# YITP Annual Report

**Yukawa Institute For**
**Theoretical Physics**
**Kyoto University**

2011

# Foreword

We present here an annual report of the scientific activities of Yukawa Institute for Theoretical Physics during the academic year 2011.

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 2011 we held two long-term workshops on ”Dynamics and correlations in exotic nuclei” and on ”Novel Quantum States in Condensed Matter: Correlation, Frustration and Topology”, and extensive discussions have been exchanged. Our report contains some of the results obtained during these workshops.

Director
Taichi Kugo

# Contents

## Chapter 1

# People

4 January 2012

# 1.1 Regular Staff and Guest Professors (2011 April – 2012 March)

## Regular Staff

**Tohru Eguchi**
Professor (E) [– 2012.3.31]

**Hisao Hayakawa**
Professor (C)

**Ken-ichi Shizuya**
Professor (E) [– 2012.3.31]

**Taichiro Kugo**
Professor (E)

**Misao Sasaki**
Professor (A)

**Takami Tohyama**
Professor (C)

**Takahiro Tanaka**
Professor (A)

**Akira Ohnishi**
Professor (N)

**Masaru Shibata**
Professor (A)

**Ryu Sasaki**
Associate Professor (E)

**Masatoshi Murase**
Associate Professor (C)

**Hiroshi Kunitomo**
Associate Professor (E)

**Naoki Sasakura**
Associate Professor (E)

**Keisuke Totsuka**
Associate Professor (C)

**Shigehiro Nagataki**
Associate Professor (A)

**Ken-iti Izawa**
Associate Professor (E)

**Naoyuki Itagaki**
Associate Professor (N)

**Fumihiro Takayama**
Associate Professor (E)

**Kazuo Hosomichi**
Associate Professor (E)

**Takao Morinari**
Assistant Professor (C) [– 2012.3.31]

**Daisuke Jido**
Assistant Professor (N)

**Seiji Terashima**
Assistant Professor (E)

**Hirofumi Wada**
Assistant Professor (C) [– 2012.3.31]

**Yuko Fujita**
Project Manager

**Takayuki Muranushi**
Assistant Professor (A)

**Takahiro Sagawa**
Assistant Professor (C) [2011.4.1 –]

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. Grzegorz Szamel**
(Colorado State University)
2011.4.12 — 2011.7.11
*Nonequilibrium physics of disordered materials : glass transition and jamming transition*

**Prof. Barton Zweibach**
(Massachusetts Institute of Technology)
2011.6.1 — 2011.8.31
*T-duality, String Field Theory, and Superstrings*

**Prof. Valeri Frolov**
(University of Alberta)
2011.10.1 — 2011.12.31
*Black hole physics*

**Prof. Philippe de Forcrand**
(ETH Zürich)
2011.12.28 — 2012.3.27
*Lattice QCD at finite density*

# 1.2 Research Fellows and Graduate Students (2011 April – 2012 March)

## Research Fellows

**Norichika Sago** (A) [2008.12.1 – ]

**Takatoshi Ichikawa** (N) [2009.4.1 – ]

**Kenta Kiuchi** (A) [2010.2.1 – ]

**Atsushi Nishizawa** (A) [2010.4.1 – ]

**Takashi Hiramatsu** (A) [2010.4.1 – ]

**Yudai Suwa** (A) [2010.4.1 – ]

**Laila Alabidi** (A) [2010.11.1 – ]

**Keisuke Izumi** (A) [2011.4.1 – 2011.8.31]

**Marco Ruggieri** (N) [2009.9.28 – 2011.9.27]

**Takashi Shimomura** (E) [2009.10.1 – 2011.9.30]

**Andrew Doukas Jason** (A) [2009.11.25 – 2011.11.24]

**Yeizon Rodriguez Garcia** (A) [2011.11.30 – 2011.12.20]

**Takenori Furumoto** (N) [2010.4.1 – 2012.3.31]

**Yasuyuki Hatsuda** (E) [2010.4.1 – 2012.3.31]

**Alberto Martinez Torres** (N) [2010.3.10 – 2012.3.31]

**Mamoru Matsuo** (C) [ – 2012.3.31]

**Shigetoshi Sota** (C) [2007.9.1 – 2012.3.31]

**Tadahiro Suhara** (N) [2011.4.1 – 2012.3.31]

**Masato Taki** (E) [2009.4.1 – 2012.3.31]

**Tatsuro Yuge** (C) [2011.10.1 – 2012.3.31]

**Masashi Kimura** (A) [2011.4.1 – ]

**Zhi Li** (C) [2011.4.1 – ]

**Masato Minamitsuji** (A) [2011.4.1 – ]

**Chul Moon Yoo** (A) [2011.4.1 – ]

**Kenji Morita** (N) [2011.4.1 – ]

**Hiroki Nagakura** (A) [2011.4.1 – ]

**Ryo Saito** (A) [2011.4.1 – ]

**Kazuhiro Sakai** (E) [2011.4.1 – ]

**Lee Shiu-hang** (A) [2011.4.1 – ]

**Hiroki Ohta** (C) [2011.4.1 – ]

**Naoki Yoshioka** (C) [2011.4.1 – ]

**Lu Hantao** (C) [2011.7.1 – ]

**Andrea Prudenzia** (E) [2011.10.21 – ]

**Hirotaka Ito** (A) [2011.11.1 – ]

**Masaomi Ono** (A) [2011.11.1 – ]

## Graduate Students

**Koji Azuma** (E) [2009.4.1 – ]

**Masahiro Ikeda** (C) [2009.4.1 – ]

**Kouki Ishimoto** (C) [2009.4.1 – ]

**Koki Nakata** (C) [2009.4.1 – ]

**Soichiro Isoyama** (A) [2009.4.1 – ]

**Yuusuke Kourai** (A) [2009.4.1 – ]

**Kazuyuki Sugimura** (A) [2009.4.1 – ]

**Kazuhiko Kamikado** (N) [2008.4.1 – ]

**Manabu Sakai** (E) [2008.4.1 – ]

**Kazuya Misao** (A) [2008.4.1 – ]

**Hirotada Okawa** (A) [2007.4.1 – ]

**Maiko Kouriki** (E) [2007.4.1 – ]

**Kentaro Tanabe** (A) [2007.4.1 – ]

**Yuichiro Nakai** (E) [2007.4.1 – ]

**Atsushi Naruko** (A) [2007.4.1 – ]

**Tatsuhiro Misumi** (E) [2007.4.1 – ]

**Takahiro Himura** (C) [2007.4.1 – ]

**Takanori Sugimoto** (C) [2007.4.1 – ]

**Sugure Tanzawa** (A) [2005.4.1 – ]

**Hiroyuki Yoshidsumi** (C) [2006.4.1 – ]

**Koutarou Kyutoku** (A) [2007.4.1 – ]

**Moto Araki** (C) [2010.4.1 – ]

**Takashi Nakano** (N) [2010.4.1 – ]

**Tsubasa Takahashi** (E) [2010.4.1 – ]

**Tomotsugu Takahashi** (A) [2010.4.1 – ]

**Masahiro Nozaki** (E) [2010.4.1 – ]

**Naofumi Hama** (E) [2010.4.1 – ]

**Hirotsugu Mitsui** (E) [2010.4.1 – ]

**Kiyoshi Kanazawa** (C) [2010.4.1 – ]

**Wataru Eguchi** (C) [2010.4.1 – ]

**Koudai Sugimoto** (C) [2010.4.1 – ]

**Kiyotaka Yoshida** (C) [2010.4.1 – ]

**Zhang Yingli** (A) [2010.10.1 – ]

**Ryo Murakami** (C) [2011.4.1 – ]

**White Jonathan** (A) [2011.4.1 – ]

**Kazuya Shinjo** (C) [2011.4.1 – ]

**Yasunori Matsui** (C) [2011.4.1 – ]

**Tomohiko Sano** (C) [2011.4.1 – ]

**Satoshi Takada** (C) [2011.4.1 – ]

**Takumi Imai** (E) [2011.4.1 – ]

**Tomoki Nosaka** (E) [2011.4.1 – ]

**Hashiba Noritoshi** (E) [2011.4.1 – ]

**Yusuke Kimura** (E) [2011.10.1 – ]

# Ph.D Awarded

**Maiko Kohriki**
*Gauge Fixing of Modified Cubic Open Superstring Field Theory* (E)
(supervisor: Hiroshi Kunitomo)

**Koutarou Kyutoku**
*The black hole-neutron star binary merger in full general relativity:dependence on neutron star equations of state* (A)
(supervisor: Masaru Shibata)

**Tatsuhiro Misumi**
*Research on novel lattice fermions toward efficient QCD simulations* (E)
(supervisor: Kenichi Shizuya)

**Yuichiro Nakai**
*New Aspects of Gauge Mediation* (E)
(supervisor: Ken-Iti Izawa)

**Atsushi Naruko**
*Non-linear Cosmological Perturbation Theory* (A)
(supervisor: Misao Sasaki )

**Hirotada Okawa**
*Black Hole Collision in Higher Dimensions* (A)
(supervisor: Masaru Shibata)

**Takanori Sugimoto**
*Dynamical Properties in Low-Dimensional Quantum Spin Systems* (C)
(supervisor: Takami Tohyama)

**Kentaro Tanabe**
*Black Holes and Asymptotics in Higher Dimensional Spacetimes* (A)
(supervisor: Misao Sasaki)

Chapter 2

# Research Activities

# 2.1 Research Summary

# Astrophysics and Cosmology Group

## Inflation and Early Universe

K. Sugimura and M. Sasaki, together with D. Yamauchi, studied a multi-field open inflation model, in which one of the fields dominates quantum tunneling from a false vacuum while the other field governs slow-roll inflation within the bubble nucleated from false vacuum decay. They found that the model considered is the first concrete, viable model of open inflation realized with a simple potential. Then they found that the tunneling rate increases in general in comparison with the single field case, though the increase is small unless the inflaton affects the instanton solution substantially.

Y. Zhang and M. Sasaki studied cosmological solutions in a model of non-local gravity with a large bare cosmological constant. In the absence of matter, they found an expanding universe solution with decelerated expansion without any fine-tuning of the parameter. Thus the effect of the bare cosmological constant is shielded in this solution, suggesting the possibility of a new solution to the cosmological constant problem in non-local gravity.

M. Sasaki, together with A. Abolhasani and H. Firouzjahi, studied a class of hybrid inflation models which had not been carefully discussed previously. They found that for models with a mild water-fall phase transition the induced curvature perturbation from the waterfall field was too large to satisfy the COBE normalization, hence excluding a substantial fraction of the parameter space.

## Cosmic Censorship

There is a claim that a static charged black hole (Reissner-Nordström black hole) can be overcharged by absorbing a charged test particle. If it is true, it might give a counter example to the weak cosmic censorship conjecture, which states that spacetime singularities are never observed by a distant observer. S. Isoyama, N. Sago and T. Tanaka have claimed that the back reaction effects of a charged particle cannot be neglected when judging whether the suggested process is really a counter example to the cosmic censorship conjecture or not. Furthermore, they argued that all the back reaction effects can be properly taken into account when we consider the trajectory of a particle on the border between the plunge and bounce orbits. In such marginal cases the Reissner-Nordström black hole can never be overcharged via the absorption of a charged particle. Since all the plunge orbits are expected to have a higher energy than the marginal orbit, they concluded that there is no supporting evidence that indicates the violation of the cosmic censorship in the proposed overcharging process.

## Cosmology with Space-based Gravitational-Wave Detectors

A. Nishizawa and T. Tanaka, together with K. Yagi and A. Taruya, investigated the constraints on the equation of state of dark energy with future space-based gravitational-wave detectors with/without identifying the redshifts of host galaxies. The sensitivity to the primordial gravitational waves has also been studied, properly dealing with the residual of the neutron-star binary foreground.

## Testing Modified Gravity using Gravitational Waves

T. Tanaka, together with K. Yagi, L. C. Stein and N. Yunes, considered a general class of modified gravity theories extended through the addition of all terms quadratic in the curvature tensor coupled to scalar fields. The coupled field equations in the post-Newtonian (PN) approximation, assuming a comparable-mass, have been derived and solved. They found that black holes in Einstein-Dilaton-Gauss-Bonnet and Chern-Simons theory can have hair, while neutron stars have no scalar monopole charge, in diametrical opposition to results in scalar-tensor theories. They also found that scalar field emission mainly dominates the energy flux budget, sourcing even-parity dipole scalar radiation and odd-parity quadrupole scalar radiation, correcting the general relativistic prediction at relative-1PN and 2PN orders.

## Simulation for Supernova Explosion

Recent simulations of multidimensional neutrino-radiation hydrodynamics show the successful shock expansion to the outside of the iron core, which was not able to be found in spherically symmetric simulations. However, the explosion energy obtained in the multidimensional simulations is smaller than the typical observed value by one or two orders of magnitude. Y. Suwa and his collaborators suggested a new possibility for making the explosion energy greater by including neutrino collective oscillation. They performed axisymmetric simulations and showed that some parameter regions actually produce sufficiently strong explosion based on this scenario.

Y. Suwa, together with T. Takiwaki and K. Kotake, developed a new code that can solve neutrino-radiation hydrodynamics in three dimension. Using this code, they investigated how the three dimensional (3D) hydrodynamic motion affects the neutrino-heating, and found that 3D effects could lead to a larger neutrino-heating rate than two dimensional (axial symmetric) ones due to longer dwell time of matter in the heating regime.

## Central Engine of Long Gamma-Ray Bursts

S. Nagataki performed GRMHD simulations to investigate the effects of extracting rotation energy of a Kerr black hole, which can be formed at the center of a massive star at the final stage of its life. It was found that a jet is launched by the effect, and it was confirmed that a stronger jet is driven from a more rapidly rotating black hole. This can be a promising mechanism of the central engine of long-duration GRBs.

## Relativistic Sunyaev-Zel'dovich effect in a galaxy cluster

S. Nagataki investigated the relativistic correction for Sunyaev-Zel'dovich effect in a galaxy cluster with his collaborators (D. Prokhorov, Y. Dubois, T. Akahori, K. Yoshikawa, S. Colafrancesco, K. Seon). This is because temperature of electrons in a large cluster can be very high and relativistic correction cannot be negligible. Numerical simulations of colliding galaxy clusters were performed using Smoothed Particle Hydro code. Then a mock observation was done to investigate whether the relativistic effects can be deduced from future observations such as Planck. We succeeded in showing that electron temperature of a galaxy cluster can be estimated precisely when the relativistic corrections are taken into account.

## Photospheric Emission from GRB Jet

S. Nagataki and J. Aoi studied the thermal emission from a photosphere of a GRB jet with their collaborator, A. Mizuta. The energy spectrum of a GRB is typically non-thermal, but it may be explained due to superposition of thermal spectrum that are emitted from photosphere of the jet. This is because each region of the photosphere has different temperature. Numerical simulations of GRB jets by a relativistic hydro code were performed to investigate this effect. It was found that the superposition of thermal spectrum can result in non-thermal-like spectrum. Especially it was confirmed that low-energy side of the spectrum can be similar to observations.

## Thermal Ultraviolet/Soft X-Ray Emission from Failed GRBs

S. Nagataki pointed out the possibility that thermal UV/Soft X-ray emission can be detected by future satellites from failed GRBs with his collaborators, M. Xu and Y. Huang. Theoretically it is hard to satisfy a condition to produce a successful GRB. So, it is natural to consider that failed GRBs, which could not produce highly relativistic jets to emit a large amount of gamma-rays, exist in the universe. In this case, thermal emission in UV/Soft X-ray band is highly expected. We estimated their flux, and we concluded that they can be detected by the future mission such as MAXI.

## Binary System of PSR B1259-63/LS 2883

S. Nagataki performed numerical simulations for the binary system PSR B1259-63/LS 2883 where a pulsar wind interact with its companion star's wind/disk. Observationally double peaks in light curves are detected in multi-wavelength (from radio to TeV gamma-rays). It is generally believed that these peaks are signatures for a pulsar to enter into the disk of the companion star. However, the disk can be brown away by the pulsar wind. We have performed numerical simulations to show such a detailed interaction between pulsar wind and companion star's wind/disk.

## Double Neutron Star and Black hole-Neutron Star Binaries

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. The merger of NS-NS or BH-NS binaries is also a likely progenitor of the central engine of short GRBs. To accurately predict gravitational waveforms in the late inspiral and merger phases of these binaries as well as to clarify the merger process for studying the merger hypothesis of the short GRBs, it is necessary to solve Einstein's equation as well as the HD/MHD equations taking into account a realistic microphysics for NSs. The unique theoretical approach to this issue is numerical relativity, in which all these equations are solved numerically. K. Kiuchi, K. Kyutoku, H. Okawa, Y. Sekiguchi, and M. Shibata with K. Hotokezaka performed a variety of numerical simulations for NS-NS and BH-NS binaries in the framework of numerical relativity changing mass, BH spin, and NS's equations of state. For NS-NS binaries, they clarified the dependence of gravitational waveforms on the equations of state and masses of NSs, in particular for the case that a massive neutron star is formed after the merger. In particular new is that Sekiguchi, Kiuchi, Kyutoku, and Shibata performed the simulation for NS-NS incorporating neutrino cooling effects and a physical equation of state in which the finite-temperature effect is taken into account. They showed for the first time in general relativity that the neutrino luminosity could be as high as several times $10^{53}$ erg/s.

For BH-NS binaries, Kyutoku and his collaborators performed numerical simulations for a variety of equations of state with nonspinning and spinning BHs and quantitatively clarified that gravitational-wave frequency at the onset of tidal disruption of NS depends strongly on the equation of state. These imply that detection of gravitational waves will lead to constraining equations of state of nuclear matter. For the case that NS is tidally disrupted, a disk of mass $\sim 0.01$–$0.4 M_{\odot}$ may be formed. The formed BH-disk system was shown to have a favorable property for short GRBs. Kyutoku's PhD thesis on this topic was published as the Springer thesis.

## Developing Numerical Relativity Code with Radiation and Formalism

To perform an astrophysical simulation, we have to implement physical processes in the numerical code. In numerical relativity, this task has not been done until quite recently. In particular, this was the case for multi-dimensional radiation hydrodynamics in general relativity. We had not had even a formalism that can be useful in numerical relativity. In such a situation, M. Shi-

bata, K. Kiuchi, Y. Sekiguchi, and Y. Suwa developed a new formalism of neutrino-radiation transport, and then, Y. Sekiguchi started implementing this new formulation in his code. Shibata and Sekiguchi also performed a simulation for black hole-torus systems based on this new formalism and showed it possible to perform physical simulations using it.

## MHD Simulations in Numerical Relativity

Neutron stars in nature are usually strongly magnetized, and subject to a variety of magnetohydrodynamic instabilities. K. Kiuchi, K. Kyutoku, and M. Shibata developed a new 3D GRMHD code in which mesh-refinement technique is incorporated and the magnetic flux conservation is preserved within the truncation error. They also performed 3D numerical-relativity simulations for rapidly and differentially rotating magnetized neutron stars that are possible outcomes after the merger of binary neutron stars. They found that a strong Poynting flux is emitted due to the differential rotation and the typical magnetic luminosity is $10^{47}\,\mathrm{ergs/s}$ for the magnetic-field strength $10^{13}\,\mathrm{G}$ and rotational period $\sim 1$ ms. They also found that the jet is subject to a kink instability.

## Gravitational Waves from Massive Torus surrounding Black Holes

K. Kiuchi and M. Shibata with P. J. Montero and J. A. Font performed 3D numerical-relativity simulations for the system composed of a black hole and massive self-gravitating torus. Such a system could be formed after the core collapse of very massive stars. They found that the torus is unstable to non-axisymmetric deformation if its mass is larger than $\sim 10\%$ of the mass of the black hole. They also showed that the system with deformed torus emits quasi-periodic gravitational waves for a long term, which may be detected by advanced LIGO and KAGRA if the source is located within $\sim 100\,\mathrm{Mpc}$.

# Condensed Matter and Statistical Dynamics Group

## Advanced Statistical Dynamics

The subjects of advanced statistical dynamics are nonequilibrium statistical mechanics, nonlinear sciences and biological physics. The main goal in this field is to understand how dynamical nonequilibrium structures are sustained in nature based on tools of statistical physics. Thus, the research areas are spreaded in variety of fields in social sciences, biology, chemisty, engineering, mathematics and physics. The current research activities of our group are nanophysics, granular physics, nonlinear rheology in glassy materials, biomechanics, and system biology. This academic year, Hayakawa has organized an international workshop "Nonequilibrium dynamics in astrophysics and material science", and Hayakawa was involved as one of the orgnaizers of French-Japan meeting on Jamming, Glasses and Phase Transitions at Paris and IUTAM symposium on mobile particulate systems at Bangalore. Hirofumi Wada and Takahiro Sagawa received the Young Scientist Awards of the Physical Society of Japan. Masatoshi Murase organized Kyoto University International Forum on "Towards a New Synthesis of Knowledge" at Kyoto University Clock Tower Centenial Hall.

*Phase transition in peristaltic transport of frictionless granular particles*

Yoshioka and Hayakawa have numerically studied flows of dissipative particles driven by the peristaltic motion of a tube. A transition from a slow "unjammed' flow to a fast "jammed' flow is found through the observation of the flow rate at a critical width of the bottleneck of a peristaltic tube. It is also found that the average and fluctuation of the transition time, and the peak value of the second moment of the flow rate exhibit power-law divergence near the critical point and that these variables satisfy scaling relationships near the critical point. The dependence of the critical width and exponents on the peristaltic speed and the density is also discussed.

*Geometric expression for nonequilibrium entropy production*

T. Sagawa and H. Hayakawa studied the properties of the entropy production in transitions between nonequilibrium steady states (NESSs). Based on the full counting statistics of of Markovian jump processes, they derived a general formula for the excess part of the cumulant generating function of the entropy production for quasi-static transitions between NESSs. The obtained formula is geometrical; the excess cumulant generating function depends only on a trajectory in the parameter space, analogous to the Berry phase in quantum mechanics. Their result can exactly be applied to nonlinear-nonequilibrium situations beyond the linear response regime.

*Nonequilibrium thermodynamics of feedback control*

T. Sagawa and his collaborator studied the nonequilibrium properties of feedback control on thermodynamic systems. In particular, they generalized nonequilibrium equalities, such as the fluctuation theorem and the Jarzynski equality, to situations in which multiple measurements and feedback control are performed on a stochastic thermodynamic system with multi-heat baths. As a corollary, they derived a generalized second law of thermodynamics including the term of information transfer.

*Jamming transition for frictional grains*

M. Otsuki and H. Hayakawa have numerically investigated the critical rheology of sheared frictional granular materials near jamming transition. It is confirmed that there exists a true critical density which characterizes the onset of the yield stress and two fictitious critical densities which characterize the scaling laws of rheological properties. We find the existence of a hysteresis loop between two of the critical densities for each friction coefficient. It is noteworthy that the critical scaling law for frictionless jamming transition seems to be still valid even for frictional jamming despite using fictitious critical density values.

*Weakly nonlinear analysis for sheared granular flow*:

K. Satioh and H. Hayakawa has carried out weakly nonlinear analysis of a two dimensional sheared granular flow under the Lees-Edwards boundary condition. They derive the time dependent Ginzburg?Landau equation of a disturbance amplitude starting from a set of granular hydrodynamic equations and discuss the bifurcation of the steady amplitude in the hydrodynamic limit.

*Geometric aspects of the viscous dynamics of a rotating elastic filament*

It is known that an elastic rod rotating in a viscous fluid undergoes a shape transition from a twirling (axial spinning) to a whirling state (crankshafting motion) at a certain critical frequency [Wolgemuth et al., Phys. Rev. Lett. 84, 1623 (2000)]. Although this is an example of the classical buckling of driven elastic filaments, the physical properties of such whirling rods are largely unknown, owing to their strongly nonlinear character. Wada analytically and numerically demonstrate that this dynamical transition occurs to reduce the viscous energy dissipation. A simple geometric interpretation underlying this observation is also given. These results provide a fundamental scenario for viscous twist transport in flexible filaments and are potentially important in the analysis of biopolymer dynamics such as DNA supercoiling during transcriptions.

*Living systems and their evolution*

M. Murase discussed possible effects of external stimuli on living organisms. Because living systems can show adaptation to environmental stimuli, it is difficult to estimate their biological effects from a point of view of simple input-output relationship. Nevertheless, as living systems had accumulated various stimuli during their past

events, even a small amount of stimulus might cause non-negligible biological effects. Different tissue cells have quite different characteristics, which might lead to diverse results to the same stimuli depending on cell types.

## 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 effects. 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 phenomena. The area of current research in our group includes dynamical properties of strongly-correlated electron systems, physics of the iron-based- and the cuprate superconductors, and exotic phenomena in low-dimensional quantum magnetism.

*Spin and orbital characters of excitations in iron arsenides revealed by simulated resonant inelastic x-ray scattering*: After intensive study of iron arsenides motivated by the discovery of high-temperature superconductivity, it has been recognized that both spin and orbital degrees of freedom are the key to understanding the physics of iron arsenides. We examined the orbital excitations coupled to the spin degree of freedom in the parent state of the iron-arsenide superconductor, based on the calculation in a five-band itinerant model. The calculated Fe $L_3$-edge resonant inelastic x-ray scattering spectra disclose the presence of spin-flip excitations involving several specific orbitals. Magnon excitations predominantly composed of a single orbital component can be seen in experiments, although its spectral weight is smaller than spin-flipped interorbital high-energy excitations. The detailed polarization and momentum dependence was also discussed with predictions for the experiments.

*Quantum dynamics of a driven correlated system, coupled to phonons*: One of the outstanding contemporary challenges in condensed matter physics is to understand the dynamics of interacting quantum systems exposed to an external perturbation. We studied a doped strongly correlated system coupled to phonons, where the energy gained by the motion of a charge carrier along the field is absorbed by quantum spin and phonon degrees of freedom which are all explicitly included in the model. We found that the coupling to phonons decreases carrier mobility and that the spin subsystem absorbs the energy from the field more efficiently than the lattice for model parameters fitting cuprate superconductors.

