YITP Annual Report

Yukawa Institute For
Theoretical Physics
Kyoto University

2007

Foreword

We present here an annual report of the scientific activities of Yukawa Institute for Theoretical Physics during the academic year 2007.

First of all it is our great pleasure to report the 2008 Nobel physics prize awarded to our former director, Toshihide Maskawa for his contribution to the theory of CP violation. This is the 2nd Nobel prize given to the affiliates of our Institution. We consider that the award exemplifies the high standard of research conducted at our Institute and we would like to maintain our tradition of excellence in research in the future.

From the academic year 2007 we started our new project of "Yukawa International Program of Quark-Hadron Sciences (YIPQS)" funded by Japan Minsitry of Education, Culture and Sports. In this project we select a few research topics in each year and host long-term workshops extending over periods of a few months. We invite leading experts from the world in each topic and aim at fruitful collaboration among the workshop participants. In the year 2007, workshops in the area of the interface of cosmology and string theory, condensed matter theory and also quark hadron physics were held. Our report contains some of the new developments initiated by these workshops.

Director
Tohru Eguchi

Contents

Chapter 1

People

1.1 Regular Staff and Guest Professors (2007 April – 2008 March)

Regular Staff

Tohru Eguchi
Professor (E) [2007.04.1 –]

Taichiro Kugo
Professor (E)

Masao Ninomiya
Professor (E) [– 2008.03.31]

Ken-ichi Shizuya
Professor (E)

Teiji Kunihiro
Professor (N) [– 2008.03.31]

Shin Mineshige
Professor (A) [– 2008.03.31]

Misao Sasaki
Professor (A)

Hisao Hayakawa
Professor (C)

Takami Tohyama
Professor (C)

Ryu Sasaki
Associate Professor (E)

Masatoshi Murase
Associate Professor (C)

Hiroshi Kunitomo
Associate Professor (E)

Naoki Sasakura
Associate Professor (E)

Tetsuya Onogi
Associate Professor (E)

Keisuke Totsuka
Associate Professor (C)

Shigehiro Nagataki
Associate Professor (A)

Ken-iti Izawa
Associate Professor (E)

Yoshiko Kanada-En'yo
Associate Professor (N)

Takao Morinari
Research Associate (C)

Daisuke Jido
Research Associate (N)

Seiji Terashima
Research Associate (E)

Kenji Fukushima
Research Associate (N) [2007.09.1 –]

Hirofumi Wada
Research Associate (C) [2007.10.1 –]

Yuko Fujita
Project Manager () [2007.10.1 –]

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. Alexey Alexandrovich Starobinskiy
(Landau Institute for Theoretical Physics)
2007.4.1 — 2007.6.30
Cosmology

Prof. Sergey Odintsov
(ICREA & IEEC, Barcelona)
2007.7.23 — 2007.10.22
Particle Cosmology

Prof. William Bardeen
(Fermilab)
2007.10.1 — 2007.12.31
Phenomenology of large N Field Theory

Prof. Hans-Yürgen Mikeska
(University of Hannover)
2007.12.10 — 2008.3.9
Novel quantum phases and multi-spin exchange interactions in low-dimemsional quantum magnets

1.2 Research Fellows and Graduate Students (2007 April – 2008 March)

Research Fellows

Postdoctoral Research Fellows

Antonino Flachi (A) [2004.8.3 –]

Cecilia Albertsson (E) [2005.10.1 –]

Kimitake Hayasaki (A) [2006.4.1 –]

Tetsuo Hyodo (N) [2006.4.1 – 2008.11.30]

Masaaki Takashina (N) [2006.4.1 – 2008.3.31]

Hiroyuki Abe (E) [2006.4.1 – 2008.10.31]

Tetsuji Kimura (E) [2006.10.1 –]

Fabio Scardigli (A) [2006.10.2 – 2008.10.1]

Viktor Gabor Czinner (A) [2006.11.21 – 2008.11.20]

Keitaro Takahashi (A) [2007.4.1 – 2008.12.31]

Yuuiti Sendouda (A) [2007.4.1 –]

Seung-il Nam (N) [2007.4.1 –]

Michio Ohtsuki (C) [2007.4.1 – 2008.9.30]

Takeshi Morita (E) [2007.4.1 – 2007.9.30]

Etsuko Itou (E) [2007.4.1 – 2008.9.30]

Hideaki Iida (N) [2007.10.1 –]

Toru Takahashi (N) [2007.10.1 –]

Masafumi Kurachi (E) [2007.10.1 – 2008.9.30]

Hiroyuki Fuji (E) [2007.10.1 – 2008.9.30]

Antonio Enea Romano (A) [2007.10.28 –]

JSPS Invitation Fellows, long term

Istvan Ra'cz (A) [2006.10.5 – 2007.8.4]

Graduate Students

Takahiro Himura (C) [2007.4.1 –]

Maiko Kohriki (E) [2007.4.1 –]

Takahiro Mimori (C) [2007.4.1 –]

Tatsuhiro Misumi (E) [2007.4.1 –]

Yuichiro Nakai (E) [2007.4.1 –]

Atsushi Naruko (A) [2007.4.1 –]

Kentaro Tanabe (A) [2007.4.1 –]

Junichi Aoi (A) [2006.4.1 –]

Tatsuya Kubota (E) [2006.4.1 – 2008.3.31]

Masashi Kyoutani (A) [2006.4.1 – 2008.3.31]

Masaki Murata (E) [2006.4.1 –]

Noriaki Ogawa (E) [2006.4.1 –]

Hiroomi Tanaka (N) [2006.4.1 – 2008.3.31]

Daisuke Yamauchi (A) [2006.4.1 –]

Hiroyuki Yoshidsumi (C) [2006.4.1 –]

Youhei Ota (E) [2003.4.1 – 2008.3.31]

Roji Kawabata (A) [2005.4.1 – 2008.3.31]

Sugure Tanzawa (A) [2005.4.1 –]

Kohta Murase (A) [2005.4.1 –]

Hiroaki Ueda (C) [2005.4.1 –]

Takayoshi Miki (C) [2005.4.1 – 2008.3.31]

Mituhisa Ohta (E) [2005.4.1 –]

Kiki Vierdayanti (A) [2005.4.1 – 2008.3.31]

Chihiro Nakajima (A) [2007.4.1 –]

Yoshiharu Tanaka (A) [2004.4.1 –]

Ken Nagata (A) [2004.4.1 – 2008.3.31]

Kazuya Mitsutani (N) [2004.4.1 –]

Yuya Sasai (E) [2004.4.1 –]

Michihisa Takeuchi (E) [2004.4.1 –]

Yasutaka Taniguchi (N) [2006.4.1 – 2008.3.31]

Takahiro Nishino (C) [2006.7.1 –]

Tatsuya Tokunaga (E) [2003.4.1 – 2008.3.31]

Norita Kawanaka (A) [2003.4.1 – 2008.3.31]

Tetsuya Mitsudo (C) [2006.7.1 –]

Atsushi Kawarada (C) [2006.7.1 –]

Ph.D Awarded

Norita Kawanaka
Theory of X-ray Emissions from Black Hole Accretion Disks with Coronae (A)
(supervisor: Shin Mineshige)

Yasutaka Taniguchi
Clustering and Deformations in sd-shell Region (N)
(supervisor: Yoshiko Kanada-En'yo)

Tatsuya Tokunaga
String Theory in Calabi-Yau Backgrounds (E)
(supervisor: Hiroshi Kunitomo)

Chapter 2

Research Activities

2.1 Research Summary

Astrophysics and Cosmology Group

The final goal of this group is to acquire a comprehensive understanding of the whole evolution of our universe from its birth to the present as well as its rich structures and diverse activities at present, on the basis of fundamental laws of nature and observations. Due to this basic nature, researches of this group are always cross-disciplinary and cover a quite wide range of subjects from mathematical studies of spacetimes to phenomenological modeling of astronomical objects. Further, major topics are strongly influenced by new developments in investigations of fundamental laws as well as in observations.

Now, here is the summary of major research activities and achievements by this group in 2007.

Gamma-Ray Bursts

The mechanism of the central engine of long gamma-ray bursts is still unknown. In order to understand the central engine, a high-quality numerical code including the effects of a lot of microphysics and macrophysics has to be developed. Thus, S. Nagataki, (in collaboration with Takahashi, Mizuta, and Takiwaki) performed numerical simulations on collapsars with Newtonian gravity, magnetic fields, nuclear reactions, realistic equation of state, and neutrino physics, although a gamma-ray burst jet could not be launched. Thus he is planning to add the effects of general relativity in the near future.

The mechanism of prompt emission from gamma-ray bursts (GRBs) is not well known. K. Murase and S. Nagataki (in collaboration with K. Ioka, K. Toma, and T. Nakamura) proposed a new model that prompt emission may come from the unstable photosphere. Many models including this model predict high-energy gamma-ray emission which can be detected by the Fermi satellite. K. Murase with K. Ioka provided a useful recipe to obtain several important quantities of the GRB fireball (e.g., the optical depth) only from observations of high-energy gamma rays. These high-energy gamma rays may be cascaded in the intergalactic space. K. Murase and S. Nagataki with K. Asano studied this cascaded emission in detail and pointed out the importance of effects caused by the cosmic infrared background.

Even ultra-high-energy cosmic rays (UHECRs) may come from GRBs. K. Murase and S. Nagataki (in collaboration with , K. Ioka and T. Nakamura) comprehensively studied the possibility that GRBs are potential accelerators of ultra-high-energy nuclei in various scenarios, and discussed implications for the multi-messenger astronomy in the future. Especially, high-energy neutrino emission was investigated by K. Murase and S. Nagataki with F. Iocco, and P.D. Serpico. Not only direct neutrinos but also indirect neutrinos were studied by K. Murase and S. Nagataki with H. Takami and K. Sato.

Particle Acceleration in Relativistic Shocks

Shock acceleration theory predicts a power-law spectrum in the test particle approximation, and there are two ways to calculate the power-law index, namely Peacock's approximation and Vietri's formulation. In Peacock's approximation, it is assumed that particles cross a relativistic shock front many times and that the energy gain factors for each step are fully uncorrelated. In contrast, correlation of the distribution of the energy-gain factors is considered in Vietri's formulation. J. Aoi, K. Murase and S. Nagataki examined how Peacock's approximation differs from Vietri's formulation. It is useful to know when one can use Peacock's approximation, because the power-law index is easily obtained by the approximation. As a result, they found that the power-law index hardly differs between the two methods, and they concluded one can use Peacock's approximation reliably for a wide range of relativistic shock conditions.

Blandford-Znajek Effects for a Rapidly Rotating Black Hole

The Blandford-Znajek mechanism, by which the rotational energy of a black hole is extracted through electromagnetic fields, is one of the promising candidates as an essential process of the central engine of active compact objects such as gamma-ray bursts. The only known analytical solution of this mechanism is the perturbative monopole solution for the Kerr parameter a up to the second order terms. In order to apply the Blandford-Znajek mechanism to rapidly rotating black holes, Tanabe and Nagataki tried to obtain the perturbation solution up to the fourth order. As a result, they found that the fourth order terms of the vector potential diverge at infinity, and this implies that the perturbation approach breaks down at a large distance from the black hole.

Massive binary black holes

Hierarchical structure formation hypothesis of the Universe inevitably leads to formation of massive binary black holes (BBHs) with a sub-parsec separation in galactic nuclei. However, there is yet no definitive observational evidence for such BBHs. Here, K. Hayasaki and S. Mineshige, together with H. Sudou, proposed a new theoretical scenario in which detectable signals from BBHs are expected. Moreover, K. Hayasaki and S. Mineshige, together with Luis C. Ho, confirmed the formation of a triple disk system, which is composed of accretion disks

around respective black holes and a circumbinary disk surrounding both of them. They also found that there are characteristic signals from BBHs with a tripe disk system.

On the other hand, it is still unknown how a binary system of massive BHs evolves after its semi-major axis reached the sub-parsec scale where the dynamical friction with the neighboring stars is no longer effective (the so-called the final parsec problem). K. Hayasaki proposed a new mechanism that the frictional interaction between the BBH and the triple disk system makes the BBH naturally coalesce within a Hubble time, which helps to solve the final parsec problem.

Magnetic Field

The origin of magnetic fields in various astronomical objects, such as galaxies and clusters of galaxies, has been one of the most important problems in the modern astrophysics and cosmology. K. Takahashi is trying to understand the magnetogenesis, generation of magnetic fields, in the early universe from primordial density fluctuations. In the primordial plasma, electrons and protons are coupled strongly through Coulomb interaction but tiny deviation between their motions is induced by their mass difference. This deviation results in then magnetogenesis and the amplitude of the generated magnetic fields was estimated using the second-order cosmological perturbation theory. As a result, it was shown that the amplitude is large enough to explain the seed magnetic fields, which would have been amplified by galactic dynamo to the observed value.

Braneworld

Many authors focus on the higher-codimensional brane world scenario. However, in this scenario the brane becomes an uncontrollable spacetime singularity due to its self-gravity. It is necessary to develop a regularization method to realize a reasonable higher-codimension brane world. D.Yamauchi and M.Sasaki investigated on a specific regularization scheme, in which a codimension-$(q+1)$ brane is expanded into q-dimensions and it becomes codimension-1 brane with q compact dimensions without Z_2 symmetry between the branes. As a first step to formulate this framework, they solved the junction conditions for both difference and mean extrinsic curvatures in terms of the matter on the brane and the curvature in the bulk and derived an effective Einstein equation on the brane without Z_2 symmetry.

Higher Dimensional Black Holes

Recently, higher dimensional black holes attract much attention because of association with string theory or brane world scenario.

Non-asymptotically flat balck holes: So far, many researchers have focused mainly on asymptotically flat and stationary higher dimensional black holes. However, there is no reason to restrict the asymptotic structures of higher dimensional spacetimes to the flat spacetime. C.Yoo and collaborators discussed effects of a difference in spacetime topology on the black hole dynamics using two different dynamical black hole solutions which describe coalescing black holes on flat base space and Eguchi-Hanson base space respectively. As a result, the area of an overall black hole horizon at the creation time in the coalescing black holes solutions on Eguchi-Hanson space is larger than that on the flat space. This fact suggests that the black hole production on the Eguchi-Hanson space is easier than that on the flat space. In the framework of the brane world scenario, higher dimensional black holes are expected to be produced in a future linear collider. The results in this work suggest that the production rate of black holes in a linear collider may depend on the structure of the higher dimensional spacetime. Thus, one might be able to obtain the information about the higher dimensional spacetime structure from the black hole production rate.

