
YITP Annual Report

**Yukawa Institute For
Theoretical Physics
Kyoto University**

2014

Foreword

We present here an annual report of the scientific activities of Yukawa Institute for Theoretical Physics during the academic year 2014.

From the year 2007 we started our new project of “Yukawa International program of Quark-Hadron Sciences (YIPQS)” funded by Japan Ministry of Education, Culture, Sports, Science and Technology. In this project we select a few research topics each year for long-term workshops and invite leading experts from abroad to stimulate discussions and foster collaborations among workshop participants. In the year 2014 we held three long-term workshops on “Holographic vistas on Gravity and Strings”, “Novel Quantum States in Condensed Matter 2014 (NQS2014)” and on “Hadrons and Hadron Interactions in QCD 2015 (HHIQCD2015)” and extensive discussions have been exchanged. Our report contains some of the results obtained during these workshops.

Director
Misao Sasaki

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Chapter 1

People

1.1 Regular Staff and Guest Professors (2014 April – 2015 March)

Regular Staff

Misao Sasaki
Professor (A)

Sinya Aoki
Professor (E)

Hisao Hayakawa
Professor (C)

Akira Ohnishi
Professor (N)

Masaru Shibata
Professor (A)

Tadashi Takayanagi
Professor (E)

Shigeki Sugimoto
Professor (E) [2014.4.1 –]

Shinji Mukohyama
Professor (A) [2014.10.1 –]

Takahiro Tanaka
Concurrent Post Professor (A) [2014.4.1 –]

Masatoshi Murase
Associate Professor (C)

Hiroshi Kunitomo
Associate Professor (E)

Naoki Sasakura
Associate Professor (E)

Keisuke Totsuka
Associate Professor (C)

Ken-Iti Izawa
Associate Professor (E) [– 2015.3.31]

Naoyuki Itagaki
Associate Professor (N)

Fumihito Takayama
Associate Professor (E)

Yoshitaka Hatta
Associate Professor (N)

Atsushi Taruya
Associate Professor (A)

Antonio De Felice
Associate Professor (A)

Kazuo Hosomichi
Associate Professor (E) [– 2014.8.31]

Yudai Suwa
Associate Professor (A)

Masaki Shigemori
Hakubi Project Associate Professor (E)

Masanori Hanada
Hakubi Project Associate Professor (E)

Seiji Terashima
Assistant Professor (E)

Yu Watanabe
Assistant Professor (C)

Ippeï Danshita
Assistant Professor (C)

Tetsuo Hyodo
Assistant Professor (N)

Takayuki Muranushi
Assistant Professor (A) [– 2014.5.31]

Yuko Fujita
Assistant Professor(Project Manager)

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

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

Visiting Professors

Prof. Roberto EMPARAN
(Universitat de Barcelona)
2014.4.28 — 2014.7.27
Gravity in the limit of many dimensions

Prof. Sumit Ranjan DAS
(University of Kentucky)
2014.5.13 — 2013.8.12
Time Dependent backgrounds in Gauge-Gravity Duality

Prof. Oleg SUSHKOV
(University of New South Wales)
2014.9.7 — 2014.12.6
Theoretical study of novel quantum states and dynamical properties in strongly correlated electron systems

Prof. Pierre Louis DESCOUVEMONT

(Universite Libre de Bruxelles)

2015.1.1 — 2015.3.31

Microscopic nuclear structure and reaction approaches for light nuclei

1.2 Research Fellows and Graduate Students (2014 April – 2015 March)

Research Fellows

Yu-ichiro Sekiguchi (A) [2011.1.1 – 2015.3.31]
Kenta Kiuchi (A) [2010.2.1 –]
Takashi Hiramatsu (A) [2010.4.1 –]
Takatoshi Ichikawa (N) [2009.4.1 –]
Goro Ishiki (E) [2013.4.1 – 2014.10.31]
Hiroki Nagakura (A) [2011.4.1 –]
Takashi Yoshida (A) [2013.4.1 –]
Kenji Morita (N) [2014.8.1 –]
Hiroataka Irie (E) [2012.4.1 – 2015.3.31]
Hajime Sotani (N) [2012.11.1 – 2014.6.30]
Toshiya Namikawa (A) [2013.4.1 – 2014.8.31]
Koki Nakata (C) [2013.4.1 – 2015.3.31]
Shunsuke Yabunaka (C) [2014.4.1 –]
Kouji Kashiwa (N) [2014.4.1 –]
Mitsutoshi Fujita (E) [2014.4.1 –]
White Jonathan (A) [2014.4.1 – 2014.9.30]
Yuichi Takamizu (A) [2012.4.1 – 2015.3.31]
Atsushi Ogasawara (E) [2014.6.1 – 2015.3.31]
Kengo Kikuchi (E) [2014.7.1 – 2015.3.31]
Zhang, Ying-li (A) [2013.10.1 – 2014.9.30]
Hirohada Okawa (A) [2014.7.1 –]
Takumi Iritani (E) [2014.7.1 –]
Chunshan Liu (A) [2014.8.16 –]
Ryo Saito (A) [2014.10.1 – 2015.3.31]
Yusuke Kimura (E) [2014.10.1 –]
Tong-gyu Lee (N) [2014.10.1 – 2015.3.31]
Natsumi Ikeno (N) [2014.10.1 – 2015.3.31]
Tsunenori Inakura (N) [2014.11.1 – 2015.3.31]
Manjon, Jenifer Nebreda (N) [2013.10.1 – 2014.9.30]
Wakana Iwakuni (A) [2013.4.1 –]
Syu Tanaka (C) [2014.4.1 – 2015.3.31]
Keiko Murano (E) [2013.7.1 – 2014.5.31]
Noburo Shiba (E) [2013.9.26 – 2015.3.31]
Daisuke Nomura (E) [2013.10.16 –]

Yuki Yokokura (E) [2014.4.1 – 2014.10.31]
Pawel Pitor Caputa (E) [2014.2.1 – 2014.10.31]
Song He (E) [2013.11.1 –]

Graduate Students

Yuusuke Kourai (A) [2009.4.1 –]
Masahiro Nozaki (E) [2010.4.1 –]
Naofumi Hama (E) [2010.4.1 –]
Kiyoshi Kanazawa (C) [2010.4.1 –]
Koudai Sugimoto (C) [2010.4.1 –]
Kazuya Shinjo (C) [2011.4.1 –]
Tomohiko Sano (C) [2011.4.1 –]
Satoshi Takada (C) [2011.4.1 –]
Tomoki Nosaka (E) [2011.4.1 –]
Yusuke Kimura (E) [2011.10.1 –]
Terukazu Ichihara (N) [2012.4.1 –]
Kyohei Kawaguchi (A) [2012.4.1 –]
Tokiro Numasawa (E) [2012.4.1 –]
Shoichiro Tsutsui (N) [2014.4.1 –]
Yasuho Yamashita (A) [2012.4.1 –]
Yuta Yoshida (N) [2012.4.1 –]
Kota Watanabe (C) [2012.4.1 –]
Kazuhiko Tanimoto (C) [2012.4.1 –]
Takumi Ohta (C) [2013.4.1 –]
Ryosuke Hara (C) [2013.4.1 –]
Tomohisa Okazaki (A) [2013.4.1 –]
Hidekazu Tsukiji (N) [2013.4.1 –]
Ichihiko Hashimoto (A) [2013.4.1 –]
Kento Watanabe (E) [2013.4.1 –]
Minkyu Park (E) [2013.4.1 –]
Jaewang Choi (E) [2013.4.1 –]
Yu Takaoka (C) [2014.4.1 –]
Yukihisa Imamura (C) [2014.4.1 –]
Kazuma Nagao (C) [2014.4.1 –]
Haruki Uchida (A) [2014.4.1 –]
Naoya Oishi (A) [2014.4.1 –]

Yuki Kamiya (N) [2014.4.1 –]

Kazuma Shimizu (E) [2014.4.1 –]

Masamichi Miyaji (E) [2014.4.1 –]

Guillem Domenech Fuertes (A) [2014.10.1 –]

Ph.D Awarded

Kiyoshi Kanazawa

Statistical mechanics for athermal fluctuation: Non-Gaussian noise in physics (C)
(supervisor: Hisao Hayakawa)

Yusuke Kimura

Classification of the Landscape of F-theory Vacua over $K3 \times K3$ by Gauge Groups: Comparison of $SO(10)$ -vacua and $SU(5)$ -vacua as an Application (E)
(supervisor: Hiroshi Kunitomo)

Ryo Murakami

Effect of the Elastic Vibration of Isothermal Elastic Sphere upon Head-on Collision (C)
(supervisor: Hisao Hayakawa)

Masahiro Nozaki

Quantum Entanglement of Local Operators (E)
(supervisor: Tadashi Takayanagi)

Koudai Sugimoto

Theoretical Study of Electron Dynamics in Multi-Orbital Antiferromagnetic Metals (C)
(supervisor: Keisuke Totsuka)

Chapter 2

Research Activities

2.1 Research Summary

Astrophysics and Cosmology Group

Inflation and Early Universe

A. De Felice, S. Mukohyama and T. Tanaka with A. E. Gumrukcuoglu and N. Tanahashi studied cosmological perturbations in bigravity theory with two fluids each of which is coupled to one of the two metrics. They clarify the stability conditions of the cosmological perturbations. They extend the condition for the absence of the so-called Higuchi ghost, and showed that the condition is guaranteed to be satisfied on the healthy branch. They also examined the squared propagation speeds of perturbations and derived the conditions for the absence of the gradient instability.

S. Mukohyama with A. E. Gumrukcuolu and L. Heisenberg investigated cosmological perturbations in nonlinear massive gravity with a new effective matter coupling proposed recently. They obtained the stability condition and put constraints on the parameters of the theory.

A. De Felice and M. Sasaki analyzed a wide class of non-local gravity theories and found that almost all of them suffer from the existence of a ghost degree of freedom except for a very special case already discussed in the literature.

A. De Felice together with S. Tsujikawa and K. Koyama investigated the behavior of cosmological perturbation in the context of GLPV theories (beyond Horndeski scalar tensor theories) and found that, unless initial conditions are fine tuned, there should be large deviations from General Relativity in terms of the anisotropic parameter of the two gravitational potentials.

Y. Zhang, D. Yeom and M. Sasaki studied the Hawking-Moss instanton in bigravity and found that it may explain a large number of e-folds that is necessary for successful inflation, in contrast to the case of general relativity where it fails to predict a large number of e-folds.

J. White, Y. Zhang and M. Sasaki studied the curvature perturbation spectrum in a couple of models of open inflation and re-discovered that the scalar power is suppressed on large scales, while the tensor power is almost scale-free and unsuppressed up to the curvature scale.

T. Hiramatsu and M. Sasaki with R. Saito and A. Naruko formulated the cosmic microwave background equations up through second order in perturbation theory by means of a new method based on the curve-of-sight formula. This will be a useful tool for comparing future CMB experiments with theoretical predictions.

Theory of Gravity

Y. Yamashita, A. De Felice and T. Tanaka discussed the ghost free conditions when we add matter coupled to two metrics to the ghost-free bigravity theory. They

showed that the Boulware-Deser ghost generally revives in the presence of doubly coupled matter fields and also that the ghost free condition strongly restricts the model of doubly coupled matter. This result may give a hit to the attempt to deduce the ghost-free bigravity as a low-energy effective theory, starting with more fundamental theory.

T. Tanaka with M. Kimura, H. Ishihara and K. Matsuno proposed a simple method to prove non-smoothness of a black hole horizon. The existence of a C^1 extension across the horizon implies that there is no C^{N+2} extension across the horizon if some components of N -th covariant derivative of Riemann tensor diverge at the horizon in the coordinates of the C^1 extension. This gives a simple method to confirm the existence of a curvature singularity for several cases where the scalar the Ricci scalar and the Kretschmann invariant are finite at the horizon.

S. Mukohyama with C. Lin, R. Namba and R. Saitou studied the Hamiltonian structure of a new scalar-tensor theory of gravity beyond Horndeski theory, called GLPV theory. They proved that the number of physical degrees of freedom is three at fully nonlinear level.

S. Mukohyama proposed a new quasidilaton theory of Poincare invariant massive gravity. He found a scaling-type exact solution that expresses a self-accelerating de Sitter universe, and then showed the stability of the solution in a range of parameters.

Observational Cosmology

A. Taruya and T. Hiramatsu with T. Nishimichi, F. Bernardeau, and K. Koyama developed a resummed perturbative calculations for cosmological power spectra and correlation functions in the context of modified gravity. It is shown explicitly that the multipoint propagator expansion, which has been originally formulated in GR, is successfully applied to the in $f(R)$ gravity as one of the representative modified gravity models. The analytically calculated power spectrum and correlation function are in agreement with N -body simulations in both real and redshift spaces.

A. Taruya with T. Kashiwagi, Y. Suto, I. Kayo, T. Nishimichi, and K. Yahata considered how far-infrared (FIR) emission of galaxies affects the most widely used Galaxy extinction map called SFD map. It is previously found that the surface number density of galaxies as a function of the r -band extinction, $A_{r,\text{SFD}}$ is positively correlated with $A_{r,\text{SFD}}$. Taking account of the contamination of their FIR emission, they construct an analytic model to explain the anomaly of this surface number density. The agreement with the model prediction suggests that the FIR emission of galaxies is mainly responsible for the

observed anomaly.

In order to clarify the impact of the small-scale physics to the large-scale structure of the universe, A. Taruya with T. Nishimichi and F. Bernardeau presented detailed simulation measurement of the nonlinear mode-coupling in the power spectrum. It is found that while the mode-coupling structure can be explained to a large extent with the standard perturbation theory, the coupling of the short-wave modes is significantly damped away, making them contributing only weakly to the growth of long-wave modes.

A. Taruya with Y-S. Song and A. Oka considered to what extent cosmological constraint is improved by combining the statistical power of both the power spectrum and bispectrum at large scales. Based on the Fisher matrix analysis, they estimate the benefit of combining the power spectra and bispectra, finding that the constraints on the cosmic expansion and growth of structure will be improved by a factor of two. This compensates for the loss of constraining power using the power spectrum alone due to the randomness of the relative velocities.

Gravitational Waves

The final phase of compact binary systems composed of neutron star (NS) and/or black hole (BH) is among the most promising sources for kilo-meter-size laserinterferometric gravitational-wave detectors such as advanced LIGO and KAGRA. Modeling gravitational waves from their late inspiral to merger phases for the use of data analysis is an urgent task and theoretical waveforms can be accurately derived only by numerical-relativity (NR) simulations. M. Shibata with collaborators for the first time derived accurate, long-term waveforms in NR using low-eccentricity initial data derived by Kyutoku et al., and showed that the modeling by an effective-one-body approach works well except for the last orbits before the onset of the merger.

After the merger of NS-NS and BH-NS binaries, a substantial amount of the neutron-rich matter can be ejected from the system. The ejected matter will produce heavy elements such as gold through the r-process nucleosynthesis. Subsequently, the unstable heavy elements decay and heat up the ejecta, which will shine for 1–10 days with the luminosity larger than 10^{41} ergs/s if the ejected mass is $0.01M_{\odot}$. This possible transient electromagnetic source, called kilonova or macronova, is among the most promising sources of electromagnetic counterparts of gravitational waves. Y. Sekiguchi, K. Kiuchi, and M. Shibata with K. Kyutoku performed for the first time NR radiation-hydrodynamics simulations for NS-NS mergers using nuclear-theory-based tabulated equations of state to explore ejecta properties. The simulations were performed on the “K” computer. They found that the ejecta are composed of components of a broad neutron richness. This is well-suited for reproducing solar-abundance pattern for the r-process nucleosynthesis elements, as first demonstrated by Wanajo, Sekiguchi, et al.

Because NSs are strongly magnetized, magnetohydrodynamics effects should play a key role in the merger process of NS binaries. K. Kiuchi, Y. Sekiguchi, and M. Shibata with K. Kyutoku performed the highest-resolution

general-relativistic magnetohydrodynamics simulations for NS-NS binary on the “K” computer. They found that the magnetic fields are steeply amplified by the Kelvin-Helmholtz instability in ~ 1 millisecond after the onset of the merger to the maximum magnetic field $\sim 10^{17}$ G. They also confirmed that the magnetic field is subsequently amplified by the magnetorotational instability in the evolution of the formed hypermassive neutron star (HMNS). After substantial angular momentum transport, the HMNS collapses to a rotating black hole surrounded by a highly magnetized torus, which could be the engine for driving strong outflow and mass ejection.

The gravitational waveforms in the ghost-free bigravity theory deviate from those in general relativity, exhibiting graviton oscillations. T. Tanaka in collaboration with T. Narikawa, K. Ueno, H. Tagoshi, N. Kanda and T. Nakamura investigated the prospects for the detection of the signature of bigravity theory in gravitational waveforms from coalescing compact binaries. They considered a subclass of the bigravity model pointed out to be healthy by T. Tanaka and A. De Felice with T. Nakamura. They found that the bigravity waveform shows strong amplitude modulation, and showed that there is a detectable region of the bigravity parameters for the advanced ground-based laser interferometers, such as Advanced LIGO, Advanced Virgo, and KAGRA.

For a self-gravitating particle of mass orbiting a Kerr black hole, T. Tanaka with S. Isoyama, L. Barack, S. R. Dolan, A. Le Tiec, H. Nakano, A. G. Shah and N. Warburton computed the shift in the frequency of the innermost stable circular equatorial orbit due to the conservative gravitational self-force. They gave numerical results for the ISCO frequency shift as a function of the black hole spin, compared them with predictions based on the post-Newtonian approximation and the effective one-body model.

T. Namikawa, and A. Taruya with D. Yamauchi have discussed the future prospects for high-sensitivity cosmic microwave background (CMB) experiments, and pointed out for the first time that the gravitational-wave induced lensing signals, imprinted on the CMB maps, can be detected. Even in the case of small tensor-to-scalar ratio, $r \lesssim 0.1$, the lensing signals will be detected at more than 3σ significance level, offering an independent confirmation of the gravitational waves complementary to B-mode polarization experiments.

High-Energy Astrophysics

By performing a very long-term hydrodynamic simulations with detailed neutrino radiative transfer, Y. Suwa evaluated when and where lattice structures of nuclei form inside protoneutron stars that consist of free nucleons (protons and neutrons) and electrons. This indicates the phase transition from protoneutron stars to neutron stars that have hard crust on their surface.

Y. Suwa with T. Takiwaki and K. Kotake performed full three-dimensional (3D) and axisymmetric two-dimensional (2D) simulations of core-collapse supernova explosions driven by neutrino heating and investigated the hydrodynamic features depending on the spatial

dimensions. They found that 2D models are more energetic than 3D models. The difference is a consequence of different direction of turbulent cascade, i.e., 2D (3D) models exhibit inverse (normal) cascade, which transfers turbulent energy from small (large) to large (small) scales.

Y. Suwa with T. Enoto derived the neutrino transfer equation in strongly magnetized media and they solved this equation with diffusion approximation to evaluate the degree of asymmetry of neutrino distribution function. They found that poloidal component of magnetic fields leads to asymmetric neutrino emission in meridional plane and transfers linear momentum, while the toroidal component leads to asymmetry transferring angular momentum. Combined with the current observations of magnetars, which are most magnetized objects in the universe, they gave constraints on the strength of internal magnetic fields.

Y. Suwa with T. Nakamura, K. Kashiyama, D. Nakauchi, T. Sakamoto, and N. Kawai investigated the time evolutions of neutrino dominated accretion disks of $\sim 0.1M_{\odot}$ and evaluated mass accretion onto the central black holes. With Blandford-Znajek process, which extracts rotational energy of black holes, they calculated the brightness of radiation and found that it can account for obscured extended emissions that accompany short-hard gamma-ray bursts.

H. Nagakura with K. Sumiyoshi and S. Yamada developed three-dimensional Boltzmann hydrodynamics code for core-collapse supernovae. They proposed a novel numerical method for coupling between Boltzmann neutrino transfer and hydrodynamics with taking into account of all orders of v/c terms. They carried out a series of basic tests and also demonstrated the gravitational collapse of supernova progenitors.

H. Nagakura and W. Iwakami with S. Yamada investigated the effect of rotation on the explosion of core-collapse supernovae in three dimensional simulations. They revealed that there are critical value of the specific angular momentum for a given combination of mass accretion rate and neutrino luminosity.

T. Yoshida with S. Okita and H. Umeda investigated the possibility of a super-luminous Type Ic core-collapse supernova producing ^{56}Ni of several solar-mass. This supernova is evolved from a very massive star with the initial mass of $110 - 270M_{\odot}$ and the metallicity of $Z \sim 0.004$. An energetic aspherical supernova explosion of the star produces the ^{56}Ni yield enough to reproduce the light curve of super-luminous SN 2007bi. This explosion also shows large velocity dispersion. An aspherical core-collapse supernova evolved from a very massive star has a possibility of a subgroup of super-luminous supernovae.

T. Yoshida with K. Takahashi and H. Umeda performed a stellar evolution simulation of first stars and calculate stellar yields of first supernovae. The initial mass range of $12 - 140M_{\odot}$ is taken and stellar rotation is taken into account. A weak explosion is assumed as supernova explosions and, thus, only the material in outer layer is ejected. Based on the obtained abundance distributions of these supernovae, they found abundance signatures constraining the progenitor characteristics such as stellar mass and

rotation of first supernovae.

Condensed Matter and Statistical Dynamics Group

Condensed-Matter Physics

The subjects of condensed-matter physics are the states of matter that emerge at low-temperatures as a consequence of non-trivial many-body correlation. The main goal in this field is to understand how interplay among such low-energy degrees of freedom as charge, spin and (electron) orbital, when combined with a few simple fundamental principles (e.g. Fermi statistics, electromagnetic force), leads to a variety of (sometimes even macroscopic) phenomena. The area of current research in our group includes unconventional topological phases and quantum phase transitions in systems of ultra-cold atoms, phases of frustrated magnets on a layered triangular lattice, symmetry-protected topological phases in quantum spin chains in high magnetic fields, and dynamics in one-dimensional fermionic topological phases.

Symmetry-protected topological plateaus in one-dimensional quantum spin chains: There are a variety of states of matter called “topological”, that defy the traditional Landau-type description. These states are roughly categorized into two. First class is characterized by long-range entanglement and is robust against any kind of local perturbations and disorder. The second category, now dubbed “symmetry-protected topological (SPT)”, is stable only in the presence of certain symmetries (e.g., time-reversal, reflection, space groups). Extending the results of the preceding work, Totsuka, together with Takayoshi and Tanaka from National Institute for Materials Science, considered, in search of the possibility of a new class of realistic SPT phases, one-dimensional generic spin- S quantum magnets subject to high magnetic fields. They obtained the result that when the quantity $Q(S - m^z)$ (Q and m^z being the number of spins per unit cell and magnetization per site, respectively) is integer, the magnetization plateaus with SPT order is possible depending on the parity of $Q(S - m^z)$. This kind of SPT plateaus belong to one of the four topological classes predicted in the presence of reflection and $U(1)$ symmetries.

Phase diagrams of $SU(N)$ ultra-cold fermions in one dimension: The realization of quantum degeneracy in alkaline-earth and the related cold fermions (e.g., ^{87}Sr , ^{171}Yb , and ^{173}Yb) opened the possibility of simulating $SU(N)$ quantum systems that are hardly realized in the usual condensed-matter settings. Using various techniques (e.g., renormalization group, strong-coupling expansions, and density-matrix renormalization group), Totsuka and his collaborators mapped out the $T = 0$ phases of such $SU(N)$ cold fermions loaded in a one-dimensional optical lattice. They considered two (related but slightly) different systems both of which are realizable in the cold-atom experiments. They focused on the case of half-filling (i.e., N fermions per site) and showed that the phase diagrams of these system is remarkably rich. Among the

phases obtained, the $SU(N)$ SPT phases are of particular interest. Totsuka and Tanimoto investigated the SPT phases from the quantum-entanglement point of view and numerically demonstrated that a set of non-local order parameters is quite useful in identifying the topological class of a given state.

Superfluid obeying a nonlinear Schrödinger equation with cubic and quintic nonlinearities: It has been established that Bose-Einstein Condensates (BEC) of a weakly interacting dilute Bose gas near zero temperature can be quantitatively described by the Gross-Pitaevskii (GP) equation that is a type of nonlinear Schrödinger equation (NLSE) with cubic nonlinearity. When a BEC is loaded onto an optical lattice, the inter-particle interaction relative to the kinetic energy can be widely controlled so that one can achieve a strongly interacting regime where the superfluid (SF) state does not obey the GP equation any longer. Danshita and coworkers have shown a SF state of Bose-Bose mixtures in optical lattices obeys a NLSE with cubic-quintic nonlinearity in parameter regions close to the discontinuous quantum phase transition between SF and Mott insulator. They analyzed dark solitary waves on the basis of the derived equations of motion, and analytically calculated the size and the inertial mass to find that they diverge at the first-order SF-MI transition point. The divergent behaviors of the solitary waves are remarkable in the sense that they manifest criticality associated with the first-order quantum phase transition, which is not exhibited by linear excitations or thermodynamic quantities of uniform SF states. An interpretation of the emergence of such criticality was presented in connection with surface critical phenomena, which generically occurs near first order phase transitions in the presence of a barrier potential (or surface).

Quantum phase transitions of layered spin-1/2 antiferromagnets on a triangular lattice: Recently, an experimental group at Tokyo Institute of Technology has reported the magnetization curve of $\text{Ba}_3\text{CoSb}_2\text{O}_9$, which is supposed to be well described by the antiferromagnetic spin-1/2 XXZ model on an equilateral-triangular lattice. However, the latest experiments with single crystals have found a magnetization anomaly at a strong magnetic field $H \simeq 0.7H_s$, which is unexpected from theoretical analyses on the spin-1/2 XXZ model of single layer. Here H_s is the saturation field. Danshita and coworkers considered the antiferromagnetic coupling J' between layers of the triangular-lattice antiferromagnets, and analyzed the system with the use of a numerical cluster mean-field method with a scaling scheme (CMF+S). They have shown that even a small J' can change the nature of the ground state, giving rise to additional quantum phase transitions at a strong field above the one-third magnetization plateau. The computed magnetization curve quantitatively agrees with the experimental results and properly explains the

observed magnetization anomaly as a first-order transition between different high-field quantum states.