*Spin excitation assisted by non-softening phonon for spin-Peierls model*: One-dimensional quantum spin system coupled with lattice degree of freedom has been extensively studied experimentally and theoretically, since the systems provide a playground of spin-Peierls transition. The discovery of $CuGeO_3$ has casted a problem on the conventional mechanism of the spin-Peierls transition, since the soft-phonon mode associated to lattice alternation has never been found. We studied spin dynamics of the spin-Peierls chain with non-softening phonon. The dynamical spin correlation function and phonon excitation spectrum were calculated by using dynamical density-matrix renormalization group method. We found a new spin excitation assisted by non-softening phonon. The excitation is located above phonon in energy and shows a dispersive feature with strong intensity near the momentum $\pi$. The phonon excitation spectrum is also influenced by the spin-phonon interaction. We discussed the possibility of observing the spin-phonon coupled features in inorganic spin-Peierls compound $CuGeO_3$.

*Enhancement of antiferromagnetic correlations below superconducting transition temperature in bilayer superconductors*: Recently nuclear magnetic resonance experiments in multilayered cuprate superconductors revealed that enhancement of the antiferromagnetic order occurs below the superconducting transition temperature. Since it is believed that the antiferromagnetic correlation plays a crucial role in the mechanism of high-temperature superconductivity, an important issue here is whether superconducting order coexists with antiferromagnetic order or not. The question is how the enhancement of the antiferromagnetic order occurs. There are two possibilities: one is that the enhancement is associated with the intrinsic nature of the interplay between the mechanism of superconductivity and the antiferromagnetic correlation. The other is that the enhancement is associated with the proximity effect between an antiferromagnetic ordered layer and a superconducting layer. Yoshizumi, Morinari, and Tohyama examined a bilayer system with interactions which stabilize superconductivity and antiferromagnetic order within a mean field theory. They found that when one layer is superconducting and the other layer is antiferromagnetically ordered, the proximity effect leads to a clear enhancement below the superconducting transition temperature. Meanwhile, if antiferromagnetic order and superconductivity coexist within a single layer, then there is no enhancement below the superconducting transition temperature. Their result suggests that the experimentally observed enhancement of antiferromagnetic order should be associated with the proximity effect.

# 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 2011.

## Nuclear structure and dynamics

*Linear chain structure of four $\alpha$ particles in $^{16}O$:* Ichikawa, Itagaki and their collaborators investigated the linear chain configurations of four-$\alpha$ clusters in $^{16}$O using a Skyrme cranked Hartree-Fock method and discussed the relationship between the stability of such states and angular momentum. They showed the existence of a region of angular momentum ($J = 13 \sim 18\hbar$) where the linear chain configuration is stabilized. They also demonstrated that stable states with a large moment of inertia ($\Theta/\hbar^2 = 7.3 \sim 8.2$ MeV$^{-1}$) can exist.

*Cluster correlations for low-lying intruder states of $^{12}Be$:* The formation of intruder states in the low-lying states of $^{12}$Be=$\alpha$+$\alpha$+4$N$ has been studied by Itagaki and collaborators by applying the generalized two-center cluster model, which can optimize the excess neutrons' orbits depending on the $\alpha$-$\alpha$ distance. The correlation energy for the intruder states has been analyzed from the viewpoint of two different pictures based on the cluster structure: the covalent picture around two $\alpha$ clusters and the binary He-cluster picture.

*Three triton states in $^{9}Li$:* Furumoto, Ichikawa, and Itagaki *et al*. have investigated whether three-triton states appear or not in excited states of $^{9}$Li. They also searched for a signature of the gaslike three-triton state, which is partly an analogy to the the case of the three-$\alpha$ state in $^{12}$C (Hoyle state). For this purpose, they used both three-triton and $\alpha$+t+n+n wave functions to describe the low-lying states of $^{9}$Li and took into account the coupling effect between them. They have shown that the states in which the three-triton components dominate indeed appear below the three-triton threshold energy, although the root-mean-square radii of those states are not so much expanded in comparison with the gaslike state of three $\alpha$'s.

*Nuclear fission reaction:* Ichikawa and his collaborators investigated nuclear fission processes for $^{180}$Hg and $^{236}$U. They calculated potential-energy surfaces for a typical actinide nucleus and for 12 even isotopes in the range $^{178}$Hg-$^{200}$Hg, demonstrating the radical differences between actinide and mercury potential surfaces. They discussed these differences and how the changing potential-energy structure along the mercury isotope chain affects the observed (a)symmetry of the fission fragments. They also showed that the mechanism of asymmetric fission is very different in proton-rich mercury isotopes compared to the actinide region.

*Nuclear scattering reaction:* Furumoto and his collaborators presented a new global optical potential for nucleus-nucleus systems, including neutron-rich and proton-rich isotopes, in the energy range of $50 \sim 400$ MeV/u. The global optical potential is represented by a linear combination of 10-range Gaussian functions. The expansion coefficients depend on the incident energy, the projectile and target mass numbers and the projectile atomic number, while the range parameters are taken to depend only on the projectile and target mass numbers. The full set of the range parameters and the coefficients for all the projectile-target combinations at each incident energy are provided on a permanent open-access website together with a Fortran program for calculating the microscopic-basis global optical potential for a desired projectile nucleus by the spline interpolation over the incident energy and the target mass number.

*Two-neutron correlation:* Suhara and his collaborators investigated two-neutron densities obtained from microscopic wave functions of $^{6}$He and $^{8}$He to reveal di-neutron correlations. In particular, the comparison of the two-neutron density with the product of one-neutron densities is useful for a quantitative discussion of di-neutron correlations. The calculations show that the $S = 0$ spatial two-neutron correlation increases at the surface of $^{6}\mathrm{He}(0_1^+)$ and $^{8}\mathrm{He}(0_2^+)$. The enhancement is remarkable in the $^{6}\mathrm{He}(0_1^+)$ ground state but not as prominent in the $^{8}\mathrm{He}(0_1^+)$ ground state. Configuration mixing of many Slater determinants is essential to describe the di-neutron correlations. Two-neutron densities in $^{12}$C wave functions with $\alpha$-cluster structures are also studied.

*Cluster structures in nuclei:* Suhara and his collaborators investigated cluster states in $^{9}$Li with calculations of a $^{6}$He-$t$ cluster model. Results suggest $^{6}$He-$t$ cluster states near the $^{6}$He-$t$ threshold energy. These states construct a $K^\pi = 1/2^-$ band and their neutron configuration is similar to that of the $K^\pi = 0_2^+$ band in $^{10}$Be. They also investigated structures of excited states in $^{11}$B with a method of $\beta$-$\gamma$ constraint antisymmetrized molecular dynamics in combination with the generator coordinate method. Various excited states with developed cluster core structures are suggested in positive- and negative-parity states. For negative-parity states, they suggest a band with a $2\alpha$+$t$ cluster structure. This band starts from the $3/2_3^-$ state and can correspond to the experimental band observed recently. In positive-parity states, two $\alpha$ core cluster structures with surrounding nucleons are found. A $K^\pi = 1/2^+$ band is suggested to be constructed from a remarkably developed cluster structure with a large prolate deformation. They discuss features of the cluster structure in association with molecular orbital structures of $^{10}$Be.

*Hypernuclear structure and production cross section of* $\Lambda$

*and Ξ hypernuclei studied with antisymmetrized molecular dynamics:* Ohnishi in collaboration with Isaka, Matsumiya, Tsubakihara, Kimura and Dote developed an extended version of antisymmetrized molecular dynamics to study the structure of Λ and Ξ hypernuclei. By using effective Λ*N* and Ξ*N* interactions, they investigated the structure of ${}^{9}_{\Lambda}$Be, ${}^{13}_{\Lambda}$C, ${}^{20,21}_{\Lambda}$Ne, ${}^{25}_{\Lambda}$Mg and ${}^{12}_{\Xi}$Be hypernuclei. The changes to nuclear deformation caused by Λ particles are discussed. Λ in the *p* wave is found to enhance nuclear deformation, while that in the *s* wave reduces it. This effect is prominent in ${}^{13}_{\Lambda}$C and the $K^{\pi} = 0^{-}_{1} \otimes \Lambda_{s}$ cluster states in ${}^{21}_{\Lambda}$Ne. In Ξ hypernuclei, it is found that the calculated peak position of the production cross section depends on the Ξ*N* effective interaction and the magnitude of spin-flip and non-spin-flip cross sections of $K^{-}p \to K^{+}\Xi^{-}$ elemental processes. It is suggested that the ${}^{12}\mathrm{C}(K^{-},K^{+}){}^{12}_{\Xi}$Be reaction possibly provides information about the spin-dependent Ξ*N* interaction.

# Hadron structure and dynamics

*Dynamically generated resonances of three-body systems in a Faddeev approach*: Martínez Torres, Jido and their collaborator invesitgated the $KK\bar{K}$ system in a coupled channel approach based on solving the Faddeev equations considering the $KK\bar{K}$, $K\pi\pi$ and $K\pi\eta$ channels. They found a quasibound state around 1420 MeV with $I = 1/2$ and $J^{\pi} = 0^{-}$ below the three kaon threshold, which can be identified with the K(1460) resonance. Martínez Torres and his collaborators performed a calculation for the three-body $N\bar{K}K$ scattering amplitude by using the fixed-center approximation, and found a $N\bar{K}K$ hadron state. The results are in agreement with others obtained in previous theoretical works. Martínez Torres and Jido in collaboration with Khemchandani and Hosaka also studied three-pseudoscalar $\pi K\bar{K}$ and $\pi\pi\eta$ coupled system. A resonance with $I = 1$ and $J^{\pi} = 0^{-}$ is found with mass $\sim$ 1400 MeV when the $K\bar{K}$ system gets reorganized as the $f_0(980)$. This resonance is identified with the $\pi(1300)$. Further, the two-body amplitude which describes the interaction between a $\pi$ and the $f_0(980)$ is extracted from the study of the $\pi K\bar{K}$ and $\pi\pi\eta$ systems and is then employed to study the $f_0(980)\pi\pi$ system. As a result, a scalar resonance is found near 1790 MeV. These findings support the existence of a new $f_0$ resonance near 1790 MeV, as found by BES and Crystal Barrel.

*Coupling vector and pseudo scalar mesons to study baryon resonances:* Martínez Torres and collaborators performed a study of meson-baryon systems with total strangeness -1 within a framework based on the chiral and hidden local symmetries. These systems consist of octet baryons, pseudoscalar and vector mesons. The motivation of the present work is to study the effect of coupling of the closed vector meson-baryon (VB) channels to these resonances. The calculations done within this formalism reveal a very strong coupling of the VB channels to the $\Lambda(1405)$ and $\Lambda(1670)$. In the isospin 1 case, they find evidence for a double pole structure of the $\Sigma(1480)$ which, like the isospin 0 resonances, is also found to couple strongly to the VB channels. The strong coupling of these low-lying resonances to the VB channels can have important implications on certain reactions producing them.

*Compositeness of dynamically generated states in a chiral unitary approach*: Jido in collaboration with Hyodo and Hosaka has studied the structure of dynamically generated states in the chiral unitary approach from a viewpoint of their compositeness. They analyzed the properties of bound states, virtual states, and resonances in a single-channel chiral unitary approach, paying attention to the energy dependence of the chiral interaction. Definition of the compositeness of a bound state is given using the field renormalization constant of the bound state propagator in the relativistic field theory. Applying this scheme to the chiral unitary approach, they find that the bound state generated by the energy-independent interaction is always a purely composite particle, while the energy-dependent chiral interaction introduces the elementary component, depending on the value of the cutoff parameter.

*Heavy quarkonia at finite temperature based on the QCD sum rules:* Morita, in collaboration with Gubler, Suzuki and Oka, investigated the spectral modifications of heavy quarkonia at finite temperatures using QCD sum rules combined with the maximum entropy method (MEM). MEM enables us to obtain the spectral property without a particular ansatz. They applied the method to charmonia and found that the ground state charmonia melt at $T < 1.2T_c$ by the medium effect. They investigated the bottomonia, which are one of experimental topics in heavy ion collisions at LHC. They found that the lowest pole obtained by MEM contains contribution from the excited states below threshold. Carefully analyzing the structure of the lowest pole, they pointed out that those excited states melt at lower temperatures than the ground state.

*Identifying multiquark hadrons from heavy-ion collisions:* Identifying hadronic molecular states and/or hadrons with multiquark components either with or without exotic quantum numbers is a long-standing challenge in hadronic physics. Furumoto, Jido, Ohnishi, Sekihara and Yazaki in collaboration with Cho, Hyodo, Ko, Lee, Nielsen and Yasui suggest that studying the production of these hadrons in relativistic heavy ion collisions offers a promising resolution to this problem as yields of exotic hadrons are expected to be strongly affected by their structures. Using the coalescence model for hadron production, they find that, compared to the case of a nonexotic hadron with normal quark numbers, the yield of an exotic hadron is typically an order of magnitude smaller when it is a compact multiquark state and a factor of 2 or more larger when it is a loosely bound hadronic molecule. It is further found that some of the newly proposed heavy exotic states could be produced and realistically measured in these experiments.

*Hyperon matter and black hole formation in failed supernovae:* Ohnishi in collaboration with Nakazato, Furusawa, Sumiyoshi, Yamada and Suzuki investigated the emergence of hyperons in black-hole-forming failed supernovae, which are caused by the dynamical collapse

of nonrotating massive stars. By performing neutrino-radiation hydrodynamical simulations in general relativity adopting realistic hyperonic equation-of-state (EOS), attractive and repulsive cases are examined for the potential of $\Sigma$ hyperons. Since hyperons soften EOS, they shorten the time interval from the bounce to black hole formation, which corresponds to the duration of neutrino emission. This effect is larger for the attractive case than the repulsive case because $\Sigma$ hyperons appear more easily. In addition, they investigate the impacts of pions to find that they also promotes the recollapse towards the black hole formation.

# QCD matter and phase diagram

*Functional RG approach to QCD phase diagram with isospin chemical potential:* Kamikado in collaboration with Strodthff, Von Smekal and Wambach studied QCD phase diagram with finite isospin chemical potential using the function renormalization group (FRG) method. In the chiral effective (quark-meson) model with FRG evolution, it is demonstrated that the charged pion starts to condense at $T = 0$ when the charge chemical potential reaches the pion pole mass (known as "silver blaze") instead of the screening mass. They also calculated phase diagram in $T - \mu - \mu_f$ space and evaluated the effects of the mesonic fluctuation by comparing FRG and mean-field results.

*Strong-coupling analysis of parity phase structure in staggered-Wilson lattice fermions:* Nakano, Misumi and Ohnishi in collaboration with Kimura investigated the parity phase structure with new lattice fermions (staggered-Wilson fermions) in the strong-coupling lattice QCD. Following two main results are obtained by performing the hopping parameter expansion and the effective potential analysis in the strong-coupling limit. In some range of the fermion mass parameter, the parity-broken phase exists because the pion condensate is nonzero. It is possible to take a chiral limit because the pions become massless Nambu-Goldstone bosons on the phase boundary. These results strongly suggest that it is possible to perform lattice Monte-Carlo simulations with staggered-Wilson fermions by tuning the mass parameter to take a chiral limit as in the Wilson fermion.

*Possibility of QCD critical point sweep during black hole formation:* Ohnishi, Nakano and Ruggieri in collaboration with Ueda and Sumiyoshi investigated the possibility to probe the QCD critical point during the dynamical black hole formation from a gravitational collapse of a massive star, where the temperature and the baryon chemical potential become as high as $T \sim 90$ MeV and $\mu_B \sim 1300$ MeV. Comparison with the phase boundary in chiral effective models suggests that quark matter is likely to be formed before the horizon is formed. Furthermore, the QCD critical point may be probed during the black hole formation. The critical point is found to move in the lower temperature direction in asymmetric nuclear matter, and in some of the chiral models it is found to be in the reachable region during the black hole formation processes.

*Phase diagram of chiral effective models at imaginary chemical potential;* Morita, in collaboration with Skokov, Friman and Redlich, investigated the phase diagram of chiral effective models at imaginary chemical potential. Using the two flavor PNJL model in the mean field approximation, they analyzed the phase structure with a particular emphasis on role of the Polyakov loop potential and the interplay of the chiral and deconfinement transition. They found that the critical endpoint of the deconfinement transition which exists in the imaginary chemical potential is sensitive to such an interplay. They also studied the effect of the fluctuation of the chiral order parameter on the phase structure by making use of the functional renormalization group method. They found that the smoothened order parameter by the fluctuations alters a global structure of the phase diagram.

*Deconfinement and chiral symmetry restoration in a strong magnetic background:* Ruggieri in collaboration with Gatto studied the interplay among chiral symmetry restoration and deconfinement of color in high temperature QCD, and in presence of a strong magnetic background. It is shown that the interaction responsible for the chiral symmetry breaking must take into account an explicit dependence on the Polyakov loop, the latter being an approximate order parameter for the deconfinement. This aspect is important, since lattice simulations show that a magnetic background does not split the two QCD transitions; on the other hand, previous theoretical calculations using chiral models lead to a split of the two. The most natural way to have agreement between numerical simulations and theoretical predictions is to take into account the explicit dependence on the Polyakov loop of the interaction.

*Magnetic susceptibility of the quark condensate and polarization from chiral models:* Ruggieri in collaboration with Frasca studied the magnetic susceptibility of the chiral condensate as well as the polarization in a magnetic field, the latter being defined via the ratio $\langle\bar{\psi}\Sigma^{\mu\nu}\psi\rangle/\langle\bar{\psi}\psi\rangle$, where $\psi$ is a quark field and $\Sigma$ is the usual covariant spin matrix. An interesting result, confirmed by recent lattice simulations, is that at large magnetic fields a saturation of $\langle\bar{\psi}\Sigma^{\mu\nu}\psi\rangle$ takes place. The natural interpretation of this saturation is that at large fields, only the lowest Landau level gives a contribution to the chiral condensate, hence this zero mode is the most relevant one for chiral symmetry breaking in a strong magnetic field.

*Collective modes in the color flavor locked phase:* Ruggieri in collaboration with Anglani and Mannarelli studied the effective action of the color-flavor-locked phase of high density QCD. In this action, the relevant fields are the massless Goldstone mode related to the breaking of the baryonic $U(1)$ symmetry (superfluid mode), and the amplitude mode (Higgs mode). It is important to understand the interactions between the two modes. This aspect was studied by means of a first principle computation of the effective action, where possible relevance of the results for the physics of compact stellar objects is also discussed.

# 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. Noncommutative 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

*— supersymmetry breaking—*

Historically, visible sector supersymmetry breaking was abandoned due to phenomenological difficulties such as the prediction of light superpartners, and in turn, hidden sector supersymmetry breaking has been adopted. However, in the presence of the hidden sector, additional visible supersymmetry breaking is not forbidden phenomenologically. *Izawa*, *Nakai* and *Shimomura* proposed a supersymmetric extension of the standard model whose Higgs sector induces a spontaneous supersymmetry breaking by itself. The visible sector turns out to have a possibly light pseudo-goldstino in addition to extra Higgs particles, both of which stem from supersymmetry breaking dynamics. In such a setup of visible supersymmetry breaking, future experiments may reveal a part of supersymmetry breaking dynamics rather directly.

*— beyond the standard model —*

ATLAS and CMS in LHC have reported new physics results this year. In the Higgs searches and the searches for beyond the standard model inclusing SUSY, a large por-

tion of the parameter spaces has been excluded. In Higgs searches, they also suggest event excesses which may be related to Higgs particles with the mass around 125GeV in the decay mode into two photons. In these situations, a YITP workshop "Toward elementary particle theory beyond the standard model (in the light of new experimental results)" was organized by *Takayama* with Kitano (Tohoku) and Ibe (ICRR, Tokyo).

*— dark matters —*
In the light of new LHC bound on dark matter couplings with quarks and leptons, *Takayama* investigated the status of the thermal history of dark matter and the future prospects for collider experiments and direct/indirect dark matter observations.

## Quantum gravity

One of the main purposes of quantum gravity is to construct a theory which does not contain space-time in its basic formulation but generates it as an emergent infrared phenomenon. Among various proposals of such theories, the tensor models are recently being actively studied by a number of young researchers. Encouraged by the success of the matrix models as the two-dimensional simplicial quantum gravity, the tensor models were proposed a long time ago by *Sasakura* and some others to give well-defined models of the simplicial quantum gravity with arbitrary dimensions. Later Sasakura proposed a new approach, which specifically regarded the rank-three tensor models as models for dynamical fuzzy spaces. The main advantage of this new approach was that the rank-three tensor models can treat any dimensional cases, while the ranks of the tensor models depended necessarily on dimensions if the tensor models were interpreted as describing the simplicial quantum gravity. This led to the expectation that the rank-three tensor models would give a unified formulation which generates various dimensional spaces.

In the new interpretation, the generalized hermiticity condition in the rank-three tensor models corresponds to a certain cyclic property of the fuzzy spaces. *Sasakura* has shown that the fuzzy spaces with the property have various physically interesting characteristics. One is that, although the function algebras of the fuzzy spaces may generally be non-associative, various properties analogous to quantum mechanics hold. Another is that the symmetry of the rank-three tensor models can be shown to be represented systematically by *n*-ary transformations on the fuzzy spaces, which are also known to play significant roles in formulating M-theory.

It is widely accepted that time is not a global entity, but is just a local and relative quantity which is defined only by physical processes. On the other hand, local time is generally a confusing issue in the emergent picture of space-time, since there is no locality before the emergence of a space. Nevertheless *Sasakura* has successfully introduced "local" time into the rank-three tensor model by constructing Hamilton formalism with a first class constraint algebra. It has been verified that the first class constraint algebra correctly reproduces that of the ADM formalism of the general relativity in the limit of the usual space.

## String theory & SUSY gauge theories

*— $\mathcal{N}=2$ supersymmetric gauge theories —*
It is known that the non-perturbative quantum effects of 4d $\mathcal{N}=2$ supersymmetric gauge theory can be captured by classical complex geometry. This geometry is usually called the Seiberg-Witten curve when it is a curve, or just the Seiberg-Witten geometry when it is not. Many methods to obtain the solutions were devised over the years. However, the known $\mathcal{N}=2$ gauge theories are only for those in some special classes and there are no unified or uniform understanding of them.

*Terashima* and Tachikawa found a uniform solution to the 4d $\mathcal{N}=2$ gauge theory with a simple gauge group $G=A,D,E$ when the one-loop contribution to the beta function from any irreducible component R of the hypermultiplets is less than or equal to half of that of the adjoint representation. Many pieces of supporting evidences, for example by analyzing the system from the point of view of the 6d N=(2,0) theory compactified on a sphere were provided.

*— partition functions for susy gauge theories on 4 & 5 spheres —*
Among recent developments in supersymmetric gauge theories, there has been an important technical breakthrough based on explicit path integration using SUSY localization principle. The exact results for partition functions on deformed or compact manifolds serve as a powerful tool to probe various strong coupling behaviors. They also facilitate the study of the new aspects of the six-dimensional nontrivial quantum theory on the worldvolume of parallel M5-branes through compactification on spheres.

*Hama* and *Hosomichi* explored possible deformations of the round 4-sphere which can accommodate $\mathcal{N}=2$ supersymmetric gauge theories through the analysis of a generalized set of Killing spinor equations.

*Hosomichi*, *Seong* and *Terashima* constructed general supersymmetric gauge theories on a 5-sphere and, as a first step towards their exact partition functions, showed that the non-zero contribution to the path integral localizes onto a generalization of instanton configurations on $\mathbb{CP}^2$.

*— 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.

*Hatsuda* with Ito and Satoh investigated gluon scattering amplitudes in the $\mathcal{N}=4$ super Yang-Mills theory via AdS/CFT. Such a scattering amplitude at strong coupling can be computed by the area of the minimal surface in the AdS space. They analyzed a set of integral equations that gives the minimal area corresponding to the scattering amplitude, and found some analytic expressions of the multi-gluon scattering amplitudes.

*Hatsuda* with Fujita and Takayanagi investigated the

Lorentzian AdS wormholes. They computed the holographic entanglement entropy to probe this geometry, and found that there exists a mass gap in its holographic dual gauge theory.

*— 6d supersymmetric field theory —*
Supersymmetric field theories in six dimensions attract renewed interests in recent years. They offer a unified picture of interrelations among field theories in various dimensions. An intriguing feature of quantum field theories in six dimensions is the existence of interacting theories whose fundamental excitations are strings rather than particles. The non-critical $E_8$ string theory, or the E-string theory, is known as the simplest theory of this kind with minimal amount of supersymmetry. The study of the BPS spectrum of this theory has some history, in connection with Seiberg–Witten theories and topological string theories. *K. Sakai* found a Nekrasov-type expression for the Seiberg–Witten prepotential for the E-string theory toroidally compactified down to four dimensions. This serves as the first explicit result for the full BPS partition function of the theory. The prepotential is interpreted as the genus zero topological string amplitude for a Calabi–Yau threefold known as the local $\frac{1}{2}$K3, while higher genus amplitudes are also of interest. *K. Sakai* formulated a method of constructing these higher genus amplitudes by making full use of the Seiberg–Witten curve and the holomorphic anomaly equation. The amplitudes up to genus three were explicitly constructed for the most general local $\frac{1}{2}$K3.

*— superstring field theory —*
*Kohriki*, *Kugo* and *Kunitomo* studied the gauge-fixing problem of modified cubic open superstring field theory in detail both for the Ramond and Neveu-Schwarz sectors in the Batalin-Vilkovisky (BV) framework. They proved for the first time that the same form of action as the classical gauge-invariant one with the ghost-number constraint on the string field relaxed gives the master action satisfying the BV master equation. In a kind of $b_0 = 0$ gauge, they explicitly obtained the NS propagator which has poles at the zeros of the Virasoro operator $L_0$.