Vacuum polarization effects in asymptotically adS black hole geometries: In order to investigate the holographic conjecture for brane localized black holes, it was pointed out that a necessary step is the solution of the semiclassical Einstein equations for asymptotically anti-de Sitter black holes. The right hand side of Einstein equations consists of the quantum energy momentum tensor, whose computation is highly non-trivial. A. Flachi and T. Tanaka developed a new method to compute the vacuum polarization for a quantum field on a non-asymptotically flat black hole geometry, and explicitly applied this method to the case of a (scalar) conformal field theory on and AdS-Schwarzschild black hole.

Micro black holes: Within the context of TeV-scale gravity, the possibility that colliders or cosmic ray facilities may observe micro black holes has attracted enormous attention. A close look at the limits on the fundamental Planck scale shows that a window of about 5 TeV is open for the LHC to observe such exotic events, while the window is much wider for collisions of cosmic rays. A. Flachi, M. Sasaki and T. Tanaka investigated how the phenomena of Hawking evaporation is affected by the fact that black holes created in collisions of particles are generically spinning. The results pointed to some new experimental signatures for micro black hole production.

A. Flachi and V.G. Czinner started to work on the interaction of branes with black holes in higher dimensional spacetimes. The main objective is to understand the dynamics of a brane under the influence of the gravitational field of a black hole. The specific problem they considered was the static configurations of the brane on spherically symmetric black hole background, in cases for which the thickness of the brane is small but not exactly zero. This work is still an ongoing project.

Cosmological Perturbation

Y. Tanaka and M. Sasaki formulated non-linear formalism for cosmological perturbation during single scalar inflation model, using gradient expansion approach, to study the primodial non-Gaussianity from inflation. The

approach is not to perturbatively expand non-linear equation, but to solve it iteratively in spatial gradient order. They obtained a general solution of non-linear curvature perturbation during single scalar field inflation without neglecting second order of spatial gradient, and applied the solution to calculation of non-Gaussianity of the curvature perturbation in a specific inflation model, the Strabinsky model in which slow-roll is temporarily violated. They calculated the bispectrum of the curvature perturbation, and found that the non-linear parameter f_{NL} which parametrizes the bispectrum will probably be large in the model, compared to the standard slow-roll model.

V.G. Czinner considered general-relativistic rotational perturbations in homogeneous and isotropic Friedman-Robertson-Walker cosmologies. The main interest of this research was to make a systematic comparison of the rotational effects in spatially flat models with the presence and the absence of a cosmological constant. As a result, he obtained analytic expressions for all the time-dependent coefficients of the relative temperature fluctuations induced by rotations in both cases. It is found that they decay exponentially and there is a factor 1/3 between the correspondent values of the models with zero and nonzero cosmological constant. Additionally, using the results of recent measurements of the dipole component of the CMBR, they made an estimation for the upper bound of the magnitude of the rotation of the universe at the time of decoupling and today.

Gravity Theories with Higher Curvature Corrections

A phenomenologically viable way towards the quantum theory of gravity, such as superstring theories, is to study observational consequences of gravity theories augmented by perturbative corrections through non-linear curvature terms in the Lagrangian. One of those particular features recently drawing people's attention is their potential capability as the source of the mysterious dark energy being said to fill up more than 70% of the energy budget of the current universe. M. Sasaki and Y. Sendouda worked on this subject together with N. Deruelle, who visited YITP in 2007. One of their achievements is an action-principle based formulation of junction conditions, a set of basic equations for the geometry sourced by infinitely thin matter distribution, for gravity theories with Lagrangian being an arbitrary function of the Ricci scalar, $f(R)$. In particular, upon contrasting with the case of the conventional Einstein gravity, they claimed importance of the coupling of matter fields to the new gravitational scalar degree of freedom in constructing so-called braneworld models. Extending this idea, consequences of non-minimal couplings in the dark energy models originating from higher curvature corrections were also explored. They succeeded in modeling a simple example of non-minimally coupled theory that evades both cosmological and solar-system gravity requirements leading to a suggestion of a new viable class of $f(R)$ dark energy models in which gravitational coupling of matter is appropriately "detuned."

Generalized Uncertainty Principles

F. Scardigli worked on the application of Generalized Uncertainty Principles (GUP) to the computation of physical properties of micro black holes. Mass thresholds, lifetimes, entropy and heat capacity for micro black holes in their late Schwarzschild phase have been computed, using two different generalized uncertainty principles (GUPs), in the framework of models with extra spatial dimensions. Emissions of both photons and gravitons (in the bulk) were taken into account. Both principles (the one suggested by string theory (ST), and the other by micro black hole gedanken experiments (MBH)) predict the existence of remnants, as end product of the evaporation. However, the two different GUPs present also appreciably different results: in particular, mass thresholds of micro black holes are lower if computed with the MBH GUP, and their lifetimes are longer than those computed with ST GUP. The experiments scheduled at LHC next year should be able to discriminate clearly between the two alternatives.

F.Scardigli also worked, in collaboration with P.Jizba (Freie Universität Berlin, Germany), M.Blasone and G.Vitiello (University of Salerno, Italy), on foundations of Quantum Mechanics, in the framework proposed by 't Hooft according to which quantum behaviour can be reproduced by adding dissipation to an underlying classical system. They studied the possibility of explicitly mimic the interaction between quantum systems, starting from classical systems. Two classical dissipative Bateman's oscillators give origin, after enforcing the dissipation constraint, to a composite quantum system consisting of an isotonic quantum oscillator interacting through a "spin-orbital interaction" with an effective external magnetic field. In the limit of a large separation from the interaction region one can recover, as elementary subsystems, two independent quantum oscillators. Among the possible developments of this research, there are a renormalization group analysis of the dissipation constraint, and the possibility to give a deterministic description of the hydrogen atom.

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 this subgroup are granular physics, nonlinear rheology in glassy materials, biomechanics, and system biology.

Long time tails of granular systems:

The existence of long-time tails has been known from early 1970s, which are the consequence of conservation laws such as the mass, momentum and energy. Inspite of unfamiliar characteristics of granular systems, there are, at least, hydrodynamic modes such as the density, and the velocity field in granular flows. Thus, it is natural to believe the existence of long-tails in the velocity autocorrelation function and the correlation function of the shear stress, while there is no such a tail in the correlation in energy flux. Hayakawa and Otsuki performed research to confirm this naive picture quantitatively for freely cooling granular systems from numerical simulations and analytic calculations.

They have also confirmed that the long tails are surpressed under the existence of shears. They quantitatively discussed the crossover from the conventional tail to a fast decaying tail in long time region. The striking nature revealed in this work was that this behavior is common in both granular systems and sheared isothermal liquids.

Heat conductions in a quasi-one dimensional system:

The heat conduction is one of central issues of nonequilibrim physics. It is believed that any 1D system does not have a finite heat conductivity but any 3D system has it. However, there is no actual 1D system in the real world. Therefore, it is important to discuss what happens in quasi-1D systems. Nishino discussed the heat conduction of hard-core gases confined in a quasi-one dimensional box, and the existence of the crossover from a 1D-like behavior to a 3D-like behavior was confirmed.

Mode-coupling theory of sheared dense granular liquids:

The jamming transition is a general concept for the transition from a liquid like state to a solid like state. This transition can be observed in dense granular systems and is similar to the glass transition for non-dissipative particles. Hayakawa and Otsuki did research to check whether (i) the mode-coupling theory (MCT) for sheared non-dissipative liquids can be used in sheared granular liquids, and (ii) the MCT is useful to characterize the jamming transition. The answer of the first question was YES, but the answer of the second question was NO. Although MCT is not appropriate in characterizing the jamming transition in which contact force between particles plays a crucial roles, to clarify the applicability of MCT to granular systems was useful, because MCT can be used dense liquids.

Elastic Model for Polymorphic Transformations of Bacterial Flagellar Filaments:

Force-induced reversible transformations between coiled and normal polymorphs of bacterial flagella have been observed in recent optical-tweezer experiment. Wada and Netz introduced an elastic rod model with two competing helical states governed by a fluctuating spin-like variable that represents the underlying conformational states of flagellin monomers. Using hybrid Brownian dynamics Monte Carlo simulations, they showed that a helix undergoes shape transitions dominated by domain wall nucleation and motion in response to externally applied uniaxial tension. A scaling argument for the critical force was presented and shown to be in good agreement with experimental and simulation results. Stretching-rate-dependent elasticity including a buckling instability were found to be consistent with the experiment, too.

The constitution principle in body and brain:

It was believed as recently as the 1970s that the brain processed information sequentially by following a chain of commands. Visual information enters through the eyes and is relayed sequentially via the thalamus to the visual cortex. The information in the visual cortex is then sent to other parts of the cortex for higher-order processing in the brain. However, there appears interactive pathway: the information is sent not only from the eyes but also from the visual cortex and other parts of the cortex. Here, the complex networks in the brain seem to obey the constitution principle: if a region A connects to B, then B connects reciprocally back to A. Recent study by Murase revealed that this principle holds not only for the subsystems of the brain but also at the level of connections among those subsystems. The resulting dense interconnections among various components in the brain engineer both coherence and cooperation within the system: what a local component within a given subsystem does depends on what all the other components of all the subsystems are doing. Consequently, it was clear from the present study that knowledge of these interconnections transforms traditional perceptions of the brain as a highly hierarchical structure.

Condensed-Matter Physics

The subject 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 this subgroup covers dynamical properties of high-temperature superconductors, exotic phenomena in low-dimensional quantum magnetism and physics of ultra cold atoms.

Origin of high-energy kink of spectral function in high-temperature superconductors: Recent angle-resolved photoemission experiments on hole-doped high-temperature superconductors exhibited the high-energy kink in their spectra. Tohyama and his collaborators showed that spectral functions within the extended t-J model, evaluated using the finite-temperature diagonalization of small clusters, exhibit the kink structure in the single-particle dispersion. The origin of the kink is attributed to strong correlations and incoherent hole propagation at large binding energies. From this, it was also predicted that electron-doped systems do not exhibit such a high-energy kink.

Strong coupling analysis of undoped high-temperature superconductors: One of the most fundamental questions about high-temperature superconductivity is how to describe doped holes introduced in the CuO_2 plane. Experimentally, the excitation spectrum associated with a single hole is observed by angle resolved photoemission spectroscopy (ARPES) in such undoped compounds as $Sr_2CuO_2Cl_2$ and $Ca_2CuO_2Cl_2$. The observed line shapes are anomalously broad and the origin of this broadening is controversial. Morinari approached this issue starting from the π-flux mean-field theory with dynamically generated mass. It was argued that the phase fluctuations lead to quite a broad line shape which is consistent with the experiment. In a fermionic description of the localized spins, the π-flux mean-field state has been proposed by Affleck and Marston. Although the quasiparticles in the mean-field theory are gapless and are represented by Dirac fermions, the excitation energy gap is generated dynamically due to phase fluctuations, or U(1) gauge field fluctuations. It was found that the strong coupling effect leads to a small polaron formation of those Dirac fermions. Because of the small polaron formation, the excitation spectrum becomes anomalously broad.

Single hole motion coupled to optical phonons in antiferromagnets: Interplay of strong electron correlation and phonons is one of hot topics in condensed-matter physics. Tohyama and his collaborators presented an efficient numerical method for the description of ground state and spectral properties of a doped hole in generalized t-J models coupled to optical phonons. They found that the spectral properties in the strong coupling regime are consistent with recent high-resolution angle resolved photoemission spectra.

Application of theory for resonant inelastic X-ray scattering to two-leg ladder copper oxides: Tohyama and his collaborators applied their theory for resonant inelastic X-ray scattering to two-leg ladder copper oxides that show excitation gaps in the spin channel. Calculations based on a Hubbard model showed that momentum dependence of the Mott gap excitation exhibits little change upon hole-doping, indicating the formation of hole pairs. This theoretical result is in good agreement with experimental data obtained in SPring-8.

Multipolar order in frustrated magnets: Quantum nature of spins sometimes leads to unexpected states. Among them is a spin-multipolar order where the spin itself is disordered and nevertheless magnetic long-range order occurs in certain tensor operators. The possibility of multipolar order in frustrated spin systems is now one of the hot topics both from purely theoretical- and from an experimental viewpoint (e.g. $NiGa_2S_4$ and $(CuBr)LaNb_2O_7$). Totsuka and his collaborators (Corboz, Läuchli and Tsunetsugu) used large-scale numerical simulations and low-energy field theory to map out the quantum phase diagram of an $S = 1$ bilinear-biquadratic model on a railroad-trestle (a one-dimensional version of a triangular lattice) and showed that a trimerized phase, which is a one-dimensional analogue of a three-sublattice nematic phase proposed in the two-dimensional case, is stabilized in a relatively wide region.

The spin gap of quantum paramagnets can be controlled by an applied external magnetic field, which plays a role of *tunable* chemical potential of Bose particles, and when it becomes zero a Bose-Einstein condensation (BEC) of magnetic particles occurs. This phenomena is by now fairly well understood both theoretically and experimentally; after the spin BEC, magnetic order develops in the direction perpendicular to the applied field and the system enters a spin-superfluid phase. However, if a condensation occurs not in a single-magnon channel but in a two-magnon channel, spin-BECs *without* transverse magnetic order may well be expected. Ueda and Totsuka proposed this scenario to explain unusual magnetism of a two-dimensional magnet $(CuBr)LaNb_2O_7$.

