. Additionally, conditions for classical stability of non-topological strings were derived for spontaneous breaking extended to $SU(N) \times U(1) \to SU(N-1) \times U(1)$. Unfortunately, while the parameters in the breaking of natural grand unified theories showed that non-topological strings were classically unstable, in 2023, multiple pulsar timing array experimental groups discovered evidence of gravitational waves, which has been suggested to be explicable by unstable cosmic strings. (Nobuhiro Maekawa)

Using the auxiliary field method, we investigated a class of effective field theories which are equivalent with the scalar effective field theory including higher derivative terms. We are responsible for the sections of the searches for non-Higgs heavy BSM bosons (Z', W', leptoquarks, etc.) and of the searches for quark and lepton compositeness in the Particle Data Group collaboration. We wrote two reviews on the search of leptoquark and on the search of quark and lepton compositeness which will be published in 2024 edition of the Particle Data Book. (Masaharu Tanabashi)

A discrepancy has been reported between the prediction of the standard model (SM) and the measured value in the B meson decay process $B \to D^{(*)} l\bar{\nu}$. If it is due to new physics, the discrepancy suggests new particle around TeV scale, and therefore it could be important to study a possibility of new physics scenario. We consider R_2 leptoquark model and study not only $B \to D^{(*)} l\bar{\nu}$ but also $b \to s\nu\bar{\nu}$ and $b \to sl^+l^-$ processes where some deviations from the SM predictions have also been reported recently. As discussed in the literature, the leptoquark model can induce the contribution to $B \to D^{(*)}\tau\bar{\nu}$ process to explain the anomaly. We investigated $b \to s\nu\bar{\nu}$ in the parameter region where the anomaly in $B \to D^{(*)}\tau\bar{\nu}$ process can be explained. We found that neutral B meson mixing constrains the deviation in $b \to s\nu\bar{\nu}$. (Kazuhiro Tobe)

I worked with Bijaya Kumar Sahoo and Kota Yanase to investigate the contribution of various new physics beyond the standard model to the electric dipole moment of Xe atom. I also investigated the two-loop level contribution of the R-parity violating supersymmetric extension of the standard model to the electric dipole moments of various systems and constrained the CP violation of many R-parity violating interactions. (Nodoka Yamanaka)

3.1.2 String Theory and Mathematics Group

We investigated the non-stationary difference equation for the conformal block of the deformed Virasoro algebra. We have shown that this equation can be regarded as a quantization of the discrete Painlevé VI equation, where the Hamiltonian is identified with a translation element in the extended affine Weyl group of $D_5^{(1)}$. We also recast the original difference equation as a coupled system for a pair of functions and conjectured that the five dimensional instanton partition function coming from the affine Laumon space provides a solution to the coupled system. (H. Kanno)

We have developed the attractive gravity probe surface (AGPS) for cosmological context and found that we can show the positivity of the quai-local mass on the AGPS. (T. Shiromizu)

We have worked on a holographic model of QCD to examine the high-density phases of QCD at low temperature. By modeling them with the classical solution of a 5d YM theory written in terms of a simple ansatz, we have derived the equation of state of the high-density phase. Using this result, we have worked out the M-R plot of neutron stars. One of the main efforts in this research project has been to improve a numerical algorithm for this study and furthermore to constrain the parameter space of the model that leads to a prediction consistent with the experimental data. (T. Sakai)

In four-dimensional asymptotically flat spacetime, there exists a gravitational effect that is of the same order as the centrifugal force in the radial coordinate, even though the spacetime is nearly flat. This effect was pointed out by us. It interferes with the motion of null geodesics, preventing them from reaching infinity. In our previous work, we derived a sufficient condition for null geodesics to reach infinity. This year, we have refined this sufficient condition. (K. Izumi)

3.1.3 Cosmology and Theoretical Astrophysics Group

I studied compact stars in the $F(R)$ gravity framework with Mr. Numajiri, my student, and the Group at Central China Normal University (CCNU). $F(R)$ gravity is one of the typical gravity theories modified from Einstein's general relativity. The $F(R)$ gravity includes a scalar mode in addition to the standard mode of the gravitational wave. We investigated the effects of the scalar mode on the profile of the compact stars, such as mass, radius, etc. I also studied the entropies in the gravity theories. Mainly with Sergei D. Odintsov and also with Valerio Faraoni, I studied the origin of the entropies. And also with Odintsov and Tanmoy Paul, I studied the cosmology based on several kinds of entropy functions proposed so far. Related to the above-mentioned entropic cosmology, we also proposed the unified scenario of inflation and dark energy based on the holographic scenario. I also studied some excentric objects like a gravastar, wormhole, etc. with G. G. L. Nashed or with Odintsov, Vasilis Oikonomou, and other researchers based on several kinds of modified gravity theories. In the gravity theories including the Gauss-Bonnet invariant in the action, the propagating speed of the gravitational wave is generally different from the speed of light. I investigated the speed in several situations with Odintsov, Oikonomou, and other researchers and considered several scenarios where we can escape from the observational constraints given by GW170817 etc. The gravity theory based on non-metricity instead of curvature was also well investigated with the group of CCNU and with Salvatore Capozziello and his student. I also wrote a long review article about the possible finite-time cosmological singularities with Jaume de Haro, Odintsov, Oikonomou, and Supriya Pan. This article was published in Physics Report. (Nojiri)

We need to remove the foreground radiation from the Milky Way in order to extract information about inflationary gravitational waves from the B-mode patterns of cosmic microwave polarisation anisotropy. In our previous delta-map method for foreground removal, it was difficult to improve sensitivity by increasing the number of observation bands, since the number of observation bands is limited by the number of parameters of the assumed foreground model. In this paper, we extend the previous method in such a way that it can be adapted to an arbitrary number of observation bands. We show that our method can increase the sensitivity to the tensor-to-scalar ratio r without introducing significant bias, using parametric likelihood and realistic foreground and CMB simulations. (Ichiki)

This year, we published key cosmology results from the intermediate data of the Subaru Hyper Suprime-Cam (HSC) survey, e.g., real-space cosmic shear [56], Fourier-space cosmic shear [55], the combination of cosmic shear, galaxy-galaxy lensing, and galaxy-galaxy clustering (the so-called 3x2pt) [53, 54, 57]. Our constraints on $S_8 \equiv \sigma_8\sqrt{\Omega_{\rm m}/0.3}$, one of the cosmological parameters that describes the clumpiness of large-scale structure, showed consistently lower values with 2-σ significance compared to the constraints from primary CMB measurements by the Planck satellite (Planck collaboration, A&A 641, A6, 2020), which confirmed the S_8 tension emerging from the late 2010s (Fig. 3.1). I presented 7 (2) invited talks about this result at international (domestic) conferences.

My other activities include [64], which placed cosmological constraints based on galaxy abundance, galaxy-galaxy clustering, and galaxy-galaxy lensing measured by Kilo-Degree Survey (KiDS). In this

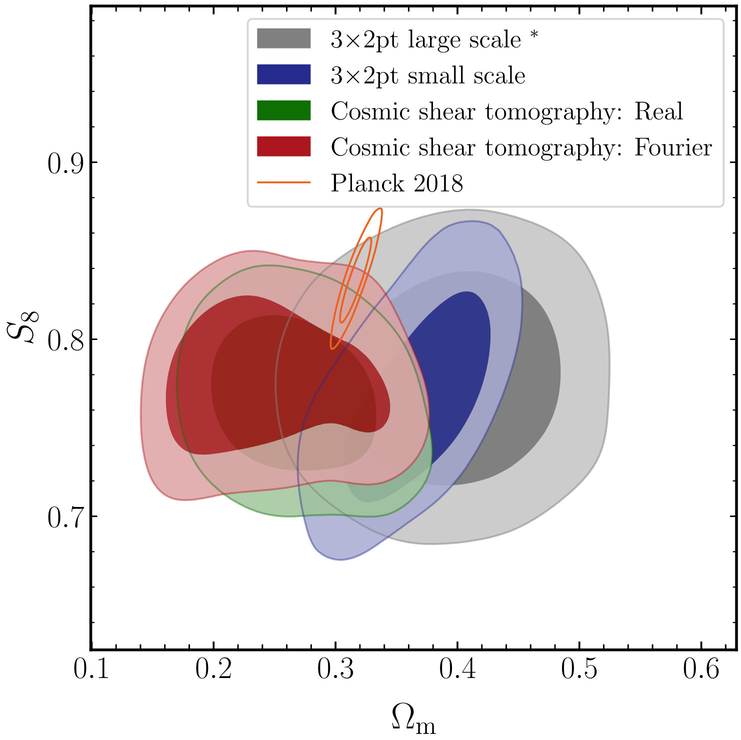


Figure 3.1: Cosmological constraints from the Subaru HSC intermediate data and Planck primary CMB. Quoted from [57].

analysis, we used the model calibrated against the one used in the HSC-Y3 analyses. This is the first KiDS paper that Japanese researchers joined as external collaborators, which was enabled by our collaboration within the DMNet framework. (Miyatake)

We have developed a method to measure the photometric redshift of galaxies taken by the imaging observations, based on the machine-learning. It outperforms the traditional template fitting method and can be applied for cosmological analysis. We find that the galaxy redshift distribution infered from our method is well consistent with what estimated by other independent method, a cross-correlation with spec-z (known redshift) sample (Rau et al. submitted). With the great help of the post-doc at Nagoya, we also explore the effect of *blending* of multiple galaxies on the photometric redshift, which will be of great importance in coming deep imaging surveys such as Rubin-LSST, Roman, or Euclid. The methodology will be naturally extended by the image-based analysis in coming years. (A. J. Nishizawa)

We have proposed a three-field inflationary model which is consistent with the current CMB observations by Planck and BICEP/Keck collaborations (Morishita, Takahashi, Yokoyama, 2022). We have developed the phenomenological model in the context of the sneutrinos scenario, and carefully investigated the possibility of successful leptogenesis/baryogenesis with taking active neutrinos masses into account. We found that the tensor-to-scalar ratio is required to be larger than 10^{-4} for the successful model (Takahashi, Yamada, Yokoyama, 2022). As another collaborative work, we have carefully investigated the inspiral spin parameter of the binary black hole system in the case where the binary system consists of the primordial black hole. We found that the typical amplitude of the inspiral spin is in order of 10^{-3} and the correlations between the spin parameter, chirp mass, and mass ratio are not significant (Koga et al., 2022) (Yokoyama).

We presented new bounds on the cosmic abundance of magnetic monopoles based on the survival of primordial magnetic fields in the early universe. The new bounds can be stronger than the conventional Parker bound from galactic magnetic fields, as well as bounds from direct searches. We also investigated an intriguing possibility that the Peccei-Quinn field simultaneously explains inflation, the strong CP problem, and dark matter. We also studied the cosmological squeezing of axion fluctuations during and after inflation. (Kobayashi)

My collaborators and I found that optical clusters are anisotropically distributed, which alters the mass-richness relation as well as boost the lensing signals of the clusters on large scales. Ignoring this effect can bias the cosmological measurements using optical clusters. Therefore, we modeled this anisotorpy of the optical clusters and applied it to the redMaPPer cluster catalog from Sloan Digital Sky Survey (Park et al., 2022). In addition, I developed a method to quantify the boost on the large-scale lensing signals using spectroscopic galaxies (Sunayama 2023). This method enables to give a tight prior on the boost parameters used in cosmological analysis and will potentially improve the constraining power on cosmological parameters. In the fall, I was invited to the Institute of Advanced Study in Princeton to give a talk about my recent work (Sunayama).

We have done the two distinct research works. In the former one, we compute the propagation of gravitational waves in Horndeski theory at which geometrical optics holds. Distinguished from the previous works, we choose the coordinate so that the scalar mode of gravitational waves propagates on its sound cone. This choice allows us to physically understand that the number density of the scalar graviton conserves as long as the scalar field behaves as a perfect fluid. We make it easier to confirm that the conservation of the number density of the scalar graviton breaks if the imperfect fluid part of the scalar-field interactions emerges c.f. Pujolas, Sawicki, and Vikman 2011. In the case of the generalised Brans-Dicke theory, where the scalar field behaves as the perfect fluid in the Einstein frame, we find an effective metric that characterises the sound cone of the scalar mode.

In the latter one, we present a review paper that comprehensively describes cosmological probes of gravity theories ahead the forthcoming observations. The paper consists of the latest knowledge of theoretical studies of modified gravity : the Horndeski and DHOST family, massive gravity/bigravity, metric-affine gravity, and cuscuton/minimally-modified gravity and major observables of CMB and LSS. We provide an outlook of modified gravity at latest in terms of physical motivations, validity, appealing features, the level of maturity, and calculability. We conclude in the outlook that the Horndeski theory is one of the most well-developed theory to be tested. Related to this review paper, we have held a symposium in the autumn JPS meeting on testing gravity on cosmological scales (Arai).

3.1.4 Computational Theoretical Physics Laboratory

Hydrodynamic simulation: The hydrodynamic model is the most successful model for description of quark-gluon plasma (QGP) in the relativistic heavy-ion collisions. The viscous property of QGP is one of the key aspects of the strongly interacting QGP (sQGP). In 2020, we apply our hydrodynamics codes to analyses of small systems as well as large systems at RHIC and the LHC. Also, we investigate possibility of existence of the QCD critical point which is the end point of the QCD phase boundary, analyzing the Beam Energy Scan experiment at RHIC. Furthermore, we analyze mixed harmonic cumulants in heavy-ion collisions at the LHC. We find that the observables have sensitivity to temperature dependence of shear and bulk viscosities of QGP.

Cold and Dense QCD: Understanding of the QCD phase diagram is one of the most important subjects in hadron and nuclear physics. In particular, investigation of possible phases in low temperature and high density region is the center of attention, after success of detailed measurement of radius and mass of neutron stars. Here we approach the issues from point of view of QCD effective theories which are not exact QCD but contain feature of QCD: one is the Gross Neveu Model and the other one is two color QCD. Also, we investigate the magnetic effect on color superconductivity phase, using the NJL model. (Chiho Nonaka)

Cosmological Simulation: The tomography of the polarized Sunyaev-Zeldvich effect due to free electrons of galaxy clusters can be used to constrain the nature of dark energy because CMB quadrupoles at different redshifts as the polarization source are sensitive to the integrated Sachs-Wolfe effect. Here we show that the low multipoles of the temperature and E-mode polarization anisotropies from the all-sky CMB can improve the constraint further through the correlation between them and the CMB quadrupoles viewed from the galaxy clusters. Using a Monte-Carlo simulation made possible by KMI's cluster computer, we find that low multipoles of the temperature and E-mode polarization anisotropies potentially improve the constraint on the equation of state of dark energy parameter by ~ 17 percent. (Kiyotomo Ichiki)

3.2 Division of Experimental Studies

3.2.1 Flavor Physics Group (including FlaP)

• B and tau physics at Belle and Belle II

The SupperKEKB/Belle II experiment provides unique opportunities for critical test of SM and search for New Physics with variety of channels in B and τ decays. The experiment has started physics data taking with all subdetector components installed since March 2019. The experiment had the Long Shutdown 1 (LS1) period from June 2022, and restarted Run2 from January 2023. Belle II experiment has accumulated 424 fb^{-1} data until LS1, which is comparable to the full data size of the BaBar experiment.

One of the biggest challenges in the B and Tau-Lepton Physics Group is to find evidence of New Physics beyond the Standard Model (SM). There is a hint in existing data collected by the B-factory experiments Belle and BaBar, and also by the LHCb experiment at CERN. These three experiments have reported a deviation from SM prediction on $R(D^{(*)})$, which is the ratio of the branching fraction of the semileptonic decay of the B meson to the final state with the τ lepton, $B \to D^{(*)}\tau\nu$, over to those with the muon or electron, $B \to D^{(*)}\ell\nu(\ell = e, \mu)$. Although the weak interaction in the SM does not distinguish the three leptons, this "lepton flavor universality" may be violated in NP models, such as the charged Higgs and the lepto-quark model. Members of the Flavor Physics Group at Nagoya University have contributed to the $R(D^{(*)})$ measurements at the Belle experiment in the past years. We started the first $R(D^{(*)})$ measurements with 189 fb^{-1} at the Belle II experiment, applying a new hadronic τ-tagging method. Although the error will still be large and dominated by the statistical uncertainty, the result could provide a fully independent cross check of the $R(D^{(*)})$ anomaly by a new experiment. Many precise corrections applied to the data, since it is the first measurement of new experiment, and achieved high accuracy level. The result is

$$R(D^*) \equiv \frac{\mathcal{B}(B \to D^*\tau\nu)}{\mathcal{B}(B \to D^*\ell\nu)} = 0.262^{+0.041}_{-0.039}(\text{stat.})^{+0.035}_{-0.032}(\text{syst.}), \tag{3.1}$$

which is consistent with both the previous measurements and the SM expectations. Including this result, the excess from the SM is changed from $3.2\sigma \to 3.3\sigma$. The analysis achieve a $R(D^{(*)})$ measurement with improved sensitivity using the early data and establish a baseline for future analyses in the Belle II experiment.

In addition to the measurement of $R(D^{(*)})$, we measure the branching fraction of tauonic B decays as $B \to \tau\nu$ with the data recorded until LS1. This decay model is considered to have a strong correlation with the new physics involved in $R(D^{(*)})$ anomaly. In this fiscal year, we have completed the table of the systematic uncertainties. With 362 fb^{-1} data, we expect 46% statistical error and 15% systematic error, which should be compared with the Belle result of 38% and 16% errors using 711 fb^{-1} data. We obtain a similar sensitivity to the previous Belle result, while with half the dataset.

We are also working on the measurement of time-dependent CP violation in rare B decays of $B^{\pm} \to \rho^{\pm}\rho^{0}$. After the development of analysis framework with the measurement of the branching fraction of $B^{\pm} \to \rho^{\pm}\rho^{0}$ with 189 fb^{-1} data, we extended the analysis to measure the time-dependent CP violation, $\phi_2(\beta)$ of Unitary Triangle. We developed the fitting method and the probability density functions to extract the signal parameters and validated using the control samples. Almost all systematic uncertainties are checked and evaluated. The systematic errors are reduced by the level of the statistical errors.

We also measured the $e^+e^- \to \pi^+\pi^-\pi^0\gamma$ cross section using initial-state radiation. The precise result of the e^+e^- cross section will be crucial input to estimate the hadron vacuum polarization effects and the SM prediction of the anomalous magnetic moment of the muon (g-2). In particular, the result recently reported by the Fermilab g-2 experiment has confirmed the deviation reported earlier by the Brookhaven experiment, and the combined result has about 4.2σ deviation from the SM value. The cross-section has been measured using the initial Belle II data. The uncertainties on the efficiency of charged particle and π^0 are the major source of the systematic error. After the precise evaluation of those uncertainties, we have obtained the hadronic vacuum polarization contribution of 3π as

$$\alpha_{\mu}^{LO,HVO,3\pi}(0.62 - 1.8\mathrm{GeV}) = (48.91 \pm 0.25(stat) \pm 1.07(syst)) \times 10^{-10}, \quad (3.2)$$

which is 6.5% higher than the global fit result with 2.5σ significance.

We have started searching for the CP violation effect in the decay of $\tau \to K_S\pi\nu_\tau$, which may arise from the new physics effect in the decay vertex with new scaler boson, such as charged Higgs in the intermediate state. In the measurement, we will measure the CP violating angler distribution. We developed tools to calculate the angle in the boosted rest frame using Monte-Carlo simulation data and tried to improve the event selection criteria.

- **ATLAS**

KMI achievements in 2023 at the energy-frontier LHC-ATLAS experiment

Our scientific goals are to reveal the structure of vacuum and the origin of the mass of particles through the measurements of the Higgs-boson properties and to discover new phenomena arising from physics beyond the Standard Model (SM) such as supersymmetry. In 2023, two analyses based on the full Run 2 (2015–2018) data samples were completed: the search for Higgs-pair (di-Higgs) production and the search for long-lived particles (LLP) included in R-parity-violating SUSY models. The dataset includes 140 fb^{-1} of proton-proton collisions at a centre-of-mass energy of $\sqrt{s} = 13$ TeV. No significant signals were found in these searches, and stringent limits were set on the cross sections. We continue our effort for the thin gap chamber (TGC) and Level-1 muon trigger operation in Run 3, accumulating the data samples of proton-proton collisions with a centre-of-mass energy of $\sqrt{s} = 13.6$ TeV. In parallel, we have been developing advanced technologies for the muon trigger system to be used at the High-Luminosity LHC (HL-LHC) planned to start in 2030. The system determines which physics events are retained for offline data analyses, and is of fundamental importance to the ATLAS physics program.

Physics achievements

(1) Search for di-Higgs production

We searched for nonresonant di-Higgs production, which is sensitive to the self-coupling of the Higgs boson, in the $b\bar{b}b\bar{b}$ final state. The analysis utilised the full Run 2 dataset and targeted both the gluon–gluon fusion and vector-boson fusion (VBF) production modes. No evidence of the signal was found and the observed (expected) upper limit on the cross-section for nonresonant di-Higgs production was determined to be 5.4 (8.1) times the SM prediction at 95% confidence level. Constraints were placed on modifiers to the HHH and $HHVV$ couplings. The observed (expected) 2σ constraints on the HHH coupling modifier, κ_λ, were determined to be $[-3.5,\ 11.3]$ ($[-5.4,\ 11.4]$), while the corresponding constraints for the $HHVV$ coupling modifier, κ_{2V}, were $[-0.0,\ 2.1]$ ($[-0.1,\ 2.1]$). The results were published in Phys. Rev. D 108, 052003 (2023).
The search for nonresonant di-Higgs production in the $b\bar{b}b\bar{b}$ final state was combined with the searches in the $b\bar{b}\tau\tau$ and $b\bar{b}\gamma\gamma$ final states and also the single Higgs boson analyses to further constrain the Higgs boson self-coupling. The values outside the interval $-1.4 < \kappa_\lambda < 6.1$ were excluded at 95% confidence level (Figure 3.2(a)). The results were published in Phys. Lett. B 843, 137745 (2023).

(2) Search for LLP production

No new physics phenomena were observed yet with focus on prompt decays, and new weakly-interacting particles can have long lifetimes. We searched for LLP decaying into hadrons using events that contain multiple energetic jets and a displaced vertex in the full Run 2 dataset. The search employed dedicated reconstruction techniques that significantly increase the sensitivity to LLP decaying in the ATLAS inner detector. We established a data-driven method of background estimation for SM processes and instrumental effects. The observed event yields were compatible with those expected from background processes. The results are used to set limits at 95% confidence level on model-independent cross sections for processes beyond the SM, and on scenarios with pair production of SUSY particles with long-lived electroweakinos that decay via a small R-parity-violating coupling. The results were published in JHEP 06, 200 (2023).

(3) Uncertainty estimation for top-quark mass measurement using J/ψ

The Nagoya group has been focusing on top-quark physics historically since the LHC start and made various results with Run 1 dataset. A precise measurement of the top-quark mass has been becoming important with even higher statistics, in order to understand the stability of vacuum. We are working on the top-mass measurement using a J/ψ meson. This channel can suppress the large uncertainty from jet energy measurement, which has been one of the largest uncertainties in some high-statistics channels. We confirmed that the uncertainty due to jet energy measurement is less than 0.1 GeV. Dominant systematic uncertainty arises from the signal modeling, for which preliminary estimation was provided.

(4) Background separation for STXS measurement of the VBF Higgs production

Simplified Template Cross Sections (STXS) have been adopted by the LHC experiments as a common framework for Higgs measurements. Their purpose is to reduce the theoretical uncertainties that are directly folded into the measurements as much as possible, while at the same time allowing for the combination of the measurements between different decay channels as well as between experiments. In 2022, we launched a new analysis on the STXS for the VBF Higgs production. We reconstruct Higgs boson candidates using the Higgs boson decay to tau leptons. The STXS bins are defined with the Higgs boson transverse momentum and the invariant mass of the leading and sub-leading jets. In 2023, we optimised the BDT-based method of the separation between the signal and background from the Z boson decay to tau leptons. The overall analysis method was beging finalised, to be followed by the unblinding.

Trigger achievements

(1) Operation

KMI keeps playing a main role in the operation and the maintenance of the muon trigger system with TGC, which covers the pseudorapidity range $1.05 < |\eta| < 2.4$. Doctor course students at Nagoya contributed to the highly efficient and continuous operation of TGC by taking 24-hour TGC oncall shifts about 70 days in 2023. The integrated luminosity for the data recorded in 2023 was 30 fb^{-1}, resulting in a Run 3 total value of 65 fb^{-1}.

We successfully activated the coincidence with the Tile hadronic calorimeter on 3 July and New Small Wheel on 4 July (Figure 3.2(b)). The trigger rate reduction at an instantaneous luminosity of 2×10^{34} $\mathrm{cm}^{-2}\mathrm{s}^{-1}$ was measured as ~ 2 kHz by the Tile and ~ 6 kHz by the NSW, respectively.

Using the acquired data, we measured the TGC position relative to monitored drift tube chambers used for precision muon tracking. No significant position difference from Run 2 was obtained.

(2) Phase-II upgrade

HL-LHC starting from 2030 is planned to increase the luminosity by a factor of about 10 compared to the current LHC for more precise measurements of the Higgs boson properties and sensitive searches for the physics beyond the SM. The trigger and data acquisition system of the ATLAS experiment is being upgraded to cope with the higher radiation levels, the higher detector occupancy, and the higher data rate at HL-LHC (called Phase-II upgrade). Y. Horii is leading the developments as the Level-0 Endcap Muon Trigger Coordinator.

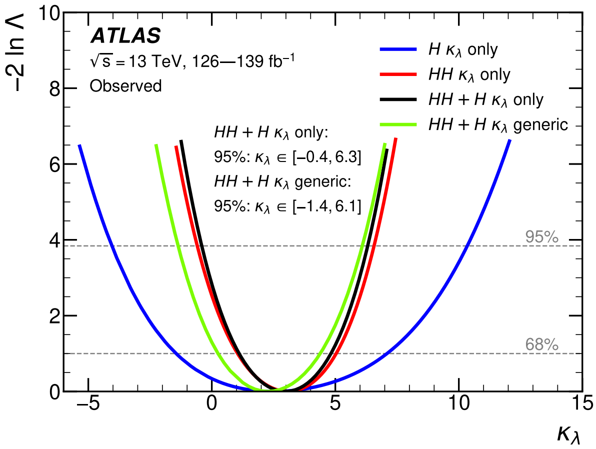
This year, we performed gamma and neutron irradiation tests for SFP+ transceivers to be used for the TGC frontend boards, and confirmed that they have sufficient tolerance against total ionising dose and non-ionising energy loss. We also tested 40 TGC frontend boards from initial batch of mass production. They satisfy the requirement, indicating a great start of the mass production for the 1434 boards to be installed in the TGC system.