*Kugo*, *Kunitomo* and *Zwiebach* attempted to construct a field theory for the type II superstring based on the Wess-Zumino-Witten (WZW) type formulation with non-polynomial interactions. They constructed consistent kinetic and cubic interaction terms but did not yet succeed in extending them to a fully gauge-invariant non-polynomial action.

*— moonshine phenomenon —*
*Eguchi* continued to study the moonshine phenomenon of K3 elliptic surface and Mathieu group M24. He has shown that the twisted genera for conjugacy classes of type I (those which come from M23) has a very simple expression in terms of eta products of cycle representations of the conjugacy classes. This observation may contribute to the clarification of the mysterious connection of K3 surface and Mathieu group. He has also studied the new examples of moonshine phenomenon recently discovered by Harvey and his collaborators.

## Condensed matter physics

*— gauge theory and graphene —*
Great attention has recently been directed to graphene, an atomic layer of graphite, which supports "Dirac fermions" as charge carriers and which thus is of interest to particle physicists as well. Of particular interest is bilayer graphene which, in a magnetic field, has an octet of characteristic (pseudo)zero-energy Landau levels with an extra twofold degeneracy in Landau orbitals $n = 0$ and $n = 1$. This degeneracy has an origin in the chiral anomaly in 1+1 dimensions. *Shizuya* noted that this orbital degeneracy is lifted by quantum fluctuations of the valence band (acting as the "Dirac sea"). This is a quantum effect analogous to the Lamb shift in the hydrogen atom. He explored the structure of the pseudo-zero-mode octet in bilayer graphene with this Lamb shift taken into account and in comparison with some recent experiments; a paper is in preparation.

## Integrable systems

*— exactly solvable quantum mechanics and novel families of orthogonal polynomials—*
Exactly solvable quantum mechanics, or exactly solvable eigenvalue problems of certain self-adjoint operators, is the best arena for investigating orthogonal polynomials, which offer the easiest way to realize the complete set of mutually orthogonal eigenfunctions. However, Bochner's theorem declares that orthogonal polynomials satisfying second order differential equations are classical orthogonal polynomials only, that is the Hermite, Laguerre, Jacobi and Bessel. One generalization is achieved by introducing difference Schrödinger equations, which is referred to as the discrete quantum mechanics. The entire families of Askey scheme of hypergeometric orthogonal polynomials and their $q$ analogues were obtained as the main parts of the eigenfunctions of exactly solvable discrete quantum mechanics by *Sasaki* and Odake a few years ago. Another generalization is fulfilled by introducing orthogonal polynomials with degrees $\ell + n$, ($\ell \geq 1$), $n = 0, 1, 2 \ldots$. The first example were introduced by Gomez-Ullate et al for $\ell = 1$ and called the exceptional polynomials. They simply do not satisfy the three term recurrence relations. *Sasaki* and Odake introduced the exceptional Laguerre and Jacobi polynomials and the exceptional Askey-Wilson, Wilson, ($q$)-Racah polynomials for arbitrary $\ell \geq 1$ in recent years. This year they further introduced multi-indexed Laguerre and Jacobi polynomials and the ($q$)-Racah polynomials. These polynomials depend on a set of distinct natural numbers $\mathscr{D} = \{d_1, d_2, \ldots, d_M\}$ and the simplest case of $\mathscr{D} = \{\ell\}$ corresponds to the exceptional orthogonal polynomials. They are supposed to offer many applications in various disciplines of physical/mathematical sciences. For example, they provide many explicit examples of exactly solvable birth and death processes and they are supposed to play important roles in quantum information 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 fundamentaly 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 program**

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

1. Sep 20 – Oct. 28, 2011: "Dynamics and correlations in exotic nuclei"
   http://www2.yukawa.kyoto-u.ac.jp/~ykis2011/dcen
   Chairman: Masayuki Matsuo and Yoshiko Kanada-En'yo

2. Nov. 7 – Dec. 9,, 2011: "Novel Quantum States in Condensed Matter: Correlation, Frustration and Topology"
   http://www2.yukawa.kyoto-u.ac.jp/ws/2011/nqs2011
   Chairman: Norio Kawakami

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 three international programs of this molecule-type as listed below;

1. Arp 18 – May 18, 2011: "Dense strange nuclei and compressed baryonic matter"
   Core members: Mannque Rho, Hyun Kyu Lee, Masayasu Harada, Akira Ohnishi

2. Aug. 22 – Sep. 9, 2011: "Renormalization Group Approach from Ultra Cold Atoms to the Hot QGP"
   Core members: Jan Martin Pawlowski, Kenji Fukushima, Taichiro Kugo

3. Feb. 9 – 24, 2012: "New-type of Fermions on the Lattice"
   Core members: Philippe de Forcrand, Michael Creutz, David Adams

4. Mar. 1 – 31, 2012: "Nuclear Forces and Nuetron-rich Matter"
   Core members: Peter Ring, Takaharu Otsuka, Yasuyuki Suzuki, Naoyuki Itagaki

5. Mar. 25 – Apr. 8, 2012: "Recent advances in numerical and analytical methods for black hole dynamics"
   Core members: Vitor Cardoso, Oscar Dias, Helvi Witek, Akihiro Ishibashi

**YIPQS symposium** In order to commemorate the completion of the 5 year long-term workshop program and its successful update, We have invited leading experts from various fields and hold the following symposium discussing the recent developments and future perspectives in theoretical physics.

- Feb 6 – 8, 2012: "YIPQS Symposium Perspectives in Theoretical Physics – From Quark-Hadron Sciences to Unification of Theoretical Physics –"
  http://www2.yukawa.kyoto-u.ac.jp/ws/2011/qhs2utp/
  Chairman: Tohru Eguchi and Akira Ohnishi
  Invited Speakers: Michael Creutz, Akira Furusaki, Gary W. Gibbons, Tetsuo Hatsuda, Kazuo Hosomichi, Christian Maes, Hitoshi Murayama, Tsvi Piran, Eliezer Rabinovici, Peter Schuck, Gordon Semenoff, Naoshi Sugiyama, Xin-Nian Wang, Jan Zaanen.

One of the central themes of the symposium is to summarize the achievements of the long-term workshop program and quark-hadron sciences. Another important aspect of this symposium is to give the perspectives for the possible unification of theoretical physics. The detailed information of the symposium can be seen at the website written above.

## Organization

The executive committee was organized in the Yukawa Institute to run the whole program. The committee members are;
Akira Ohnishi (chair), Taichiro Kugo (vice-chair), Tohru Eguchi, Hisao Hayakawa, Misao Sasaki, Masaru Shibata, Kenichi Shizuya, Takahiro Tanaka, Takami Tohyama, Naoyuki Itagaki, Hiroshi Kunitomo, Teiji Kunihiro, Koichi Yazuki.
One special duty professor, one associate professor and three postdocs 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 2011)

**11-1** Naofumi Hama, Kazuo Hosomichi, Sungjay Lee, *SUSY Gauge Theories on Squashed Three-Spheres* (January); arXiv:1102.4716[hep-th]

**11-2** T. Yoshida, N. Itagaki, K. Katō, *Symplectic structure and monopole strength in 12C* (January);Phys. Rec C83; 024301 (2011) arXiv:1101.2723[nucl-th]

**11-3** Atsushi Naruko, Misao Sasaki, *Conservation of the nonlinear curvature perturbation in generic single-field inflation* (January);Class. Quant. Grav. 28: 072001(2011) arXiv:1101.3180[astro-ph.CO]

**11-4** Ali Akbar Abolhasani, Hassan Firouzjahi, Misao Sasaki, *Curvature perturbation and waterfall dynamics in hybrid inflation* (January); arXiv:1106.6315[astro-ph.CO]

**11-5** Roberto Anglani, Massimo Mannarelli, Marco Ruggieri, *Collective modes in the color flavor locked phase* (January);New J. Phys 13: 055002 (2011) arXiv:1101.4277[hep-ph]

**11-6** Michael Creutz, Taro Kimura, Tatsuhiro Misumi, *Aoki Phases in the Lattice Gross-Neveu Model with Flavored Mass terms* (January);Phys. Rev. D83: 094506 (2011) arXiv:1101.4239[hep-lat]

**11-7** Satoru Odake, Ryu Sasaki, *Dual Christoffel transformations* (January);Prog. Theor. Phys. 126 1 (2011) arXiv:1101.5468[math-ph]

**11-8** K.-I. Izawa, Yuichiro Nakai, Takashi Shimomura, *Higgs Portal to Visible Supersymmetry Breaking* (January);JHEP 1103: 007 (2011) arXiv:1101.4633[hep-ph]

**11-9** Jinn-Ouk Gong, Takahiro Tanaka, *A covariant approach to general field space metric in multi-field inflation* (January);JCAP 1103: 015 (2011) arXiv:1101.4809[astro-ph.CO]

**11-10** Shinya Kanemura, Osamu Seto, Takashi Shimomura, *Masses of dark matter and neutrino from TeV scale spontaneous $U(1)_{B-L}$ breaking* (January);Phys. Rev. D84: 016004 (2011) arXiv:1101.5713[hep-ph]

**11-11** Kent Yagi, Norihiro Tanahashi, Takahiro Tanaka, *Probing the size of extra dimension with gravitational wave astronomy* (January);Phys. Rev D83: 084036 (2011) arXiv:1101.4997[gr-qc]

**11-12** Yoichi Ikeda, Tetsuo Hyodo, Daisuke Jido, Hiroyuki Kamano, Toru Sato and Koichi Yazaki, *Structure of Lambda(1405) and threshold behavior of piSigma scattering* (January);Prog. Theor. Phys. 125: 1205 (2011) arXiv:1101.5190nucl-th]

**11-13** H. Nagahiro, K. Nawa, S. Ozaki, D. Jido, A. Hosaka, *Composite and elementary natures of a1(1260) meson* (January);Phys. Rev. D83: 111504 (2011) arXiv:1101.3623[hep-ph]

**11-14** Yasuyuki Hatsuda, Katsushi Ito, Kazuhiro Sakai, Yuji Satoh, *g-functions and gluon scattering amplitudes at strong coupling* (January);JHEP 1104: 100 (2011) arXiv:1102.2477[hep-th]

**11-15** Ju-Jun Xie, A. Martinez Torres, E. Oset, *Faddeev fixed center approximation to the $N\bar{K}K$ system and the signature of a $N^*(1920)(1/2^+)$ state* (February);Phys. Rev. C83: 065207 (2011) arXiv:1010.6164v3 [nucl-th]

**11-16** Satoru Kaneko, Hiroki Saito, Joe Sato, Takashi Shimomura, Oscar Vives, Masato Yamanaka, *Correlation between flavour violating decay of long-lived slepton and tau in the coannihilation scenario with Seesaw mechanism* (February);Phys. Rev. D83: 115005 (2011) arXiv:1102.1794[hep-ph]

**11-17** Antonio De Felice, Teruaki Suyama, Takahiro Tanaka, *Stability of Schwarzschild-like solutions in f(R,G) gravity models* (February);Phys. Rev D83: 104035 (2011) arXiv:1102.1521[gr-qc]

**11-18** Satoru Odake, Ryu Sasaki, *The Exceptional $(X_\ell)$ (q)-Racah Polynomials* (February);Prof. Theor. Phys. 125: 851 (2011) arXiv:1102.0812[math-ph]

**11-19** A. Martinez Torres, D. Jido, Y. Kanada-En'yo, *Study of the $KK\bar{K}$ system and dynamical generation of the K(1460) resonance* (February);Phys. Rev. C83: 065205 (2011) arXiv:1102.1505[nucl-th]

**11-20** Hirotada Okawa, Ken-ichi Nakao, Masaru Shibata, *Is super-Planckian physics visible? – Scattering of black holes in 5 dimensions* (February);Phys. Rev D83: 121501 (2011) arXiv:1105.3331[gr-qc]

**11-21** Tatsuo Azeyanagi, Noriaki Ogawa, Seiji Terashima, *On Non-Chiral Extension of Kerr/CFT* (February);JHEP 1106: 081 (2011) arXiv:1102.3423[hep-th]

**11-22** Kunihiko Terasaki, *Tetra-quark mesons with exotic quantum numbers - their production and related -* (February); arXiv:1102.3750[hep-ph]

**11-23** A. Ohnishi, H. Ueda, T.Z. Nakano, M. Ruggieri, K. Sumiyoshi, *Possibility of QCD critical point sweep during black hole formation* (February); arXiv:1102.3753[nucl-th]

**11-24** C.-L. Ho, R. Sasaki, *Zeros of the exceptional Laguerre and Jacobi polynomials* (February); arXiv:1102.5669[math-ph]

**11-25** Yoshimi Kanehata, Tatsuo Kobayashi, Yasufumi Konishi, Osamu Seto, Takashi Shimomura, *Constraints from Unrealistic Vacua in the Next-to-Minimal Supersymmetric Standard Model* (February);Prog. Theor. Phys. 126 1051 (2011) arXiv:1103.5109[hep-ph]

**11-26** Kouki Nakata, Gen Tatara, *Magnon Pumping by a Time-Dependent Transverse Magnetic Field in Ferromagnetic Insulators* (March);J. Phys. Soc.Jpn 80 054602 (2011) arXiv:1101.2137cond-mat.mes-hall]

**11-27** Kyungil Kim, Daisuke Jido, Su Houng Lee, *Diquarks: a QCD sum rule perspective* (March);Phys. Rev. C84: 025204 (2011) arXiv:1103.0826[nucl-th]

**11-28** Marco Frasca, Marco Ruggieri, *Magnetic Susceptibility of the Quark Condensate and Polarization from Chiral Models* (March);Phys. Rev. D83: 094024 (2011) arXiv:1103.1194[hep-ph]

**11-29** Masaki Murata, Martin Schnabl, *On Multibrane Solutions in Open String Field Theory* (March);Prog. Theor. Phys. Suppl. 188: 50 (2011) arXiv:1103.1382[hep-th]

**11-30** Frederico Arroja, Takahiro Tanaka, *A note on the role of the boundary terms for the non-Gaussianity in k-inflation* (March);JCAP 1105: 005 (2011) arXiv:1103.1102[astro-ph.CO]

**11-31** Takahiro Tanaka, Yuko Urakawa, *Dominance of gauge artifact in the consistency relation* (March); arXiv:1103.1251[astro-ph.CO]

**11-32** ExHIC Collaboration: Akira Ohnishi, Sungtae Cho, Takenori Furumoto, Tetsuo Hyodo, Daisuke Jido, Che Ming Ko, Su Houng Lee, Marina Nielsen, Takayasu Sekihara, Shigehiro Yasui, Koichi Yazaki, *Exotics from Heavy Ion Collisions* (March); arXiv:1103.1700[nucl-th]

**11-33** Daisuke Jido, *Lambda(1405) and kaonic few-body states in chiral dynamics* (March); arXiv:1103.2592[nucl-th]

**11-34** Takayasu Sekihara, Tetsuo Hyodo, Daisuke Jido, *Probing internal structure of Lambda(1405) in meson-baryon dynamics with chiral symmetry* (March); arXiv:1103.2418[nucl-th]

**11-35** Satoru Odake, Ryu Sasaki, *Discrete Quantum Mechanics* (March);J. Phys. A44: 353001 (2011) arXiv:1104.0473[math-ph]

**11-36** Kohei Kamada, Yuichiro Nakai, Manabu Sakai, *Inflation in Gauge Mediation and Gravitino Dark Matter* (March);Prog. Theor. Phys. 125: 395 (2011) arXiv:1103.5097[hep-ph]

**11-37** Tatsuo Kobayashi, Yuichiro Nakai, Manabu Sakai, *(Extra)Ordinary Gauge/Anomaly Mediation* (March);JHEP 1106: 0329 (2011) arXiv:1103.4912[hep-ph]

**11-38** K. Shizuya, *Many-body corrections to cyclotron resonance in bilayer graphene with weak electron-hole asymmetry* (March);Phys. Rev B84: 075409 (2011) arXiv:1103.5696[cond-mat.mes-hall]

**11-39** Marco Ruggieri, *The Critical End Point of Quantum Chromodynamics Detected by Chirally Imbalanced Quark Matter* (March);Phys. Rev. D84: 014011 (2011) arXiv:1103.6186[hep-ph]

**11-40** Kentaro Tanabe, Shunichiro Kinoshita, Tetsuya Shiromizu, *Asymptotic flatness at null infinity in arbitrary dimensions* (March);Phys. Rev D84: 044055 (2011) arXiv:1104.0303[gr-qc]

**11-41** Chul-Moon Yoo, Sugure Tanzawa, Misao Sasaki, *Gregory-Laflamme instability of a slowly rotating black string* (March);Int. J. Mod. Phys D20: 963 (2011) arXiv:1103.6081[hep-th]

**11-42** Takamitsu Tatsuoka, Hideki Ishihara, Masashi Kimura, Ken Matsuno, *Extremal Charged Black Holes with a Twisted Extra Dimension* (April);Phys. Rev. D85: 044006 (2012) arXiv:1110.6731[hep-th]

**11-43** Akira Ohnishi, Kohtaroh Miura, Takashi Z. Nakano, *Another mean field treatment in the strong coupling limit of lattice QCD* (April);PoS (Lattice2010) 208 arXiv:1104.1029[hep-lat]

**11-44** H. T. Cho, Jason Doukas, Wade Naylor, A. S. Cornell, *Quasi-normal modes for doubly rotating black holes* (April);Phys. Rev. D83: 124034 (2011) arXiv:1104.1281[hep-th]

**11-45** Naoki Sasakura, *Tensor models and 3-ary algebras* (April); arXiv:1104.1463[hep-th]

**11-46** Kazuharu Bamba, Shin'ichi Nojiri, Sergei D. Odintsov, Misao Sasaki, *Screening of cosmological constant for De Sitter Universe in non-local gravity, phantom-divide crossing and finite-time future singularities* (April); arXiv:1104.2692[hep-th]

**11-47** Philipp Gubler, Kenji Morita, Makoto Oka, *Charmonium spectra at finite temperature from QCD sum rules with the maximum entropy method* (April);Phys. Rev. Lett. 107: 092003 (2011) arXiv:1104.4436[hep-ph]

**11-48** Tetsuo Hyodo, Daisuke Jido, *The nature of the Lambda(1405) resonance in chiral dynamics* (April);Prog. Par. Nucl. Phys. 67: 55 (2012) arXiv:1104.4474[nucl-th]

**11-49** Mitsutoshi Fujita, Yasuyuki Hatsuda, Tadashi Takayanagi, *Probing AdS Wormholes by Entanglement Entropy* (April); arXiv:1104.4907[hep-th]

**11-50** Keisuke Izumi, Shinji Mukohyama, *Nonlinear superhorizon perturbations in Horava-Lifshitz gravity* (April); arXiv:1105.0246[hep-th]

**11-51** Naoki Sasakura, *Tensor models and hierarchy of n-ary algebras* (April);Int. J. Mod Phys. A26: 3249 (2011) arXiv:1104.5312[hep-th]

**11-52** Satoru Odake, Ryu Sasaki, *Exactly Solvable Quantum Mechanics and Infinite Families of Multi-indexed Orthogonal Polynomials* (April); arXiv:1105.0508[math-ph]

**11-53** T. Ichikawa, N. Itagaki1, T. Kawabata, Tz. Kokalova, and W. von Oertzen, *Gas-like state of $\alpha$ clusters around a 16O core in 24Mg* (May);Phys. Rev. C83: 061301 (2011)

**11-54** T. Ichikawa, J. A. Maruhn, N. Itagaki, and S. Ohkubo, *Linear Chain Structure of Four-$\alpha$ Clusters in 16O core in 24Mg* (May);Phys. Rev. Lett.107: 112501 (2011)

**11-55** Daisuke Yamauchi, Andrei Linde, Atsushi Naruko, Misao Sasaki, Takahiro Tanaka, *Open inflation in the landscape* (May);Phys. Rev. D84: 043513 (2011) arXiv:1105.2674[hep-th]

**11-56** Amihay Hanany, Vishnu Jejjala, Sanjaye Ramgoolam, Rak-Kyeong Seong, *Calabi-Yau Orbifolds and Torus Coverings* (May);JHEP 1109: 116 (2011) arXiv:1105.3471[hep-th]

**11-57** Jinn-Ouk Gong, Jai-chan Hwang, Wan Il Park, Misao Sasaki, Yong-Seon Song, *Conformal invariance of curvature perturbation* (May); arXiv:1107.1840[gr-qc]

**11-58** Kazuki Hasebe, Keisuke Totsuka, *Hidden Order and Dynamics in Supersymmetric Valence Bond Solid States – Super-Matrix Product State Formalism* (May); arXiv:1105.3529[cond-mat.str-el]

**11-59** Norihiro Tanahashi, Takahiro Tanaka, *Black holes in braneworld models* (May);Prog. Theor. Phys. Suppl. 189: 227 (2011) arXiv:1105.2997[hep-th]

**11-60** Natsumi Ikeno, Rie Kimura, Junko Yamagata-Sekihara, Hideko Nagahiro, Daisuke Jido, Kenta Itahashi, Li Sheng Geng, Satoru Hirenzaki, *Precision Spectroscopy of Deeply Bound Pionic Atoms and Partial Restoration of Chiral Symmetry in Medium* (May);Prog. Theor. Phys. 126: 483 (2011) arXiv:1107.5918[nucl-th]

**11-61** Frederico Arroja, Antonio Enea Romano, Misao Sasaki, *Large and strong scale dependent bispectrum in single field inflation from a sharp feature in the mass* (June); arXiv:1106.5384[astro-ph.CO]

**11-62** Naoki Sasakura, *Super tensor models, super fuzzy spaces and super n-ary transformations* (June);Int. J. Mod. Phys. A26: 4203 (2011) arXiv:1106.0379[hep-th]

**11-63** H. T. Cho, A. S. Cornell, Jason Doukas, Wade Naylor, *Scalar spheroidal harmonics in five dimensional Kerr-(A)dS* (June); arXiv:1106.1426[gr-qc]

**11-64** N. Ikeno, J. Yamagata-Sekihara, H. Nagahiro, D. Jido, S. Hirenzaki, *Formation of Heavy Meson Bound States by Two Nucleon Pick-up Reactions* (June); arXiv:1110.6504[nucl-th]

**11-65** A. Martínez Torres, K. P. Khemchandani, D. Jido, A. Hosaka, *Theoretical support for the $\pi(1300)$ and the recently claimed $f_0(1790)$ as molecular resonances* (June); arXiv:1106.6101[nucl-th]

**11-66** K. P. Khemchandani, A. Martínez Torres, H. Kaneko, H. Nagahiro, A. Hosaka, *Coupling vector and pseudoscalar mesons to study baryon resonances* (June); arXiv:1107.0574[nucl-th]

**11-67** Sugumi Kanno, Misao Sasaki, Jiro Soda, *Holographic Dual of de Sitter Universe with AdS Bubbles* (July); arXiv:1107.1491[hep-th]

**11-68** Kunihiko Terasaki, *X(3872) and Its Iso-Triplet Partners* (July); arXiv:1107.5868[hep-ph]

**11-69** Mandar Patil, Pankaj S. Joshi, Ken-ichi Nakao, Masashi Kimura, *Acceleration of particles and shells by Reissner-Nordström naked singularities* (July); arXiv:1108.0288[gr-qc]

**11-70** Kenji Morita, Vladimir Skokov, Bengt Friman, Krzysztof Redlich, *Probing deconfinement in a chiral effective model with Polyakov loop at imaginary chemical potential* (August); arXiv:1107.2273[hep-ph]

**11-71** Kenji Morita, Vladimir Skokov, Bengt Friman, Krzysztof Redlich, *Role of mesonic fluctuations in the Polyakov loop extended quark-meson model at imaginary chemical potential* (August); arXiv:1108.0735[hep-ph]

**11-72** Ying-li Zhang, Misao Sasaki, *Screening of cosmological constant in non-local cosmology* (August);Int. J. Mod. Phys. D21: 1250006 (2012) arXiv:1108.2112[gr-qc]

**11-73** Yuji Tachikawa, Seiji Terashima, *Seiberg-Witten Geometries Revisited* (August); arXiv:1108.2315[hep-th]

**11-74** K. Muta, T. Furumoto, T. Ichikawa, N. Itagaki, *Three triton states in 9Li* (August); arXiv:1106.0957[nucl-th]

**11-75** Tomohiro Harada, Masashi Kimura, *Collision of an object in the transition from adiabatic inspiral to plunge around a Kerr black hole* (August);Phys. Rev. D84: 124032 (2011) arXiv:1109.6722[gr-qc]

**11-76** Tetsuo Hyodo, Daisuke Jido, Atsushi Hosaka, *Compositeness of dynamically generated states in chiral unitary approach* (August);Phys. Rev. C85: 015201 (2012) arXiv:1108.5524[nucl-th]

**11-77** Soichiro Isoyama, Norichika Sago, Takahiro Tanaka, *Cosmic censorship in overcharging a Reissner-Nordström black hole via charged particle absorption* (September);Phys. Rev. D84: 124024 (2011) arXiv:1108.6207[gr-qc]

**11-78** Daisuke Jido, Soichiro Goda, *Partial restoration of chiral symmetry and pion in nuclear medium* (September); arXiv:1108.6144[nucl-th]

**11-79** Takayasu Sekihara, Tetsuo Hyodo, Daisuke Jido, *Internal structure of the Lambda(1405) resonance probed in chiral unitary amplitude* (September); arXiv:1109.0061[nucl-th]

**11-80** A. Martínez Torres, L. R. Dai, C. Koren, D. Jido, E. Oset, *The KD, $\eta D_s$ interaction in finite volume and the $D_{s^*0}(2317)$ resonance* (September); arXiv:1109.0396[hep-lat]