Dual-vortex theory for magnetization plateaus: The phase interference effects are known to play crucial roles in quantum mechanics. One of the most remarkable examples in condensed-matter physics would be the celebrated Haldane's theory for the distinction between spin chains with S=half-odd integer and ones with S=integer; Berry's phase gives rise to destructive interference among different topological configurations and eventually suppresses spin gaps in the S=half-odd integer cases. Another example of spin-S dependent phenomena can be found when a strong magnetic field is applied to quantum magnets. As the external field is increased, sometimes the system ceases to respond to the field and forms flat regions (plateaus) in the field vs magnetization curve. Although a clever flux-insertion argument tells that these plateaus are possible only when magnetization m satisfies the condition $Q(S-m)$=(integer), the geometrical implication of this condition had not been known so far. By using a geometrical theory of crystal momenta and low-energy effective field theory (a dual vortex theory), Tanaka and Totsuka clarified its topological meaning and showed that the topological interference among vortices selects these special values of m.

Simulating quantum effects in curved spacetime in cold

atoms: Since the experimental realization of Bose-Einstein condensation in cold atoms in 1995, this system is one of the most active research fields in condensed-matter physics. Compared to the other systems, cold atom systems are extremely clean. Remarkably one can control the interaction between the atoms by making use of the Feshbach resonance. Collaborating with Y. Kurita (Osaka City Univ.), Morinari proposed a realistic experiment to simulate quantum effects in curved spacetime in cold atoms. In 1981, Unruh proposed that a fluid system can be used to study physics of curved spacetime because the equations describing fluctuations in a background flow and the field equations in curved spacetime have the same form in common. This analogy holds for quantum fluids as well. Although there are some proposals about simulating physics in curved spacetime by using cold atoms, most of them are hard to realize experimentally. Kurita and Morinari proposed that a sonic horizon can be easily created by changing the interaction between the atoms using Feshbach resonance. The Hawking temperature estimated from numerical simulations is of the order of nK, which will become experimentally accessible in the near future. The model was extended to calculate the spectrum of the particle creation in collaboration with M. Kobayashi, M. Tsubota, and H. Ishihara at Osaka City University.

Nuclear Theory Group

The main focus of this 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 is a brief review the research activity in the academic year of 2007.

Nuclear structure and reaction

The goal of nuclear structure physics is to construct the unified microscopic comprehension of properties of nuclear many-body systems. Recently, various new phenomena have been discovered in the ground and excited states of unstable nuclei as well as stable nuclei owing to the progress of experimental facilities such as the RI beam factory. The aim is to understand these phenomena and to provide theoretical predictions while focusing on the clustering aspect of the nuclear system.

Concerning the vanishing of the neutron magic number $N = 8$ in unstable nuclei, ^{12}Be has been attracting a great deal of interest. The transition property in the ground band of ^{12}Be is helpful in knowing the feature of the deformation, which is a key factor of the vanishing of the magic number. In order to investigate the neutron deformation, Takashina and Kanada-En'yo studied proton inelastic scattering on ^{12}Be by the microscopic coupled-channel calculation using the antisymmetrized molecular dynamics (AMD) wave functions, and obtained the neutron quadrupole transition strength B_n in the ground band. They also showed that the value of B_n was inconsistent with that derived by the phenomenological analysis, and that the phenomenological approach was inadequate for unstable nuclei.

There were remarkable activities also in structure studies of unstable and stable nuclei. Kanada-En'yo studied the ground and excited states of He isotopes with the AMD method, and showed the dineutron (two neutron spin-zero pair) correlation in neutron-rich He isotopes. She also suggested possible appearance of the dilute gas-like state of dineutrons around an alpha core in the excited state of ^{8}He. For light nuclei, Taniguchi, Kanada-En'yo and collaborators performed systematic study of deformation and clustering in $Z = N =$even nuclei in the *sd*-shell region by using a method of the deformed-basis AMD. Nuclear structures in the deformed region are discussed focusing on deformations and clustering. It was found that the deformations often involve cluster structures.

Hadron structure and dynamics

Structure of the $\Lambda(1405)$ *in chiral dynamics*: Hyodo and Jido, with L. Roca (visitor), studied the behavior with the number of colors (N_c) for $\Lambda(1405)$ obtained dynamically within the chiral unitary approach. The leading order chiral meson-baryon interaction manifests a nontrivial N_c dependence for SU(3) baryons, which gives a finite attractive interaction in some channels in the large N_c limit. As a consequence, the SU(3) singlet ($\bar{K}N$) component of the $\Lambda(1405)$ survives in the large N_c limit as a bound state, while the other components dissolve into the continuum. Investigating the N_c scaling of the decay width they found an indication that the three-quark component does not dominate the structure of the $\Lambda(1405)$ resonance. Hyodo and Jido, with Sekihara, investigated electromagnetic form factors of $\Lambda(1405)$. Especially the electromagnetic mean squared radii, $\langle r^2\rangle_{\rm E}$ and $\langle r^2\rangle_{\rm M}$, were studied in detail. Describing the excited baryons as dynamically generated resonances in the octet meson and octet baryon scattering, they evaluated $\langle r^2\rangle_{\rm E}$ and $\langle r^2\rangle_{\rm M}$ for $\Lambda(1405)$ on the resonance pole and obtained complex values. Considering also $\Lambda(1405)$ obtained by neglecting decay channels, they found that the electric mean squared radius is negative and its absolute value is larger than that of typical ground state baryons. This implies that $\Lambda(1405)$ has a structure in which K^- is widely spread around p.

Origin of the resonances in the chiral unitary approach: Hyodo, Jido and a collaborator studied the origin of the resonances associated with the pole singularities of the scattering amplitude in the chiral unitary approach. A "natural renormalization" scheme was proposed for the amplitude without genuine quark states (CDD poles), using the low energy interaction and the general principle of the scattering theory. The method to distinguish the dynamically generated resonances from genuine CDD poles was developed, utilizing the natural renormalization scheme and phenomenological fitting. The method was applied to physical meson-baryon scatterings, showing that the $\Lambda(1405)$ resonance is largely dominated by the meson-baryon molecule component. In contrast, the $N(1535)$ required a sizable CDD pole contribution, while the effect of the meson-baryon dynamics was also important based on the analysis of the coupling strengths.

Effective $\bar{K}N$ *interaction based on chiral SU(3) dynamics*: Hyodo and a collaborator derived the effective $\bar{K}N$ interaction based on chiral SU(3) coupled-channel dynamics and studied its extrapolation below the $\bar{K}N$ threshold in detail. The coupled-channel scattering equations were reduced into the single-channel equation with the effective interaction by eliminating the channels other than $\bar{K}N$. The importance of the two-pole structure of the $\Lambda(1405)$ was discussed, pointing out the attractive forces in *both* $\bar{K}N$ and $\pi\Sigma$ channels as the physical origin of the two poles. An equivalent local potential in coordinate space was then constructed so as to reproduce the full scattering amplitude of the chiral SU(3) coupled-channel framework. Several realistic chiral SU(3)-based models were examined in comparison to reach conclusions about the uncertainties involved. It turned out that, in the region relevant to the discussion of deeply bound $\bar{K}$-nuclear few-body systems, the resulting energy-dependent, equiva-

lent local potential is substantially less attractive than the one suggested in previous purely phenomenological treatments. The strong interaction in $\pi\Sigma$ channel, as indicated by the chiral low energy theorem, is responsible for the relatively weaker attraction of the effective $\bar{K}N$ interaction.

η *Photoproduction and N^* resonances*: K. S. Choi, Nam, H.-Ch. Kim and A. Hosaka studied the η photoproduction using the effective Lagrangian approach at the tree level. They included six nucleon resonances, that is, $D_{13}(1520)$, $S_{11}(1535)$, $S_{11}(1650)$, $D_{15}(1675)$, $P_{11}(1710)$, $P_{13}(1720)$ as well as possible background contributions. In addition, they included new nucleon resonance $N^*(1675)$ which was announced by the GRAAL, CB-ELSA and Tohoku LNS-GeV-γ experiments. They investigated a possible role of the resonance with testing its spin and parity for four different cases of $J^P = 1/2^{\pm}$ and $3/2^{\pm}$. They calculated various cross sections including beam asymmetries for the neutron and proton targets. A noticeable isospin asymmetry was observed in the transition amplitudes for proton and neutron targets. This observation might indicate that the new resonance can be identified with a nonstrange member of the baryon antidecuplet.

Kaon semileptonic decay (K_{l3}) form-factor in the nonlocal chiral quark model: Nam and H. -Ch. Kim investigated the kaon semileptonic decay (K_{l3}) form factors within the framework of the nonlocal chiral quark model from the instanton vacuum, taking into account the effects of flavor SU(3) symmetry breaking. All theoretical calculations were carried out without any adjustable parameter. They also showed that the present results satisfied the Callan-Treiman low-energy theorem as well as the Ademollo-Gatto theorem. It turned out that the effects of flavor SU(3) symmetry breaking were essential in reproducing the kaon semileptonic form factors. The present results were in a good agreement with experiments, and compatible with other model calculations.

Electromagnetic form factors of the pion and kaon from the instanton vacuum: Nam and his collaborator investigated the pion and kaon (π^+, K^+, K^0) electromagnetic form factors in the space-like region: $Q^2 \lesssim 1$ GeV, based on the gauged low-energy effective chiral action from the instanton vacuum in the large N_c limit. Explicit flavor SU(3) symmetry breaking was taken into account. The nonlocal contributions turned out to be crucial to reproduce the experimental data. While the pion electromagnetic form factor was in good agreement with the data, the kaon one seems underestimated. They also calculated the electromagnetic charge radii for the pion and kaon: $\langle r^2 \rangle_{\pi^+} = 0.455$ fm^2, $\langle r^2 \rangle_{K^+} = 0.486$ fm^2 and $\langle r^2 \rangle_{K^0} = -0.055$ fm^2 without any adjustable free parameter except for the average instanton size and inter-instanton distance, and they were compatible with the experimental data. The low-energy constant L_9 in the large N_c limit was also estimated to be 8.42×10^{-3} from the pion charge radius.

Magnetic susceptibility of QCD vacuum at finite density: Nam and his collaborator also investigated the magnetic susceptibility (χ) of the QCD vacuum at finite quark-chemical potential ($\mu \neq 0$) and at zero temperature ($T = 0$) to explore the pattern of the magnetic phase transition of the vacuum. For this purpose, they employed the framework of the mu-modified nonlocal chiral quark model from the instanton vacuum in the chiral limit. Focusing on the Nambu-Goldstone phase characterized by $\langle iq^+q \rangle \neq 0$, they found that the magnetic susceptibility χ turned out to decrease smoothly with respect to μ. At the critical quark-chemical potential $\mu_c \sim 320$ MeV, which was determined consistently within the present framework, the strength of the chi became about a half of its vacuum value, and the first-order magnetic phase transition took place.

Pseudoscalar-meson–octet-baryon coupling constants in two-flavor lattice QCD: Meson-Baryon couplings constants are of great importance, since baryons are building blocks of the matter and mesons are responsible for baryon-baryon interactions. Takahashi, in collaboration with G.Erkol and M.Oka, evaluated the πNN, $\pi\Sigma\Sigma$, $\pi\Lambda\Sigma$, $K\Lambda N$ and $K\Sigma N$ coupling constants and the corresponding monopole masses in lattice QCD with two flavors of dynamical quarks. The parameters representing the SU(3)-flavor symmetry were computed at the point where the three quark flavors are degenerate at the physical s-quark mass. In particular, They obtained $\alpha \equiv F/(F+D) = 0.384(8)$. The quark-mass dependences of the coupling constants were obtained by changing the u- and the d-quark masses. They finally found that the SU(3)-flavor parameters have weak quark-mass dependence and thus the SU(3)-flavor symmetry is broken by only a few percent in the chiral limit.

Axial charge of N(1535) in lattice QCD with two flavors of dynamical quarks: Axial charges are key quantities for the clarification of the chiral structure in low-energy hadron dynamics. However they are often difficult to measure in experiments, and lattice QCD studies are desired. Takahashi and Kunihiro performed the first lattice QCD study of the axial charge $g_A^{N^*N^*}$ of $N^*(1535)$. The measurement was performed with two flavors of dynamical quarks employing the renormalization-group improved gauge action at β=1.95 and the mean-field improved clover quark action with the hopping parameters, κ=0.1375, 0.1390 and 0.1400. In order to avoid signal contaminations by $N^*(1650)$, they constructed 2×2 correlation matrices and diagonalized them so that clear signal separation can be found. The wraparound contributions in the correlator, which can be another source of signal contamination, were eliminated by imposing the Dirichlet boundary condition in the temporal direction. They found that the axial charge of $N^*(1535)$ takes small values as $g_A^{N^*N^*} \sim 0.2$, which is found almost independent of quark masses.

Sigma meson in pole-dominated QCD sum rules: Jido, in collaboration with Kojo, investigated the properties of the σ meson using the QCD sum rules (QSR) for tetraquark operators. Acceptably wide Borel windows originate in preparing favorable linear combinations of operators and including the dimension 12 terms in the OPE. Taking into

account of the possible large widths, they calculated the mass of the sigma meson as 600 $\sim$ 800 MeV, which is much closer to the experimental value, $\sim$ 500 MeV, than the mass evaluated by 2-quark correlator, *i.e.*, $\sim$ 1.0 GeV. This indicates that the tetraquark state shares a larger fraction in the σ meson than ordinary two quark meson states.

Three-quark systems in Maximally Abelian gauge: Maximally Abelian (MA) gauge is the gauge based on the dual superconductor picture which is a possible scenario of the color confinement. QCD is reduced to Abelian theory (MA projected QCD) with monopoles for infrared region in MA gauge . It is known by lattice QCD calculation that the $Q\bar{Q}$ potential becomes linear in the MA projected QCD. The MA projected QCD has both electric and magnetic monopole currents, and is decomposed into two parts by Hodge decomposition: one is the monopole part including only the magnetic monopole current, and the other is the photon part including only the electric current. Iida, Sakumichi and Suganuma studied the static 3Q potential in the MA projected QCD, the monopole part and the photon part in SU(3) quenched lattice QCD quantitatively. They found that both the MA projected QCD and the monopole part have almost the same string tension of the 3Q system as that in the original SU(3) QCD, while no linear part appears in the 3Q potential in the photon part. They also examined the 3Q potential in the 4-dim. Z_3 spin system obtained by Maximal Center (MC) gauge fixing and MC projection. The string tension in the MC projected QCD accurately coincided with that in the monopole part. They established Abelian Dominance, Monopole Dominance, and Center Dominance for the string tension of the 3Q potential.