The TGCs in the endcap inner layer have only two layers, and roughly 10% of the coverage is missing in the trigger due to high current observed in one or two layers. A new type of TGCs with three layers was designed with the same envelope as the two-layer chambers. We developed a test system of the new TGCs using aforementioned TGC frontend boards, and confirmed that the new TGCs have sufficient performance, i.e. low noise level, low cross talks, and high detection efficiency for minimum ionising particles (Figure 3.2(c), (d)).

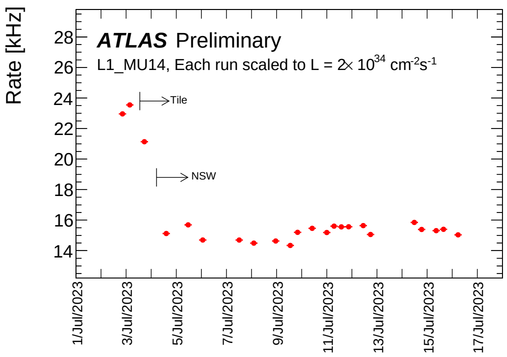
• Fundamental Astroparticle Physics

T-violation in resonance reactions, neutron interferometry, neutron lifetime, medium range interactions

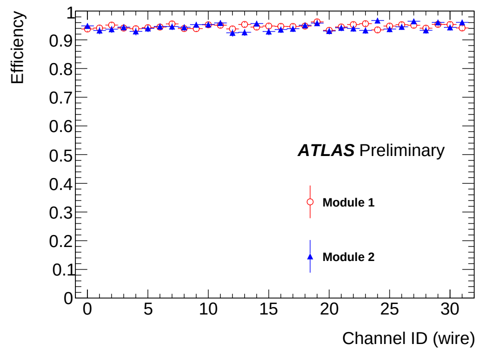
The enhancement of the violation of time-reversal symmetry is predicted in the neutron capture reaction for some nuclei. The enhancement depends on the resonance parameters and spin states of the nuclei. We successfully estimated the enhancement factor for ^{139}La as a target candidate at the order of 10^6 by measuring angular correlation terms of (n, γ) reaction by using germanium detectors in ANNRI neutron beam line in Material and Life Science Experimental Facility (MLF) at J-PARC. The enhancement of the symmetry violation is related to the reaction mechanism of compound nuclei. The detailed analysis of compound states can be discussed by using polarized neutrons, polarized targets, and polarity of γ rays. We have developed high-performance ^{3}He neutron spin filter for epi-thermal neutrons. We measured the angular correlation terms of ($\vec{n}$, γ) reaction by using the spin filter on the beamline. The brute-force nuclear polarization technique was applied to the metal lanthanum to measure the asymmetry of the capture reaction between neutron spin directions. This was a demonstration of whole setup of the T-violation search experiment. We have also developed the polarimeter of γ ray to install the beamline. By combining information of the correlation terms, a more detailed understanding of the compound nuclei can be discussed.



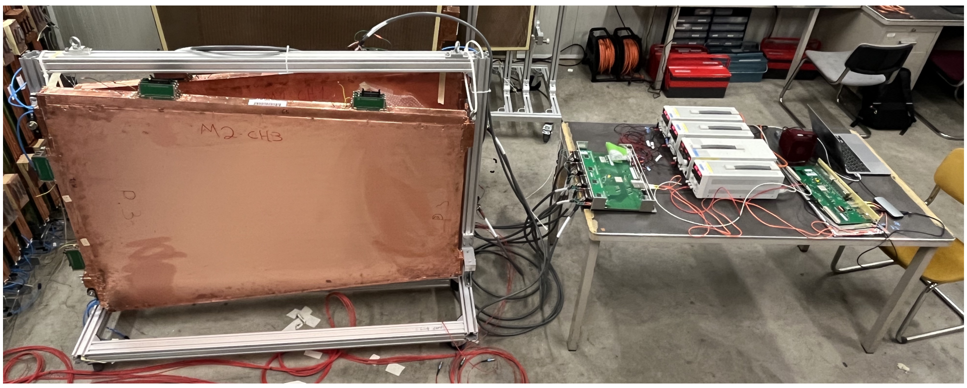
(a)



(b)



(c)



(d)

Figure 3.2: (a) Observed values of the test statistic ($-2\ln\Lambda$), as a function of the κ_λ parameter for the single-Higgs (blue) and di-Higgs (red) analyses, and their combination (black) derived with all other coupling modifiers fixed to unity. The combined result for the generic model (free floating κ_t, κ_b, κ_V and κ_τ) is also superimposed (green curve). (b) Trigger rate of the primary Level-1 muon trigger with a threshold of the transverse momentum of 14 GeV, scaled to the instantaneous luminosity of 2×10^{34} cm^{-2}s^{-1}, as a function of time in 2023. The coincidence has been activated with Tile (3 July) and NSW (4 July), and the trigger rate was reduced. (c) Efficiency of the new type of TGCs. The results for two modules are shown with red and blue plots. The observed inefficiency of several % is consistent with the dead regions due to internal support structure of the chambers. (d) A photo of the new type of TGCs and the test system.

For the T-violation search experiment, the polarized nuclear target has to be prepared. A $LaAlO_3$ single crystal, which has the perovskite structure, is a candidate for the polarized target. The collaborative study started to grow large crystals with Tohoku University. Dynamical nuclear polarization (DNP) system are developing with Hiroshima University, Osaka University and Yamagata University. The enhanced polarization of ^{139}La nuclei was demonstrated by the DNP method with the $LaAlO_3$ single crystal grown by ourselves.

These results showed the feasibility of the T-violation search experiment with high sensitivity, which is comparable to that of neutron EDM and which has different systematics. We are continuing detailed design of the T-violation search experiment in the international collaboration 'NOPTREX'.

The cold-neutron interferometer with pulsed neutrons was constructed on NOP beamline. Neutron scattering lengths of some nuclei were measured precisely by using the interferometer. This demonstrates the feasibility of search for small interactions, for example, gravity and dark energy.

The recent values of neutron lifetime deviate far beyond the systematic errors claimed in the past and sometimes can be a trigger of discussion of new physics. We published the first result of neutron lifetime measurement by using pulsed neutron beam at NOP beamline in J-PARC. The time projection chamber (TPC) detects both of the electrons from neutron beta decay and the nuclear reaction by ^3He in order to estimate the flux simultaneously. The measured value was 898^{+18}_{-20} s, which still has a large uncertainties. To improve the statistics the upstream beam optics was upgraded. By using high flux neutron beam, large amounts of data are being accumulated. We have also taken various data to survey the origin of the systematic uncertainties by using the improved statistics.

Nuclear emulsion as a neutron detector with high position resolution were developed with the emulsion group in Nagoya University. It will be applied to various experiments including a study of gravity. Neutron small angle scattering with nanoparticles can be used for search for new interactions in the medium range.

Understanding Cosmic-Ray Air Shower using Accelerator

The Large Hadron Collider forward (LHCf) experiment measures neutral particles emitted in the very forward angle region of hadron-hadron collisions at LHC. A similar version of the experiment RHICf has been done at RHIC with polarized proton-proton collisions at 510 GeV. Knowledge of the forward particle production is expected to improve the hadronic interaction models used in the interpretation of cosmic-ray air shower observations. In September 2022 LHCf have performed an operation with $\sqrt{s}$ = 13.6 TeV proton-proton collisions. The main target of this operation is to increase the statistics of rare events like high energy π^0s and η. Thanks to the upgraded data-taking system, 300 millions events was obtained in total, which was factor 5 more than the data obtained in 2015. A joint operation with ATLAS was performed in the operation as well as the past operations. It was a first time to have joint data taking with ATLAS ZDC and RPs detectors, which can allow us to extend the physics cases like diffractive event measurements and the one-pion-exchange measurement. The number of common events with ATLAS was dramatically improved to approximately 300 M from 6 M in 2015 operation. In October, a beam test at CERN-SPS was performed also to make a precise energy calibration of the detectors.

Dark Matter and Neutrino Experiments at Kamioka Mine

Super-Kamiokande (SK) is the 50-kton water Cherenkov detector underground of the Kamioka Observatory dedicated to the observation of neutrinos and possible proton decay. SK has prepared for the observation of supernova relic neutrinos emitted by all of the supernova explosions by adding gadolinium (Gd) to the pure water in the detector. Despite the difficult COVID-19 situation, followed by the first 0.01 % Gadolinium loading in 2020 summer, an additional 0.02 % Gadolinium was successfully introduced in the summer of 2022. Again no major impact on detector performance has been observed. A new Honda neutrino flux model has been developed with hadron production models tuned with the existing accelerator data. We have successfully produced the initial results, which were compared with the new Bartol neutrino flux model. It was discussed in the dedicated annual workshop for atmospheric neutrino productions, WANP2023. Construction of Hyper-Kamiokande (HK) is on going successfully. construction. In 2022, the access tunnel to the main cavern has been completed, and excavation of the main cavity has started. The Nagoya group intensively contribute to the study of the performance of 136 new 20" B&L PMTs installed in the Super-K tank since 2018. This is the first massive long-term test in the water. We confirmed the new Hyper-K PMTs successfully work as we expected from the study done in the air past. We concluded the final data analysis of XMASS experiment for a WIMP search with a full data set of 1590.9 days. We also published on searching for neutrinoless quadruple beta decays. At the end of 2022, the collaboration completed its activity.

Dark Matter and Neutrino Experiments at Laboratori Nazionali del Gran Sasso (LNGS)

The XENONnT experiment, the latest detector of the XENON dark matter program, was constructed to look for elusive dark matter particles. The detector holds almost 6 tonnes of ultrapure liquid xenon as a target medium. The XENON experiment aims at detecting tiny amount of charge and light produced after the interaction of a dark matter particle with a xenon nucleus. The detector is installed inside a water Cherenkov active muon and neutron veto. Despite the pandemic situation, XENONnT was successfully constructed and commissioned from spring 2020 to spring 2021. Afterwards, the XENONnT experiment took the first science data (SR0) over 97.1 days, from July 6 to November 10, 2021. The analysis for the weakly interacting massive particles (WIMPs) with this data was reported in March, and published on July 2023. The result of a blind analysis with an exposure of 1.1 ton years showed that the observed data was consistent with the background-only model. Although the exposure was similar to that of XENON1T SR1, the exclusion limit obtained with this initial data was improved by $\sim$2 due to the improvement of the detector background. After the SR0, further upgrades on the detector has been performed in this year. Firstly, the radon distillation system has been upgraded to perform the removal of radons in the liquid phase of the detector. With this upgrade, the concentration of radon, the source of largest background for the WIMPs search, has been reduced from 1.8 to 1 μBq/kg. The other upgrade is on the neutron veto system, which is based on the tequnique of water chenrenkov detector. While the system was operated during the SR0, the neutron tagging efficiency was limited to about 50% due to the lack of gadolinium in the system. The initial test for gadolinium insertion has been performed. With these upgrade, the XENONnT continues to take data to further improve the sensitivity. The analysis of other physics targets, such as low-energy interaction of the solar neutrinos, is also ongoing.

We are also conducting various R&D works for the future DARWIN/XLZD project, an experiment with 50-100 ton double-phase xenon Time Projection Chamber (TPC). With its great sensitivity to rare WIMP-nucleus interaction, the DARWIN/XLZD experiment has to improve background rates achieved by the currently leading experiments such as XENONnT. One of the most important background for WIMPs search is radiogenic neutrons, and photo-sensor is the major origin of them. Therefore, we have been investigating new candidates of photo-sensors to suppress the radio activity. Silicon photo multiplier (SiPM) is one of the good candidate for this purpose, while its very high dark count rate reduced the sensitivity for low mass dark matter. We have been developing the low dark count SiPM with Hamamatsu photonics to solve this problem. the characterization of the new SiPM was performed this year and the result showed the significant improvement on dark count rate (factor of $\sim$5). In addition to this, the other type of the photo-sensor which uses the photocathod and SiPM together, was tested as well.

Search for dark matter and research on the origin of cosmic rays with gamma-ray observations

Cosmic gamma rays are produced through interactions between dark matter, CRs, and the interstellar medium. Therefore, they can serve as indicators to search for dark matter and investigate the properties and distribution of CRs and interstellar media.

We are currently developing a next-generation gamma-ray observatory, called the CTA, to observe cosmic gamma rays in the energy range from well below 100 GeV to above 100 TeV. This involves overseeing the development, procurement, and calibration of silicon photomultipliers (SiPMs) for small-sized telescopes (SSTs) installed in the CTA. Currently, we are building a camera for the first SST and have procured all SiPM modules required for one camera and some spares.

Since we plan to build more than 40 SSTs with 2,048 SiPMs, it is important to understand their failure modes and rates. In an initial test, we measured the leakage current of a SiPM module, totaling 64 SiPMs, for more than half a year and found that it was fairly stable in most SiPMs and did not cause any issues during the observations. Although one SiPM exhibited a 10-hold increase in the leakage current, no visible increase was observed in its dark count rate, indicating that the increase was not caused by a higher dark count rate. Additionally, the voltage dependence of the leakage current exhibited resistor-like behavior, verifying the existence of a current source parallel to the SiPMs. We speculate that this increase in current was caused by a circuit-board defect.

Furthermore, the leakage current in 20% of the SiPMs jumped by fixed amounts and some SiPMs exhibited several jump modes. We speculate that these modal jumps are caused by the activation and deactivation of a certain defect, and that multimodal behavior is caused by multiple defects. In fact, we observed localized light emission from hot-carrier luminescence at these defect sites and found that the luminosity was proportional to the current. Additionally, emission sites tended to be located at microcell corners, indicating the structural cause of the defects. Hence, we could reduce the defect rate by correcting these structural issues.

Directional Dark Matter Search

Direction sensitive search is a new promising methodology for direct dark matter detection and its identification. However, expected nuclear recoils scattered by WIMPs like dark matter and target nuclei recoils in the detector being low-energy of 10-100 keV scale because of lowness of the dark matter velocity. The expected track length in the solid (or liquid) detector is less than 1 μm, therefore development of technologies to obtain tracking information in such a short distance is the unique key of the project.

We also investigate use of proton recoil tracks for light dark matter search. There are several discussions on boosted dark matter or multi components dark matter. In such a scenario mass of sub-Gev/c^2 or less and having relatively larger speed than WIMP and recoiled proton tracks could be detectable. The other physics target by use of recoil proton is neutron measurement. On surface and underground studies on neutron flux measurements were performed.

NEWSdm (Nuclear Emulsion WIMPs Search directional measurement) experiment has been operated by the international collaboration consisting of 12 institutes, 5 countries. Current main experimental site is the National Laboratory of Gran Sasso (LNGS), Italy, and R&D and data analysis sites are KMI, Nagoya University, Toho University and Napoli university. This project utilize originally developed the Nano Imaging Tracker (NIT) which is super-high resolution tracking device based on nuclear emulsion with 10 nm scale resolution and also, new readout systems to obtain nano-scale direction information continue to develop in KMI and Italian group, those systems are very unique in this experiment. NIT has a good signal noise ratio, especially electron background rejection power (10^{-3} or even better).

NEWSdm facility in LNGS, underground site in Hall-F. In the site , an emulsion gel production machineinstalled at the end of 2018, have produced NIT devices under clean condition at deep underground since 2019. Full chain, preparation / exposure and development of emulsion films were in the underground site. Film scanning and analysis were performed with dedicated microscopes at Nagoya University and Toho university.

Demonstrations of data analysis and scanning using several g target mass were repeated. At the exposure time, the NIT devices were at the condition of -30 degree temperature and surrounded by thick polyethylene shields. By doing several runs with the same condition at a day, a week, a month of exposure, the detected number of signal-like candidates in initial condition was larger than expected.

Tryals of reduction of intrinsic background have been continued from 2023. ^{14}C in Gelatin emits β rays and a few developed grains will be created at the β ray stopping points. This would be the largest source of background events in the future experiment. Gelatin is natural polymer and natural abundance of ^{14}C in but polymer from petroleum has negligibly small abundance of it. While to make emulsion gel, there are not so good binder than gelatin and only a few prior studies can be found in literature. Emulsion gel procuctio tryal with PVA (PlyVinyl Alchol) were continuously performed and several parameters are tuned to make a good emulsion gel. With a recipe currently achieved, emulsion gel have sensitive to 100 keV carbon ion beam (dummy signal of recoils by WIMP) but lower efficiency than usual NIT.

Nuclear Emulsion Technologies

Nagoya University is almost the only university/public research institute capable of research, development and manufacturing of nuclear emulsions. In recent years, the use of emulsion films has expanded beyond elementary particle physics to include various imaging fields, and the demand for them is growing on the order of 1000m^2. To promote further research activities, an upgrade of the emulsion gel/film facility operating at Nagoya University has been completed by 2021. Currently, a large gel production machine is in operation, 20kg of emulsion gel can be produced a day. This corresponds to approximately 10 m^2 emulsion films. We also developed a roll-to-roll automatic coating machine. This machine can pull the base film directly from the roll, pour the emulsion gel on the surface, dry it continuously, and finally wind the film onto another roll. Automation has made it possible to produce films of sufficient thickness and uniformity in a short period of time. In 2023, these mass production systems were in stable operation for emulsion experiments such as FASER, DsTau, SND, and NINJA, contributing to the realization of these projects.

Also our emulsion scannig facility is assuming role of the center of nuclear emulsion analysis for particle physics ,muon radiography and other applications. The HTS1 is working for these applications and is the world fastest emulsion scanning system. The 2nd generation system, HTS2, is under commisioning and the new nuclear emulsion has been developing. The new gel has lager AgBr crystals and optimized for HTS2 optics. In order to get the further scannig throughput and covinience for other institutes and groups, also the third generation of scanning system has been developping.

The developement of PTS, which is focused to read-out for fine graine emulsion "NIT", is on going for the directional dark matter search, NEWSdm. In last year, we reported that a novel ellipse analysis with the 2nd order moment method has been implemented, thereby causing carbon ion tracks down to kinetic energy of 30 keV to be detected. The recent upgrade of PTS has been achieved 4 times of throughtput as last year version. That is corresponding over 400g per year of the capability of analysis speed. A new new objective and imager was equipped which had 8 time field of view, and develope new method of correcting aberration of optics. At present, the further tuning of algorithm is ongonging. The next upgrade will increase the effective frame rate by equipping multiple image sensors, enabling kg-scale experiments with a few number of PTS systems.

Balloon Experiment for Gamma-rays Astronomy using Nuclear Emulsion Technology

Observation of cosmic gamma rays is important in understanding high-energy phenomena in the universe. Since 2008, the Fermi Gamma-ray Space Telescope has surveyed the sub-GeV/GeV gamma-ray sky and provided a large amount of data. However, observation remains difficult owing to the lack of angular resolution, and new issues have arisen.

We started up a precise gamma-ray observation project, Gamma-Ray Astro-Imager with Nuclear Emulsion (GRAINE), using balloon-borne emulsion gamma-ray telescopes to enable high angular resolution, polarization-sensitive, and large-aperture observations in the 0.01–100 GeV energy region. In the last balloon experiment (GRAINE 2018), which was performed in April 2018, we succeeded in the first detection of a celestial gamma-ray object, Vela pulsar, via the balloon-borne emulsion telescope. The expanse of the gamma-ray image in the 100-MeV region is $\sim 0.4^\circ$, which is the expected performance of our telescope, and the world's highest angular resolution was demonstrated.

We start the scientific observation phase by enlarging the aperture area, extending the flight duration, and repeating balloon flights. The next balloon experiment (GRAINE 2023) is approved by JAXA and scheduled in March 2023 (The original schedule was in 2021, but postponed due to covid 19). The experiment aims at the observation of Vela pulsar, Geminga pulsar, the galactic center, etc. in the GeV energy region, and the survey of transient phenomena by the largest aperture area telescope.

Since June 2022, we conducted nuclear emulsion production using new facilities in Nagoya University at full-capacity operation for the first time, and completed 600 m^2 of Nagoya-made emulsion films for the next experiment. We have also developed a 6-m long large pressurized vessel gondola, which mounts 2.5-m^2-aperture-area emulsion telescopes (6.6 times larger than that of GRAINE 2018) and attitude monitors, via various performance and environmental tests. All equipment and films were shipped to Alice Springs, Australia at the end of 2022 and the beginning of 2023.

We conducted fourth balloon experiment, GRAINE 2023, in 2023 April in Australia. The flight succeeded and we recovered the emulsion films . Then, we completed the development process for the flight films, and started to read out the recorded tracks at the Nagoya University. The analysis is ongoing.

Study for Neutrino Physics using Nuclear Emulsion

Tau neutrino is the one of the least known standard model particles. It is due to large uncertainty of its production and difficulties in detection and identification. So far tau neutrino-nucleon interaction cross section has a large error of several tens % and we, **DsTau, SHiP**, are aiming to measure it within10% accuracy. And we also study tau neutrino production at the forward direction from the LHC collision point by **FASER**ν.

DsTau experiment aims to study the tau neutrino production with CERN SPS 400 GeV proton on tungsten and molybdenum target. DsTau will provide accurate tau neutrino flux information for future experiments like SHiP measuring tau neutrino cross section with high statistics by performing a detailed analysis of the differential production cross-section of $Ds \to \tau + \nu_\tau$ and the $\tau \to X + \nu_\tau$. Nuclear emulsion trackers used in DsTau can identify $Ds \to \tau + \nu_\tau$ cascade decay, thanks to the sub-micrometric position resolution of emulsion. The uncertainty of tau neutrino production flux will be reduced below 10% using 1000 detected such a cascade decays from 2×10^8 proton -tungsten interaction. After the success of the data collection and analysis status of the 2018 pilot run, DsTau is officially approved as **CERN NA65**. The physics run started from 2021 and we performed a largest scale , more than 2 times of 2021 or 2022 , beam exposure in 2023. The physics 2021-2023 run are performed successfully and in total 74 (41 tungsten, 33 molybdenum) Emulsion Cloud Chamber (ECC) modules were exposed to 10^5 protons/cm^2 beams. A total of 2^8 proton tungsten/molybdenum interactions are accumulated in the ECCs. The emulsion films of 2023 physics run films were developed and are sending to Nagoya University to scan. Currently analyzing proton-tungsten interactions in Pilot 2018 run data and Physics run films are under scanning.

SHiP experiment is planning to expose tau neutrinos from 2031 or later. Currently we are polishing the design of the beam dump facility and detector components to get the approval. We are doing performance tests for tau decay daughter track's change and momentum measurements. Thanks to sub-micrometric resolution of nuclear emulsion, a compact spectrometer length of 3 cm can determine charged track's charge for momentum $\leq$ 7 GeV/c. The compact emulsion spectrometer (CES) has emulsion films as a tracking device with low density 1.5cm spacers. The CES performance tests have been conducted with several base materials. As a result the glass base or solid thicker base (COP) make the distortion of emulsion plates smaller and then produce better performance on momentum resolution.

FASERν is a project taking data in 2022-2025 and later aiming to study high energy neutrinos from the ATLAS collision point at 480m distance in forward direction. 1.1 tons of neutrino ECC detector using 1mm thick tungsten plates as neutrino interacting targets interleaved with nuclear emulsion films (cross section of 25cm $\times$ 30cm.), mounted in the TI12 tunnel. ECCs are exchanged three times par year to keep the accumulated number of tracks density in emulsion films lower than 10^7 tracks par cm^2. We started scanning of developed films of a ECC (F222) exposed in 2022 and neutrino event search/analysis in subsample of F222 are performed.

The NINJA experiment at J-PARC and related activities

Currently study of Sub-Multi GeV neutrinos is one of most important subject in the field of particle physics because almost long baseline neutrino oscillation experiments which search for the CP violation in the lepton sector use neutrinos in this energy region and the main systematic error in current and future neutrino oscillation analysis is caused from the uncertainty of neutrino-nucleus interactions in this energy region. Furthermore, the MiniBooNE experiment at Fermilab reported an anomaly of 4.7 sigma excess of electron like neutrino events in Sub GeV energy region which indicates the existence of a sterile neutrino. Sterile neutrino search is also a big topics in this field because it is not predicted by the Standard Model and a candidate of right-handed neutrino, dark matter or dark radiation. However, the MiniBooNE signal has been not concluded as evidence of sterile neutrino because there is still a possibility that it comes from an unknown systematic error, for instance, the uncertainty of neutrino-nucleus interactions. So more precision measurement of short baseline neutrino oscillation like MiniBooNE condition is needed. In summary, the study of Sub-Multi GeV neutrinos is a key to open physics beyond the Standard Model.

The NINJA experiment aims to measure Sub-Multi GeV neutrino-nucleus interactions precisely and search for sterile neutrino at the same physics condition in the MiniBooNE with different detector and accelerator at J-PARC. Thanks to the excellent position resolution of the emulsion detector which is the main detector in NINJA, we can measure not only leptons but also hadrons from neutrino interactions at low energy threshold. This allows us to reconstruct neutrino interactions without ambiguities. Actually, we clearly demonstrated to detect below 500 MeV/c protons from neutrino interactions in iron and water target which could not be detected so far. Then we found the disagreement between the measured data and the simulated prediction in backward pion production at anti neutrino-iron interactions. This indicates the understanding of neutrino-nucleus interactions are not enough and our measurements is effective to modify the current neutrino interaction models or the current neutrino interaction generators.Currently, we have anlyzed neutrino-water interactions with a 250 kg large mass detector (iron:130 kg, water:75 kg, emulsion:30 kg, CH:15 kg) which implemented neutrino beam exposure from Nov. 2019 to Feb. 2020 as our 1st Physics Run.

The activities of the NINJA experiment have been documented at Snowmass2021 as one of the leading precise neutrino-nucleus interaction measurement experiments. Furthermore, NINJA-type water target emulsion detector was adopted as one of the near detectors for ESSnuSB project, a future ultra-large long-baseline neutrino oscillation experiment.