**11-81** Daisuke Jido, Hideko Nagahiro, Satoru Hirenzaki, *Nuclear bound state of eta'(958) and partial restoration of chiral symmetry in the eta' mass* (September);Phys. Rev C85: 032201(R) (2012) arXiv:1109.0394[nucl-th]

**11-82** Kanabu Nawa, Sho Ozaki, Hideko Nagahiro, Daisuke Jido, Atsushi Hosaka, *Complex 2D Matrix Model and Geometrical Map on Complex-Nc Plane* (September); arXiv:1109.0426[hep-ph]

**11-83** Yasuyuki Hatsuda, Katsushi Ito, Yuji Satoh, *T-functions and multi-gluon scattering amplitudes* (September); arXiv:1109.5564[hep-th]

**11-84** Satoru Hirenzaki, Daisuke Jido, Hideko Nagahiro, *Eta-prime bound states in nuclei and partial restoration of chiral symmetry* (September); arXiv:1109.2761[hep-ph]

**11-85** Daisuke Yamauchi, Keitaro Takahashi, Yuuiti Sendouda, Chul-Moon Yoo, *Weak lensing of CMB by cosmic (super-)strings* (September); arXiv:1110.0556[astro-ph.CO]

**11-86** Tatsuhiro Misumi, Michael Creutz, Taro Kimura, Takashi Z. Nakano, Akira Ohnishi, *Aoki Phases in Staggered-Wilson Fermions* (October);PoS Lattice2011: 118 (2011) arXiv:1110.1231[hep-lat]

**11-87** Taro Kimura, Michael Creutz, Tatsuhiro Misumi, *Index Theorem and Overlap Formalism with Naive and Minimally Doubled Fermions* (October); arXiv:1110.2482[hep-lat]

**11-88** Kazuyuki Sugimura, Daisuke Yamauchi, Misao Sasaki, *Multi-field open inflation model and multi-field dynamics in tunneling* (October); arXiv:1110.4773[gr-qc]

**11-89** Sungwook E. Hong, Ewan D. Stewart, Heeseung Zoe, *Anthropic Likelihood for the Cosmological Constant and the Primordial Density Perturbation Amplitude* (October); arXiv:1110.3119[astro-ph.CO]

**11-90** Valeri P. Frolov, *Weakly magnetized black holes as particle accelerators* (October);Phys. Rev. D85: 024020 (2012)

**11-91** Taro Kimura, Shota Komatsu, Tatsuhiro Misumi, Toshifumi Noumi, Shingo Torii, Sinya Aoki, *Revisiting symmetries of lattice fermions via spin-flavor representation* (October);JHEP 01:048 (2012) arXiv:1111.0402[hep-lat]

**11-92** Takahisa Igata, Tomohiro Harada, Masashi Kimura, *Effect of a Weak Electromagnetic Field on Particle Acceleration by a Rotating Black Hole* (November); arXiv:1202.4859[gr-qc]

**11-93** Naoki Sasakura, *Canonical tensor models with local time* (November); arXiv:1111.2790[hep-th]

**11-94** Kazuhiro Sakai, *Topological string amplitudes for the local half K3 surface* (November); arXiv:1111.3967[hep-th]

**11-95** Kenji Morita, Vladimir Skokov, Bengt Friman, Krzysztof Redlich, *Probing deconfinement in the Polyakov-loop extended Nambu-Jona-Lasinio model at imaginary chemical potential* (November); arXiv:1111.3446[hep-ph]

**11-96** Yuto Ito, Takuya Okuda, Masato Taki, *Line operators on $S^1 \times R^3$ and quantization of the Hitchin moduli space* (November); arXiv:1111.4221[hep-th]

**11-97** H. T. Cho, A. S. Cornell, Jason Doukas, T. -R. Huang, Wade Naylor, *A New Approach to Black Hole Quasinormal Modes: A Review of the Asymptotic Iteration Method* (November); arXiv:1111.5024[gr-qc]

**11-98** Maiko Kohriki, Taichiro Kugo, Hiroshi Kunitomo, *Gauge Fixing of Modified Cubic Open Superstring Field Theory* (November);Prog. Theor. Phys. 127 : 243 (2012) arXiv:1111.4912[hep-th]

**11-99** Kentaro Tanabe, Tetsuya Shiromizu, Shunichiro Kinoshita, *Late-time symmetry near black hole horizons* (December);Phys. Rev D85: 024048 (2012) arXiv:1112.0408[gr-qc]

**11-100** Masato Minamitsuji, Kunihito Uzawa, *Dynamics of partially localized brane systems* (December);Phys. Rev. D84: 126006 (2011) arXiv:1109.1415[hep-th]

**11-101** Masato Minamitsuji, Kunihito Uzawa, *Warped de Sitter compactifications in the scalar-tensor theory* (December);Phys. Lett. B710: 358 (2012) arXiv:1109.4818[hep-th]

**11-102** Masato Minamitsuji, Kunihito Uzawa, *Warped spherical compactifications in the gravity theory* (December); arXiv:1110.2843[hep-th]

**11-103** Parvin Moyassari, Masato Minamitsuji, *Degravitation Features in the Cascading Gravity Model* (December); arXiv:1112.1089[hep-th]

**11-104** G. Ramalho, D. Jido, K. Tsushima, *Valence quark and meson cloud contributions for the gamma* Lambda -¿ Lambda* and gamma* Sigma0 -¿ Lambda* reactions* (December); arXiv:1202.2299[hep-ph]

**11-105** Ling Bao, Elli Pomoni, Masato Taki, Futoshi Yagi, *M5-branes, toric diagrams and gauge theory duality* (December); arXiv:1112.5228[hep-th]

**11-106** Akira Ohnishi, *Phase diagram and heavy-ion collisions: Overview* (December); arXiv:1112.3210[nucl-th]

**11-107** A. Ohnishi, K. Miura, T.Z. Nakano, N. Kawamoto, H. Ueda, M. Ruggieri, K. Sumiyoshi, *QCD critical point in the strong coupling lattice QCD and during black hole formation* (December); arXiv:1201.6206[nucl-th]

**11-108** Masato Minamitsuji, Kunihito Uzawa, *Warped de Sitter compactifications* (December);JHEP 1201: 142 (2012) arXiv:1103.5326[hep-th]

**11-109** Tohru Eguchi, Kazuhiro Hikami, *Twisted elliptic genus for K3 and Borcherds product* (December); arXiv:1112.5928[hep-th]

**11-110** K Shizuya, *Many-body corrections to cyclotron resonance in graphene* (December);JPCS 334: 012046 (2011)

**11-111** K. Shizuya, *Cyclotron resonance and renormalization in graphene and its bilayer* (December);

**11-112** ExHIC Collaboration: Sungtae Cho, Takenori Furumoto, Tetsuo Hyodo, Daisuke Jido, Che Ming Ko, Su Houng Lee, Marina Nielsen, Akira Ohnishi, Takayasu Sekihara, Shigehiro Yasui, Koichi Yazaki, *Studying Exotic Hadrons in Heavy Ion Collisions* (December); arXiv:1107.1302[nucl-th]

**11-113** Antonino Flachi, Takahiro Tanaka, *Chiral Phase Transitions around Black Holes* (December);Phys. Rev. D84:061503 (2011) arXiv:1106.3991[hep-th]

**11-114** Atsushi Nishizawa, Kent Yagi, Atsushi Taruya, Takahiro Tanaka, *Cosmology with space-based gravitational-wave detectors — dark energy and primordial gravitational waves —* (December);Phys. Rev. D85: 044047 (2012) arXiv:1110.2865[astro-ph.CO]

**11-115** Kent Yagi, Leo C. Stein, Nicolas Yunes, Takahiro Tanaka, *Post-Newtonian, Quasi-Circular Binary Inspirals in Quadratic Modified Gravity* (December); arXiv:1110.5950[gr-qc]

### 2.2.2 Publications and Talks by Regular Staff (April 2011 — March 2012)

## Hisao Hayakawa

*Journal Papers*

1. Naoki Yoshioka and Hisao Hayakawa,
"Phase transition in peristaltic transport of frictionless granular particles,"
Phys. Rev. E **85**, 031302 (2012) (7pages)

2. Naoki Yoshioka, Ferenc Kun, and Nobuyasu Ito,
"Time evolution of damage in thermally induced creep rupture,"
EPL **97**, 26006 (2012).

3. Takahiro Sagawa and Hisao Hayakawa,
"Geometrical expression of excess entropy production,"
Phys. Rev. E **84**, 051110 (2011) (6 pages).

4. Kuniyasu Saitoh and Hisao Hayakawa,
"Weakly nonlinear analysis of two dimensional sheared granular flow,"
Granular Matter **13**, 697-711 (2011).

5. Michio Otsuki and Hisao Hayakawa,
"Critical scaling near jamming transition for frictional granular particles "
Phys. Rev. E **83**, 051301 (2011) 042901 (9 pages).

*Talks at International Conferences*

1. Hisao Hayakawa,
"Nonequilibrium entropy and response theory of dissipative particles " Invited,
in East Asia Joint Seminar on Statistical Physics 2012, at Suzhou, China, March 18, 2012

2. Hisao Hayakawa,
"Nonlinear analysis of sheared granular flow: Beyond granular hydrodynamics " Invited,
in IUTAM Symposium Symposium " Mobile Particulate System " at Bangalore, India, January 25, 2012

3. Hisao Hayakawa,
"Jamming transition at finite temperature "
,
in Unifying Concepts in Glassy Physics V at Paris, France, December 16, 2011

4. Hisao Hayakawa,
"Response theory around a non-equilibrium steady state in terms of full-counting statistics " Invited,
in Japan-France joint seminar on " Jamming, glasses and phase transitions " at Paris, France, December 7, 2011

5. Hisao Hayakawa,
"Response theory around a non-equilibrium steady state in terms of full-counting statistics " Invited,
in Tamura Memorial Symposium, at Osaka Prefecture University, December 4, 2011

6. Hisao Hayakawa,
"Introduction to nonequilibrium statistical physics " ,
in Nonequilibrium dynamics in astrophysics and material science, at YITP, November 2, 2011

7. Hisao Hayakawa,
"Granular hydrodynamics: an overview and future perespective " Invited,
in " Fluctuations and response in granular materials ", at Aspen, CO, USA May 29, 2011

*Invited Seminars* (Overseas)

1. Hisao Hayakawa,
"Scaling of jamming transitions", newline at Delft University of Technology, the Netherlands, March 29, 2012

2. Hisao Hayakawa,
"Scaling theory for jamming transitions", newline at University of Twente, the Netherlands, March 28, 2012

3. Hisao Hayakawa,
"Granular jet; is it a perfect fluid?", newline at Niels Bohr Institute, Denmark, March 26, 2012

*Invited Seminars* (in Japan)

1. Hisao Hayakawa,
"Subcritical behavior in jamming transition of frictional grains", newline Kick-off meeting of the core-to-core program on international research network for non-equilibrium dynamics of soft matter, at Kyoto University, April 20, 2011

## Kazuo Hosomichi

*Talks at International Conferences*

1. "SUSY Gauge Theories on Squashed Three-Spheres," Invited, in "Spring String Workshop," CQUeST, Sogang University, Korea, May 2011.
2. "A Virasoro Symmetry Hidden in 4D Gauge Theories," Invited, in the Autum JPS meeting 2011, Hirosaki University, September 2011.
3. "SUSY Gauge Theories on Squashed Three-Spheres," "AGT on the S-duality Wall," Invited talks in the 4th Taiwan String Workshop, NCTU Taiwan, December 2011.
4. "SUSY Gauge Theories on Squashed Three-Spheres," Invited, in "Classical and Quantum Integrable Systems 2012", Joint Institute for Nuclear Research, Russia, January 2012.
5. "M-theory and exact results in SUSY gauge theories," Invited, in YIPQS symposium "Perspectives in Theoretical Physics", Yukawa Institute for Theoretical Physics, Kyoto University, February 2012.

*Invited Seminars* (in Japan)

1. "Exact results in 3-dim gauge theories and M2-branes," Invited talk at YITP Workshop "Field Theory and String Theory," Yukawa Institute for Theoretical Physics, July 2011.
2. "Developments in SUSY Gauge Theories and M-theory," Invited lectures at "Chubu Summer School," Tokai University Seminar House at Yamanakako Lake, August-September 2011.
3. "Localization in 3D SUSY gauge theories and matrix models," Invited, in "Matrix Models and related topics", Rikkyo University, February 2012.

## Naoyuki Itagaki

*Journal Papers*

1. M. Ito, N. Itagaki, and K. Ikeda, "Cluster correlations for low-lying intruder states of $^{12}$Be", Phys. Rev. C **85** (2012) 014302 1-14.
2. T. Ichikawa, J. A. Maruhn, N. Itagaki, and S. Ohkubo, "Linear chain structure of four-alpha clusters in $^{16}$O", Phys. Rev. Lett. **107** (2011) 112501 1-4.

*Books and Proceedings*

1. Itagaki N.; Kokalova Tz.; von Oertzen W.; et al., "Three-$\alpha$ cluster state around $^{40}$Ca core", 2nd Workshop on State of the Art in Nuclear Cluster Physics, Univ Libre Brussels, Brussels, Belgium, May 25-28, 2010, International Journal of Modern Physics E **20** (2011) 1012-1017.
2. Cseh J.; Itagaki N.; Ploszajczak M.; et al., "Phases of cluster states", 2nd Workshop on State of the Art in Nuclear Cluster Physics, Univ Libre Brussels, Brussels, Belgium, May 25-28, 2010, International Journal of Modern Physics E **20** (2011) 807-810.

*Talks at International Conferences*

1. "Simplified modeling of cluster-shell competition and appearance of various cluster structures in light nuclei" Plenary,
   at "Yukawa International Seminar, Frontier Issues in Physics of Exotic Nuclei", YITP Kyoto Univ., Kyoto, Japan,
   October 2011.
2. "Exotic clustering in light nuclear systems" Plenary,
   at "GCOE Symposium Links among Hierarchies" , Kyoto Univ., Kyoto, Japan,
   February 2011.

*Invited Seminars* (in Japan)

1. "Various structure in exotic nuclei,"
   Dept. of Phys., Univ. of Tsukuba, January 2012 (intensive lecture series).

## Ken-Iti Izawa

*Journal Papers*

1. K.-I. Izawa, Y. Nakai and T. Shimomura,
   "Higgs Portal to Visible Supersymmetry Breaking,"
   JHEP **1103** (2011) 007 (22 pages), YITP-11-08, arXiv:1101.4633 [hep-ph].

## Daisuke Jido

*Journal Papers*

1. Sungtae Cho *et al.* (ExHIC Collaboration), "Identifying multiquark hadrons from heavy ion collisions", Phys. Rev. Lett. **106** (2011) 212001 (4 pages), arXiv:1011.0852 [nucl-th], YITP-10-117.

2. Takayasu Sekihara, Tetsuo Hyodo, and Daisuke Jido, "Internal structure of the resonant $\Lambda(1405)$ state in chiral dynamics", Phys. Rev. C **83** (2011) 055202 (28 pages). arXiv:1012.3232 [nucl-th], YITP-10-99.

3. Hideko Nagahiro, Kanabu Nawa, Sho Ozaki, Daisuke Jido, and Atsushi Hosaka, "Composite and elementary natures of $a_1(1260)$ meson", Phys. Rev. D **83** (2011) 111504 (R) (5 pages), arXiv:1101.3623 [hep-ph], YITP-11-13.

4. Yoichi Ikeda, Tetsuo Hyodo, Daisuke Jido, Hiroyuki Kamano, Toru Sato, and Koichi Yazaki, "Structure of $\Lambda(1405)$ and threshold behavior of $\pi\Sigma$ scattering", Prog. Theor. Phys. **125** (2011) 1205-1224, arXiv:1101.5190 [nucl-th], YITP-11-12.

5. A. Martinez Torres, D. Jido, and Y. Kanada-En'yo, "Theoretical study of the $\bar{K}KK$ system and dynamical generation of the $K(1460)$ resonance", Phys. Rev. C **83** (2011) 065205 (11 pages), arXiv:1102.1505 [nucl-th], YITP-11-19.

6. Kyungil Kim, Daisuke Jido, and Su Houng Lee, "Diquarks: a QCD sum rule perspective", Phys. Rev. C **84** (2011) 025204 (5 pages), arXiv:1103.0826 [nucl-th], YITP-11-27.

7. A. Martinez Torres, K. P. Khemchandani, D. Jido, and A. Hosaka, "Theoretical support for the $\pi(1300)$ and the recently claimed $f_0(1790)$ as molecular resonances", Phys. Rev. **D84** (2011) 074027 (8 pages), arXiv:1106.6101 [nucl-th], YITP-11-65.

8. Sungtae Cho *et al.* (ExHIC Collaboration), "Eexotic hadrons in heavy ion collisions", Phys. Rev. C **84** (2011) 064910 (17 pages), arXiv:1107.1302 [nucl-th], YITP-11-112.

9. Natsumi Ikeno, Rie Kimura, Junko Yamagata-Sekihara, Hideko Nagahiro, Daisuke Jido, Kenta Itahashi, Li Sheng Geng, and Satoru Hirenzaki, "Precision spectroscopy of deeply bound pionic atoms and partial restoration of chiral symmetry in medium", Prog. Theor. Phys. **126** (2011) 483-509, arXiv:1107.5918 [nucl-th], YITP-11-60.

10. N. Ikeno, J. Yamagata-Sekihara, H. Nagahiro, D. Jido, and S. Hirenzaki, "Formation of heavy-meson bound states by two-nucleon pick-up reactions", Phys. Rev. C **84** (2011) 054609 (8 pages), arXiv:1110.6504 [nucl-th], YITP-11-64.

11. Takayasu Sekihara, Alberto Martinez Torres, Daisuke Jido, and Eulogio Oset, "Theoretical study of incoherent $\phi$ photoproduction on a deuteron target" Eur. Phys. J. **A48** (2012) 10 (17 pages), arXiv:1008.4422 [nucl-th], YITP-10-72.

12. Tetsuo Hyodo and Daisuke Jido, "The nature of the $\Lambda(1405)$ resonance in chiral dynamics", Prog. Part. Nucl. Phys. **67** (2012) 55-98, arXiv:1104.4474 [nucl-th], YITP-11-48.

13. Tetsuo Hyodo, Daisuke Jido, and Atsushi Hosaka, "Compositeness of dynamically generated states in a chiral unitary approach", Phys. Rev. C **85** (2012) 015201 (16 pages), arXiv:1108.5524 [nucl-thj] YITP-11-76.

14. A. Martinez Torres, L. R. Dai, C. Koren, D. Jido, and E. Oset, "$KD$, $\eta D_s$ interaction in finite volume and the $D_{s*0}(2317)$ resonance", Phys. Rev. D **85** (2012) 014027 (11 pages), arXiv:1109.0396 [hep-lat], YITP-11-80.

*Books and Proceedings*

1. Tetsuo Hyodo, Daisuke Jido, and Atsushi Hosaka, "Hadronic molecules in chiral dynamics", Journal of Physics: Conference Series **302** (2011) 012053.

2. Tetsuo Hyodo, Daisuke Jido, and Atsushi Hosaka, "Origin and compositeness of baryons in chiral dynamics", AIP Conference Proceedings **1388** (2011) 46-52.

3. Daisuke Jido, "$\Lambda(1405)$ and kaonic few-body states in chiral dynamics", AIP Conference Proceedings **1388** (2011) 65-71, arXiv:1103.2592 [nucl-th], YITP-11-33.

4. H. Nagahiro, K. Nawa, S. Ozaki, D. Jido, and A. Hosaka, "A study of mixing properties of $a_1(1260)$ meson", AIP Conference Proceedings **1388** (2011) 302-305.

5. Akira Ohnishi *et al.* (ExHIC Collaboration), "Exotics from heavy ion collisions", AIP Conference Proceedings **1388** (2011) 404-407, arXiv:1103.1700 [nucl-th], YITP-11-32.

6. Kyung-Il Kim, Daisuke Jido, and Su Houng Lee, "A QCD sum rule approach with an explicit di-quark field", AIP Conference Proceedings **1388** (2011) 447-450.

7. Satoru Hirenzaki, Natsumi Ikeno, Daisuke Jido, and Hideko Nagahiro, "Structure and formation of eta- and pi-nucleus systems", AIP Conference Proceedings **1388** (2011) 495-501.

8. Takayasu Sekihara, Tetsuo Hyodo, and Daisuke Jido, "Probing internal structure of $\Lambda(1405)$ in meson-baryon dynamics with chiral symmetry", AIP Conference Proceedings **1388** (2011) 593-595, arXiv:1103.2418 [nucl-th], YITP-11-34.

*Talks at International Conferences*

1. "Partial restoration of chiral symmetry in nuclei", Workshop on 'Future Prospects of Hadron Physics at J-PARC and Large Scale Computational Physics', February 9-11, 2012, Ibaraki Quantum Research Center, Tokai, Ibaraki, Japan.

2. "A possible story of $\eta'$ meson in medium", Invited, "Eta-prime in-medium" workshop, February 6-7, 2012, II. Physikalisches Institut, University of Gießen, Gießen, Germany.

3. "Partial restoration of chiral symmetry in nuclear medium and $\eta'$ mesonic nuclei", Invited, Workshop on new frontiers in QCD, October 27-28, 2011, Yonsei University, Seoul, Korea.

4. "Hadron Physics at J-PARC – exotic hadrons and hadrons in nuclei –", Invited, Korea-Japan workshop on nuclear and hadron physics at J-PARC, September 22-23, 2011, Seoul National University, Seoul, Korea.

5. "Pseudoscalar mesons in nuclei and partial restoration of chiral symmetry", Invited, XIV International Conference on Hadron Spectroscopy (Hadron2011), June 13-17, 2011, Künstlerhaus, Munich, Germany.

6. "Dynamically generated baryon states", Invited and Plenary, The 8th International Workshop on the Physics of Excited Nucleons (NSTAR2011), May 17-20, 2011, Thomas Jefferson National Accelerator Facility, Newport News, Virginia USA.

*Invited Seminars* (Overseas)

1. "Hadron physics at J-PARC – exotic hadrons and hadrons in nuclei –", Yonsei University, Seoul, Korea, 21 September 2011.

2. "Pseudoscalar mesons in nuclei and partial restoration of chiral symmetry", Physics Department, Technische Universität München, Germany, 20 June 2011.

*Invited Seminars* (in Japan)

1. "$\eta'$ meson in nuclear medium", Tokyo Institute of Technology, Megro, Tokyo, 8 March 2012.

2. "Chiral symmetry and $U_A(1)$ anomaly", Nara Women's University, Nara, 20 August 2011.

## Taichiro Kugo

*Journal Papers*

1. Taichiro Kugo
   "String Field Theories", Prog. Theor. Phys. Supplement **188** (2011) 1 – 8.

2. Maiko Kohriki, Isao Kishimoto, Taichiro Kugo, Hiroshi Kunitomo and Masaki Murata
   "Gauge-Fixing Problem in Modified Cubic Superstring Field Theory", Prog. Theor. Phys. Supplement **188** (2011) 263 – 271.

3. Maiko Kohriki, Taichiro Kugo and Hiroshi Kunitomo
   "Gauge Fixing of Modified Cubic Open Superstring Field Theory", Prog. Theor. Phys. **127** (2012), 243 – 270. arXiv:1111.4912 [hep-th], YITP-11-98.

*Talks at International Conferences*

1. “Concluding Remarks”, in “International Workshop on Grand Unified Theories” (GUT 2012) Kyoto, Japan, March 15 – 17, 2012.

*Invited Seminars* (in Japan)

1. “Three Family Quarks and Leptons as Nambu-Goldstone Chiral Supermultiplets,” Department of Physics, Kanazawa University, December 13, 2011 (in Japanese).

## Hiroshi Kunitomo

*Journal Papers*

1. M. Kohriki, T. Kugo and H. Kunitomo, “Gauge Fixing of Modified Cubic Open Superstring Field Theory,” Prog. Theor. Phys. **127** (2012) 243, arXiv:1111.4912 [hep-th], YITP-11-98.

*Books and Proceedings*

1. M. Kohriki, H. Kunitomo and M. Murata, “No-ghost theorem for Neveu-Schwarz string in 0-picture via similarity transformation,” Prog. Theor. Phys. Suppl. **188** (2011) 254.
2. M. Kohriki, I.Ḱishimoto, T. Kugo, H. Kunitomo and M. Murata, “Gauge-fixing problem in modified cubic superstring field theory,” Prog. Theor. Phys. Suppl. **188** (2011) 263.

*Books and Proceedings*

1. M. Kohriki, H. Kunitomo and M. Murata, “No-ghost theorem for Neveu-Schwarz string in 0-picture via similarity transformation,” Prog. Theor. Phys. Suppl. **188** (2011) 254.
2. M. Kohriki, I.Ḱishimoto, T. Kugo, H. Kunitomo and M. Murata, “Gauge-fixing problem in modified cubic superstring field theory,” Prog. Theor. Phys. Suppl. **188** (2011) 263.

## Takao Morinari

1. T. Himura, T. Morinari, and T. Tohyama, “Pressure effects on Dirac fermions in $\alpha$-(BEDT-TTF)$_2$I$_3$,” J. Phys.: Condens. Matter 23 (2011) 464202.

## Masatoshi Murase

*Journal Papers*

1. H.Miyata, K. Ishizawa, M. Ishido, K. Sugawara, M. Murase and T. Hondo, “Biological Effects of Electromagnetic Fields” Japanese Journal of Clinical Ecology 20 (1) 23-31 (2011).

2. K. Yoshimura, H. Ohta, M. Murase and K. Nishimura, “Novel Phenomena in Integrated Complex Sciences” Jouranl of Physics, Conference Series 344 011001(2012).

*Talks at International Conferences*

1. “A New Synthesis of Knowledge” in Kyoto University International Forum “Towards a New Synthesis of Knowledge,” Kyoto, Japan, October 2011.

*Invited Series Lectures* (in Japan)

1. Living systems: Cognition and Evolution (Series Lecture), September 2011, Department of Physics, Ritsumeikan University.