Phase diagram and dynamics of a one-dimensional fermion model with Majorana edge modes: As exemplified by the model of the spineless p -wave superconductor introduced by Kitaev, one-dimensional fermion models with pairing terms sometimes exhibit emergent Majorana modes at the edges of the system. Due to their non-local character, these Majorana edge modes are not only interesting in its own right, but also believed useful in realizing quantum computation. Ohta, Tanaka, Dan-shita, and Totsuka investigated a one-dimensional fermion model that support several edge modes (the generalized cluster model) and determined its zero-temperature phase diagram using the combination of various methods. They then considered the behavior of the non-local correlation functions, which characterize the topological nature of the ground states, and the entanglement entropy under the sweep of the model parameters (sweep dynamics) to find peculiar periodic (spatial) structures. The emergence of these periodic structure was attributed to the Bogoliubov excitations generated during the sweep.

Advanced Statistical Dynamics

The subjects of advanced statistical dynamics are nonequilibrium statistical mechanics, nonlinear sciences and biological physics. The main goal in this field is to understand how dynamical nonequilibrium structures are sustained in nature based on tools of statistical physics. Thus, the research areas are spread in variety of fields in social sciences, biology, chemistry, engineering, mathematics and physics. The current research activities of our group are granular physics, nonlinear rheology in glassy materials, mesoscopic transport quantum systems, the basis of quantum mechanics and system biology. This academic year, Hayakawa was involved as one of the organizers of the following international workshops "Interface fluctuations and KPZ universality class", "Thermodynamics, Large Deviation and Transportation", and "Frontiers of Statistical Mechanics: from Non-equilibrium Fluctuations to Active Matter".

Mode coupling theory for sheared granular liquids

K. Suzuki and H. Hayakawa have studied the theory of sheared dense granular flow in terms of They semi-quantitatively reproduce the behavior of the shear viscosity or the shear stress against the density. Hayakawa presented several invited talks on this subject and published one proceedings paper.

Stress avalanches in jammed granular materials

H. Hayakawa and M. Otsuki have analyzed studied the mechanism of emergence of the shear modulus above the jamming transition. What they found is that there is a cross-over from the known scaling at which stress network is unchanged to a new scaling caused by the stress avalanches. They also succeed to explain quantitative connection between the new scaling law and the avalanche size distribution. They published one paper in a refereed journal. Hayakawa presented several invited talks on this subject.

non-Gaussian noise in physical systems

Kiyoshi Kanazawa and Hisao Hayakawa with Takahiro Sagawa and Tomihiko G. Sano have developed the theory of non-Gaussian noise appears in physical systems. One of the most remarkable findings of this team (KK-TS-HH) is to clarify the mechanism to appear non-Gaussian noise in the long time limit, in which there must be both Gaussian thermal environment and athermal environment. They also obtained the formula to infer the properties of environment from the motion of the tracer. The paper has been published in PRL. They (KK-TGS-TS-HH) also developed a systematic theory to describe nonlinear friction systems under the influence of non-Gaussian noise. This paper has been accepted for publication in J. Stat. Phys. They (KK-TS-HH) also analyze avalanche noise in electrical circuits with athermal noise. The formulas they obtained imply that we can extract a positive amount of work and power from the avalanche noise as a result of the geometrical effect. The paper has been published in PRE.

The project on non-Gaussian noise is now a part of international collaborations. E. Fedor-K. Kanazawa- H. Hayakawa-P. Visco- F. van Wijland applied this idea to energetics of active motion in living cells, which has been published in PRE. EF has stayed in YITP two months (Feb-March in 2015) and is developing an idea that active noise (collaborated with Gaussian noise) can be used the motion of a tracer in glassy materials. Andera Cairoli in UK has also stayed at YITP three months (January-March, 2015) and is developing the path integral formalism for non-Gaussian noise.

Theory of cohesive fine powders under shear

S. Takada, K. Saitoh and H. Hayakawa performed three dimensional molecular dynamics simulation of cohesive dissipative powders under a shear. They demonstrated that various patterns appear thanks to coexistence of inelastic collisions and attractive interaction of fine powders from their molecular dynamics simulation. They also clarify the mechanism of non-Gaussian velocity distribution function appears in the plate-gases coexistence phase. This subject has been published in PRE.

They extend their analysis into two directions. One is the microscopic approach to characterize the rheology of dilute fine powders starting from inelastic Boltzmann equation. They extended the Chapman-Enskog theory for hard core systems to the attractive systems, and determine the rate of energy cooling and transport coefficients. They obtained good agreement between the theory and the simulation based on the dynamic simulation Monte-Carlo. They are in the final stage to write the paper. Another direction is that they use dynamic-van der Waals model to characterize pattern formation. They successfully obtain the neutral curve to distinguish stable uniform flow from the pattern appears in simulation. This has been submitted to arXiv:1505.0476.

Stochastic mean field Model of Heat Engine partitioned by Fluctuating Piston

T. G. Sano and H. Hayakawa propose a stochastic mean field model of heat engine partitioned by a finite-mass piston. The time evolution equations for the density and the temperature of the enclosed gas are proposed, tak-

ing into account the stochastic equation of motion of the piston, and the energy conservation for the gas. We find that the obtained efficiency at the maximum power operation is close to the Chhabadal-Novikov-Curzon-Ahlborn (CNCA) efficiency, if the piston is sufficiently heavy and elastic for collisions with particles, even when the system is far from equilibrium. The results of our stochastic mean field model are consistent with those for our event driven molecular dynamics simulation. This has been submitted to arXiv:1412.4468.

Geometric pumping induced by shear flow in dilute liquid crystalline polymer solutions

S. Yabunaka and H. Hayakawa investigate nonlinear rheology of dilute liquid crystalline polymer solutions under time dependent two-directional shear flow. They analyze the Smoluchowski equation, which describes the dynamics of the orientation of a liquid crystalline polymer, by employing technique of the full counting statistics. In the adiabatic limit, we derive the expression for time integrated currents generated by a Berry-like curvature. Using this expression, it is shown that the expectation values of the time-integrated angular velocity of a liquid crystalline polymer and the time-integrated stress tensor are generally not zero even if the time average of the shear rate is zero. The validity of the theoretical calculations is confirmed by direct numerical simulations of the Smoluchowski equation. This has been published in JCP 142, 054903 (2015).

Non-divergent representation of non-Hermitian operator near the exceptional point with application to a quantum Lorentz gas

K. Hashimoto, K. Kanki, H. Hayakawa and T. Petrosky propose a non-singular representation for a non-Hermitian operator even if the parameter space contains exceptional points (EPs), at which the operator cannot be diagonalized and the usual spectral representation ceases to exist. Their representation has a generalized Jordan block form and is written in terms of extended pseudo-eigenstates. Their representation improves the accuracy of numerical calculations of physical quantities near EPs. They demonstrate the usefulness of our representation by investigating Boltzmann's collision operator in a one-dimensional quantum Lorentz gas in the weak coupling approximation. The paper has been published in PTEP.

Nonadiabatic pumping for spin-Boson system

K. Watanabe and H. Hayakawa clarified the role of non-adiabatic effects in a quantum pumping. They derived the formula of the non-adiabatic pumping current based on the Markovian quantum master equation. When they periodically control the temperature of two reservoirs for a spin-boson system, they found that the pumping current strongly depended on the initial condition, and thus, the current deviated from that predicted by the adiabatic treatment. They also analytically obtained the contribution of non-adiabatic effects in the pumping current proportional to Ω^2 where Ω is the angular frequency of the temperature control. The validity of the analytic expression was verified by their numerical calculation. They also proposed the extended fluctuation theorem for slowly modulated systems. The paper has been published in PTEP.

Generalization of quantum f -divergence and its geometrical properties

Y. Watanabe and Y. Takaoka define a class of generalized quantum f -divergences. They satisfy the non-negativity, CPTP monotonicity, and coincide with the classical f -divergences in the case that the two quantum states are commutable. Also, they reveal the maximum and minimum in the class. Furthermore, they show the expression for the induced metrics and connections from the generalized quantum f -divergences as their information-geometrical properties. On the top of that, they derive the condition that the induced connections become metric.

Analysis of Relaxation Time Scales in Isolated Quantum Systems by using Band Random Matrices

Relaxation of an isolated quantum system to an equilibrium state is a basic presupposition for quantum statistical mechanics being applicable to the system. Y. Watanabe and T. N. Ikeda focus on the band structure of the matrix elements of the Hamiltonian that consists of few-body interactions, analyze the relaxation time scales of the band random matrix theory, and show that they become longer for larger systems when a proper scaling of the band width taken into account.

Problems of Cognition Towards a Synthesis of Complex System Sciences

Sciences of reductionism and sciences of constructionism have often been considered as completely different subjects. In the present paper, however, M. Murase and T. Murase attempted to present a new perspective which can integrate these different subjects based on the idea that quite different subjects must be merely different aspects of the same cognitive processes of human beings. It is true that different persons observe the same environmental world differently. But, it is also true that the same person can observe the same environmental world differently depending on the different contexts. This is the main reason why there are so many different kinds of subjects. We should not consider which one is right and which one is wrong. Instead, we should take account of the world from a point of view of multiple perspectives.

Nuclear Theory Group

The main focus of our research group is the basic investigation of nuclear physics covering all the physical phenomena governed by the strong interactions, such as the structure and the dynamics of nuclei and hadrons, and properties of hadron-quark many-body system in finite temperatures and densities. Here we briefly review our research activity in the academic year of 2014.

Nuclear structure and dynamics

Exotic structure in ^{16}O studied with covariant density functional theory: Itagaki and collaborators studied 4α linear-chain structure (LCS) in high-lying collective excitation states of ^{16}O with a covariant density functional theory is presented. The low-spin states are obtained by configuration mixing of particle-number and angular-momentum projected quadrupole deformed mean-field states with generator coordinate method (GCM). The high-spin states are determined by cranking calculations. These two calculations are based on the same energy density functional PC-PK1. We have found the LCS candidate in both high-lying low-spin GCM states and cranking high-spin states with similar moment of inertia and band-head energy, which are estimated to be around 0.11 MeV and 30 MeV, respectively.

Rod-shaped nuclei with extreme spin and isospin: Zhao, Itagaki and collaborators have investigated the stabilization of the anomalous rod shape in Carbon isotopes. For this aim, they used the cranking covariant density functional theory, and discussed simultaneously the two mechanisms, extreme spin and isospin, to stabilize such novel shape. By adding valence neutrons and rotating the system, they found that the mechanism stabilizing the rod shape, i.e., the σ -orbitals (parallel to the symmetry axis) of the valence neutrons, important for the rod shape, are lowered by the rotation due to the Coriolis term. The coherent effects of the spin and isospin enhances the stability of the rod-shaped configuration. This provides a strong hint that a rod shape could be realized in nuclei towards extreme spin and isospin.

Collective Hamiltonian for nuclear wobbling modes: Zhao and collaborators have investigated the wobbling motion of triaxial nuclei within a new framework of collective Hamiltonian, where the collective potential and mass parameter are obtained from the tilted axis cranking mean-field approach. For each of the three kinds of wobblers, triaxial rotor, longitudinal wobbler, and transverse wobbler, the calculated wobbling energies are in a very good agreement with the corresponding exact solutions from particle rotor model. Moreover, it is found that the change of the wobbling frequency with respect to the increasing nuclear spin could be explained with the stiffness of the collective potential.

Magnetic and antimagnetic rotation: Zhao and his col-

laborator have investigated both the magnetic and antimagnetic rotation bands in a single nucleus, ^{110}Cd , with the self-consistent tilted axis cranking covariant density functional theory. The energy spectra, the angular momentum, the deformation parameters, and the reduced $M1$ and $E2$ transition probabilities are calculated with various configurations. It is found that the configuration has to be changed to reproduce the energy spectra and angular momenta for both the magnetic and antimagnetic rotational bands. The shears mechanism for the magnetic rotation and the two-shears-like mechanism for the antimagnetic rotation are clearly exhibited by examining the orientation of the neutron and proton angular momenta.

The existence of high-spin torus isomers and their precession motions: Ichikawa, Itagaki, and collaborators have systematically investigated the existence of exotic torus isomers and their precession motions for a series of $N = Z$ even-even nuclei from ^{28}Si to ^{56}Ni . To systematically investigate the existence of torus isomers, they used the cranked three-dimensional Hartree-Fock (HF) method with various Skyrme interactions. They also used the three-dimensional time-dependent Hartree-Fock (TDHF) method for describing the precession motion of the torus isomer. They obtained high-spin torus isomers in ^{36}Ar , ^{40}Ca , ^{44}Ti , ^{48}Cr , and ^{52}Fe . The emergence of the torus isomers is associated with the alignments of single-particle angular momenta, which is the same mechanism as found in ^{40}Ca . They found that all the obtained torus isomers execute the precession motion at least two rotational periods. The moment of inertia about a perpendicular axis, which characterizes the precession motion, is found to be close to the classical rigid-body value. The high-spin torus isomer of ^{40}Ca is not an exceptional case. They concluded that similar torus isomers exist widely in nuclei from ^{36}Ar to ^{52}Fe and they execute the precession motion.

Constraints on the Density Dependence of the Nuclear Symmetry Energy: Inakura, in collaboration with Nakada, investigated four quantities, connected with properties of the neutron skin and its dynamics, which are expected to be useful for narrowing down the parameter L characterizing the poorly known density dependence of the symmetry energy. We found that the cross section and the polarizability of low-energy dipole mode is not suitable for obtaining constraints on L from experiment because the correlations between L and them have strong interaction dependence. The neutron skin thickness is well correlated with L . However, it is difficult to precisely determine the skin thickness at current situation. A product of the dipole polarizability and the symmetry energy at the saturation density is the most hopeful quantity for narrowing down L . Its correlation coefficient in ^{132}Sn is $r = 0.953$ in our calculations.

Mass and radius formulas for low-mass neutron stars: Sotani and Ohnishi, in collaboration with Iida and Oya-

matsu, successfully constructed theoretical formulae for the masses and radii of low-mass neutron stars from various models consistent with empirical masses and radii of stable nuclei. They also discovered a new equation-of-state parameter characterizing the structure of low-mass neutron stars. This parameter could be constrained from future observations of low-mass neutron stars.

The database for nuclear equations of state: Ohnishi in collaboration with Ishizuka and their collaborators constructed a database of equations of state (EOSs), EOSDB, by compiling data from the literature. EOSDB contains basic properties of EOSs of symmetric nuclear matter and pure neutron matter as well as detailed information of the theoretical models. It also includes information on symmetry energy, which is attracting much attention recently. It is revealed that some theoretical EOSs commonly used in astrophysics do not satisfy the experimental constraints.

α -cluster excited states in ^{32}S : Yoshida and collaborators investigate the α -cluster excited states in ^{32}S with an extended $^{28}\text{Si}+\alpha$ cluster model, which includes the ^{28}Si core excitation and the α -cluster breaking. They obtain $J^\pm = 0^+, 2^+, 4^+$ and 6^+ states in a rotational band having a remarkably developed α -cluster structure in the energy region near the $^{28}\text{Si}+\alpha$ -threshold. They discuss the ^{28}Si core excitation in the $^{28}\text{Si}+\alpha$ system and show that the ^{28}Si core excitation plays a role to stabilize the α -cluster excited states. They also investigate the α -cluster breaking at the ^{28}Si core surface and find that the α -cluster breaking is minor in the $^{28}\text{Si}+\alpha$ system.

Hadron structure and dynamics

Hadron mass scaling near the s -wave threshold: Hyodo has studied the influence of a two-hadron threshold for the hadron mass scaling with respect to some quantum chromodynamics parameters. A quantum mechanical model is introduced to describe the system with a one-body bare state coupled with a single elastic two-body scattering. The general behavior of the energy of the bound and resonance state near the two-body threshold for a local potential is derived from the expansion of the Jost function around the threshold. In p or higher partial waves, the scaling law of the stable bound state continues across the threshold describing the real part of the resonance energy. In contrast, the leading contribution of the scaling is forbidden by the nonperturbative dynamics near the s -wave threshold. As a consequence, the bound state energy is not continuously connected to the real part of the resonance energy. This universal behavior originates in the vanishing of the field renormalization constant of the zero-energy resonance in the s wave. A proof is given for the vanishing of the field renormalization constant, together with a detailed discussion.

Comprehensive analysis of the wave function of a hadronic resonance and its compositeness: Hyodo in collaboration with Sekihara and Jido has developed a theoretical framework to investigate the two-body composite structure of a resonance as well as a bound state from its

wave function. Writing down explicitly the wave function for a resonance state obtained with a general separable interaction, compositeness is expressed in terms of the position of the resonance pole, the residue of the scattering amplitude at the pole and the derivative of the Green function of the free two-body scattering system. At the same time, the formulation provides the elementariness expressed with the resonance properties and the two-body effective interaction, and confirms the sum rule showing that the summation of the compositeness and elementariness gives unity. In this formulation the weak binding relation for the scattering length and effective range can be derived. As its applications, they study the compositeness of the $\Lambda(1405)$ resonance and the light scalar and vector mesons described with refined amplitudes in coupled-channel models with interactions up to the next to leading order in chiral perturbation theory. It is found that $\Lambda(1405)$ and $f_0(980)$ are dominated by the $\bar{K}N$ and $K\bar{K}$ composite states, respectively, while the vector mesons $\rho(770)$ and $K^*(892)$ are elementary.

Lambda-Lambda interaction from relativistic heavy-ion collisions: Morita and Ohnishi in collaboration with Furumoto gave constraint on the $\Lambda\Lambda$ interaction from the two-particle intensity correlation function of Λ measured in relativistic heavy-ion collisions. $\Lambda\Lambda$ interaction is one of the keys to predict the dense matter equation of state and the existence of the H -dibaryon. The bond energy of the double hypernucleus had been the only source of $\Lambda\Lambda$ interaction. By taking account of collective expansion and Σ^0 feed down effects, they concluded that the scattering length of $\Lambda\Lambda$ should be in the range of $1/a_0 < -0.8 \text{ fm}^{-1}$. Higher statistics data would constrain $\Lambda\Lambda$ interaction more stringently, and the same technique is applicable to various hadron-hadron pairwise interactions.

High-Energy QCD, QCD matter, and phase diagram

Auxiliary field Monte Carlo simulation of strong-coupling lattice QCD for QCD phase diagram: The sign problem exists in lattice QCD at finite chemical potential, and it causes difficulty in performing precise Monte-Carlo simulations of finite density matter. Ichihara and Ohnishi in collaboration with Nakano investigated the QCD phase diagram in lattice QCD in the strong coupling limit, where the sign problem is milder, by using the auxiliary field Monte Carlo method. The obtained phase boundary is found to agree with the one evaluated in another independent framework, then the QCD phase boundary is settled in the strong coupling limit. Ichihara and Ohnishi extended their study to the strong but finite coupling region. Temporal plaquette terms are found to reduce the chiral condensate as predicted in the mean field analysis. Spatial plaquette terms do not affect the chiral condensate significantly, but make the sign problem severer.

Gluon helicity ΔG from a universality class of operators on a lattice: Hatta, in collaboration with Ji and Zhao,

found a novel method to compute the gluon helicity contribution ΔG to the nucleon spin on a Euclidean lattice. ΔG can be computed via a universality class of operators describing the helicity or polarization of the on-shell gluon radiation. In particular, the matrix elements of certain operators in a nucleon of momentum P^z are shown to be directly related to ΔG with only power-law $(1/P^z)^2$ corrections.

Systematic study of exact solutions in second-order conformal hydrodynamics Hatta and collaborators found a number of new exact solutions in second-order conformal relativistic hydrodynamics. This is achieved by mapping Minkowski space onto various curved spacetimes such as anti-de Sitter space and hyperbolic space. It is shown how the solutions of ideal hydrodynamics are modified by the second-order effects including vorticity.

Analytical computation of the harmonic flow parameters v_n : Hatta, in collaboration with Xiao, Noronha and Torrieri analytically computed the flow parameters v_n which are important observables in heavy-ion collisions. ($n = 2$ is the famous elliptic flow.) Using the anisotropically deformed Gubser flow and the Cooper-Frye formula, an explicit, analytical formula for $v_n(p_t)$ is obtained including the case with nonvanishing shear viscosity. It is shown that the strength of viscous corrections grows linearly with n .

Use of the Husimi distribution for nucleon tomography: In the context of nucleon structure, the Wigner distribution is often used to visualize the phase-space distribution of partons inside the nucleon. However, the Wigner distribution does not allow for a probabilistic interpretation because it can take negative values. In pursuit for a positive phase-space distribution in QCD, Hatta, together with Hagiwara, proposed to use instead the Husimi distribution. The positivity of the Husimi distribution is demonstrated in a simple one-loop model.

Comparing analytical and numerical solutions of second-order hydrodynamics: Hatta, in collaboration with Pang, Wang and Xiao, derived a new exact solution of second-order hydrodynamics which generalizes the Gubser flow. At the same time, the second-order hydrodynamic equations are solved numerically using the state-of-the-art hydrodynamic code. A perfect agreement between the analytical and numerical approaches has been achieved.

Analytical solutions of the relativistic Boltzmann equation: Hatta and collaborators found analytical solutions of the relativistic Boltzmann equation in the relaxation time approximation. Solutions which are expanding one-dimensionally and three-dimensionally are obtained, and they are compared with the corresponding solutions in second-order hydrodynamics and the fluid-gravity correspondence.

Scale dependence of baryon number fluctuations: Morita, in collaboration with Redlich, investigated the momentum scale dependence of higher order cumulants of net baryon number in chiral quark-meson model. Using the functional renormalization group method, they found that infrared cutoff in the momentum scale modifies the

critical property of the cumulants, such as negative sixth order cumulant at $\mu = 0$, when the cutoff scale is larger than the soft pion mode.

Partition function zeros in canonical approach with a solvable model: Morita, in collaboration with Nakamura, investigated behavior of Yang-Lee zeros of a chiral random matrix model which is a solvable model for chiral phase transition in QCD. They constructed the partition function as a fugacity polynomial and studied effects of truncation on the position of Yang-Lee zeros by comparing the exact solution. They found that the truncation of very high order terms does not affect the position of the zero closest to the real μ axis, but the distribution of the zeros resembles that of non-critical free partition function when the truncation reaches some critical values, N_{\max} . They compare N_{\max} for the closest Yang-Lee zero and higher order cumulants and estimate the necessary numbers in lattice QCD simulation and event-by-event measurements in heavy ion collisions.

Phase structure of $SU(3)$ gauge-Higgs unification models at finite temperature: Kashiwa in collaboration with Tanizaki calculated a one-loop effective potential of $SU(3)$ gauge-Higgs unification models at finite temperature with a compactified extra-dimension. Detailed structures of the one-loop effective potential with the nontrivial Polyakov loop phase and with the nontrivial Wilson line phase along the extra-dimension were investigated. Effects of a domain structure for the electroweak phase transition were discussed.

Lee-Yang zero distribution of high temperature QCD and Roberge-Weiss phase transition: Kashiwa in collaboration with Nagata, Nakamura and Nishigaki investigated canonical partition functions and the distribution of Lee-Yang zeros at finite density and high temperature. The analytic derivation of the canonical partition functions and Lee-Yang zeros using the saddle point approximation at high temperature was presented. Lattice QCD simulation in a canonical approach was also performed. By comparing the analytic and lattice results, the canonical partition functions are found to follow the Gaussian distribution of the baryon number and then the first-order Roberge-Weiss phase transition is exhibited from the accumulation of Lee-Yang zeros of these canonical partition functions.

Particle Physics Group

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

In particle phenomenology, the current experimental results are considered to be very accurately described by the Standard Model (SM) with $SU(3) \times SU(2) \times U(1)$ gauge group. However, this model cannot be the final theory for the following reasons; it contains too many tunable parameters which can only be determined by experiments, it suffers from the hierarchy problem, and it does not contain the dark matter and the neutrino masses. Thus particle physics beyond the SM is actively investigated by many members of this group. The study of the Higgs sector is now one of the hot topics thanks to the LHC experiments at CERN. The Higgs sector explains the origin of the particle masses through the mechanism of the spontaneous symmetry breaking. Another important topic is the mechanism of the supersymmetry breaking. The supersymmetry is a highly attractive idea, since it solves the hierarchy problem of the SM and unifies naturally the gauge couplings of the SM at a high energy scale, suggesting a Grand Unified Theory (GUT) of gauge fields and matters. However, no experimental evidence of the supersymmetry has been observed yet. Reconciliation of the present experimental situation with theoretical requirements is highly wanted. Supergravity, a local gauge theory of supersymmetry, is also investigated by some members of the group.

Quantum Chromodynamics (QCD) is a non-Abelian gauge theory coupled with matter fields. This theory describes the hadronic systems, and has various applications in particle phenomenology as well as in astrophysics. Because of its strong interactions, understanding its properties requires non-perturbative approaches to quantum field theories. Lattice QCD gives a practical and powerful numerical method to analyze the non-perturbative aspects of QCD. Recently, a new method based on the duality between gravity and gauge theory has emerged from the study of string theory. This new method analyzes QCD in terms of gravity or string theory, and can relatively easily derive some results which are difficult to obtain directly from gauge theory per se.

It is yet not known how to incorporate the principle of quantum mechanics into the gravity or the general relativity. Application of the standard quantization procedure to the general relativity is met with many serious problems, including uncontrollable UV divergence. A consistent theory of quantum gravity seems to require a new notion of space-time, which replaces the classical space-time notion that is a continuous smooth manifold. Non-commutative space-time (or fuzzy space, more generally)

is one candidate, which actually has been noted to appear in quantum gravity and string theory under certain conditions. Based on this quantum space-time notion, quantum gravity is investigated by some of the group members.

String theory is a theory of one-dimensionally extended objects like string, trying to give a consistent unified theory of all the interactions and matters. To relate the string theory to the real nature, compactification is a vital step, since the consistency of the string theory requires the space-time dimension to be ten, and the extra six-dimensions must be compactified to small sizes. The mode of compactification determines the possible contents of gauge theory and matters in low energy, and finding realistic compactifications is an important topic. This is studied by the group members. However, at present infinite possibilities of compactifications are known, and non-perturbative formulation of the string theory seems to be required for it to have predictable powers to the real nature. As study in this direction, the string field theory and the M-theory are investigated by the group members, too. Black hole physics based on string theory and mathematical aspects of string theory are also actively researched by the group members.

Historically the development of particle physics came hand in hand with that of field theory, which is not only a common language of particle physics but also a central tool in modern theoretical physics, including cosmology, condensed matter, and statistical physics. Thinking of this powerful generality of field theory, some of the group members study related topics in condensed matter physics and integrable systems.

Here is a summary of main works of the members of the particle physics group in the academic year 2011.