3.2.2 Origin of Spacetime Structures Group

X-ray observatory XRISM (X-Ray Imaging and Spectroscopy Mission)

XRISM is a JAXA-lead X-ray astronomy satellite, to be launched in JFY 2023. Based on the heritage of the Hitomi X-ray observatory, XRISM focuses on its soft X-ray super high resolution spectroscopy with an energy resolution of $sim5$ eV using a calorimeter array, 30 times better than existing X-ray CCD detectors. Because it does not use dispersion optics, the energy resolution is not affected by the spatial structure of the target and therefore is a powerful tool to observe diffuse objects, such as clusters of galaxies and super-nova remnants.

The XRISM the satellite is assembled and environmental testing were underway. It will be shipped to the launch site at Spring 2023. The ground support systems and science analysis software are also ready. Target selection of Performance Verification Phase has been defined. Uxg member is contributing in developing the information sharing system, as a member of the science operations preparation team (SOPT).

The Imaging X-ray Polarimetimetry Explorer (IXPE) mission

IXPE is a SMEX mission lead by MSFC/NASA, launched in 9 December 2021, into a 600 km circular orbit at approximately 0° inclination. The mission provides the first imaging-polarimetry observation in the 2–8 keV X-ray bands. It has already revealed the EM-effect of extremely high magnetic field of a Magnetor (highly magnet1zed neutron-star) 4U 0142+6's surface, geometric limitation of X-ray emitter in AGNs, as well as apparently turbulent magnetic field of SNR shock waves. Nagoya University provided the thermal-shield for the X-ray mirror optics, based on the experience on those of the Suzaku and Hitomi satellites.

The MeV astronomy satellite COSI (COMPTON Spectrometer and Imager) mission

COSI is the newest SMEX mission selected by NASA, to be launched into equatorial low-earth orbit on mid-2027. COSI is a MeV all-sky survey mission, which was last performed in 1990-2000 by the CGRO/COMPTEL mission. The main detector is made of Ge double-sided strip detectors and operated as a semiconductor Compton telescope. With its good energy resolution, COSI is good at line detection in 0.2-3 MeV, which includes 511 keV annihilation-line, $56Co$, $44Ti$, ^{60}Fe, ^{26}Al and others. The project is lead by UC Berkeley/SSL, and Nagoya University supports the MeV science analysis study and sub-detectors "BTO" (Background and Transient Observer) dedicated for transient monitoring and supporting background estimation.

X-ray optics and detector development activities

In view of the future X-ray observatory, we are developing new optics. One is a new mirror using domestic electroforming technology, and aiming at a few arcsec level of angular resolution. The technology is adopted as one of the optics for FORXSI-4 sounding rocket mission to be launched in April 2024. It is dedicated for Solar flare observations, and now the flight models are in fabrication and calibration.

The JEDI mission, a wide-band fine imaging probe in 0.5-80 keV as well as far UV in 250–300 nm wavelength, is proposed for launch around early-2030s. The main science aim is to observe the time-evolution (such as SNe afterglow) in wide energy-band around X-ray, to reveal the physical structures around variable high-energy sources such as, SNe shock breakout, Galactic X-ray binaries, Tidal Disruption Event at the central super-massive black hole, stellar flares, as well as diffuse hard X-ray

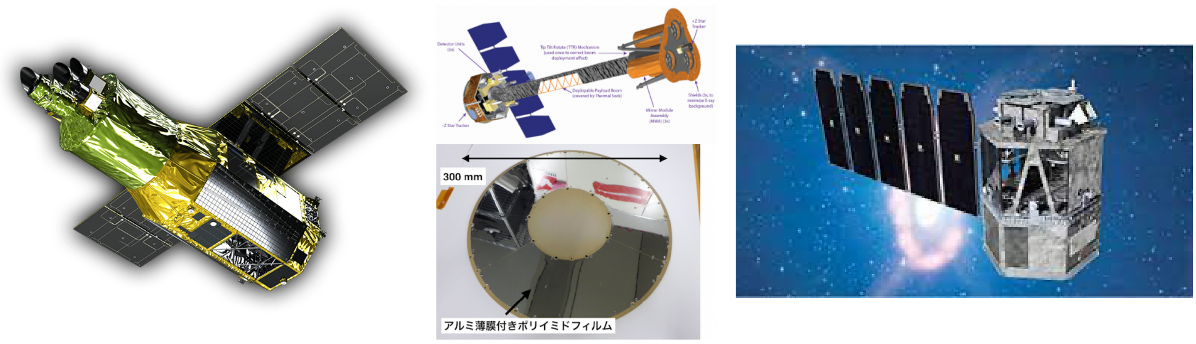


Figure 3.3: (left) The XRISM mission image. (middle) The IXPE mission and its thermal shield. (right) Image of the COSI mission.

emissions from young SNRs (sometines a GeV counterpart). Nagoya University is one of the leading member in satellite systems and detector sub-systems design.

We are also developing "miniSGD" scientific ballooning trial experiment. It uses similar detector technologies to be adopted by JEDI, using the Double-sided Si Strip Detectors (DSSDs) and CdTe double-sided Strip Detector combined as yet another semiconductor Compton telescope. Original plan was to fly this mission concept verification system on April-May 2023 and the 40 cm large 60 kg compact system has been developed and tested. Unfortunately the flight was canceled because of issued unrelated to miniSGD. The technology development and performance verification activities are extensively conducted. In particular, improvement of Compton imaging angular resolution measure (ARM) by adopting depth-sensing to CdTe-DSD signals has been done, and now it provides the best ARM value in 356 keV at 3.0 degree (FWHM, ARM).

X-ray data analysis: merging cluster of galaxies

Cluster of galaxies are the node of the large-scale-structure, and is the largest self-gravitating system in the Universe. We are analyzing a early-phase merging cluster using X-ray data of Suzaku and XMM-Newton. In the bridge region connecting the two clusters, we found two zones with high-pressure. We performed detailed 3D analysis of an early-phase merging cluster, and revealed its 3D structure for the first time.

Thundercloud gamma-ray observation

Thunderclouds are known to emit gamma rays with energy as high as 30 MeV. As one of the applications of space-borne compact X-ray/gamma-ray detector technology, we are performing gamma-ray observations of winter thunderclouds around the seashore of Japan Sea. To investigate the electron acceleration region of gamma-ray flashes (TGFs) associated with lightning discharge, we developed a new direction sensitive detectors system and deployed two sets of them on FY2022. The observation champaign is continuing.

3.2.3 Instrument Development Laboratory

Operation of the TOP counter in the Belle II experiment

We have operated the TOP detector, which is the Cherenkov ring imaging detector for the particle identification in the Belle II detector. TOP detector measures the Cherenkov photon's arrival time and position on the photodetector, MCP-PMT, attached on the end of quartz radiator.

The Belle II operation was continued by the end of June 2022. The integrated luminosity is about 400 fb^{-1}. Then, we have started the long shutdown 1 (LS1) period, for about one year. During the

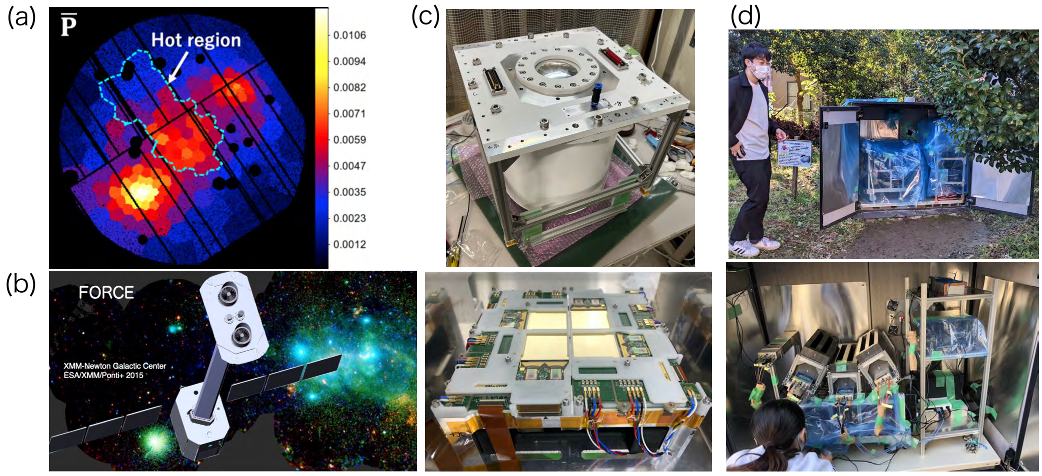


Figure 3.4: (a) Plasma pressure distribution of a merging cluster CIZA J1358.9-4750. (b) The FORCE mission. (c) miniSGD system and its CdTe-DSD imager. (d) Thunder cloud gamma-ray observation champaign of FY2021.

LS1, we replaced the MCP-PMTs, which shows some deterioration of the photo-cathode efficiency, and the malfunctioned frontend electronics. As shown in Figure 3.5, we moved old ALD-type PMTs to lower slots of TOP detectors, since the lower slots are rather easy to replace for future, and installed new 224 MCP-PMTs with life-extended ALD-type.

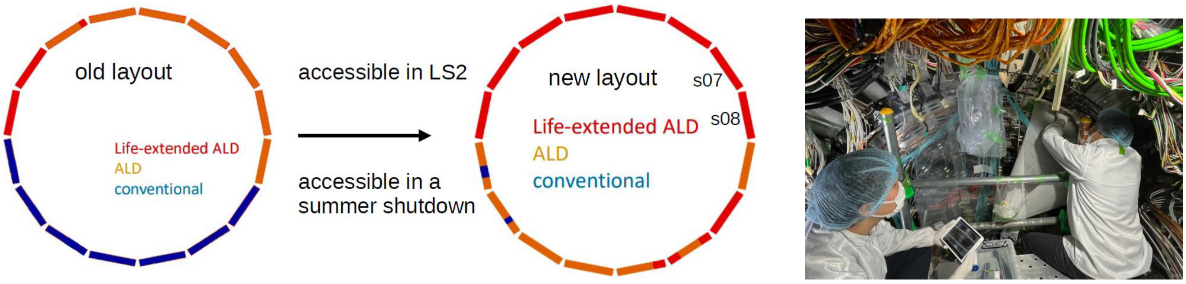


Figure 3.5: Layout of MCP-PMTs installed in the TOP detector and photo during the PMT replacement.

First, we have performed the lifetime test using the removed PMTs, and obtained the longer lifetime than that of in situ and no clear degradation as expected from the R&D test result, which is shown in Figure 3.6.

We have investigated the reason of faster QE deterioration in situ. One of the difference is the temperature in situ. The temperature at around the PMT region in the TOP module is about 40 deg-C, because of the electronics heating, which is a bit higher than the lifetime test environment. We set up the lifetime test bench inside the oven and tested the removed PMTs with the temperature of 40-50 deg-C. The result indicates a bit faster QE drop in the high temperature condition than room temperature, while we need further study using different samples to conclude the effect.

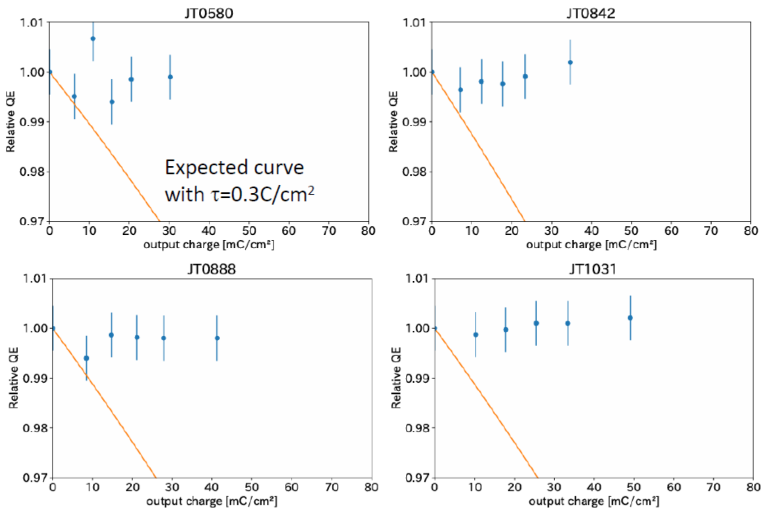


Figure 3.6: Relative quantum efficiency depending on the output charge for the removed PMTs, tested at the Nagoya test bench. Orange curve shows the expected curve with the lifetime of 0.3 C/cm^2, which is the lifetime obtained by data in situ.

Chapter 4

Research Related Activities

4.1 Conferences and meetings held by KMI

[1] JACST15周年記念シンポジウム
Date: 11-12 May, 2023
Place: ES635, Nagoya Univ.
Style: Domestic
Number of participants:
Sponsorship: 科学技術広報研究会（JACST） Co-sponsorship: KMI
Web site: https://jacst.gitlab.io/15th/

[2] The 32nd Workshop on General Relativity and Gravitation in Japan (JGRG 32) Date: 27 Nov - 1 Dec, 2023
Place: Sakata and Hirata Hall, Nagoya Univ.
Style: International
Number of participants (foreign): 240 (31)
Sponsorship: Graduate School of Mathematics KMI, Nagoya University
Web site: https://sites.google.com/view/jgrg-32

[3] 「一般相対論と幾何」(GRGeo) Date: 8-9 Feb, 2024
Place: ES635
Style: Domestic
Number of participants: 55
Sponsorship: KMI
Web site: https://www.math.nagoya-u.ac.jp/~shiromizu/grmath2024/

[4] The 5th KMI school (KMI school 2024): Quantum Computing for Particle Physics and Astrophysics Date: 5-7 Mar, 2024
Place: ES635+online
Style: International
Number of participants (foreign): 66(13) onsite, 65(25) online
Sponsorship: ICEPP, University of Tokyo, KMI, NAIAS, Nagoya University
Web site: https://www.kmi.nagoya-u.ac.jp/workshop/kmi-school-2024/

4.2 Seminars and Collquia

[1] 2023/04/13 17:00- KMI Colloquium
"Dark Matter Detection via the Excitation of Qubits"
Prof. Takeo MOROI (University of Tokyo)

[2] 2023/05/31 17:00- KMI Colloquium
"How baryons appear in low-energy QCD: Domain-wall Skyrmion phase in strong magnetic fields"
Prof. Muneto Nitta (Keio University)

[3] 2023/06/14 17:00- KMI Colloquium
"Observation of MeV gamma-ray in the Galactic Center region using an electron tracking Compton telescope loaded on balloons"
Prof. Atsushi Takada (Kyoto University)

[4] 2023/07/13 17:00- KMI Colloquium
"Holographic Universe from Quantum Information"
Prof. Tadashi Takayanagi (YITP Kyoto University, Inamori Research Institute for Science, Kavli IPMU University of Tokyo)

[5] 2023/07/25 11:00- KMI Experiment Seminar
"Dark Matter Candidate within the Standard Model"
Prof. Glennys Farrar (New York University)

[6] 2023/08/04 16:30- KMI Experiment Seminar
"Hunting the WIMP: The path towards the ultimate direct detection experiment"
Dr. Adam Brown (University of Freiburg)

[7] 2023/09/20 17:30- KMI Topics
"Spectroscopy of muonic helium hyperfine structure and reporalization of negative muon at J-PARC"
Mr. Seiso Fukumura (Phi-lab, Nagoya Univ.)

[8] 2023/09/25 14:00- KMI Theory Seminar
"Primordial magnetogenesis in multicomponent dark matter"
Dr. Filippo Anzuini (University of Melbourne)

[9] 2023/10/18 17:30- KMI Topics
"Deep learning for continuous gravitational waves"
Dr. Takahiro S. Yamamoto (Nagoya University)

[10] 2023/10/25 17:00- KMI Colloquium
"Close to Detection: Nano-Hertz Gravitational Wave Background"
Prof. Keitaro Takahashi (Kumamoto University)

[11] 2023/11-10 15:00- KMI Colloquium
"From Cold Atoms to Pulsar Timing Arrays: Looking for the Biggest Bangs since the Big Bang"
Prof. John Ellis (CERN & King's College London)

[12] 2023/11/22 17:30- KMI Topics
"Universality at large complexity"
Prof. Masataka Watanabe (Department of informatics, Nagoya University)

[13] 2023/12/01 15:30- KMI Theory Seminar
"Probing strong gravity when gravity waves"
Prof. Nicolas Yunes (University of Illinois at Urbana-Champaign)

[14] 2023/12/13 14:00- KMI Colloquium
"How can we know about GUT?"
Prof. Naoyuki Haba (Osaka Metropolitan University)

[15] 2023/12/18 14:00- KMI Theory & QG joint Seminar
"Black hole solutions in GR and f(R) gravitational theories"
Prof. Gamal G. L. Nashed （The British University in Egypt)

[16] 2024/01/15 14:00- KMI Theory & QG joint Seminar
"Going beyond the standard LCDM model by Cosmography"
Prof. Salvatore Capozziello (Universita' di Napoli "Fedrico II" Scuola Superiore Meridionale

[17] 2024/02/13 16:00- KMI Experiment Seminar
"Performance of novel Silicon Photo-Multipliers for the nEXO and DarkSide-20k experiments"
Dr. Giacomo Gallina (Princeton University)

[18] 2023/02/22 17:00- KMI Colloquium
"Cosmic Antimatter Search with Balloon-Borne Liquid Argon TPC – The GRAMS Experiment?"
Prof. Kohei Yorita (Waseda University)

4.3 Awards

No awards this year.

Chapter 5

Publications and Presentations

† indicates a publication/presentation that includes FlaP members.

5.1 Published papers

5.1.1 Division of Theoretical Studies

Refereed papers

[1] † B. R. He, M. Harada and B. S. Zou, "Ground states of all mesons and baryons in a quark model with Hidden Local Symmetry", Eur. Phys. J. C 83, no.12, 1159:1-6 (2023). DOI: https://doi.org/10.1140/epjc/s10052-023-12338-5

[2] † Y. K. Kong, T. Minamikawa and M. Harada, "Neutron star matter based on a parity doublet model including the a0(980) meson", Phys. Rev. C 108, 055206:1-15 (2023). DOI:https://doi.org/10.1103/P

[3] † T. Minamikawa, B. Gao, T. Kojo and M. Harada, "Parity doublet model for baryon octets: diquark classifications and mass hierarchy based on the quark-line diagram", Phys. Rev. D 108, no.7, 076017:1-17 (2023). DOI:https://doi.org/10.1103/PhysRevD.108.076017

[4] † H. Takada, D. Suenaga, M. Harada, A. Hosaka and M. Oka, "Axial anomaly effect on three-quark and five-quark singly heavy baryons", Phys. Rev. D 108, no.5, 054033:1-15 (2023) DOI:https://doi.org/10.1103/PhysRevD.108.054033

[5] † B. R. He, M. Harada and B. S. Zou, "Quark model with Hidden Local Symmetry and its application to Tcc", Phys. Rev. D 108, no.5, 054025:1-5 (2023). DOI:https://doi.org/10.1103/PhysRevD.108.054

[6] † M. H. Mun, I. J. Shin, W. G. Paeng, M. Harada and Y. Kim, "Nuclear structure in parity doublet model", Eur. Phys. J. A 59, no.7, 149:1-6 (2023). DOI:https://doi.org/10.1140/epja/s10050-023-01064-x

[7] † X. Chu, J. Hisano, A. Ibarra, J.Kuo, and J. Pradler, "Multipole vector dark matter below the GeV scale", Phys.Rev.D 108 (2023) 1, 015029.

[8] † T. Banno, J. Hisano, T. Kitahara, N. Osamura, "Closer look at the matching condition for radiative QCD θ parameter", JHEP 02, 195 (2024).

[9] A. Barone, S. Hashimoto, A. Juettner, T. Kaneko and R. Kellermann, " Approaches to inclusive semileptonic $B_{(s)}$-meson decays from Lattice QCD", JHEP 07 (2023) 145, doi:10.1007/JHEP07(2023)145 [2305.14092 [hep-lat]].

[10] P. Mohanta, T. Kaneko and S. Hashimoto, "$B_s \to K\ell\nu$ form factors from lattice QCD with domain-wall heavy quarks", Proceedings of Science, Lattice 2023 (2024) 267, doi:10.22323/1.453.0267 [arXiv:2401.01570 [hep-lat]].

[11] Y. Aoki, B. Colquhoun, H. Fukaya, S. Hashimoto, T. Kaneko, R. Kellermann, J. Koponen and E. Kou, " $B \to D^*\ell\nu$ semileptonic form factors from lattice QCD with Möbius domain-wall quarks" , Phys. Rev. D 109 (2024) 074503, doi:10.1103/PhysRevD.109.074503 [arXiv:2306.05657 [hep-lat]].

[12] S. Banik, A. Crivellin, S. Iguro and T. Kitahara, "Asymmetric di-Higgs signals of the next-to-minimal 2HDM with a U(1) symmetry," Phys. Rev. D **108** (2023) no.7, 075011 doi:10.1103/PhysRevD.108.0 [arXiv:2303.11351 [hep-ph]].

[13] T. Kitahara and K. Tobioka, "Sterile neutrinos in light of the Cabibbo-angle anomaly," J. Phys. Conf. Ser. **2446** (2023) no.1, 012009 doi:10.1088/1742-6596/2446/1/012009

[14] A. Crivellin, M. Kirk, T. Kitahara and F. Mescia, "Global fit of modified quark couplings to EW gauge bosons and vector-like quarks in light of the Cabibbo angle anomaly," JHEP **03** (2023), 234 doi:10.1007/JHEP03(2023)234 [arXiv:2212.06862 [hep-ph]].

[15] M. Fedele, M. Blanke, A. Crivellin, S. Iguro, T. Kitahara, U. Nierste and R. Watanabe, "Impact of Λb→Λc$\tau\nu$ measurement on new physics in b→clν transitions," Phys. Rev. D **107** (2023) no.5, 055005 doi:10.1103/PhysRevD.107.055005 [arXiv:2211.14172 [hep-ph]].

[16] A. Dery, M. Ghosh, Y. Grossman, T. Kitahara and S. Schacht, "A precision relation between Γ(K $\to \mu^+\mu^-$)(t) and $\mathcal{B}(K_L \to \mu^+\mu^-)/\mathcal{B}(K_L \to \gamma\gamma)$," JHEP **03** (2023), 014 doi:10.1007/JHEP03(2023)014 [arXiv:2211.03804 [hep-ph]].

[17] S. Iguro, T. Kitahara, Y. Omura and H. Zhang, "Chasing the two-Higgs doublet model in the di-Higgs boson production," Phys. Rev. D **107** (2023) no.7, 075017 doi:10.1103/PhysRevD.107.075017 [arXiv:2211.00011 [hep-ph]].

[18] C. Delaunay, J. P. Karr, T. Kitahara, J. C. J. Koelemeij, Y. Soreq and J. Zupan, "Self-Consistent Extraction of Spectroscopic Bounds on Light New Physics," Phys. Rev. Lett. **130** (2023) no.12, 121801 doi:10.1103/PhysRevLett.130.121801 [arXiv:2210.10056 [hep-ph]].

[19] Y. Hamada, T. Kitahara and Y. Sato, "Monopole-fermion scattering and varying Fock space," JHEP **11** (2022), 116 doi:10.1007/JHEP11(2022)116 [arXiv:2208.01052 [hep-th]].

[20] S. Iguro, T. Kitahara and Y. Omura, "Scrutinizing the 95–100 GeV di-tau excess in the top associated process," Eur. Phys. J. C **82** (2022) no.11, 1053 doi:10.1140/epjc/s10052-022-11028-y [arXiv:2205.03187 [hep-ph]].

[21] A. Crivellin, M. Kirk, T. Kitahara and F. Mescia, "Large t→cZ as a sign of vectorlike quarks in light of the W mass," Phys. Rev. D **106** (2022) no.3, L031704 doi:10.1103/PhysRevD.106.L031704 [arXiv:2204.05962 [hep-ph]].

[22] E. Goudzovski, D. Redigolo, K. Tobioka, J. Zupan, G. Alonso-Álvarez, D. S. M. Alves, S. Bansal, M. Bauer, J. Brod and V. Chobanova, *et al.* "New physics searches at kaon and hyperon factories," Rept. Prog. Phys. **86** (2023) no.1, 016201 doi:10.1088/1361-6633/ac9cee [arXiv:2201.07805 [hep-ph]].

[23] Y. Kanda and N. Maekawa, "Stability of the embedded string in the $SU(N) \times U(1)$ Higgs model and its application", Physical Review D 107 (2023) 9, 096007, arXiv:2303.09517 [hep-ph], doi:10.1103/PhysRevD.107.096007.

[24] B. K. Sahoo, N. Yamanaka, K. Yanase, "Revisiting Theoretical Analysis of Electric Dipole Moment of ^{129}Xe," Phys. Rev. A **108**, 042811 (2023).

[25] N. Yamanaka, "R-parity violating two-loop level rainbowlike contribution to the fermion electric dipole moment," Phys. Rev. D **108**, 095004 (2023).

[26] H. Awata, K. Hasegawa, H. Kanno, R. Ohkawa, Sh. Shakirov, J. Shiraishi and Y. Yamada: Non-stationary difference equation and affine Laumon space: — Quantization of discrete Painlevé equation —, SIGMA **19** (2023) 089.

[27] M. Hamanaka, S.-C. Huang and H. Kanno: Solitons in Open $N = 2$ String Theory, *PTEP* **2023** (2023) 043B03.

[28] K. Izumi, Y. Tomikawa, T. Shiromizu and H. Yoshino: Attractive gravity probe surfaces in higher dimensions, PTEP **2023**, no.4, 043E01 (2023)

[29] K. Izumi, K. Shimada, K. Tomonari and M. Yamaguchi: Boundary conditions for constraint systems in variational principle, PTEP **2023**, no.10, 103E03 (2023)

[30] T. Shiromizu and K. Izumi: Attractive gravity probe surface with positive cosmological constant, PTEP **2023**, no.10, 103E02 (2023)

[31] T. Shiromizu and K. Izumi: Attractive gravity probe surface, positivity of quasi-local mass, and Arnowitt–Deser–Misner mass expression, PTEP **2024**, no.1, 013E01 (2024)

[32] K. Numajiri, Y. X. Cui, T. Katsuragawa and S. Nojiri, "Revisiting compact star in F(R) gravity: Roles of chameleon potential and energy conditions," Phys. Rev. D **107** (2023) no.10, 104019 doi:10.1103/PhysRevD.107.104019 [arXiv:2302.03951 [gr-qc]].