## Shigehiro Nagataki

*Journal Papers*

1. S.-H. Lee, D. Ellison, S. Nagataki, “A Generalized Model of Nonlinear Diffusive Shock Acceleration Coupled to an Evolving Supernova Remnant” The Astrophysical Journal, accepted, arXiv:1203.3614 [astro-ph].

2. J. Takata, A. Okazaki, S. Nagataki, T. Naito, A. Kawachi, S.-H. Lee, M. Mori, K. Hayasaki, M.S. Yamaguchi, S.P. Owocki, “Modeling high-energy light curves of the PSR B1259-63/LS 2883 binary based on 3-D SPH simulation” The Astrophysical Journal, accepted, arXiv:1203.2179 [astro-ph].

3. M. Xu, S. Nagataki, Y. F. Huang,
   “Failed GRBs: Thermal Soft X-ray Emissions Accompanied by Peculiar Afterglows”
   The Astrophysical Journal **746** (2012) 49.

4. M. Actis et al. (672 authors in alphabetical order),
   “Design concepts for the Cherenkov Telescope Array CTA: an advanced facility for ground-based high-energy gamma-ray astronomy”
   Experimental Astronomy **32** (2011) 93-316.

5. D.A. Prokhorov, Y. Dubois, S. Nagataki, T. Akahori, K. Yoshikawa,
   “Unveiling the 3D Temperature Structure of Galaxy Clusters by Means of the Thermal Sunyaev-Zel’dovich Effect”
   Monthly Notice of Royal Astronomical Society **415** (2011) 2505-2512.

6. D.A. Prokhorov, S. Colafrancesco, T. Akahori, E.T. Million, S. Nagataki, K. Yoshikawa,
   “A High-Frequency Study of the Sunyaev-Zel’dovich Effect Morphology in Galaxy Clusters”
   Monthly Notice of Royal Astronomical Society **416** (2011) 302-310.

7. A. Okazaki, S. Nagataki, T. Naito, A. Kawachi, K. Hayasaki, S.P. Owocki, J. Takata,
   ‘’Hydrodynamic Interaction between the Be Star and the Pulsar in the TeV Binary PSR ‘’
   Publications of the Astronomical Society of Japan **63** (2011) 893-901.

8. S. Nagataki,
   ‘’Rotating BHs as Central Engine of Long GRBs: Faster is Better‘’
   Publications of the Astronomical Society of Japan **63** (2011) 1243-1249.

9. M. Xu, S. Nagataki, Y.F. Huang,
   ‘’An Off-Axis Relativistic Jet Model for the Type Ic supernova SN2007gr‘’
   The Astrophysical Journal **735** (2011) 3.

10. A. Mizuta, S. Nagataki, J. Aoi,
    ‘’Thermal Radiation from GRB Jets‘’
    The Astrophysical Journal **732** (2011) 26.

11. D.A. Prokhorov, S. Colafrancesco, T. Akahori, K. Yoshikawa, S. Nagataki, K.-I. Seon,
    ‘’Can Electron Distribution Functions be Derived via the Sunyaev-Zel’dovich Effect¿’
    Astronomy and Astrophysics **529** (2011) A39.

*Talks at International Conferences*

1. “GRMHD simulations of collapsars: dynamics and explosive nucleosynthesis”,
   in “Nuclear Astrophysics XVI,” Ringberg, Germany,
   March 2012.

2. “Central Engine of Long Gamma-Ray Bursts”, Invited,
   in “International Workshop on Particles and Radiation from Cosmic Accelerators CA2012,” Chiba, Japan,
   February 2012.

3. “Numerical Study of Propagation of UHECRs”, Invited,
   in “International Symposium on Particle Astrophysics and Cosmology Including Fundamental InteraCtions (PACIFIC 2011),” Moorea, French Polynesia,
   September 2011.

4. “Numerical Study of Propagation of UHECRs”,
   in “32nd International Cosmic Ray Conference (ICRC2011),” Beijing, China,
   August 2011.

5. “Numerical Propagation of UHECRs: Spectrum, Arrival Direction, Composition”, Invited,
   in “International Conference “Multi-Messenger Astronomy of Cosmic Rays,” Beijing, China,
   April 2011.

*Invited Seminars* (Overseas)

1. “Theoretical Study on Propagation of UHECRs and Letter of Intent for TA Collaboration,”
   University of Utah, Utah, USA, June 2011.

2. “Introduction of Our Two Projects: UHECRs and Supernova Remnants,”
   KASI, Chungnam, Korea, May 2011.

3. “From Supernovae to Supernova Remnants,”
   National Astronomical Observatory of China, Beijing, China, April 2011.

*Invited Seminars* (in Japan)

1. “Theoretical Study on the Central Engine of GRB,”
   YITP, December 2011 (in Japanese).

2. “My Study on High Energy Astrophysics,”
   Osaka Univ., December 2011 (in Japanese).

## Akira Ohnishi

*Journal Papers*

1. Akihiro Nishiyama and Akira Ohnishi, “Entropy Production in Gluodynamics in temporal axial gauge in 2+1 dimensions”, Prog. Theor. Phys. **125** (2011), pp 775-793, YITP-10-116, arXiv:1011.4750 [nucl-th].

2. M. Isaka, M. Kimura, A. Doté, and A. Ohnishi, “Deformation of hypernuclei studied with antisymmetrized molecular dynamics”, Phys. Rev. C **83** (2011), 044323 [6 pages], arXiv:1104.3940 [nucl-th].

3. Masahiro Isaka, Masaaki Kimura, Akinobu Doté, and Akira Ohnishi, “Shell and cluster states of ${}^{21}_{\Lambda}$Ne studied with antisymmetrized molecular dynamics”, Phys. Rev. C 83 (2011), 054304 [8 pages].

4. Sungtae Cho, Takenori Furumoto, Tetsuo Hyodo, Daisuke Jido, Che Ming Ko, Su Houng Lee, Marina Nielsen, Akira Ohnishi, Takayasu Sekihara, Shigehiro Yasui, Koichi Yazaki (ExHIC Collaboration), “Identifying Multiquark hadrons from Heavy Ion Collisions”, Phys. Rev. Lett. **106** (2011), 212001 [4 pages], YITP-10-117, arXiv:1011.0852 [nucl-th].

5. Akihiro Nishiyama and Akira Ohnishi, “Entropy current for the relativistic Kadanoff-Baym equation and H-theorem in $O(N)$ theory with NLO self-energy of $1/N$ expansion”, Prog. Theor. Phys. **126** (2011), pp 249-267, YITP-10-51, arXiv:1006.1124 [nucl-th].

6. A. Ohnishi, H. Ueda, T. Z. Nakano, M. Ruggieri, K. Sumiyoshi, “Possibility of QCD critical point sweep during black hole formation”, Phys. Lett. B **704** (2011), pp 284-290, YITP-11-23, arXiv:1102.3753 [nucl-th].

7. Sungtae Cho, Takenori Furumoto, Tetsuo Hyodo, Daisuke Jido, Che Ming Ko, Su Houng Lee, Marina Nielsen, Akira Ohnishi, Takayasu Sekihara, Shigehiro Yasui, Koichi Yazaki (ExHIC Collaboration), “Exotic Hadrons in Heavy Ion Collisions”, Phys. Rev. C **84** (2011), 064910 [17 pages], YITP-11-112, arXiv:1107.1302 [nucl-th].

8. Ken’ichiro Nakazato, Shun Furusawa, Kohsuke Sumiyoshi, Akira Ohnishi, Shoichi Yamada, Hideyuki Suzuki, “Hyperon Matter and Black Hole Formation in Failed Supernovae”, Astrophys. J. 745 (2012), 197, arXiv:1111.2900 [astro-ph.HE].

9. Masahiro Isaka, Hiroaki Homma, Masaaki Kimura, Akinobu Dote, Akira Ohnishi, “Modification of triaxial deformation and change of spectrum in ${}^{25}_{\Lambda}$Mg caused by $\Lambda$ hyperon”, Phys. Rev. C **85** (2012), 034303 [8 pages], arXiv:1109.1116 [nucl-th].

*Books and Proceedings*

1. Akira Ohnishi, Sungtae Cho, Takenori Furumoto, Tetsuo Hyodo, Daisuke Jido, Che Ming Ko, Su Houng Lee, Marina Nielsen, Takayasu Sekihara, Shigehiro Yasui, Koichi Yazaki (ExHIC Collaboration), “Exotics from Heavy Ion Collisions”, AIP Conf. Proc. 1388 (2011), pp 404-407, YITP-11-32, arXiv:1103.1700 [nucl-th].

2. Masahiro Isaka, Hiroaki Honma, Masaaki Kimura, Akinobu Dote, Akira Ohnishi, Impurity Effects in ${}^{12}_{\Lambda}$Be and ${}^{21}_{\Lambda}$Ne Hypernucl”, Int. J. Mod. Phys. E **20** (2011), pp 859-862.

3. Tatsuhiro Misumi, Michael Creutz, Taro Kimura, Takashi Z. Nakano, Akira Ohnishi, “Aoki Phases in Staggered-Wilson Fermions”, PoS **Lattice 2011** (2011), 108 [7 pages], YITP-11-86, arXiv:1110.1231 [hep-lat].

4. Kohtaroh Miura, Takashi Z. Nakano, Akira Ohnishi, Noboru Kawamoto, "QCD Phase Diagram in Strong Coupling Lattice QCD with Polyakov Loops", PoS **LATTICE 2011** (2011), 318 [7 pages].

*Talks at International Conferences*

1. "Brown-Rho Scaling in the Strong Coupling Lattice QCD", Dense strange nuclei and compressed baryonic matter, Apr.18-May 18, 2011, Kyoto, Japan.
2. "QCD critical point in the strong coupling lattice QCD and during black hole formation" (Invited, Plenary), Three days on Quarkyonic Island, May.19-21, 2011, Wroclaw, Poland.
3. "Auxiliary field Monte-Carlo study of the QCD phase diagram at strong coupling", Renormalization Group Approach from Ultra Cold Atoms to the Hot QGP, Aug. 22-Sep. 9, 2011, Kyoto, Japan.
4. "Lambda-Lambda correlation in high-energy heavy-ion collisions" (Plenary), VII Workshop on Particle Correlation and Femtoscopy (WPCF2011), Sep. 20-24, 2011, Tokyo, Japan.
5. "Phase diagram and heavy-ion collisions: Overview" (Invited, Plenary), XLI International Symposium on Multiparticle Dynamics (ISMD2011), Sep. 26-30, 2011, Miyajima, Japan.
6. "Phenomenological approach to dense hyperon mixed matter EOS", Dynamics and correlations in exotic nuclei (DCEN2011), Sep.20-Oct.28, 2011, Kyoto, Japan.
7. "Probing the QCD Critical Point in Core Collapsing Compact Stars" (Invited, Plenary), Critical Point and Onset of Deconfinement (CPOD), Nov.7-11, 2011, Wuhan, China.
8. "Symmetry energy in dense matter and its relation to phase boundary", YITP-KoRIA Workshop on Nuclear Symmetry Energy, Nov.10-12, 2011, Kyoto, Japan.
9. "QCD critical point sweep during black hole formation" (Plenary), Origin of Matter and Evolution of Galaxies (OMEG 11), Nov.14-17, 2011, RIKEN, Wako, Japan.
10. "Auxiliary field Monte-Carlo study of the QCD phase diagram at strong coupling", YIPQS-HPCI International Molecule-type Workshop on New Type of Fermions on the Lattice, Feb.9-24, 2012, Kyoto, Japan.
11. "Lambda-Lambda Correlation in (K-,K+) Reaction and Heavy-ion Collisions" (Invited, Plenary), Workshop On Hyperon-Hyperon Interactions and Searches for Exotic Di-Hyperons in Nuclear Collisions, Feb.29-Mar.2, 2012, BNL, USA.

*Invited Seminars* (in Japan)

1. "Dense matter equation of state and neutron stars" (in Japanese), Nuclear Matter in Neutron Stars, Sep. 13, 2011, RIKEN, Wako, Japan.
2. "Equation of State and Compact Stars" (in Japanese), Invited Seminar at Tokyo University of Science, Dec.9, 2011, Noda, Japan.
3. "Equation of State and Compact Stars" (in Japanese), Supernova workshop, Dec.26-27, 2011, Kyoto, Japan.
4. "Neutron Star and Equation of State" (in Japanese, Invited), Symposium at 67th JPS Annual Meeting on "Nuclear Matter in Neutron Stars Probed by Experiments and Observations", Mar.24-27, 2012, Kwansai Gakuin University, Nishinomiya, Japan.

## Takahiro Sagawa

*Journal Papers*

1. Takahiro Sagawa,
   "Hamiltonian Derivations of the Generalized Jarzynski Equalities under Feedback Control,"
   J. Phys: Conf. Ser. **297**, 012015 (2011) (7 pages).
2. Takahiro Sagawa and Hisao Hayakawa,
   "Geometrical expression of excess entropy production,"
   Phys. Rev. E **84**, 051110 (2011) (6 pages).
3. Yu Watanabe, Takahiro Sagawa, and Masahito Ueda,

"Uncertainty relation revisited from quantum estimation theory ,"
Phys. Rev. A **84**, 042121 (2011) (7 pages).

4. Takahiro Sagawa,
"Thermodynamics of Information Processing in Small Systems"
Prog. Theor. Phys. **127**, 1-56 (2012, invited paper).

5. Takahiro Sagawa and Masahito Ueda,
"Nonequilibrium thermodynamics of feedback control ,"
Phys. Rev. E **85**, 021104 (2012) (16 pages).

*Talks at International Conferences*

1. "Information thermodynamics: The Jarzynski equality and the second law of thermodynamics for information processing processes," Invited,
in "Thermodynamics: Can macro learn from nano?," Malmo, Sweden,
May 2011.

2. "Thermodynamics of Feedback Control in Small Nonequilibrium Systems," Invited,
in "Regional Bio-Soft Matter Workshop: Non-equilibrium statistical Physics in Bio-Soft Systems," Taipei, Taiwan,
October 2011.

3. "Nonequilibrium Thermodynamics with Feedback Control," Invited,
in "East Asia Joint Seminars on Statistical Physics 2012," Suzhou, China,
March 2012.

*Invited Seminars* (Overseas)

1. "Information Thermodynamics in Small Systems,"
Nielse Bohr Institute, Denmark, May 2011.

2. "Nonequilibrium Thermodynamics of Information Processing,"
Universidad Complutense de Madrid, Spain, November 2011.

3. "Thermodynamics of information processing in small systems,"
Academia Sinica, Taiwan, January 2012.

*Invited Seminars* (in Japan)

1. "Information thermodynamics in small nonequilibrium systems,"
Dept. of Phys., Tohoku Univ., June 2011 (in Japanese).

2. "Thermodynamics of information processing and Maxwell's demon,"
Dept. of Comp. Sys. Sci., Nagoya Univ., July 2011 (in Japanese).

3. "Information and thermodynamics with feedback control,"
In JPS Autumn Meeting, for the 5th Young Scientist Award of The Physical Society of Japan, Toyama Univ., September 2011 (in Japanese).

4. "Thermodynamics of information processing in small systems,"
Dept. of Appl. Phys., Univ. Tokyo, December 2011 (in Japanese).

5. "Second law of thermodynamics for information processing processes,"
In Second Workshop of Information Network, Umeda Campus, Kansai-Gakuin Univ., January 2012 (in Japanese).

6. "Second law of thermodynamics for information processing processes,"
Dept. of Bioinfo. Eng., Osaka Univ., February 2012 (in Japanese).

7. "Second Law-like Inequalities with Quantum Relative Entropy: An Introduction,"
Dept. of Phys., Kinki Univ., March 2012 (in Japanese).

8. "Thermodynamics of information processing in small systems,"
In JPS Annual Meeting, for the joint symposium of region 11 and 12, Kansai-Gakuin Univ., March 2012 (in Japanese).

## Ryu Sasaki

*Journal Papers*

1. C-L. Ho, S. Odake and R. Sasaki,
"Properties of the exceptional ($X_\ell$) Laguerre and Jacobi polynomials," SIGMA **7** (2011) 107 (24 pp), YITP-09-70, `arXiv:0912.5477[math-ph]`.

2. S. Odake and R. Sasaki,
"Exactly solvable quantum mechanics and infinite families of multi-indexed orthogonal polynomials," Phys. Lett. **B702** (2011) 164-170, YITP-11-52 arXiv:1105.0508[math-ph].

*Talks at International Conferences*

1. 'Infinite Families of Exceptional Orthogonal Polynomials," Invited,
in International Conference on Asymptotics and Special Functions, City University of Hong Kong, Hong Kong,
May 30–June 3 2011.

2. "Exactly Solvable Quantum Mechanics and Infinite Families of Multi-indexed Orthogonal Polynomials," Invited,
in 8th Bologna Workshop on CFT and Integrable Models Bologna, Italy
September 2011.

3. "Exactly Solvable Quantum Mechanics and Infinite Families of Multi-indexed Orthogonal Polynomials," Invited, Plenary
Superintegrability, Exact Solvability, and Special Functions Cuernavaca, MLexico,
February 2012.

*Invited Seminars* (Overseas)

1. "Exactly Solvable Quantum Mechanics and Infinite Families of Multi-indexed Orthogonal Polynomials,"
Taipei String Seminar, Dept. of Physics, National Taiwan University, Taipei, August 2011.

2. "Exactly Solvable Quantum Mechanics and Infinite Families of Multi-indexed Orthogonal Polynomials,"
Dept. of Physics, Universit'a di Roma TRE Rome, September 2011

*Invited Seminars* (in Japan)

1. "Exactly Solvable Quantum Mechanics and Infinitely Many New Orthogonal Polynomials,"
Dept. of Phys., Kumamoto Univ. Kumamoto, May 2011 (in Japanese).

2. "Exceptional Jacobi polynomials as global solutions of Fuchsian differential equations having $3+\ell$ regular singularities,"
RIMS, Kyoto University, Kyoto, July 2011 (in Japanese).

3. "Exactly Solvable Quantum Mechanics and Multi-Indexed Orthogonal Polynomials,"
Muroran Summer School, Dept. of Math., Muroran Institute of Technology. Muroran, August 2011 (in Japanese).

4. "Exactly Solvable Quantum Mechanics and Multi-Indexed Orthogonal Polynomials,"
Dept. of Phys., Hokkaido Univ. Sapporo, August 2011 (in English).

5. "Exactly Solvable Quantum Mechanics and Multi-Indexed Orthogonal Polynomials,"
in Workshop on Accessory Parameters, Tambara Institute of Mathematical Sciences, The University of Tokyo, October 2011 (in Japanese).

6. "Exactly Solvable Quantum Mechanics and Infinitely Families of Multi-Indexed Orthogonal Polynomials,"
in Geometry, Mathematical Physics, and Quantum Theory 19th Numadzu Workshop, Numadzu National College of Technology
Numadzu, February 2012 (in Japanese).

7. "Exactly Solvable Quantum Mechanics and Infinitely Families of Multi-Indexed Orthogonal Polynomials,"
in Workshop on Accessory Parameters, Dept. of Math., Kumamoto Univ.
Kumamoto, March 2012 (in Japanese).

## Misao Sasaki

*Journal Papers*

1. K. Sugimura, D. Yamauchi and M. Sasaki, "Multi-field open inflation model and multi-field dynamics in tunneling," JCAP **1201**, 027 (2012) [arXiv:1110.4773 [gr-qc]].

2. Y. -l. Zhang and M. Sasaki, "Screening of cosmological constant in non-local cosmology," Int. J. Mod. Phys. D **21**, 1250006 (2012) [arXiv:1108.2112 [gr-qc]].

3. J. -O. Gong, J. -c. Hwang, W. -I. Park, M. Sasaki and Y. -S. Song, "Conformal invariance of curvature perturbation," JCAP **1109**, 023 (2011) [arXiv:1107.1840 [gr-qc]].

4. S. Kanno, M. Sasaki and J. Soda, "Holographic Dual of de Sitter Universe with AdS Bubbles," Nucl. Phys. B **855**, 361 (2012) [arXiv:1107.1491 [hep-th]].

5. A. A. Abolhasani, H. Firouzjahi and M. Sasaki, "Curvature perturbation and waterfall dynamics in hybrid inflation," JCAP **1110**, 015 (2011) [arXiv:1106.6315 [astro-ph.CO]].

6. F. Arroja, A. E. Romano and M. Sasaki, "Large and strong scale dependent bispectrum in single field inflation from a sharp feature in the mass," Phys. Rev. D **84**, 123503 (2011) [arXiv:1106.5384 [astro-ph.CO]].

7. D. Yamauchi, A. Linde, A. Naruko, M. Sasaki and T. Tanaka, "Open inflation in the landscape," Phys. Rev. D **84**, 043513 (2011) [arXiv:1105.2674 [hep-th]].

8. C. -M. Yoo, S. Tanzawa and M. Sasaki, "Gregory-Laflamme instability of a slowly rotating black string," Int. J. Mod. Phys. D **20**, 963 (2011) [arXiv:1103.6081 [hep-th]].

9. A. Naruko and M. Sasaki, "Conservation of the nonlinear curvature perturbation in generic single-field inflation," Class. Quant. Grav. **28**, 072001 (2011) [arXiv:1101.3180 [astro-ph.CO]].

10. N. Deruelle, M. Sasaki, Y. Sendouda and A. Youssef, "Inflation with a Weyl term, or ghosts at work," JCAP **1103**, 040 (2011) [arXiv:1012.5202 [gr-qc]].

11. S. 'i. Nojiri, S. D. Odintsov, M. Sasaki and Y. -l. Zhang, "Screening of cosmological constant in non-local gravity," Phys. Lett. B **696**, 278 (2011) [arXiv:1010.5375 [gr-qc]].

12. J. -O. Gong and M. Sasaki, "Waterfall field in hybrid inflation and curvature perturbation," JCAP **1103**, 028 (2011) [arXiv:1010.3405 [astro-ph.CO]].

13. A. E. Romano and M. Sasaki, "Spatial averaging and apparent acceleration in inhomogeneous spaces," Gen. Rel. Grav. **44**, 353 (2012) [arXiv:0905.3342 [astro-ph.CO]].

*Talks at International Conferences*

1. "Delta N Formalism and Superhorizon Curvature Perturbation," Invited, "Cosmological Non-Gaussianity: Observations Confront Theory Workshop," 13 – 15 May, U Michigan, Ann Arbor, USA.

2. "Delta N Formalism and Curvature Perturbations on Superhorizon Scales," Invited, Conference on "Cosmology Since Einstein," 30 May – 1 June, HKUST, Hong Kong.

3. "Open inflation in the landscape," Invited, Takehara workshop on "Theoretical Physics," 6 – 8 June, Takehara, Japan.

4. "Open Inflation in the Landscape," Invited, 5th PI/Solvay/APC joint workshop on "Cosmological Frontiers in Fundamental Physics," 14 – 17 June, APC Paris, France.

5. "Non-Gaussianity from inflation," Invited, WKYC 2011 "Future of Large Scale Structure Formation," 27 June – 1 July, KIAS Seoul, Korea.

6. "Bigbang, Inflation and Quantum Cosmology," Public Lecture, 2011 APCTP International School on "Numerical Relativity and Gravitational Waves," 28 July – 3 August, APCTP Pohang, Korea.

7. "Conformal-invariance of curvature perturbation and related issues," Invited, Informal Workshop on "Theoretical Cosmology," 15 – 23 September, U Portsmouth, UK.

8. "Open inflation in the string landscape," Invited, Xth International Conference on "Gravitation, Astrophysics and Cosmology (ICGAC10)," Invited, 17 – 22 December, Quy-Nhon, Vietnam.

9. "Cosmology Now and Tomorrow," Key Note Talk, 2012 KASI-YITP Joint-Workshop: "Cosmology Now and Tomorrow," 17 – 18 February, KASI Daejeon, Korea.

10. "Testing the string theory landscape in cosmology," Invited, The 5th workshop on "Superstring Theory and Cosmology," 21 – 23 February, Beppu, Japan

*Invited Seminars* (Overseas)

1. "Open inflation in the string theory landscape," ASC cosmology seminar, 6 May, ASC Munich, Germany.

2. "Open Inflation in the Landscape," Joint Tufts/CfA/MIT Cosmology Seminar, 10 May, MIT, USA.

3. "Testing the string theory landscape in cosmology," CCPP HEP Seminar, 21 March, CCPP NYU, USA.

## Naoki Sasakura

*Journal Papers*

1. N. Sasakura,
"Tensor models and 3-ary algebras,"
J. Math. Phys. **52**, 103510 (2011) [arXiv:1104.1463 [hep-th]], YITP-11-45.

2. N. Sasakura,
"Tensor models and hierarchy of n-ary algebras,"
Int. J. Mod. Phys. A **26**, 3249 (2011) [arXiv:1104.5312 [hep-th]], YITP-11-51.

3. N. Sasakura,
"Super tensor models, super fuzzy spaces and super n-ary transformations,"
Int. J. Mod. Phys. A **26**, 4203 (2011) [arXiv:1106.0379 [hep-th]], YITP-11-62.

4. N. Sasakura,
"Canonical tensor models with local time,"
Int. J. Mod. Phys. A **27**, 1250020 (2012) [arXiv:1111.2790 [hep-th]], YITP-11-93 .

*Talks at International Conferences*

1. "Fuzzy spaces from tensor models, cyclicity condition, and n-ary algebras,"
in "Workshop on Noncommutative Field Theory and Gravity," Corfu, Greece, September 2011.

*Invited Seminars* (in Japan)

1. "Recent developments of tensor models and introduction of local time,"
Inst. of Phys., Univ. of Tsukuba, February 2012 (in Japanese).

## Masaru Shibata

*Journal Papers*

1. M. Shibata, Y. Suwa, J. Kiuchi, and K. Ioka,
"Afterglow of binary neutron star merger,"
Astrophys. J. Lett. **734** (2011) L36–L40.