QCD matter and phase diagram

Spectral properties of the quark around the critical region at finite temperature: Kunihiro and collaborators explored possible modification of the quark quasi-particle picture around the chiral transition at finite temperature. Around the critical point, there may appear soft modes which are coupled to the fluctuations of the order parameter of the phase transition. Investigating the quark self-energy due to this bosonic mode at finite temperature, they revealed that the spectral function of the quark present three peaks in the low-energy region: The two of them existing in the positive-and negative-energy regions correspond to the normal-quark and plasmino excitations familiar in the hard-thermal loop approximation valid in the extremely high-temperature region. The novel point of their findings was that there appears an additional excitation with a vanishingly small energy. Mitsutani, Kunihiro and collaborators studied the properties of massless and massive quarks coupled with a scalar and pseudoscalar boson at finite temperature in Yukawa models at the one-loop order. The behavior of the spectral function and the pole structure of the propagator were analyzed as functions of temperature T and the quark mass m_f. It was shown that the three-peak structure of the spectral function found in a previous work for massless quarks is formed at temperatures comparable to the boson mass even for finite m_f, but gradually ceases to exist as m_f becomes larger. They identified the three poles of the quark propagator corresponding to the collective excitations of the quark in the complex energy plane. It was clarified that the three trajectories made by the poles along with a variation of T undergo a structural rearrangement at a critical quark mass when m_f is increased. This suggested that the physics content of the collective quark excitations is changed in a drastic way at this point. The results were nicely accounted for with the notion of the level mixing induced by a resonant scattering of the massive boson with quarks and holes of thermally excited anti-quarks. They suggested that such a change of the quark spectral function might manifest itself in the cross section of the lepton-pairs created in Quark-Gluon Plasma.

Quest for "correct" relativistic hydrodynamic equations for viscous fluid: The suggestion that the QCD matter created in RHIC may be an almost perfect fluid prompted the study of the transport properties of the strongly correlated matter and the relativistic hydrodynamic equations which properly describe the dynamical evolution of a viscous fluid. Kunihiro and collaborators derived a class of relativistic hydrodynamic equations with dissipative effects from the underlying Boltzmann equation in a systematic way on the basis of so called the renormalization-group method. Examining the equations thus obtained, Kunihiro and a collaborator proposed a stable first-order relativistic dissipative hydrodynamic equation in the particle frame (Eckart frame) for the first time. The equation to be proposed was in fact previously derived by Tsumura, Kunihiro and Ohnishi. They demonstrated that the equilibrium state is stable with respect to the time evolution described by the hydrodynamic equation in the particle frame. They claimed that the proposed equation may be a proper starting point for constructing second-order causal relativistic hydrodynamics, to replace Eckart's particle-flow theory.

Small-x partons in heavy-ion collisions: Fukushima investigated the small-x degrees of freedom of partons which contribute to the early-time dynamics toward thermalization in heavy-ion collisions. It wa established that the McLerran-Venugopalan (MV) model is a good approximation of the QCD partition function in the saturated regime where the wee partons are abundant due to quantum evolution. Fukushima made a careful analysis on the mathematical structure of the MV model and pointed out that the numerical implementation in existing works has a significant difference from the original analytical definition of the model. He showed that this difference may result in a wrong estimate of the initial energy density and the produced particle number associated with the heavy-ion collisions. He further discussed that the successful estimate reported in existing numerical simulations is the result of the fitting procedure with the model parameter so as to reproduce the particle multiplicity. His work was a foundation to construct a fully self-consistent theory toward the early-time dynamics.

Particle Physics Group

The research field of the particle physics group is wide and diverse. Particle physics is a branch of physics studying the origin of matter and spacetime as well as their interactions. Its final goal is to find a single principle that governs the nature itself; such a unifying theory is frequently referred to as the "Theory of Everything". *String theory* is a promising candidate of such an ultimate theory and has been studied by many of the group members. At low energy scales physics observed in experiments are described accurately by the Standard Model (SM) of $SU(3) \times SU(2) \times U(1)$. However, this is not a complete theory as it contains too many tunable parameters, and it suffers from the hierarchy problem. The dark matter and the dark energy are still mysterious and have to be clarified. *Phenomenology* of particle physics beyond the SM is actively investigated by the members, who work in close contact with experimental groups. 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. Driven by new concepts, developed in the string theory, such as gauge/gravity duality, field theory has made remarkable progress in recent years. *Lattice QCD* is a powerful method to analyze non-perturbative aspects of QCD, which is essential for constructing phenomenological models beyond the SM, and is also important to study new phenomena that may arise in finite temperature and/or finite density QCD.

String theory

Eguchi, with Y. Tachikawa (IAS), analyzed the coupled N=2 supergravity and Yang-Mills system using holomorphy, near the rigid limit where the former decouples from the latter. They found that there appears generically a new mass scale around gM_{pl} where g is the gauge coupling constant and M_{pl} is the Planck scale.

For the description of string propagation on noncompact or singular Calabi-Yau manifolds by CFT, continuous as well as discrete representations appear in the theory. *Eguchi*, with Y. Sugawara (Tokyo) and A. Taormina (Durham), proposed a method of combining these discrete and continuous representations so that the resulting combinations have a simpler modular behavior and can be used as conformal blocks of the theory. They computed elliptic genera of ALE spaces and obtained results which agree with those suggested from the decompactification of K3 surface.

The double spinor (DS) formalism is a candidate giving a Lagrangian description of the pure spinor (PS) formalism. *Kunitomo*, with S. Mizoguchi (KEK), studied the Lorentz invariance of $D = 4$ and 6 superstrings in the DS formalism, which are equivalent to the $D = 4$ and 6 superstrings in the PS formalism in the sense of the BRST cohomology. They constructed the BRST invariant Lorentz generators in the $D = 4$ and 6 DS superstrings, and showed that those do not form closed algebra.

Terashima, with M. Eto (Pisa) and K. Hashimoto (RIKEN), studied QCD string in the Seiberg dual of supersymmetric gauge theories and found that it can be understood as classical vortex string in the Seiberg dual theory. He also investigated, with K. Hashimoto (RIKEN) and C.I. Tan (Brown), the decay of glueballs in the holographic QCD.

Using the tachyon condensation on unstable D-branes, D-brane in noncommutative space can be obtained. This construction gives an interpretation of important mathematical ideas, such as the ADHM construction of instantons, but had not been applied for compact spaces. *Terashima* considered unstable D-branes on torus and found an exact solution of the tachyon condensation. The Nahm transformation, which is a generalization of the Fourier transformation, can be understood in string theory from this solution.

Kimura formulated a generalization of the Atiyah-Singer index theorems on even-dimensional compact manifolds in the presence of torsion. The formulae obtained are inevitable when one count the number of massless modes in low energy effective theories derived from the compactifications by the manifolds with torsion.

With L. Hlavaty and L. Snobl (Czech Technical University), *Albertsson* reformulated the conditions for the gluing matrix defining consistent boundary conditions of two-dimensional nonlinear sigma models. They derived the Poisson-Lie T-plurality transformation rules for these conditions, and applied them to two- and three-dimensional models. They found an obstacle in that the conditions in some models transform into nonlocal dual conditions.

In collaboration with R. Reid-Edwards (DESY), *Albertsson* and *Kimura* derived the boundary conditions of the nonlinear sigma model in the doubled geometry formalism proposed by Hull, as well as studied the allowed D-brane embeddings in this model. The target spaces allowed in Poisson-Lie T-plurality arise as a special case of the doubled geometry formalism.

Albertsson and *Kimura* furthermore studied possible generalisations of the Atiyah-Singer index theorem in the presence of non-closed flux, $dH \neq 0$, which would be useful in the flux compactification.

Murata, with H. Hata (Kyoto), studied dynamical baryons in the Sakai-Sugimoto model of holographic QCD in the case of three flavors. The baryon classical solution in this model is given by the BPST instanton. They proposed a new Chern-Simons (CS) term which is gauge invariant and given as an integral over a six dimensional space whose boundary is the original five dimensional spacetime. Collective coordinate quantization using the new CS term led to correct baryon states and their mass formulaS.

Murata, in collaboration with H. Hata and S. Yamato (Kyoto), also analyzed static properties of nucleons in the two flavor Sakai-Sugimoto model. They constructed a four-dimensional chiral current from the Noether current of local gauge transformations, and examined it for nucleons with quantized collective coordinates to compute their charge distribution, charge radii, magnetic moments and axial vector coupling. Most of the results are closer to the experimental values than those in the Skyrme model.

As an approach to quantum gravity, *Ogawa* was interested in problems about microstates of black holes. He especially focused on the fuzzball conjecture and other related topics, such as bubbling AdS geometries and their coarse-graining.

With K. Takahashi (Kyoto), *Kimura* and *Ohta* investigated Type II orientifolds on a non-factorizable torus with/without orbifolding. They applied non-factorizable $Z_M \times Z_N$ orbifold models, classified recently in the heterotic string, to Type IIA string theory, which give rise to rather richer structure by inclusion of D-branes. They also classified orientifolds and constructed new supersymmetric Type IIA orientifold models.

In collaboration with Y. Nagatani (OIQP), H.B. Nielsen (NBI), *Habara* and *Ninomiya* showed that, according to the supersymmetry, the vacuum of the boson is necessarily a sea filled with negative energy particles just like the Dirac sea. They constructed a method to regularize the divergence coming from the infinite particles of the sea and pointed out that a "hole", appearing when one removes a negative energy particle from the sea, corresponds to an anti-particle in the bosonic case, too.

They further showed that quantum pair production occurs from the Dirac and boson sea in the gravitational background fields. Then they derived the conformal anomaly from this quantum pair production. Since this mechanism can be applied to the cases of the electromagnetic background fields, the chiral anomaly via quantum pair production can be also obtained in the exactly same manner. All the anomalies can be commonly explained by this mechanism of the quantum pair production from the sea.

Field theory

Kugo and *Tokunaga*, with M. Kobayashi (KEK), calculated the electric and magnetic dipole moments (EDM) of dyon fermions within N=2 supersymmetric Yang-Mills theory including the theta-term. It is found, in particular, that the gyroelectric ratio deviates from the canonical value of 2 for the monopole fermion $(n_m = 1, n_e = 0)$ in the case $\theta \neq 0$. Applying the S-duality transformation to the result for the dyon fermions, they obtained an explicit prediction for the EDM of the charged fermion. This approach provides a novel method for computing the EDM induced by the theta-term.

Kugo and *Itou*, with T. Higashi (Osaka), showed the Wilson effective action for general Yang-Mills gauge theory satisfies the usual form of Batalin-Vilkovisky (BV) master equation, despite that a momentum cutoff apparently breaks the gauge invariance. In the case of Abelian gauge theory, in particular, it actually deduces the Ward-Takahashi identity for Wilson action recently derived by Sonoda.

A great deal of attention has recently been directed to graphene, an atomic layer of graphite, which supports "relativistic" charge carriers behaving like massless Dirac fermions. *Shizuya* studied the *electromagnetic response of graphene in a magnetic field*, with focus on revealing possible "relativistic" signatures in graphene. He pointed out that graphene, even in its vacuum state, is a dielectric medium, with the Coulomb interaction screened efficiently on the scale of the magnetic length, and that the static structure factors show unusual electronic correlations at short wavelengths; these are relativistic effects specific to graphene.

Bilayer graphene is as exotic as monolayer graphene and has a unique property that its band gap is externally controllable. *Misumi and Shizuya* pointed out that the splitting of nearly-degenerate pseudo-zero-mode Landau levels, specific to bilayer graphene in a magnetic field, is also controlled by an inplane field or by an injected current; this leads to a possibility of the current-driven quantum Hall effect around filling factor $\nu = \pm 2$ in bilayer graphene.

The concept of fuzzy space is an interesting quantum alternative for the classical notion of continuous spacetime. *Sasakura* and *Sasai* dealt with Hopf algebraic symmetries on noncommutative spacetime. This is a new concept of symmetry, which generalizes the conventional Lie group symmetries and is applicable for spacetime symmetries on noncommutative space-times. They made clear how to construct quantum field theory possessing such Hopf algebraic symmetries, and the physical meanings of such symmetries. *Sasakura* also studied tensor models, which can be regarded as dynamical theory of fuzzy spaces. He found some persuasive evidences for that the general relativity appears on fuzzy spaces as low-energy effective description in tensor models.

Integrable systems

As is well-known, most fundamental theorems in field theory are stated in terms Heisenberg operators. However, the knowledge of exact Heisenberg operator solutions was extremely limited; only for the harmonic oscillator and free field theory as an infinite collection of independent harmonic oscillators. *R. Sasaki* and S. Odake (Shinshu) constructed, for the first time, the Heisenberg operator solutions as many as the degree of freedom for a class of interacting multi-particle systems, the Calogero systems based on any root system. They also produced a comprehensive theory of Heisenberg operator solutions, creation-annihilation operators, dynamical symmetry algebras for various exactly solvable 'discrete' quantum mechanical systems. Based on a 'discrete' quantum mechanics corresponding to the q-Hermite polynomials, they provided dynamical construction of the so-called q-oscillator, that is the q-deformation of the algebra of the creation-annihilation operators of the harmonic oscillator. Difference equation versions of quasi-exactly solvable quantum mechanics are formulated by them for

various examples of single and many degrees of freedom cases. A special type of hermitian matrix models (the so-called Jacobi or tri-diagonal matrices) are introduced and solved by them to derive the known hypergeometric orthogonal polynomials of the Askey scheme.

Based on the relationship between the Fokker-Planck equations and the Schrödinger equations, various examples of quasi-exactly solvable Fokker-Planck equations are given by *R. Sasaki* and Ho.

Phenomenology

Cosmological inflation is expected to be a key ingredient to realize our present universe. Various possible candidates have been considered as origins of inflaton fields in particle-physics models. Weakly coupled fields such as moduli fields in supersymmetric models may be plausible candidates to yield nearly flat potential for slow-roll inflation.