Particle phenomenology and supersymmetry

— *Inflation models* —

One of the ways to determine physical laws is to specify model parameters. Thus selection of basic laws may be achieved by that of fundamental parameters. Izawa investigated inflationary selection of model parameters with simple inflaton potentials as an example of fundamental theory. It turned out that marginal parameters for eternal inflation provide specific models that are consistent to cosmological observations.

— *Lepton flavor physics and dark matter* —

Takayama and Ogasahara together with Kobayashi (Hokkaido), Omura (Nagoya), Hamada, Yasuhara (Kyoto) studied the possibility where flavored higgses and TeV scale right handed neutrinos simultaneously explain stable dark matter, tiny non-zero neutrino masses and observed structure of the lepton mixing matrix. They showed that some of TeV scale right handed neutrinos become stable and obtain the desired dark matter relic density and this model realizes the observed non-zero value of a lepton mixing angle θ_{13} .

The characteristic structure of observed lepton mixing matrix might be explained by group theoretical properties of underlying flavor symmetry in lepton sector. In such viewpoints, many models with lepton flavor symmetry has been proposed. Many of them exhibit remnant symmetries on charged lepton and neutrino mass matrices after the original flavor symmetry breaking. Takayama together with Kobayashi, Omura and Yasuhara investigated the implication to lepton flavor violating phenomena due to such a remnant symmetry on lepton yukawa couplings with extended higgs sectors in a model independent method.

— *Next-to-Minimal Supersymmetric SM and superheavy right-handed neutrinos*—

Even though no concrete signals of physics beyond the Standard Model (SM) have been observed at the LHC, supersymmetric (SUSY) extensions of the SM are believed to be one of the most attractive candidates of physics beyond the SM. Under such a situation, indirect searches for SUSY particles using the processes such as the muon $g - 2$ and the charged lepton flavor violation are useful to probe SUSY particles. During this academic year, Nomura gave six invited talks about the situation of the muon $g - 2$ calculation. Nomura also discussed lepton flavor violation in the Next-to-MSSM (NMSSM) extended with superheavy right-handed neutrinos with Nakamura (Tohoku).

Lattice QCD

— *Hadron-Hadron Interactions* —

Etminan (YITP and Birjand), Aoki and Murano with Ishii(Osaka), Nemura, Sasaki (Tsukuba), Doi, Hatsuda, Ikeda (Riken) and Inoue (Nihon) reported their research on the nucleon-omega interaction in lattice QCD. They found a possibility of the bound state in this channel.

Aoki and Muranoi with Ishii(Osaka), Nemura, Sasaki (Tsukuba), Charon, Doi, Hatsuda, Ikeda (Riken) and Inoue (Nihon) investigated properties of medium-heavy nuclei using nucleon-nucleon potential obtained from lattice QCD simulation. They obtained the binding energy for carbon and oxygen.

— *Chiral properties of QCD* —

Aoki with Creutz (BNL) published their research on some aspect of 2-flavor QCD with non-zero θ term at low energy, using chiral perturbation theory. They found at $\theta = \pi$ that the eta condensation occurs at small quark mass, violating the CP symmetry spontaneously.

Aoki with Fukaya (Osaka), Hashimoto, Kaneko, Matsufuru and Noaki (KEK) calculated the electromagnetic pion form factor in lattice QCD in the epsilon regime. They extracted the pion charge radius, which is consistent with the experiment.

Aoki with Feng, Hashimoto and Kaneko (KEK) investigated time-like pion form factor in lattice QCD. They obtained the form factor and compared the results with phenomenological model

— *Partial restoration of chiral symmetry inside the color flux tube*—

Between quark and antiquark, there appears a tube structure of chromo fields, which is called as the color flux tube. It produces a linear confining potential. Iritani with Cossu and Hashimoto (KEK) analyzed chiral symmetry breaking inside the color flux tube. From numerical simulation of lattice QCD, it is clarified that the magnitude of the chiral condensate is reduced inside the color flux. It suggests partial restoration of chiral symmetry inside the hadrons.

— *Linkage between quark confinement and chiral symmetry breaking*—

Iritani with Doi and Suganuma (Kyoto) discussed the linkage between quark confinement and chiral symmetry breaking. By expanding the Polyakov loop in terms of the Dirac operator, it is clarified that various Dirac eigenmodes characterize the confining properties of the Polyakov loop. This behavior differs from the case of chiral symmetry breaking, which is originated only from low-lying eigenmodes. It implies there are no naive one-to-one correspondences between these phenomena in terms of the Dirac operator.

— *QCD thermodynamics from gradient flow*—

The gradient flow is a kind of smearing technique in lattice gauge theories, which has many interesting properties and applications. Iritani with Asakawa and Kitazawa (Osaka), Hatsuda (RIKEN), Suzuki (Kyushu), and Itou (KEK) investigated thermodynamics of QCD from the energy-momentum tensor, which is defined through the gradient flow. Generally thermodynamic quantities are calculated by the indirect integral method in lattice QCD, however, it is possible to measure them directly from the energy-momentum tensor by the gradient flow method. From the gradient flow analysis, the reference scales are also determined with high accuracy. Such scale determinations are indispensable to the measurements of the physical quantities at the continuum limit in lattice QCD.

— *Finite-density QCD*—

Aoki, Hanada and Nakamura (Hiroshima) proposed a numerical method to make the sign problem in finite-density lattice QCD milder, by improving so-called density of state method. They demonstrated it by using the random matrix model as an example.

Field theories

Aoki with Balog (Wigner Research Center) and Weisz (Max-Planck) investigated large N scalar model in 3-dimensions. They showed that the beta function associated to the running 4-point coupling is walking when the ratio of the particle mass and an effective 4-point coupling is small.

Aoki and Kikuchi with Onogi(Osaka) investigate the gradient flow equation of O(N) nonlinear sigma model in the large N limit and showed that the 2-point function is finite in this limit.

— *QFT and entanglement entropy*—

Aoki, Iritani, Nozaki, Numasawa and Shiba with Tasaki (Gakushuin) proposed a definition of the entanglement entropy in lattice gauge theories. They showed that the

definition they proposed satisfies all the standard properties of the entanglement entropy.

Shiba developed the computational method of entanglement entropy based on the idea that the trace of the n -th power of the reduced density matrix is written as the expectation value of the local operator. He applied it to study the mutual Renyi information (MRI) of disjoint compact regions A and B in the locally excited states in QFT, in the limit when the separation r between A and B is much greater than their sizes. For the general QFT which has a mass gap, he computed MRI explicitly and found that this result is interpreted in terms of an entangled state in quantum mechanics. For a free massless scalar field, he obtained the leading r dependence of MRI.

Quantum gravity

An ultimate goal of research of quantum gravity is to successfully construct a theory which does not contain space-time in its basic formulation but generates it as an infrared emergent phenomenon. An important issue in this direction of research is the choice of fundamental variables to describe space-time. The two-dimensional quantum gravity is known to be successfully described by the matrix models, which have matrices as fundamental variables. As generalization to higher dimensions, Sasakura and a few other groups proposed a long time ago models which have tensors as fundamental variables. Recently, such tensor models were analytically analyzed, and it was shown that singular manifolds dominate. This property is pathological and disappointing, since our actual space cannot be described by singular manifolds, and therefore the tensor models do not seem a good candidate for quantum gravity. On the other hand, it is known that this pathological behavior commonly appears in lattice approaches to Euclidean quantum gravity, and can be cured by introducing a time direction. In fact, the tensor models above are for the Euclidean quantum gravity. Prompted by these facts, to introduce a time direction to tensor models, Sasakura formulated a tensor model in the canonical formalism as a first-class totally constrained system. Such a canonical tensor model was shown to be unique under some physically reasonable assumptions. Moreover, it was shown that there exists a formal limit in which the first-class constraint algebra agrees with that of the ADM formalism of general relativity, and that the simplest case with $N=1$ agrees exactly with the mini-superspace approximation of general relativity. Currently, the major question is whether the canonical tensor model can generate objects like our space-time as its infrared emergent phenomenon. This is the problem of the dynamics of the canonical tensor model, and we have had some major progress in the last few years. Sasakura and Sato in Wits University in South Africa have shown that the renormalization group flow of random tensor networks, i.e. statistical systems on random networks, can be generated by the Hamiltonian constraint of the canonical tensor model. This suggests that the dynamics of the canonical tensor model may be understood in terms of random tensor networks. This insight would be very helpful, since one can refer to statistical systems, which are generally more un-

derstandable than quantum gravity. In fact, Sasakura, Sato and Narain in Naresuan University in Thailand showed that the exact physical wave functions of the quantum canonical tensor model for general N can be obtained by using the partition function of the random tensor networks. This was really surprising to us, since the sets of partial differential equations for the physical wave functions are too complicated to be solved exactly for general N . This exact physical wave function is an important starting point for the future study of the space-time quantum dynamics in the canonical tensor model.

String theory & SUSY gauge theories

— *AdS/CFT* —

The AdS/CFT correspondence is one of the most important dualities in string theory. Recently, there are many attempts to understand the strong coupling dynamics in supersymmetric gauge theories by using the AdS/CFT correspondence. Especially there have been remarkable progresses of AdS/CFT correspondence owing to the applications of ideas the condensed matter physics and quantum information theory.

He, Numasawa, Takayanagi and Watanabe computed the time evolution of entanglement entropy for locally excited states in two dimensional rational conformal field theories. They found a universal rule that the entanglement entropy always increases by the logarithm of a quantity called the quantum dimension of a primary operator. This paper was selected as a highlight in the Physical Review D.

Shiba, Takayanagi with Mollabashi studied the entanglement entropy between two conformal field theories which are interacting with each other. They showed that in general such entanglement entropy follow a volume law rather than the area law which is known to be true for the entanglement between two subregions in a single field theory. They also proposed a conjecture of holographic calculation of this class of entanglement entropy and reproduced the volume law with qualitatively correct coefficients.

Caputa, Nozaki and Takayanagi analyzed the entanglement entropy of locally excited states in large N conformal field theories. They first showed that computations in holographic entanglement entropy leads to a logarithmic time evolution after the local operator excitation. Next they analyzed the large N free field theories in four dimension using a field theory replica method. They computed the increase amount of entanglement entropy and showed that it can be explained in terms of finite dimensional Hilbert space considerations. In particular they found that there is a phase transition with respect to the replica number in the Renyi entanglement entropy.

Caputa and Takayanagi with Simon and Stikonas computed the time evolution of entanglement entropy for locally excited states at finite temperature. They found that the result is not affected for integrable theories like two dimensional rational conformal field theories. However, the finite temperature effect is manifest in the strongly coupled conformal field theories with gravity duals, where

the initial logarithmic growth is ended at a time of inverse temperature and approaches to a constant value.

— *Superstring field theory* —

Kunitomo constructed the full equations of motion (EOMs) of the Wess-Zumino-Witten (WZW) type heterotic string field theory including both the Neveu-Schwarz and Ramond sectors. They were constructed in the form of an infinite number of first-order equations for an infinite number of independent string fields. The conventional EOMs, which was partially obtained by himself using the fermion expansion, are obtained by solving the extra equations for the extra string fields with a certain assumption at the linearized level.

He also re-examined the gauge symmetries of the action supplemented by the constraint in the WZW-type open superstring field theory. This pseudo-action was found to have additional gauge symmetries, which apparently seemed to be missing, provided we impose the constraint after the transformation. Respecting these additional symmetries, he proposed a prescription for the new Feynman rules of the Ramond sector, and showed that they reproduce the well-known on-shell four- and five-point amplitudes with external fermions.

— *2+1 dimensional Yang-Mills-Chern-Simons theory* —

Mitsutoshi Fujita and Sugimoto together with Rene Myers and Charles Melby-Thompson studied 2+1 dimensional Yang-Mills-Chern-Simons theory with 1+1 dimensional defects using string theory. They found a way to realize the system in string theory and analyzed it using holography. As a result, they found some curious phase transition when the temperature of the system and/or positions of the defects are changed.

— *A Localization Computation in Confining Phase* —

It is very hard to compute analytically generic observables in a quantum field theory. However, for supersymmetric field theory, we compute some observables analytically and exactly. Terashima showed that there are observables we can compute exactly using the localization technique, in four dimensional supersymmetric gauge theories even in the confining phase.

— *Ramond-Ramond couplings of D-branes* —

D-branes play significant roles in understanding superstring theories mainly because D-branes have conserved charges (which can be regarded as generalized electric charges and magnetic charges). They are called Ramond-Ramond charges. Terashima with Hashimoto and Sugishita derived the most general formula for the Ramond-Ramond charges of D-branes.

— *Superconformal Chern Simons matrix model* —

For the three dimensional $\mathcal{N} = 4$ $U(N)$ superconformal Chern-Simons theories of the circular quiver type, Moriyama and Nosaka computed the all-order perturbative corrections in $1/N$ to the free energy.

They also found that some of the non-perturbative corrections, which correspond to the membrane instantons, can be expressed universally in terms of derivatives of the generalized hypergeometric series and proceeded to obtain a concrete result for a two-parameter subclass of these theories.

They further discovered a non-trivial relation between the free energy of a particular superconformal Chern-Simons theory in this subclass and the free energy of the refined topological string theory on a background reminiscent of the local D_5 del Pezzo surface.

— *ABJ theory* —

Shigemori with Hirano (Witwatersrand University) and Keita Nii (Nagoya University) studied supersymmetric Wilson loops in the $\mathcal{N} = 6$ supersymmetric $U(N) \times U(N+M)$ Chern-Simons-matter theory called the ABJ theory. He derived a new representation of ABJ Wilson loops by analytically continuing with respect to M the Wilson loops in the lens space theory, generalizing his previous work on the ABJ partition function. He showed that the resulting expression for the Wilson loops is consistent with the non-perturbative Seiberg duality expected to exist in the ABJ theory.

Shigemori with Hirano (Witwatersrand University), Honda (Harish-Chandra Research Institute), and Okuyama (Shinshu University) studied the duality between the ABJ theory and the $\mathcal{N} = 6$ Vasiliev higher spin theory on AdS_4 . Building on his earlier results on the ABJ partition function, he developed the systematic $1/M$ expansion, corresponding to the weak coupling expansion in the higher spin theory, and compared the leading $1/M$ correction, finding agreement up to an ambiguity that appears in the bulk one-loop calculation.

— *Black hole microstate geometries and non-geometries* —

Black holes have thermodynamical entropy and must represent a statistical mechanical ensemble of many underlying microstates. Identifying the microstates in string theory is the key to understanding quantum gravity and resolving fundamental problems such as the information paradox. Some of the microstates have been constructed in supergravity, but they are known to be insufficient to account for the black hole entropy. Therefore, it is important to search for a wider class of microstate solutions in more general frameworks.

Shigemori with Bena (CEA Saclay) and Warner (USC) studied the 3-charge black hole called the D1-D5-P black hole from a AdS/CFT viewpoint. For this system, he had previously argued that there exists a new class of smooth solutions called superstrata which are parametrized by functions of two variables. He studied the structure of the states in the D1-D5-P black hole using the boundary CFT, and identified a current-algebra sector of states which are expected to be visible and realized as smooth superstratum geometries in six-dimensional supergravity. He also estimated how much of the black hole entropy must be visible as those smooth geometries and argued that the power growth of the entropy must be reproducible by superstrata.

Shigemori with Bena (CEA Saclay), Giusto (University of Padova) Russo (Queen Mary University of London) Warner (USC), based on the intuition of the work just mentioned, constructed the first examples of superstratum geometries. He demonstrated that these geometries are smooth and horizonless, and depend on arbitrary contin-

uous functions of (at least) two variables. He also gave the precise CFT dual of these solutions and showed that they are not dual to descendants of chiral primaries. They are thus much more general than all the known solutions whose CFT dual is precisely understood. This construction represents a substantial step toward the ultimate goal of constructing the fully generic superstratum that can account for a finite fraction of the black hole entropy.

Minkyu Park and Shigemori studied configurations of codimension-2 branes in string theory using the framework of five-dimensional supergravity. Codimension-2 branes are produced in generic situations out of ordinary branes of higher codimension by the supertube effect and, when they are exotic branes, spacetime generally becomes non-geometric. Configurations with codimension-2 branes are expected to play an important role in understanding the microstates of black holes.

—*Black hole, gauge/gravity duality, BFSS matrix model*—

Hanada and Ishiki studied Banks-Fishler-Shenker-Susskind (BFSS) matrix model by using the Monte Carlo method. In order to perform large-scale simulations by using K-supercomputer, Hanada developed a new simulation method with Kaneko (KEK), Nishimura (KEK) and Tsuchiya (Shizuoka). Based on this, he wrote a simulation code, which will become publicly available soon.

Aoki, Hanada and Iizuka studied the classical time evolution of BFSS matrix model, which should correspond to a highly stringy black hole according to the gauge/gravity duality conjecture. They found several qualitative features which are consistent with dual gravity predictions. With Gur-Ari (Stanford) and Shenker (Stanford), Hanada further studied the detail of this theory, especially how the information of a small perturbation is scrambled. The scrambling time turned out to grow logarithmically with the size of the system, which is the same as a black hole.

Hanada, Maltz (IPMU) and Susskind (Stanford) argued that the deconfinement transition in Yang-Mills theories can be understood as condensation of long and winding flux string. By re-interpreting flux string as fundamental string, it provides us with a heuristic explanation for the equivalence between deconfinement phase and a black hole.

—*Holographic QCD*—

Hanada studied instanton dynamics of a holographic analogue of QCD. A nontrivial temperature dependence, which is consistent with the lattice QCD result, has been found.

—*Matrix models and non-perturbative string theory*—

Matrix models are known to be a non-perturbative description of string theory. The resolvent operator is then a central object in matrix models. For instance, with utilizing the loop equation, all of the perturbative amplitudes including those of instanton corrections can be obtained from the spectral curve of the resolvent operator. However, at the level of non-perturbative completion, the resolvent operator is not sufficient degree of freedom to describe everything in non-perturbative string theory.

Irie with Chan (Tunghai) and Niedner (Oxford) and Yeh (NCTS) proposed that the missing non-perturbative information can be captured by generalized Wronskians of the Baker-Akhiezer systems in matrix models. In particular, they discussed the isomonodromy descriptions and their consistency with spectral dualities. Since the consistency with the Seiberg-Shih relation and the Kac table labeling are shown, these degrees of freedom are argued to be identified with FZZT-Cardy branes in Liouville theory.

Yukawa International Program for Quark-Hadron Sciences

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

Aim of the program

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

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

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

International collaboration program

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

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

Long-stay programs

In this academic year the following three long-stay programs were held;

1. May. 11 – July 18, 2014: “Holographic vistas on Gravity and Strings”
<http://www2.yukawa.kyoto-u.ac.jp/~holography.ws/holography.html>
Chairman: Akihiro Ishibashi, Tadashi Takayanagi and Takahiro Tanaka
2. Nov. 04 – Dec. 05, 2014: “Novel Quantum States in Condensed Matter 2014 (NQS2014)”
<http://www2.yukawa.kyoto-u.ac.jp/~nqs2014.ws/index.html>
Chairman: Hikaru Kawamura, Takami Tohyama and Keisuke Totsuka
3. Feb. 15 – Mar. 21, 2015: “Hadrons and Hadron Interactions in QCD 2015 (HHIQCD2015)”
<http://www2.yukawa.kyoto-u.ac.jp/~hhiqcd.ws/index.html>
Chairman: Sinya Aoki and Atsushi Hosaka

The detailed information of each program can be seen at the website written above.

International molecule-type workshops

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

discussion in this small program will evolve to form a research collaboration. The proposal has been received anytime within the budget limit. This program should involve at least one core participant from abroad, and should be long for two weeks or more. The selection of this program is also made by the executive committee.

In this academic year there were five international programs of this molecule-type as listed below;

1. Sep. 8 – Sep. 19 , 2014: "Relativistic cosmology"
Core members: Kazuya Koyama and Atsushi Taruya
2. Jan. 6 – Jan. 23 , 2015: "Structure and reaction of light exotic nuclei"
Core members: Carlos Bertulani, Naoyuki Itagaki and Pierre Descouvemont
3. Feb. 04 – Feb. 17 , 2015: "Frontiers of Statistical Mechanics: from Non-equilibrium Fluctuations to Active Matter"
Core members: Masaki Sano, Hugues Chate, Hisao Hayakawa and Julien Tailleur

Yukawa International School

In the fiscal year 2013, Yukawa Institute started to support organizing one-week international schools for graduate students regularly at least once a year, as long as the institute budgetary condition allows.

In 2014, the following international school was held, and YIPQS program supported it in part.

- "International School of Gravitational Physics"
Mar. 25 – Mar. 28 , 2015.
Invited lectures: Patrick Brady (Wisconsin-Milwaukee), Kunihito Ioka (KEK), Christian Ott (Caltech), Nicolas Yunes (Montana State).
Sponsors: YITP (Gravitational Wave Research Center, International Research Exchange and Partnership, and YIPQS program), Grant-in-Aid for Scientific Research on Innovative Areas "New Developments in Astrophysics Through Multi-Messenger Observations of Gravitational Wave Sources"

Organization

The executive committee was organized in the Yukawa Institute to run the whole program. The committee members are;

Akira Ohnishi (chair), Sinya Aoki, Yoshitaka Hatta, Hisao Hayakawa, Naoyuki Itagaki, Hiroshi Kunitomo, Teiji Kunihiro, Sinji Mukohyama, Misao Sasaki, Masaru Shibata, Shigeki Sugimoto, Yudai, Suwa, Tadashi Takayanagi (vice chair), Takahiro Tanaka, Keisuke Totsuka.

Two special duty associate professors were hired to enhance the research activities at the Yukawa Institute. The website of the program is;
<http://www2.yukawa.kyoto-u.ac.jp/~yipqs/index-e.html>.

2.2 Publications

2.2.1 YITP preprints (January~December 2014)

- 14-1** Naoki Sasakura, Yuki Sato, *Interpreting canonical tensor model in minisuperspace*, arXive:1401.2062 [hep-th], (January)
- 14-2** Terukazu Ichihara, Akira Ohnishi, Takashi Z. Nakano, *Auxiliary field Monte-Carlo simulation of strong coupling lattice QCD for QCD phase diagram*, arXive:1401.4647 [hep-lat], (January)
- 14-3** Naoki Sasakura, Yuki Sato, *Ising model on random networks and the canonical tensor model*, arXive:1401.7806 [hep-th], (January)
- 14-4** Yasuho Yamashita, Takahiro Tanaka, *Mapping de Rham-Gabadadze-Tolley bigravity into braneworld setup*, arXive:1401.4336 [hep-th], (January)
- 14-5** Markus B. Frob, Jaume Garriga, Sugumi Kanno, Misao Sasaki, Jiro Soda, Takahiro Tanaka, Alexander Vilenkin, *Schwinger effect in de Sitter space*, arXive:1401.4137 [hep-th], (January)
- 14-6** Yoshitaka Hatta, Jorge Noronha, Bo-Wen Xiao, *Exact analytical solutions of second-order conformal hydrodynamics*, Phys. Rev. D 89, 051702 (2014) arXive:1401.6248 [hep-th], (January)
- 14-7** Hajime Sotani, Kostas D. Kokkotas, Pablo Laguna, Carlos F. Sopuerta, *Electromagnetic waves from neutron stars and black holes driven by polar gravitational perturbations*, Gen. Rel. Grav. 46 (2014) 1675 arXive:1402.0251 [astro-ph.HE], (January)
- 14-8** Hajime Sotani, *Electron screening effects on crustal torsional oscillations*, Phys. Lett. B 730 (2014) 166 arXive:1401.6977 [astro-ph.HE], (January)
- 14-9** Naoki Sasakura, Yuki Sato, *Exact free energies of statistical systems on random networks*, SIGMA 10 (2014), 087 arXive:1402.0740 [hep-th], (January)
- 14-10** Toshiya Namikawa, *Cosmology from weak lensing of CMB*, PTEP 2014, 06B108 arXiv:1403.3569 [astro-ph.CO], (January)
- 14-11** K. Tsubakihara, A. Ohnishi, T. Harada, *Isvector potential of Σ in nuclei and neutron star matter*, arXive:1402.0979 [nucl-th], (February)
- 14-12** Sinya Aoki, Michael Creutz, *Pion masses in 2-flavor QCD with η condensation*, Phys. Rev. Lett. 112, 141603 (2014) arXive:1402.1837 [hep-lat], (February)
- 14-13** Sinya Aoki, *Lattice Studies for hadron spectroscopy and interactions*, PoS(Hadron 2013)020 arXive:1402.3059 [hep-lat], (February)
- 14-14** Akira Ohnishi, Naoki Yamamoto, *Magnetars and the Chiral Plasma Instabilities*, arXive:1402.4760 [astro-ph.HE], (February)
- 14-15** Hajime Sotani, *Scalar gravitational waves from relativistic stars in scalar-tensor gravity*, Phys. Rev. D89:064031, 2014 arXive:1402.5699 [astro-ph.HE], (February)
- 14-16** Y. Yamaguchi, S. Ohkoda, A. Hosaka, T. Hyodo, S. Yasui, *Heavy quark symmetry in multi-hadron systems*, Phys. Rev. D 91, 034034 (2015) arXive:1402.5222 [hep-ph], (February)
- 14-17** Song He, Tokiro Numasawa, Tadashi Takayanagi, Kento Watanabe, *Quantum Dimension as Entanglement Entropy in 2D CFTs*, Phys. Rev. D 90, 041701 (2014) arXive:1403.0702 [hep-th], (February)
- 14-18** Ali Mollabashi, Noburo Shiba, Tadashi Takayanagi, *Entanglement between Two Interacting CFTs and Generalized Holographic Entanglement Entropy*, arXive:1403.1393 [hep-th], (March)
- 14-19** Jan de Boer, Daniel R. Mayerson, Masaki Shigemori, *Classifying Supersymmetric Solutions in 3D Maximal Supergravity*, Class. Quantum Grav. 31 (2014) 235004 arXive:1403.4600 [hep-th], (March)
- 14-20** Faisal Etminan, Hidekatsu Nemura, Sinya Aoki, Takumi Doi, Tetsuo Hatsuda, Yoichi Ikeda, Takashi Inoue, Noriyoshi Ishii, Keiko Murano, Kenji Sasaki (HAL QCD Collaboration), *Spin-2 $N\Omega$ Dibaryon from Lattice QCD*, arXive:1403.7284 [hep-lat], (March)
- 14-21** Yoshitaka Hatta, Jorge Noronha, Bo-Wen Xiao, *A systematic study of exact solutions in second-order conformal hydrodynamics*, Phys. Rev. D 89, 114011 (2014) arXive:1403.7693 [hep-th], (March)
- 14-22** Takeshi Chiba, Antonio De Felice, Shinji Tsujikawa, *Cosmological Scaling Solutions for Multiple Scalar Fields*, Phys. Rev. D90 (2014) 023516 arXive:1403.7604 [gr-qc], (March)
- 14-23** Antonio De Felice, A.Emir Gumrukcuoglu, Shinji Mukohyama, Norihiro Tanahashi, Takahiro Tanaka, *Viable cosmology in bimetric theory*, JCAP 1406 (2014) 037 arXive:1404.0008 [hep-th], (March)