2. K. Kiuchi, S. Yoshida, and M. Shibata,
"Non-axisymmetric instabilities of neutron stars with purely toroidal magnetic fields,"
Astron. and Astrophys. **532** (2011) A30-1–17.

3. M. Shibata and K. Taniguchi,
"Coalescence of black hole-neutron star binaries,"
Living Review in Relativity **14** (2011) 6-1–90.

4. M. Shibata, K. Kiuchi, Y. Sekiguchi, and Y. Suwa,
"Truncated Moment Formalism for Radiation Hydrodynamics in Numerical Relativity,"
Prog. Theor. Phys. **125** (2011) 1255–1287.

5. H. Okawa, K. Nakao, and M. Shibata,
"Is super-Planckian physics visible?: Scattering of black holes in 5-dimension"
Phys. Rev. D **83** (2011) 121501-1–5.

6. K. Hotokezaka, K. Kyutoku, H. Okawa, M. Shibata, and K. Kiuchi,
"Binary neutron star mergers: Dependence on the nuclear equation of state,"
Phys. Rev. D **83** (2011) 124008-1–12.

7. K. Kiuchi, M. Shibata, P.J. Montero, and J.A. Font,
"Gravitational waves from the Papaloizou-Pringle instability in black hole-torus systems,"
Phys. Rev. Lett. **106** (2011) 251102-1–4.

8. Y. Sekiguchi and M. Shibata,
"Formation of black hole and accretion disk in collapsar,"
Astrophys. J. **737** (2011) 6-1–28.

9. Y. Sekiguchi, K. Kiuchi, K. Kyutoku, and M. Shibata,
"Gravitational waves and neutrino emission from the merger of binary neutron stars,"
Phys. Rev. Lett. **107** (2011) 051102-1–5.

10. K. Kyutoku, H. Okawa, M. Shibata, and K. Taniguchi,
"Gravitational waves from spinning black hole-neutron star binaries: dependence on black hole spins and on neutron star equations of state,"
Phys. Rev. D **84** (2011) 064018-1–32.

11. H. Yoshino and M. Shibata,
"Higher-dimensional numerical relativity: Current status,"
Prog. Theor. Phys. Suppl. **189** (2011) 269–310.

12. Y. Sekiguchi, K. Kiuchi, K. Kyutoku, and M. Shibata,
"Effects of hyperons in binary neutron star mergers,"
Phys. Rev. Lett. **107** (2011) 211101-1–5.

13. H. Yoshino and M. Shibata,
"Exploring Higher-Dimensional Black Holes in Numerical Relativity,"
Prog. Theor. Phys. Suppl. **190** (2011) 282–303.

*Books and Proceedings*

1. Akira Ukawa, Shinya Aoki, Tetsuo Hatuda, Masaru Shibata, Masayuki Umemura, and Jun Nishimura,
Computation and Universe (in Japanese),
Iwanami, (2012) 250 pages.

*Talks at International Conferences*

1. "Coalescence of binary neutron stars and black hole-neutron star binaries" (invited) in "Advances in Computatoinal Astrophysics", Cefalu, Italy, June 13–17, 2011.

2. "Higher dimensional numerical relativity" (invited) in "Numerical relativity beyond astrophysics", Edinburgh, Scotland, July 11–15, 2011.

3. "Higher dimensional numerical relativity" (invited) in "Numerical relativity and high energy physics", Madeira island, Portugal, Aug. 31–Sept. 4, 2011.

4. "Gravitational waves from binary neutron stars" (invited) in "Black Holes: New horizons", Banff, Canada, November 20–25, 2011.

5. "Coalescence of binary neutron stars and black hole-neutron star binaries" (invited) in "7th ICGC", Goa, India, Dec 14–19, 2011.

## Ken-ichi Shizuya

*Books and Proceedings*

1. K. Shizuya, "Many-body corrections to cyclotron resonance in graphene,"
J. Phys.: Conf. Ser. **334** (2011) 012046 1-5, YITP-11-110.

*Talks at International Conferences*

1. "Cyclotron resonance and renormalization in graphene and its bilayer", CARBOMAT 2011 (Workshop on Carbon-based low-dimensional Materials), Catania, Italy, Dec. 5-7, 2011.

## Fumihiro Takayama

*Invited Seminars* (in Japan)

1. "Long-Lived Massive Particles and the Implications to Dark Matter Physics,"
Dept. of Physics, Niigata Univ., December 2011 (in Japanese).

## Takahiro Tanaka

*Journal Papers*

1. A. Nishizawa, K. Yagi, A. Taruya and T. Tanaka,
"Cosmology with space-based gravitational-wave detectors — dark energy and primordial gravitational waves —,"
Phys. Rev. D **85**, 044047 (18pages) (2012), YITP-11-114, [arXiv:1110.2865 [astro-ph.CO]].

2. S. Isoyama, N. Sago and T. Tanaka,
"Cosmic censorship in overcharging a Reissner-Nordström black hole via charged particle absorption,"
Phys. Rev. D **84**, 124024 (15pages) (2011), YITP-11-77, [arXiv:1108.6207 [gr-qc]].

3. A. Flachi and T. Tanaka,
Phys. Rev. D **84**, 061503 (5pages) (2011), YITP-11-113, [arXiv:1106.3991 [hep-th]].

4. N. Tanahashi and T. Tanaka,
   Prog. Theor. Phys. Suppl. **189**, 227 (42pages) (2011), YITP-11-59, [arXiv:1105.2997 [hep-th]].

5. D. Yamauchi, A. Linde, A. Naruko, M. Sasaki and T. Tanaka,
   Phys. Rev. D **84**, 043513 (14pages) (2011), YITP-11-55, [arXiv:1105.2674 [hep-th]].

6. T. Tanaka and Y. Urakawa,
   "Dominance of gauge artifact in the consistency relation for the primordial bispectrum,"
   JCAP **1105**, 014 (2011), YITP-11-31, [arXiv:1103.1251 [astro-ph.CO]].

7. F. Arroja and T. Tanaka,
   "A note on the role of the boundary terms for the non-Gaussianity in general k-inflation,"
   JCAP **1105**, 005 (2011), YITP-11-30, [arXiv:1103.1102 [astro-ph.CO]].

8. A. De Felice, T. Suyama and T. Tanaka,
   "Stability of Schwarzschild-like solutions in f(R,G) gravity models,"
   Phys. Rev. D **83**, 104035 (12pages) (2011), YITP-11-17, [arXiv:1102.1521 [gr-qc]].

9. K. Yagi, N. Tanahashi and T. Tanaka,
   "Probing the size of extra dimension with gravitational wave astronomy,"
   Phys. Rev. D **83**, 084036 (2011), YITP-11-11, [arXiv:1101.4997 [gr-qc]].

10. Y. Urakawa and T. Tanaka, "Natural selection of inflationary vacuum required by infra-red regularity Prog. Theor. Phys. **125**, 1067 (23pages) (2011) YITP-10-81, [arXiv:1009.2947 [hep-th]].

*Talks at International Conferences*

1. "Some issues about infrared divergences during inflation," Invited,
   in "Mini-Workshop on cosmology," APCTP, Pohan, Korea,
   November 2011.

2. "Hawking radiation of interacting fields," Invited,
   in BIRS Workshop (11w5099) "Black Holes: New Horizons," Banff, Canada,
   October 2011.

3. "Some issues about infrared divergences during inflation," Invited,
   in "Pre-Planckian Inflation," Minesota university, USA,
   October 2011.

4. "Constraints on modified gravity models from future gravitational wave observations," Invited,
   in KIAS-YITP Joint workshop "String Theory, Holography and Beyond," KIAS, Seoul, Korea,
   October 2011.

5. "Infrared divergences and cosmological observables," Invited,
   in "UK Cosmo," Portsmouth university, UK,
   September 2011.

6. "IR issues during inflation - constraints on quantum state -," Invited,
   in "Cosmological Frontiers in Fundamental Physics Workshop," Paris, France,
   June 2011.

7. "IR issues during inflation - constraints on quantum state -," Invited,
   in "Cosmological Non-Gaussianity: Observations Confront Theory Workshop," Michigan, USA,
   May 2011.

8. "Tensor perturbation constraint on inflation models with non-negligible spatial curvature in landscape scenario," Invited,
   in "Bubbles in the Sky," UC Davies, USA,
   April 2011.

*Invited Seminars* (in Japan)

1. "Hawking radiation of Interacting Field - BH localized on the Randall-Sundrum II braneworld -,"
   Kinki Univ, January 2012 (in Japanese).

2. "Progress in Gravitational Wave Physics,"
   Annual meeting of Physical Society of Japan, September 2011 (in Japanese).

## Seiji Terashima

*Journal Papers*

1. T. Azeyanagi, N. Ogawa and S. Terashima, "On Non-Chiral Extension of Kerr/CFT," JHEP **1106** (2011) 081, arXiv:1102.3423 [hep-th].

2. Y. Tachikawa and S. Terashima, "Seiberg-Witten Geometries Revisited," JHEP **1109** (2011) 010, arXiv:1108.2315 [hep-th].

*Talks at International Conferences*

1. "Seiberg-Witten Geometry revisited," Invited, in "String Theory, Holography, and Beyond," KIAS, Korea, September 2011.

*Invited Seminars* (in Japan)

1. "Multiple M5-branes and ABJM Action," Dept. of Phys., Univ. of Tokyo, June 2011.

2. "Seiberg-Witten Geometry Revisited," Dept. of Phys., Nagoya Univ. , October 2011.

## Takami Tohyama

*Journal Papers*

1. T. Motohashi, Y. Sugimoto, Y. Masubuchi, T. Sasagawa, W. Koshibae, T. Tohyama, H. Yamauchi and S. Kikkawa, "Impact of lithium composition on the thermoelectric properties of the layered cobalt oxide system $Li_xCoO_2$," Phys. Rev. B **83** (2011) 195128 (7 pages), arXiv:1104.2419 [cond-mat.str-el].

2. E. Kaneshita, K. Tsutsui and T. Tohyama, "Spin and orbital characters of excitations in iron arsenides revealed by simulated Fe L-edge RIXS," Phys. Rev. B **84** (2011) 020511(R) (4 pages), arXiv:1104.5424 [cond-mat.str-el].

3. L. Vidmar, J. Bonca, S. Maekawa and T. Tohyama, "Quantum Dynamics of a Driven Correlated System, Coupled to Phonons," Phys. Rev. Lett. **107** (2011) 246404 (4 pages), arXiv:1107.1040 [cond-mat.str-el].

4. W. Chen, O. P. Sushkov and T. Tohyama, "ARPES Spectral Function in Lightly Doped and Antiferromagnetically Ordered $YBa_2Cu_3O_{6+y}$," Phys. Rev. B **84** (2011) 195125 (12 pages), arXiv:1104.5424 [cond-mat.str-el].

5. T. Tohyama, E. Kaneshita and T. Morinari, "Charge and spin dynamics in antiferromagnetic metallic phase of iron-based superconductors," J. Phys. Chem. Solids **72** (2011) 315-318.

6. K. Tsutsui, T. Tohyama and S. Maekawa, "Theory of resonant inelastic X-ray scattering spectrum for Ni impurities in cuprates," J. Phys. Chem. Solids **72** (2011) 354-357.

7. K. Sugimoto, E. Kaneshita and T. Tohyama, "Parameter dependence of optical conductivity in antiferromagnetic phase of iron pnictides," Physica C **471** (2011) 666-669.

8. T. Sugimoto, S. Sota and T. Tohyama, "Spin Excitation and Phonon Effect for Frustrated Spin-Peierls Model," J. Phys. Sco. Jpn. **80** Supplement B (2011) SB017 (3 pages).

9. T. Himura, T. Morinari and T. Tohyama, "Pressure effects on Dirac fermions in alpha-$(BEDT\text{-}TTF)_2I_3$," J. Phys: Cond. Matter **23** (2011) 464202 (18 pages), arXiv:1108.0791 [cond-mat.mes-hall].

10. H. Matsueda, S. Sota, T. Tohyama and S. Maekawa, "Relaxation Dynamics of Photocarriers in One-Dimensional Mott Insulators Coupled to Phonons," J. Phys. Sco. Jpn. **81** (2012) 013701 (4 pages), arXiv:1005.1690 [cond-mat.str-el].

11. T. Tohyama, "Recent Progress in Physics of High-Temperature Superconductors," Jpn. J. Appl. Phys. **51** (2012) 010004 (13 pages).

12. T. Sugimoto, S. Sota and T. Tohyama, "Spin Excitation Assisted by Non-Softening Phonon for Spin-Peierls Model,"

J. Phys. Sco. Jpn. **81** (2012) 034706 (8 pages), arXiv:1109.2410 [cond-mat.str-el].

13. K. Ishii, K. Tsutsui, K. Ikeuchi, I. Jarrige, J. Mizuki, H. Hiraka, K. Yamada, T. Tohyama, S. Maekawa, Y. Endoh, H. Ishii and Y. Q. Cai,
"Electronic excitations around the substituted atom in $La_2Cu_{1-y}Ni_yO_4$ as seen via resonant inelastic x-ray scattering,"
Phys. Rev. B **85** (2012) 104509 (5 pages).

*Talks at International Conferences*

1. "Theory of Inelastic X-Ray Resonance Scattering in Iron Arsenides," Invited,
in "8th International Conference on Stripes and High Tc Superconductivity STRIPES 11," Rome, Itary,
July 2011.

2. "Spin and Charge Excitations in the Antiferromagnetic Metallic Phase of Iron Arsenides: Inelastic Neutron Scattering and Resonant Inelastic X-Ray Scattering," Invited,
in "The 26th International Conference on Low Temperature Physics," Beijing, China,
August 2011.

3. "Theory of Inelastic X-Ray Resonance Scattering in Iron Arsenides," Invited,
in "JUM@P'11: Joint Users' Meeting at PSI 2011 "Resonant Inelastic and Elastic X-ray Scattering"," PSI, Switzerland,
September 2011.

4. "Spin and Charge Dynamics in Iron Pnictides," Invited,
in "Gorden Godfrey Workshop on "Spins and Strong Correlations"," Sydney, Australia,
October 2011.

5. "Photoexcited states and nonequilibrium photo dynamics of one-dimensional strongly correlated electron systems," Invited,
in "The 26th Nishinomiya-Yukawa Memorial International Workshop "Novel Quantum States in Condensed Matter 2011 (NQS2011)"," Kyoto, Japan,
December 2011.

*Talks at domenstic Conferences*

1. "Spin and charge dynamics in the antiferromagnetic phase of iron-arsenide superconductors: Inelastic neutron scattering and resonant inelastic x-ray scattering," Invited,
in "Physics of Iron-Based Superconductivity," YITP, Kyoto,
June 2011.

2. "Spin dynamics of $CuGeO_3$," Invited,
in "Workshop: CROSSROAD of Users and J-PARC," Tokai,
October 2011.

3. "Dirac electrons in iron-based superconductors,"
in "5-th GCOE Workshop," Sendai,
January 2012.

4. "L-edge RIXS in cuprates,"
in "JPS meeting," Kansei Univ.,
March 2012.

*Invited Seminars* (in Japan)

1. "L-edge RIXS in cuprates and iron-pnictides,"
ISSP, Univ. of Tokyo, December 2011 (in Japanese).

## Keisuke Totsuka

*Journal Papers*

1. K. Hasebe and K. Totsuka,
"Hidden order and dynamics in supersymmetric valence-bond solid states: Supermatrix product state formalism",
Phys. Rev. **B84** (2011) 104426 (19 pages), YITP-11-58, arXiv:1105.3529 [cond-mat].

2. K. Totsuka, P. Lecheminant and S. Capponi,
"Semiclassical approach to competing orders in a two-leg spin ladder with ring exchange", Phys. Rev. **B86** (2012) 014435 (14 pages), YITP-12-26, arXiv:1204.0333 [cond-mat].

*Talks at International Conferences*

1. "Spin-liquid plateaus in frustrated spin systems",
in "Novel Quantum States in Condensed Matter" YITP, Kyoto, Japan, November 2011.

*Talks at Domestic Conferences*

1. “Spin-liquid magnetization plateaus”,
   in 67th Annual Meeting of the Physical Society of Japan Kwansei Gakuin University, Nishinomiya, Japan, march 2012.

*Invited Seminars* (in Japan)

1. “Geometric Approach to Magnetization Plateaus”,
   Dept. of Phys., Osaka University, March 2012 (Science Seminar).

# Hirofumi Wada

*Journal Papers*

1. Hirofumi Wada,
   “Geometry of twist transport in a rotating elastic rod ”
   Phys. Rev. E **84**, 042901 (2011) (4 pages).

*Talks at International Conferences*

1. “Geometry and energetics of twist transport in a rotating elastic rod,” Invited,
   in Regional Bio-soft Matter Workshop: Non-equilibrium Statistical Physics in Bio-Soft Systems, National Taiwan University, Taipei: October 27-29, 2011.

*Invited Seminars* (in Japan)

1. “Viscoelastic swimming at Low Reynolds number,”
   in Workshop ”Biological Locomotion and Syncronization”, Ohnuma, Hokkaido: August 16-20 (2011).

### 2.2.3 Publications and Talks by Research Fellows and Graduate Students (April 2011– March 2012)

## Takenori Furumoto

*Journal Papers*

1. Sungtae Cho, Takenori Furumoto, Tetsuo Hyodo, Daisuke Jido, Che Ming Ko, Su Houng Lee, Marina Nielsen, Akira Ohnishi, Takayasu Sekihara, Shigehiro Yasui and Koichi Yazaki,
   "Identifying multiquark hadrons from heavy ion collisions,"
   Phys. Rev. Lett. **106** (2011) 212001 (4 pages), YITP-10-117, arXiv:1011.0852 [nucl-th].

2. K. Muta, T. Furumoto, T. Ichikawa, and N. Itagaki,
   "Three-triton states in $^{9}$Li,"
   Phys. Rev. **C84** (2011) 034305 (6 pages), arXiv:1106.0957 [nucl-th].

3. Sungtae Cho, Takenori Furumoto, Tetsuo Hyodo, Daisuke Jido, Che Ming Ko, Su Houng Lee, Marina Nielsen, Akira Ohnishi, Takayasu Sekihara, Shigehiro Yasui and Koichi Yazaki,
   "Exotic hadrons in heavy ion collisions,"
   Phys. Rev. **C84** (2011) 064910 (17 pages), arXiv:1107.1302 [nucl-th].

*Books and Proceedings*

1. Akira Ohnishi, Sungtae Cho, Takenori Furumoto, Tetsuo Hyodo, Daisuke Jido, Che Ming Ko, Su Houng Lee, Marina Nielsen, Takayasu Sekihara, Shigehiro Yasui and Koichi Yazaki,
   "Exotics from Heavy Ion Collisions,"
   AIP Conference Proceedings, **1388** (2011) 404 (4 pages), YITP-11-32, arXiv:1103.1700 [nucl-th].

2. T. Furumoto, Y. Sakuragi, and Y. Yamamoto,
   "Role of Three-Body force in Proton and Heavy-Ion Scattering,"
   Journal of Physics: Conference Series, **312** (2011) 082022 (6 pages).

*Talks at International Conferences*

1. "Prediction of Repulsive Potential for High-energy Heavy-ion Scatterings,"
   in "Rutherford Centennial Conference on Nuclear Physics," The University of Manchester, Manchester, UK,
   August 2011.

2. "Dynamical evolution of heavy-ion scattering in the high-energy region,"
   in "YKIS2011 Symposium, Frontier Issues in Physics of Exotic Nuclei," YITP, Kyoto University, Japan,
   October 2011.

## Soichiro Isoyama

*Journal Papers*

1. S. Isoyama, N. Sago and T. Tanaka,
   "Cosmic censorship in overcharging a Reissner-Nordstrom black hole via charged particle absorption,"
   Phys. Rev. **D84** (2011) 124024 (15 pages), YITP-11-77, arXiv:1108.6207 [gr-qc].

*Talks at International Conferences*

1. "Maximum charge of a black hole via charged particle absorption,",
   in "Asia Pacific School/Workshop on cosmology and gravitation," Shanghai, China,
   February 2011.

2. "Cosmic censorship in overcharging a Reissner-Nordstrom black hole via charged particle absorption,",
   in "GCOE Symposium Emerging Frontiers of Physics ," Kyoto, Japan,
   February 2011.

3. "Cosmic censorship in overcharging a Reissner-Nordstrom black hole via charged particle absorption,",
   in "The 21st workshop on General Relativity and Gravitation in Japan ," Sendai, Japan,
   September 2011.

4. “The role of higher black hole perturbation in gravitational waves from an EMRI binary system,”,
   in “ Japanese Physical Society,” Hirosaki, Japan,
   September 2011.

5. “Gravitational waves from an EMRI binary system,”,
   in “GCOE Symposium Links among Hierarchies ,” Kyoto, Japan,
   February 2012.

6. “The second order disspative effect of the self-force in gravitational waves from an EMRI binary system,”,
   in “ Japanese Physical Society,” Nishinomiya, Japan,
   March 2012.

## Kenta Kiuchi

*Journal Papers*

1. Y. Sekiguchi, K. Kiuchi, K. Kyutoku and M., Shibata, ,
   “Effects of hyperons in binary neutron star mergers,”
   Physical Review Letters **107** (2011) 211101 (5 pages), arXiv:1110.4442 [astro-ph.HE].

2. Y. Sekiguchi, K. Kiuchi, K. Kyutoku and M., Shibata, ,
   “Effects of hyperons in binary neutron star mergers,”
   Physical Review Letters **107** (2011) 051102 (5 pages), arXiv:1105.2125 [gr-qc].

3. K. Kiuchi, M., Shibata, P. J. Montero and J. A. Font,
   “Gravitational waves from the Papaloizou-Pringle instability in black hole-torus systems,”
   Physical Review Letters **106** (2011) 251102 (4 pages), arXiv:1105.5035 [astro-ph.HE] .

4. K. Hotokezaka, K. Kyutoku, H. Okawa, M. Shibata and K. Kiuchi,
   “Binary Neutron Star Mergers: Dependence on the Nuclear Equation of State,”
   Physical Review D **83** (2011) 124008 (12 pages), arXiv:1105.4370 [astro-ph.HE] .

5. M. Shibata, Y. Suwa, K. Kiuchi and K. Ioka,
   “Afterglow of binary neutron star merger,“
   Astrophysical Journal Letter, **734** (2011), L36 (5 pages), arXiv:1105.3302 [astro-ph.HE] .

6. K. Kiuchi, S. Yoshida and M. Shibata,
   “Non-axisymmetric instabilities of neutron star with toroidal magnetic fields,“
   Astronomy and Astrophysics, **532**, (2011) A30 (17 pages), arXiv:1104.5561 [astro-ph.HE] .

7. M. Shibata, K. Kiuchi, Y. Sekiguchi and Y. Suwa,
   “Truncated Moment Formalism for Radiation Hydrodynamics in Numerical Relativity,“
   Progress of Theoretical Physics, **125**, (2011) 1255 (32 pages), arXiv:1104.3937 [astro-ph.HE].

8. H. Nagakura, H. Ito, K. Kiuchi and S. Yamada,
   “Jet propagations, breakouts and photospheric emissions in collapsing massive progenitors of long duration gamma ray bursts,“
   Astrophysical Journal **731**, (2011) 80 (18 pages) arXiv:1009.2326 [astro-ph.HE].

*Talks at International Conferences*

1. “Gravitational waves and neutrino emission from the merger of binary neutron stars”, Plenary,
   in “ASTRONUM2011”, Valencia, Spain,
   June 2011.

2. “Gravitational waves and neutrino emission from the merger of binary neutron tars,” Invited,
   in “Amaldi 9 & NRDA,” Cardiff University, Wales,
   July 2011.

3. “Gravitational waves and neutrino emission from the merger of binary neutron stars”, Plenary,
   in “JGRG21”, Sendai, Japan,
   September 2011.

*Invited Seminars* (Overseas)

1. “Stability of magnetized neutron stars,”
   The Seoul branch office of APCTP at Souel Korea, November 2011.

*Invited Seminars* (in Japan)

1. "Stability of magnetized neutron stars,"
   Dept. of Phys., Waseda Univ., January 2012.

## Koutarou Kyutoku

*Journal Papers*

1. Y. Sekiguchi, K. Kiuchi, K. Kyutoku, and M. Shibata,
   "Effects of hyperons in binary neutron star mergers,"
   Phys. Rev. Lett. **107** (2011) 211101 (5 pages), arXiv:1110.4442 [astro-ph].
2. K. Kyutoku, H. Okawa, M. Shibata, and K. Taniguchi,
   "Gravitational waves from spinning black hole-neutron star binaries: dependence on black hole spins and on equations of state,"
   Phys. Rev. D **84** (2011) 064018 (32 pages), arXiv:1108.1189 [astro-ph].
3. Y. Sekiguchi, K. Kiuchi, K. Kyutoku, and M. Shibata,
   "Gravitational waves and neutrino emission from the merger of binary neutron stars,"
   Phys. Rev. Lett. **107** (2011) 051102 (5 pages), arXiv:1105.2125 [gr-qc].
4. K. Hotokezaka, K. Kyutoku, H. Okawa, M. Shibata, and K. Kiuchi,
   "Binary neutron star mergers: dependence on the nuclear equation of state,"
   Phys. Rev. D **83** (2011) 124008 (12 pages), arXiv:1105.4370 [astro-ph].

*Talks at International Conferences*

1. "The black hole-neutron star binary merger,"
   in "Rironkon Symposium," National Astronomical Observatory of Japan, November 2011.

*Invited Seminars* (Overseas)

1. "Gravitational waves from black hole-neutron star binaries: dependence on boack hole spins and on neutron star equations of state,"
   University of Wisconsin-Milwaukee, USA, September 2011

*Invited Seminars* (in Japan)

1. "Gravitational waves from black hole-neutron star binaries,"
   KEK, May 2011 (in Japanese).