In contrast, strongly coupled fields might naively seem inappropriate to achieve flatness of the potential due to large dynamical corrections to the potential. However, if dynamical scale as large as fundamental cutoff scale is to be considered, low-energy degrees of freedom may just behave as weakly coupled fields in effective theory description below the cutoff scale.

In collaboration with K. Hamaguchi and H. Nakajima (Tokyo), *Izawa* considered dynamical models of inflation with composite inflatons by means of massive supersymmetric gauge theory. Nearly flat directions and stable massive ones in the potential are identified and slow-roll during inflation is examined. This kind of dynamical inflations may be ubiquitous in fundamental unified theory with supersymmetry, which should contain gauge theories for interactions of elementary particles.

In the supergravity/string model building beyond the standard model, it is important to stabilize moduli at a supersymmetry (SUSY) breaking vacuum with a vanishingly small vacuum energy required by the observations. One of the known best ways to realize such a moduli stabilization is a compactification of supergravity/string theories with nontrivial background fluxes. *Abe* and his collaborators studied phenomenological/cosmological aspects of flux compactifications, *e.g.* a general condition to obtain vanishing vacuum energy with a dynamical SUSY breaking, superparticle spectra with a dynamically sequestered SUSY breaking sector and a neutralino abundance as a dark matter candidate in the minimal SUSY standard model without an electroweak fine-tuning. They also studied metastability of the SUSY breaking vacua in generic dynamical SUSY breaking models, and proposed a scenario yielding controllable and realistic metastable vacua by conformal dynamics.

Kurachi studied theoretical aspects of the Higgsless model, which is one of the candidates to solve the naturalness problem of the Standard Model. It was well known that the model, unlike many other models in the same class, is perturbative at low-energy region. However, it had been judged by just looking at the elastic longitudinal W-boson scattering amplitude, and the effects of inelastic scatterings which involve the excited modes of the W-boson had not been taken into account. He, with R.S. Chivukula (Michigan State), E.H. Simmons (Michigan State), H.-J. He (Tsinghua) and M. Tanabashi (Nagoya), clarified the upper bound of the energy range in which the model is perturbative by calculating the scattering amplitudes which include coupled channel involving higher excited modes.

Lattice QCD

Following last years study, *Onogi*, with JLQCD collaboration, further studied the low-lying eigenvalue spectrum of the QCD Dirac operator to match with that of chiral Random Matrix Theory (ChRMT). Using the overlap fermion formulation, they could make the sea quark mass as low as ~ 3 MeV on a $16^3 \times 32$ lattice at a lattice spacing a $\simeq 0.11$ fm. They compared the low-lying eigenvalue distributions and found a good agreement with the analytical predictions of ChRMT. By matching the lowest-lying eigenvalue they extracted the chiral condensate, $\Sigma(2GeV)[MSbar] = [251(7)(11)MeV]^3$.

Onogi, with S. Aoki (Tsukuba), H. Fukaya (RIKEN) and S. Hashimoto (KEK), also studied the extraction of θ vacuum physics from fixed topology simulation. In finite volume the partition function of QCD with a given θ is a sum of different topological sectors with a weight primarily determined by the topological susceptibility. If a physical observable is evaluated only in a fixed topological sector, the result deviates from the true expectation value by an amount proportional to the inverse space-time volume 1/V. Using the saddle point expansion, they derived formulas to express the correction due to the fixed topological charge in terms of a 1/V expansion. Applying this formula, they also proposed a method to determine the topological susceptibility in QCD.

As for a candidate of the strong coupling gauge theory which triggers the electroweak symmetry breaking, it is known that the theory possessing approximate scale invariance has several phenomenological advantages. It is also known that the two-loop beta function of the QCD have a nontrivial infrared fixed point when the number of fermion flavors is larger than some critical number. If the existence of theories which have the infrared fixed point beyond perturbative regime is confirmed, those theories become strong candidates of the near-conformal dynamical electroweak symmetry breaking models. *Kurachi* and *Onogi*, with collaborators, started preparatory studies for the calculation of the running coupling of QCD with many flavors by using a new method on the discretized space-time lattice.

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)."

Aim of the program

By the end of 1970's, the final understanding was reached that Quantum Chromodynamics (QCD) is the 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, such as the vacuum structures at extremely high temperature in the Early Universe and at extremely high density in compact stars. 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. In order to achieve this goal through 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, twister string theory, non-perturbative and/or non-equilibrium dynamics, etc.

International collaboration program

As a core activity of the YIPQS, long-stay collaboration 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, although the organizing committee should include a member of Yukawa Institute. The themes of the long-stay programs are selected by the YIPQS executive committee with taking account of comments and opinions from the international advisory committee. The programs are to be endorsed by the steering/advisory committee of the Yukawa Institute. The proposed program plans are also 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 and in the form of printed documents.

In the academic year 2007 the following three programs were held;

1. Nov. 3 – 28, 2007: Scientific Program on Gravity and Cosmology
   URL: http://www2.yukawa.kyoto-u.ac.jp/~gc2007/

2. Nov. 5 – 30, 2007: Yukawa International Seminar (YKIS) 2007 – Interaction and Nanostructure Effects in Low-dimensional Systems
   URL: http://www2.yukawa.kyoto-u.ac.jp/~ykis2007/

3. Jan. 28 – Mar. 21, 2008: New Frontiers in QCD 2008 – Fundamental Problems in Hot and/or Dense Matter
   URL: http://www2.yukawa.kyoto-u.ac.jp/~nfqcd08/

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

Smaller-size international collaboration programs are also organized to cope with the rapid development of the research in this field. The are called international "molecular-type". It is expected that the group discussion in these small programs will evolve to form research collaboration. Proposals are received anytime within the budget limit. Each molecular-type program requires at least two core participants from abroad, and should last longer than two weeks. The selection of these programs is also made by the executive committee.

In the academic year 2007 there were two international programs of the molecular-type as listed below;

1. Oct. 20 – 27, 2007: Towards the Precise Predictions of CP Violation

2. Dec. 2007 – Jan. 2008: Black Holes in Dense Stellar Systems

Organization

The executive committee was organized in the Yukawa Institute to run the whole program. The committee members are;
Teiji Kunihiro (chair), Taichiro Kugo, Tohru Eguchi, Kenichi Shizuya, Misao Sasaki, Shin Mineshige, Takami Tohyama, Hisao Hayakawa, Hiroshi Kunitomo.

One assistant 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 Research Highlights

Instanton framework for nonperturbative QCD properties

Seung-il Nam (YITP)

It has been well known that the strongly interacting systems are governed by quantum chromodynamics (QCD). Being different from the high-energy region, in which perturbative methods can be applied by virtue of the asymptotic freedom, various nonperturbative approaches have been proposed to overcome difficulties of solving QCD in low-energy one for several decades. The lattice simulation of QCD must be a most promising one to explore the nonperturbative QCD, together with the drastic development of computing power. At the same time, guided by relevant symmetries and fundamental laws, effective models, reflecting low-energy natures of QCD, have also provided profound insight to this complicated regime. Among them, the instanton vacuum configuration, based on the semi-classical solution of the Yang-Mill action, has provided successful descriptions for the nonperturbative QCD phenomena, such as the spontaneous breakdown of chiral symmetry (SBχS). The extensions of this interesting self-consistent method to the systems at finite quark-chemical potential (μ) and/or temperature (T) have been also investigated [1, 2] with increasing interest focusing on the QCD phase structure.

First, we computed the pion and kaon electromagnetic (EM) form factors, using the instanton framework [3], with only two phenomenological parameters: the average instanton size $\bar{\rho} \approx 1/3$ fm and inter-instanton distance $\bar{R} \approx 1$ fm. The effective chiral action derived from the framework was written in the chiral limit as follows:

$$S_{\rm eff} = -{\rm Sp}\ln\left[i\partial + iM(i\partial)\right], \qquad (1)$$

where the Sp and $M(i\partial)$ stand for a functional integral over color, flavor, Dirac-spin indices and a momentum-dependent quark mass, determined self-consistently, respectively. Considering all local and nonlocal contributions, generated systematically from the functional derivative of the effective action with respect to the external pseudoscalar source fields, we could obtain very reasonable results for the Q^2 dependence of the form factors and the EM charge radii. For instance, we had $\langle r^2\rangle_{\pi^+} = 0.455\,{\rm fm}^2$, which deviates only a few percent from the experimental value. In contrast to the pion case, the kaon form factor showed slight differences in comparison to the experiments, because of the absence of the meson-loop (ML) correction corresponding to the $1/N_c$ correction. To overcome this problem, we performed basic studies on the ML correction in Ref. [4]. As expected, we could produce significant improvement by the ML correction, and are planing to investigate various hadronic properties with explicit flavor SU(3) braking in near future.

We also took into account the instanton framework, modified by the finite quark-chemical potential (μ), considering the various low-energy constants and condensates in medium [5, 6]. Note that the effective chiral action with the finite μ could be obtained simply by replacing $\partial_\mu \to \partial_\mu - \mu_\mu$, where $\mu_\mu = (0,0,0,\mu)$ in Eq. (1), whereas the $M(i\partial)$ was modified considerably. In Ref. [5], we computed the pion weak-decay constant F_π, and it turned out that the first-order chiral phase transition took place at $\mu_c \approx 320$ MeV, which is about 20 MeV above the normal nuclear density ρ_0. The color superconducting (CSC) energy gap started to exist beyond it. According to the breakdown of Lorentz invariance due to the finite μ, we observed significant difference between the time and space components of F_π, indicating the importance of the p-wave contribution. Simultaneously, the partially restored chiral symmetry was indicated by about 15% increasing pion mass at μ_c. The magnetic QCD susceptibility χ at finite μ was also calculated [6]. It indicates the response of the QCD vacuum to the externally induced constant EM field. This interesting physical quantity may shed light on the hadronic origin of the magnetic properties of the neutron star and on describing the exclusive photoproduction of the hard dijets. From the numerical results, we observed that the first-order *magnetic* phase transition, corresponding to the chiral phase transition of the QCD vacuum. We also found that the χ was very sensitive to the change of the μ and became unstable to the EM field in the vicinity of the ρ_0

Finally, we investigated an effective thermodynamic potential with T-dependent instanton contributions. For this purpose, we studied the T-modification of the instanton properties, such as the instanton packing fraction (density), average size and distribution function, in terms of the periodic instanton in the Euclidean-time direction, so called *caloron*. Following the method suggested in Ref. [1, 2], we derived T- and momentum-dependent quark mass, which made significant differences in comparison to usual effective approaches. With these ingredients, the thermodynamic potential was constructed incorporating the Matsubara formula and the zero-T instanton effective action.

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Uncertainty principles and deterministic approach to Quantum Mechanics

Fabio Scardigli (YITP)
Present address: LeCosPA Center, Department of Physics, National Taiwan University, Taipei 106, Taiwan

Generalized uncertainty principles: In Ref. [1], I studied, with a collaborator, how generalized uncertainty principles would appear in a Universe with (large) extra dimension(s), when only gravity propagates in the extra dimensions. Explicit expressions for such GUPs in 4+n dimensions have been obtained and their holographic properties investigated. Unexpected new results have emerged. Some versions of GUP do not appear to satisfy the holographic counting of degrees of freedom. Remarkably, a particular version of GUP (see [2]) obeys the holographic principle, at least in 4 dimensions. However, when extra spatial dimensions are admitted, the holographic counting is lost [1]. Somehow, holography seems to dictate the (correct?) number of space-time dimensions. The generalization of the GUP [2] to a Universe with extra dimensions depends of course on which braneworld model is adopted, and in a critical way, on the behaviour of the black hole solutions in the braneworld. We have explored also the reverse point of view, namely what kinds of metrics are able to produce GUPs satisfying the holographic counting in 4+n dimensions. Here, strong indications point towards a violation of the equivalence principle at short distances, if one wants to hold holography and extra dimensions at the same time (a paper on this has been just accepted [3]). A different kind of generalization that is going to be investigated is the extension of the GUP in Ref.[4] to AdS-Schwarzschild metrics. Preliminary calculations show an interesting influence of the cosmological constant (non local effect) on the GUP analytical structure (local effect). At present, using two different generalized uncertainty principles, we are computing reliable values for mass thresholds, lifetimes, entropy and heat capacity of micro black holes close to their late Schwarzschild phase, in models with extra spatial dimensions. Emission of both photons and gravitons (in the bulk) are taken into account (see Ref.[5]). A clash seems to appear between the stringy inspired GUP (which displays an error linear in the energy term) and the possibility to reveal (at LHC) micro black holes, which have a gravitational radius sub-linear in the energy (in $4+n$ dimensions). However, the so called MBH GUP does not seem to suffer of this problem, and the results obtained with it are compared with those of stringy GUP.

Foundations of Quantum Mechanics: In the framework proposed by 't Hooft [6], according to which quantum behaviour can be reproduced by adding dissipation to an underlying classical system, with some colleagues (M.Blasone, P.Jizba, G.Vitiello), we are studying how to explicitly insert the interaction in the 't Hooft models. Following the way opened in [7], we study now two classical Bateman oscillators which, after that a dissipation constraint *a la* 't Hooft has been enforced, can generate genuine different interacting quantum systems. An ambitious goal of this project is to reproduce typical quantum features like "entanglement" between systems and "linear superposition", starting from underlying classical systems. At the moment we have obtained a quantum isotonic oscillator, which, for an opportune range of parameters, can be also interpreted as a particle in an effective magnetic field interacting through a spin-orbital interaction term. The mapping of this system into the Coulomb problem is also an aim of this project. A typical property of the 't Hooft approach is that, for a given classical system, there may exist many different "quantum shadows", depending on the choice of the dissipation constraint. This kind of research in foundations of quantum theory naturally interfaces also with (and has plentiful consequences in) quantum information theory.

Planetary Systems: Starting again from the ideas in [6], I developed a quantum-like description of the planetary systems [8]. The description seems to work very well for the known planetary systems close to us (Solar system, Jupiter, Saturn and Uranus satellites systems). Moreover, it contains a very good prediction of the basic features of the rings of Saturn, Jupiter, Uranus. Some parts of the wave function language seem indeed to be able to describe also features of classical systems. In future studies I aim to develop the model, refining its predictive ability, especially as regard to the flatness of planetary systems, which seems to be encoded in some analytical properties of the wave function, and to look for confirmation also in extra solar planetary systems. In fact, only from a few years astronomers have found evidences of multiple planetary systems around a single star.