[33] S. Nojiri, S. D. Odintsov and V. Faraoni, "Generalized black hole entropy in two dimensions," Int. J. Geom. Meth. Mod. Phys. **20** (2023) no.09, 2350148 doi:10.1142/S0219887823501487 [arXiv:2303.02663 [hep-th]].

[34] S. Nojiri and S. D. Odintsov, "Micro-canonical and canonical description for generalised entropy," Phys. Lett. B **845** (2023), 138130 doi:10.1016/j.physletb.2023.138130 [arXiv:2304.09014 [gr-qc]].

[35] S. Nojiri, S. D. Odintsov and D. Sáez-Chillón Gómez, "Unifying inflation with early and late dark energy in Einstein–Gauss–Bonnet gravity," Phys. Dark Univ. **41** (2023), 101238 doi:10.1016/j.dark.2023.101 [arXiv:2304.08255 [gr-qc]].

[36] S. Nojiri, S. D. Odintsov and T. Paul, "Holographic realization of constant roll inflation and dark energy: An unified scenario," Phys. Lett. B **841** (2023), 137926 doi:10.1016/j.physletb.2023.137926 [arXiv:2304.09436 [gr-qc]].

[37] S. Nojiri and G. G. L. Nashed, "Hayward black hole in scalar-Einstein-Gauss-Bonnet gravity in four dimensions," Phys. Rev. D **108** (2023) no.2, 024014 doi:10.1103/PhysRevD.108.024014 [arXiv:2306.14162 [gr-qc]].

[38] S. Nojiri, S. D. Odintsov, T. Paul and S. SenGupta, "Horizon entropy consistent with the FLRW equations for general modified theories of gravity and for all equations of state of the matter field," Phys. Rev. D **109** (2024) no.4, 043532 doi:10.1103/PhysRevD.109.043532 [arXiv:2307.05011 [gr-qc]].

[39] S. Nojiri and S. D. Odintsov, "Propagation speed of gravitational wave in scalar–Einstein–Gauss-Bonnet gravity," Nucl. Phys. B **998** (2024), 116423 doi:10.1016/j.nuclphysb.2023.116423 [arXiv:2308.06731 [gr-qc]].

[40] J. de Haro, S. Nojiri, S. D. Odintsov, V. K. Oikonomou and S. Pan, "Finite-time cosmological singularities and the possible fate of the Universe," Phys. Rept. **1034** (2023), 1-114 doi:10.1016/j.physrep.2023.09.003 [arXiv:2309.07465 [gr-qc]].

[41] S. Nojiri and G. G. L. Nashed, "Wormhole solution free of ghosts in Einstein's gravity with two scalar fields," Phys. Rev. D **108** (2023) no.12, 124049 doi:10.1103/PhysRevD.108.124049 [arXiv:2309.12379 [hep-th]].

[42] K. Hu, M. Yamakoshi, T. Katsuragawa, S. Nojiri and T. Qiu, "Nonpropagating ghost in covariant f(Q) gravity," Phys. Rev. D **108** (2023) no.12, 124030 doi:10.1103/PhysRevD.108.124030 [arXiv:2310.15507 [gr-qc]].

[43] S. Nojiri and G. G. L. Nashed, "Stable gravastar with large surface redshift in Einstein's gravity with two scalar fields," JCAP **03** (2024), 023 doi:10.1088/1475-7516/2024/03/023 [arXiv:2310.16068 [gr-qc]].

[44] S. Nojiri, S. D. Odintsov and T. Paul, "Microscopic interpretation of generalized entropy," Phys. Lett. B **847** (2023), 138321 doi:10.1016/j.physletb.2023.138321 [arXiv:2311.03848 [gr-qc]].

[45] S. Nojiri, S. D. Odintsov and V. K. Oikonomou, "Propagation of gravitational waves in Einstein-Gauss-Bonnet gravity for cosmological and spherically symmetric spacetimes," Phys. Rev. D **109** (2024) no.4, 044046 doi:10.1103/PhysRevD.109.044046 [arXiv:2311.06932 [gr-qc]].

[46] S. Capozziello, M. Capriolo and S. Nojiri, "Gravitational waves in f(Q) non-metric gravity via geodesic deviation," Phys. Lett. B **850** (2024), 138510 doi:10.1016/j.physletb.2024.138510 [arXiv:2401.06424 [gr-qc]].

[47] T. Kobayashi and D. Perri, "Parker bounds on monopoles with arbitrary charge from galactic and primordial magnetic fields," Phys. Rev. D **108**, no.8, 083005 (2023) [arXiv:2307.07553 [hep-ph]].

[48] D. Dal Cin and T. Kobayashi, "Ultraviolet sensitivity of Peccei-Quinn inflation," Phys. Rev. D **108**, no.6, 063530 (2023) [arXiv:2305.18524 [hep-ph]].

[49] K. Ishikawa, T. Sunayama,... et al., Robustness of baryon acoustic oscillations measurements with photometric redshift uncertainties, MNRAS, Volume 526, Issue 4, pp.5374-5385 (2023), arXiv:2306.01696

[50] T. Sunayama, Observational constraints of an anisotropic boost due to the projection effects using redMaPPer clusters, MNRAS, Volume 521, Issue 4, pp.5064-5076 (2023), arXiv:2205.03233

[51] Y. Park, T. Sunayama,... et al., Cluster cosmology with anisotropic boosts: validation of a novel forward modelling analysis and application on SDSS redMaPPer clusters, MNRAS, Volume 518, Issue 4, pp.5171-5189 (2023), arXiv: 2112.09059

[52] J. Shi, T. Sunayama, T. Kurita, M. Takada, S. Sugiyama, R. Mandelbaum, H. Miyatake, S. More, T. Nishimichi, and H. Johnston. The intrinsic alignment of galaxy clusters and impact of projection effects. MNRAS, 528(2):1487–1499, February 2024.

[53] S. Sugiyama, H. Miyatake, S. More, X. Li, M. Shirasaki, M. Takada, Y. Kobayashi, R. Takahashi, T. Nishimichi, A. J. Nishizawa, M. M. Rau, T. Zhang, R. Dalal, R. Mandelbaum, M. A. Strauss, T. Hamana, M. Oguri, K. Osato, A. Kannawadi, B.-C. Hsieh, W. Luo, R. Armstrong, J. Bosch, Y. Komiyama, R. H. Lupton, N. B. Lust, S. Miyazaki, H. Murayama, Y. Okura, P. A. Price, P. J. Tait, M. Tanaka, and S.-Y. Wang. Hyper Suprime-Cam Year 3 results: Cosmology from galaxy clustering and weak lensing with HSC and SDSS using the minimal bias model. PRD, 108(12):123521, December 2023.

[54] S. More, S. Sugiyama, H. Miyatake, M. M. Rau, M. Shirasaki, X. Li, A. J. Nishizawa, K. Osato, T. Zhang, M. Takada, T. Hamana, R. Takahashi, R. Dalal, R. Mandelbaum, M. A. Strauss, Y. Kobayashi, T. Nishimichi, M. Oguri, W. Luo, A. Kannawadi, B.-C. Hsieh, R. Armstrong, J. Bosch, Y. Komiyama, R. H. Lupton, N. B. Lust, L. A. MacArthur, S. Miyazaki, H. Murayama, Y. Okura, P. A. Price, P. J. Tait, M. Tanaka, and S.-Y. Wang. Hyper Suprime-Cam Year 3 results: Measurements of clustering of SDSS-BOSS galaxies, galaxy-galaxy lensing, and cosmic shear. PRD, 108(12):123520, December 2023.

[55] R. Dalal, X. Li, A. Nicola, J. Zuntz, M. A. Strauss, S. Sugiyama, T. Zhang, M. M. Rau, R. Mandelbaum, M. Takada, S. More, H. Miyatake, A. Kannawadi, M. Shirasaki, T. Taniguchi, R. Takahashi, K. Osato, T. Hamana, M. Oguri, A. J. Nishizawa, A. A. P. Malag´on, T. Sunayama, D. Alonso, A. Slosar, W. Luo, R. Armstrong, J. Bosch, B.-C. Hsieh, Y. Komiyama, R. H. Lupton, N. B. Lust, L. A. MacArthur, S. Miyazaki, H. Murayama, T. Nishimichi, Y. Okura, P. A. Price, P. J. Tait, M. Tanaka, and S.-Y. Wang. Hyper Suprime-Cam Year 3 results: Cosmology from cosmic shear power spectra. PRD, 108(12):123519, December 2023.

[56] X. Li, T. Zhang, S. Sugiyama, R. Dalal, R. Terasawa, M. M. Rau, R. Mandelbaum, M. Takada, S. More, M. A. Strauss, H. Miyatake, M. Shirasaki, T. Hamana, M. Oguri, W. Luo, A. J. Nishizawa, R. Takahashi, A. Nicola, K. Osato, A. Kannawadi, T. Sunayama, R. Armstrong, J. Bosch, Y. Komiyama, R. H. Lupton, N. B. Lust, L. A. MacArthur, S. Miyazaki, H. Murayama, T. Nishimichi, Y. Okura, P. A. Price, P. J. Tait, M. Tanaka, and S.-Y. Wang. Hyper Suprime-Cam Year 3 results: Cosmology from cosmic shear two-point correlation functions. PRD, 108(12):123518, December 2023.

[57] H. Miyatake, S. Sugiyama, M. Takada, T. Nishimichi, X. Li, M. Shirasaki, S. More, Y. Kobayashi, A. J. Nishizawa, M. M. Rau, T. Zhang, R. Takahashi, R. Dalal, R. Mandelbaum, M. A. Strauss, T. Hamana, M. Oguri, K. Osato, W. Luo, A. Kannawadi, B.-C. Hsieh, R. Armstrong, J. Bosch, Y. Komiyama, R. H. Lupton, N. B. Lust, L. A. MacArthur, S. Miyazaki, H. Murayama, Y. Okura, P. A. Price, T. Sunayama, P. J. Tait, M. Tanaka, and S.-Y. Wang. Hyper Suprime-Cam Year 3 results: Cosmology from galaxy clustering and weak lensing with HSC and SDSS using the emulator based halo model. PRD, 108(12):123517, December 2023.

[58] K. Ishikawa, T. Sunayama, A. J. Nishizawa, H. Miyatake, and T. Nishimichi. Robustness of baryon acoustic oscillations measurements with photometric redshift uncertainties. MNRAS, 526(4):5374–5385, December 2023.

[59] T. Zhang, X. Li, R. Dalal, R. Mandelbaum, M. A. Strauss, A. Kannawadi, H. Miyatake, A. Nicola, A. A. P. Malag´on, M. Shirasaki, S. Sugiyama, M. Takada, and S. More. A general

framework for removing point-spread function additive systematics in cosmological weak lensing analysis. MNRAS, 525(2):2441–2471, October 2023.

[60] M. M. Rau, R. Dalal, T. Zhang, X. Li, A. J. Nishizawa, S. More, R. Mandelbaum, H. Miyatake, M. A. Strauss, and M. Takada. Weak lensing tomographic redshift distribution inference for the Hyper Suprime-Cam Subaru Strategic Program three-year shape catalogue. MNRAS, 524(4):5109–5131, October 2023.

[61] C. Cuesta-Lazaro, T. Nishimichi, Y. Kobayashi, C.-Z. Ruan, A. Eggemeier, H. Miyatake, M. Takada, N. Yoshida, P. Zarrouk, C. M. Baugh, S. Bose, and B. Li. Galaxy clustering from the bottom up: a streaming model emulator I. MNRAS, 523(3):3219–3238, August 2023.

[62] S. Arai, K. Aoki, Y. Chinone, R. Kimura, T. Kobayashi, H. Miyatake, D. Yamauchi, S. Yokoyama, K. Akitsu, T. Hiramatsu, S. Hirano, R. Kase, T. Katsuragawa, Y. Kobayashi, T. Namikawa, T. Nishimichi, T. Okumura, M. Shiraishi, M. Shirasaki, T. Sunayama, K. Takahashi, A. Taruya, and J. Tokuda. Cosmological gravity probes: connecting recent theoretical developments to forthcoming observations. Progress of Theoretical and Experimental Physics, 04 2023. ptad052.

[63] D. Rana, S. More, H. Miyatake, S. Grandis, M. Klein, E. Bulbul, I. N. Chiu, S. Miyazaki, and N. Bahcall. The eROSITA Final Equatorial-Depth Survey (eFEDS) - Splashback radius of X-ray galaxy clusters using galaxies from HSC survey. MNRAS, 522(3):4181–4195, July 2023.

[64] A. Dvornik, C. Heymans, M. Asgari, C. Mahony, B. Joachimi, M. Bilicki, E. Chisari, H. Hildebrandt, H. Hoekstra, H. Johnston, K. Kuijken, A. Mead, H. Miyatake, T. Nishimichi, R. Reischke, S. Unruh, and A. H. Wright. KiDS-1000: Combined halo-model cosmology constraints from galaxy abundance, galaxy clustering, and galaxy-galaxy lensing. A&A, 675:A189, July 2023.

[65] E. P. Longley, C. Chang, C. W. Walter, J. Zuntz, M. Ishak, R. Mandelbaum, H. Miyatake, A. Nicola, E. M. Pedersen, M. E. S. Pereira, J. Prat, J. S´anchez, L. F. Secco, T. Tr¨oster, M. Troxel, A. H. Wright, and LSST Dark Energy Science Collaboration. A unified catalogue-level reanalysis of stage-III cosmic shear surveys. MNRAS, 520(4):5016–5041, April 2023.

[66] T. Kitayama, S. Ueda, N. Okabe, T. Akahori, M. Hilton, J. P. Hughes, Y. Ichinohe, K. Kohno, E. Komatsu, Y.-T. Lin, H. Miyatake, M. Oguri, C. Sif´on, S. Takakuwa, M. Takizawa, T. Tsutsumi, J. van Marrewijk, and E. J. Wollack. Galaxy clusters at z 1 imaged by ALMA with the Sunyaev-Zel’ dovich effect. PASJ, 75(2):311–337, April 2023.

[67] H. Sakamoto, K. Ahn, K. Ichiki, H. Moon and K. Hasegawa, “Probing the Early History of Cosmic Reionization by Future Cosmic Microwave Background Experiments,” Astrophys. J. **930**, no.2, 140 (2022)

[68] P. Villanueva-Domingo and K. Ichiki, “21 cm Forest Constraints on Primordial Black Holes,” PASJ, **75**, Issue Supplement 1, pp.S33-S49

[69] K. Kadota, P. Villanueva-Domingo, K. Ichiki, K. Hasegawa and G. Naruse, “Boosting the 21 cm forest signals by the clumpy substructures,” JCAP **03**, 017 (2023)

[70] Y. Minami and K. Ichiki, “Extended delta-map: A map-based foreground removal method for CMB polarization observations,” PTEP **2023**, no.3, 033E01 (2023)

[71] Hung-Yu Jian, Lihwai Lin, Bau-Ching Hsieh, Kai-Yang Lin, Keiichi Umetsu, Carlos Lopez-Coba, Yusei Koyama, Chin-Hao Hsu, Yung-Chau Su, Yu-Yen Chang, Tadayuki Kodama, Yutaka Komiyama, Surhud More, Atsushi J. Nishizawa, Masamune Oguri, Ichi Tanaka, "Star Formation Properties of Sloan Digital Sky Survey BOSS Void Galaxies in the Hyper Suprime-Cam Survey", The Astrophysical Journal, Volume 926, Issue 2, id.115, 13 pp., Jan. 2022

[72] Yoshiki Matsuoka, Kazushi Iwasawa, Masafusa Onoue, Takuma Izumi, Nobunari Kashikawa, Michael A. Strauss, Masatoshi Imanishi, Tohru Nagao, Masayuki Akiyama, John D. Silverman, Naoko Asami, James Bosch, Hisanori Furusawa, Tomotsugu Goto, James E. Gunn, Yuichi Harikane, Hiroyuki Ikeda, Rikako Ishimoto, Toshihiro Kawaguchi, Nanako Kato, Satoshi Kikuta, Kotaro Kohno, Yutaka Komiyama, Chien-Hsiu Lee, Robert H. Lupton, Takeo Minezaki, Satoshi Miyazaki, Hitoshi Murayama, Atsushi J. Nishizawa, Masamune Oguri, Yoshiaki Ono, Masami Ouchi, Paul A. Price, Hiroaki Sameshima, Naoshi Sugiyama, Philip J. Tait, Masahiro Takada, Ayumi Takahashi, Tadafumi Takata, Masayuki Tanaka, Yoshiki Toba, Yousuke Utsumi, Shiang-Yu Wang, Takuji Yamashita, "Subaru High-z Exploration of Low-luminosity Quasars (SHELLQs). XVI. 69 New Quasars at 5.8 ¡ z ¡ 7.0", The Astrophysical Journal Supplement Series, Volume 259, Issue 1, id.18, 19 pp., March 2022

[73] Daichi Akino, Dominique Eckert, Nobuhiro Okabe, Mauro Sereno, Keiichi Umetsu, Masamune Oguri, Fabio Gastaldello, I-Non Chiu, Stefano Ettori, August E. Evrard, Arya Farahi, Ben Maughan, Marguerite Pierre, Marina Ricci, Ivan Valtchanov, Ian Mccarthy, Sean Mcgee, Satoshi Miyazaki, Atsushi J. Nishizawa, Masayuki Tanaka, "HSC-XXL : Baryon budget of the 136 XXL Groups and Clusters", Publications of the Astronomical Society of Japan, Volume 74, Issue 1, pp.175-208, Feb. 2022

[74] T. Takahashi, T. Yamada and S. Yokoyama, "Sneutrinos as two inflatons and curvaton and leptogenesis," JCAP **11**, 021 (2022) doi:10.1088/1475-7516/2022/11/021 [arXiv:2208.08296 [hep-ph]].

[75] T. Fujita, Y. Minami, M. Shiraishi and S. Yokoyama, "Can primordial parity violation explain the observed cosmic birefringence?," Phys. Rev. D **106**, no.10, 103529 (2022) doi:10.1103/PhysRevD.106.103 [arXiv:2208.08101 [astro-ph.CO]].

[76] Y. Koga, T. Harada, Y. Tada, S. Yokoyama and C. M. Yoo, "Effective Inspiral Spin Distribution of Primordial Black Hole Binaries," Astrophys. J. **939**, no.2, 65 (2022) doi:10.3847/1538-4357/ac93f1 [arXiv:2208.00696 [gr-qc]].

[77] Y. Morishita, T. Takahashi and S. Yokoyama, "Multi-chaotic inflation with and without spectator field," JCAP **07**, no.07, 042 (2022) doi:10.1088/1475-7516/2022/07/042 [arXiv:2203.09698 [astro-ph.CO]].

[78] C. Rampf, S. Saga, A. Taruya and S. Colombi, "Fast and accurate collapse-time predictions for collisionless matter," Phys. Rev. D **108** (2023) no.10, 10, doi:10.1103/PhysRevD.108.103513

[79] S. Saga, S. Colombi and A. Taruya, "The gravitational force field of proto-pancakes," Astron. Astrophys. **678** (2023), A168, doi:10.1051/0004-6361/202346968

[80] S. Saga, M. Shiraishi, K. Akitsu and T. Okumura, "Imprints of primordial magnetic fields on intrinsic alignments of galaxies," Phys. Rev. D **109** (2024) no.4, 043520, doi:10.1103/PhysRevD.109.043520

Non-refereed papers

[1] T. Bose, A. Boveia, C. Doglioni, S. P. Griso, J. Hirschauer, E. Lipeles, Z. Liu, N. R. Shah, L. T. Wang and K. Agashe, *et al.* "Report of the Topical Group on Physics Beyond the Standard Model at Energy Frontier for Snowmass 2021," [arXiv:2209.13128 [hep-ph]].

[2] R. Boughezal, Z. Ligeti, W. Altmannshofer, S. Das Bakshi, F. Caola, M. Chala, A. Diaz-Carmona, W. Chen, N. Darvishi and B. Henning, *et al.* "Theory Techniques for Precision Physics – Snowmass 2021 TF06 Topical Group Report," [arXiv:2209.10639 [hep-ph]].

[3] Koichi Murase, Yukinao Akamatsu, Masayuki Asakawa, Tetsufumi Hirano, Masakiyo Kitazawa, Kenji Morita, Yasusi Nara, Chiho Nonaka and Akira Ohnishi, "Dynamically Integrated Transport Model for High-energy Nuclear Collisions at $3 < \sqrt{s_{NN}} < 30$ GeV", JPS Conf.Proc. 32 (2020) 010081

[4] T. Shiromizu, 相対性理論における数学, 数理科学2024年1月号

[5] I. Izumi, ブラックホール表面積上限定理の一般化——強重力から弱重力へ, 日本物理学会誌78巻09号（2023年9月号）「最近の研究から」

5.1.2 Division of Experimental Studies

Refereed papers

[1] † Y.Horii, ATLAS Collaboration, Deep Generative Models for Fast Photon Shower Simulation in ATLAS, Comput Softw Big Sci, 8, 7, Mar. 2024

[2] † Y.Horii, ATLAS Collaboration, A precise measurement of the Z-boson double-differential transverse momentum and rapidity distributions in the full phase space of the decay leptons with the ATLAS experiment at $\sqrt{s} = 8$ TeV, Eur. Phys. J. C, 84, 315, Mar. 2024

[3] † Y.Horii, ATLAS Collaboration, Search for new phenomena with top-quark pairs and large missing transverse momentum using 140 fb−1 of pp collision data at $\sqrt{s} = 13$ TeV with the ATLAS detector, JHEP, 03, 139, Mar. 2024

[4] † Y.Horii, ATLAS Collaboration, Search for the decay of the Higgs boson to a Z boson and a light pseudoscalar particle decaying to two photons, Phys. Lett. B, 850, 138536, Mar. 2024

[5] † Y.Horii, ATLAS Collaboration, Study of High-Transverse-Momentum Higgs Boson Production in Association with a Vector Boson in the qqbb Final State with the ATLAS Detector, Phys. Rev. Lett., 132, 131802, Mar. 2024

[6] † Y.Horii, ATLAS Collaboration, Measurement of the Centrality Dependence of the Dijet Yield in p+Pb Collisions at √sNN = 8.16TeV with the ATLAS Detector, Phys. Rev. Lett., 132, 102301, Mar. 2024

[7] † Y.Horii, ATLAS Collaboration, Study of $Z \to ll\gamma$ decays at $\sqrt{s} = 8$ TeV with the ATLAS detector, Eur. Phys. J. C, 84, 195, Feb. 2024

[8] † Y.Horii, ATLAS Collaboration, Measurement of the production cross-section of J/ψ and $\psi(2S)$ mesons in pp collisions at $\sqrt{s} = 13$ TeV with the ATLAS detector, Eur. Phys. J. C, 84, 169, Feb. 2024

[9] † Y.Horii, ATLAS Collaboration, Search for top-philic heavy resonances in pp collisions at $\sqrt{s}$ = 13 TeV with the ATLAS detector, Eur. Phys. J. C, 84, 157, Feb. 2024

[10] † Y.Horii, ATLAS Collaboration, Search for a CP-odd Higgs boson decaying into a heavy CP-even Higgs boson and a Z boson in the lltt and $\nu\nu$bb final states using 140 fb−1 of data collected with the ATLAS detector, JHEP, 02, 197, Feb. 2024

[11] † Y.Horii, ATLAS Collaboration, Search for resonant production of dark quarks in the dijet final state with the ATLAS detector, JHEP, 02, 128, Feb. 2024

[12] † Y.Horii, ATLAS Collaboration, Search for pair production of squarks or gluinos decaying via sleptons or weak bosons in final states with two same-sign or three leptons with the ATLAS detector, JHEP, 02, 107, Feb. 2024

[13] † Y.Horii, ATLAS Collaboration, Search for non-resonant Higgs boson pair production in the 2b + 2l + ETmiss final state in pp collisions at $\sqrt{s}$ = 13 TeV with the ATLAS detector, JHEP, 02, 037, Feb. 2024

[14] † Y.Horii, ATLAS Collaboration, Electron and photon energy calibration with the ATLAS detector using LHC Run 2 data, JINST, 19, P02009, Feb. 2024

[15] † Y.Horii, ATLAS Collaboration, Probing the CP nature of the top–Higgs Yukawa coupling in ttH and tH events with H→bb decays using the ATLAS detector at the LHC, Phys. Lett. B, 849, 138469, Feb. 2024

[16] † Y.Horii, ATLAS Collaboration, Search for quantum black hole production in lepton+jet final states using proton-proton collisions at $\sqrt{s}$ = 13TeV with the ATLAS detector, Phys. Rev. D, 109, 032010, Feb. 2024

[17] † Y.Horii, ATLAS Collaboration, Search for New Phenomena in Two-Body Invariant Mass Distributions Using Unsupervised Machine Learning for Anomaly Detection at $\sqrt{s}$ = 13TeV with the ATLAS Detector, Phys. Rev. Lett., 132, 081801, Feb. 2024

[18] † Y.Horii, ATLAS Collaboration, Measurement of the H→$\gamma\gamma$ and H→ZZ*→4l cross-sections in pp collisions at $\sqrt{s}$ = 13.6 TeV with the ATLAS detector, Eur. Phys. J. C, 84, 78, Jan. 2024

[19] † Y.Horii, ATLAS Collaboration, Studies of new Higgs boson interactions through nonresonant HH production in the bb$\gamma\gamma$ final state in pp collisions at $\sqrt{s}$ = 13 TeV with the ATLAS detector, JHEP, 01, 066, Jan. 2024

[20] † Y.Horii, ATLAS Collaboration, Differential cross-section measurements of the production of four charged leptons in association with two jets using the ATLAS detector, JHEP, 01, 004, Jan. 2024

[21] † Y.Horii, ATLAS Collaboration, Observation of W$\gamma\gamma$ triboson production in proton-proton collisions at $\sqrt{s}$ = 13 TeV with the ATLAS detector, Phys. Lett. B, 848, 138400, Jan. 2024

[22] † Y.Horii, ATLAS Collaboration, Search for the Zγ decay mode of new high-mass resonances in pp collisions at $\sqrt{s}$ = 13 TeV with the ATLAS detector, Phys. Lett. B, 848, 138394, Jan. 2024