- 14-24** Dong-il Hwang, Soo A Kim, Dong-han Yeom, *No-boundary wave function for two-field inflation*, *Class.Quant.Grav.*32:115006,2015 arXiv:1404.2800 [gr-qc], (April)
- 14-25** Misao Sasaki, Dong-han Yeom, *Thin-shell bubbles and information loss problem in anti de Sitter background*, *JHEP* 12(2014)155 arXiv:1404.1565 [hep-th], (April)
- 14-26** M. Tanaka, K. Hotokezaka, K. Kyutoku, S. Wanajo, K. Kiuchi, Y. Sekiguchi, and M. Shibata, *Radioactively Powered Emission from Black Hole-Neutron Star Mergers*, *Astrophys. J.*780, 31 (2014) arXiv:1310.2774 [astro-ph.HE], (April)
- 14-27** H. Nagakura, K. Hotokezaka, Y. Sekiguchi, M. Shibata, and K. Ioka, *Jet Collimation in the Ejecta of Double Neutron Star Merger: New Canonical Picture of Short Gamma-ray Bursts*, *Astrophys. J. Lett.* 784, L28 (2014) arXiv:1403.0956 [astro-ph.HE], (April)
- 14-28** M. Shibata, H. Nagakura, Y. Sekiguchi, and S. Yamada, *Conservative form of Boltzmann's equation in general relativity*, *Phys. Rev. D*89, 084073 (2014) , (April)
- 14-29** Shinya Wanajo, Yuichiro Sekiguchi, Nobuya Nishimura, Kenta Kiuchi, Koutarou Kyutoku, Masaru Shibata, *Production of all the r-process nuclides in the dynamical ejecta of neutron star mergers*, arXiv:1402.7317 [astro-ph.SR], (April)
- 14-30** Kenta Kiuchi, Koutarou Kyutoku, Yuichiro Sekiguchi, Masaru Shibata, Tomohide Wada, *High-resolution numerical-relativity simulations for the merger of binary magnetized neutron stars*, arXiv:1407.2660 [astro-ph.HE] , (April)
- 14-31** Koutarou Kyutoku, Masaru Shibata, Keisuke Taniguchi, *Reducing orbital eccentricity in initial data of binary neutron stars*, *Phys.Rev.D*90:064006,2014 arXiv:1405.6207 [gr-qc], (April)
- 14-32** Helvi Witek, Hirotada Okawa, Vitor Cardoso, Leonardo Gualtieri, Carlos Herdeiro, Masaru Shibata, Ulrich Sperhake, Miguel Zilhao, *Higher dimensional Numerical Relativity: code comparison*, *Phys. Rev. D* 90, 084014 (2014) arXiv:1406.2703 [gr-qc], (April)
- 14-33** Soichiro Isoyama, Leor Barack, Sam R. Dolan, Alexandre Le Tiec, Hiroyuki Nakano, Abhay G. Shah, Takahiro Tanaka, Niels Warburton, *Gravitational Self-Force Correction to the Innermost Stable Circular Equatorial Orbit of a Kerr Black Hole*, *Phys. Rev. Lett.* 113, 161101 (2014) arXiv:1404.6133 [gr-qc], (April)
- 14-34** Hajime Sotani , *Observational discrimination of Eddington-inspired Born-Infeld gravity from general relativity*, *Phys.Rev.D*89:104005,2014 arXiv:1404.5369 [astro-ph.HE], (April)
- 14-35** Masanori Hanada, Jonathan Maltz, Leonard Susskind, *Deconfinement transition as black hole formation by the condensation of QCD strings*, *Phys. Rev. D* 90, 105019 (2014) arXiv:1405.1732 [hep-th], (April)
- 14-36** Iosif Bena, Masaki Shigemori and Nicholas P. Warner, *Black-Hole Entropy from Supergravity Superstrata States*, *JHEP*10(2014)140 arXiv:1406.4506 [hep-th], (April)
- 14-37** Yoshitaka Hatta, Bo-Wen Xiao, *Building up the elliptic flow: analytical insights*, arXiv:1405.1984 [nucl-th], (May)
- 14-38** H. Fukaya, S. Aoki, S. Hashimoto, T. Kaneko, H. Matsufuru, J. Noaki , *Computation of the electromagnetic pion form factor from lattice QCD in the epsilon regime*, *Phys. Rev. D* 90, 034506 (2014) arXiv:1405.4077 [hep-lat], (May)
- 14-39** Toshio Motoba, L. Tang et al., *Experiments with the High Resolution Kaon Spectrometer at JLab Hall C and the new spectroscopy of ^{12}B hypernuclei*, *Phys. Rev. C* 90, 034320 (2014) arXiv:1406.2353 [nucl-th], (May)
- 14-40** Yuta Hamada, Tatsuo Kobayashi, Atsushi Ogasahara, Yuji Omura, Fumihito Takayama, Daiki Yasuhara, *Revisiting Discrete Dark Matter Model: $\theta_{13} \neq 0$ and v_R Dark Matter*, *JHEP*10(2014)183 arXiv:1405.3592 [hep-ph], (May)
- 14-41** Masahiro Nozaki, *Notes on Quantum Entanglement of Local Operators*, arXiv:1405.5875 [hep-th], (May)
- 14-42** Pawel Caputa, Masahiro Nozaki, Tadashi Takayanagi, *Entanglement of Local Operators in large N CFTs*, arXiv:1405.5946 [hep-th], (May)
- 14-43** Kazuo Hosomichi, Sungjay Lee, *Self-dual Strings and 2D SYM* , arXiv:1406.1802 [hep-th], (May)
- 14-44** Sam Young, Christian T. Byrnes, Misao Sasaki, *Calculating the mass spectrum of primordial black holes*, *JCAP* 1407 (2014) 045 arXiv:1405.7023 [gr-qc], (May)
- 14-45** Roberto Emparan, Ryotaku Suzuki, Kentaro Tanabe, *Decoupling and non-decoupling dynamics of large D black holes*, arXiv:1406.1258 [hep-th], (June)
- 14-46** Yuhma Asano, Goro Ishiki, Shinji Shimasaki, *Emergent bubbling geometries in gauge theories with $SU(2|4)$ symmetry*, arXiv:1406.1337 [hep-th], (June)
- 14-47** Jakob Hansen, Dong-han Yeom, *Charged black holes in string-inspired gravity: I. Causal structures and responses of the Brans-Dicke field*, *JHEP* 10(2014)040 arXiv:1406.0976 [hep-th], (June)

- 14-48** Ryo Tamura, Shu Tanaka, Takahisa Ohno, Hideaki Kitazawa, *Magnetic ordered structure dependence of magnetic refrigeration efficiency*, J. Appl. Phys. 116, 053908 (2014) arXiv:1406.6462 [cond-mat.mtrl-sci], (June)
- 14-49** Shinji Hirano, Keita Nii, Masaki Shigemori, *ABJ Wilson loops and Seiberg Duality*, Prog. Theor. Exp. Phys. (2014) 113B04 arXiv:1406.4141 [hep-th], (June)
- 14-50** Hajime Sotani, *Stellar oscillations in Eddington-inspired Born-Infeld gravity*, Phys. Rev. D 90, 124037, 2014 arXiv:1406.3097 [astro-ph.HE], (June)
- 14-51** Yudai Suwa, Shoichi Yamada, Tomoya Takiwaki, Kei Kotake, *The criterion of supernova explosion revisited: the mass accretion history*, arXiv:1406.6414 [astro-ph.HE], (June)
- 14-52** Hiroshi Kunitomo, *First-Order Equations of Motion for Heterotic String Field Theory*, PTEP(2014) 093B07 arXiv:1407.0801 [hep-th], (July)
- 14-53** Sinya Aoki, Janos Balog, Peter Weisz, *Walking in the 3-dimensional large N scalar model*, arXiv:1407.7079 [hep-lat], (July)
- 14-54** K.-I. Izawa, *Fine tunings for inflation with simple potentials*, arXiv:1407.2328 [hep-ph], (July)
- 14-55** Tetsuo Hyodo, *Hadron mass scaling near the s-wave threshold*, Phys. Rev. C 90, 055208, 2014 arXiv:1407.2372 [hep-ph], (July)
- 14-56** Sanefumi Moriyama, Tomoki Nosaka, *Partition Functions of Superconformal Chern-Simons Theories from Fermi Gas Approach*, arXiv:1407.4268 [hep-th], (July)
- 14-57** Jonathan White, Ying-li Zhang, Misao Sasaki, *Scalar suppression on large scales in open inflation*, Phys. Rev. D 90, 083517 (2014) arXiv:1407.5816 [astro-ph.CO], (July)
- 14-58** Yudai Suwa, Teruaki Enoto, *Anisotropic neutrino effect on magnetar spin: constraint on inner toroidal field*, MNRAS 443, 3586-3593 (2014) arXiv:1407.4653 [astro-ph.HE], (July)
- 14-59** Yoshitaka Hatta, Jorge Noronha, Giorgio Torrieri, Bo-Wen Xiao, *Flow harmonics within an analytically solvable viscous hydrodynamic model*, Phys. Rev. D 90, 074026 (2014) arXiv:1407.5952 [hep-ph], (July)
- 14-60** Masashi Kimura, Hideki Ishihara, Ken Matsuno, Takahiro Tanaka, *A simple diagnosis of non-smoothness of black hole horizon: Curvature singularity at horizons in extremal Kaluza-Klein black holes*, arXiv:1407.6224 [gr-qc], (July)
- 14-61** Pisin Chen, Yen Chin Ong, Dong-han Yeom, *Generalized Uncertainty Principle: Implications for Black Hole Complementarity*, JHEP 12 (2014) 021 arXiv:1408.3763 [hep-th], (August)
- 14-62** Noburo Shiba, *Entanglement Entropy of Disjoint Regions in Excited States : An Operator Method*, arXiv:1408.0637 [hep-th], (August)
- 14-63** Atsushi Taruya, Takahiro Nishimichi, Francis Bernardeau, Takashi Hiramatsu, Kazuya Koyama, *Regularized cosmological power spectrum and correlation function in modified gravity models*, Phys. Rev. D 90, 123515 (2014) arXiv:1408.4232 [astro-ph.CO], (August)
- 14-64** Kengo Kikuchi, Tetsuya Onogi, *Generalized Gradient Flow Equation and Its Application to Super Yang-Mills Theory*, arXiv:1408.2185 [hep-th], (August)
- 14-65** Yudai Suwa, Nozomu Tominaga, *How Much Can ^{56}Ni Be Synthesized by Magnetar Model for Long Gamma-ray Bursts and Hypernovae?*, arXiv:1408.3116 [astro-ph.HE], (August)
- 14-66** Takashi Inoue, Sinya Aoki, Bruno Charron, Takumi Doi, Tetsuo Hatsuda, Yoichi Ikeda, Noriyoshi Ishii, Keiko Murano, Hidekatsu Nemura, Kenji Sasaki (HAL QCD Collaboration), *Medium-Heavy Nuclei from Nucleon-Nucleon Interactions in Lattice QCD*, Phys. Rev. C 91, 011001 (2015) arXiv:1408.4892 [hep-lat], (August)
- 14-67** Kenji Morita, Takenori Furumoto, Akira Ohnishi, *Lambda-Lambda interaction from relativistic heavy-ion collisions*, Phys. Rev. C 91, 024916 (2015) arXiv:1408.6682 [nucl-th], (August)
- 14-68** Bum-Hoon Lee, Wonwoo Lee, Daeho Ro, Donghan Yeom, *Instantons near a tachyonic top in anti de Sitter and the no-boundary regulator*, arXiv:1409.3728 [hep-th], (September)
- 14-69** Bum-Hoon Lee, Wonwoo Lee, Daeho Ro, Donghan Yeom, *Oscillating Fubini instantons in curved space*, arXiv:1409.3935 [hep-th], (September)
- 14-70** Ryo Saito, Atsushi Naruko, Takashi Hiramatsu, Misao Sasaki, *Geodesic "curve"-of-sight formulae for the cosmic microwave background: a unified treatment of redshift, time delay, and lensing*, JCAP10(2014)051 arXiv:1409.2464 [astro-ph.CO], (September)
- 14-71** Shinya Aoki, Masanori Hanada, Atsushi Nakamura, *Taming the pion condensation in QCD at finite baryon density*, arXiv:1410.7421 [hep-lat], (September)
- 14-72** Kenji Morita, Krzysztof Redlich, *Momentum scale dependence of the net quark number fluctuations near chiral crossover*, PTEP 043D03 (2015) arXiv:1409.8001 [hep-ph], (September)

- 14-73** Gaurav Narain, Naoki Sasakura, Yuki Sato, *Physical states in the canonical tensor model from the perspective of random tensor networks*, arXiv:1410.2683 [hep-th], (October)
- 14-74** Terukazu Ichihara, Akira Ohnishi, *Fluctuation effects on QCD phase diagram at strong coupling*, PoS(LATTICE2014)188 arXiv:1503.07049 [hep-lat], (October)
- 14-75** Sanefumi Moriyama, Tomoki Nosaka, *ABJM Membrane Instanton from Pole Cancellation Mechanism*, arXiv:1410.4918 [hep-th], (October)
- 14-76** Pawel Caputa, Joan Simon, Andrius Stikonas, Tadashi Takayanagi, *Quantum Entanglement of Localized Excited States at Finite Temperature*, arXiv:1410.2287 [hep-th], (October)
- 14-77** Shinji Mukohyama, *A new quasidilaton theory of massive gravity*, arXiv:1410.1996 [hep-th], (October)
- 14-78** Naofumi Hama, Tatsuma Nishioka, Tomonori Ugajin, *Supersymmetric Rényi Entropy in Five Dimensions*, arXiv:1410.2206 [hep-th], (October)
- 14-79** Seiji Terashima, *A Localization Computation in Confining Phase*, arXiv:1410.3630 [hep-th], (October)
- 14-80** Takaaki Yokozawa, Mitsuhiro Asano, Tsubasa Kayano, Yudai Suwa, Nobuyuki Kanda, Yusuke Koshio, Mark R. Vagins, *Probing Rotation of Core-collapse Supernova with Concurrent Analysis of Gravitational Waves and Neutrinos*, arXiv:1410.2050 [astro-ph.HE], (October)
- 14-81** V. Bois, S. Capponi, P. Lecheminant, M. Moliner, K. Totsuka, *Phase diagrams of one-dimensional half-filled two-orbital $SU(N)$ cold fermions systems*, Phys. Rev. B 91, 075121 (2015) arXiv:1410.2974 cond-mat.str-el], (October)
- 14-82** Stefano Ansoldi, Takahiro Tanaka, *Tunnelling with wormhole creation*, arXiv:1410.6202 [gr-qc], (October)
- 14-83** Ying-li Zhang, Misao Sasaki, Dong-han Yeom, *Homogeneous Instantons in Bigravity*, JHEP 1504 (2015) 016 arXiv:1411.6769 [hep-th], (October)
- 14-84** Hideaki Iida, Teiji Kunihiro, Akira Ohnishi, Toru T. Takahashi, *Time evolution of gluon coherent state and its von Neumann entropy in heavy-ion collisions*, arXiv:1410.7309 [hep-ph], (October)
- 14-85** JLQCD collaboration: H. Fukaya, S. Aoki, G. Cossu, S. Hashimoto, T. Kaneko, J. Noaki, *Topology density correlator on dynamical domain-wall ensembles with nearly frozen topological charge*, arXiv:1411.1473 [hep-lat], (October)
- 14-86** Takumi Iritani, Guido Cossu, Shoji Hashimoto, *Partial restoration of chiral symmetry inside hadrons*, arXiv:1412.2322 [hep-lat], (October)
- 14-87** Mitsutoshi Fujita, Sarah Harrison, Andreas Karch, Rene Meyer, Natalie M. Paquette, *Towards a Holographic Bose-Hubbard Model*, arXiv:1411.7899 [hep-th], (November)
- 14-88** Takayasu Sekihara, Tetsuo Hyodo, Daisuke Jido, *Comprehensive analysis of the wave function of a hadronic resonance and its compositeness*, arXiv:1411.2308 [hep-ph], (November)
- 14-89** Shoichiro Tsutsui, Hideaki Iida, Teiji Kunihiro, Akira Ohnishi, *Parametric Instability of Classical Yang-Mills Fields under Color Magnetic Background*, Phys. Rev. D 91, 076003 (2015) arXiv:1411.3809 [hep-ph], (November)
- 14-90** Sungtae Cho, Koichi Hattori, Su Hounng Lee, Kenji Morita, Sho Ozaki, *Charmonium Spectroscopy in Strong Magnetic Fields by QCD Sum Rules: (I) S-Wave Ground States*, Phys. Rev. D 91, 045025 (2015) arXiv:1411.7675 [hep-ph], (November)
- 14-91** Takahiro Nishimichi, Francis Bernardeau, Atsushi Taruya, *Anomalous coupling of the small-scale structures to the large-scale gravitational growth*, arXiv:1411.2970 [astro-ph.CO], (November)
- 14-92** Toshiya Namikawa, Daisuke Yamauchi, Atsushi Taruya, *Future detectability of gravitational-wave induced lensing from high-sensitivity CMB experiments*, Phys. Rev. D 91, 043531 (2015) arXiv:1411.7427 [astro-ph.CO], (November)
- 14-93** Long-Gang Pang, Yoshitaka Hatta, Xin-Nian Wang, Bo-Wen Xiao, *Analytical and numerical Gubser solutions of the complete second-order hydrodynamics*, Phys. Rev. D 91, 074027 (2015) arXiv:1411.7767 [hep-ph], (November)
- 14-94** Kunihiko Terasaki, *$X(3872) \rightarrow J/\psi \pi \pi \pi$ as a Three-Step Decay*, arXiv:1411.7483 [hep-ph], (November)
- 14-95** Kenji Sasaki, Sinya Aoki, Takumi Doi, Tetsuo Hatsuda, Yoichi Ikeda, Takashi Inoue, Noriyoshi Ishii, Keiko Murano, (HAL QCD Collaboration), *Coupled channel approach to strangeness $S = -2$ baryon-baryon interactions in Lattice QCD*, arXiv:1504.01717 [hep-lat], (December)
- 14-96** Xu Feng, Sinya Aoki, Shoji Hashimoto, Takashi Kaneko, *Time-like pion form factor in lattice QCD*, Phys. Rev. D 91, 054504 (2015) arXiv:1412.6319 [hep-lat], (December)
- 14-97** H. Mei, K. Hagino, J. M. Yao, T. Motoba, *Microscopic particle-rotor model for the low-lying spectrum of Λ hypernuclei*, PHYSICAL REVIEW C 90, 064302 (2014) arXiv:1406.4604 [nucl-th], (December)

- 14-98** Sanefumi Moriyama, Tomoki Nosaka, *Exact Instanton Expansion of Superconformal Chern-Simons Theories from Topological Strings*, arXiv:1412.6243 [hep-th], (December)
- 14-99** Antonio De Felice, Misao Sasaki, *Ghosts in generalized non-local gravity theories*, Phys.Lett.B 743, 189 (2015) arXiv:1412.1575 [gr-qc], (December)
- 14-100** Takashi Hiramatsu, Yuhei Miyamoto, Jun'ichi Yokoyama, *Effects of thermal fluctuations on thermal inflation*, arXiv:1412.7814 [hep-ph], (December)
- 14-101** Toshiya Kashiwagi, Yasushi Suto, Atsushi Taruya, Issha Kayo, Takahiro Nishimichi, Kazuhiro Yahata, *Modeling the anomaly of surface number densities of galaxies on the Galactic extinction map due to their FIR emission contamination*, Astrophys.J. 799 (2015) 2, 132 arXiv:1412.0354 [astro-ph.CO], (December)
- 14-102** Yoshikazu Hagiwara, Yoshitaka Hatta, *Use of the Husimi distribution for nucleon tomography*, Nucl.Phys. A 940 (2015) 158 arXiv:1412.4591 [hep-ph], (December)
- 14-103** Masamichi Miyaji, Shinsei Ryu, Tadashi Takayanagi, Xueda Wen, *Boundary States as Holographic Duals of Trivial Spacetimes*, arXiv:1412.6226 [hep-th], (December)
- 14-104** Jyotirmoy Bhattacharya, Veronika E. Hubeny, Mukund Rangamani, Tadashi Takayanagi, *Entanglement density and gravitational thermodynamics*, arXiv:1412.5472 [hep-th], (December)
- 14-105** Song He, Tokiro Numasawa, Tadashi Takayanagi, Kento Watanabe, *Notes on Entanglement Entropy in String Theory*, arXiv:1412.5606 [hep-th], (December)
- 14-106** Hiroshi Kunitomo, *Symmetries and Feynman Rules for Ramond Sector in Open Superstring Field Theory*, arXiv:1412.5281v1 [hep-th], (December)
- 14-107** Koji Hashimoto, Sotaro Sugishita, Seiji Terashima, *Ramond-Ramond couplings of D-branes*, arXiv:1501.00995 [hep-th], (December)
- 14-108** Keisuke Nakamura, Daisuke Nomura, *Charged Lepton Flavor Violation in the Semi-Constrained NMSSM with Right-Handed Neutrinos*, Phys. Lett. B 746 (2015) 396-405 arXiv:1501.05058 [hep-th], (December)
- 14-109** Sinya Aoki, Kengo Kikuchi, Tetsuya Onogi, *Gradient Flow of $O(N)$ nonlinear sigma model at large N* , JHEP 1504 (2015) 156 arXiv:1412.8249 [hep-th], (December)
- 14-110** Kazuo Hosomichi, *A review on SUSY gauge theories on S^3* , arXiv:1412.7128 [hep-th], (December)
- 14-111** Jeremy Reeves, Bryce Gadway, Tom Bergeman, Ipeei Danshita, Dominik Schneble, *Superfluid Bloch dynamics in an incommensurate lattice*, New J. Phys. 16, 065011 (2014) arXiv:1402.4830 [cond-mat.quant-gas], (December)
- 14-112** Ipeei Danshita, Daisuke Yamamoto, Yasuyuki Kato, *Cubic-quintic nonlinearity in superfluid Bose-Bose mixtures in optical lattices: Heavy solitary waves, barrier-induced criticality, and current-phase relations*, Physical Review A 91, 013630 (2015) arXiv:1409.7185 [cond-mat.quant-gas], (December)
- 14-113** Daisuke Yamamoto, Giacomo Marmorini, Ipeei Danshita, *Microscopic Model Calculations for the Magnetization Process of Layered Triangular-Lattice Quantum Antiferromagnets*, Phys. Rev. Lett. 114, 027201 (2015) arXiv:1411.4233 [cond-mat.str-el], (December)
- 14-114** Laurent Freidel, Yuki Yokokura, *Non-equilibrium thermodynamics of gravitational screens*, arXiv:1405.4881 [gr-qc], (December)
- 14-115** Hikaru Kawai, Yuki Yokokura, *Phenomenological Description of the Interior of the Schwarzschild Black Hole*, arXiv:1409.5784 [hep-th], (December)

2.2.2 Publications and Talks by Regular Staff (April 2014 — March 2015)

Sinya Aoki

Journal Papers

1. Sinya Aoki, Michael Creutz,
"Pion masses in 2-flavor QCD with η condensation",
Phys.Rev.Lett. 112 (2014) 141603, 1-5,
YITP-14-12, arXiv:1402.1837[hep-lat].
2. Faisal Etminan, Hidekatsu Nemura, Sinya Aoki, Takumi Doi, Tetsuo Hatsuda, Yoichi Ikeda, Takashi Inoue, Noriyoshi Ishii, Keiko Murano, Kenji Sasaki (HAL QCD Collaboration),
"Spin-2 $N\Omega$ Dibaryon from Lattice QCD",
Nucl. Phys. A928 (2014) 89-98, YITP-14-20, arXiv:1403.7284[hep-lat].
3. H. Fukaya, S. Aoki, S. Hashimoto, T. Kaneko, H. Matsufuru, J. Noaki,
"Computation of the electromagnetic pion form factor from lattice QCD in the epsilon regime",
Phys. Rev. D 90, (2014) 034506, YITP-14-38, arXiv:1405.4077 [hep-lat].
4. Sinya Aoki, Janos Balog and Peter Weisz,
"Walking in the 3-dimensional large N scalar model",
JHEP 1409 (2014) 167, YITP-14-53, arXiv:1407.7074[hep-lat].
5. Takashi Inoue, Sinya Aoki, Bruno Charron, Takumi Doi, Tetsuo Hatsuda, Yoichi Ikeda, Noriyoshi Ishii, Keiko Murano, Hidekatsu Nemura, Kenji Sasaki (HAL QCD Collaboration),
"Medium-Heavy Nuclei from Nucleon-Nucleon Interactions in Lattice QCD",
Phys. Rev. C91 (2015) 0110001(R), YITP-14-66, arXiv:1408.4892[hep-lat].
6. Xu Feng, Sinya Aoki, Shoji Hashimoto, Takashi Kaneko,
"Time-like pion form factor in lattice QCD",
Phys. Rev. D91 (2015) 054504, YITP-14-96, arXiv:1412.6319[hep-lat].
7. Sinya Aoki, Kengo Kikuchi, Tetsuya Onogi
"Gradient Flow of $O(N)$ nonlinear sigma model at large N ",
JHEP 1504(2015)156, YITP-14-109, arXiv:1412.8249[hep-lat].

Books and Proceedings

1. S. Ueda, S. Aoki, T. Aoyam, K. Kanaya, H. Matsufuru, S. Motoki, Y. Namekawa, H. Nemura, Y. Taniguchi, N. Ukita,
"Development of an object oriented lattice QCD code 'Bridge++'",
J.Phys.Conf.Ser. 523 (2014) 012046.
2. JLQCD collaboration: H. Fukaya, S. Aoki, G. Cossu, S. Hashimoto, T. Kaneko, J. Noaki,
"Topology density correlator on dynamical domain-wall ensembles with nearly frozen topological charge",
PoS Lattice2014 (2015) 323, YITP-14-85, arXiv:1411.1473[hep-lat].
3. Sinya Aoki, Michael Creutz,
"Pion masses in 2-flavor QCD with $\hat{\Lambda}\bar{\Lambda}$ condensation",
PoS Lattice2014 (2015) 316, YITP-15-27, arXiv:1504.01454[hep-lat].