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Lattice QCD Study of Axial charges of negative parity nucleons

Toru T. Takahashi (YITP)

Chiral symmetry is an approximate global symmetry in QCD, the fundamental theory of the strong interaction; this symmetry together with its spontaneous breaking has been one of the key ingredients in the low-energy hadron or nuclear physics. Due to its spontaneous breaking, up and down quarks, whose current masses are of the order of a few MeV, acquire the large constituent masses of a few hundred MeV, and are consequently responsible for about 99% of mass of the nucleon and hence that of our world. One would thus consider that chiral condensate $\langle\bar{\psi}\psi\rangle$, the order parameter of the chiral phase transition, plays an essential role in the hadron-mass genesis in the light quark sector. On the other hand, chiral symmetry gets restored in systems where hard external energy scales such as high-momentum transfer, temperature(T), baryon density and so on exist, owing to the asymptotic freedom of QCD. Then, are all hadronic modes massless in such systems? Can hadrons be massive even without non-vanishing chiral condensate?

An interesting possibility was suggested some years ago by DeTar and Kunihiro [1], who showed that nucleons can be massive even without the help of chiral condensate due to the possible chirally invariant mass terms, which give degenerated finite masses to the members in the chiral multiplet even when chiral condensate is vanishing. To show this possibility for a finite-T case, they introduced a linear sigma model which offers a nontrivial chiral structure in the baryon sector and a mass-generation mechanism completely and essentially different from that by the spontaneous chiral symmetry breaking [1].

Interestingly enough, their chiral doublet model has recently become a source of debate as a possible scenario of *observed parity doubling in excited baryons* [2, 3, 4]. It is known that the nucleon spectrum shows a parity doubling pattern to some extent, for which we have no satisfactory explanation. However, if we employ the chiral doublet model and assume that excited nucleons are decoupled from the chiral condensate ("chiral restoration" in excited nucleons) [1, 2], positive- and negative-parity nucleons readily have *degenerated finite masses* even in a chiral broken vacuum, and at the same time they would all have *very small axial charges*. If this interesting scenario is the case, the origin of mass of $N^*(1535)$ (or excited nucleons) is essentially different from that of the positive-parity ground-state nucleon $N(940)$, which mainly arises from the spontaneous chiral symmetry breaking.

It is thus an intriguing problem to reveal the chiral structure of excited baryons in the light quark sector beyond model considerations. As mentioned above, the key observables which are sensitive to the chiral structure of the baryon sector is axial charges [1]. In this report, we show the first unquenched lattice QCD study [5] of the axial charges $g_A^{N^*N^*}$ of $N^*(1535)$ and $N^*(1650)$. The measurement was done using the gauge configurations with two light dynamical quarks [5, 6] on a $16^3 \times 32$ lattice whose lattice spacing is about 0.1555 fm.

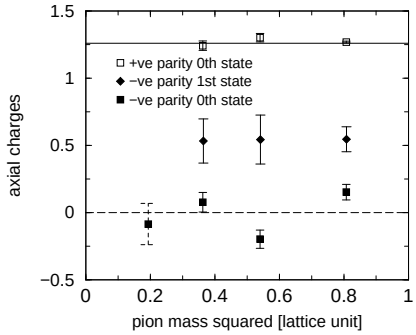

Figure 2.1: The renormalized axial charges of the positive- and the negative-parity nucleons are plotted as a function of the squared pion mass m_π^2. The solid line is drawn at $g_A = 1.26$ and the dashed line is drawn at $g_A = 0$.

In Fig. 2.1, renormalized axial charges of the positive- and negative-parity nucleons are plotted as a function of the squared pion mass m_π^2. One finds at a glance that the axial charge g_A^{0-} of $N^*(1535)$ (ground state in negative parity channel) takes quite small value, as $g_A^{0-} \sim \mathcal{O}(0.1)$. On the other hand, the axial charge g_A^{1-} of $N^*(1650)$ (1st excited-state in negative parity channel) is found to be about 0.55. Although the observed small g_A^{0-} is consistent with the parity-doubling scenario [2, 3, 4], the relatively larger g_A^{1-} is not. The striking feature is that these axial charges, $g_A^{0-} \sim 0$ and $g_A^{1-} \sim 0.55$, are consistent with the naive nonrelativistic quark model calculations, $g_A^{0-} = -\frac{1}{9}$ and $g_A^{1-} = \frac{5}{9}$. Though these results could not be the favorable evidences for the attempting chiral restoration scenario in (low-lying) excited hadrons, further investigations on the axial charges of $N^*(1535)$ or other excited baryons will cast light on the chiral structure of the low-energy hadron dynamics and on where hadronic masses come from.

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2.3 Publications

2.3.1 YITP preprints (January∼December 2007)

07-01 Seiji Terashima, *Supertubes in matrix model and DBI action* (March); JHEP **0703** (2007) 075. hep-th/0701179.

07-02 Masakiyo Kitazawa, Teiji Kunihiro and Yukio Nemoto, *Novel Collective Excitations and Quasi-particle Picture of Quarks Coupled with a Massive Boson at Finite Temperature* (January); Prog. Theor. Phys. **117** (2007) 103-138. hep-ph/0609164.

07-03 Mihoko M. Nojiri and Michihisa Takeuchi, *The Study of q(L) q(L) production at CERN LHC in the l+- l+- channel and sensitivity to other models* (January); Phys. Rev. **D76** (2007) 015009. hep-ph/0701190.

07-04 H. Fukaya, S. Aoki, T.W. Chiu, S. Hashimoto, T. Kaneko, H. Matsufuru, J. Noaki, K. Ogawa, M. Okamoto, T. Onogi and N. Yamada, *Two-flavor lattice QCD simulation in the epsilon-regime with exact chiral symmetry* (February); Phys. Rev. Lett. **98** (2007) 172001. hep-lat/0702003.

07-05 Misao Sasaki, *Nonlinear curvature perturbations in an exactly soluble model of multi-component slow-roll inflation* (February); Class. Quant. Grav. **24** (2007) 2433-2438. astro-ph/0702182.

07-06 Hiroyuki Abe and Yutaka Sakamura, *Supersymmetry breaking in a warped slice with Majorana-type masses* (February); JHEP **0703** (2007) 106. hep-th/0702097.

07-07 H. Abuki, *BCS/BEC crossover in Quark Matter and Evolution of its Static and Dynamic properties: From the atomic unitary gas to color superconductivity* (May); Nucl. Phys. **A791** (2007) 117-164. hep-ph/0605081.

07-08 Antonino Flachi and Takahiro Tanaka, *Branes and Black holes in Collision* (March); Phys. Rev. **D76** (2007) 025002. hep-th/0703019.

07-09 Minako Honda, Yee Kao, Naotoshi Okamura, Alexey Pronin and Tatsu Takeuchi, *The Effect of Topcolor Assisted Technicolor, and other models, on Neutrino Oscillation* (April); Proc. of International Workshop *Nagoya 2006, The origin of mass and strong coupling gauge theories* 21-24 November 2006. arXiv:0704.0369 [hep-ph].

07-10 Choon-Lin Ho and Ryu Sasaki, *Deformed multivariable Fokker-Planck equations* (March); J. Math. Phys. **48** (2007) 073302. cond-mat/0703291.

07-11 K. Shizuya, *Electromagnetic response and effective gauge theory of graphene in a magnetic field* (February); Phys. Rev. **B75** (2007) 245417. arXiv: cond-mat/0702674 [cond-mat.mes-hall].

07-12 Hiroyuki Abe, Tatsuo Kobayashi and Yuji Omura, *Relaxed fine-tuning in models with non-universal gaugino masses* (March); Phys. Rev. **D76** (2007) 015002. hep-ph/0703044.

07-13 Kazuharu Bamba, *Property of the spectrum of large-scale magnetic fields from inflation* (March); Phys. Rev. **D75** (2007) 083516. astro-ph/0703647.

07-14 Yuya Sasai and Naoki Sasakura, *Braided quantum field theories and their symmetries* (April); Prog. Theor. Phys.**118** (2007) 785-814. arXiv:0704.0822 [hep-th].

07-15 Noriaki Ikeda and Tatsuya Tokunaga, *An Alternative Topological Field Theory of Generalized Complex Geometry* (April); JHEP **0709** (2007) 009. arXiv:0704.1015 [hep-th].

07-16 Yasunari Kurita and Takao Morinari, *Formation of a sonic horizon in isotropically expanding Bose-Einstein condensates* (April); Phys. Rev. **A76** (2007) 053603. arXiv:0704.1096 [cond-mat.other].

07-17 H. Iida, H. Suganuma and T. T. Takahashi, *Scalar-quark systems and chimera hadrons in SU(3)(c) Lattice QCD* (March); Phys. Rev. **D75** (2007) 114503. hep-lat/0703019.

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07-21 Choon-Lin Ho and R Sasaki, *Quasi-exactly solvable Fokker-Planck equations* (May); Annals of Physics **323** (2008) 883-892. arXiv:0705.0863 [cond-mat].

07-22 Kunihiko Terasaki, *D(s0)+(2317) as an iso-triplet four-quark meson and production of its neutral and doubly charged partners* (April); Prog. Theor. Phys. Suppl. **168** (2007) 211-218. arXiv:0704.3299 [hep-ph].

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07-24 Toru Kojo, Daisuke Jido and Arata Hayashigaki, *Exotic hadron in pole-dominated QCD sum rules* (April); Prog. Theor. Phys. Suppl. **168** (2007) 58-61. arXiv:0704.0413 [hep-ph].

07-25 Tetsuo Hyodo, Daisuke Jido and Atsushi Hosaka, *Study of exotic hadrons in s-wave chiral dynamics* (April); Prog. Theor. Phys. Suppl. **168** (2007) 32-35. arXiv:0704.1527 [hep-ph].

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07-28 Daisuke Yamauchi and Misao Sasaki, *Brane world in arbitrary dimensions without Z(2) symmetry* (May); Prog. Theor. Phys. **118** (2007) 245-256. arXiv:0705.2443 [gr-qc].

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07-30 Christian T. Byrnes, Kazuya Koyama, Misao Sasaki and David Wands, *Diagrammatic approach to non-Gaussianity from inflation* (May); JCAP **0711** (2007) 027. arXiv:0705.4096 [hep-th].

07-31 Yoshiharu Tanaka and Misao Sasaki, *Gradient expansion approach to nonlinear superhorizon perturbations. II. A Single scalar field* (June); Prog. Theor. Phys. **118** (2007) 455-473. arXiv:0706.0678 [gr-qc].

07-32 Naoki Sasakura, *The Fluctuation spectra around a Gaussian classical solution of a tensor model and the general relativity* (June); Int. J. Mod. Phys. A **A23** (2008) 693-718. arXiv:0706.1618 [hep-th].

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07-37 Hiroyuki Abe, Yeong Gyun Kim, Tatsuo Kobayashi and Yasuhiro Shimizu, *TeV scale partial mirage unification and neutralino dark matter* (June); JHEP **0709** (2007) 107. arXiv:0706.4349 [hep-ph].

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07-39 Satoru Odake, Yamac Pehlivan and Ryu Sasaki, *Interpolation of SUSY quantum mechanics* (July); J. Phys. **A40** (2007) 11973-11986. arXiv:0707.0314 [math-ph].

07-40 Hisao Hayakawa and Michio Otsuki, *Long-time tails in freely cooling granular gases* (June); Phys. Rev. **E76** (2007) 051304. arXiv:0706.3956 [cond-mat.stat-mech].

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07-42 Ryu Sasaki, *Quasi Exactly Solvable Difference Equations* (August); J. Math. Phys. **48** (2007) 122104 (11 pages). arXiv:0708.0702[nlin:SI].

07-43 Hiroyuki Abe, Tetsutaro Higaki and Tatsuo Kobayashi, *More about F-term uplifting* (July); Phys. Rev. **D76** (2007) 105003. arXiv:0707.2671 [hep-th].

07-44 Satoru Odake and Ryu Sasaki, *Multi-Particle Quasi Exactly Solvable Difference Equations* (August); J. Math. Phys. **48** (2007) 122105. arXiv:0708.0716 [nlin.SI].

07-45 Holger B. Nielsen and Masao Ninomiya, *Search for Effect of Influence from Future in Large Hadron Collider* (July); Int. J. Mod. Phys. **A23** (2008) 919-932. arXiv:0707.1919 [hep-ph].

07-46 Ki-Seok Choi, Seung-il Nam, Atsushi Hosaka and Hyun-Chul Kim, *eta Photoproduction and N* resonances* (July); J. Phys. **G36** (2009) 015008. arXiv:0707.3854 [hep-ph].

07-47 Hiroyuki Abe, Tatsuo Kobayashi and Yuji Omura, *R-symmetry, supersymmetry breaking and metastable vacua in global and local supersymmetric theories* (August); JHEP **0711** (2007) 044. arXiv:0708.3148 [hep-th].

07-48 Makoto Kobayashi, Taichiro Kugo and Tatsuya Tokunaga, *Electric Dipole Moments of Dyon and 'Electron'* (August); Prog. Theor. Phys. **118** (2007) 921-934. arXiv:0708.1393 [hep-th].

07-49 Shin'ichi Nojiri and Sergei D. Odintsov, *Modified non-local-F(R) gravity as the key for the inflation and dark energy* (August); Phys. Lett. **B659** (2008) 821-826. arXiv:0708.0924 [hep-th].

07-50 Shinsuke Kawai and Yuji Sugawara, *D-branes in T-fold conformal field theory* (September); JHEP **0802** (2008) 027. arXiv:0709.0257 [hep-th].

07-51 Satoshi Iso, Takeshi Morita and Hiroshi Umetsu, *Higher-spin gauge and trace anomalies in two-dimensional backgrounds* (October); Nucl. Phys. **B799** (2008) 60-79. arXiv:0710.0453 [hep-th].