[23] † Y.Horii, ATLAS Collaboration, Measurement of the tt cross section and its ratio to the Z production cross section using pp collisions at $\sqrt{s}$ = 13.6 TeV with the ATLAS detector, Phys. Lett. B, 848, 138376, Jan. 2024

[24] † Y.Horii, ATLAS Collaboration, Search for non-resonant production of semi-visible jets using Run 2 data in ATLAS, Phys. Lett. B, 848, 138324, Jan. 2024

[25] † Y.Horii, ATLAS Collaboration, Evidence for the Higgs Boson Decay to a Z Boson and a Photon at the LHC, Phys. Rev. Lett., 132, 021803, Jan. 2024

[26] † Y.Horii, ATLAS Collaboration, Observation of WZγ Production in pp Collisions at $\sqrt{s}$ = 13TeV with the ATLAS Detector, Phys. Rev. Lett., 132, 021802, Jan. 2024

[27] † Y.Horii, ATLAS Collaboration, Search for heavy Majorana or Dirac neutrinos and right-handed W gauge bosons in final states with charged leptons and jets in pp collisions at $\sqrt{s}$ = 13 TeV with the ATLAS detector, Eur. Phys. J. C, 83, 1164, Dec. 2023

[28] † Y.Horii, ATLAS Collaboration, Search for flavour-changing neutral tqH interactions with H $\rightarrow \gamma\gamma$ in pp collisions at $\sqrt{s}$ = 13 TeV using the ATLAS detector, JHEP, 12, 195, Dec. 2023

[29] † Y.Horii, ATLAS Collaboration, Search for direct production of electroweakinos in final states with one lepton, jets and missing transverse momentum in pp collisions at $\sqrt{s}$ = 13 TeV with the ATLAS detector, JHEP, 12, 167, Dec. 2023

[30] † Y.Horii, ATLAS Collaboration, Evidence of pair production of longitudinally polarised vector bosons and study of CP properties in ZZ $\rightarrow$ 4l events with the ATLAS detector at $\sqrt{s}$ = 13 TeV, JHEP, 12, 107, Dec. 2023

[31] † Y.Horii, ATLAS Collaboration, Search for heavy Higgs bosons with flavour-violating couplings in multi-lepton plus b-jets final states in pp collisions at 13 TeV with the ATLAS detector, JHEP, 12, 081, Dec. 2023

[32] † Y.Horii, ATLAS Collaboration, Search for vector-boson resonances decaying into a top quark and a bottom quark using pp collisions at $\sqrt{s}$ = 13 TeV with the ATLAS detector, JHEP, 12, 073, Dec. 2023

[33] † Y.Horii, ATLAS Collaboration, Search for heavy long-lived multi-charged particles in the full LHC Run 2 pp collision data at $\sqrt{s}$ = 13 TeV using the ATLAS detector, Phys. Lett. B, 847, 138316, Dec. 2023

[34] † Y.Horii, ATLAS Collaboration, Measurement of the Higgs boson mass with H$\rightarrow\gamma\gamma$ decays in 140 fb−1 of $\sqrt{s}$ = 13 TeV pp collisions with the ATLAS detector, Phys. Lett. B, 847, 138315, Dec. 2023

[35] † Y.Horii, ATLAS Collaboration, Search for exclusive Higgs and Z boson decays to $\omega\gamma$ and Higgs boson decays to K$*\gamma$ with the ATLAS detector, Phys. Lett. B, 847, 138292, Dec. 2023

[36] † Y.Horii, ATLAS Collaboration, Pursuit of paired dijet resonances in the Run 2 dataset with ATLAS, Phys. Rev. D, 108, 112005, Dec. 2023

[37] † Y.Horii, ATLAS Collaboration, Combined Measurement of the Higgs Boson Mass from the H$\rightarrow\gamma\gamma$ and H$\rightarrow$ZZ$\rightarrow$4l Decay Channels with the ATLAS Detector Using $\sqrt{s}$ = 7, 8, and 13 TeV pp Collision Data, Phys. Rev. Lett., 131, 251802, Dec. 2023

[38] † Y.Horii, ATLAS Collaboration, Search for Dark Photons in Rare Z Boson Decays with the ATLAS Detector, Phys. Rev. Lett., 131, 251801, Dec. 2023

[39] † Y.Horii, ATLAS Collaboration, Performance of the reconstruction of large impact parameter tracks in the inner detector of ATLAS, Eur. Phys. J. C, 83, 1081, Nov. 2023

[40] † Y.Horii, ATLAS Collaboration, Search for pair production of third-generation leptoquarks decaying into a bottom quark and a tau-lepton with the ATLAS detector, Eur. Phys. J. C, 83, 1075, Nov. 2023

[41] † Y.Horii, ATLAS Collaboration, Search for single vector-like B quark production and decay via B → bH(bb) in pp collisions at $\sqrt{s}$ = 13 TeV with the ATLAS detector, JHEP, 11, 168, Nov. 2023

[42] † Y.Horii, ATLAS Collaboration, Search for direct production of winos and higgsinos in events with two same-charge leptons or three leptons in pp collision data at $\sqrt{s}$ = 13 TeV with the ATLAS detector, JHEP, 11, 150, Nov. 2023

[43] † Y.Horii, ATLAS Collaboration, Search for magnetic monopoles and stable particles with high electric charges in $\sqrt{s}$ = 13 TeV pp collisions with the ATLAS detector, JHEP, 11, 112, Nov. 2023

[44] † Y.Horii, ATLAS Collaboration, Tools for estimating fake/non-prompt lepton backgrounds with the ATLAS detector at the LHC, JINST, 18, T11004, Nov. 2023

[45] † Y.Horii, ATLAS Collaboration, Fast b-tagging at the high-level trigger of the ATLAS experiment in LHC Run 3, JINST, 18, P11006, Nov. 2023

[46] † Y.Horii, ATLAS Collaboration, Evidence of off-shell Higgs boson production from ZZ leptonic decay channels and constraints on its total width with the ATLAS detector, Phys. Lett. B, 846, 138223, Nov. 2023

[47] † Y.Horii, ATLAS Collaboration, Measurement of the cross-sections of the electroweak and total production of a $Z\gamma$ pair in association with two jets in pp collisions at $\sqrt{s}$ = 13 TeV with the ATLAS detector, Phys. Lett. B, 846, 138222, Nov. 2023

[48] † Y.Horii, ATLAS Collaboration, Search for pairs of muons with small displacements in pp collisions at $\sqrt{s}$ = 13 TeV with the ATLAS detector, Phys. Lett. B, 846, 138172, Nov. 2023

[49] † Y.Horii, ATLAS Collaboration, Comparison of inclusive and photon-tagged jet suppression in 5.02 TeV Pb+Pb collisions with ATLAS, Phys. Lett. B, 846, 138154, Nov. 2023

[50] † Y.Horii, ATLAS Collaboration, Search for a new pseudoscalar decaying into a pair of muons in events with a top-quark pair at $\sqrt{s}$ = 13TeV with the ATLAS detector, Phys. Rev. D, 108, 092007, Nov. 2023

[51] † Y.Horii, ATLAS Collaboration, Luminosity determination in pp collisions at $\sqrt{s}$ = 13 TeV using the ATLAS detector at the LHC, Eur. Phys. J. C, 83, 982, Oct. 2023

[52] † Y.Horii, ATLAS Collaboration, Search for lepton-flavour violation in high-mass dilepton final states using 139 fb−1 of pp collisions at $\sqrt{s}$ = 13 TeV with the ATLAS detector, JHEP, 10, 082, Oct. 2023

[53] † Y.Horii, ATLAS Collaboration, Search for periodic signals in the dielectron and diphoton invariant mass spectra using 139 fb−1 of pp collisions at $\sqrt{s}$ = 13 TeV with the ATLAS detector, JHEP, 10, 079, Oct. 2023

[54] † Y.Horii, ATLAS Collaboration, Measurements of multijet event isotropies using optimal transport with the ATLAS detector, JHEP, 10, 060, Oct. 2023

[55] † Y.Horii, ATLAS Collaboration, Search for a new heavy scalar particle decaying into a Higgs boson and a new scalar singlet in final states with one or two light leptons and a pair of τ-leptons with the ATLAS detector, JHEP, 10, 009, Oct. 2023

[56] † Y.Horii, ATLAS Collaboration, Search for leptoquarks decaying into the bτ final state in pp collisions at √s = 13 TeV with the ATLAS detector, JHEP, 10, 001, Oct. 2023

[57] † Y.Horii, ATLAS Collaboration, Integrated and differential fiducial cross-section measurements for the vector boson fusion production of the Higgs boson in the H→WW→eν μ ν decay channel at 13 TeV with the ATLAS detector, Phys. Rev. D, 108, 072003, Oct. 2023

[58] † Y.Horii, ATLAS Collaboration, Observation of Single-Top-Quark Production in Association with a Photon Using the ATLAS Detector, Phys. Rev. Lett., 131, 181901, Oct. 2023

[59] † Y.Horii, ATLAS Collaboration, Measurement of Suppression of Large-Radius Jets and Its Dependence on Substructure in Pb+Pb Collisions at √sNN = 5.02TeV with the ATLAS Detector, Phys. Rev. Lett., 131, 172301, Oct. 2023

[60] † Y.Horii, ATLAS Collaboration, Measurement of the Sensitivity of Two-Particle Correlations in pp Collisions to the Presence of Hard Scatterings, Phys. Rev. Lett., 131, 162301, Oct. 2023

[61] † Y.Horii, ATLAS Collaboration, Observation of an Excess of Dicharmonium Events in the Four-Muon Final State with the ATLAS Detector, Phys. Rev. Lett., 131, 151902, Oct. 2023

[62] † Y.Horii, ATLAS Collaboration, Observation of the γ $\gamma \rightarrow \tau$ τ Process in Pb+Pb Collisions and Constraints on the τ-Lepton Anomalous Magnetic Moment with the ATLAS Detector, Phys. Rev. Lett., 131, 151802, Oct. 2023

[63] † Y.Horii, ATLAS Collaboration, Performance and calibration of quark/gluon-jet taggers using 140 fb−1 of pp collisions at √s = 13 TeV with the ATLAS detector, Chinese Phys. C, 48, 023001, Sep. 2023

[64] † Y.Horii, ATLAS Collaboration, Search for Majorana neutrinos in same-sign WW scattering events from pp collisions at √s = 13 TeV, Eur. Phys. J. C, 83, 824, Sep. 2023

[65] † Y.Horii, ATLAS Collaboration, Searches for exclusive Higgs and Z boson decays into a vector quarkonium state and a photon using 139 fb−1 of ATLAS √s = 13 TeV proton–proton collision data, Eur. Phys. J. C, 83, 781, Sep. 2023

[66] † Y.Horii, ATLAS Collaboration, Measurements of differential cross sections of Higgs boson production through gluon fusion in the H→WW*→ final state at √s = 13 TeV with the ATLAS detector, Eur. Phys. J. C, 83, 774, Sep. 2023

[67] † Y.Horii, ATLAS Collaboration, Measurement of the Bs0 $\rightarrow$ μ μ effective lifetime with the ATLAS detector, JHEP, 09, 199, Sep. 2023

[68] † Y.Horii, ATLAS Collaboration, Search for dark matter produced in association with a Higgs boson decaying to tau leptons at √s = 13 TeV with the ATLAS detector, JHEP, 09, 189, Sep. 2023

[69] † Y.Horii, ATLAS Collaboration, Search for a light charged Higgs boson in t → H±b decays, with H± → cb, in the lepton+jets final state in proton-proton collisions at $\sqrt{s}$ = 13 TeV with the ATLAS detector, JHEP, 09, 004, Sep. 2023

[70] † Y.Horii, ATLAS Collaboration, Anomaly detection search for new resonances decaying into a Higgs boson and a generic new particle X in hadronic final states using $\sqrt{s}$ = 13TeV pp collisions with the ATLAS detector, Phys. Rev. D, 108, 052009, Sep. 2023

[71] † Y.Horii, ATLAS Collaboration, Search for nonresonant pair production of Higgs bosons in the bbbb final state in pp collisions at $\sqrt{s}$ = 13TeV with the ATLAS detector, Phys. Rev. D, 108, 052003, Sep. 2023

[72] † Y.Horii, ATLAS Collaboration, New techniques for jet calibration with the ATLAS detector, Eur. Phys. J. C, 83, 761, Aug. 2023

[73] † Y.Horii, ATLAS Collaboration, Calibration of the light-flavour jet mistagging efficiency of the b-tagging algorithms with Z+jets events using 139 fb−1 of ATLAS proton–proton collision data at $\sqrt{s}$ = 13 TeV, Eur. Phys. J. C, 83, 728, Aug. 2023

[74] † Y.Horii, ATLAS Collaboration, Search for pair-produced vector-like top and bottom partners in events with large missing transverse momentum in pp collisions with the ATLAS detector, Eur. Phys. J. C, 83, 719, Aug. 2023

[75] † Y.Horii, ATLAS Collaboration, Measurements of WW production in decay topologies inspired by searches for electroweak supersymmetry, Eur. Phys. J. C, 83, 718, Aug. 2023

[76] † Y.Horii, ATLAS Collaboration, Studies of the muon momentum calibration and performance of the ATLAS detector with pp collisions at $\sqrt{s}$ = 13 TeV, Eur. Phys. J. C, 83, 686, Aug. 2023

[77] † Y.Horii, ATLAS Collaboration, Search for single production of vector-like T quarks decaying into Ht or Zt in pp collisions at $\sqrt{s}$ = 13 TeV with the ATLAS detector, JHEP, 08, 153, Aug. 2023

[78] † Y.Horii, ATLAS Collaboration, Evidence for the charge asymmetry in pp → tt production at $\sqrt{s}$ = 13 TeV with the ATLAS detector, JHEP, 08, 077, Aug. 2023

[79] † Y.Horii, ATLAS Collaboration, Search for pair-production of vector-like quarks in pp collision events at $\sqrt{s}$ = 13 TeV with at least one leptonically decaying Z boson and a third-generation quark with the ATLAS detector, Phys. Lett. B, 843, 138019, Aug. 2023

[80] † Y.Horii, ATLAS Collaboration, Observation of gauge boson joint-polarisation states in WZ production from pp collisions at $\sqrt{s}$ = 13 TeV with the ATLAS detector, Phys. Lett. B, 843, 137895, Aug. 2023

[81] † Y.Horii, ATLAS Collaboration, Measurement of the Higgs boson mass in the H→ZZ∗→4l decay channel using 139 fb−1 of 13 TeV pp collisions recorded by the ATLAS detector at the LHC, Phys. Lett. B, 843, 137880, Aug. 2023

[82] † Y.Horii, ATLAS Collaboration, Measurement of the charge asymmetry in top-quark pair production in association with a photon with the ATLAS experiment, Phys. Lett. B, 843, 137848, Aug. 2023

[83] † Y.Horii, ATLAS Collaboration, Measurement of the polarisation of W bosons produced in top-quark decays using dilepton events at $\sqrt{s} = 13$ TeV with the ATLAS experiment, Phys. Lett. B, 843, 137829, Aug. 2023

[84] † Y.Horii, ATLAS Collaboration, Constraints on the Higgs boson self-coupling from single- and double-Higgs production with the ATLAS detector using pp collisions at $\sqrt{s} = 13$ TeV, Phys. Lett. B, 843, 137745, Aug. 2023

[85] † Y.Horii, ATLAS Collaboration, Measurements of the suppression and correlations of dijets in Xe+Xe collisions at $\sqrt{s}$NN = 5.44 TeV, Phys. Rev. C, 108, 024906, Aug. 2023

[86] † Y.Horii, ATLAS Collaboration, Search for flavor-changing neutral-current couplings between the top quark and the Z boson with proton-proton collisions at $\sqrt{s} = 13$TeV with the ATLAS detector, Phys. Rev. D, 108, 032019, Aug. 2023

[87] † Y.Horii, ATLAS Collaboration, Search for displaced photons produced in exotic decays of the Higgs boson using 13 TeV pp collisions with the ATLAS detector, Phys. Rev. D, 108, 032016, Aug. 2023

[88] † Y.Horii, ATLAS Collaboration, Search for the charged-lepton-flavor-violating decay Z→eμ in pp collisions at $\sqrt{s} = 13$TeV with the ATLAS detector, Phys. Rev. D, 108, 032015, Aug. 2023

[89] † Y.Horii, ATLAS Collaboration, Measurement of the inclusive tt production cross section in the lepton+jets channel in pp collisions at $\sqrt{s} = 7$TeV with the ATLAS detector using support vector machines, Phys. Rev. D, 108, 032014, Aug. 2023

[90] † Y.Horii, ATLAS Collaboration, Measurement of the production of a W boson in association with a charmed hadron in pp collisions at $\sqrt{s} = 13$TeV with the ATLAS detector, Phys. Rev. D, 108, 032012, Aug. 2023

[91] † Y.Horii, ATLAS Collaboration, Measurements of Higgs boson production by gluon-gluon fusion and vector-boson fusion using H→WW→e$\nu\mu\nu$ decays in pp collisions at $\sqrt{s} = 13$ TeV with the ATLAS detector, Phys. Rev. D, 108, 032005, Aug. 2023

[92] † Y.Horii, ATLAS Collaboration, Strong Constraints on Jet Quenching in Centrality-Dependent p+Pb Collisions at 5.02 TeV from ATLAS, Phys. Rev. Lett., 131, 072301, Aug. 2023

[93] † Y.Horii, ATLAS Collaboration, Search for Heavy Neutral Leptons in Decays of W Bosons Using a Dilepton Displaced Vertex in $\sqrt{s} = 13$TeV pp Collisions with the ATLAS Detector, Phys. Rev. Lett., 131, 061803, Aug. 2023

[94] † Y.Horii, ATLAS Collaboration, Test of CP Invariance in Higgs Boson Vector-Boson-Fusion Production Using the H→$\gamma\gamma$ Channel with the ATLAS Detector, Phys. Rev. Lett., 131, 061802, Aug. 2023

[95] † Y.Horii, ATLAS Collaboration, ATLAS flavour-tagging algorithms for the LHC Run 2 pp collision dataset, Eur. Phys. J. C, 83, 681, Jul. 2023

[96] † Y.Horii, ATLAS Collaboration, Search for resonant WZ production in the fully leptonic final state in proton–proton collisions at $\sqrt{s} = 13$ TeV with the ATLAS detector, Eur. Phys. J. C, 83, 633, Jul. 2023

[97] † Y.Horii, ATLAS Collaboration, Measurement of exclusive pion pair production in proton–proton collisions at $\sqrt{s} = 7$ TeV with the ATLAS detector, Eur. Phys. J. C, 83, 627, Jul. 2023

[98] † Y.Horii, ATLAS Collaboration, Search for doubly charged Higgs boson production in multi-lepton final states using 139 fb−1 of proton–proton collisions at √s = 13 TeV with the ATLAS detector, Eur. Phys. J. C, 83, 605, Jul. 2023

[99] † Y.Horii, ATLAS Collaboration, Search for dark matter produced in association with a single top quark and an energetic W boson in √s = 13 TeV pp collisions with the ATLAS detector, Eur. Phys. J. C, 83, 603, Jul. 2023

[100] † Y.Horii, ATLAS Collaboration, Measurement of the CP properties of Higgs boson interactions with -leptons with the ATLAS detector, Eur. Phys. J. C, 83, 563, Jul. 2023

[101] † Y.Horii, ATLAS Collaboration, Search for supersymmetry in final states with missing transverse momentum and three or more b-jets in 139 fb−1 of proton–proton collisions at √s = 13 TeV with the ATLAS detector, Eur. Phys. J. C, 83, 561, Jul. 2023

[102] † Y.Horii, ATLAS Collaboration, Search for an axion-like particle with forward proton scattering in association with photon pairs at ATLAS, JHEP, 07, 234, Jul. 2023

[103] † Y.Horii, ATLAS Collaboration, Combination of inclusive top-quark pair production cross-section measurements using ATLAS and CMS data at √s = 7 and 8 TeV, JHEP, 07, 213, Jul. 2023

[104] † Y.Horii, ATLAS Collaboration, Search for ttH/A→tttt production in the multilepton final state in proton–proton collisions at √s = 13 TeV with the ATLAS detector, JHEP, 07, 203, Jul. 2023

[105] † Y.Horii, ATLAS Collaboration, Search for new phenomena in multi-body invariant masses in events with at least one isolated lepton and two jets using √s = 13 TeV proton–proton collision data collected by the ATLAS detector, JHEP, 07, 202, Jul. 2023

[106] † Y.Horii, ATLAS Collaboration, A search for heavy Higgs bosons decaying into vector bosons in same-sign two-lepton final states in pp collisions at √s = 13 TeV with the ATLAS detector, JHEP, 07, 200, Jul. 2023

[107] † Y.Horii, ATLAS Collaboration, Search for a new scalar resonance in flavour-changing neutral-current top-quark decays t → qX (q = u, c), with X → bb, in proton-proton collisions at √s = 13 TeV with the ATLAS detector, JHEP, 07, 199, Jul. 2023

[108] † Y.Horii, ATLAS Collaboration, Model-independent search for the presence of new physics in events including H → $\gamma\gamma$ with √s = 13 TeV pp data recorded by the ATLAS detector at the LHC, JHEP, 07, 176, Jul. 2023

[109] † Y.Horii, ATLAS Collaboration, Searches for lepton-flavour-violating decays of the Higgs boson into eτ and $\mu\tau$ in √s = 13 TeV pp collisions with the ATLAS detector, JHEP, 07, 166, Jul. 2023

[110] † Y.Horii, ATLAS Collaboration, Search for boosted diphoton resonances in the 10 to 70 GeV mass range using 138 fb−1 of 13 TeV pp collisions with the ATLAS detector, JHEP, 07, 155, Jul. 2023

[111] † Y.Horii, ATLAS Collaboration, Inclusive and differential cross-sections for dilepton tt production measured in √s = 13 TeV pp collisions with the ATLAS detector, JHEP, 07, 141, Jul. 2023

[112] † Y.Horii, ATLAS Collaboration, Search for dark photons from Higgs boson decays via ZH production with a photon plus missing transverse momentum signature from pp collisions at √s = 13 TeV with the ATLAS detector, JHEP, 07, 133, Jul. 2023

[113] † Y.Horii, ATLAS Collaboration, Search for high-mass W γ and Z γ resonances using hadronic W/Z boson decays from 139 fb−1 of pp collisions at √s = 13 TeV with the ATLAS detector, JHEP, 07, 125, Jul. 2023

[114] † Y.Horii, ATLAS Collaboration, Search for third-generation vector-like leptons in pp collisions at √s = 13 TeV with the ATLAS detector, JHEP, 07, 118, Jul. 2023

[115] † Y.Horii, ATLAS Collaboration, Search for dark matter produced in association with a dark Higgs boson decaying into W+W− in the one-lepton final state at √s = 13 TeV using 139 fb−1 of pp collisions recorded with the ATLAS detector, JHEP, 07, 116, Jul. 2023

[116] † Y.Horii, ATLAS Collaboration, Search for a new Z' gauge boson in 4 μ events with the ATLAS experiment, JHEP, 07, 090, Jul. 2023

[117] † Y.Horii, ATLAS Collaboration, Measurement of the properties of Higgs boson production at √s = 13 TeV in the H → γ γ channel using 139 fb−1 of pp collision data with the ATLAS experiment, JHEP, 07, 088, Jul. 2023

[118] † Y.Horii, ATLAS Collaboration, Inclusive-photon production and its dependence on photon isolation in pp collisions at √s = 13 TeV using 139 fb−1 of ATLAS data, JHEP, 07, 086, Jul. 2023

[119] † Y.Horii, ATLAS Collaboration, Determination of the strong coupling constant from transverse energy-energy correlations in multijet events at √s = 13 TeV with the ATLAS detector, JHEP, 07, 085, Jul. 2023

[120] † Y.Horii, ATLAS Collaboration, Charged-hadron production in pp, p+Pb, Pb+Pb, and Xe+Xe collisions at √sNN = 5 TeV with the ATLAS detector at the LHC, JHEP, 07, 074, Jul. 2023

[121] † Y.Horii, ATLAS Collaboration, Measurements of Z γ +jets differential cross sections in pp collisions at √s = 13 TeV with the ATLAS detector, JHEP, 07, 072, Jul. 2023

[122] † Y.Horii, ATLAS Collaboration, Search for resonant and non-resonant Higgs boson pair production in the bb decay channel using 13 TeV pp collision data from the ATLAS detector, JHEP, 07, 040, Jul. 2023

[123] † Y.Horii, ATLAS Collaboration, Search for leptonic charge asymmetry in ttW production in final states with three leptons at √s = 13 TeV, JHEP, 07, 033, Jul. 2023

[124] † Y.Horii, ATLAS Collaboration, Search for new phenomena in final states with photons, jets and missing transverse momentum in pp collisions at √s = 13 TeV with the ATLAS detector, JHEP, 07, 021, Jul. 2023

[125] † Y.Horii, ATLAS Collaboration, Combination of searches for invisible decays of the Higgs boson using 139 fb−1 of proton-proton collision data at √s = 13 TeV collected with the ATLAS experiment, Phys. Lett. B, 842, 137963, Jul. 2023

[126] † Y.Horii, ATLAS Collaboration, Search for flavour-changing neutral-current couplings between the top quark and the photon with the ATLAS detector at √s = 13 TeV, Phys. Lett. B, 842, 137379, Jul. 2023

[127] † Y.Horii, ATLAS Collaboration, Measurement of cross sections for production of a Z boson in association with a flavor-inclusive or doubly b-tagged large-radius jet in proton-proton collisions at √s = 13TeV with the ATLAS experiment, Phys. Rev. D, 108, 012022, Jul. 2023

[128] † Y.Horii, ATLAS Collaboration, Search in diphoton and dielectron final states for displaced production of Higgs or Z bosons with the ATLAS detector in √s = 13TeV pp collisions, Phys. Rev. D, 108, 012012, Jul. 2023

[129] † Y.Horii, ATLAS Collaboration, Measurement of Z production in pp collisions at √s = 13 TeV with the ATLAS detector, Eur. Phys. J. C, 83, 539, Jun. 2023

[130] † Y.Horii, ATLAS Collaboration, Search for Higgs boson pair production in association with a vector boson in pp collisions at √s = 13 TeV with the ATLAS detector, Eur. Phys. J. C, 83, 519, Jun. 2023