Talks at International Conferences

1. "Some topics in 2-flavor QCD at zero and finite temperature," Invited,
in Workshop "Facing Strong Dynamics",
Liselund Castle, Denmark,
June 2-6, 2014.
2. "Pion masses in 2-flavor QCD with eta condensation,"
in "Lattice 2014," Columbia University,
New York, USA,
June 23-28, 2014.
3. "Finite-volume methods for hadrons and their interactions in lattice QCD," Invited,
Plenary,
in "CERN Theory Workshop Conceptual advances in lattice gauge theory (LGT14),"
CERN, Geneva, Switzerland,
July 21 - August 1, 2014.
4. "Hadron interactions from lattice QCD,"
Invited, Plenary,
in "KITPC program "Present Status of the

Nuclear Interaction Theory", " KITPC/ITP-CAS, Beijing, China, August 25-September 19, 2014.

5. "2-flavor QCD with non-degenerate quarks," Invited, Plenary, in "Creutz Fest 2014 "A Celebration of the Career and Accomplishments of Michael Creutz", " Physics Department, BNL, USA, September 4-5, 2014.
6. "Hadron interaction in lattice QCD," Invited, in "Long-term workshop on "Hadrons and Hadron Interactions in QCD 2015 (HHIQCD2015)", " YITP, Kyoto, Japan, February 12-March 21, 2015.

Ippei Danshita

Journal Papers

1. I. Danshita, R. Hipolito, V. Oganesyan, and A. Polkovnikov, "Quantum damping of Fermi-Pasta-Ulam revivals in ultracold Bose gases," *Prog. Theor. Exp. Phys.* **2014** (2014) 043I03 (8 pages).
2. J. B. Reeves, B. Gadway, T. Bergeman, I. Danshita, and D. Schneble, "Superfluid Bloch dynamics in an incommensurate optical lattice," *New J. Phys.* **16** (2014) 065011 (8 pages), YITP-14-111, arXiv:1402.4830 [cond-mat].
3. I. Danshita, D. Yamamoto, and Y. Kato, "Cubic-quintic nonlinearity in superfluid Bose-Bose mixtures in optical lattices: Heavy solitary waves, barrier-induced criticality, and current-phase relations," *Phys. Rev. A* **91** (2015) 013630 (17 pages), YITP-14-112, arXiv:1409.7185 [cond-mat].
4. D. Yamamoto, G. Marmorini, and I. Danshita, "Microscopic Model Calculations for the Magnetization Process of Layered Triangular-Lattice Quantum Antiferromagnets," *Phys. Rev. Lett.* **114** (2015) 027201 (5 pages), YITP-14-113, arXiv:1411.4233 [cond-mat].

Talks at International Conferences

1. "Quantum tricriticality and heavy solitary waves of binary Bose mixtures in optical lattices," Invited, in "579th Wilhelm and Else Heraeus Seminar 'Quo vadis BEC? V'," Physikzentrum, Bad Honnef, Germany, December 2014.
2. "Superfluid-Mott insulator transitions of binary Bose mixtures in optical lattices," Invited, in "Novel Quantum States in Condensed Matter 2014," YITP Kyoto University, Kyoto, Japan, December 2014.

Invited Seminars (in Japan)

1. "Quantum tricriticality and bright-like dark solitons near the superfluid-insulator transition of binary Bose mixtures," Theory of Quantum Matter Unit, Okinawa Institute of Science and Technology, April 2014.
2. "Quantum phase transitions of Bose gases in optical lattices," Department of Earth and Space Science, Osaka University, May 2014 (in Japanese).
3. "Instanton effects in one-dimensional Bose gases," Keio University, September 2014 (in Japanese).
4. "Phase transition from superfluid to Mott insulator of binary Bose mixtures in optical lattices," Dept. of Phys., Tokyo Institute of Technology, October 2014 (in Japanese).

Yoshitaka Hatta

Journal Papers

1. Y. Hatta, X. Ji and Y. Zhao, "Gluon helicity ΔG from a universality class of operators on a lattice," *Phys. Rev. D* **89** (2014) 085030 (6 pages), arXiv:1310.4263 [hep-ph], YITP-13-111.
2. Y. Hatta, J. Noronha and B. Xiao, "Systematic study of exact solutions in

- second-order conformal hydrodynamics,”
Phys. Rev. **D89** (2014) 114011 (16 pages),
arXiv:1310.4263 [hep-th], YITP-14-21.
3. Y. Hatta and B. Xiao,
“Building up the elliptic flow: analytical insights,”
Phys. Lett. **B736** (2014) 180 (16 pages),
arXiv:1405.1984 [nucl-th], YITP-14-37.
 4. Y. Hatta, J. Noronha, G. Torrieri and Y. Zhao,
“Flow harmonics within an analytically solvable viscous hydrodynamic model,”
Phys. Rev. **D90** (2014) 074026 (15 pages),
arXiv:1407.5952 [hep-ph], YITP-14-59.
 5. Y. Hagiwara and Y. Hatta,
“Use of the Husimi distribution for nucleon tomography,”
Nucl. Phys. **A940** (2015) 158 (9 pages),
arXiv:1412.4591 [hep-ph], YITP-14-102.
 6. L. Pang, Y. Hatta, X. Wang and B. Xiao,
“Analytical and numerical Gubser solutions of the second order hydrodynamics,”
Phys. Rev. **D91** 074027 (2015) (5 pages),
arXiv:1411.7767 [hep-ph], YITP-14-93.
 7. Y. Hatta, M. Martinez and B. Xiao,
“Analytical solutions of the relativistic Boltzmann equation,”
Phys. Rev. **D91** (2015) 085024 (9 pages),
arXiv:1502.05894 [hep-th], YITP-15-11.

Talks at International Conferences

1. “Exact solutions of relativistic conformal hydrodynamics,” Invited,
in “Symposium on the frontier of hadron physics at CNMS,” Wuhan, China, June 2014
2. “Nucleon spin and tomography,” Invited,
in “Hadron physics with high-momentum hadron beams at J-PARC,” KEK, Japan, March 2015
3. “Recent developments in nucleon spin decomposition,” Invited,
in “The 21st international symposium on spin physics (SPIN2014),” Beijing, China, October 2014
4. “The nucleon spin and angular momentum,” Invited

in “Fourth joint meeting of the nuclear physics divisions of the APS and the physical society of Japan (HAWAII2014),” Hawaii, USA, October 2014.

Invited Seminars (in Japan)

1. “Exact solutions of second-order conformal hydrodynamics,”
in “QCD Club,” Department of Physics, University of Tokyo, April 2014.

Hisao Hayakawa

Journal Papers

1. Kiyoshi Kanazawa, Tomohiko G. Sano, Takahiro Sagawa, and Hisao Hayakawa, "Asymptotic derivation of Langevin-like equation with non-Gaussian noise and its analytical solution ", J. Stat. Phys. (in press); arXiv:1412.2233
2. Kiyoshi Kanazawa, Tomohiko G. Sano, Takahiro Sagawa, and Hisao Hayakawa, "Minimal Model of Stochastic Athermal Systems: Origin of Non-Gaussian Noise". Phys. Rev. Lett. **114**, 090601 (2015)[6 pages]
3. Kazunari Hashimoto, Kazuki Kanki, Hisao Hayakawa, and Tomio Petrosky, "Non-divergent representation of a non-Hermitian operator near the exceptional point with application to a quantum Lorentz gas", Prog. Theor. Exp. Phys. **2015**, 023A02 (2015) [22pages] .
4. Shunsuke Yabunaka and Hisao Hayakawa, "Geometric pumping induced by shear flow in dilute liquid crystalline polymer solutions ", J. Chem. Phys. **142**, 054903 (2015) [9 pages].
5. Satoshi Takada, Kuniyasu Saitoh, and Hisao Hayakawa, "Simulation of cohesive fine powders under a plane shear", Phys. Rev. E **90**, 062207 (2014) [12 pages]
6. Kota L. Watanabe and Hisao Hayakawa, "Non-adiabatic effect in quantum pumping for a spin-boson system", Prog. Theor. Exp. Phys. **2014**, 113A01 (2014) [25 pages].

7. E. Fodor, K. Kanazawa, H. Hayakawa, P. Visco, and F. van Wijland, "Energetics of active fluctuations in living cells ", Phys. Rev. E **90**, 042724 (2014) [11 pages]
8. Michio Otsuki and Hisao Hayakawa, "Avalanche contribution to shear modulus of granular materials" Phys. Rev. E **90**, 042202 (2014) [9 pages]
9. Kiyoshi Kanazawa, Takahiro Sagawa, and Hisao Hayakawa, "Energy pumping in electrical circuits under avalanche noise", Phys. Rev. E **90**, 012115 (2014) [8 pages]

Books and Proceedings

1. Koshiro Suzuki and Hisao Hayakawa, "Rheology of dense sheared granular liquids (invited)" AIP Conf. Proc. **1628**, 457-466 (2014), Proceedings of the 29th. international symposium on Rarefied Gas Dynamics, edited by Jing Fan.

Talks at International Conferences

1. Hisao Hayakawa, "Rheology of dense sheared granular liquids: A mode-coupling approach (invited)", in the 19th international symposium on Rarefied Gas Dynamics at Xian, China (2014, July 13-18). .
2. Hisao Hayakawa, "Rheology of Dense Granular Flow: Drag law of a moving tracer (invited, plenary)", in the Continuous modeling of discrete systems 13, at Salt-Lake City, UT, USA (2014, July 21-25) .
3. Hisao Hayakawa, "Shear modulus caused by stress avalanches for jammed granular materials under oscillatory shear (invited)", in Avalanches, Intermittency, Non-linear Responses in Far-From-Equilibrium Solids (2014, September 14- December 14)
4. Hisao Hayakawa, "Non-equilibrium Statistical Mechanics of Sheared Dense Granular Flow: Fluctuation theorem and mode-coupling theory for nonlinear rheology (invited)" in Frontiers of Statistical Mechanics: from Non-Equilibrium Fluctuations to Active Matter at YITP Kyoto University, Kyoto, Japan (2015, Feb 4-17)
5. Hisao Hayakawa, "Fluctuating motion of a tracer under the influence of dry friction and/or non-Gaussian noise (invited)"

in Frontiers of Statistical Mechanics: from Non-Equilibrium Fluctuations to Active Matter at YITP Kyoto University, Kyoto, Japan (2015, Feb 4-17)

6. Hisao Hayakawa, "Rheology of avalanched granular materials" in Physics of Structural and Dynamics Hierarchy in Soft Matter at The Institute of Industrial Science, the University of Tokyo, Tokyo, Japan (2015, March 16-18)
7. Hisao Hayakawa, "Mode-coupling theory for sheared dense granular liquids (invited)" in Mini-workshop on the physics of amorphous solids at The Institute of Industrial Science, the University of Tokyo, Tokyo, Japan (2015, March 20)
8. "Linking center symmetry and chiral symmetry," Invited, Plenary, in "4th International Symposium on Symmetries in Subatomic Physics," National Taiwan University, Taipei, Taiwan, June 2009.

Invited Seminars (Overseas)

1. Lecture on " Granular Gases, Jamming Transition, and Jammed Solids (3 days lecture)" at Shanghai Jiao Tong University, March 30-April 2, 2015.

Invited Seminars (in Japan)

1. " Non-equilibrium identities and nonlinear response theory for dissipative classical systems ," at OIST (2014, March 11).
2. "Stress Avalanches in Jammed Solids,' ' at YITP (2014, September 19).
3. "Topological P and CP Violation in Heavy-Ion Collisions," Dept. of Phys., Tokyo Metropolitan Univ., January 2010 (in Japanese).

Takashi Hiramatsu

Journal Papers

1. A. Taruya, T. Nishimichi, F. Bernardeau, T. Hiramatsu and K. Koyama, "Regularized cosmological power spectrum

- and correlation function in modified gravity models,”
Phys. Rev. **D90** (2014) 123515, arXiv:1408.4232 [astro-ph], YITP-14-63.
- R. Saito, A. Naruko, T. Hiramatsu and M. Sasaki,
“Geodesic it curve-of-sight formulae for the cosmic microwave background: a unified treatment of redshift, time delay, and lensing,”
J. Cosmol. Astropart. Phys. **1410** (2014) 051, arXiv:1409.2464 [astro-ph], YITP-14-70.
 - T. Hiramatsu, Y. Miyamoto and J. Yokoyama,
“Effects of thermal fluctuations on thermal inflation,”
J. Cosmol. Astropart. Phys. **1503** (2015) 024, arXiv:1412.7814 [hep-ph], YITP-14-100.

Talks at International Conferences

- “progress of code development : 2nd-order Einstein-Boltzmann solver for CMB anisotropy,”
in “24th JGRG,” Kavli IPMU, Kashiwa, JAPAN,
10-14 November 2014.
- “progress of code development : 2nd-order Einstein-Boltzmann solver for CMB anisotropy,”
in “Relativistic Cosmology,” YITP, Kyoto, JAPAN,
8-19 September 2014.

Invited Seminars (in Japan)

- “progress of code development : 2nd-order Einstein-Boltzmann solver for CMB anisotropy,”
Dept. of Phys., Kobe Univ., October 2014.
- “Field-theoretical simulations of cosmic strings,”
Dept. of Phys., Osaka City Univ., February 2015.

Tetsuo Hyodo

Journal Papers

- T. Hyodo, T. Hatsuda and Y. Nishida,
“Universal physics of three bosons with isospin,”
Phys. Rev. **C89** (2014) 032201 (5 pages), arXiv:1311.6289 [hep-ph], YITP-13-121.
- Y. Yamaguchi, S. Ohkoda, A. Hosaka, T. Hyodo and S. Yasui,
“Heavy quark symmetry in multi-hadron systems,”
Phys. Rev. **D91** (2015) 034034 (32 pages), arXiv:1402.5222 [hep-ph], YITP-14-16.
- T. Hyodo,
“Hadron mass scaling near the s-wave threshold,”
Phys. Rev. **C90** (2014) 055208 (10 pages), arXiv:1407.2372 [hep-ph], YITP-14-55.

Talks at International Conferences

- “Universal physics of three bosons with isospin,” Invited,
in “Hadron physics symposium,” Nagoya Univ., Japan, April 2014
- “Toward realistic prediction of the $\Lambda(1405)$ production in K-d reaction,” Invited,
in “HaPhy-CLAS Workshop on Hadron Productions,” Daegu, Korea, August 2014
- “Structure of near-threshold hadrons,” Invited,
in “International Workshop on Critical Stability in Few-Body Systems,” RIKEN, Japan, January 2015

Invited Seminars (in Japan)

- “Universal physics of three bosons with isospin,”
Nagoya Univ., June 2014.
- “Compositeness of hadrons and near-threshold dynamics,”
KEK Tsukuba., June 2014.

Naoyuki Itagaki

Journal Papers

- J. M. Yao, N. Itagaki, and J. Meng, “Searching for 4 alpha linear-chain structure in excited states of ^{16}O with a covariant density

functional theory," *Phys. Rev. C* **90** (2014) 054307, (9 pages), arXiv:1403.7940 [nucl-th].

2. T. Ichikawa, K. Matsuyanagi, J.A. Maruhn, and N. Itagaki, "High-spin torus isomers and their precession motions," *Phys. Rev. C* **90** (2014) 034314, (11 pages), arXiv:1408.0360 [nucl-th].

Talks at International Conferences

1. "Exotic structure in light nuclei, " Invited, Plenary, in "Korea Physical Society Meeting," Kim Daejung Convention Center, Gwangju, Korea, September 2014.

Ken-iti Izawa

Journal Papers

1. K.-I. Izawa, "Fine tunings for inflation with simple potentials," *PTEP* **2014** (2014) 113B05 (6 pages), YITP-14-54, arXiv:1407.2328 [hep-ph].

Hiroshi Kunitomo

Journal Papers

1. H. Kunitomo, "First Order Equations of Motion for Heterotic String Field Theory," *Prog. Theor. Exp. Phys.* **2014** (2014) , 093B07 (20 pages), YITP-14-52, arXiv:1407 [quant-ph].
2. H. Kunitomo, "Symmetries and Feynman Rules for Ramond Sector in Open Superstring Field Theory," *Prog. Theor. Exp. Phys.* **2014** (2014) 033B11 (22 pages), YITP-14-106, arXiv:1412.5281 [hep-th].

Talks at International Conferences

1. "The Ramond Sector of Heterotic String Field Theory" Invited in "String Field Theory and Related Aspects VI," SISSA, Trieste, Italy, July 21 - August 1 2014.

Talks at Domestic Conferences

1. "Symmetries and Feynman Rules for Ramond Sector in WZW-type Superstring Field Theories" (in Japanese) Invited in "String Field Theory 2015," Nara Women's U., Nara, Japan, March 5 - 6 2015.

Invited Seminars (in Japan)

1. "The Ramond Sector of Heterotic String Field Theory" May 21, 2014 (in Japanese), Univ. of Tokyo, Komaba, Japan.

Masatoshi Murase

Journal Papers

1. M. Murase and T. Murase, "Structuralism Revisited: On the Basis of Self-nonselself Circulation Theory" *Journal of Quality Education* Vol.6, 27-49, 2014.
2. T. Murase and M. Murase, "The significance of Meta-cognitive Learning in Educational Process: An Analogy between Educational Process and Recovery Process from Illness" *Journal of Quality Education*, Vol.6, 51-68, 2014.
3. T. Murase and M. Murase, "Construction of Self-nonselself Circulation Nursing Theory" *Toyota Red-Cross College* Vol.10, 69-85, 2015.

Talks at International Conferences

1. M. Murase, International Workshops on "Science of Complexity" held at Yukawa Institute for Theoretical Physics, Kyoto University on January 20-21, 2014

Organizer of International Conferences

1. M. Murase, with K. Nishimura and S. Ohno, International Workshop on "Science Education", Date: March. 11 (Wed.), 2015, 15:00 - 20:00, Place: Kyoto University Meusium.

Organizer of Interdisciplinary Conferences

1. M. Murase, with E. Yamaguchi, J. Yamagiwa, M. Takada, and K. Hasegawa
The interdisciplinary workshops on “What are the required talents for Globalization?” at Advanced Scientific Technology & Management Research Institute of Kyoto (ASTEM) on January 23, 2014.
2. M. Murase, with E. Yamaguchi, J. Yamagiwa, M. Takada, and K. Hasegawa
The interdisciplinary workshops on the Kyoto Arts & Education Forum on “A Dialogue between Arts and Science” at Yukawa Institute for Theoretical Physics, Kyoto University on January 25, 2014.
3. M. Murase, with E. Yamaguchi, J. Yamagiwa, M. Takada, and K. Hasegawa
The Kyoto Forum on “New Energy from a Point of View of Fukushima” at Yukawa Institute for Theoretical Physics, Kyoto University on February 22, 2014.
4. M. Murase, with E. Yamaguchi, J. Yamagiwa, M. Takada, and K. Hasegawa
The interdisciplinary workshops on “Arts” at Advanced Scientific Technology & Management Research Institute of Kyoto (ASTEM) on March 27, 2014.
5. M. Murase, with E. Yamaguchi, J. Yamagiwa, M. Takada, and K. Hasegawa
The interdisciplinary workshops on “Innovation of Science and Technology” at Advanced Scientific Technology & Management Research Institute of Kyoto (ASTEM) on May 22, 2014.
6. M. Murase, with E. Yamaguchi, J. Yamagiwa, M. Takada, and K. Hasegawa
The interdisciplinary workshops on “Population of Japan” at Advanced Scientific Technology & Management Research Institute of Kyoto (ASTEM) on June 26, 2014.
7. M. Murase, with N. Morishita
The interdisciplinary symposium on “Ethics and Medicine” at International Conference Room, Kyoto University Clock Tower on June 14-15, 2014.
8. M. Murase, with E. Yamaguchi, J. Yamagiwa
The interdisciplinary symposium on “Integrated Science” at Kyoto University on July 2, 2014.
9. M. Murase, with E. Yamaguchi, J. Yamagiwa, M. Takada, and K. Hasegawa
The interdisciplinary workshops on “Japanese Politics” at Advanced Scientific Technology & Management Research Institute of Kyoto (ASTEM) on July 24, 2014.
10. M. Murase, with K. Nishimura, Y. Gunji, T. Murase, K. Utsumi, K. Kawaguchi,
The interdisciplinary symposium on “Science and Education” at International Conference Room, Kyoto University Clock Tower on July 24, 2014.
11. M. Murase, with T. Saeki, T. Murase, K. Ikeda
The interdisciplinary symposium on “Cognition, Life and Physical World” at IMPACT HUB KYOTO on August 30, 2014.
12. M. Murase, with E. Yamaguchi, J. Yamagiwa, M. Takada, and K. Hasegawa
The interdisciplinary workshops on “Medical Science in Japan: Mind” at Kyoto University on September 25, 2014.
13. M. Murase, with T. Saeki, T. Murase, K. Saeki
The interdisciplinary symposium on “Integrated Science and Cognitive Science” at IMPACT HUB KYOTO on October 19, 2014.
14. M. Murase, with E. Yamaguchi, J. Yamagiwa, M. Takada, and K. Hasegawa
The interdisciplinary workshops on “iPS Cells and Cellular Biology on the basis of Current Technology” at Kyoto University on October 30, 2014.
15. M. Murase, with N. Imai, T. Murase
The interdisciplinary workshops on “Medical Science, Life Science, and Social Science” at Mie University supported by Kyoto University SPRITIRS Project on New Integrated Creative Sciences (Project Leader: Masatoshi Murase) on October 30, 2014.
16. M. Murase, with E. Yamaguchi
The interdisciplinary workshops on “Life

Science and Philosophy Towards a New Synthesis of Knowledge” at Kyoto University on November 13, 2014.

17. M. Murase, with E. Yamaguchi, M. Takada, and K. Hasegawa
The interdisciplinary workshops on “How can we define our future planning” at Kyoto University on November 27, 2014.
18. M. Murase, with E. Yamaguchi, M. Takada, and K. Hasegawa
The interdisciplinary workshops on “Agriculture” at Kyoto University on December 24, 2014.
19. M. Murase, with E. Yamaguchi, M. Takada, and K. Hasegawa
Invited Speaker: Masatoshi Murase; The interdisciplinary workshops on “Metabiology and Integrated Science” at Kyoto University on February 26, 2014.
20. M. Murase, with E. Yamaguchi, M. Takada, Y. Gunji and K. Hasegawa
The interdisciplinary workshops on “What is Complexity?” at Kyoto University on March 26, 2014.

Invited and Public Lectures (in Japan)

1. M. Murase, "Integrated Life Science and Medicine,"
Mie University, Graduate School of Medicine, May, 16, 2014.
2. M. Murase, "Life Science and Biological Physics"
Kyoto University Salon Talk, Kyoto University Clock Tower, June 10, 2014.
3. M. Murase, “Structuralism and Living Systems,”
Yukawa Institute for Theoretical Physics, Kyoto University, July 18, 2014.
4. M. Murase, "Kyoto University Academic Day 2014,"
Kyoto University, Kyoto University Clock Tower, Sep.26, 2014.
5. M. Murase, "Physics on Complexity and Living Systems”
Ritsumeikan University, Sep.8-12, 2014.

6. M. Murase, “Structuralism and biophysics,”
Yukawa Institute for Theoretical Physics, Kyoto University, October. 16, 2014.
7. M. Murase, “Biophysics and Applications,”
Yukawa Institute for Theoretical Physics, Kyoto University, December. 25, 2014.

Daisuke Nomura

Journal Papers

1. K. Nakamura and D. Nomura,
“Charged Lepton Flavor Violation in the Semi-Constrained NMSSM with Right-Handed Neutrinos,”
Phys. Lett. **B746** (2015) 396-405,
arXiv:1501.05058 [hep-ph], YITP-14-108.

Talks at International Conferences

1. “Theoretical status of muon $g - 2$ in SM and BSM,” Invited,
at “The 8th collaboration meeting on muon $g - 2$ /EDM experiments at J-PARC,” KEK, Tsukuba, Japan
July 17-19, 2014
2. “ $g - 2$: Theory,” Invited,
at “Belle II Theory Interface Platform (B2TiP) meeting,” KEK, Tsukuba, Japan
October 30-31, 2014
3. “Theoretical updates on muon $g - 2$,” Invited,
at “The 9th collaboration meeting on muon $g - 2$ /EDM experiments at J-PARC,” KAIST, South Korea
November 6–8, 2014

Invited Seminars (in Japan)

1. “Theory of Muon $g - 2$,”
Dept. of Phys., Kyoto Univ., May 21 2014
(in Japanese).
2. “Current status and prospects of muon fundamental physics,”
at the workshop “New developments in muon science at J-PARC MUSE” KEK Tokai campus, Ibaraki, July 30 2014 (in Japanese).
3. “Status of Standard Model prediction for muon $g - 2$,”

at the workshop “CP violation in elementary particles and composite systems,” RCNP, Osaka Univ., November 10-11, 2014 (in Japanese)

Akira Ohnishi

Journal Papers

1. Hajime Sotani, Kei Iida, Kazuhiro Oyama, and Akira Ohnishi, “Mass and radius formulas for low-mass neutron stars”, *Prog. Theor. Exp. Phys.* **2014** (2014), 051E01 [8 pages], YITP-13-86, arXiv:1401.0161 [astro-ph.HE].
2. Kenji Morita, Takenori Furumoto, Akira Ohnishi, “Lambda-Lambda interaction from relativistic heavy-ion collisions”, *Phys. Rev. C* **91** (2015), 024916 [16 pages], YITP-14-67, arXiv:1408.6682 [nucl-th].
3. Chikako Ishizuka, Takuma Suda, Hideyuki Suzuki, Akira Ohnishi, Kohsuke Sumiyoshi, Hiroshi Toki, “EOSDB: The Database for Nuclear EoS”, *Publ. Astron. Soc. Japan* **67** (2015), 13 [17 pages], arXiv:1408.6230 [nucl-th].
4. Terukazu Ichihara, Akira Ohnishi, Takashi Z. Nakano, “Auxiliary field Monte-Carlo simulation of strong coupling lattice QCD for QCD phase diagram”, *Prog. Theor. Exp. Phys.* **2014** (2014), 123D02 [23 pages], YITP-14-2, arXiv:1401.4647 [hep-lat].