07-52 Seung-il Nam and Hyun-Chul Kim, *Electromagnetic form factors of the pion and kaon from the instanton vacuum* (September); Phys. Rev. **D77** (2008) 094014. arXiv:0709.1745 [hep-ph].

07-53 Andrey A. Bytsenko, *Homology and K–Theory Methods for Classes of Branes Wrapping Nontrivial Cycles* (October); arXiv:0710.0305 [hep-th].

07-54 Koji Hashimoto, Chung-I Tan and Seiji Terashima, *Glueball decay in holographic QCD* (September); Phys. Rev. **D77** (2008) 086001. arXiv:0709.2208 [hep-th].

07-55 Takeshi Higashi, Etsuko Itou and Taichiro Kugo, *The BV Master Equation for the Wilson Action in general Yang-Mills Gauge Theory* (September); Prog. Theor. Phys. **118** (2007) 1115-1125. arXiv:0709.1522 [hep-th].

07-56 Satoshi Iso, Takeshi Morita and Hiroshi Umetsu, *Hawking radiation via higher-spin gauge anomalies* (October); Phys. Rev. **D77** (2008) 045007. arXiv:0710.0456 [hep-th].

07-57 Hiroyuki Abe and Yutaka Sakamura, *Moduli stabilization in 5D gauged supergravity with universal hypermultiplet and boundary superpotentials* (September); Nucl. Phys. **B796** (2008) 224-245. arXiv:0709.3791 [hep-th].

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07-60 Ki-Seok Choi, Seung-il Nam, Atsushi Hosaka and Hyun-Chul Kim, *A New nucleon resonance in eta photoproduction* (October); To appear in the Proc. of NSTAR07, 5-8 Sep 2007. arXiv:0710.2185 [hep-ph].

07-61 Naoki Sasakura, *The Lowest modes around Gaussian solutions of tensor models and the general relativity* (October); Int. J. Mod. Phys. **A23** (2008) 3863-3890. arXiv:0710.0696 [hep-th].

07-62 Hiroyuki Hata and Masaki Murata, *Baryons and the Chern-Simons term in holographic QCD with three flavors* (October); Prog. Theor. Phys.**119** (2008) 461-490. arXiv:0710.2579 [hep-th].

07-63 Ryu Sasaki, *New Quasi Exactly Solvable Difference Equation* (December); Proc. of NEEDS2007, Int. J. Nonlinear Math. Phys. **15** Supplement **3** (2008) 363-374. arXiv:0712.2616 [nlin.SI].

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07-65 Teiji Kunihiro and Kyosuke Tsumura, *Application of the renormalization-group method to the reduction of transport equations* (December); J. Phys. **A39** (2006) 8089-8104. hep-th/0512108.

07-66 Seung-il Nam and Hyun-Chul Kim, *Pion electromagnetic charge radii and rho-meson mass shift at finite density* (January); Submitted to Phys.Lett.B. arXiv:0801.4653 [hep-ph].

07-67 Sinya Aoki, Hidenori Fukaya, Shoji Hashimoto and Tetsuya Onogi, *Theta vacuum physics from QCD at fixed topology* (October); PoS LAT2007 (2007) 080. arXiv:0710.4469 [hep-lat].

07-68 Jinn-Ouk Gong, *The lessons from the running of the tensor-to-scalar ratio* (October); arXiv:0710.3835 [astro-ph].

07-69 Hisao Hayakawa and Michio Otsuki, *Mode-coupling theory of sheared dense granular liquids* (October); Prog. Theor. Phys. **119** (2008) 381-402. arXiv:0710.4188 [cond-mat.stat-mech].

07-70 Takeshi Higashi, Kiyoshi Higashijima and Etsuko Itou, *Supersymmetric three dimensional conformal sigma models* (October); To appear in the proc. of SUSY07, Karlsruhe, Germany, 26 Jul-1 Aug 2007. arXiv:0710.4604 [hep-th].

07-71 Keitaro Takahashi, Kiyotomo Ichiki and Naoshi Sugiyama, *Electromagnetic Properties of the Early Universe* (October); Phys. Rev. **D77** (2008) 124028. arXiv:0710.4620 [astro-ph].

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07-73 Shin'ichi Nojiri, Sergei D. Odintsov and Petr V. Tretyakov, *From inflation to dark energy in the non-minimal modified gravity* (October); Prog. Theor. Phys. Suppl. **172** (2008) 81-89. arXiv:0710.5232 [hep-th].

07-74 Masakiyo Kitazawa, Teiji Kunihiro, Kazuya Mitsutani, and Yukio Nemoto, *Spectral properties of massless and massive quarks coupled with massive boson at finite temperature* (October); Phys. Rev. **D77** (2008) 045034. arXiv:0710.5809 [hep-ph].

07-75 Hiroshi Ohki, Hideo Matsufuru and Tetsuya Onogi, *High precision study of B*B pi coupling in unquenched QCD* (November); PoS LAT 2007 (2007) 365. arXiv:0711.0245 [hep-lat].

07-76 Nathalie Deruelle, Misao Sasaki and Yuuiti Sendouda, *Junction conditions in f(R) theories of gravity* (November); Prog. Theor. Phys. **119** (2008) 237-251. arXiv:0711.1150 [gr-qc].

07-77 Chul-Moon Yoo, Hideki Ishihara, Ken-ichi Nakao and Hideyuki Tagoshi, *Magnification Probability Distribution Functions of Standard Candles in a Clumpy Universe* (November); Prog. Theor. Phys. **120** (2008) 961-983. arXiv:0711.2720 [astro-ph].

07-78 Yuya Sasai and Naoki Sasakura, *Domain wall solitons and Hopf algebraic translational symmetries in noncommutative field theories* (November); Phys. Rev. **D77** (2008) 045033. arXiv:0711.3059 [hep-th].

07-79 Kenji Fukushima, *Randomness in infinitesimal extent in the McLerran-Venugopalan model* (November); Phys. Rev. **D77** (2008) 074005. arXiv:0711.2364 [hep-ph].

07-80 K. Shizuya *Static structure factor for graphene in a magnetic field* (November); Phys. Rev. **B77** (2008) 075419. arXiv:0711.4233 [cond-mat.mes-hall].

07-81 Holger Bech Nielsen and Masaao Ninomiya, *Complex action, prearrangement for future and Higgs broadening* (November); Published in *Bled 2007, What comes beyond the standard model* 144-185. arXiv:0711.3080 [hep-ph].

07-82 Tetsuji Kimura, Mitsuhisa Ohta and Kei-Jiro Takahashi, *Type IIA orientifolds and orbifolds on non-factorizable tori* (December); Nucl. Phys. **B798**

(2008) 89-123. arXiv:0712.2281 [hep-th].

07-83 D. Jido, M. Doering and E. Oset, *Transition form factors of the N*(1535) as a dynamically generated resonance* (December); Phys. Rev. **C77** (2008) 065207. arXiv:0712.0038 [nucl-th].

07-84 Nobuyuki Sakai and Misao Sasaki, *Stability of Q-balls and Catastrophe* (December); Prog. Theor. Phys. **119** (2008) 929-937. arXiv:0712.1450 [hep-ph].

07-85 S. Aoki, H. Fukaya, S. Hashimoto, J. Noaki, T. Kaneko, H. Matsufuru, T. Onogi, N. Yamada, for the JLQCD Collaboration, *BK with two flavors of dynamical overlap fermions* (January); Phys. Rev. **D77** (2008) 094503. arXiv:0801.4186 [hep-lat].

07-86 Pierre Binetruy, Misao Sasaki and Kunihito Uzawa, *Dynamical D4-D8 branes in supergravity* (December); arXiv:0712.3615 [hep-th].

07-87 Antonino Flachi and Takahiro Tanaka, *Vacuum polarization in asymptotically anti-de Sitter black hole geometries* (March); Phys. Rev. **D78** (2008) 064011. arXiv:0803.3125 [hep-th].

07-88 H. T. Ueda and K. Totsuka, *Ground-state phase diagram and magnetic properties of a tetramerized spin-1/2 J_1-J_2 model: BEC of bound magnons and absence of the transverse magnetization* (March); Phys. Rev. **B76** (2007) 214428. arXiv:0710.0463 [cond-mat.str-el].

07-89 Seung-il Nam and Hyun-Chul Kim, *Magnetic susceptibility of QCD vacuum at finite density from the nonlocal chiral quark model* (December); Mod. Phys. Lett. **A23** (2008) 2360. arXiv:0712.2151 [hep-ph].

07-90 Hiroyuki Abe, Tatsuo Kobayashi and Yuji Omura, *Metastable supersymmetry breaking vacua from conformal dynamics* (December); Phys. Rev. **D77** (2008) 065001. arXiv:0712.2519 [hep-ph].

07-91 Satoru Odake and Ryu Sasaki, *Orthogonal Polynomials from Hermitian Matrices* (December); J. Math. Phys. **49** (2008) 053503. arXiv:0712.4106 [math.CA].

07-92 K.-I. Izawa, *Marginally Eternal Inflation* (February); hep-ph/0702127.

07-93 K.-I. Izawa and Y. Shinbara, *Supersymmetric tuned inflation* (October); arXiv:0710.1141 [hep-ph].

07-94 K. Hamaguchi,K.-I. Izawa and H. Nakajima, *Supersymmetric Inflation of Dynamical Origin* (January); Phys. Lett. **B662** (2008) 208-212. arXiv:0801.2204 [hep-ph].

07-95 Tetsuo Hyodo and Wolfram Weise, *Effective anti-K N interaction based on chiral SU(3) dynamics* (December); Phys. Rev. **C77** (2008) 035204. arXiv:0712.1613 [nucl-th].

07-96 Seung-il Nam and Hyun-Chul Kim, *Pion electromagnetic form-factor at finite density* (December); Submitted to Proc. of the workshop on Strangeness in Multi-Quark Systems, Sendai, Japan, 26-28 Nov 2007. arXiv:0712.3346 [hep-ph].

07-97 Tetsuo Hyodo, Daisuke Jido and Luis Roca, *Structure of the (1405) baryon resonance from its large N(c) behavior* (December); Phys. Rev. **D77** (2008) 056010. arXiv:0712.3347 [hep-ph].

07-98 Hiroyuki Abe, Tetsutaro Higaki, Tatsuo Kobayashi and Yuji Omura, *Dynamically sequestered F-term uplifting in extra dimension* (January); JHEP **0804** (2008) 072. arXiv:0801.0998 [hep-th].

07-99 Holger B. Nielsen and Masao Ninomiya, *Test of Influence from Future in Large Hadron Collider: A Proposal* (February); arXiv:0802.2991 [physics.gen-ph].

2.3.2 Publications and Talks by Regular Staff (April 2007 — March 2008)

Tohru Eguchi

Journal Papers

1. T. Eguchi and Y. Tachikawa,
   Rigid limit in N=2 supergravity and weak-gravity conjecture,
   JHEP **0708** (2007) 068.
2. T. Eguchi and Y. Tachikawa,
   Geometric engineering limit and weak gravity conjecture,
   Int. J. Mod. Phys. **A23** (2008) 2067-2073.

Talks at International Conferences

1. Rigid Limit of N=2 Supergravity and Weak Gravity Conjceture,
   Conference in honor of C.N. Yang ’s 85th Birthday, Singapore, 10/31-11/3, 2007.
2. Geometric engineering limit and weak gravity conjecture,
   at “ Workshop on Progress of String Theory and Quantum Field Theory, ” 7-10 Dec 2007, Osaka, Japan.

Invited Seminars (in Japan)

1. Superstring Theory and Mysteries of Universe (in Japanese),
   University of Tokyo, Open Lectures, 20 April 2007.
2. Superstring Theory and Eisnstein’s Dream (in Japanese),
   Review Lecture of Japan Physical Society Meeting, Hokkaido University, Sapporo, 23 September 2007.

Kenji Fukushima

Journal Papers

1. K. Fukushima,
   Randomness in infinitesimal extent in the McLerran-Venugopalan model,
   Phys. Rev. **D77** (2008) 074005, (9 pages), arXiv:0711.2364 [hep-ph], YITP-07-79.
2. K. Fukushima,
   Phase diagrams in the three-flavor Nambu-Jona-Lasinio model with the Polyakov loop,
   Phys. Rev. **D77** (2008) 114028, (17 pages), arXiv:0803.3318 [hep-ph], YITP-08-19.

Talks at International Conferences

1. McLerran-Venugopalan model in the heavy-ion collision,
   Hadron Physics at RHIC, Invited, 3–14 Dec. 2007, APCTP, Pohan, Korea.
2. Chiral symmetry and heavy-ion collisions,
   The 20th International Conference on Ultra-Relativistic Nucleus Nucleus Collisions (Quark Matter 2008), Plenary, 4–10 Feb. 2008, Jaipur, India.

Invited Seminars (Overseas)

1. Deconfinement in hot and dense QCD (lecture),
   APCTP, 12 Dec. 2007, Pohan, Korea.

Invited Seminars (in Japan)

1. Problems in the numerical implementation of the Color Glass Condensate model (in Japanese),
   7 Nov. 2007, Dept. Physics, Univ. of Tokyo-Komaba.

Hisao Hayakawa

Journal Papers

1. Hisao Hayakawa and Michio Otsuki,
   Long-time tails in freely cooling granular gases,
   Phys. Rev. E **76** (2007) 051304 (11pages).
2. Hisao Hayakawa and Michio Otsuki,
   Mode-coupling theory of sheared dense granular liquids,
   Prog. Theor. Phys. **119** (2008) 381-402.

Talks at International Conferences

1. Long time tails of granular gases,
   16 November 2007, Japan-Solvenia joint seminar, Kyoto, Japan.
2. Universal description of jamming and glass transition,
   Invited, 22–24 November 2007, Fukuoka International Workshop on Unifying Concepts of Glass Transition, Fukuoka, Japan.

3. The long-time tails in granular fluids, 29–30, November 2007, Symposium on "50th anniversary of Alder transition", Kanazawa, Japan.
4. Rheology of solids, liquids and gases, Invited, 28 January–21 March, New Frontiers in QCD 2008: Fundamental problems in hot and/or dense matter, Kyoto, Japan.