[131] † Y.Horii, ATLAS Collaboration, Measurements of observables sensitive to colour reconnection in tt events with the ATLAS detector at √s = 13 TeV, Eur. Phys. J. C, 83, 518, Jun. 2023

[132] † Y.Horii, ATLAS Collaboration, Searches for new phenomena in events with two leptons, jets, and missing transverse momentum in 139 fb−1 of √s = 13 TeV pppp collisions with the ATLAS detector, Eur. Phys. J. C, 83, 515, Jun. 2023

[133] † Y.Horii, ATLAS Collaboration, Constraints on spin-0 dark matter mediators and invisible Higgs decays using ATLAS 13 TeV pp collision data with two top quarks and missing transverse momentum in the final state, Eur. Phys. J. C, 83, 503, Jun. 2023

[134] † Y.Horii, ATLAS Collaboration, Observation of four-top-quark production in the multilepton final state with the ATLAS detector, Eur. Phys. J. C, 83, 496, Jun. 2023

[135] † Y.Horii, ATLAS Collaboration, Search for long-lived, massive particles in events with displaced vertices and multiple jets in pp collisions at √s = 13 TeV with the ATLAS detector, JHEP, 06, 200, Jun. 2023

[136] † Y.Horii, ATLAS Collaboration, Search for excited τ -leptons and leptoquarks in the final state with τ -leptons and jets in pp collisions at √s = 13 TeV with the ATLAS detector, JHEP, 06, 199, Jun. 2023

[137] † Y.Horii, ATLAS Collaboration, Measurement of single top-quark production in the s-channel in proton–proton collisions at √s = 13 TeV with the ATLAS detector, JHEP, 06, 191, Jun. 2023

[138] † Y.Horii, ATLAS Collaboration, Search for pair-produced scalar and vector leptoquarks decaying into third-generation quarks and first- or second-generation leptons in pp collisions with the ATLAS detector, JHEP, 06, 188, Jun. 2023

[139] † Y.Horii, ATLAS Collaboration, Exclusive dielectron production in ultraperipheral Pb+Pb collisions at √sNN = 5.02 TeV with ATLAS, JHEP, 06, 182, Jun. 2023

[140] † Y.Horii, ATLAS Collaboration, Search for heavy, long-lived, charged particles with large ionisation energy loss in pp collisions at √s = 13 TeV using the ATLAS experiment and the full Run 2 dataset, JHEP, 06, 158, Jun. 2023

[141] † Y.Horii, ATLAS Collaboration, Search for flavour-changing neutral current interactions of the top quark and the Higgs boson in events with a pair of τ -leptons in pp collisions at √s = 13 TeV with the ATLAS detector, JHEP, 06, 155, Jun. 2023

[142] † Y.Horii, ATLAS Collaboration, Search for light long-lived neutral particles that decay to collimated pairs of leptons or light hadrons in pp collisions at √s = 13 TeV with the ATLAS detector, JHEP, 06, 153, Jun. 2023

[143] † Y.Horii, ATLAS Collaboration, Measurement of the tt production cross-section in pp collisions at √s = 5.02 TeV with the ATLAS detector, JHEP, 06, 138, Jun. 2023

[144] † Y.Horii, ATLAS Collaboration, Measurement of electroweak Z( )jj production and limits on anomalous quartic gauge couplings in pp collisions at √s = 13 TeV with the ATLAS detector, JHEP, 06, 082, Jun. 2023

[145] † Y.Horii, ATLAS Collaboration, Cross-section measurements for the production of a Z boson in association with high-transverse-momentum jets in pp collisions at √s = 13 TeV with the ATLAS detector, JHEP, 06, 080, Jun. 2023

[146] † Y.Horii, ATLAS Collaboration, A search for new resonances in multiple final states with a high transverse momentum Z boson in √s = 13 TeV pp collisions with the ATLAS detector, JHEP, 06, 036, Jun. 2023

[147] † Y.Horii, ATLAS Collaboration, Search for direct pair production of sleptons and charginos decaying to two leptons and neutralinos with mass splittings near the W-boson mass in √s = 13 TeV pp collisions with the ATLAS detector, JHEP, 06, 031, Jun. 2023

[148] † Y.Horii, ATLAS Collaboration, Measurement of the top-quark mass using a leptonic invariant mass in pp collisions at √s = 13 TeV with the ATLAS detector, JHEP, 06, 019, Jun. 2023

[149] † Y.Horii, ATLAS Collaboration, Search for heavy resonances decaying into a Z or W boson and a Higgs boson in final states with leptons and b-jets in 139 fb−1 of pp collisions at √s = 13 TeV with the ATLAS detector, JHEP, 06, 016, Jun. 2023

[150] † Y.Horii, ATLAS Collaboration, Measurement of the total cross section and -parameter from elastic scattering in pp collisions at √s = 13 TeV with the ATLAS detector, Eur. Phys. J. C, 83, 441, May 2023

[151] † Y.Horii, ATLAS Collaboration, Measurement of the nuclear modification factor of b-jets in 5.02 TeV Pb+Pb collisions with the ATLAS detector, Eur. Phys. J. C, 83, 438, May 2023

[152] † Y.Horii, ATLAS Collaboration, Measurement of the total and differential Higgs boson production cross-sections at √s = 13 TeV with the ATLAS detector by combining the H → ZZ* → 4l and H → γ γ decay channels, JHEP, 05, 028, May 2023

[153] † Y.Horii, ATLAS Collaboration, Production of Υ(nS) mesons in Pb+Pb and pp collisions at 5.02 TeV, Phys. Rev. C, 107, 054912, May 2023

[154] † Y.Horii, ATLAS Collaboration, Correlations between flow and transverse momentum in Xe+Xe and Pb+Pb collisions at the LHC with the ATLAS detector: A probe of the heavy-ion initial state and nuclear deformation, Phys. Rev. C, 107, 054910, May 2023

[155] † Y.Horii, ATLAS Collaboration, Measurement of substructure-dependent jet suppression in Pb+Pb collisions at 5.02 TeV with the ATLAS detector, Phys. Rev. C, 107, 054909, May 2023

[156] † Y.Horii, ATLAS Collaboration, Measurements of the suppression and correlations of dijets in Pb+Pb collisions at √sNN = 5.02 TeV, Phys. Rev. C, 107, 054908, May 2023

[157] † Y.Horii, ATLAS Collaboration, Measurement of muon pairs produced via $\gamma\gamma$ scattering in nonultraperipheral Pb+Pb collisions at √sNN = 5.02 TeV with the ATLAS detector, Phys. Rev. C, 107, 054907, May 2023

[158] † Y.Horii, ATLAS Collaboration, Differential tt cross-section measurements using boosted top quarks in the all-hadronic final state with 139 fb−1 of ATLAS data, JHEP, 04, 080, Apr. 2023

[159] † K. Inami, Belle Collaboration, Search for the semiletptonic decays Ξc0 → Ξ0 ℓ+ ℓ− at Belle, PRD 109, 052003 (2024 March 15)

[160] † K. Inami, Belle Collaboration, Search for the baryon and lepton number violating decays D → p ℓ, PRD 109, L031101 (2024 February 5)

[161] † T. Iijima, K. Inami, Belle Collaboration, Search for charged-lepton flavor violation in (2S) → $\ell\mp\tau\pm$ (ℓ=e, μ) decays at Belle, JHEP 2402,187 (2024 February 23)

[162] † T. Iijima, K. Inami, Belle Collaboration, Observation of charmed strange meson pair production in (2S) decays and in e+e− annihilation at √s = 10.52 GeV, PRD 108, 112015 (2023 December 28)

[163] † K. Inami, Belle Collaboration, Search for a dark leptophilic scalar produced in association with $\tau+\tau-$ pair in e+e− annihilation at center-of-mass energies near 10.58 GeV, PRD 109, 032002 (2024 February 5)

[164] † K. Inami, Belle Collaboration, Evidence of B0 → p$\Sigma-\pi-$ at Belle, PRD 108, 052011 (2023 September 22)

[165] † T. Iijima, Belle Collaboration, Search for double-charmonium state with ηc J/ψ at Belle, JHEP 2308,121 (2023 August 18)

[166] † T. Iijima, K. Inami, Belle Collaboration, Search for CP violation in D(s)+ → K+KS0h+h− (h=K, π) decays and observation of the Cabibbo-suppressed decay Ds+ → K+K−KS0π+, PRD 108, L111102 (2023 December 21)

[167] † K. Inami, Belle Collaboration, Measurement of the e+e−→ Bs0 Bs0 X cross section in the energy range from 10.63 to 11.02 GeV using inclusive Ds± and D0 production, JHEP 2308,131 (2023 August 21)

[168] † T. Iijima, K. Inami, Belle Collaboration, First Simultaneous Determination of Inclusive and Exclusive —Vub—, PRL 131, 211801 (2023 Nov 21)

[169] † T. Iijima, K. Inami, Belle Collaboration, Study of the muon decay-in-flight in the $\tau-\rightarrow\mu-\nu\ \mu\ \nu\ \tau$ decay to measure the Michel parameter ξ ', PRD 108, 012003 (2023 July 11)

[170] † T. Iijima, K. Inami, Belle Collaboration, First measurement of the Michel parameter ξ ' in the $\tau-\rightarrow\mu-\nu\ \mu\ \nu\ \tau$ decay at Belle, PRL 131, 021801 (2023 July 11)

[171] † H. Hirata, T. Iijima, Y. Kato, K. Tanida, K. Inami, Belle Collaboration, Study of the lineshape of X(3872) using B decays to D0D*0K, PRD 107, 112011 (2023 June 28)

[172] † K. Inami, Belle Collaboration, First observation of $\Lambda\pi+$ and $\Lambda\pi-$ signals near the K N (I = 1) mass threshold in Λc+ → $\Lambda\pi+\pi+\pi-$ decay, PRL 130, 151903 (2023 April 12)

[173] † K. Inami, Belle Collaboration, First observation of B → D1(→ D π + π −) ℓ + ν ℓ and measurement of the B → D(*) π ℓ + ν ℓ and B → D(*) π + π − ℓ + ν ℓ branching fractions with hadronic tagging at Belle, PRD 107, 092003 (2023 May 8)

[174] † T. Iijima, K. Inami, Belle Collaboration, Measurement of differential distributions of B → D* ℓ ν and implications on —Vcb—, PRD 108,012002 (2023 July 7)

[175] † T. Iijima, K. Inami, Belle Collaboration, First measurement of the Q2 distribution of X(3915) single-tag two-photon production, PRD 108, 012004 (2023 July 11)

[176] † T. Iijima, K. Inami, Belle Collaboration, Search for Bs0 → ℓ ∓ τ ± with the Semi-leptonic Tagging Method at Belle, JHEP 2308,178 (2023 August 28)

[177] † N. Tsuzuki, K. Inami, T. Iijima, Belle Collaboration, Search for lepton-flavor-violating τ decays into a lepton and a vector meson using the full Belle data sample, JHEP 2306,118 (2023 June 21)

[178] † K. Inami, Belle Collaboration, Search for a heavy neutrino in tau decays at Belle, PRL 131, 211802 (2023 November 22)

[179] † T. Iijima, K. Inami, Belle Collaboration, Study of B+ → p n π 0, PRD 108, 112007 (2023 December 15)

[180] † K. Inami, Belle Collaboration, Search for the lepton flavour violating decays B+ → K+ τ ± ℓ ∓ (ℓ =e, μ) at Belle, PRL 130, 261802 (2023 June 28)

[181] † K. Inami, Belle Collaboration, Study of e+e−→ Σ 0 Σ 0 and Σ + Σ − by Initial State Radiation Method at Belle, PRD 107, 072008 (2023 April 28)

[182] † T. Iijima, K. Inami, Belle Collaboration, Observation of a Threshold Cusp at the Λ η Threshold in the pK− Mass Spectrum with Λ c+ → pK− π + Decays, PRD 108, L031104 (2023 August 16)

[183] † T. Iijima, K. Inami, Belle II Collaboration, First measurement of $R(B \to K^{(*)}\mu^+\mu^-)$ and search for new physics at Belle II, Phys. Rev. D 109, 092008 (2024). Jan.

[184] † T. Iijima, K. Inami, Belle II Collaboration, Determination of $|V_{cb}|$ using $\bar{B}^0 \to D^{\star +}\ell^-\bar{\nu}_\ell$ decays with Belle II, Phys. Rev. D 108, 092013 (2023). Nov.

[185] † T. Iijima, K. Inami, Belle II Collaboration, Tests of light-lepton universality in angular asymmetries of $B^0 \to D^{\star -}\ell\nu$ decays, Phys. Rev. Lett. 131, 181801 (2023). Oct.

[186] † T. Iijima, K. Inami, Belle II Collaboration, Measurement of CP asymmetries in $B^0 \to \phi K_S$ with Belle II, Phys. Rev. D 108, 072012 (2023). Oct.

[187] † T. Iijima, K. Inami, Belle II Collaboration, Search for a $\tau^+\tau^-$ resonance in $e^+e^- \to \mu^+\mu^-\tau^+\tau^-$ events with the Belle II experiment, Phys. Rev. Lett. 131, 121802 (2023). Sep.

[188] † T. Iijima, K. Inami, Belle II Collaboration, Measurement of CP asymmetries and branching-fraction ratios for $B^\pm \to DK^\pm$ and $D\pi^\pm$ with $D \to K_S K^\pm \pi^\mp$ using Belle and Belle II data, JHEP 09 (2023) 146. Sep.

[189] † T. Iijima, K. Inami, Belle II Collaboration, Search for a long-lived spin-0 mediator in $b \to s$ transitions at the Belle II experiment, Phys. Rev. D 108, L111104 (2023). Dec.

[190] † T. Iijima, K. Inami, Belle II Collaboration, Precise measurement of the D_s^+ lifetime at Belle II, Phys. Rev. Lett. 131, 171803 (2023). Oct.

[191] † T. Iijima, K. Inami, Belle II Collaboration, Measurement of the τ-lepton mass with the Belle II experiment, Phys. Rev. D 108, 032006 (2023). Aug.

[192] † T. Iijima, K. Inami, Belle II Collaboration, Measurement of CP violation in $B^0 \to K_S\pi^0$ decays at Belle II, Phys. Rev. Lett. 131, 111803 (2023). Sep.

[193] † T. Iijima, K. Inami, Belle II Collaboration, Novel method for the identification of the production flavor of neutral charmed mesons, Phys. Rev. D 107, 112010 (2023). June.

[194] † T. Iijima, K. Inami, Belle II Collaboration, Measurement of the branching fraction and CP asymmetry of $B^0 \to \pi^0\pi^0$ decays using 2019-2021 Belle II data, Phys. Rev. D 107, 112009 (2023). June.

[195] † T. Iijima, K. Inami, Belle II Collaboration, Measurement of the B^0 lifetime and flavor-oscillation frequency using hadronic decays reconstructed in 2019-2021 Belle II data, Phys. Rev. D 107, L091102 (2023). May.

[196] † T. Iijima, K. Inami, Belle II Collaboration, A test of light-lepton universality in the rates of inclusive semileptonic B-meson decays at Belle II, Phys. Rev. Lett. 131, 051804 (2023). Aug.

[197] † T. Iijima, K. Inami, Belle II Collaboration, Search for lepton-flavor-violating τ decays to a lepton and an invisible boson at Belle II, Phys. Rev. Lett. 130, 181803 (2023). May.

[198] † T. Iijima, K. Inami, Belle II Collaboration, Search for an invisible Z' in a final state with two muons and missing energy at Belle II, Phys. Rev. Lett. 130, 231801 (2023). June.

[199] † T. Iijima, K. Inami, Belle II Collaboration, Measurement of lepton mass squared moments in $B \to X_c\ell\bar{\nu}_\ell$ decays with the Belle II experiment, Phys. Rev. D 107, 072002 (2023). Apr.

[200] † T. Fujiie, et al., (M. Kitaguchi, H. M. Shimizu), "Development of Neutron Interferometer Using Multilayer Mirrors and Measurements of Neutron-Nuclear Scattering Length with Pulsed Neutron Source", Phys. Rev. Lett. 132, 023402 (2024).

[201] † P. Strasser, et al., (MuSEUM Collaboration), (M. Kitaguchi, H. M. Shimizu), "Improved Measurements of Muonic Helium Ground-State Hyperfine Structure at a Near-Zero Magnetic Field", Phys. Rev. Lett. 131, 253003 (2023).

[202] † S. Itoh, et al., (M. Kitaguchi, H. M. Shimizu), "Demonstration of simultaneous measurement of the spin rotation of dynamically-diffracted neutrons from multiple crystal planes using pulsed neutrons", Nucl. Instr. and Meth. A1057, 168734 (2023).

[203] † S. Imajo, et al., (M. Kitaguchi, H. M. Shimizu), "Diffuse scattering model of ultracold neutrons on wavy surfaces", Phys. Rev. C 108, 034605 (2023).

[204] † Y. Taira, et al., (M. Kitaguchi), "Measurement of the spatial polarization distribution of circularly polarized gamma rays produced by inverse Compton scattering", Phys. Rev. A 107, 063503 (2023).

[205] † T. Okudaira, et al., (M. Kitaguchi, H. M. Shimizu), "Angular distribution of γ rays from a neutron-induced p-wave resonance of ^{132}Xe", Phys. Rev. C 107, 054602 (2023).

[206] † H. Akatsuka, et al., (M. Kitaguchi), "Characterization of electroless nickel-phosphorus plating for ultracold-neutron storage", Nucl. Instr. and Meth. A1049, 168106 (2023).

[207] † A. Muneem, et al., (M. Kitaguchi), "Investigation of neutron imaging applications using fine-grained nuclear emulsion", J. Appl. Phys. 133, 054902 (2023).

[208] H. Abe et al., Gamma-ray observations of MAXI J1820+070 during the 2018 outburst, Monthly Notices of the Royal Astronomical Society, 517, 4736-4751 (2022)

[209] M. Ajello et al., The Fourth Catalog of Active Galactic Nuclei Detected by the Fermi Large Area Telescope: Data Release 3, The Astrophysical Journal Supplement Series, 263, id.24 (2022)

[210] R. Caputo et al., All-sky Medium Energy Gamma-ray Observatory eXplorer mission concept, Journal of Astronomical Telescopes, Instruments, and Systems, 8, id. 044003 (2022).

[211] S. Abdollahi et al., Search for New Cosmic-Ray Acceleration Sites within the 4FGL Catalog Galactic Plane Sources, The Astrophysical Journal, 933, id.204 (2022)

[212] S. Abdollahi et al., Incremental Fermi Large Area Telescope Fourth Source Catalog, The Astrophysical Journal Supplement Series, 260, id.53 (2022)

[213] H. Tajima et al., Studies of propagation mechanism of optical crosstalk in silicon photomultipliers, accepted for Nuclear Inst. and Methods in Physics Research, A, 1049, 168029 (2023)

[214] H. Abe et al., MAGIC observations provide compelling evidence of hadronic multi-TeV emission from the putative PeVatron SNR G106.3+2.7, Astronomy & Astrophysics, 671, id.A12 (2023)

[215] † E. Aprile et al., Application and modeling of an online distillation method to reduce krypton and argon in XENON1T, Progress of Theoretical and Experimental Physics, Volume 2022, Issue 5, May 2022

[216] † E. Aprile et al., Emission of single and few electrons in XENON1T and limits on light dark matter, Phys. Rev. D 106, 022001, 2022

[217] † E. Aprile et al., Double-weak decays of 124Xe and 136Xein the XENON1T and XENONnT experiments, Phys. Rev. C 106, 024328

[218] † . Aprile et al., An approximate likelihood for nuclear recoil searches with XENON1T data, Eur. Phys. J. C 82, 989 (2022)

[219] † E. Aprile et al., Material radiopurity control in the XENONnT experiment, Eur. Phys. J. C 82, 599 (2022)

[220] † E. Aprile et al., Search for New Physics in Electronic Recoil Data from XENONnT, Phys. Rev. Lett. 129, 161805 (2022)

[221] † J. Aalbers et al., A next-generation liquid xenon observatory for dark matter and neutrino physics, J. Phys. G: Nucl. Part. Phys. 50 013001 (2022)

[222] † K. Abe et al., Search for Cosmic-Ray Boosted Sub-GeV Dark Matter Using Recoil Protons at Super-Kamiokande, Phys.Rev.Lett. 130 (2023) 3, 031802, arXiv:2209.14968

[223] † K. Abe et al., Search for solar electron anti-neutrinos due to spin-flavor precession in the Sun with Super-Kamiokande-IV, Astropart.Phys. 139 (2022) 102702, arXiv:2012.03807

[224] † K. Abe et al., First gadolinium loading to Super-Kamiokande, Nucl.Instrum.Meth.A 1027 (2022) 166248, arXiv:2109.00360

[225] † L. N. Machado et al., Pre-supernova Alert System for Super-Kamiokande, Astrophys.J. 935 (2022) 1, 40, arXiv:2205.09881

[226] † M. Mori et al., Searching for Supernova Bursts in Super-Kamiokande IV, Astrophys.J. 938 (2022) 1, 35, arXiv:2206.01380

[227] † R. Matsumoto et al., Search for proton decay via $p \to \mu^+ K^0$ in 0.37 megaton-years exposure of Super-Kamiokande, Phys.Rev.D 106 (2022) 7, 072003, arXiv:2208.13188

[228] K. Abe et al., Neutron tagging following atmospheric neutrino events in a water Cherenkov detector, JINST 17 (2022) 10, P10029, arXiv:2209.08609

[229] K. Abe et al., Search for neutrinoless quadruple beta decay of 136Xe in XMASS-I, Phys. Lett. B833 (2022) 137355, arXiv:2205.05231

[230] † K. Abe et al., Search for Cosmic-Ray Boosted Sub-GeV Dark Matter Using Recoil Protons at Super-Kamiokande, Phys. Rev. Lett. 130, 031802; Erratum Phys. Rev. Lett. 131, 159903 (2023), arXiv:2209.14968

[231] † K. Abe et al., Search for Cosmic-Ray Boosted Sub-GeV Dark Matter Using Recoil Protons at Super-Kamiokande, Phys. Rev. Lett. 130, 031802; Erratum Phys. Rev. Lett. 131, 159903 (2023), arXiv:2209.14968

[232] † Satoru Takahashi et al. , First Emulsion γ-Ray Telescope Imaging of the Vela Pulsar by the GRAINE 2018 Balloon-borne Experiment , 10.3847/1538-4357/ad0973 , The Astrophysical Journal 960.1 (2023) , 47.

[233] † Henso Abreu et al. , First direct observation of collider neutrinos with FASER at the LHC , 10.1103/PhysRevLett.131.031801 , Physical review letters 131.3 (2023) , 031801.

[234] † Shigeki Aoki et al. , Development of proton beam irradiation system for the NA65/DsTau experiment , 10.1088/1748-0221/18/10/P10008 , Journal of Instrumentation 18.10 (2023) , P10008.

[235] † OPERA Collaboration et al. , Updated constraints on sterile neutrino mixing in the OPERA experiment using a new ν e identification method , 10.1093/ptep/ptad012 , Progress of Theoretical and Experimental Physics 2023.3 (2023) , 033C01.

[236] Jonathan L Feng et al. , The forward physics facility at the high-luminosity LHC , 10.1088/1361-6471/ac865e , Journal of Physics G: Nuclear and Particle Physics 50.3 (2023) , 030501.

Non-refereed papers

[1] † T. Mogi, et al., (M. Kitaguchi, H. M. Shimizu), “Improvement of systematic uncertainties for the neutron lifetime experiment at J-PARC”, Proceedings of Science 380, 458 (2022).

[2] † G. Ichikawa, et al., (M. Kitaguchi, H. M. Shimizu), “Neutron lifetime experiment with pulsed cold neutrons at J-PARC”, Proceedings of Science 380, 457 (2022).

[3] † M. Kitaguchi, “T-violation in Neutron Scattering”, Proceedings of the 24th International Spin Symposium (SPIN2021), 011010 (2022).

[4] † T. Ino, et al., (M. Kitaguchi, H. M. Shimizu), "Optically Polarized Alkali Metal Cell for Muonic Helium Measurements", Proceedings of the 24th International Spin Symposium (SPIN2021), 021208 (2022).

[5] † R. Matsumiya, et al., (M. Kitaguchi, H. M. Shimizu), "The Precision nEDM Measurement with UltraCold Neutrons at TRIUMF", Proceedings of the 24th International Spin Symposium (SPIN2021), 020701 (2022).

[6] † H. Akatsuka, et al., (M. Kitaguchi, H. M. Shimizu), "Study of Thin Iron Films for Polarization Analysis of Ultracold Neutrons", Proceedings of the 24th International Spin Symposium (SPIN2021), 020801 (2022).

[7] † S. Fukumura, et al., (M. Kitaguchi, H. M. Shimizu), "Proposal for new measurements of muonic helium hyperfine structure at J-PARC", EPJ Web of Conferences 262, 01012 (2022).

[8] † E. Aprile et al., Effective Field Theory and Inelastic Dark Matter Results from XENON1T, arXiv:2210.07591

[9] † E. Aprile et al., Low-energy Calibration of XENON1T with an Internal 37Ar Source, arXiv:2211.14191

[10] † E. Aprile et al., The Triggerless Data Acquisition System of the XENONnT Experiment, arXiv:2212.11032

[11] † A. Tiberio et al., Results from the LHCf Run II in proton-proton collisions at $\sqrt{s} = 13$ TeV, Proceedings of EPSC 2022, 105T (2022)

[12] G. Tagliaferri et al., The small-sized telescope of CTAO, Proceedings of the SPIE, 12182, id. 121820K 13 pp. (2022)

[13] M. Ajello et al., The Fourth Catalog of Active Galactic Nuclei Detected by the Fermi Large Area Telescope – Data Release 3, arXiv:2209.12070

[14] S. Abe et al., Multi-wavelength study of the galactic PeVatron candidate LHAASO J2108+5157, arXiv:2210.00775

[15] H. Abe et al., Multi-messenger characterization of Mrk 501 during historically low X-ray and γ-ray activity, arXiv:2210.02547

[16] H. Abe et al., MAGIC observations provide compelling evidence of the hadronic multi-TeV emission from the putative PeVatron SNR G106.3+2.7, arXiv:2211.15321

[17] G. Tagliaferri et al., The small-sized telescope of CTAO, Proceedings of the SPIE, Volume 12182, id. 121820K 13 pp. (2022)

[18] K. Yamaoka, SOlar Neutron and Gamma-ray Spectroscopy mission (SONGS), Proceedings of the SPIE, Volume 12181, id. 1218125 11 pp. (2022)

[19] A. L. Steinhebel et al., AstroPix: CMOS pixels in space, arXiv:2302.00101

[20] † P. Weatherly et al., Testing Non-Standard Interactions Between Solar Neutrinos and Quarks with Super-Kamiokande, arXiv:2203.11772

[21] † K. Abe et al., Search for Cosmic-ray Boosted Sub-GeV Dark Matter using Recoil Protons at Super-Kamiokande, arXiv:2209.14968

[22] † K. Okamoto et al., Searching for neutrinos from solar flares across solar cycles 23 and 24 with the Super-Kamiokande detector, arXiv:2210.12948

[23] † M. Shinoki et al., Measurement of the cosmogenic neutron yield in Super-Kamiokande with gadolinium loaded water, arXiv:2212.10801

[24] † K. Abe et al., Direct dark matter searches with the full data set of XMASS-I, arXiv:2211.06204

5.2 Presentations at International Conferences

5.2.1 Division of Theoretical Studies

Invited Talks

[1] † M. Harada, Pentaquark picture for excited singly heavy baryons based on the chiral tetra-diquark model, Third International Workshop on the Extension Project for the J-PARC Hadron Experimental Facility (3rd J-PARC HEF-ex WS), March 14-16, 2023 AQBRC and KEK Tokai Building #1, KEK Tokai Campus, Tokai, Japan.