Books and Proceedings

1. Terukazu Ichihara, Akira Ohnishi, “Fluctuation effects on QCD phase diagram at strong coupling”, *PoS LATTICE2014* (2014), 188, YITP-14-74, arXiv:1503.07049 [hep-lat].

Talks at International Conferences

1. “Entropy production in the classical Yang-Mills theory as the coherent state dynamics”, Invited, in “RBRC workshop on The Approach to Equilibrium in Strongly Interacting Matter”, BNL, USA, April 2014.
2. “Hadron physics & Astrophysics (From Exotic Hadron to Neutron Star Matter EOS)”, Invited, in “Hadron physics symposium”, Nagoya, Japan, April 2014.

3. “Phase diagram at strong coupling”, Invited, in “The 5th Asian Triangle Heavy ion Conference 2014 (ATHIC 2014)”, Osaka, Japan, August 2014.
4. “Neutron star matter equation of state — current status and challenges —”, Invited, in “Mini-Symposium on Nuclear Matter in Neutron Stars I (EoS and Structure), 4th Joint Meeting of the APS Division of Nuclear Physics, and the Physical Society of Japan”, Waikoloa, Hawaii, USA, October 2014.
5. “Neutron star matter EOS in RMF with multi-body couplings”, in “YITP long-term workshop on Hadrons and Hadron Interactions in QCD — Effective theories and Lattice — (HHIQCD2015)” Kyoto, Japan, February-March, 2015.

Invited Seminars (in Japan)

1. “Physics of Dense Matter and Neutron Stars”, Intensive lectures in Department of Physics, Kyushu University, Japan, July 2014.
2. “Physics of Dense Matter and Neutron Stars”, Intensive lectures in Department of Physics, Osaka University, Japan, July-August 2014.
3. “QCD, Chaos and Entropy Production”, in “Turbulence, Chaos, and Gravity”, Department of Physics, Osaka University, Japan, January 2015.
4. “Collective Flows at J-PARC Energies”, in “New physics opportunities opened by heavy-ion collision experiments at J-PARC”, KEK, Tsukuba, Japan, November 2014.

Misao Sasaki

Journal Papers

1. R. Saito, A. Naruko, T. Hiramatsu and M. Sasaki, *JCAP* **1410**, no. 10, 051 (2014) [arXiv:1409.2464 [astro-ph.CO]].
2. J. White, Y. I. Zhang and M. Sasaki, *Phys. Rev. D* **90**, no. 8, 083517 (2014) [arXiv:1407.5816 [astro-ph.CO]].

3. M. Sasaki and D. h. Yeom, *JHEP* **1412**, 155 (2014) [arXiv:1404.1565 [hep-th]].
4. S. Young, C. T. Byrnes and M. Sasaki, *JCAP* **1407**, 045 (2014) [arXiv:1405.7023 [gr-qc]].
5. M. B. Frob, J. Garriga, S. Kanno, M. Sasaki, J. Soda, T. Tanaka and A. Vilenkin, *JCAP* **1404**, 009 (2014) [arXiv:1401.4137 [hep-th]].
4. “Reviving Open Inflation” ASC, Ludwig Maximilians University, Munich, Germany, 28 August, 2014.
5. “Reviving Open Inflation” University of Victoria, Victoria, Canada, 14 January, 2015.
6. “Reviving Open Inflation” The University of British Columbia, Vancouver, Canada, 15 January, 2015.

Talks at International Conferences

1. “Open Inflation Reviving,” Invited, in “Cosmological Quests for the Next Decade,” KASI, Daejeon, Korea, 16 April, 2014.
2. “Open Inflation Reviving,” Invited, in “IAS Workshop on New Perspectives on Cosmology,” HKUST, Hong Kong, 21 May, 2014.
3. “Open Inflation Reviving,” Plenary, in “The 5th Siam GR+HEP+Cosmo and Theoretical Physics Symposium,” Naresuan University, Phitsanulok, Thailand, 22 July, 2014.
4. “Cosmic inflation and its predictions,” Invited, in “2nd International Workshop on Theoretical Physics and Computational Physics,” Buon Ma Thuot, Vietnam, 30 July, 2014.
5. “Theory of cosmological perturbations,” Invited Lectures, in “W.E. Heraeus Summer School “Saalburg” for Graduate Students on “Foundations and New Methods in Theoretical Physics,” Wolfersdorf, Germany, 1,2,3 September, 2014.
6. “Creation of Universe in Bigravity,” Invited, in “Testing Gravity 2015,” SFU Harbour Center, Vancouver, Canada, 15 January, 2015.

Invited Seminars (Overseas)

1. “Recent trends in cosmology” Invited Lecture, Kunsan University, Kunsan, Korea, 29 April and 1 May, 2014.
2. “Open Inflation Reviving” Colloquium, University of California Davis, Davis, United States, 2 June, 2014.
3. “Recent trends in cosmology” Hanoi National University of Education, Hanoi, Vietnam, 25 July, 2014.

7. “Cosmological Perturbation Theory” Short Course on Advanced Topics in Cosmology, Institute for Fundamental Study, Naresuan University, Phitsanulok, Thailand, 27, 28 February and 1 March, 2015.

Naoki Sasakura

Journal Papers

1. N. Sasakura and Y. Sato, “Ising model on random networks and the canonical tensor model,” *PTEP* **2014**, no. 5, 053B03 (2014), YITP-14-3, arXiv:1401.7806 [hep-th].
2. N. Sasakura and Y. Sato, “Exact Free Energies of Statistical Systems on Random Networks,” *SIGMA* **10**, 087 (2014), YITP-14-9, arXiv:1402.0740 [hep-th].
3. G. Narain, N. Sasakura and Y. Sato, “Physical states in the canonical tensor model from the perspective of random tensor networks,” *JHEP* **1501**, 010 (2015), YITP-14-73, arXiv:1410.2683 [hep-th].
4. N. Sasakura and Y. Sato, “Renormalization procedure for random tensor networks and the canonical tensor model,” *PTEP* **2015**, no. 4, 043B09 (2015), YITP-15-3, arXiv:1501.05078 [hep-th].

Books and Proceedings

1. N. Sasakura, “Quantization of the canonical tensor model and an exact wave function,” *J.Phys.Conf.Ser.* **490** **2014** 012014.

Invited Seminars (Overseas)

1. “Canonical tensor model, and its relation to general relativity, and random tensor network,”
LPT, Université Paris-Sud, France, March 2015.
2. “Canonical tensor model, and its relation to general relativity, and random tensor network,”
CPT, Aix Marseille Université, France, March 2015.

Invited Seminars (in Japan)

1. “Exact solutions to the Wheeler-DeWitt equation of the canonical tensor model - An approach from the statistical systems on random networks,”
Keio University, September 2014 (In the meeting “Discrete approaches to dynamics of field and space-time”, in Japanese).
6. H. Witek, H. Okawa, V. Cardoso, L. Gualtieri, C. Herdeiro, M. Shibata, U. Sperhake, and M. Zilhao,
“Higher dimensional Numerical Relativity: code comparison”,
Phys. Rev. D. **90** (2014) 084014.
7. K. Taniguchi, M. Shibata, and A. Buonanno,
“Quasi-equilibrium sequences of binary neutron stars undergoing dynamical scalarization”,
Phys. Rev. D **91** (2015) 024033.
8. Y. Sekiguchi, K. Kiuchi, K. Kyutoku, and M. Shibata,
“The dynamical mass ejection from binary neutron star mergers: Radiation-hydrodynamics study in general relativity”,
Phys. Rev. D **91** (2015) 064059.

Masaru Shibata

Journal Papers

1. M. Shibata, K. Taniguchi, H. Okawa, and A. Buonanno,
“Coalescence of binary neutron stars in a scalar-tensor theory of gravity”,
Phys. Rev. D **89** (2014) 084005.
2. M. Shibata, H. Nagakura, Y. Sekiguchi, and S. Yamada,
“Conservative form of Boltzmann’s equation in general relativity”,
Phys. Rev. D **89** (2014) 084073.
3. S. Wanajo, Y. Sekiguchi, N. Nishimura, K. Kiuchi, K. Kyutoku, and M. Shibata,
“Production of all the r-process nuclides in the dynamical ejecta of neutron star mergers”,
Astrophys. J. Lett. **789** (2014) L39.
4. K. Kiuchi, K. Kyutoku, Y. Sekiguchi, M. Shibata, and T. Wada,
“High-resolution numerical-relativity simulations for the merger of binary magnetized neutron stars”,
Phys. Rev. D **90** (2014) 041502(R).
5. K. Kyutoku, M. Shibata, and K. Taniguchi,
“Reducing orbital eccentricity in initial data of binary neutron stars”,
Phys. Rev. D **90** (2014) 064006.

Talks at International Conferences

9. K. Hotokezaka, K. Kyutoku, H. Okawa, and M. Shibata,
“Exploring tidal effects of coalescing binary neutron stars in numerical relativity II: Longterm simulation”,
Phys. Rev. D **91** (2014) 064060.
1. “Merger of binary neutron stars: Gravitational waves and electromagnetic counterparts” in “Binary Neutron Star Coalescence as a Fundamental Physics Laboratory”, INT, Seattle, USA, July 10, 2014. (invited)
2. “Binary neutron star mergers: Gravitational waves and electromagnetic counterparts” in “Spanish relativity meeting”, Valencia, Spain, September 1, 2014. (invited)
3. “Binary neutron star mergers: Gravitational waves and electromagnetic counterparts” in “NEB 16 - RECENT DEVELOPMENTS IN GRAVIT”, Mykonos, September 19, 2014. (invited)
4. “Merger of binary neutron stars in numerical relativity” in “Advances and perspectives in computational nuclear physics”, Hawaii, October 7, 2014. (invited)
5. “Merger of binary neutron stars: Gravitational waves and electromagnetic counterpart” in “Conclusion Workshop

of SFB/TR7 "Gravitational Wave Astronomy", Jena, December 4, 2014. (invited)

Invited Seminars (in Japan)

1. "Binary neutron star mergers: Gravitational waves and electromagnetic counterparts", at NAOJ, Nov. 14 (2014).

Masaki Shigemori

Journal Papers

1. J. de Boer, D. R. Mayerson and M. Shigemori, "Classifying Supersymmetric Solutions in 3D Maximal Supergravity," *Class. Quant. Grav.* **31** (2014) 235004 (48 pages), arXiv:1403.4600 [hep-th].
2. S. Hirano, K. Nii and M. Shigemori, "ABJ Wilson loops and Seiberg duality," *PTEP* **2014** (2014) 113B04 (62 pages), YITP-14-49, arXiv:1406.4141 [hep-th].
3. I. Bena, M. Shigemori and N. P. Warner, "Black-Hole Entropy from Supergravity Superstrata States," *JHEP* **1410** (2014) 140 (37 pages), YITP-14-36, arXiv:1406.4506 [hep-th].

Talks at International Conferences

1. "The Black Hole Puzzle and String Theory," Invited, in "Sweden-Kyoto Symposium, Session 9: Outstanding Young Researchers—Academic Diversity, Academic Freedom," Uppsala University, Sweden, September 2014.
2. "Black holes and exotic branes in string theory," Invited, "Advanced String School 2014," Puri, India, September 2014.

Invited Seminars (in Japan)

1. "Toward construction of supergravity superstrata states," Sixth Shizuoka Intensive Lectures on Particle Physics, Shizuoka University, Japan, December 2014.

2. "Black hole spacetimes in string theory and supergravity," Dept. of Phys., Tohoku University, May 2014.
3. "Classifying codimension-2 branes in three dimensions," Dept. of Phys., Tohoku University, May 2014.

Shigeki Sugimoto

Talks at International Conferences

1. "Towards a holographic dual of 3 dim YM-CS theory with defects (and 2 dim QCD)," Invited, in "Integrability in gauge-gravity duality and strong coupling dynamics of gauge theory," Kyoto Univ., Kyoto September 2014.
2. "On a holographic description of 3 dim Yang-Mills-Chern-Simons theory with defects," Invited, in "Aspects of holography" APCTP, Pohang, Korea, July 2014.

Yudai Suwa

Journal Papers

1. Y. Suwa, "From supernovae to neutron stars," *Publ. Astron. Soc. Japan*, **66** (2014) L1 (6 pages), arXiv:1311.7249 [astro-ph.HE].
2. T. Takiwaki, K. Kotake, and Y. Suwa, "A Comparison of Two- and Three-dimensional Neutrino-hydrodynamics Simulations of Core-collapse Supernovae," *Astrophys. J.*, **786** (2014) 83 (8 pages), arXiv:1308.5755 [astro-ph.HE].
3. Y. Suwa and T. Enoto, "Anisotropic neutrino effect on magnetar spin: constraint on inner toroidal field," *Mon. Not. Roy. Astron. Soc.*, **443** (2014) 3586-3593, arXiv:1407.4653 [astro-ph.HE], YITP-14-58.
4. T. Nakamura, K. Kashiyama, D. Nakauchi, Y. Suwa, T. Sakamoto, and N. Kawai,

“Soft X-ray Extended Emissions of Short Gamma-Ray Bursts as Electromagnetic Counterparts of Compact Binary Mergers; Possible Origin and Detectability,” *Astrophys. J.*, 796 (2014) 13 (10 pages); arXiv:1312.0297 [astro-ph.HE].

Talks at International Conferences

1. “Physical ingredients of core-collapse supernovae driven by neutrino heating,” in “17th Workshop on Nuclear Astrophysics,” Ringberg Castle, Munich, Germany, April 2014.
2. “Gravitational Waves and Neutrinos from Central Engine of Gamma-Ray Bursts,” in “Gamma-Ray Bursts in the Multimessenger Era,” IPGP, Paris, France, June 2014.
3. “Multi-dimensional Simulations of Core-Collapse Supernovae,” in “Ramses Users Meeting 2014,” CEA Saclay, Paris, France, June 2014.
4. “What can we learn from gravitational waves from nearby core-collapse supernovae?,” in “The Spanish Relativity Meeting 2014,” University of Valencia, Valencia, Spain, September 2014.
5. “On Multi-Messenger Time Domain Astronomy of Core-Collapse Supernovae,” in “Conclusion Workshop of SFB/TR7 ‘Gravitational Wave Astronomy,’” Friedrich-Schiller-Universitaet Jena, Jena, Germany, December 2014.

Invited Seminars (Overseas)

1. “Physical ingredients of core-collapse supernova driven by neutrino heating,” CEA Saclay, Paris, France, June 2014.
2. “Neutrino acceleration in collapsars,” University of Valencia, Valencia, Spain, September 2014.
3. “Topics associated with formation of magnetars,” University of Basel, Basel, Switzerland, November 2014.

4. “Neutrino acceleration: analogy with Fermi acceleration and bulk Comptonization,” Max Planck Institute for Astrophysics, Garching, Germany, January 2015.

Fumihito Takayama

Journal Papers

1. T. Kobayashi, A. Ogasahara, Y. Omura, F. Takayama and D. Yasuhara, “Revisiting discrete dark matter model: $\theta_{13} \neq 0$ and ν_R dark matter,” *JHEP* **1410** (2014) 183 (31 pages), YITP-14-40, arXiv:1405.3592 [hep-ph].

Talks at International Conferences

1. “Revisiting Discrete Dark Matter Model; non-zero θ_{13} and ν_R dark matter,” in “Dark Side of the Universe 2014 workshop,” University of Cape Town, Cape Town, South Africa, November 2014.

Tadashi Takayanagi

Journal Papers

1. S. He, T. Numasawa, T. Takayanagi and K. Watanabe, “Quantum dimension as entanglement entropy in two dimensional conformal field theories,” *Phys. Rev. D* **90** (2014) 4, 041701 [arXiv:1403.0702 [hep-th]].
2. A. Mollabashi, N. Shiba and T. Takayanagi, “Entanglement between Two Interacting CFTs and Generalized Holographic Entanglement Entropy,” *JHEP* **1404** (2014) 185 [arXiv:1403.1393 [hep-th]].
3. P. Caputa, M. Nozaki and T. Takayanagi, “Entanglement of local operators in large-N conformal field theories,” *PTEP* **2014** (2014) 9, 093B06 [arXiv:1405.5946 [hep-th]].
4. P. Caputa, J. Simon, A. Stikonas and T. Takayanagi, “Quantum Entanglement of Localized Excited States at Finite Temperature,” *JHEP* **1501** (2015) 102 [arXiv:1410.2287 [hep-th]].

Talks at International Conferences

1. “Entanglement Entropy and Spacetime,” Invited, Lectures at Spring School on Superstring Theory and Related Topics, Trieste, Italy, March 31th-April 2nd, 2014.
2. “Quantum Entanglement and Local Operators,” Invited, Strings 2014, Princeton, U.S.A., June 23th-June 27th, 2014.
3. “Time evolution of entanglement entropy for local operator excitations in conformal Field Theories,” Invited, Conference on Non-equilibrium Phenomena in Condensed Matter and String Theory, Trieste, Italy, June 30th-July 4th, 2014.
4. “Holographic Entanglement between Two Interacting CFTs,” Invited, Aspen Summer Workshop: Emergent Spacetime in String Theory, Aspen, USA, July 6-Aug 3, 2014.
5. “Holographic Spacetimes from Entanglement Renormalization,” Invited, YITP Workshop on Quantum Information Physics (YQIP2014), Kyoto, Japan, Aug. 4th-7th, 2014.
6. “Entanglement Renormalization for General CFTs,” Invited, Workshop: ‘Quantum Information in Quantum Gravity’, UBC, Canada, Aug.18th-Aug.22th, 2014.
7. “Entanglement Entropy and Spacetime Geometry,” Invited, 20th European Workshop on String Theory, Mainz, Germany, Sep. 22th-Sep. 26th, 2014.
8. “Time Evolution of Entanglement Entropy for Locally Excited States,” Invited, NCTS Program on Topological Aspects of Quantum Matter, Hsinchu, Taiwan, Dec.8-12, 2014.
9. “A proposal for Surface/State correspondence from quantum entanglement,” Invited, Entangle This: Space, Time and Matter, IFT, Madrid, Spain, Feb. 16-20, 2015.
10. “Quantum Entanglement of Locally Excited States,” Invited, Simons Symposium on Quantum Entanglement, Rio Grande, Puerto Rico, Mar.15-21, 2015.

Atsushi Taruya

Journal Papers

1. Y-S. Song, T. Okumura, A. Taruya, “Broadband Alcock- Paczynski test exploiting redshift distortions,” *Phys. Rev.* **D89** (2014) 103541 (13 pages), arXiv:1309.1162 [astro-ph].
2. F. Bernardeau, T. Nishimichi, A. Taruya, “Cosmic shear full nulling: sorting out dynamics, geometry and systematics,” *Mon. Not. Royal. Soc.* **445** (2014) 1526-1537, arXiv:1312.0430 [astro-ph].
3. A. Taruya, T. Nishimichi, F. Bernardeau, T. Hiramatsu, K. Koyama, “Regularized cosmological power spectrum and correlation function in modified gravity models,” *Phys. Rev.* **D90** (2014) 123515 (23 pages), YITP-14-63, arXiv:1408.4232 [astro-ph].
4. T. Kashiwagi, Y. Suto, A. Taruya, I. Kayo, T. Nishimichi, and K. Yahata “Modeling the Anomaly of Surface Number Densities of Galaxies on the Galactic Extinction Map due to Their FIR Emission Contamination,” *Astrophys. J.* **799** (2015) 132 (18 pages), YITP-14-101, arXiv:1412.0354 [astro-ph].
5. T. Namikawa, D. Yamauchi, A. Taruya, “Future detectability of gravitational-wave induced lensing from high-sensitivity CMB experiments,” *Phys. Rev.* **D91** (2015) 043531 (9 pages), YITP-14-92, arXiv:1411.7427 [astro-ph].

Talks at International Conferences

1. “Cosmic propagators –powerful tools to characterize large-scale structure–,” Invited, in CosKASI conference “Cosmological Quests for the Next Decade,” Astronomy and Space science Institute, Daejeon, Korea, April 2014.
2. “RSD as a probe of gravity –theoretical challenge and characterization–,” Invited, in CosKASI workshop “Cosmological Quests for the Next Decade,” Astronomy

and Space science Institute, Daejeon, Korea,
April 2014.

3. “Cosmological test of gravity and dark energy with large-scale structure,” Invited, in workshop on “Cosmological frontiers in fundamental physics 2014,” AstroParticule et Cosmologie, Paris 7 University, Paris, France, June 2014.
4. “Searching for primordial gravitational waves with cosmic microwave background polarization,” Invited, in “Summer Institute 2014 – Phenomenology of Elementary Particles and Cosmology–,” Fujiyoshida, Japan, August 2014.
5. “Nonlinear mode-coupling of large-scale structure,” Invited, in YITP molecule-type workshop on “Relativistic Cosmology,” YITP-T-14-04, Japan, September 2014.
6. “Nonlinear mode-coupling of large-scale structure,” in the 24th workshop on “General Relativity and Gravitation,” Kavli institute for mathematical physics of the Universe, Kashiwa, Japan, November 2014.
7. “Perturbation theory approach to large-scale structure formation: success, limitation and beyond,” Invited, in the 2nd C-SDSS IV meeting, National Astronomical Observatories, Chinese Academy of Sciences, Beijing, China, November 2014.

Seiji Terashima

Journal Papers

1. S. Terashima, “A Localization Computation in Confining Phase,” *JHEP* **1503** (2015) 097, YITP-14-79, arXiv:1410.3630 [hep-th].
2. K. Hashimoto, S. Sugishita and S. Terashima,

“Ramond-Ramond couplings of D-branes,” *JHEP* **1503** (2015) 077, YITP-14-107, arXiv:1501.00995 [hep-th].

Talks at International Conferences

1. “On M5-branes in ABJM theory,” Invited, in “Gauge Theories in Higher Dimensions,” Leibniz University, Hannover, Germany, August 2014.

Invited Seminars (Overseas)

1. “A Localization Computation in Confining Phase,” KIAS, Korea, December 2014.
2. “A Localization Computation in Confining Phase,” Seoul National University, Korea, December 2014.

Invited Seminars (in Japan)

1. “A Localization Computation in Confining Phase,” RIKEN, November 2014.
2. “A Localization Computation in Confining Phase,” Dept. of Phys., Osaka Univ., January 2015.
3. “Topics on exact computations in supersymmetric gauge theories,” RIKEN, February 2015 (in Japanese).

Keisuke Totsuka

Journal Papers

1. V. Bois, S. Capponi, P. Lecheminant, M. Moliner, and K. Totsuka, “Phase diagrams of one-dimensional half-filled two-orbital $SU(N)$ cold fermion systems”, *Phys.Rev.B*, **91** (2015) 075121 (36 pages), arXiv:1410.2974 [cond-mat].

Talks at International Conferences

1. “Symmetry-protected topological Mott phases of ultra-cold fermions in one dimension”, in “New Horizon of Strongly-Correlated Physics”, Institute for Solid State Physics, Kashiwa, Japan, July 2014.

2. “Symmetry-protected topological Mott insulators of ultra-cold fermions in one dimension –entanglement and non-local order parameters”,
in “International seminar Topology and entanglement in correlated quantum systems”,
Max-Planck Institute for Physics of Complex Systems, Dresden, Germany,
July-August 2014.
3. “Realizing symmetry-protected topological phases with $SU(N)$ ultra-cold fermions”,
in “Novel Quantum States in Condensed Matter (NQS2014)”, Yukawa Institute for Theoretical Physics, Kyoto, Japan
November-December 2014.

Invited Seminars (Overseas)

1. “Mott insulating phases of ultra-cold alkaline-earth fermions in one dimension –phase diagram and symmetry-protected topological phases”,
Max-Planck Institute for Solid State Research, Stuttgart, Germany, July 2014.

Invited Seminars (in Japan)

1. “Symmetry-protected topological Mott insulators of ultra-cold fermions in one dimension”,
Yukawa Institute for Theoretical Physics, Kyoto Univ., April 2014.
2. “Realizing symmetry-protected topological phases with $SU(N)$ ultra-cold fermions”,
Institute of Solid State Physics, December 2014.

2.2.3 Publications and Talks by Research Fellows and Graduate Students (April 2014– March 2015)

Guillem Domènech

Journal Papers

1. G. Domènech and M. Sasaki, "Conformal frame dependence of inflation" JCAP **1504 022** (2015) arXiv:1501.07699 [gr-qc], YITP-15-6.

Talks at International Conferences

1. "Conformal frame dependence of inflation", in "JGRG24", IMPU, Tokyo, Japan, December 2014.

Invited Seminars (Overseas)

1. "Conformal frame dependence of inflation" APCTP, Korea, March 2015.

Mitsutoshi Fujita

Journal Papers

1. H. C. Chang, M. Fujita and M. Kaminski, "From Maxwell-Chern-Simons theory in AdS_3 towards hydrodynamics in $1 + 1$ dimensions," JHEP **1410**(2014)118, (53 pages) arXiv:1403.5263 [hep-th].
2. M. Fujita, S. Harrison, A. Karch, R. Meyer and N. M. Paquette, "Towards a Holographic Bose-Hubbard Model," JHEP **1504**(2015)068, (38 pages), YITP-14-87, arXiv:1411.7899 [hep-th].

Talks at International Conferences

1. "Large N orbifold equivalences in 3d CFT," Poster presentation in "Strings 2014," Princeton University, USA, June 2014.

Invited Seminars (Overseas)

1. "Towards a Holographic Bose-Hubbard Model," SISSA, Italy, November 2014

Invited Seminars (in Japan)

1. "Towards a Holographic Bose-Hubbard Model," Nagoya Univ., October 2014
2. "Towards a Holographic Bose-Hubbard Model," Kavli IPMU, October 2014

Naofumi Hama

Journal Papers

1. N. Hama, T. Nishioka and T. Ugajin, "Supersymmetric Renyi entropy in five dimensions," JHEP **1412**, 048 (2014) YITP-14-78, arXiv:1410.2206 [hep-th]. [hep-ph].

Hiroataka Irie

Invited Seminars (in Japan)

1. "Duality Constraints on String Theory," Grad. Sch. of Sci. Math. and Phys., Osaka City University, May 2014 (in Japanese).

Takumi Iritani

Journal Papers

1. T.M. Doi, H. Suganuma, and T. Iritani, "Relation between confinement and chiral symmetry breaking in temporally odd-number lattice QCD", Phys. Rev. **D90** (2014) 094505 (15 pages), arXiv:1405.1289v1 [hep-lat]].