## Kenji Morita

*Journal Papers*

1. P. Gubler, K. Morita and M. Oka,
   "Charmonium spectral at finite temperature from QCD sum rules with the maximum entropy method,"
   Phys. Rev. Lett. **107** (2011) 092003 (4 pages), YITP-11-47, arXiv:1104.4436 [hep-ph].
2. K. Morita, V. Skokov, B. Friman and K. Redlich,
   "Probing deconfinement in a chiral effective model with Polyakov loop at imaginary chemical potential,"
   Phys. Rev. **D84** (2011) 076009 (16 pages), YITP-11-70, arXiv:1107.2273 [hep-ph].
3. K. Morita, V. Skokov, B. Friman and K. Redlich,
   "Role of mesonic fluctuations in the Polyakov loop extended quark-meson model at imaginary chemical potential,"
   Phys. Rev. **D84** (2011) 074020 (8 pages), YITP-11-71, arXiv:1108.0735 [hep-ph].

*Talks at International Conferences*

1. "Probing deconfinement in a chiral effective model with Polyakov loop from imaginary chemical potential," Invited,
   in "Three Days on Quarkyonic Islands, HIC for FAIR Workshop and XXVIII Max Born Symposium" University of Wroclaw, Wrocław, Poland,
   May 19-21, 2011.
2. "Quarkonium at $T > 0$," Invited,
   in "XLI International Symposium on Multiparticle Dynamics (ISMD2011)," Miyajima Island, Japan,
   September 25-30, 2011.
3. "QCD sum rules for quarkonium at $T > 0$ with maximum entropy method," Invited,
   in "International Workshop on Heavy Quarkonium 2011 (QWG2011)," GSI,

Darmstadt, Germany,
October 4-7, 2011.

*Invited Seminars* (Overseas)

1. "QCD phase transitions at imaginary chemical potential,"
Yonsei University, Korea Republic, June 7, 2011.

2. "Baryon number probability distribution near a phase transition,"
RIKEN/BNL Research Center, USA, March 8, 2012.

## Norichika Sago

*Journal Papers*

1. L. Barack and N. Sago,
"Beyond the geodesic approximation: conservative effects of the gravitational self-force in eccentric orbits around a Schwarzschild black hole"
Phys. Rev. **D83** (2011) 084023 (24 pages), arXiv:1101.3331 [gr-qc].

2. A. Le Tiec, A. H. Mroué, L. Barack, A. Buonanno, H. P. Pfeiffer, N. Sago, and A. Taracchini,
"Periastron Advance in Black Hole Binaries"
Phys. Rev. Lett. **107** (2011) 141101 (5 pages), arXiv:1106.3278 [gr-qc].

3. N. Warburton, S. Akcay, L. Barack, J. R. Gair, and N. Sago,
"Evolution of inspiral orbits around a Schwarzschild black hole"
Phys. Rev. **D85** (2012) 061501(R) (5 pages), arXiv:1111.6908 [gr-qc].

*Talks at International Conferences*

1. "Numerical implementation and recent results of self-force calculations in Schwarzschild spacetime," Invited,
in "14th Capra Meeting on Radiation Reaction in General Relativity," University of Southampton, Southampton, UK,
July 2011.

*Invited Seminars* (in Japan)

1. "Motion of a point mass in Schwarzschild spacetime,"
Dept. of Earth and Space Science., Osaka Univ., April 2011 (in Japanese).

## Kazuhiro Sakai

*Journal Papers*

1. Y. Hatsuda, K. Ito, K. Sakai and Y. Satoh,
"*g*-functions and gluon scattering amplitudes at strong coupling,"
Journal of High Energy Physics 1104:100 (2011) 0–45, YITP-11-14, arXiv:1102.2477 [hep-th].

*Talks at International Conferences*

1. "Conformal perturbation theory for gluon scattering amplitudes," Invited,
in Institut d'Eté de Physique et Mathématique "Double Affine Hecke Algebras,
the Langlands Program, Conformal Field Theory, Super Yang-Mills Theory," Institut d'Etudes Scientifiques de Cargèse, France,
4–16 July 2011.

*Invited Seminars* (in Japan)

1. "Conformal perturbation theory for gluon scattering amplitudes,"
Dept. of Phys., Kobe University, 20 June 2011 (in Japanese).

2. "Introduction to Quantum Integrable Systems,"
Intensive course of lectures in Tokyo Inst. of Tech. and Ibaraki Univ. Joint Workshop,
Seminar House in Kusatsu, 8–10 October 2011 (in Japanese).

3. "Conformal perturbation theory for gluon scattering amplitudes,"
Inst. of Phys., Univ. of Tokyo, 19 October 2011 (in Japanese).

4. "Seiberg–Witten theories and topological string amplitudes for local $\frac{1}{2}$K3,"
Dept. of Phys., Osaka Univ., 24 January 2012.

5. "Topological string theories and modular properties — Seiberg–Witten curves, rational elliptic surfaces, Jacobi forms —," Invited,

Annual Meeting of the Mathematical Society of Japan,
Tokyo Univ. of Science, 29 March 2012 (in Japanese).

## Tadahiro Suhara

*Journal Papers*

1. Y. Kanada-En'yo, H. Feldmeier and T. Suhara,
"Two-neutron correlations in microscopic wave functions of $^{6}$He, $^{8}$He and $^{12}$C,"
Phys. Rev. **C84** (2011) 054301 (14 pages), arXiv:1107.5616[nucl-th].

2. Y. Kanada-En'yo and T. Suhara,
"$^{6}$He-triton cluster states in $^{9}$Li,"
Phys. Rev. **C85** (2012) 024303 (9 pages), arXiv:1109.4293 [nucl-th].

## Yudai Suwa

*Journal Papers*

1. M. Shibata, Y. Suwa, K. Kiuchi, and K. Ioka,
"Afterglow of a Binary Neutron Star Merger,"
Astrophys. J., **734** (2011) L36 (5 pages), arXiv:1105.3302 [astro-ph.HE].

2. M. Shibata, K. Kiuchi, Y. Sekiguchi, and Y. Suwa,
"Truncated Momentum Formalism for Radiation Hydrodynamics in Numerical Relativity,"
Prog. Theor. Phys., **125** (2011) 1255-1287, arXiv:1104.3937 [astro-ph.HE].

3. Y. Suwa, K. Kotake, T. Takiwaki, M. Liebendörfer, and K. Sato,
"Impacts of Collective Neutrino Oscillations on Core-Collapse Supernova Explosions,"
Astrophys. J., **738** (2011) 165 (13 pages), arXiv:1106.5487 [astro-ph.HE].

*Talks at International Conferences*

1. "Can Gamma-Ray Burst Jets Break Out the First Stars?," Plenary,
in "Chemical Evolution of GRB Host Galaxies," Sexten Center for Astrophysics, Bolzano, Italy, July 2011.

2. "Multi-dimensional core-collapse supernova simulations and the equation of state influence," Plenary,
in "Formations of Compact Objects: from the cradle to the grave," Waseda University, Tokyo, Japan, March 2012.

3. "Axisymmetric simulation of core-collapse supernovae with spectral neutrino transfer," Plenary,
in "16th Workshop on Nuclear Astrophysics," Ringberg Castle, Mucich, Germany, March 2012.

*Invited Seminars* (in Japan)

1. "Explosion Mechanism of Core-Collapse Supernovae and Multidimensional Simulations,"
Dept. of Phys., Konan Univ., April 2011 (in Japanese).

2. "Can Gamma-Ray Burst Jets Break Out the First Stars?,"
Division of Theoretical Astronomy, National Astronomical Observatory of Japan, January 2012 (in English).

## Alberto Martínez Torres

*Journal Papers*

1. J. J. Xie, A. Martinez Torres and E. Oset,
"Faddeev fixed center approximation to the $N\bar{K}K$ system and the signature of a $N^{*}(1920)(1/2^{+})$ state,"newline Phys. Rev. C **83**, 065207 (2011) (8 pages), YITP-11-15, arXiv:1010.6164 [nucl-th].

2. A. Martinez Torres, E. J. Garzon, E. Oset and L. R. Dai,
"Limits to the Fixed Center Approximation to Faddeev equations: the case of the $\phi(2170)$,"
Phys. Rev. D **83**, 116002 (2011) (9 pages), YITP-10-95, arXiv:1012.2708 [hep-ph].

3. J. J. Xie, A. Martinez Torres, E. Oset and P. Gonzalez,
"Plausible explanation of the $\Delta_{5/2^{+}}(2000)$ puzzle,"
Phys. Rev. C **83** (2011) 055204 (11 pages), YITP-10-109, arXiv:1101.1722 [nucl-th].

4. A. Martinez Torres, D. Jido and Y. Kanada-En'yo,
"Theoretical study of the $KK\bar{K}$ system and dynamical generation of the K(1460) resonance,"
Phys. Rev. C **83** (2011) 065205 (11 pages), YITP-11-19, arXiv:1102.1505 [nucl-th].

5. A. Martinez Torres, K. P. Khemchandani, D. Jido and A. Hosaka,
"Theoretical support for the $\pi(1300)$ and the recently claimed $f_0(1790)$ as molecular resonances,"
Phys. Rev. D **84** (2011) 074027 (8 pages), YITP-11-65, arXiv:1106.6101 [nucl-th].

6. K. P. Khemchandani, A. Martinez Torres, H. Kaneko, H. Nagahiro and A. Hosaka,
"Coupling vector and pseudoscalar mesons to study baryon resonances,"
Phys. Rev. D **84** (2011) 094018 (16 pages), YITP-11-66, arXiv:1107.0574 [nucl-th].

7. T. Sekihara, A. Martinez Torres, D. Jido and E. Oset,
"Theoretical study of incoherent $\phi$ photoproduction on a deuteron target,"
Eur. Phys. J. A **48** (2012) 10, YITP-10-72, arXiv:1008.4422 [nucl-th].

8. A. Martinez Torres, L. R. Dai, C. Koren, D. Jido and E. Oset,
"The $KD$, $\eta D_s$ interaction in finite volume and the nature of the $D_{s^*0}(2317)$ resonance,"
Phys. Rev. D **85** (2012) 014027 (11 pages), YITP-11-80, arXiv:1109.0396 [hep-lat].

9. A. Martinez Torres, M. Bayar, D. Jido and E. Oset,
"Strategy to find the two $\Lambda(1405)$ states from lattice QCD simulations,"
YITP-12-6, arXiv:1202.4297 [hep-lat].

*Talks at International Conferences*

1. "Few-body systems made of pseudoscalars,"
in "The Fifth Asia-Pacific Conference on Few-Body Problems in Physics (APFB)," Seoul, Korea,
August 2011.

2. "Unitary Chiral Dynamics: Two hadrons in a finite volume," Invited,
in "DAE-BRNS workshop on hadron physics," Bhabha Atomic Research Centre, Mumbai, India,
November 2011.

3. "Few-body resonances formed from pseudoscalars," Invited,
in "workshop Hadron Structure and Interactions 2011," RCNP, Osaka, Japan,
November 2011.

*Invited Seminars* (Overseas)

1. "Unitary chiral theory: two (in a finite volume) and three (infinite volume) hadron systems,"
Yonsei University, Seoul, Korea, October 2011.

2. " Study of the $KD$, $\eta D_s$ coupled system in a finite volume and the $D_{s*0}(2317)$ resonance,"
Tata Institute of Fundamental Research, Mumbai, India, November 2011.

## 2.3 Seminars, Colloquia and Lectures

### ▷ 2011.4.1 — 2012.3.31

4.6 Susanne Reffert (IPMU) : Dualities and Branes in the Gauge/Bethe Correspondence

4.11 Young-June Kim (University of Toronto): Comparative study of cuprates and pnictides using resonant inelastic x-ray scattering

4.13 Cristina Zambon (University of Durham): Integrable defects and related quantum algebras

4.13 Hiroki Ohta (YITP, Kyoto Univ.) : Collective dynamics in a random-field Ising model on a Bethe lattice

4.20 Yohsuke Takamori (Osaka City Univ.): Perturbative Analysis of Stationary Black Hole Magnetospheres: on the Meissner-like effect of an extreme black hole

4.21 Grzegorz Szamel (Colorado State University) : A diagrammatic approach to the dynamics of interacting Brownian particles

4.21 Jakub Ripa (Astronomical Institute of the Charles University) : Properties of the intermediate-duration gamma-ray bursts detected by the RHESSI satellite

4.25 Takahiro Sagawa (YITP, Kyoto Univ.): YITP Colloquium:Information Thermodynamics in Small Systems

4.26 Hantao Lu (Korea Institute for Advanced Study): The pairing order parameter for the $\nu = 5/2$ fractional quantum Hall state

4.27 Kenji Morita (YITP): Effect of mesonic fluctuations in the Polyakov loop extended quark-meson model at imaginary chemical potential

4.27 Kazuhiro Sakai (YITP, Kyoto Univ.) : Conformal perturbation theory for gluon scattering amplitudes

4.28 Alexander Polnarev (Queen Mary University of London) :The Problem of Initial Conditions for Primordial Black Hole Formation and Asymptotic Quasi-Homogeneous Solution

5.11 Rak-Kyeong Seong (Imperial College London / YITP) : GCOE/YITP Seminar: Brane Tilings and the mesonic moduli space of $Y_{pq}$ Theories

5.11 Grzegorz Szamel (Colorado State University) : YITP Colloquium: mode-coupling theory, replica approach and emergence of rigidity

5.18 Makoto Sakaguchi (Research and Education Center for Natural Sciences,) :Holography of dual giant Wilson loop

5.18 Hajime Yoshino (Osaka univ.) : Rigidity of amorphous solids at finite temperatures - a first principle computation of via cloned liquid approach

5.24 Wataru Koshibae (RIKEN) : Real-time dynamics of spin-electron coupled system: Numerical simulation studies of photo-induced metal-insulator transitions

5.24-25 Sang Pyo Kim (Kunsan University): GCOE/YITP Lecture Series: Effective Action in Non-trivial Background

5.25 Takayuki Hirayama (Maskawa Institute, Kyoto Sangyo U.): one loop divergences in quantum gravity with non local scalar field

5.25 Masaomi Tanaka (IPMU): 3D Explosion Geometry of Core-Collapse Supernovae

5.25 Kanke Masaki (Tohoku Univ.) : Structural phase transitions in nematic droplets induced by a static electric field.

5.26 Alan Cornell (University of the Witwatersrand): Scaling of the Yukawa couplings, Quark flavour mixings and Higgs self-coupling in the UED model

6.3 Sachiko Tsuruta (Montana State U.): Thermal Evolution of Neutron Stars: Current Status

6.8 Satoshi Shirai (KEK) : Recent Tevatron Anomalies and Their Implication for LHC

6.15 Jean-Emile Bourgine (CQUeST, Sogang University):GCOE/YITP Seminar: Bulk-boundary resonance in one matrix model and Liouville gravity.

6.21 Hiroshi Ueda (Osaka Univ.): Non-Abelian density matrix renormalization group analysis of quantum spin chain with SU(2) symmetry

6.22 Hiroaki Kanno (Graduate school of mathematics, Nagoya University) : Surface operator, branes and W algebr

6.22 Wataru Horiuchi (RIKEN Nishina center): Universal properties of short-range nucleon-nucleon correlations in nuclei

6.23 Yuma Kikuchi (RCNP Osaka University): Description of scattering states using complex scaling method and application to the break-up reaction of two-neutron halo nuclei

6.23 Ming Xu (Nanjing University): Interactions between relativistic GRB outflows and medium

6.27 Barton Zwiebach (Massachusetts Institute of Technology):YITP Colloquium: Gravity in String Theory

6.28 Seiji Yunoki (RIKEN):Microscopic study of spin-orbit-induced Mott insulator in Ir oxides

6.29 Takumi Ito (Tohoku University/University of Tokyo): Measuring Superparticle Properties with Long-Lived Stau at the LHC

7.5 Masaya Kunimi (The Univ. of Tokyo) : Analysis of one-dimensional supersolid in the presence of an obstacle

7.13 Kazuo Hosomichi (YITP, Kyoto Univ.):SUSY Gauge Theories on Squashed Three-Spheres

7.14 Masaki Yamaguchi (Osaka Univ.): Radiation mechanism of X-ray, GeV, and TeV bands in the gamma-ray binary LS 5039

7.25 Tadahiro Suhara (YITP, Kyoto U.): Exotic cluster structures in $^{14}$C

7.25-26 Koji Hukushima (Graduate School of Arts and Sciences, University of Tokyo ): Lecture series: Recent advances in statistical mechanics of random systems

7.28 Maurice van Putten (KIAS): On the origin of relativistic core-collapse supernovae and GRBs

8.3 Eulogio Oset (University of Valencia, IFIC): Finite volume effects in the meson scalar sector and generalization of Luescher approach to two coupled channels.

8.8 Andrew Wray (Lawrence Berkeley National Laboratory): Electron dynamics in topological insulator based semiconductor-metal interfaces

8.8 Susumu Okazawa (The Graduate Univ. for Advanced Studies, KEK):Stochastic Equations in Black Hole Backgrounds and Non-equilibrium Fluctuation Theorems

8.25 Tomoaki Ishiyama (University of Tsukuba, Center for Computational Sciences ): Structures of dark matter halos and subhalos

9.6 Vladimir Skokov (GSI): Introduction to functional renormalization group approach (for beginners).

9.12 Noppadol Mekareeya (Imperial College): Tri-vertices and SU(2)'s

9.27-28 Takahiro Sagawa (YITP, Kyoto Univ.): Lecture series: Quantum Measurement and Quantum Dissipation

9.29 Achim Schwenk ( TU Darmstadt and ExtreMe Matter Institute (EMMI)): YITP Colloquium:The strong interaction at neutron-rich extremes

9.30 Norihiro Iizuka (CERN): Black holes, Non-Fermi-Liquids, and Holography

10.3 Shin'ichiro Ando (Theoretical Physics and Astrophysics at California Institute of Technology ): Gamma-ray probes of dark matter annihilation

10.4 Nicolas Yunes (Physics Department, Montana State University): Gravitational Waves from Compact Binaries as Probes of the Universe

10.5 Shinji Hirano (Nagoya University) : Observations on open and closed string scattering amplitudes at high energies

10.11 Gabriele Veneziano (CERN and College de France): Big bang or Big Bounce?

10.12 Hiroaki Tanaka (University of Tokyo): Lifshitz-like Janus Solutions

10.13 Gabriele Veneziano (CERN and College de France) :YITP Colloquium: Space, time, matter: 90 years after

10.19 Tatsuro Yuge (YITP, Kyoto Univ.): Sum rule and asymptotic rule of linear response function in nonequilibrium state

10.26 Toshifumi Yamashita (Kyoto Sangyo U) : Grand gauge-Higgs unification and doublet-triplet splitting

10.28 Danny Marfatia (Kansas Univ, USA): Isospin-Violating Dark Matter

11.2 Tadashi Takayanagi (IPMU, the University of Tokyo):AdS/BCFT

11.9 Nicholas Dorey (DAMTP, University of Cambridge) : 2d/4d correspondence revisited

11.10 Giulio Casati (University of Insubria): QUANTUM THERMOMETERS: Thermalization and ergodicity in many-body quantum systems

11.11 Masahiro KOMATSU (Nagoya Univ.): Measurement of the neutrino velocity with the OPERA detector in theCNGS beam.

11.16 Shota Komatsu (Institute of Physics, University of Tokyo): On holographic three point functions for GKP strings from integrability

11.16 Janez Bonca (Jozef Stefan Institute): Nonequlibrium dynamics of many-body systems, driven by a constant electric field

11.17 Xiang-Yu Wang (Nanjing University):Hypernova model for ultra-high energy cosmic rays

11.17 Valeri Frolov (University of Alberta, Edmonton) :YITP Colloquium:Black Hole Paradigm

11.22 Yang SUN ( Shanghai Jiao Tong University) : Nuclear shell model studies of exotic nuclei and implications in astrophysics

11.24 Alexander Kusenko (UCLA): Multimessenger signals in cosmic backgrounds

11.24 Hiroyuki Ebata (The Univ. of Tokyo): Model of heaping in vibrated suspensions under slip/non slip switching boundary condition

11.28 Sandro Sorella (SISSA Trieste): Superconductivity from strong electron correlation: from the Hubbard model to graphene and High Tc materials

11.30 So Matsuura (Keio University):On Quantum Corrections to Matrix-Regularized 4D N=4 Supersymmetric Yang-Mills Theory

11.30, 12.2 Atsushi Hosaka (Osaka University):Lecture series:Exotic hadrons – Possible structures and interactions –

12.1 Veljko Dmitrasinovic (Belgrade University): Baryon magnetic moments in the chiral mixing approach

12.2 Atsushi Hosaka (RCNP, Osaka University): Exotic hadrons with heavy quarks

12.5 J.P. Francoise (Paris U.): Analytical extensions of normal forms for integrable systems

12.5 Valeri Frolov (University of Alberta): Spinoptics in a stationary spacetime

12.9 Andrea Prudenziati (YITP, Kyoto Univ.): Attempts for a world-sheet definition of the Nekrasov partition function

12.14 Masaki Shigemori (Nagoya Univ.) :Moulting black holes

12.18 Richard Schoen (Stanford University): Scalar curvature in differential geometry and relativity

12.18 Richard Schoen (Stanford University): Mass and angular momentum for asymptotically flat spacetimes

12.19 Miloslav Znojil (Nuclear Phys. Inst., Czech): Joint Seminar of RIMS and YITP

on Operator Theory & Singular Perturbations: Quantum models using cryptohermitian operators of observables

12.20 Denis Konstantinov (Okinawa Institute of Science and Technology Graduate Univ.) : Microwave-induced vanishing of magnetoconductance in classical electrons on liquid helium

12.21 Yu Nakayama (IPMU, The Univ. of Tokyo): Scale vs Conformal Invariance from Holography

1.6 Futoshi Yagi (SISSA): M5-branes, toric diagrams and gauge theory duality

1.10 Nathalie Deruelle (APC, University Paris 7): GCOE/YITP Seminar: Weyl gravity and Cosmology

1.11 Manel Perucho Pla (University of Valencia):Numerical simulations of relativistic jets

1.25 Souvik Banerjee (Institute of Physics, Bhubaneswar, India): The Holographic Spectral Functions in Non-Equilibrium States

1.25 Ryuichi Fujita (Universitat de les Illes Balears, Spain) : GCOE/YITP Seminar:Gravitational waves from extreme mass ratio inspirals to the 14th post-Newtonian order

1.30 Shankhadeep Chakrabortty (Institute of Physics, Bhubaneswar): Drag force from AdS/CFT

2.1 Sergei D. Odintsov (ICREA/ICE/IEEC, Barcelona and KMI/Nagoya):Modified gravity as dark energy: from non-singular universe to Little Rip cosmology

2.3 Gary W. Gibbons (Cambridge): Conformal Symmetry and Scaling Limits of Black holes

2.3 Anna Bodrova (Moscow State University) : Adhesion and collisional release of particles in dense planetary rings

2.9 Alex Vikman (CERN): G-Bounce

2.9 Yuki Watanabe (ASC, Munich):Gravitational enhanced friction and cosmological fluctuations in inflation

2.24 Philippe de Forcrand (ETHZ/CERN/YITP): YITP Colloquium:Lattice QCD at finite density

2.27-28 Shoichi Yamada (Waseda Univ.): Lecture series: Physics of Core-collapse Supernovae

2.29 Satoshi Yamaguchi (Osaka University):Holographic Interface

2.29 Morgane Fortin (CAMK,Poland/LUTh,Paris Observatory): Thermal and rotational evolution of neutron stars

3.1-2 Kouichi Hagino (Tohoku Univ.): Lecture Series: Many-body dynamics in unstable nuclei

3.2 Kouichi Hagino (Tohoku Univ.) : Pairing correlations and odd-even staggering in reaction cross sections of weakly bound nuclei

3.5-6 Jun'ichi Yokoyama (Tokyo Univ.): Lecture series: Inflationary Cosmology

3.7 Hirofumi Wada (YITP, Kyoto Univ.): Hierarchical helical order in twisted root growth of Arabidopsis.

3.8 Shin Nakamura (Kyoto Univ.): Nonequilibrium physics based on AdS/CFT correspondance — its explicit calculation —

3.8 Ryo Tsutsui (RESCEU, Tokyo Univ.): Are gamma-ray bursts as precise distance indicators as Type Ia Supernovae?

3.9 Tohru Eguchi (YITP): Last lecture: Recollections

3.9 Kenichi Shizuya (YITP): Last lecture: On gauge theories

3.14 Matsuo Sato (Hirosaki University): 3-algebra Model of M-theory

3.19 Jrgen Randrup (Lawrence Berkeley National Laboratory): Fragment mass distributions from strongly damped shape evolution

3.28 G.Arutyunov (Utrecht University): Towards q-deformations of the Mirror TBA

3.29 Veljko Zlatic (Institute of Physics, Zagreb, Croatia): Enhancement of the figure-of-merit in strongly correlated multilayers