[2] † M. Harada, Omega-Pi0 transition transition form factor in an effective hadronic model based on the hidden local symmetry, RCNP workshop on Hadron Physics at the LEPS2 photon beamline, SPring-8, Hyogo, Japan, March 6-7, 2023.

[3] T. Kaneko, Flavor Physics From Lattice QCD, Korean Physical Society and Physical Society of Japan Joint Symposium 2023, Daejeon, Korea, Apr 20, 2023

[4] T. Kaneko, B meson semileptonic decays from lattice QCD, 34th IUPAP Conference on Computational Physics (CCP2023), Kobe, Japan, Aug 4-8, 2023

[5] T. Kaneko, Status and progress of lattice QCD, 12th International Workshop on the CKM Unitarity Triangle (CKM2023), Santiago de Compostela, Spain, Sep 18-22, 2023

[6] N. Yamanaka, Quantification of the electric dipole moment generated by hadronic CP violation, 21st International Conference of Numerical Analysis and Applied Mathematics (ICNAAM 2023), Heraklion Crete, Greece , Sep 11-17, 2023

[7] N. Yamanaka, Quantification of the electric dipole moment generated by elementary particle physics, 6th Joint Meeting of the APS Division of Nuclear Physics and the Physical Society of Japan (HAW23), Waikoloa Hawaii, USA, Nov 26-30, 2023

[8] H. Kanno, Shakirov's non-stationary difference equation and five dimensional instanton counting with a defect, XIII Workshop Geometric Correspondences of Gauge Theories, SISSA (Trieste), Italy June 26-30, 2023

[9] K. Izumi, Area bound in weak gravity region, IBS CTPU-CAG 2023 Workshop on Modified Gravity, IBS Korea June 19-23, 2023

[10] K. Izumi, Gravity, Mass and Surface From Fundamental Physics to the Universe, MAHE Manipal India, March 6, 2024

[11] K. Izumi, Area inequality in weak gravity region HRI seminar, HRI Prayāgrāj India, March 12, 2024

[12] T. Sunayama,Cosmo Palooza, online, October 2023

[13] T. Sunayama, BCCP Seminar, University of California Berkeley, USA, September 2023

[14] T. Sunayama, DESI Lunch Seminar, University of California Berkeley, USA, September 2023

[15] H. Miyatake, High-redshift cosmology with dropout galaxies and CMB lensing, Future Science with CMB x LSS, Kyoto, Japan, Apr 10-13, 2023

[16] H. Miyatake, Cosmology from Subaru Hyper Suprime-Cam Survey Year 3 data, 2023 International Conference of Deep Space Sciences, Hefei, China, Apr 22-27, 2023

[17] H. Miyatake, HSC Year 3 Weak Lensing Cosmology Results, Largest Cosmological Surveys And Big Data Science, Bangalore, India, May 9-12, 2023

[18] H. Miyatake, Cosmology from Galaxy Clustering and Weak Lensing with HSC-Y3 and SDSS using the Emulator Based Halo Model, German Centre for Cosmological Lensing (GCCL) seminar, online, Jun 2, 2023

[19] H. Miyatake, Weak Lensing Cosmology, Understanding cosmological observations, Benasque, Spain, Jul 23-Aug 5, 2023

[20] H. Miyatake, HSC Year 3 Weak Lensing Cosmology Results, The 2nd Shanghai Assembly on Cosmology and Structure Formation, Shanghai, China, Oct 30-Nov 3, 2023

[21] H. Miyatake, HSC Year 3 Weak Lensing Cosmology Results, International Conference on Modified Gravity 2023, Wuhan, China, Nov 18-Nov 20, 2023

[22] H. Miyatake, HSC Year 3 Weak Lensing Cosmology Results, The 32nd Workshop on General Relativity and Gravitation in Japan (JGRG32), Nagoya, Japan, Nov 27-Dec 1, 2023

[23] S. Saga, Relativistic effects on redshift-space distortions, Nagoya-Melbourne Joint Research Workshop on Cosmology, Nagoya university, Nagoya, Japan, Feb 19–21, 2024

[24] S. Nojiri, F(R) Gravity at Present, Symmetry 2023 - The 4th International Conference on Symmetry, Barcelona, Spain, Jun 21–23 Jun 2023

[25] T. Kobayashi, 20th MoEDAL Collaboration Meeting, CERN, December 2023

[26] T. Kobayashi, 8th IBS-MultiDark-ICTP workshop, Institute for Theoretical Physics, Spain, November 2024

[27] T. Kobayashi, Topical seminar, Instituto de Física Corpuscular and University of Valencia, Spain, November 2023

[28] T. Kobayashi, seminar, Jagiellonian University, Poland, April 2023

Oral Presentations

[1] † M. Harada, A chiral quark model with Hidden Local Symmetry, “Fourth International Workshop on the Extension Project for the J-PARC Hadron Experimental Facility (HEF-ex 2024)”, February 19 -21, 2024, J-PARC, Japan.

[2] † M. Harada, A chiral quark model with Hidden Local Symmetry, “Nagoya Workshop on Exotic Hadrons”, November 14 - 17, 2023, Nagoya, Japan.

[3] † M. Harada, A study of neutron star matter based on a parity doublet model with a0(980) meson effect, 4th workshop on “Quarks and Compact Stars (QCS2023)”, September 23 - 26, 2023, Yangzhou, China.

[4] † M. Harada, A chiral quark model with Hidden Local Symmetry and its application to Tcc, ”International workshop on J-PARC hadron physics 2023 (J-PARC Hadron 2023)”, September 12 - 15, AYA’s Quantum Beam Research Center Tokai, Japan.

†

[5] J. Hisano, Probing Physics Beyond the Standard Model with Electric Dipole Moments, 6th Joint Meeting of the APS Division of Nuclear Physics and the Physical Society of Japan, Hawaii, Dec 1, 2023

[6] N. Yamanaka, Unphysical topological charge of nonabelian gauge theory, 6th Joint Meeting of the APS Division of Nuclear Physics and the Physical Society of Japan (HAW23), Waikoloa Hawaii, USA, Nov 26-30, 2023

[7] H. Miyatake, Measurement of high-redshift large-scale structure with Lyman Break galaxies and CMB lensing, HSC Medium-band filter Nagoya workshop, Nagoya, Japan, Sep 1, 2023

[8] H. Miyatake, Baryonic feedback in cosmological analysis, Osaka-CCA-Pisa mini-ILR workshop, Osaka, Japan, Nov 14-15, 2023

[9] H. Miyatake, High-redshift cosmology with dropout galaxies and CMB lensing, Large scale structure journal club, Edinburgh, UK, Feb 27, 2024

[10] S. Saga, Relativistic asymmetry in galaxy-galaxy and galaxy-ellipticity correlations, A journey through the theoretical universe, Université de Toulouse, France, June 28–29

[11] S. Nojiri, F(R) Gravity at Present, Modified Gravity 2023 (MOGRA 2023), Wuhan, China, Nov 18-20 2023

Poster Presentations

[1] K. Izumi, Generalization of Riemannian Penrose inequality, The 32nd workshop on general relativity and gravitation in Japan Nagoya Japan, Nov. 27- Dec. 1, 2023

[2] K. Izumi Area inequality in weak gravity region, Nishinomiya-Yukawa Symposium "General Relativity and Beyond", Kyoto japan, Feb 12-16, 2024

5.2.2 Division of Experimental Studies

Invited Talks

[1] † K. Inami, Status and prospects of measuring Electric Dipole Moment of tau lepton, The 17th International workshop on tau physics, Louisville, USA, Dec 4-8, 2023.

[2] † K. Inami, MCP-PMT R&D and quantum efficiency lifetime measurements, Workshop on Photodetectors and sensors for particle identification and new physics searches, Geneva, Switzerland, Nov. 22, 2023.

[3] M. Takahashi, Cherenkov Telescope Array: Toward Energetic Universe by Capturing Faint Light, International Conference on High Energy Particle & Astroparticle Physics (ICHEPAP2023), Saha Institute of Nuclear Physics, Dec 11–15, 2023

Oral Presentations

[1] O. Sato for FASER Collaboration, First results of LHC neutrinos with FASERnu, 38th International Cosmic Ray Conference (ICRC2023), Nagoya University, Jul26-Aug 03, 2023

[2] H. Rokujo for GRAINE Collaboration, GRAINE: sub-GeV/GeV cosmic gamma-ray imaging with emulsion telescope and balloon experiment in 2023, KASHIWA DARK MATTER SYMPOSIUM 2023,University of Tokyo Kashiwanoha Campus, December 5 – December 8, 2023

[3] H. Rokujo, Nagoya University Nuclear Emulsion Facility :Recent Activities and Prospects of Film Production, the International Conference on Materials and Systems for Sustainability 2023 (ICMaSS2023), Nagoya University, Dec1-3, 2023

[4] T. Fukuda on behalf of the NINJA Collaboration, The NINJA experiment and its future prospects, the International Conference on Materials and Systems for Sustainability 2023 (ICMaSS2023), Nagoya University, Dec1-3, 2023

Poster Presentations

[1] A. Okumura, et al., Evaluation of the effective mirror area of CTA Small-Sized Telescopes for camera design and Monte Carlo simulation, 38th International Cosmic Ray Conference, Nagoya University, Jul 26–Aug 3, 2023

[2] A. Okumura, et al., Development of a blue-mirror multilayer coating on light concentrators for future SiPM cameras, , 38th International Cosmic Ray Conference, Nagoya University, Jul 26–Aug 3, 2023

[3] A. Okumura, et al., Study on the gain and photon detection efficiency drops of silicon photomultipliers under bright background conditions, 38th International Cosmic Ray Conference, Nagoya University, Jul 26–Aug 3, 2023

[4] I. Usuda, Y. Isayama, T. Nakano, Y. Nakamura, H. Minami, S. Yamamoto, H. Rokujo and GRAINE collaboration, GRAINE project: Analysis Status of Nuclear Emulsion Converter for the 2023 balloon experiment, the International Conference on Materials and Systems for Sustainability 2023 (ICMaSS2023), Nagoya University, Dec1-3, 2023

[5] H. Minami, Development of a new fastest readout system “HTS2”., the International Conference on Materials and Systems for Sustainability 2023 (ICMaSS2023), Nagoya University, Dec1-3, 2023

[6] H. Inamoto, T. Fukuda, A. Kasumi, T. Matsuo and NINJA collaboration, Status and prospects of NINJA experiment, the International Conference on Materials and Systems for Sustainability 2023 (ICMaSS2023), Nagoya University, Dec1-3, 2023

[7] Y. Nakamura, New high-precision measurement system for emulsion gamma ray telescope in sub-GeV/GeV, 38th International Cosmic Ray Conference (ICRC2023), Nagoya University, Jul26-Aug 03, 2023

[8] H. Rokujo, Nuclear emulsion detector for large-area, high-angular-resolution gamma-ray telescope, 38th International Cosmic Ray Conference (ICRC2023), Nagoya University, Jul26-Aug 03, 2023

[9] I. Usud, for GRAINE collaboration, Development and analysis large emulsion converter for GRAINE2023 balloon-borne experiment, 38th International Cosmic Ray Conference (ICRC2023), Nagoya University, June 26-August 3, 2023

[10] H. Minami, Developments of the next-generation nuclear emulsion readout system “HTS2(Hyper Track Selector 2)”, 38th International Cosmic Ray Conference (ICRC2023), Nagoya University, Jul26-Aug 03, 2023

[11] T. Fukuda on behalf of the ESS νSB+ Collaboration, The European Spallation Source neutrino Super Beam project, 38th International Cosmic Ray Conference (ICRC2023), Nagoya University, Jul26-Aug 03, 2023

[12] Saya Yamamoto, for the GRAINE collaboration, Development of high-contrast developing for nuclear emulsion film for GRAINE experiment, 38th International Cosmic Ray Conference (ICRC2023), Nagoya University, Jul26-Aug 03, 2023

5.3 Presentations at Domestic Conferences

5.3.1 Division of Theoretical Studies

Invited Talks

[1] † M. Harada "対称性に基づく有効模型を用いたチャームハドロンの解析", 研究会「Through the Hadron, and What We Found There」, 2023/9/10, 鳥羽、日本

[2] † J. Hisano, SUSY GUTs, Norisuke Sakai Memorial Symposium "Supersymmetry, Soliton and Resurgence ", Tokyo Institute of Technology, Aug 5, 2023

[3] T. Kaneko, Flavor Physics From Lattice QCD, KEK Theory Meeting on Particle Physics Phenomenology (KEK-PH2023), 高エネルギー加速器研究機構, Nov 7-10, 2023

[4] T. Kaneko, 素粒子標準理論の精密検証に向けたB中間子崩壊の格子QCDシミュレーション, 第10回「富岳」を中核とするHPCIシステム利用研究課題成果報告会, 品川ザ・グランドホール

[5] † M. Tanabashi, 有効場の理論の等価性と非等価性, 野尻伸一教授退職記念講演会, Mar. 2, 2024

[6] N. Yamanaka, Fundamental physics with atomic nucleus, A3F-CNS Summer School 2023, 東京大学, Aug 4-10, 2023

[7] N. Yamanaka, 非可換ゲージ理論におけるトポロジカル電荷の観測不可能性, 基研研究会素粒子物理学の進展２０２３, 京都大学基礎物理学研究所, Aug 31, 2023

[8] K. Izumi, 特性曲面を用いた因果構造解析の手法とその応用, 豊田工業大学数理物理セミナー, On-line, Nov. 2, 2023

[9] K. Izumi, リーマン-ペンローズ不等式の一般化, 一般相対論と幾何, Nagoya Japan, Feb. 8-9,2024

[10] H. Miyatake, すばる望遠鏡Hyper Suprime-Camサーベイ3年目までのデータを用いた宇宙論解析, 第12回観測的宇宙論ワークショップ, 佐賀大学, Dec 11-13, 2023

[11] H. Miyatake,観測的宇宙論: 大規模銀河サーベイの現状と将来, [IPNS workshop]素粒子物理の今と未来, KEK, Dec 21-23, 2023

[12] T. Kobayashi, online seminar, 早稲田大学, January 2024

[13] T. Sunayama, NAOJ Science Colloquium, NAOJ, January, 2023

[14] T. Sunayama, ILR Symposium, NAOJ, May, 2023

[15] T. Sunayama, Kashiwa Dark Matter Symposium, Kavli IPMU, December, 2023

Oral Presentations

[1] N. Yamanaka, Unphysical topological charge of nonabelian gauge theory, 日本物理学会年次大会第78回年次大会, 東北大学, Sep 16-18, 2023

[2] N. Yamanaka, Unphysical topological charge of nonabelian gauge theory, KEK Theory meeting on Particle Physics Phenomenology (KEK-PH2023), 高エネルギー加速器研究機構, Nov 6-9, 2023

[3] K. Izumi, リーマン-ペンローズ不等式の一般化, Physics meets Mathematics, Summary Workshop, Shiga Japan, Feb 10-12, 2024

[4] S. Saga, Relativistic effects on dispersion measure space distortions, 日本天文学会 2024年春季年会, オンライン, Mar 11–15, 2024

Poster Presentations

5.3.2 Division of Experimental Studies

Invited Talks

[1] † Y. Horii, 第二世代素粒子の質量起源研究の進展とLHC高輝度化の展望, 日本物理学会2024年春季大会, 発表番号19pT1-07, オンライン, Mar. 2024

[2] Y. Horii, ミューオンで探る物質と宇宙の起源, 日本物理学会第78回年次大会, ビーム物理領域・素粒子実験領域・宇宙線・宇宙物理領域・領域10合同一般シンポジウム, 素粒子現象から巨大構造物までを透視するマルチスケールミューオンイメージングの創成と発展, 発表番号17aS31-2, 東北大学, Sep. 2023

[3] † Y. Horii, Experiment Summary: Top+SM, Workshop for Tera-Scale Physics and Beyond, JR九州ホール, Jun. 2023

Oral Presentations

[1] K. Suzuki, J-PARC muon g-2/EDM実験における実機用ミューオン冷却・取り出しシステムを用いた超低速ミューオンの生成実証とビーム特性評価, 発表番号17pRA81-11, 東北大学, Sep. 2023

[2] H. Tajima, AstroPix and Liquid-Argon TPC for MeV Gamma-ray Observatories, MPGD and Active Medium TPC Workshop, Nov 11–18, 2023

[3] 奥村曉, 重谷優斗, 河原崎琉, 田島宏康, バンソンヒョン, 古田和浩, CTA 報告 215：小口径望遠鏡の開発状況, 日本物理学会第78回年次大会, 東北大学, Sep 16–19, 2023

[4] 河原崎琉, 奥村曉, 田島宏康, 古田和浩, CTA報告 216：小口径望遠鏡用64チャンネルSiPMの暗電流の安定性試験, 日本物理学会第78回年次大会, 東北大学, Sep 16–19, 2023

[5] バンソンヒョン, 奥村暁, 田島宏康, 高橋光成, CTA報告 216：小口径望遠鏡用64チャンネルSiPMの暗電流の安定性試験, 日本物理学会第78回年次大会, 東北大学, Sep 16–19, 2023

[6] 高橋光成, 大気チェレンコフガンマ線望遠鏡の気球による絶対的エネルギー較正1, 日本物理学会第78回年次大会, 東北大学, Sep 16–19, 2023

[7] 河原崎琉, 奥村曉, 田島宏康, 古田和浩, CTA報告 216：小口径望遠鏡用64チャンネルSiPMの暗電流の安定性試験, 日本物理学会第78回年次大会, 東北大学, Sep 16–19, 2023

[8] A. Okumura, AstroPix: Development of future TeV/MeV gamma-ray telescopes, Annual Meeting on Multi Messenger Astrophysics, Suimei-kan (Gero), Dec 1–6, 2023

[9] 奥村曉, 重谷優斗、河原崎琉、田島宏康、バンソンヒョン、古田和浩, CTA 小口径望遠鏡の開発状況, 日本天文学会2023年秋季年会, 名古屋大学, Sep 20–22, 2023

[10] 高橋光成, CTAによる原始ブラックホールの探索, 第8回宇宙素粒子若手の会秋の研究会, 東京大学･宇宙線研究所, Nov 3–4, 2023

[11] 高橋光成, Primordial black hole evaporation searches with very-high-energy gamma-ray telescopes, Focus Week on Primordial Black Holes, 東京大学Kavli, Nov 13–17, 2023

[12] 高橋光成, Simulation and analysis of time-evolutional gamma-ray sources, The extreme Universe viewed in very-high-energy gamma rays 2023, 東京大学･宇宙線研究所, Feb 19–20, 2024

[13] 奥村曉, Development Status of Small-Sized Telescopes, The extreme Universe viewed in very-high-energy gamma rays 2023, 東京大学･宇宙線研究所, Feb 19–20, 2024

[14] 河原崎琉, CTA 小口径望遠鏡用 64 チャンネル SiPM の暗電流の安定性試験, 第4回 ITDC プラットフォームA （光検出器、シンチレータ）研究会, 大阪大学 Mar 7–8, 2024

[15] 河原崎琉, CTA 報告 225 : 小口径望遠鏡用 64 チャンネル SiPM の暗電流の安定性試験 (2), 日本物理学会2024年春季大会, Mar 18–21, 204

[16] 人工高分子によるゼラチンを用いない超微粒子原子核乾板の開発 †陳夏姫, 長川恵美, 岩田保, 金田英治, 占部茂治, 谷忠昭, 中竜大, 2023年度日本写真学会年次大会, 東京工業大学すずかけ台キャンパス, 2023年 7月 17日-18日

[17] NINJA 実験に用いる大粒子原子核乾板の開発 †小林春輝1、広部大和1、森元祐介1、福田努1、大関勝久1,2、谷忠昭2、長縄直崇1、岩本豪1、川那子拓己1、六條宏紀1、山本紗矢1、白田育矢1、中野敏行1、南英幸1、霞綺花1（1.名古屋大、2.日本写真学会フェロー）, 2023年度日本写真学会年次大会, 東京工業大学すずかけ台キャンパス, 2023年 7月 17日-18日

[18] NINJA実験・物理ランにおける最新の解析状況, †霞綺花, 鈴木陽介, 小田川高大, 福田努, 松尾友和, 河原宏晃, 佐藤修, 小松雅宏, 他NINJA コラボレーション（9/16）, 2023年日本物理学会第78回年次大会

[19] GRAINE計画：2023年気球実験におけるガンマ線事象解析状況, 中村悠哉(9/16), 2023年日本物理学会第78回年次大会

[20] GRAINE計画:2023年豪州気球実験エマルションコンバーターの性能評価, †臼田育矢、諫山雄大、中野敏行、中村悠哉、南英幸、山本紗矢、六條宏紀、他GRAINE collaboration(9/18),2023年日本物理学会第78回年次大会

[21] 次世代超高速原子核乾板読取装置HTS2 の開発状況, 南英幸(9/18),2023年日本物理学会第78回年次大会

[22] 原子核乾板における高コントラスト現像液の開発, †山本紗矢, 諫山雄大, 臼田育矢, 菅波亜門, 杉村昂, 中野昇, 中村友亮, 中村悠哉, 南英幸, 六條宏紀, GRAINE collaboration, 2023年日本物理学会第78回年次大会

[23] GRAINE計画：2023年豪州気球実験におけるガンマ線事象解析状況, 中村悠哉, 2023年度大気球シンポジウム, 10月23－24

[24] GRAINE 計画：原子核乾板による大面積高解像ガンマ線観測へ向けた次世代高速読取装置の開発, 南英幸, 2023年度大気球シンポジウム, 10月23－24

[25] † GRAINE2023年豪州気球実験エマルションコンバーターの解析状況, 臼田育矢、 諌山雄大、中野敏行、 中村悠哉、 南英幸、 山本紗矢、 六條宏紀、 他GRAINE collaboration, 第9回画像関連学会連合会秋季大会, 2023年11月13日-14日

[26] 原子核乾板を用いた加速器ニュートリノ実験NINJAの最新状況, 福田努，他NINJA Collaboration, 第9回画像関連学会連合会秋季大会, 2023年11月13日-14日

[27] NINJA実験に用いる大粒子原子核乾板の開発, †広部大和、 小林春輝、 森元祐介、 桑原謙一、大関勝久、 長縄直崇、 谷忠昭、 他NINJAコラボレーター, 第9回画像関連学会連合会秋季大会, 2023年11月13日-14日

[28] † 原子核乾板における高コントラスト現像の開発 3, 山本紗矢, 諌山雄大, 臼田育矢, 中村友亮, 中村悠哉, 南英幸, 六條宏紀, GRAINE collaboration, 第9回画像関連学会連合会秋季大会, 2023年11月13日-14日

[29] † タウニュートリノ生成研究－CERN・NA65/DsTau, 佐藤修，有賀昭貴, 有賀智子, 早川大樹, 小松雅宏，久下謙一, 三浦真登, 中野敏行, 奥村虎之介,六條宏紀, 吉本雅浩, 第9回画像関連学会連合会秋季大会, 2023年11月13日-14日

Poster Presentations

[1] S. Kushima, AstroPix: A novel fully-depleted CMOS pixel sensor for the MeV gamma-ray observatory, Annual Meeting on Multi Messenger Astrophysics, Suimei-kan (Gero), Dec 1–6, 2023

[2] R. Kawarasaki, Studies of the dark-current stability of 64-ch SiPMs for CTA Small-Sized Telescopes, Annual Meeting on Multi Messenger Astrophysics, Suimei-kan (Gero), Dec 1–6, 2023

[3] 原子核乾板によるレーザープラズマからのガンマ線検出への挑戦とパイロットテスト, 六條宏紀, 2023年度日本写真学会年次大会, 東京工業大学すずかけ台キャンパス, 2023年 7月17日-18日

[4] 原子核乾板の水素超増感試験, 六條宏紀、 諌山雄大, 第9回画像関連学会連合会秋季大会,2023年11月13日-14日

[5] 原子核乾板自動塗布装置の開発:消泡剤による品質改善, 杉村昂, 第9回画像関連学会連合会秋季大会, 2023年11月13日-14日

5.4 Tutorial and Reviews Articles

[1] 遠藤基, 北原鉄平, 柳生慶, 「電弱対称性の破れの破れ? Wボソン質量アノマリー」高エネルギーニュース **41-2**, 62-70 (2022)

[2] H. Kanno, Topological string of type B and complex geometry Department of physics, Graduate school of science, Kyoto university, 23 – 25 October, 2023