Books and Proceedings

1. T. Iritani, G. Cossu, and S. Hashimoto, "Partial restoration of chiral symmetry inside hadrons", Proceedings of Science (Lattice 2014) (2014) 338 (7 pages), arXiv:1412.2322 [hep-lat].

2. M. Kitazawa, M. Asakawa, T. Hatsuda, T. Iritani, E. Itou, H. Suzuki, “Measurement of thermodynamics using gradient flow”, Proceedings of Science (Lattice 2014) (2014) 022 (15 pages), arXiv:1412.4508 [hep-lat].

Talks at International Conferences

1. “Partial restoration of chiral symmetry and modification of non-perturbative properties inside color flux”, in “Hadrons and Hadron Interactions in QCD 2015”, Kyoto, Japan, March 2015.
2. “Partial restoration of chiral symmetry inside color flux”, Invited, in “High Energy Strong Interactions: A School for Young Asian Scientists”, Central China Normal University, Wuhan, China, September 2014.
3. “Partial restoration of chiral symmetry inside hadrons”, in “The 32nd International Symposium on Lattice Field Theory”, June 23-28, 2014, Columbia University, New York, USA, June 2014.

Invited Seminars (in Japan)

1. “Partial restoration of chiral symmetry inside the color flux-tube”, Dept. of Phys., Tokyo, Tokyo Institute of Technology, June 2014.

Kouji Kashiwa

Journal Papers

1. K. Kashiwa and Y. Tanizaki, “Phase structure of $SU(3)$ gauge-Higgs unification models at finite temperature,” Phys. Rev. **D89** (2014) 116013 (13 pages), arXiv:1403.2265 [hep-ph].

Talks at International Conferences

1. “Investigation of QCD phase structures from imaginary chemical potential region by using effective models,” “Hadrons and Hadron Interactions in QCD 2015,” YITP, Kyoto, Japan, March 2015.

Invited Seminars (in Japan)

1. “Effectiveness of the imaginary chemical potential for investigations of QCD phase diagram (in Japanese),” Chiba Institute of Technology, Chiba, March 2015.

Kengo Kikuchi

Journal Papers

1. K. Kikuchi and T. Onogi, “Generalized Gradient Flow Equation and Its Application to Super Yang-Mills Theory,” JHEP**1411** (2014) 094 (25pages), YITP-14-64, arXiv:1408.2185 [hep-th].
2. S. Aoki, K. Kikuchi and T. Onogi, “Gradient flow of $O(N)$ nonlinear sigma model at large N ,” JHEP**1504** (2015) 156 (21pages), YITP-14-109, arXiv:1412.8249 [hep-th].

Yusuke Kimura

Journal Papers

1. A. P. Braun, Y. Kimura and T. Watari, “The Noether-Lefschetz problem and gauge-group-resolved landscapes: F-theory on $K3 \times K3$ as a test case,” JHEP **1404** (2014) 050 (89 pages), YITP-13-129, arXiv:1401.5908 [hep-th].

Kenji Morita

Journal Papers

1. S. H. Lee, K. Morita, T. Song and C. M. Ko, “Free energy versus internal energy potential for heavy-quark systems at finite temperature,” Phys. Rev. **D89** (2014) 094015 (5 pages), YITP-13-25, arXiv:1304.4092 [hep-ph]
2. S. Cho, K. Hattori, S. H. Lee, K. Morita and S. Ozaki, “QCD sum rules for magnetically induced mixing between η_c and J/ψ ,” Phys. Rev. Lett. **113** (2014) 172301 (5 pages), arXiv:1406.4586 [hep-ph].

3. K. Morita, B. Friman and K. Redlich,
“Criticality of the net-baryon number probability distribution at finite density,”
Phys. Lett. **B741** (2015) 178 (6 pages),
arXiv:1402.5982 [hep-ph].
4. K. Morita, T. Furumoto and A. Ohnishi,
“ $\Lambda\Lambda$ interaction from relativistic heavy-ion collisions,”
Phys. Rev. **C91**, (2015) 024916 (16 pages),
YITP-14-67, arXiv:1408.8682 [nucl-th].
5. S. Cho, K. Hattori, S. H. Lee, K. Morita and S. Ozaki,
“Charmonium spectroscopy in strong magnetic fields by QCD sum rules: S-wave ground states,”
Phys. Rev. **D91** (2015) 045025 (24 pages),
YITP-14-90, arXiv:1411.7675 [hep-ph].

Books and Proceedings

1. K. Morita and K. Redlich,
“Probability distribution of conserved charges in the presence of the chiral phase transition,”
Proceedings of XXXI Max Born Symposium and HIC for FAIR Workshop “Three Days of Critical Behavior in Hot and Dense QCD,” Acta Physica Polonia B Proceedings Supplement **7**, (2014) 69 (11 pages)
2. T. Song, S. H. Lee, K. Morita, C. M. Ko,
“Free energy versus internal energy potential for heavy quark systems at finite temperature,”
Proceedings of Quark Matter 2014, Nucl. Phys. **A931** (2014) 607 (5 pages)

Talks at International Conferences

1. “Lambda-Lambda correlation in relativistic heavy ion collisions,” Invited, Resonance Workshop at Catania, November 3-7, Catania, Italy

Invited Seminars (Overseas)

1. “ A - A correlation in relativistic heavy ion collisions,” Institute of Theoretical Physics, University of Wroclaw, Wroclaw, Poland, November 2014.

Tomoki Nosaka

Journal Papers

1. Sanefumi Moriyama and Tomoki Nosaka,
“Partition functions of superconformal Chern-Simons theories from Fermi gas approach,”
JHEP **11** (2014) 164
arXiv:1407.4268 [hep-th]
YITP-14-56

Noburo Shiba

Journal Papers

1. A. Mollabashi, N. Shiba, T. Takayanagi,
“Entanglement between Two Interacting CFTs and Generalized Holographic Entanglement Entropy,”
JHEP **1404** (2014) 185 (36 pages), YITP-14-18, IPMU-14-0049, IPM/P-2014/010, arXiv:1403.1393 [hep-th]
2. N. Shiba,
“Entanglement Entropy of Disjoint Regions in Excited States : An Operator Method,”
JHEP **1412** (2014) 152 (22 pages), YITP-14-62, arXiv:1408.0637 [hep-th]

Talks at International Conferences

1. “Entanglement between two interacting CFTs and generalized holographic entanglement entropy,”
in “Strings and Fields,” YITP, Kyoto University, Kyoto, Japan,
July 2014.
2. “Entanglement between two interacting CFTs and generalized holographic entanglement entropy,” (poster presentation),
in “YITP Workshop on Quantum Information Physics (YQIP2014),” YITP, Kyoto University, Kyoto, Japan,
August 2014.

Invited Seminars (in Japan)

1. “Volume Law for the Entanglement Entropy in Non-local QFTs,”
Dept. of Phys., Nihon Univ., June 2014 (in Japanese).

2. “Entanglement between Two Interacting CFTs and Generalized Holographic Entanglement Entropy,”
Dept. of Phys., Hokkaido Univ., October 2014.

Shunsuke Yabunaka

Journal Papers

1. S. Yabunaka,
“Interface and vortex motion in the two-component complex dissipative Ginzburg-Landau equation in two-dimensional space,”
Phys. Rev. E **90** (2014) 042925 (10 pages)
2. S. Yabunaka and H. Hayakawa,
“Geometric pumping induced by shear flow in dilute liquid crystalline polymer solutions,”
J. Chem. Phys. **142** (2015) 074035 (9 pages), arXiv:1412.2558 [cond-mat].

Invited Seminars (in Japan)

1. “Self-propelled motion of a fluid droplet under chemical reaction,”
Cyber media center, Osaka University, July 2015 (in Japanese).

2.3 Seminars, Colloquia and Lectures

▷ 2014.4.1 — 2015.3.31

- 4.1 Kazunobu Maruyoshi (California Institute of Technology) :Higgsing N=1 supersymmetric gauge theories and dualities
- 4.2 Tadashi Okazaki (Osaka Univ. / California Institute of Technology) : Membrane Quantum Mechanics
- 4.4 Akira Shimizu (Graduate School of Arts and Sciences, Univ. of Tokyo) : Thermal Pure Quantum Formulation of Statistical Mechanics
- 4.8 Jun Bourdier (King's College London) : Supersymmetric Embeddings of Higher Spin Black Holes
- 4.9 Shunsuke Yabunaka (YITP, Kyoto Univ.) : Phase separation of a critical binary mixture in confined space
- 4.11 Keisuke Totsuka (YITP, Kyoto Univ.) : Symmetry-protected topological Mott insulators of ultra-cold fermions in one dimension
- 4.16 Atsushi Ikeda (Fukui Institute for Fundamental Chemistry, Kyoto Univ.) : Mean-field-like glass transition of the gaussian core model
- 4.16 Matthew McGeagh Roberts (Enrico Fermi Institute and Kadanoff Center, University of Chicago) : Entanglement Entropy in Free Gauge Theories
- 4.18 Ruben Minasian (Institut de Physique Theorique(IPhT)-CEA Saclay) : alpha-prime adventures
- 4.21 Ryosuke Yoshii (YITP, Kyoto Univ.) : Time crystal phase in a superconducting ring
- 4.22 Shu Tanaka (YITP, Kyoto Univ.) : Unconventional Phase Transitions in Frustrated Heisenberg Models
- 4.23 Fabio Scardigli (Politecnico di Milano) : Gravitational test of Generalized Uncertainty Principle
- 4.23-24 Sho Sugiura (Graduate School of Arts and Sciences, Univ. of Tokyo) : Lecture series "Formulation of statistical mechanics using thermal pure quantum state"
- 4.25 Kouji Kashiwa (YITP, Kyoto Univ.) : Effective model approach to phase structure of QCD-like theory
- 4.30 Takumi Masuda (Department of Aeronautics and Astronautics, Univ. of Tokyo) : How jamming depends on bottleneck size
- 5.9 Sotaro Sugishita (Graduate School of Science, Kyoto Univ.): Holographic Holes in Higher Dimensions
- 5.14 Hiroyasu Tajima (Institute of Industrial Science, the Univ. of Tokyo) :Refinement of Carnot's Theorem by Information Theory—Asymptotics of Thermodynamics with finite-particle heat baths—
- 5.14 Wenxing Nie (ISSP, Univ. of Tokyo) : Effect of Particle Statistics and Frustration on Ground-State Energy
- 5.16 Pengwei Zhao (YITP, Kyoto Univ.) : Novel nuclear structure from covariant density functional theory:ground state properties
- 5.19 Shu Tanaka (YITP, Kyoto Univ.) : Entanglement Properties of Two-Dimensional Statistical Mechanics Models
- 5.21 Yuki Yokokura (YITP, Kyoto Univ.) : Non-equilibrium Thermodynamics of Gravitational Screens
- 5.22 Giacomo Marmorini (Condensed Matter Theory Group, RIKEN) : New results for quantum antiferromagnets in high magnetic fields

- 5.23 Mitsutoshi Fujita (YITP, Kyoto Univ.) : Notes on the holographic boson-Hubbard model
- 6.2 Sumit Ranjan Das (University of Kentucky/YITP, Kyoto Univ.) : YITP Colloquium "HOLOGRAPHY, COSMOLOGY AND QUANTUM QUENCH"
- 6.2, 6.9, 6.16 Roberto Emparan (Universitat de Barcelona/YITP, Kyoto Univ.) : Lecture series "Classical, Quantum, and Stringy Perspectives on Black Holes"
- 6.4 Philipp Moesta (California Institute of Technology) : MAGNETOROTATIONAL CORE-COLLAPSE SUPERNOVAE IN THREE DIMENSIONS
- 6.5 Keita Kobayashi (Center for Computational Science & e-Systems, JAEA) : Quantum phases of multi-orbital Fermi gases in optical lattices
- 6.6 Shigeki Sugimoto (YITP, Kyoto Univ.) : On a holographic description of 3 dim Yang-Mills-Chern-Simons theory with defects
- 6.12 Kazuto Noda (NTT Basic Research Laboratories) : Flat band magnetism of cold fermions loaded into a multilayer Lieb optical lattice
- 6.12 Roberto Emparan (Universitat de Barcelona/YITP, Kyoto Univ.) : YITP Colloquium "The large D limit of General Relativity"
- 6.18 Tetsuo Yamaguchi (Department of Mechanical Engineering, Kyushu Univ.) : Non-equilibrium dynamics of friction and wear
- 6.18-19 Kenji Toma (Frontier Research Institute for Interdisciplinary Sciences, Tohoku Univ.) : Lecture series "Driving Mechanisms of Relativistic Jets"
- 6.2 Kenji Fukushima (Department of Physics, Univ. of Tokyo) : Challenge of QCD physics in extreme conditions
- 6.25 John Jairo Molina (Fukui Institute for Fundamental Chemistry, Kyoto Univ.) : Dynamics of Swimming Particles: A direct numerical simulation approach
- 6.3 Chul-Moon Yoo (Graduate School of Science, Nagoya University) : Spherical Domain Wall Shell Collapse in a Dust Universe
- 6.3 Shun Ogawa (Graduate School of Informatics, Kyoto University) : Nonlinear response theory in the dynamical systems with long-range interaction
- 7.1 Andreas Karch (University of Washington) : Entanglement and Holography
- 7.7 Kyogo Kawaguchi (Department of Physics, Univ. of Tokyo) : Stochastic thermodynamics of molecular motors: design principles in energetics and cooperativity
- 7.9 Yasuhiro Utsumi (Department of Physics Engineering, Faculty of Engineering, Mie Univ.) : Fluctuation theorem for heat transport probed by a thermal electrode
- 7.1 Chisa Hotta (Univ. of Tokyo) : Grand canonical analysis
- 7.11 Yuji Okawa (Graduate School of Arts and Sciences, Univ. of Tokyo) : Open superstring field theory in the small Hilbert space
- 7.18 Etsuko Ito (Theory Center, KEK) : Finite temperature phase transition, center symmetry and entanglement entropy for SU(3) gauge theory
- 7.29 Junji Fujimoto (Nagoya University):Thermal spin-orbit torques
- 8.4 Kipp Cannon (Canadian Institute for Theoretical Astrophysics) : The Exploding Sky: Prospects for Transient Gravitational-Wave Astronomy
- 8.8 Alessandro Sfondrini (Humboldt University Berlin) : Integrability for AdS3/CFT2
- 8.8 Feng-Li Lin (National Taiwan Normal Univ.) : Introduction to quantum open dynamics and its applications to quantum decoherence in some non-perturbative systems
- 8.8 Matthew Headrick (Brandeis University) : Causality, holography, and entanglement entropy
- 8.18 Ayumu Sugita (Osaka City Univ.) : Algorithms and evaluation functions for computer shogi

- 8.25 Haruki Watanabe (University of California, Berkeley) : Impossibility of realizing time crystals
- 8.25 Shigeki Sugimoto (YITP, Kyoto Univ.) : YITP Colloquium "Stringy approach to non-SUSY gauge theory"
- 8.26 Alexander V. Karpov (Flerov Laboratory of Nuclear Reactions, JINR, Russia) : Superheavy nuclei: Which regions of nuclear map are accessible in nearest future?
- 8.27 Masahiro Hotta (Department of Physics, Tohoku University) : Energy-entanglement relations in quantum information physics
- 8.28 Takahiro Nishimichi (Institut d'Astrophysique de Paris(IAP)) : Numerical studies of the large-scale structure formation beyond standard perturbation theory
- 9.8 Daisuke Satow (Brookhaven National Laboratory/Nishina Center, RIKEN) : Non-linear electromagnetic response in quark-gluon plasma
- 9.11 Gentaro Watanabe (Asia Pacific Center for Theoretical Physics) : Transient quantum fluctuation theorems and generalized energy measurements
- 9.16 So Takei (University of California, Los Angeles) : Nonequilibrium superfluid spin transport through magnetic insulators
- 9.17 Xian Gao (Department of Physics, Tokyo Institute of Technology) : Unifying framework for scalar-tensor theories of gravity
- 10.3 Kengo Kikuchi (YITP, Kyoto Univ.) : Generalized Gradient Flow Equation and Its Application to Super Yang-Mills Theory
- 10.8 Takeshi Matsumoto (Kyoto Univ.) : Response function of fluid turbulence computed via fluctuation-response relation of a Langevin system
- 10.1 Kantaro Ohmori (University of Tokyo) : Anomaly polynomial of general 6d SCFTs
- 10.15 Kazunari Hashimoto (Osaka Prefecture Univ.) : Jordan block structure of the Liouvillian for one-dimensional quantum Lorentz gas and its role in transport phenomena
- 10.17 Max Riegler (Vienna Univ. of Technology) : Higher Spin Holography in 2+1 Dimensions
- 10.23 Anna Watts (Univ. of Amsterdam) : Neutron star equation of state through current and future observations
- 10.23 Hoi-Lai Yu (Institute of Physics, Academia Sinica, Taiwan) : Geometrodynamics, and the gauging of spatial diffeomorphism and Lorentz symmetries
- 10.24 Tomoki Ohtsuki (Kavli IPMU, Univ. of Tokyo) : "Solving" critical theories of QCD chiral condensates and frustrated magnets from conformal bootstrap
- 10.27 Tatsuhiko N. Ikeda (Univ. of Tokyo) : Accuracy of the microcanonical ensemble in small isolated quantum systems
- 10.28 Kenji Morita (YITP, Kyoto Univ.) : Net Baryon Number Fluctuations and Chiral Phase Transition
- 10.3 Mordehai Milgrom (Weizmann Institute of Science) : The MOND paradigm of modified dynamics as an alternative to dark matter
- 10.31 Takumi Iritani (YITP, Kyoto Univ.) : Lattice QCD study of partial restoration of chiral symmetry breaking inside color flux tube
- 10.31 Djordje Radicevic (Stanford Univ.) : Entanglement Entropy and Lattices
- 11.7 Koji Hashimoto (Osaka Univ./RIKEN) : Turbulent meson condensation in quark deconfinement
- 11.1 Oleg P. Sushkov (Univ. of New South Wales/YITP, Kyoto Univ.) : YITP Colloquium "Violation of the Spin Statistics Theorem and the Bose-Einstein Condensation of Particles with Half Integer Spin"
- 11.12 Hajime Yoshino (Cybermedia Center, Osaka Univ.) : Hard-sphere glasses under shear in large-d limit
- 11.12 Atsushi Tamii (RCNP, Osaka Univ.) : Electric Dipole Response of Nuclei Studied by Proton Scattering: Neutron Skin, Symmetry Energy, and Pygmy Dipole Resonance

- 11.13 Kristan Jensen (C.N. Yang Institute for Theoretical Physics) : Aspects of Galilean-invariant field theory in curved spacetime
- 11.17 Benjamin Svetitsky (Tel Aviv University) : Conformal or confining? From the Higgs to three-dimensional QED
- 11.20 Veljko Dmitrašinović (Institute of Physics Belgrade, Serbia) : Recent progress in the Newtonian three-body problem
- 11.20 Koshiro Suzuki (Canon Inc.) : Rheology of Dense Sheared Granular Liquids
- 11.21 Shunji Matsuura (Riken) : Charged topological entanglement entropies and topological phases
- 11.26 Kenta Ishimoto (RIMS, Kyoto Univ.) : Hydrodynamic stability of swimming cells near a boundary
- 11.27 Laszlo Arpad Gergely (Univ. of Szeged, Hungary) : Tachyonic dark energy, gravitational waves and black hole spin detection
- 11.28 Alexander G. Magnor (Institute for Nuclear Research, Kiev, Ukraine) : Shell structure, orbit-bifurcations and quantum-classical chaos in Fermion systems
- 11.28 Wu-zhong Guo (Institute of Theoretical Physics, Chinese Academy of Sciences/YITP, Kyoto Univ.) : Holographic entanglement entropy for general higher derivative gravity
- 12.1 Hirofumi Wada (Ritsumeikan Univ.) : Morphological mechanics of self-twisting living filaments: Coiling of Physarum tube
- 12.4 Thierry Sousbie (Research Center for the Early Universe, Univ. of Tokyo) : A phase-space Vlasov-Poisson solver for cold dark matter
- 12.5 Takahiro Nishinaka (Rutgers Univ.) : Argyres-Douglas theories and S-duality
- 12.8-9 Ayumu Sugita (Osaka City Univ.) : Lecture series "Chaos and Quantum Mechanics"
- 12.11 Joshua Edward Barnes (Inst. for Astronomy, Univ. of Hawaii/YITP, Kyoto Univ.) : YITP Colloquium "COLLISIONS AS PROBES OF GALACTIC STRUCTURE"
- 12.12 Tatsuma Nishioka (Univ. of Tokyo) : Entanglement Entropy of Annulus in Three Dimensions
- 12.17 Tomoaki Niiyama (Kanazawa Univ.) : Atomic scale behaviors of intermittent plastic deformation in crystalline solids
- 12.19 Yukinari Sumino (Tohoku Univ.) : Perturbative QCD Potential at the Frontiers
- 12.24 Yu Maezawa (Bielefeld Univ., Germany) : Thermal modification of in-medium mesons from screening properties in lattice QCD
- 1.7 Kiyoshi Kanazawa (YITP, Kyoto Univ.) : Microscopic derivation of non-Gaussian Langevin equation and its analytical solution
- 1.9 Hironori Mori (Osaka Univ.) : Superconformal index on $RP^2 \times S^1$ and mirror symmetry
- 1.14 Andrea Cairoli (Queen Mary University of London) : Anomalous processes with general waiting times: functionals and multi-point structure
- 1.15 Ken Shiozaki (Dept. of Physics, Kyoto Univ.) : Classification of topological crystalline insulators and superconductors with an additional order-two point group symmetry
- 1.16 Takahiro Ueda (NIKHEF, Amsterdam) : Towards N^3LO Higgs production cross section through gluon fusion
- 1.16 Haruki Watanabe (Univ. of California, Berkeley) : Absence of Quantum Time Crystals in Ground States
- 1.20 Arnab Sen (Indian Association for the Cultivation of Science) : A topological spin glass in spin ice
- 1.26 Daniel Grumiller (Institute for Theoretical Physics, Technische Universität Wien) : Flat Space Holography
- 1.26 Nadav Drukker (King's College London) : Localization and quantum AdS_4/CFT_3 holography

- 1.28 Sugumi Kanno (Univ. of the Basque Country) : Quantum Entanglement in the Multiverse
- 1.28 Satoshi Nakajima (Univ. of Tsukuba) : Applications of the generalized quantum master equation to a quantum adiabatic pump and an excess entropy production
- 2.3 Joao Rosa (Aveiro Univ./Porto Univ.) : The fluctuation-dissipation dynamics of cosmological scalar fields
- 2.4 Ryo Tamura (National Institute for Materials Science (NIMS)) : Novel magnetic orders induced by effects of the interlayer random interaction
- 2.6 Yuho Sakatani (Seoul National Univ.) : Exotic branes and non-geometric fluxes
- 2.9-2.10 Masashi Wakamatsu (Osaka Univ.) : Lecture series "Chiral Quark Soliton Model and Physics of Nucleon Structure Functions"
- 2.10, 2.12-13 Yuji Tachikawa (School of Science, Univ. of Tokyo) : Lecture series "Supersymmetric Field Theories in Four, five and six dimensions"
- 2.17-18 Teruaki Suyama (RESCEU, Univ. of Tokyo) : Lecture series "Horndeski theory and its application"
- 2.18 Étienne Fodor (Laboratoire Matière et Systèmes Complexes Université Paris Diderot - Paris 7) : Modeling active fluctuations in living matter
- 2.20 Shin Nakamura (Chuo Univ.) : Effective Temperature of Non-equilibrium Steady States in Holography
- 2.20 Yoshiyuki Y. Yamaguchi (Graduate School of Informatics, Kyoto Univ.) : Dynamics around spatially inhomogeneous stationary states in Vlasov systems
- 2.23-24 Hirofumi Wada (Dept. of Physical Science, Ritsumeikan Univ.) : Lecture series "Mechanics and geometry applied to biology"
- 2.27 Kentaroh Yoshida (Kyoto Univ.) : Chaos in the BMN matrix model
- 3.2 Dimitri Loutchko (Fritz Haber Institute of the Max Planck Society) : Single-molecule stochastic modeling of the channeling enzyme tryptophan synthase
- 3.3 Yuya Seki (Tokyo Institute of Technology) : Quantum annealing of a mean-field model
- 3.4 Alexander Mikhailov (Fritz Haber Institute of the Max Planck Society) : Hydrodynamic Collective Effects of Active Protein Machines in Solution and Lipid Bilayers
- 3.9-11 Yasuaki Hikida (Rikkyo Univ.) : Lecture series "Higher spin gauge theory and its applications"
- 3.11 Fumika Suzuki (Univ. of British Columbia/Inst. for Molecular Science) : Gravitational decoherence
- 3.11 Friedemann Queisser (Univ. of British Columbia/Inst. for Molecular Science) : Sauter-Schwinger like tunneling in tilted Bose-Hubbard lattices in the Mott phase
- 3.13 Masato Taki (RIKEN iTHES research group) : Fiber-Base Duality & Global Symmetry Enhancement in 5D SCFT
- 3.13 Toshiya Namikawa (Stanford Univ.) : Mitigating non-primary B-mode polarization to search for gravitational waves in current and future CMB experiments
- 3.17 Teppei Okumura (Kavli IPMU, Univ. of Tokyo) : Modeling nonlinear power spectrum of dark matter halos and galaxies in redshift space
- 3.17 Takuya Higuchi (Friedrich-Alexander Universität Erlangen-Nürnberg) : Strong-Field Perspective on High-Harmonic Radiation from Bulk Solids
- 3.17-20 Chul-moon Yoo (Nagoya Univ.) : Lecture series "Inhomogeneous Lattice Universe Models"
- 3.18 Pierre Descouvemont (Université Libre de Bruxelles/YITP, Kyoto Univ.) : YITP Colloquium "The R-matrix method in nuclear physics"
- 3.2 David Kubiznak (Perimeter Institute for Theoretical Physics) : Enthalpy and chemical-type phase transitions in AdS black hole spacetimes

3.27 Matthieu Wyart (New York Univ.) :
Dense suspensions flows and shear thickening fluids

2.4 Visitors (2014)

Atom-type Visitors

Hotta, Masahiro Tohoku University 2014-08-25 – 2014-09-05
(C)

Mori, Hironori Graduate School of Science, Osaka Univ. 2015-02-02 – 2015-02-27
(E)