## 2.4 Visitors (2011)

**Atom-type Visitors**

**Kunimi, Masaya** (C)
the University of Tokyo
2011.07.04 – 2011.07.29

**Okazawa, Susumu** (C)
SOKENDAI
2011.08.01 – 2011.08.27

**Sato, Matsuo** (E)
Hirosaki University
2012.02.29 – 2012.04.08

**Visitors**

**Moriyama, Sanefumi** (E)
Nagoya University
2011.04.01 – 2012.03.31

**Reffert, Susanne** (E)
IPMU
2011.04.04 – 2011.04.06

**Corrigan, Edward** (E)
Durham University
2011.04.04 – 2011.04.15

**Zambon, Cristina** (E)
Durham University
2011.04.04 – 2011.04.15

**Tanimura, Yusuke** (N)
Tohoku University
2011.04.05 – 2011.04.08

**Jarrige, Ignace** (C)
JAEA
2011.04.10 – 2011.04.11

**Ishii, Kenji** (C)
JAEA
2011.04.10 – 2011.04.11

**Kim, Young-June** (C)
University of Toronto
2011.04.10 – 2011.04.12

**Ripa, Jakub** (A)
Astronomical Institute of the Charles University
2011.04.15 – 2011.04.23

**Lee, Hyun Kyu** (N)
Hanyang University
2011.04.17 – 2011.05.03

**Rho, Mannque** (N)
Saclay/Hanyang Univ.
2011.04.17 – 2011.04.30

**Harada, Masayasu** (N)
Nagoya Univ.
2011.04.18 – 2011.05.01

**Lu, Hantao** (C)
KIAS
2011.04.24 – 2011.04.28

**Kim, Sang Pyo** (A)
Kunsan University
2011.04.28 – 2011.06.27

**Seong, Rak-Kyeong** (E)
Imperial College London
2011.05.01 – 2011.07.18

**Saito, Keiji** (C)
Univ. of Tokyo
2011.05.10 – 2011.05.13

**Harada, Masayasu** (N)
Nagoya Univ.
2011.05.10 – 2011.05.17

**Cornell, Alan** (A)
Univ. of the Witwatersrand
2011.05.17 – 2011.06.03

**Sakaguchi, Makoto** (E)
Keio Univ.
2011.05.18 – 2011.05.19

**Koshibae, Wataru** (C)
RIKEN
2011.05.23 – 2011.05.24

**Mori, Michiyasu** (C)
JAEA
2011.05.23 – 2011.05.24

**Takayuki, Hirayama** (E)
Maskawa Institute, Kyoto Sangyo U.
2011.05.25 – 2011.05.25

**Kanke, Masaki** (C)
Tohoku Univ.
2011.05.24 – 2011.05.27

**Tanaka, Masaomi** (A)
IPMU
2011.05.25 – 2011.05.26

**Nagahiro, Hideko** (N)
Nara Women's Univ.
2011.05.31 – 2011.05.31

**Hirenzaki, Satoru** (N)
Nara Women's Univ.
2011.05.31 – 2011.05.31

**Itahashi, Kenta** (N)
RIKEN
2011.05.31 – 2011.06.02

**Nagahiro, Hideko** (N)
Nara Women's Univ.
2011.06.02 – 2011.06.02

**Hirenzaki, Satoru** (N)
Nara Women's Univ.
2011.06.02 – 2011.06.02

**Tsuruta, Sachiko** (N)
Montana State U.
2011.06.02 – 2011.06.04

**Yamauchi, Daisuke** (A)
ICRR, Univ. of Tokyo
2011.06.03 – 2011.06.05

**Shirai, Satoshi** (E)
KEK
2011.06.08 – 2011.06.09

**Jhingan, Sanjay** (A)
Center for Theoretical Physics, Jamia Millia Islamia
2011.06.10 – 2011.06.13

**Bourgine, Jean-Emile** (E)
Sogang University
2011.06.11 – 2011.06.19

**Horiuchi, Wataru** (N)
RIKEN Nishina center
2011.06.21 – 2011.06.23

**Xu, Ming** (A)
Nanjing Univ.
2011.06.21 – 2011.07.05

**Yunoki, Seiji** (C)
RIKEN
2011.06.28 – 2011.06.29

**Matsueda, Hiroaki** (C)
Sendai National College of Technology
2011.06.29 – 2011.07.01

**Matsueda, Hiroaki** (C)
Sendai National College of Technology
2011.07.06 – 2011.07.10

**Yamaguchi, Masaki** (A)
Osaka Univ.
2011.07.11 – 2011.07.15

**Murata, Masaki** (E)
RIKEN
2011.07.20 – 2011.07.24

**Hukushima, Koji** (C)
The Univ. of Tokyo
2011.07.24 – 2011.07.26

**Mimura, Yukihiro** (E)
National Taiwan University
2011.07.25 – 2011.07.26

**Van Putten, Maurice HPM** (A)
KIAS
2011.07.25 – 2011.08.02

**Koren, Cristina** (N)
Univ. of Valencia
2011.07.25 – 2011.08.20

**Oset, Eulogio** (N)
Univ. of Valencia
2011.07.25 – 2011.08.20

**Dai, Lianrong** (N)
Liaoning Normal Univ.
2011.07.26 – 2011.08.20

**Wray, Andrew** (C)
Lawrence Berkeley National Laboratory
2011.08.07 – 2011.08.09

**Sekihara, Takayasu** (N)
Tokyo Institute of Technology
2011.08.18 – 2011.08.26

**Ono, Masaomi** (A)
Kyushu University
2011.08.20 – 2011.09.05

**Ito, Hirotaka** (A)
Waseda University
2011.08.20 – 2011.09.05

**Kaneshita, Eiji** (C)
Sendai National College of Technology
2011.08.22 – 2011.08.23

**Tsutsui, Kenji** (C)
Japan Atomic Energy Agency
2011.08.22 – 2011.08.23

**Hasebe, Kazuki** (C)
Kagawa National College of Technology
2011.08.22 – 2011.08.29

**Ishiyama, Tomoaki** (A)
Univ. of Tsukuba
2011.08.25 – 2011.08.25

**Hikami, Kazuhiro** (E)
Kyushu University
2011.09.01 – 2011.09.03

**Okazaki, Atsuo** (A)
Hokkai-Gakuen Univ.
2011.09.03 – 2011.09.07

**Tanaka, Hiroaki** (E)
Graduate School of Science, the University of Tokyo
2011.09.05 – 2011.11.04

**Mekareeya, Noppadol** (E)
Max Planck Institute
2011.09.09 – 2011.09.13

**Bratovic, Nino** (N)
TUM
2011.09.09 – 2011.09.17

**Taormina, Anne** (E)
University of Durham
2011.09.13 – 2011.09.24

**Iizuka, Norihiro** (E)
CERN
2011.09.30 – 2011.09.30

**Yunes, Nicolas** (A)
Montana University
2011.09.30 – 2011.10.05

**Ando, Shin'ichiro** (A)
California Institute of Technology
2011.10.02 – 2011.10.05

**Hirano, Shinji** (E)
Nagoya Univ.
2011.10.05 – 2011.10.06

**Veneziano, Gabriele** (A)
College de France
2011.10.05 – 2011.10.18

**Urakawa, Yuko** (A)
Univ.of Barcelona, Ochanomizu Univ.
2011.10.11 – 2011.10.21

**Zhao, Peng** (E)
DAMTP, University of Cambridge
2011.10.15 – 2011.11.15

**Dorey, Nicholas** (E)
DAMTP, University of Cambridge
2011.10.15 – 2011.11.15

**Bardeen, William A.** (E)
Fermilab
2011.10.17 – 2011.10.23

**Danny, Marfatia** (E)
Kansas University
2011.10.24 – 2011.10.28

**Yamashita, Toshifumi** (E)
MISC, Kyoto Sangyo U
2011.10.26 – 2011.10.26

**Takayanagi, Tadashi** (E)
IPMU, the University of Tokyo
2011.11.02 – 2011.11.03

**Casati, Giulio** (C)
CNR-INFM and University of Insubria
2011.11.08 – 2011.11.11

**Komatsu, Masahiro** (E)
Nagoya Univ.
2011.11.11 – 2011.11.11

**He, Haoning** (A)
Nanjing University
2011.11.11 – 2012.01.17

**Hyodo, Tetsuo** (N)
TITEC
2011.11.15 – 2011.11.17

**Kusenko, Alexander** (A)
UCLA
2011.11.15 – 2011.11.27

**Komatsu, Shota** (E)
The Univ. of Tokyo
2011.11.16 – 2011.11.16

**Wang, Xiang-Yu** (A)
Nanjing University
2011.11.16 – 2011.11.18

**Kido, Eiji** (A)
ICRR, University of Tokyo
2011.11.17 – 2011.11.19

**Odake, Satoru** (E)
Shinshu Univ.
2011.11.21 – 2011.11.26

**Ebata, Hiroyuki** (C)
The Univ. of Tokyo
2011.11.24 – 2011.11.24

**Sorella, Sandro** (C)
SISSA Trieste
2011.11.28 – 2011.11.28

**Hosaka, Atsushi** (N)
Osaka Univ.
2011.11.30 – 2011.11.30

**Matsuura, So** (E)
Keio Univ.
2011.11.30 – 2011.11.30

**Francoise, Jean-Pierre** (E)
University Paris VI
2011.12.01 – 2011.12.09

**Hikami, Kazuhiro** (E)
Kyushu University
2011.12.01 – 2011.12.01

**Dmitrasinovic, Veljko** (N)
Belgrade University
2011.12.01 – 2011.12.01

**Hosaka, Atsushi** (N)
Osaka Univ.
2011.12.02 – 2011.12.02

**Neupane, Ishwaree** (A)
University of Canterbury
2011.12.09 – 2011.12.11

**Möller, Peter** (N)
Los Alamos National Laboratory
2011.12.10 – 2011.12.23

**Kaneshita, Eiji** (C)
Sendai National College of Technology
2011.12.11 – 2011.12.13

**Ogawa, Noriaki** (E)
IPMU, the University of Tokyo
2011.12.12 – 2011.12.16

**Kimura, Tetsuji** (E)
KEK
2011.12.13 – 2011.12.17

**Shigemori, Masaki** (E)
Nagoya Univ.
2011.12.14 – 2011.12.15

**Schoen, Richard** Astophysic
Stanford University
2011.12.16 – 2011.12.19

**Konstantino, Denis** (C)
Okinawa Institute of Science and Technology Graduate Univ.
2011.12.20 – 2011.12.20

**Kanno, Sugumi** (A)
Tufts University
2011.12.20 – 2012.02.04

**Nakayama, Yu** (E)
IPMU
2011.12.21 – 2011.12.22

**Kohri, Kazunori** (A)
KEK
2011.12.23 – 2011.12.29

**Deruelle, Nathalie** (A)
APC, Univ. of Paris 7
2011.12.29 – 2012.01.31

**Yagi, Futoshi** (E)
SISSA
2012.01.05 – 2012.01.06

**Fujita, Ryuichi** (A)
Universitat de les Illes Balears
2012.01.10 – 2012.02.09

**Pla, Manel Perucho** (A)
Univ. of Valencia
2012.01.11 – 2012.01.12

**Mori, Michiyasu** (C)
JAEA
2012.01.16 – 2012.01.20

**Banerjee, Souvik** (E)
Institute of Physics, Bhubaneswar
2012.01.20 – 2012.01.25

**Tolstov, Alexey** (A)
Institute for Theoretical and Experimental Physics
2012.01.22 – 2012.03.10

**Bodrova, Anna** (C)
Moscow State Univ.
2012.01.27 – 2012.03.17

**Namjoo, Mohammad Hossein** (A)
Institute for Research in Fundamental Sciences
2012.01.27 – 2012.03.31

**Chakrabortty, Shankhadeep** (E)
Institute of Physics, Bhubaneswar
2012.01.28 – 2012.02.01

**Camera, Stefano** (A)
CENTRA, Lisboa
2012.01.30 – 2012.01.31

**Hikami, Kazuhiro** (E)
Kyushu University
2012.02.01 – 2012.02.03

**Odintsov, Sergey** (A)
ICE-ICREA
2012.02.01 – 2012.02.07

**Vikman, Alexander** (A)
New York Univ.
2012.02.03 – 2012.02.10

**Watanabe, Yuki** (A)
ASC, Munich
2012.02.08 – 2012.02.11

**Odake, Satoru** (E)
Shinshu Univ.
2012.02.09 – 2012.02.10

**Fujita, Mitsutoshi** (E)
University of Washington
2012.02.09 – 2012.02.15

**Adams, David** (N)
Nanyang Technol. University, Singapore
2012.02.09 – 2012.02.23

**Creutz, Michael** (N)
Brookhaven National Laboratory
2012.02.09 – 2012.02.23

**Fortin, Morgane** (A)
CAMK,Poland/LUTh,Paris Observatory
2012.02.10 – 2012.03.12

**Schütrumpf, Bastian** (N)
University of Frankfurt
2012.02.13 – 2012.03.16

**Morita, Takeshi** (E)
University of Crete
2012.02.20 – 2012.02.20

**Morita, Takeshi** (E)
University of Crete
2012.02.24 – 2012.02.24

**Yamada, Shoichi** (A)
Waseda Univ.
2012.02.27 – 2012.02.28

**Satoh, Yuji** (E)
University of Tsukuba
2012.02.27 – 2012.03.01

**Scardigli, Fabio** (A)
Institute of Physics, Academia Sinica
2012.02.27 – 2012.03.04

**Yamaguchi, Satoshi** (E)
Osaka University
2012.02.29 – 2012.02.29

**Hagino, Kouichi** (N)
Tohoku Univ.
2012.03.01 – 2012.03.02

**Ring, Peter** (N)
University of Technology, Munich
2012.03.02 – 2012.03.31

**Flachi, Antonino** (A)
Baylor Univ.
2012.03.04 – 2012.03.14

**Kimura, Rampei** (A)
Hiroshima Univ.
2012.03.05 – 2012.03.06

**Narikawa, Tatsuya** (A)
Hiroshima Univ.
2012.03.05 – 2012.03.06

**Yokoyama, Jun'ichi** (A)
RESCEU, Tokyo Univ.
2012.03.05 – 2012.03.06

**Tachikawa, Yuji** (E)
IPMU
2012.03.05 – 2012.03.09

**Tsutsui, Ryo** (A)
RESCEU, Tokyo Univ.
2012.03.07 – 2012.03.09

**Wada, Tomohide** (A)
NAOJ
2012.03.14 – 2012.03.16

**Takata, Jumpei** (A)
The University of Hong Kong
2012.03.14 – 2012.03.19

**Sugiyama, Naonori** (A)
Tohoku University
2012.03.15 – 2012.03.17

**Komatsu, Eiichiro** (A)
Univ. of Texas, Austin
2012.03.15 – 2012.03.17

**Naitoh, Tsuguya** (A)
Yamanashi Gakuin University
2012.03.16 – 2012.03.19

**Yamaguchi, Masaki** (A)
Osaka University
2012.03.16 – 2012.03.19

**Mori, Masaki** (A)
Ritsumeikan University
2012.03.17 – 2012.03.18

**Kawachi, Akiko** (A)
Tokai University
2012.03.17 – 2012.03.18

**Dias, Oscar** (A)
CEA Saclay
2012.03.25 – 2012.04.09

**Witek, Helvi** (A)
CENTRA, IST
2012.03.25 – 2012.04.10

**Cardoso, Vitor** (A)
CENTRA, IST
2012.03.25 – 2012.04.10

**Arutyunov, Gleb** (E)
Utrecht U.
2012.03.26 – 2012.03.30

**Zlatic, Veljko** (C)
Institut of Physics, Croatia
2012.03.27 – 2012.04.04

In the above lists, the symbols A, C, E and N in the parentheses are thefollowing 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 (YKIS2011)

**YKIS2011 : Frontier Issues in Physics of Exotic Nuclei**

Oct 11 - Oct 15, 2011, Chaired by Masayuki Matsuo and Yoshiko Kanada-Enyo 138 participants (43 from abroad)

For details, see http://www.yukawa.kyoto-u.ac.jp/contents/seminar/archive/2011/ykis2011/ykis/

## Nishinomiya-Yukawa Symposium 2011

**Novel Quantum States in Condensed Matter: Correlation, Frustration and Topology**

Nov 7 - Dec 9, 2011, Chaired by Norio Kawakami, 160 participants (42 from abroad)

For details, see http://www2.yukawa.kyoto-u.ac.jp/ws/2011/nqs2011/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.

### ▷ 2011.4.1 — 2012.3.31

Here is the list of workshops with the dates, the names of organizers, the number of participants, the proceedings and the url's.

**YITP-W-11-01** unused no.

**YITP-W-11-02**
*Physics of Iron-Based High-Temperature Superconductivity*, Jun 16-17,2011. H. Kontani, T. Tohyama, Y. Matsuda, H.Ikeda, K. Kuroki,R. Arita, *81-participants,* Bussei Kenkyuu 96-5

**YITP-W-11-03**
*Exotic structure of low-lying states of nuclei probing with E0 and E1 transitions*, Dec 7 - 9, 2011. M. Ito, M. Kimura, K. Hagino, Y. Funaki, T. Myo, T. Yamada, K. Yoshida, Y. Kanada-Enyo, T. Kawabata, N. Itagaki, *29-participants,*

**YITP-W-11-04**
*Econophysics 2011 - The Hitchhiker's Guide to the Economy*, Jul 15 - 16, 2011. H. Aoyama, H. Yoshikawa, A. Sato, H. Iyetomi, W. Souma, Y. Fujiwara, Y. Ikeda, J. Maskawa, H. Yokoyama, *89-participants,* Bussei Kenkyuu 97-1 & Soryuushiron Kenkyuu 119-3
http://www.econophysics.jp/yitp11/

**YITP-W-11-05**
*Field Theory and String Theory*, Jul 25 - 29, 2011. T. Azeyanagi, Y. Imamura, Y. Okawa, M. Kato, H. Kunitomo, T. Sakai, M. Sakamoto, S. Sugimoto, T. K. Hashimoto, M. Hamanaka, K. Yoshida, S. Moriyama, *165-participants,*
http://www2.yukawa.kyoto-u.ac.jp/ qft/

**YITP-W-11-06**
*Microscopic nuclear reaction theory*, Aug 1 - 3, 2011. T. Furumoto, T. Ichikawa, M. Takashina, K. Ogata, N. Itagaki, *52-participants,* Soryuushiron Kenkyuu 119-4B
http://www2.yukawa.kyoto-u.ac.jp/ws/2011/mnrt11/

**YITP-W-11-07**
*The 56th Condensed Matter Physics Summer School*, Aug 1 - 5, 2011. , *203-participants,* Bussei Kenkyuu 97-5

**YITP-W-11-08**
*Summer School on Astronomy and Astrophyiscs 2011*, Aug 1 - 4, 2011. , *382-participants,*

**YITP-W-11-09**
*Summer Institute 2011*, Aug 12 - 18, 2011. M. Bando, T. Kugo, M. Yamaguchi, T. Kobayashi, K. Hamaguchi, S. Matsumoto, H. Terao, M. Tanimoto, T. Asaka, H. Nakano, T. Kurimoto, S. Kanemura, K. Aoki, D. Suematsu, M. Aoki, S. Takeda, J. Kubo, *67-participants,*
http://wwwhep.s.kanazawa-u.ac.jp/SI2011/index-e.html

**YITP-W-11-10**
*Young Nuclear and Particle Physist Group of Japan*, Aug 16 - 21, 2011. , *268-participants,*

**YITP-W-11-11**
*Physics of Nonequilibrium Systems - A Bridge between Micro and Macro -*, Aug 18 - 20, 2011. M. Ichikawa, K. Saito, T. Sagawa, T. Sasamoto, M. Sano, H.

Hayakawa, *172-participants,*
http://www2.yukawa.kyoto-u.ac.jp/ noneq11/ index.html

**YITP-W-11-12**
*51th Summer School for the Organization of Young Biophysicists*, Aug 25 - 28, 2011. A. Yamamoto, M. Takami, N. Hori, T. Terakawa, H. Sakai, H. Fujiwara, M. Suzuki, M. Matsuoka, T. Baba, K. Maki, *89-participants,*
http://www.bpwakate.net/summer/

**YITP-W-11-13**
*KIAS-YITP joint workshop 2011"String Theory, Holography and Beyond*, Sep 20 - 24, 2011. Piljin Yi, Deog-Ki Hong, M. Sasaki, S. Terashima, T. Takayanagi, Nick Evans, *99-participants,*
http://newton.kias.re.kr/ string/workshop2011 /index.html

**YITP-W-11-14**
*Thermal Quantum Field Theory and Their Applications*, Aug 22 - 24, 2011. M. ASAKAWA, S. ABE, K. IIDA, T. INAGAKI, S. EJIRI, A. OHNISHI, M. OKUMURA, M. SAKAGAMI, M. TACHIBANA, C. NONAKA, M. MINE, S. MUROYA, *109-participants,* Soryuushiron Kenkyuu 119-4C
http://www.riise.hiroshima-u.ac.jp/TQFT/

**YITP-W-11-15**
*2011 Kyoto University International Forum "Towards a New Synthesis of Knowledge"*, Oct 15 - 16, 2011. G. H. Pollack, K. Oike, I. Tsuda, J. Yokoyama, T. Ohno, K. Nishimura, K. Yoshimura, M. Murase, *179-participants,*
http://www2.yukawa.kyoto-u.ac.jp/ws/ 2011/2011kyo/

**YITP-W-11-16**
*Nonequilibrium Dynamics in Astrophysics and Material Science*, Oct 31 - Nov 3, 2011. H. Hayakawa, E. Kokubo, K. Shibata, S. Toh, A. Ohnishi, T. Hatano, K. Nishida, *77-participants,*
http://www.kwasan.kyoto-u.ac.jp/ndams/

**YITP-W-11-17**
*Nuclear symmetry energy and physics fo neutron-rich nuclei and nuclear matter*, Nov 10 - 12, 2011. K. Iiida, N. Itagaki, T. Ichikawa, A. Ohnishi, A. Ono, T. Kajino, H. Sakurai, Myung-Ki Cheoun, Chang Ho Hyun, Su Houng Lee, Yongseok Oh, *32-participants,*

**YITP-W-11-18**
*GUT2012*, Mar 15 -17, 2012. Rabindra N. Mohapatra, Qaisar Shafi, N.Okada, Y.Hosotani, Y. Kawamura, R.Kitano, T. Kobayashi, Y.Koide, T. Kugo, N.Maekawa, T.Fukuyama, *80-participants,*
http://www-conf.kek.jp/gut2012/GUT2012.htm

**YITP-W-11-19**
*Frontiers of statistical physics for information processing - toward control of information and fluctuation*, Mar 21 - 23, 2012. M. Yasuda, M. Ohzeki,T. Obuchi, *61-participants,*
http://www-adsys.sys.i.kyoto-u.ac.jp/ mohzeki/YSMSPIP/

**YITP-W-11-20**
*Phase Transition Dynamics in Soft Matter : Bridging Microscale and Mesoscale*, Feb 20 - 22, 2012. J. Yamamoto, T. Araki, J. Fukuda, A. Furukawa, H. Hayakawa, T. Ohta, H. Tanaka, T. Taniguchi, R. Yamamoto, *165-participants,*
http://softmatt-net.xsrv.jp/YITP2012/

**YITP-W-11-21**
*The summer school 'From Quarks to Supernovae'*, Aug 4 - 8, 2011. S. Aoki, T. Hatsuda, E. Hiyama, A. Ohnishi, M. Shibata, *61-participants,*
http://www.jicfus.jp/field5/jp/promotion/ school/

**YITP-W-11-22**
*Monte Carlo Tools for LHC*, Sep 5 - 10, 2011. M. Nojiri, S. Matsumoto, T. Moroi, David Grellscheid, H. Murayama, Michael Seymour, Peter Skands, Bryan Webber, F. Takayama, *62-participants,*
http://www.hep.phy.cam.ac.uk/theory/ mcschool11/

**YITP-W-11-23**
*entanglement in quantum many body systems and renormalization*, Dec 14 - 16,

2011. K. Okunishi, T. Tohyama, K. Totsuka, T. Nishino, K. Harada, T. Hikihara, H. Matsueda, *49-participants,*
http://www.yukawa.kyoto-u.ac.jp/contents/seminar/archive/2011/yitp-w-11-23/

**YITP-W-11-24**
*Supernova explosion and numerical simulations*, Dec 26 - 28, 2011. , *47-participants,*
http://www2.yukawa.kyoto-u.ac.jp/ws/2011/sn11/index.html

**YITP-W-11-25**
*Hierarchy in Physics through Information - It's Control and Emergence*, Jan 5 - 7, 2012. I. Ojima, S. Tanimura, I. Tsutsui, T. Sagawa, R. Sasaki, Y. Shikano, A. Hosoya, M. orikawa, *83-participants,*
http://www.th.phys.titech.ac.jp/shikano/yitp11/

**YITP-W-11-26**
*2012 Asia-Pacific School/Workshop on Cosmology and Gravitation*, Mar 1 -4, 2012. Rong-Gen Cai, S. Hayward, Gungwon Kang, Sang Pyo Kim, James M. Nester, Hoi-Lai Yu, M. Sasaki, M. Shibata, T. Shiromizu, N. Seto, J. Soda, T. Tanaka, K. Maeda, *108-participants,*
http://www2.yukawa.kyoto-u.ac.jp/ws/2011/aps2012/index.html

**YITP-W-11-27**
*Toward elementary particle theory beyond the standard model (in the light of new experimental results)*, Mar 19 - 23, 2012. M. Ibe, R. Kitano, F. Takayama, *48-participants,*
http://www2.yukawa.kyoto-u.ac.jp/takayama/YITP_ws2012March_BSM/

## 3.3 Regional Schools supported by YITP

## ▷ 2011.4.1—2012.3.31

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-11-01**
*The 39th Hokuriku-Shinetsu Particle Physics Theory Group Meeting* , May 27 - 29, 2011, Fukui Kenritsu Sabae Seinen no Ie.
M. Horibe

**YITP-S-11-02**
*Chubu Summer School*, Aug 30 - Sep 2, 2011, Yamanakako Seminar House, Tokai Univesity.
S. Odake
Soryuushiron Kenkyuu 119-3

**YITP-S-11-03**
*16th Niigata-Yamagata joint school*, Nov 4 -6, 2011, Tendo, Yamagata.

**YITP-S-11-04**
*24th Workshop in Hokkaido Nuclear Theory Group*, Nov 18 - 21, 2011, Hokkaido University.
K. Yamamoto

**YITP-S-11-05**
*34rd Shikoku Seminar*, Dec 17 - 18, 2011, Ehime University.
H. So

**YITP-S-11-06**
*Shinshu Winter School*, Mar 1 - 4, 2012, Shiga Heights Villa, Ochanomizu University.
Y. Kawamura