[3] † Yoshitaka Itow, Experimental Neutrino physics, Korea, Feb. 2023

Chapter 6

International Relations

6.1 International Collaborations

Collaboration Name	the other parties
MWA	CSIRO, Curtin University, University of Western Australia (Australia), Kumamoto University, Nagoya University (Japan), Shanghai Astronomical Observatory (China), and others
LiteBIRD	KEK, IMPU, Berkeley, MPA and others (26 organizations)
Subaru Hyper Suprime-Cam	NAOJ, Kavli IMPU, Princton, ASIAA, Nagoya, others (all institues in Japan and Taiwan)
Roman Space Telescope	NASA, STScI, Caltech, Kavli IMPU, Nagoya, and others
Euclid	European Space Agency (ESA), Institut Astrophysique de Paris, University of Edinburgh, Chiba, Kavli IPMU, Nagoya, and others
Vera C. Rubin Observatory's LSST	NOIRLab, SLAC, University of Edinburgh, Kavli IPMU, Nagoya, and others
ATLAS	CERN, High Energy Accelerator Research Organization (KEK), and others (170+ institutions)
Belle	High Energy Accelerator Research Organization (KEK), Tohoku University, Niigata University, University of Tokyo, Osaka University, Nara Women's University, National Taiwan University (Taiwan), University of Hawaii (USA), Budker Institute of Nuclear Physics (Russia), Institute for Theoretical and Experimental Physics (Russia), University of Ljubljana (Slovenia), Max Planck Institut fur Physik Muenchen (Germany), Karlsruhe Institute of Technology (Germany), and others
Belle II	High Energy Accelerator Research Organization (KEK), Tohoku University, Niigata University, University of Tokyo, Osaka University, Nara Women's University, National Taiwan University (Taiwan), University of Hawaii (USA), Budker Institute of Nuclear Physics (Russia), Institute for Theoretical and Experimental Physics (Russia), University of Ljubljana (Slovenia), Max Planck Institut fur Physik Muenchen (Germany), Karlsruhe Institute of Technology (Germany), and others

Muon $g-2$/EDM	Ibaraki University, High Energy Accelerator Research Organization (KEK), Japan Atomic Energy Agency (JAEA), J-PARC center, The graduate university for advanced studies (Soken-dai), Tokyo Institute of Technology, The University of Tokyo, Kyushu University, Nagoya University, Niigata University, Osaka University, International University for Health and Welfare, RCNP. Osaka University, Research Center for Electron-Photon Science, Tohoku University, RIKEN, Toyama College, TRIUMF (Canada), University of Victoria (Canada), University of British Columbia (Canada), Charles University, Faculty of Mathematics and Physics, Prague (Czech Republic), CNRS/IN2P3/UPMC/LPNHE (France), LPNHE Paris (France), LPNHE Paris Sorbonne Universite (France), Central University of Karnataka (India), Indian Institute of Technology Hyderabad (India), Manipal Academy of Higher Education (India), Budker Institute of Nuclear Physics (Russia), Korea University (Republic of Korea), Sungkyunkwan University (Republic of Korea), Center for Axion and Precision Physics Research (CAPP), Institute for Basic Science (IBS) (Republic of Korea), KAIST (Republic of Korea), Seoul National University (Republic of Korea)
XRISM	JAXA, NASA (US), Kanto Gakuin University, Kwansei Gakuin University, Kyoto University, Nagoya University, Nara University of Education, Nara Women's University, Nihon Fukushi University, Osaka University, RIKEN, Rikkyo University, Saitama University, Shibaura Institute of Technology, Shizuoka University, Tohoku Gakuin University, Tokyo Metropolitan University, Tokyo University of Science, University of Miyazaki, University of Tokyo, Waseda University, Canadian Light Source Inc. (Canada), University of Chicago (US), Harvard-Smithsonian Center for Astrophysics (US), Lawrence Livermore National Laboratory (US), Massachusetts Institute of Technology (US), Saint Mary's University (Canada), University of Maryland (US), University of Michigan (US), University of Waterloo (US), University of Wisconsin (US), Yale University (US), ESA (European Space Agency), European Sauther Observatory (Germany), SRON (Netherland), University of Amsterdam (Neitherland), University of Durham (UK), University of Geneva (Switzerland) and others
Athena X-ray observatory	European Space Agency, ISAS/JAXA, NASA (USA) and others
FORCE X-ray observatory	ISAS/JAXA, Kyoto University, Osaka University, Miyazaki University, NASA(USA), and others
The Compton Spectrometer and Imager (COSI)	SSL University of California Berkeley, CASS UC San Diego, U.S. Naval Research Laboratory, NASA Goddard Space Flight Center, IRAP Toulouse, Clemson University, Louisiana State University, Los Alamos National Laboratory, Istituto Nazionale di Astrofisica, IoA Insitute of Astronomy, National Tsing Hua University, Kavli IPMU, The University of Tokyo, KMI Nagoya University, Universität Würzburg
NOPTREX	KEK, RCNP Osaka Univ., Indiana Univ., (organizations)

TUCAN	KEK, RCNP Osaka Univ., TRIUMF, The University of Winnipeg and others (12 organizations)
Cherenkov Telescope Array (CTA)	Max-Planck-Institut für Kernphysik, and others (216 organizations)
Fermi Gamma-ray Space Telescope	NASA Goddard Space Flight Center, and others (57 organizations)
All-sky Medium Energy Gamma-ray Observatory	NASA Goddard Space Flight Center, and others (39 organizations)
LHCf	INFN University of Florence (Italy), University of Catania (Italy), Ecole Polytechnique (France), LBNL Berkeley (USA), Waseda University, Kanagawa University, Tokushima University, Shibaura Institute of Technology, University of Tokyo
RHICf	INFN University of Florence (Italy), University of Catania (Italy), Tokushima University, Shibaura Institute of Technology, Waseda University, University of Tokyo, RIKEN, Japan Atomic Energy Agency, Korea University (Korea), Seoul National University (Korea)
Super-Kamiokande	Kamioka Observatory, Institute of Cosmic Ray Research (ICRR), University of Tokyo, and others (40 organizations)
Hyper-Kamiokande	Kamioka Observatory, Institute of Cosmic Ray Research (ICRR), University of Tokyo, and others (76 organizations)
XENON	Istituto Nazionale di Fisica Nucleare, Laboratori Nazionale del Gran Sasso (INFN-LNGS), and others (28 organizations)
DARWIN	University of Zurich, University of Freiburg and others (33 organizations)
XMASS	Kamioka Observatory, Institute of Cosmic Ray Research (ICRR), University of Tokyo, and others (14 organizations)
OPERA	INR Institute for Nuclear Research (Russia), University of Napoli (Italy), University of Bari (Italy), Lomonosov Moscow State University (Russia), Kobe University (Japan), Univer-sity of Bern (Switzerland), Nagoya University (Japan), METU Middle East Technical University (Turkey), Univer-sity of Padova (Italy), Universite de Savoie (France), Ham-burg University (Germany), JINR-Joint Institute for Nuclear Research (Russia), INFN-Laboratori Nazionali del Gran Sasso (Italy), University of Bologna(Italy), Universite de Strasbourg (France) , Toho Univeristy (Japan), University of Roma (Italy), Gyeongsang National University (Korea), In-stitute for Theoretical and Experimental Physics (Russia), Universite Libre de Bruxelles (Belgium) and others
NEWSdm	INR Institute for Nuclear Research (Russia), University of Napoli (Italy), University of Bari (Italy), Lomonosov Moscow State University (Russia), METU Middle East Technical University (Turkey), JINR-Joint Institute for Nuclear Re-search (Russia), INFN-Laboratori Nazionali del Gran Sasso (Italy), University of Roma (Italy), Institute for Theoretical and Experimental Physics (Russia)

NINJA	ICRR, University of Tokyo (Japan), IPMU, University of Tokyo (Japan), Kanagawa University (Japan), King's College London (UK), Kobe University (Japan), Kyoto University (Japan), Nihon University (Japan), RIKEN (Japan), Ruer Bošković Institute (Croatia), Toho University (Japan), Yokohama National University (Japan)
FASER	University of California (USA), CERN (Switherland), University of Geneva (Switzerland), University of Bern (Switzerland), Chiba University (Japan), Kyushyu University (Japan), Universitat Bonn (Germany), Nikhef National Institute for Subatomic Physics (Netherlands), University of Liverpool (United Kingdom), Tsinghua University (China), INFN Sezione di Genova (Italy), University of Oregon (USA), University of Washington (USA), University of London (United Kingdom), Universitat Gottingen (Germany), Israel Institute of Technology (Israel), DESY (Germany), ETH Zurich (Switherland), Weizmann Institute of Science (Israel), Universitat Mainz (Germany), University of Sussex (United Kingdom), University of Manchester (United Kingdom), Universita di Napoli Federico II (Italy), KEK (Japan), Charles University (Czech Republic)
DsTau	University of Bern (Switzerland), JINR-Joint Institute for Nuclear Research(Russia), METU Middle East Technical University (Turkey), Institute of Space Science (Romania)

SHiP	University of Sofia (Bulgaria), UTFSM (Universidad Técnica Federico Santa Maria) (Chile), NBI (Niels Bohr Institute), Copenhagen University (Denmark), LAL, Univ. Paris-Sud, CNRS/IN2P3 (France), LPNHE Univ. Paris 6 et 7 (France), Humboldt University of Berlin (Germany), University of Bonn, (Germany), University of Hamburg (Germany), Forschungszentrum Jülich (Germany), University of Mainz, (Germany), University and INFN of Bari (Italy),University and INFN of Bologna (Italy),Istituto Nazionale di Fisica Nucleare (INFN), Sezione di Cagliari (Italy), Università Federico II and INFN of Naples (Italy), University La Sapienza and INFN of Rome (Italy), Lab. Naz. Frascati (Italy), Lab. Naz. Gran Sasso, (Italy), Aichi University of Education (Japan), Kobe University, (Japan), Nagoya University (Japan), Nihon University (Japan), Toho University (Japan), Gyeongsang National University (Korea), KODEL, Korea University (Korea), University of Leiden,(The Netherlands), Laboratory of Instrumentation and high-energy Particle physics (LIP) (Portugal), Joint Institute of Nuclear Research (JINR) (Russia), Institute for Theoretical and Experimental Physics (ITEP) (Russia), Institute for Nuclear Research (INR) (Russia), P.N. Lebedev Physical Institute of the Russian Academy of Sciences (LPI) (Russia), National University of Science and Technology "MISIS" (Russia), National Research Centre (NRC) "Kurchatov Institute" (Russia), Institute for High Energy Physics (Russia), Petersburg Nuclear Physics Institute (PNPI) (Russia), Moscow Engineering Physics Institute (MEPhI) (Russia), Skobeltsyn Institute of Nuclear Physics of Moscow State University (Russia) ,Yandex School of Data Analysis (Russia), Institute of Physics, University of Belgrade, (Serbia), Stockholm University (Sweden), Uppsala University, (Sweden), CERN, University of Geneva (Switzerland), Ecole Polytechnique Federale de Lausanne (EPFL) (Switzerland), University of Zurich (Switzerland), Middle East Technical University (METU) (Turkey), Ankara University (Turkey), Imperial College London (UK), University College London (UK), Rutherford Appleton Laboratory (RAL) (United Kingdom), Bristol University (UK), Warwick University (UK), Taras Shevchenko National University of Kyiv (Ukraine), Florida University (USA)

6.2 Visitors

Name	Affiliation	Period	Host
Sergey Shikalova Odintsv	Institut de Ciències de l' Espai (CSIC – ICE)	2023/4/5-4/18	S. Nojiri
Dalibor Skoupil	Nuclear Physics Institute Czech Academy of Sciences, Řež	2023/5/8-5/28	Y. Yamaguchi
Eiichiro Komatsu	Max Planck Institute for Astrophysics (MPA)	2023/6/1-6/30	K. Ichiki
Radu Dobre	Institute of Space Science	2023/6/1 - 8/3	O. Sato
Yen Chin Ong	Yangzhou University	2023/7/3-7/17	K. Izumi
Zonghong Zhu	Beijing Normal University	2023/8/2-8/11	S. Kawamura
Jean-Philippe Lansberg	Laboratoire de Physique des 2 infinis Irene Joliot-Curie	2023/9/27-10/7	N. Yamanaka
Kate Lynch	Laboratoire de Physique des 2 infinis Irene Joliot-Curie	2023/9/27-10/7	N.Yamanaka
Kenji Kadota	中国科学院大学杭州高等研究院	2023/12/16-2024/1/27	K.Ichiki
Gamal Gergess Lamee Nashed	Centre of Theoretical Physics, British University in Egypt	2023/12/11-12/24	S.Nojiri
Salvatore Capozziello	Dipartimento di Fisica "E. Pancini" , Università di Napoli "Federico II"	2024/1/5-1/27	S.Nojiri
Youngman Kim	Rare Isotope Science Project, Institute for Basic Science	2024/1/27-1/31	M.Harada
Luca Moleri	Weizmann Institute of Science	2024/2/25-3/2	M.Horii

Chapter 7

Public Relations

7.1 Media Relations

[1] KEK記者サロン, 「なんでも透視?! 宇宙線と加速器で広がるマルチスケールミューオンイメージング」
Date: 18 May 2023
Related KMI member: Yasuyuki Horii
講演題目「LHC加速器を用いた素粒子研究の現状と展開」

[2] Press release「高感度の新型中性子干渉計の開発に成功－中性子の相互作用の精密測定が可能に－」
Date: 15 Jan, 2024
Related KMI member: Masaaki Kitaguchi, Hirohiko M. Shimizu
News link: https://www.nagoya-u.ac.jp/researchinfo/result/2024/01/post-612.html
Related link: https://www.nagoya-u.ac.jp/researchinfo/result/upload_images/20240115_kmi_2.pdf
Joint press release: RIKEN, KEK, J-PARC, Kyoto University Date: 22 July, 2022
Related KMI member: Yoshitaka Itow, Shingo Kazama
News link: `https://www.kmi.nagoya-u.ac.jp/eng/blog/2022/07/22/xenonnt_first_results/`
Related link: `http://www.xenon1t.org` (Press release by XENON collaboration)

Date: 22 July, 2022
Related KMI member: Yoshitaka Itow, Shingo Kazama
News link: `https://www.kmi.nagoya-u.ac.jp/eng/blog/2022/07/22/xenonnt_first_results/`
Related link: `http://www.xenon1t.org` (Press release by XENON collaboration)

7.2 Outreach Events held by KMI

[1] 宇宙線測定体験会2023
Date: 30 July 2023
Place: KMI
Number of Participants: 40
Co-host: KMI and ICRC2023 and 加速キッチン

[2] 「シャボン膜で読み解く宇宙の謎」– ホームカミングデイ2023
Date: 21 October 2023

Place: KMI
Number of Participants: 60
Co-host: KMI and KMI-SCT

[3] 「暗黒物質ってなんなん？ – What's the matter with dark matter?」 Dark Matter Day 2023 in Japan
Date: 28 October 2023
Lecturer: Masatoshi Kobayashi (KMI)
Place: KamiokaLab + Online
Number of Participants: 30
Co-host: KMI and KamiokaLab

7.3 Outreach Events held by KMI members

[1] H. Miyatake, 宮武さん、「HSC国際チームが宇宙の標準理論検証」って何がすごいんですか！? , 名大研究フロントライン, 12 April 2023

[2] M. Kitaguchi, 物理やってるけど最近悩んでます, Idea Stoa LUNCH, 20 April 2023

[3] K. Nakazawa, シチズンサイエンス・ワークショップ「雷から文化を創造する」, シチズンサイエンス雷雲プロジェクト, 9 July 2022

[4] H. Miyatake and A. Minamizaki, これがハカセ夫婦の生きる道, 名古屋大学オープンキャンパス2023, 8 August 2023

[5] J. Hisano, 名古屋市科学館「高校生による科学の広場」での講評, 28 January 2024

7.4 Public Lectures by KMI members

Name	Date	Location	Event Title	Lecture title	Approx. # of participants
Nobuhiro Maekawa	2023/9/26-28	KEK	入門連続講義	（自然なSO(10), E6）大統一理論入門	40
Tetsuya Shiromizu	2023/11/18	オンライン	第二回「極限宇宙」市民講演会	2023年極限宇宙の旅	230
Hironao Miyatake	2023/8/11	名古屋大学	2023年度学びの杜・学術コース	宇宙の暗黒成分の謎に迫る	17
Masaaki Kitaguchi	2023/10/26	三重県立伊勢高校	出前講義	物理を楽しもう	60
Yoshitaka Itow	2023/07/02	中日文化センター	公開講座	宇宙線はどこで生まれるのか宇宙線の生まれ故郷を探る: 宇宙線とはなにか	20
Hiroyasu Tajima	2023/08/06	中日文化センター	公開講座	宇宙線はどこで生まれるのか宇宙線の生まれ故郷を探る: 超新星爆発と宇宙線	20
Hiroyasu Tajima	2023/09/03	中日文化センター	公開講座	宇宙線はどこで生まれるのか宇宙線の生まれ故郷を探る: ブラックホールと宇宙線	20
Yoshitaka Itow	2023/12/03	中日文化センター	公開講座	宇宙線はどこで生まれるのか宇宙線の生まれ故郷を探る: 宇宙線の最高エネルギー	20

7.5 KMI Science Communication Team

KMI supports outreach activities by a student group called KMI Science Communication Team (KMISCT; `https://teamkmisc.wixsite.com/home`). Here is the list of activities and products from KMISCT.

- Dark Candy: Detailed explanations of topics related to particle physics and cosmology (link).
- Podcast "The Particle Physics Roundtable": Invites a guest from KMI and ask the frontline of their research area (link).
  Here is the list of guest in FY2022.
  - Shingo Kazama and Akira Okumura
  - Shin'ichi Nojiri
  - Kazuhiro Nakazawa
  - Kiyotomo Ichiki
  - Takashi Kaneko
  - Teppei Kitahara

7.6 Other Contributions by KMI members

Name	Activity
Junji Hisano	Editor of Physics Letters B
Hironao Miyatake	13th Subaru Time Allocation Committee
Keisuke Izumi	重力理論解析への招待　古典論から量子論まで（サイエンス社）

Chapter 8

External Funding related with KMI

Grant-in-Aid for Scientific Research (KAKENHI)

(All items are for PI (Principal Investigator) if not specified. Co-I stands for Co-Investigator.)

Name	Research Funds	ID	Amount [JPY] (Direct Expense)
FUKUDA, Tsutomu	Grants-in-Aid for Scientific Research (B)	21H01108	7,750,000
FUKUDA, Tsutomu	Grant-in-Aid for Challenging Exploratory Research	21K18627	2,329,195
FUKUDA, Tsutomu	Grant-in-Aid for Scientific Research on Innovative Areas [Co-I]	18H05537	8,500,000
HARADA, Masayasu	Scientific Research (S) [Co-I]	23H05439	4,200,000
HISANO, Junji	Scientific Research (C)	21K03572	1,170,000
HISANO, Junji	Scientific Research (B) [Co-I]	20H01895	500,000
HORII, Yasuyuki	Transformative Research Areas (B)	21H05085	9,700,000
HORII, Yasuyuki	Scientific Research (S) [Co-I]	22H04944	8,900,000
ICHIKI, Kiyotomo	Scientific Research (C)	18K03616	700,000
ICHIKI, Kiyotomo	Scientific Research (A) [Co-I]	21H04467	600,000
IIJIMA, Toru	Promotion of Joint International Research (International Leading Research)	22K21347	78,230,000
IIJIMA, Toru	Scientific Research (S)	23H05433	24,770,000
IIJIMA, Toru	Scientific Research (A)	23H00109	12,800,000
IIJIMA, Toru	Specially Promoted Research	k0H05625	6,000,000
INAMI, Kenji	Scientific Research (A) [Co-I]	19H00682	3,000,000
INAMI, Kenji	Promotion of Joint International Research (International Leading Research) [Co-I]	22K21347	6,000,000
INAMI, Kenji	Scientific Research (S) [Co-I]	23H05433	3,760,000
ITOW, Yoshitaka	Scientific Research (A)	21H0446	13,130,000
ITOW, Yoshitaka	Transformative Research Areas (A) [Co-I]	18H05538	12,194,000
ITOW, Yoshitaka	Scientific Research (A) [Co-I]	19H00675	650,000
ITOW, Yoshitaka	Scientific Research (B) [Co-I]	20H01917	130,000
IZUMI, Keisuke	Bilateral Joint Research (JSPS-DST)	JPJSBP 120227705	1,000,000
IZUMI, Keisuke	Scientific Research (B)[Co-I]	20H01902	200,000
IZUMI, Keisuke	Transformative Research Areas (A)[Co-I]	21H05189	500,000
IZUMI, Keisuke	Transformative Research Areas (A)[Co-I]	21H05182	100,000
KANEKO, Takashi	Scientific Research (B)	21H01085	3,300,000
KANNO, Hiroaki	Scientific Research (C)	23K03087	400,000
KAWAMURA, Seiji	Scientific Research (B)	22H01247	4,800,000

KAWAMURA, Seiji	Challenging Research (Exploratory)	21K18626	2,400,000
KAZAMA, Shingo	Scientific Research (B)	20H01931	4,700,000
KAZAMA, Shingo	Transformative Research Areas (A)	21H05455	2,000,000
KAZAMA, Shingo	Scientific Research (A) [Co-I]	21H04471	500,000
KAZAMA, Shingo	Scientific Research (A) [Co-I]	21H04466	300,000
KAZAMA, Shingo	Grant-in-Aid for Scientific Research on Innovative Areas (Research in a proposed research area) [Co-I]	19H05805	2,400,000
KAZAMA, Shingo	Scientific Research (A) [Co-I]	22H00127	200,000
KITAGUCHI, Masaaki	Scientific Research (B)	21H01092	2,500,000
KITAGUCHI, Masaaki	Scientific Research (A) [Co-I]	21H04475	200,000
KITAGUCHI, Masaaki	Scientific Research (A) [Co-I]	22H00140	200,000
KITAGUCHI, Masaaki	Scientific Research (B) [Co-I]	22H01231	200,000
KITAGUCHI, Masaaki	Scientific Research (B) [Co-I]	22H01236	200,000
KITAGUCHI, Masaaki	Scientific Research (B) [Co-I]	23H03659	100,000
KITAHARA, Teppei	Early-Career Scientists	19K14706	600,000
KOBAYASHI, Takeshi	Scientific Research (C)	22K03595	900,000
MAEKAWA, Nobuhiro	Scientific Research (C)	19K03823	800,000
MIYATAKE, Hironao	Promotion of Joint International Research (International Leading Research) [Co-I]	22K21349	5,440,000
MIYATAKE, Hironao	Scientific Research (A)	20H01932	7,500,000
MIYATAKE, Hironao	Grant-in-Aid for Transformative Research Areas (A)	23H04005	2,400,000
NAKAMURA, Mitsuhiro	Grant-in-Aid for Specially promoted Research	18H05210	48,900,000
NAKANO, Toshiyuki	Grant-in-Aid for Specially promoted Research [Co-I]	18H05210	2,000,000
NAKANO, Toshiyuki	Grants-in-Aid for Scientific Research (A) [Co-I]	21H04472	2,500,00
NAKANO, Toshiyuki	Grants-in-Aid for Scientific Research (B) [Co-I]	22H01233	800,000
NAKAZAWA, Kazuhiro	Scientific Research (A)	20H00157	5,100,000
NAKAZAWA, Kazuhiro	Scientific Research (A) [Co-I]	22H00145	1,050,000
NAKAZAWA, Kazuhiro	Scientific Research on Innovative Areas (A)	21H00166	2,600,000
OKUMURA, Akira	Scientific Research (B)	20H01916	6,100,000
TAJIMA, Hiroyasu	Scientific Research (A)	21H04468	6,100,000
ROKUJO, Hiroki	Grants-in-Aid for Scientific Research (B)	20H01915	1,700,000
ROKUJO, Hiroki	Grants-in-Aid for Scientific Research (B) [Co-I]	20H01233	500,000
SAGA, Shohei	Grant-in-Aid for Research Activity Start-up	23K19050	1,100,000
SATO, Osamu	Grants-in-Aid for Scientific Research (B) [Co-I]	21H01108	50,000
SATO, Osamu	Grant-in-Aid for Specially promoted Research [Co-I]	18H05210	2,000,000
SATO, Osamu	Grant-in-Aid for Scientific Research on Innovative Areas [Co-I]	18H05535	50,000
SATO, Osamu	Grant-in-Aid for Scientific Research on Innovative Areas	18H05541	14,200,000
SHIMIZU, Hirohiko	Challenging Research (Exploratory)	22K18996	3,600,000
SHIMIZU, Hirohiko	Scientific Research (S) [Co-I]	20H05646	2,000,000
SHIMIZU, Hirohiko	Scientific Research (B) [Co-I]	23H03659	450,000
SHIROMIZU, Tetsuya	Scientific Research (C)	21K03551	400,000
SHIROMIZU, Tetsuya	Transformative Research Areas (A)	21H05189	13,800,000
SHIROMIZU, Tetsuya	Transformative Research Areas (A)[Co-I]	21H05182	100,000
SHIROMIZU, Tetsuya	International Collaborative Research[Co-I]	23KK0048	400,000
SUNAYAMA, Tomomi	Transformative Research Areas (A)	20H05855	300,000
SUZUKI, Kazuhito	Scientific Research (A) [Co-I]	22H00141	150,000
TOBE, Kazuhiro	Scientific Research (C)	20K03947	800,000
YOKOYAMA, Shuichiro	Scientific Research (C)	20K03968	1,000,000

YOSHIHARA, Keisuke	Scientific Research (B)	22H03867	6,300,000

Other Research Funds

Name	Research Funds	ID	Amount [JPY] (Direct Expense)
HISANO, Junji	JSPS Core-to-core program		13,074,300
ICHIKI, Kiyotomo	JST FOREST	JPMJFR20352935	7,900,000
ICHIKI, Kiyotomo	AIP Acceleration Research	JP20317829	9,700,000
KAWAMURA, Seiji	Murata Science Foundation		3,000,000
KAZAMA, Shingo	JST FOREST	JPMJFR212Q	7,100,000
KITAGUCHI, Masaaki	Nagoya Univ. MIRAI project		400,000
MINAMIZAKI, Azusa	Daiko Foundation		950,000
MIYATAKE, Hironao	JST FOREST	JPMJFR2137	11,200,000
MIYATAKE, Hironao	T-GEx tailor-made grant		2,700,000
MIYATAKE, Hironao	T-GEx seed funding		50,000
MIYATAKE, Hironao	AY2023 Nagoya University Global Multi-Campus Seed Funding Grants		2,000,000
NAKAZAWA, Kazuhiro	JAXA/ISAS Strategic development [Co-I]		2,400,000
NAKAZAWA, Kazuhiro	JAXA/ISAS Basic development for onboard equipment		2,000,000