Visitors

Maruyoshi, Kazunobu (E) California Institute of Technology
2014/4/1 – 2014/4/2

Lau, Pak Hang Chris (E) University of Cambridge
2014/4/1 – 2014/4/13

Okazaki, Tadashi (E) Osaka Univ./California Institute of Technology
2014/4/2 – 2014/4/3

Yamamoto, Kazuhiro (A) Hiroshima University
2014/4/2 – 2014/4/2

Naruko, Atsushi (A) Tokyo Tech
2014/4/2 – 2014/4/4

Bourdier, Jun (E) King's College London
2014/4/7 – 2014/4/11

Roberts, Matthew McGeagh (E) Enrico Fermi Institute and Kadanoff Center, University of Chicago
2014/4/13 – 2014/4/18

Minasian, Ruben (E) Institut de Physique Theorique(IPhT)-CEA Saclay
2014/4/14 – 2014/4/19

Shimada, Hidehiko (E) Okayama Institute for Quantum Physics
2014/4/14 – 2014/4/21

Naruko, Atsushi (A) Tokyo Tech
2014/4/14 – 2014/4/14

Kobayashi, Tatsuo (E) Hokkaido University
2014/4/17 – 2014/4/22

Deffayet, Cedric (A) IAP
2014/4/19 – 2014/4/23

Scardigli, Fabio (A) Politecnico di Milano
2014/4/22 – 2014/4/26

Sugiura, Sho (C) Graduate School of Arts and Sciences, Univ. of Tokyo
2014/4/23 – 2014/4/24

Sousbie, Thierry (A) Institut d'Astrophysique de Paris
2014/4/24 – 2014/4/26

Ishida, Muneyuki (E) School of Science and Engineering, Meisei Univ.
2014/4/30 – 2014/5/6

Masuda, Takumi (C) Univ. of Tokyo
2014/4/30 – 2014/4/30

Nie, Wenxing (C) ISSP, Univ. of Tokyo
2014/5/14 – 2014/5/15

Tajima, Hiroyasu (C) Institute of Industrial Science, Univ. of Tokyo
2014/5/14 – 2014/5/15

Azeyanagi, Tatsuo (E) Ecole Normale Supérieure
2014/5/20 – 2014/5/29

Kobayashi, Tatsuo (E) Hokkaido University
2014/5/22 – 2014/5/26

Marmorini, Giacomo (C) Condensed Matter Theory Group, RIKEN
2014/5/22 – 2014/5/23

von Oertzen, W. (N) Helmholtz-Zentrum Berlin
2014/5/22 – 2014/5/24

Mösta, Philipp (A) California Institute of Technology
2014/6/2 – 2014/6/5

Nagata, Keitaro (N) KEK
2014/6/3 – 2014/6/8

Kadoh, Daisuke (N) KEK
2014/6/4 – 2014/6/8

Krejcirik, Vojtech (N) RIKEN
2014/6/5 – 2014/6/6

- Noda, Kazuto** (C) NTT Basic Research Laboratories
2014/6/12 – 2014/6/13
- Niedner, Benjamin** (E) University of Oxford
2014/6/18 – 2014/8/18
- Toma, Kenji** (A) Frontier Research Institute for Interdisciplinary Sciences, Tohoku Univ.
2014/6/18 – 2014/6/19
- Torres, Theo Junior Vincente** (A) University Paris Diderot, Paris VII
2014/6/19 – 2014/8/18
- Colleaux, Aimeric Jean Rene** (A) University Paris VII, Paris Diderot
2014/6/19 – 2014/8/18
- Sekihara, Takayasu** (N) RCNP, Osaka Univ.
2014/6/19 – 2014/6/19
- Yoo, Chul-Moon** (A) Nagoya Univ.
2014/6/30 – 2014/7/1
- Das, Diptarka** (E) University of California, Santa Barbara
2014/7/1 – 2014/7/30
- Karch Andreas** (E) Univ. of Washington
2014/7/1 – 2014/7/1
- Utsumi, Yasuhiro** (C) Mie University
2014/7/9 – 2014/7/9
- Hotta, Chisa** (C) Univ. of Tokyo
2014/7/10 – 2014/7/10
- Okawa, Yuji** (E) Univ. of Tokyo
2014/7/11 – 2014/7/11
- Itou, Etsuko** (E) Theory Center, KEK
2014/7/17 – 2014/7/19
- Kobayashi, Tatsuo** (E) Hokkaido University
2014/7/17 – 2014/7/22
- Meyer, Rene** (E) Kavli IPMU, Univ. of Tokyo
2014/7/22 – 2014/7/30
- Yoshida, Tetsuya** (N) Tokyo Institute of Technology
2014/7/23 – 2014/7/25
- Fujimoto, Junji** (C) Osaka Univ.
2014/7/29 – 2014/7/29
- Lin, Feng-Li** (E) National Taiwan Normal University
2014/7/30 – 2014/8/9
- Wu, Shang-Yu** (E) National Chiao Tung University
2014/8/1 – 2014/8/7
- Headrick, Mathew Peter** (E) Brandeis University
2014/8/2 – 2014/8/9
- Sato, Yuki** (E) University of Witwatersrand
2014/8/4 – 2014/9/16
- Sfondrini, Alessandro** (E) Humboldt University Berlin
2014/8/7 – 2014/8/19
- Morita, Takeshi** (E) Shizuoka Univ.
2014/8/8 – 2014/8/12
- Ueda, Hiroaki** (C) Okinawa Institute of Science and Technology Graduate Univ.
2014/8/11 – 2014/8/22
- Kobayashi, Tatsuo** (E) Hokkaido University
2014/8/11 – 2014/8/17
- Shimada, Hidehiko** (E) Okayama Institute for Quantum Physics
2014/8/14 – 2014/8/15
- Bhattacharya, Jyotirmoy** (E) Kavli IPMU, Univ. of Tokyo
2014/8/15 – 2014/8/17
- Wan, Mew-Bing** (A) APCTP
2014/8/18 – 2014/10/18
- Nishimichi, Takahiro** (A) Institut d'Astrophysique de Paris
2014/8/19 – 2014/8/30
- Jamil, Mubasher** (A) School of Natural Sciences, National University of Sciences and Technology
2014/8/19 – 2014/9/20
- Eguchi, Tohru** (E) Rikkyo University
2014/8/21 – 2014/8/22
- Sugawara, Yuji** (E) Ritsumeikan University
2014/8/22 – 2014/8/22
- Hotta, Masahiro** (C) Tohoku University
2014/8/25 – 2014/9/5
- Alexander V. Karpov** (M) Flerov Laboratory of Nuclear Reactions, JINR, Russia/Visiting Prof. of Tokyo Institute of Technology
2014/8/25 – 2014/8/27

- Valageas, Patrick** (A) Institut de physique theorique, CEA Saclay
2014/9/1 – 2014/9/30
- Svetitsky, Benjamin** (E) Tel Aviv University
2014/9/1 – 2014/11/27
- Maruhn, Joachim** (N) Universitat Frankfurt
2014/9/6 – 2014/9/12
- Satow, Daisuke** (N) Brookhaven National Laboratory/Nishina Center, RIKEN
2014/9/7 – 2014/9/8
- Koyama, Kazuya** (A) ICG, University of Portsmouth
2014/9/8 – 2014/9/19
- Wands, David** (A) ICG, University of Portsmouth
2014/9/8 – 2014/9/13
- Bruni, Marco** (A) ICG, University of Portsmouth
2014/9/8 – 2014/9/16
- Watanabe, Gentaro** (C) APCTP
2014/9/11 – 2014/9/17
- Tasinato, Gianmassimo** (A) ICG, University of Portsmouth
2014/9/12 – 2014/9/19
- Takei, So** (C) UCLA
2014/9/14 – 2014/9/16
- Hollo, Laszlo** (E) Wigner Research Centre for Physics
2014/9/15 – 2014/9/26
- Balog, Janos** (E) Wigner Research Center for Physics
2014/9/16 – 2014/10/7
- Gao, Xian** (A) Department of Physics, Tokyo Institute of Technology
2014/9/16 – 2014/9/18
- Bajnok, Zoltan** (E) Wigner Research Centre for Physics
2014/9/16 – 2014/9/24
- Toth, Gabor Zsolt** (E) Wigner Research Centre for Physics
2014/9/16 – 2014/10/6
- Hatsuda, Yasuyuki** (E) DESY
2014/9/16 – 2014/9/26
- Satoh, Yuji** (E) Univ. of Tsukuba
2014/9/16 – 2014/9/17
- Ohkubo, Shigeo** (N) University of Kochi
2014/9/17 – 2014/9/18
- Yamanaka, Yoshiya** (N) Waseda University
2014/9/17 – 2014/9/18
- Hirabayashi, Yoshiharu** (N) Hokkaido Univ.
2014/9/18 – 2014/9/18
- Satoh, Yuji** (E) Univ. of Tsukuba
2014/9/22 – 2014/9/26
- Uegaki, Eiji** (N) Akita University
2014/9/24 – 2014/9/26
- Hatsuda, Yasuyuki** (E) DESY
2014/9/30 – 2014/10/2
- Barnes, Joshua Edward** (A) Institute of Astronomy, Univ. of Hawaii at Manoa
2014/10/1 – 2015/3/31
- Riegler, Max Robert** (E) Vienna University of Technology
2014/10/1 – 2015/1/31
- Ohmori, Kantaro** (E) Univ. of Tokyo
2014/10/10 – 2014/10/10
- Yu, Hoi-Lai** (A) Institute of Physics, Academia Sinica
2014/10/21 – 2014/10/31
- Ikeda, Tatsuhiko N.** (C) Univ. of Tokyo
2014/10/22 – 2014/11/3
- Kobayashi, Tatsuo** (E) Hokkaido University
2014/10/23 – 2014/10/26
- Watts, Anna** (N) Univ. of Amsterdam
2014/10/23 – 2014/10/23
- Takahashi, Tadayuki** (N) JAXA
2014/10/23 – 2014/10/23
- Tamura, Hirokazu** (N) Tohoku Univ.
2014/10/23 – 2014/10/23
- Ohtsuki, Tomoki** (E) Kavli IPMU, Univ. of Tokyo
2014/10/24 – 2014/10/25
- Milgrom, Mordehai** (A) Weizmann Institute of Science
2014/10/28 – 2014/11/4
- Radicevic, Djordje** (E) Stanford Univ.
2014/10/30 – 2014/11/1
- Jensen, Kristan** (E) C.N. Yang Inst. for Theoretical Physics
2014/11/13 – 2014/11/14

- Matsuura, Shunji** (E) Riken
2014/11/20 – 2014/11/22
- Dmitrasinovic, Veljko** (N) Inst. of Physics
Belgrade
2014/11/20 – 2014/11/20
- Gergely, Laszlo Arpad** (A) Univ. of
Szeged
2014/11/22 – 2014/11/28
- Gong, Jinn-Ouk** (A) APCTP
2014/11/23 – 2014/11/30
- Namba, Ryo** (A) Kavli IPMU, Univ. of
Tokyo
2014/11/26 – 2014/11/28
- Nakamura, Keisuke** (E) Tohoku Univer-
sity
2014/12/3 – 2014/12/9
- Sousbie, Thierry** (A) (Research Center for
the Early Universe, Univ. of Tokyo
2014/12/4 – 2014/12/7
- Yeom, Dong-han** (A) LeCosPA, National
Taiwan Univ.
2014/12/7 – 2014/12/17
- Sugita, Ayumu** (N) Osaka City Univ.
2014/12/8 – 2014/12/9
- Kobayashi, Tatsuo** (E) Hokkaido Univer-
sity
2014/12/11 – 2014/12/14
- Uegaki, Eiji** (N) Akita University
2014/12/18 – 2014/12/18
- Sumino, Yukinari** (E) Tohoku Univ.
2014/12/19 – 2014/12/20
- Naruko, Atsushi** (A) Tokyo Institute of
Technology
2014/12/22 – 2014/12/27
- Maetzawa, Yu** (E) Bielefeld Univ., Ger-
many
2014/12/24 – 2014/12/25
- Cairolì, Andrea** (C) Queen Mary Univer-
sity of London
2015/1/5 – 2015/3/30
- Ueda, Takahiro** (N) Nikhef, Netherlands
2015/1/5 – 2015/1/16
- Bertulani, Carlos** (N) Texas A&M Univer-
sity - Commerce
2015/1/6 – 2015/1/17
- Matsumoto, Takuma** (N) Fac. of Sciences,
Kyushu Univ.
2015/1/6 – 2015/1/8
- Horiuchi, Wataru** (N) Graduate School of
Science, Hokkaido University
2015/1/6 – 2015/1/7
- Ogata, Kazuyuki** (N) RCNP, Osaka Univ.
2015/1/7 – 2015/1/9
- Kobayashi, Tatsuo** (E) Hokkaido Univer-
sity
2015/1/8 – 2015/1/14
- Ogata, Kazuyuki** (N) RCNP, Osaka Univ.
2015/1/15 – 2015/1/16
- Horiuchi, Wataru** (N) Graduate School of
Science, Hokkaido University
2015/1/18 – 2015/1/21
- Matsumoto, Takuma** (N) Fac. of Sciences,
Kyushu Univ.
2015/1/19 – 2015/1/22
- Sen, Arnab** (C) Indian Association for the
Cultivation of Science
2015/1/19 – 2015/1/20
- Grumiller, Daniel** (E) Inst. for Theoretical
Physics, Technische Universität Wien
2015/1/23 – 2015/1/26
- Drukker, Nadav** (E) King's College Lon-
don
2015/1/25 – 2015/1/29
- Kanno, Sugumi** (A) Univ. of the Basque
Country
2015/1/26 – 2015/1/29
- Fodor, Étienne** (C) University Paris
Diderot (Paris VII)
2015/2/1 – 2015/3/20
- Rosa, Jão** (A) Aveiro Univ.
2015/2/1 – 2015/2/4
- Fedrow, Joseph M.** (A) UC San Diego
2015/2/1 – 2015/2/7
- Mori, Hironori** (E) Graduate School of
Science
2015/2/2 – 2015/2/27
- Chate, Hugues** (E) CEA Saclay
2015/2/3 – 2015/2/19
- Tailleur, Julien** (C) CNRS, Université
Paris-Diderot
2015/2/3 – 2015/2/18
- Sakatani, Yuho** (E) Seoul National Univ.
2015/2/4 – 2015/2/6
- Ikeda, Tatsuhiko** (C) School of Science,
Univ. of Tokyo
2015/2/4 – 2015/2/13

Tamura, Ryo (C) National Institute for Materials Science (NIMS)
2015/2/4 – 2015/2/6

Wakamatsu, Masashi (N) Osaka Univ.
2015/2/9 – 2015/2/11

Loutchko, Dimitri (C) Fritz Haber Institute
2015/2/9 – 2015/3/8

Suyama, Teruaki (A) RESCEU, Univ. of Tokyo
2015/2/17 – 2015/2/18

Hiyama, Emiko (N) RIKEN
2015/2/20 – 2015/2/21

Isaka, Masahiro (N) RIKEN
2015/2/20 – 2015/2/21

Wada, Hirofumi (C) Ritsumeikan Univ.
2015/2/23 – 2015/2/24

Narain, Gaurav (E) IF, Naresuan University
2015/2/25 – 2015/3/8

Uegaki, Eiji (N) Akita Univ.
2015/2/27 – 2015/2/27

Suhara, Tadahiro (N) Matsue College of Technology
2015/2/28 – 2015/3/1

Seki, Yuya (C) Tokyo Institute of Technology
2015/3/2 – 2015/3/6

Furumoto, Takenori (N) Ichinoseki National College of Technology
2015/3/2 – 2015/3/5

Hikida, Yasuaki (E) Rikkyo Univ.
2015/3/9 – 2015/3/11

Odsuren, Myagmarjav (N) Nuclear Research Center, NUM
2015/3/9 – 2015/3/27

Ikeda, Tatsuhiko (C) Univ. of Tokyo
2015/3/10 – 2015/3/20

Hiyama, Emiko (N) Riken
2015/3/10 – 2015/3/10

Suzuki, Fumika (A) Univ. of British Columbia/Inst. for Molecular Science
2015/3/11 – 2015/3/13

Queisser, Friedemann (A) Univ. of British Columbia/Inst. for Molecular Science
2015/3/11 – 2015/3/13

Higuchi, Takuya (C) Friedrich-Alexander Universität Erlangen-Nürnberg
2015/3/16 – 2015/3/20

Uegaki, Eiji (N) Akita Univ.
2015/3/16 – 2015/3/20

Okumura, Teppei (A) Kavli IPMU, Univ. of Tokyo
2015/3/16 – 2015/3/18

Yoo, Chulmoon (A) Nagoya Univ.
2015/3/17 – 2015/3/20

Myo, Takayuki (N) Osaka Inst. of Technology
2015/3/18 – 2015/3/18

Kikuchi, Yuma (N) RIKEN
2015/3/18 – 2015/3/18

Kubiznak, David (A) Perimeter Institute for Theoretical Physics
2015/3/20 – 2015/3/21

Miura, Kohtaroh (N) Nagoya University
2015/3/25 – 2015/3/26

Nara, Yasushi (N) Akita International University
2015/3/26 – 2015/3/26

In the above lists, the symbols A, C, E and N in the parentheses are the following abbreviations of research fields:
A: Astrophysics and Cosmology
C: Condensed Matter and Statistical Physics
E: Elementary Particle Theory
N: Nuclear Physics Theory

Chapter 3

Workshops and Conferences

3.1 International Workshops and Conferences

Since 1978, a series of international physics workshops, called *Yukawa International Seminar (YKIS)* are held annually or bi-annually. *The Nishinomiya Yukawa Memorial Project* was initiated by Nishinomiya city where the late Prof. Hideki Yukawa lived when he wrote his famous papers on the meson theory. As one of the major programs of this project, an international symposium open to public was held every year in Nishinomiya city, and its post/pre-workshop held at YITP. In recent years both the Nishinomiya Yukawa Symposium and its post/pre-workshops are held at YITP, Kyoto.

As of the academic year 2007, Yukawa Institute for Theoretical Physics launched a new five-year project, "*Yukawa International Program for Quark-Hadron Sciences (YIPQS)*." A few research topics are selected each year and a long-term workshop focused on each topic, extending over a period of a few months, is organized by inviting leading experts from the world. Emphasis is laid on fostering fruitful collaboration among the workshop participants.

In addition to these regular annual conferences, many international workshops and conferences of various sizes and durations from several days to more than one month are held every year.

Here is a list of main international workshops and conferences held in the academic year 2011.

Yukawa International Seminar (YKIS2014)

YKIS2014 : Nonequilibrium Phenomena in Novel Quantum States

Dec 3 - Dec 5, 2014, Chaired by Takami Tohyama 70 participants (19 from abroad)

For details, see <http://www2.yukawa.kyoto-u.ac.jp/~nqs2014.ws/YKIS2014/index.html>

Nishinomiya-Yukawa Symposium 2014

Nishinomiya Yukawa Symposium on Hadrons and Hadron Interactions in QCD 2015

Feb 15 - Mar 21, 2015, Chaired by Sinya Aoki, 142 participants (45 from abroad)

For details, see <http://www2.yukawa.kyoto-u.ac.jp/~hhiqcd.ws/index.html>

3.2 YITP Workshops

YITP workshops are one of the main activities of Yukawa Institute. The aim of them is to open new research fields and stimulate nationwide collaborations. Workshop plans can be proposed by any researcher and are approved by the Committee on Research Projects of the Institute. Small workshops, summer schools and regional schools to educate young researchers are positively supported.

In the past 5 years, more than 20 workshops are held each year with 1500 strong participants visiting YITP. The list of the workshops together with the number of participants for the last academic year is given below.

▷ 2014.4.1 — 2015.3.31

Here is the list of workshops with the dates, the names of organizers, the number of participants.

YITP-W-14-01

Low-x meeting 2014, Jun.17-21. Yoshitaka Hatta, Christopher Royon, 60-participants,

YITP-W-14-02

Higgs Modes in Condensed Matter and Quantum Gases, Jun.23-25. Masaki Oshikawa, Yusuke Kato, Norio Kawakami, Yoshiro Takahashi, Ippei Danshita, Naoto Tsuji, Shunji Tsuchiya, Keisuke Totsuka, Muneto Nitta, 103-participants,

YITP-W-14-03

Summer school on 'From quark to supernova', Jul.22-26. Masaru Shibata, Sinya Aoki, Tetsuo Hatsuda, Emiko Hiyama, 60-participants,

YITP-W-14-04

Strings and Fields, Jul.22-26. Tatsuo Azeanagi, Masashi Hamanaka, Koji Hashimoto, Kazuo Hosomichi, Hiroshi Kunitomo, Tadakatsu Sakai, Makoto Sakamoto, Shigeki Sugimoto, Yuji Tachikawa, Tadashi Takayanagi, Satoshi Yamaguchi, Kentaroh Yoshida, Yuji Okawa, 150-participants,

YITP-W-14-05

Progress in Particle Physics 2014, Jul.28-Aug.1. T. Abe, M. Ibe, F. Takayama, K. Tsumura, K. Nakayama, K. Hamaguchi, S. Matsumoto, T. Misumi, 125-participants,

YITP-W-14-06

Summer School on Astronomy and Astrophysics 2014, Jul.28-31. Chiaki Gen, Shirasaki Masato, Kunimitsu Taro, Ushiba

Takafumi, Oka Akira, Eda Kazunari, Kobayashi Shogo, Chon Sunmyon, Hayatsu Natsuki, Takahashi Kou, Yoshida Daisuke, Yatabe Akihiro, 345-participants,

YITP-W-14-07

The 59th Condensed Matter Physics Summer School, Jul.29-Aug.2. Masanori Yoshida, Taiki Haga, Tomoo Onaga, Hideyuki Kawasoko, Shundai Abe, Mai Saitoh, Sumire Ono, Naohiro Temmoku, Motohiro Horie, Ryosuke Hara, Shinji Koshida, Misako Shinosaki, Ryosuke Numakura, Taiki Nishiguchi, 206-participants,

YITP-W-14-08

YITP Workshop on Quantum Information Physics (YQIP 2014), Aug.4-7. Masahiro Hotta, Gen Kimura, Hiroaki Matsueda, Takao Morinari, Yasusada Nambu, Takahiro Sagawa, Tadashi Takayanagi, Keisuke Totsuka, Izumi Tsutui, Yu Watanabe, 106-participants,

YITP-W-14-09

The 60th Summer School for Young Researchers of Nuclear and Particle Physics, Aug.4-9. Takaya Miyamoto, Asobu Suzuki, Kohei Teramatsu, Masatoshi Yamada, Tetsuya Fujita, Satoru Kohara, Akane Iikura, Kazuhiro Endo, Hiroki Matsuno, Daisuke Takeda, Yuichi Motohiro, Yoshihiko Kobayashi, Junya Usui, 211-participants,

YITP-W-14-10

Summer School for Japanese Young Quantum Information Researchers, Aug.8-10. Daisuke Sakuma, Yuta Masuyama, Shun Kawakami, Maria Fuwa, Jisho Miyazaki, Yuki Doi, Yoshiaki Tsujimoto, Takahiko Satoh, Yu Watanabe, Saki Tanaka, Atushi

Shimbo, 119-participants,

YITP-W-14-11

The 54th Summer School for Japanese Young Biophysics Researchers, Aug.8-11. Daichi Yamada, 73-participants,

YITP-W-14-12

Interface fluctuations and KPZ universality class - unifying mathematical, theoretical, and experimental approaches, Aug.20-23. Kazumasa Takeuchi, Tomohiro Sasamoto, Takashi Imamura, Hisao Hayakawa, Yu Watanabe, 71-participants,

YITP-W-14-13

Physics of novel superconductivity, Oct.21-22. Ryotaro Arita, Hiroaki Ikeda, Yoshiaki Ono, Kazuhiko Kuroki, Hiroshi Kontani, Takami Tohyama, Yuji Matsuda, 80-participants,

YITP-W-14-14

New Trends in Quantum Many-body Physics, Dec.15-17. Kouichi Okunishi, Naoki Kawashima, Shingi Todo, Takami Tohyama, Keisuke Totsuka, Tomotoshi Nishino, Kenji Harada, Toshiya Hikihara, 51-participants,

YITP-W-14-15

Workshop on gravitational-wave and electromagnetic signals from compact binary mergers and related topics, Feb.12-14. Yuichiro Sekiguchi, Masaru Shibata, Takahiro Tanaka, Takashi Nakamura, Kuni-hito Ioka, Shinya Wanajo, Masaomi Tanaka, 50-participants,

YITP-W-14-16

Thermodynamics, Large deviation and Transportation, Sep.17-18. Shin-ichi Sasa, Naoko Nakagawa, Hisao Hayakawa, 32-participants,

3.3 Regional Schools supported by YITP

▷ 2014.4.1—2015.3.31

Here is the list of the Regional Schools with the dates, the place, the name(s) of the main invited Lecturer(s) and the participating Universities.

YITP-S-14-01

Hokuriku Spring School 2014, May 16-18, M. Hanada(Kyoto Univ.), H. Aoyama(Kyoto Univ.), Kanazawa Univ., Fukui Univ. Niigata Univ., Toyama Univ.

YITP-S-14-02

Chuubu Summer School 2014, Sep.5-8, S. Nakamura (Chuo Univ.), Shizuoka Univ., Shinshu Univ., Tokai Univ., Univ. of Shizuoka

YITP-S-14-03

19th Niigata-Yamagata joint school, Nov.7-9, K. Kohri (KEK), Niigata Univ., Yamagata Univ., Tohoku Univ., Ohu Univ., Joetsu Univ. of Edu.

YITP-S-14-04

The 27th Hokkaido Nuclear Theory Group Meeting, Nov.19-21, D. Jido (Tokyo Metro. Univ.), H. Fujioka (Kyoto Univ.), Hokkaido Univ., Kitami Inst. of Tech., Hokusei Gakuen Univ., Sapporo Gakuin Univ.

YITP-S-14-05

The 37th Shikoku Seminar on Particle and Nuclear Physics, Dec.13-14, S. Tsujikawa (Tokyo Univ. of Sci.), Tokushima Univ., Ehime Univ., Kochi Univ., Niihama Inst. of Tech.

YITP-S-14-06

Hokuriku-Shinetsu Winter School, Feb.20-23, N. Haba (Shimane Univ.), S. Matsumoto (Kavli IPMU), Toyama Univ., Kanazawa Univ., Kinjo Univ., Kinjo Col.