Invited Seminars (in Japan)

1. Long-tails, Jamming and Glass Transition, 2 October 2007, 21st COE symposium, Kyoto University, Kyoto.
2. Kinetics of nonequilibrium systems, 12–14 December 2007, (series lecture), Dep. of Physics, the Univeristy of Tokyo.
3. Long-time tails of particle systems, 11 January 2008, Dep. of Physics, Chuo University, Tokyo.
4. Mode-coupling theory for dense granular liquids, 22 February 2008, Earthquarke research institute, the University of Tokyo, Tokyo.

Ken-Iti Izawa

Journal Papers

1. K. Hamaguchi, K.-I. Izawa, and H. Nakajima, Supersymmetric Inflation of Dynamical Origin, Phys. Lett. **B662** (2008) 208-212, arXiv:0801.2204 [hep-ph], YITP-07-94.

Daisuke Jido

Journal Papers

1. T. Hyodo, D. Jido and L. Roca, Structure of the $\Lambda(1405)$ baryon resonance from its large N_c behavior, Phys. Rev. D **77** (2008) 056010, (5 pages), arXiv:0712.3347 [hep-ph], YITP-07-97.

Books and Proceedings

1. T. Kunihiro, H. En'yo, M. Harada, T. Hatsuda, A. Hosaka, D. Jido, Y. Kanada-En'yo, S.H. Lee, A. Nakamura, T. Nakano, M. Oka and H. Suganuma, New frontiers in QCD: Exotic hadrons and hadronic matter, Prog. Theor. Phys. Suppl. **168** (2007), proceedings of Yukawa International Seminar, YKIS 2006, Kyoto, Japan, November 20-December 8, 2006.
2. E. Oset, M. Doring, D. Strottman, D. Jido, M. Napsuciale, K. Sasaki, C.A. Vaquera-Araujo, M. Kaskulov, E. Hernandez, H. Nagahiro, S. Hirenzaki, Photo- and Electron-Production of Mesons on Nucleons and Nuclei, Prog. Part. Nucl. Phys. **61** (2008) 260-275, proceedings of International School of Nuclear Physics: 29th Course: Quarks in Hadrons and Nuclei, Erice, Sicily, Italy, 16-24 Sep 2007.

Talks at International Conferences

1. The $A_{1/2}$, $S_{1/2}$ form factors of the $N(1535)$ as a dynamically generated resonance, the Second International Workshop on "Eta Meson Physics (ETA07)," Plenary, May 10 - May 11, 2007, Peniscola, Spain.
2. In-medium properties of $N(1535)$ probed by eta-mesic nuclei and chiral symmetry for baryon resonances, International Workshop on Nuclear Physics at J-PARC, Pre-symposium of INPC2007, June 1-2, 2007, Tokai, Ibaraki, Japan.
3. In-medium properties of pion and partial restoration of chiral symmetry in nuclear medium, International Nuclear Physics Conference (INPC2007), June 3 - June 8, 2007, Tokyo International Forum, Tokyo, Japan.
4. Structure of $N(1535)$ in the aspect of chiral symmetry, Workshop on "Chiral Symmetry in Hadron and Nuclear Physics: Chiral07," Invited, 13-16 Nov 2007, Osaka, Japan.
5. Structure of $N(1535)$ in the aspect of chiral symmetry, Workshop on "Hadron Physics at RHIC," Plenary, 3–14 December, 2007, PosTech, Korea.

Invited Seminars (in Japan)

1. Baryon resonances in chiral dynamics with coupled channel approach (in Japanese), 30 October 2007, Nagoya University.
2. η mesic nuclei and in-medium properties of $N(1535)$ (in Japanese), 14 June 2007, Riken.

Yoshiko Kanada-En'yo

Journal Papers

1. A. Doté, Y. Kanada-En'yo, H. Horiuchi, Y. Akaishi and K. Ikeda,
   Explicit Treatment of the Tensor Force with the Method of Antisymmetrized Molecular Dynamics,
   Prog. Theor. Phys. **115** (2006) 1069-1092.
2. Y. Kanada-En'yo,
   Negative parity states of ^{11}B and ^{11}C and the similarity with ^{12}C,
   Phys. Rev. C **75** (2007) 024302 (7 pages).
3. T. Kawabata et al.,
   $2\alpha + t$ cluster structure in ^{11}B,
   Phys. Lett. **B646** (2007) 6-11.
4. Yoshiko Kanada-En'yo and Berndt Muller,
   Suppression of p-wave baryons in quark recombination,
   Phys. Rev. C **74**, (2006) 06190(R) (3 pages).
5. W. von Oertzen, M. Freer and Y. Kanada-En'yo,
   Nuclear clusters and nuclear molecules,
   Phys. Rep. **432** (2006) 43-113.
6. Y. Kondo, O. Morimatsu, T. Nishikawa and Y. Kanada-En'yo,
   Positive and negative-parity flavor-octet baryons in coupled QCD sum rules,
   Phys. Rev. D **75** (2007) 034010 (7 pages).
7. Y. Kanada-En'yo,
   Structure of Ground and Excited States of ^{12}C,
   Prog. Theor. Phys. **114** (2007) 655-680.
8. Y.Taniguchi, M.Kimura, Y.Kanada-En'yo, H.Horiuchi,
   Coexistence of cluster structure and mean-field-type structure in medium-weight nuclei,
   Nucl. Phys. A**787**, 547c-552c (2007).
9. Y. Kanada-En'yo, O. Morimatsu and T. Nishikawa,
   Axial Vector Tetraquark with Two s-quarks,
   Prog. Theor. Phys. Suppl. No.**168**, 194-197 (2007).
10. T. Nishikawa, Y. Kondo, O. Morimatsu and Y. Kanada-En'yo,
    Pentaquarks in QCD Sum Rules,
    Prog. Theor. Phys. Suppl. No.**168**, 54-57 (2007).
11. Y. Kanada-En'yo,
    Cluster aspect of light unstable nuclei,
    Nucl. Phys. A**805**, 392c-399c(2008).
12. Y. Kanada-En'yo,
    Dineutron structure in 8He,
    Phys. Rev. C**76**, 044323 (10 pages) (2007).
13. Y. Taniguchi, M. Kimura, Y. Kanada-En'yo and H. Horiuchi,
    Triaxiality and Clustering in 40Ca,
    Phys. Rev. C**76**, 044317 (10 pages) (2007).
14. M. Takashina and Y. Kanada-En'yo,
    Inelastic proton scattering and neutron quadrupole transitions of 12Be,
    Phys.Rev.C **77**, 014604 (6 pages) (2008).
15. N. Furutachi, M. Kimura, A. Doté, Y. Kanada-En 'yo and S. Oryu,
    Cluster Structures in Oxygen isotopes,
    Prog. Theor. Phys. **119**,403-420 (2008) .

Books and Proceedings

1. Y. Kanada-En'yo,
   Three-center clustering in ^{11}C and ^{13}C,
   proceedings of Osaka Spring Workshop on Cluster Condensation and Nucleon Correlation in Nuclei, Apr. 2006, Osaka, Japan, Mod. Phys. Lett. **A21** (2006) 2403-2409.
2. Y. Kanada-En'yo and M. Kimura,
   Clster aspect in unstable nuclei in p-shell and sd-shell regions,
   Proceedings of International Conference on Frontiers of Nuclear Structure (NS 2006), June 2006, Shanghai, China,
   Int. J. Mod. Phys. E **15** (2006) 1541-1548.
3. Y. Kanada-En'yo, Y. Taniguchi and M. Kimura,
   Cluster structure in light neutron-rich nuclei,
   Jour. Phys. Conference series **111** 012002 (6 pages) (2008). The 9th international conference on "clustering aspects of nuclear structure and dynamics"(Cluster07), Stratford upon Avon, UK, September 3-7, 2007.

Talks at International Conferences

1. Three-center clustering in ^{11}C and ^{13}C,
   Osaka Spring Workshop on "Cluster Condensation and Nucleon Correlation in Nuclei", 26 - 28 April 2006, Osaka, Japan.
2. Clster aspect in unstable nuclei in p-shell and sd-shell regions,
   International Conference on Frontiers of Nuclear Structure (NS 2006), Invited, 12-17 June 2006, Shanghai, China.

3. ^{12}C 2nd 0+ state and its family in the vicinity,
   Workshop on Cluster and nuclear force in light nuclei, 25 Sep. 2006, Osaka, Japan.
4. ^{12}C 2nd 0+ state and its family in the vicinity,
   2nd German-Japanese Workshop on Nuclear Structure and Astrophysics, Invited, 4-7 October 2006, RIKEN, Japan.
5. Axial Vector Tetraquark with Two s-quarks,
   Yukawa International Seminar (YKIS) 2006 on "New Frontiers in QCD", 20 November-8 December 2006, Kyoto, Japan.
6. Cluster aspect of light unstable nuclei,
   The International Nuclear Physics Conference (INPC2007), Tokyo Japan, June 308, 2007 (invited).
7. Excited states of B and C isotopes and their cluster aspect,
   The International Symposium on Physics of Unstable Nuclei(ISPUN07), Hoi An, Vietnam, July 3-7, 2007 (invited).
8. Cluster structure in light neutron-rich nuclei,
   The Cluster Conference(Cluster07), Stratford upon Avon, September 3-7, 2007 (invited).
9. Cluster Model Calculations,
   International Joint Workshop, LACM-EFES-JUSTIPEN Meeting Oak Ridge, USA, January 23-25, 2008 (invited).

Invited Seminars (in Japan)

1. Lecture series "Cluster structures in Nuclei" (in Japanese),
   10-12 October 2007, Dept. Physics, Kyushu University, Fukuoka.

Taichi Kugo

Journal Papers

1. Makoto Kobayashi, Taichiro Kugo and Tatsuya Tokunaga,
   Electric Dipole Moments of Dyon and 'Electron',
   Prog. Theor. Phys. **118** (2007) 921 – 934. arXiv:0708.1393 [hep-th]. YITP-07-48.
2. Takeshi Higashi, Etsuko Itou and Taichiro Kugo,
   The BV Master Equation for the Wilson Action in General Yang-Mills Gauge Theory,
   Prog. Theor. Phys. **118** (2007) 1115 – 1125. arXiv:0709.1522[hep-th]. YITP-07-55.

Invited Seminars (in Japan)

1. Electric Dipole Moment of Dyon and 'Electron' (in Japanese),
   23 March 2008, JPS Annual Meeting, Kinki University.

Hiroshi Kunitomo

Journal Papers

1. H. Kunitomo, Shun'ya Mizoguchi,
   Lower-dimensional superstrings in the double-spinor formalism,
   Prog. Theor. Phys. **117** (2007) 765-793, hep-th/0612183, YITP-06-67.
2. H. Kunitomo, Shun'ya Mizoguchi,
   Lorentz anomaly in the semi-light-cone gauge superstrings,
   Prog. Theor. Phys.**118** (2007) 559-576, arXiv:0706.3982 [hep-th], YITP-07-38.

Talks at International Conferences

1. Lorentz anomaly in the lower-dimensional double-spinor superstrings,
   Japan Physical Society Annual Meeting, Autum 2007, 21 September, Hokkaido University.

Shin Mineshige

Journal Papers

1. N. Kawanaka, Y. Kato, and S. Mineshige,
   X-Ray emissions from Three-Dimensional Magneto-hydrodynamic Coronal Accretion Flow,
   Pub. Astron. Soc. Japan **60** (2008) 399-405.
2. R. Kawabata, S. Mineshige, and N. Kawanaka,
   Coronal Neutrino Emission in Hypercritical Accretion Flows,
   Astrophys. J. **675** (2008) 596-603.
3. K. Ohsuga, and S. Mineshige,
   Why Is Supercritical Disk Accretion Feasible?,
   Astrophys. J. **670** (2007) 1283-1290.

4. P. Hut, S. Mineshige, D. C. Heggie, and J. Makino,
   Modeling Dense Stellar Systems,
   Prog. Theor. Phys. **118** (2007) 187-209.
5. D. C. Heggie, P. Hut, S. Mineshige, J. Makino, and H. Baumgardt,
   The Core Radius of a Star Cluster Containing a Massive Black Hole,
   Pub. Astron. Soc. Japan **59** (2007) L11-L14.
6. N. Kawanaka and S. Mineshige,
   Neutrino-cooled Accretion Disk and Its Stability,
   Astrophys. J. **662** (2007) 1156-1166.

Books and Proceedings

1. S. Kato, J. Fukue, and S. Mineshige,
   Black-Hole Accretion Flow: Towards a New Paradigm,
   Kyoto University Press (2008) 550 pages. ISBN978–87698-740-5.
2. K. Koyama, and S. Mineshige (ed.),
   Black Holes and High-Energy Phenomena,
   Nihon-Hyoronsha (2008) 244 pages. (in Japanese) ISBN978-4-535-60728-6.

Talks at International Conferences

1. Black Hole Accretion: Overview,
   APPC10 (10th Asia Pacific Physics Conferences), Invited lecture, 21–24 August 2007, Pohang (APCTP), Korea.
2. Modeling Super-Eddington Accretion Flow,
   International conference, "Hot Disk and Cool Flow", Invited talk, 25–29 March 2008, Funadesladen, Sweden.

Takao Morinari

Journal Papers

1. T. Morinari,
   Strong coupling analysis of QED_3 for excitation spectrum broadening in undoped high-temperature superconductor,
   Phys. Rev. B **77** (2008) 075128, (5 pages), arXiv:0709.4550 [cond-mat].
2. Y. Kurita and T. Morinari,
   Formation of a sonic horizon in isotropically expanding Bose-Einstein condensates,
   Phys. Rev. A **76** (2007) 053603, (6 pages), arXiv:0704.1096 [cond-mat], YITP-07-16.

Books and Proceedings

1. T. Morinari,
   Chiral spin texture scenario for high-temperature superconductivity,
   Physica C **460** (2007) 1000-01.

Masatoshi Murase

Journal Papers

1. M. Murase,
   Environmental pollution and health: an interdisciplinary study of the bioeffects of electromagnetic fields,
   SANSAI: An Environmental Journal for the Global Community. Kyoto University No.3, (2008) 1-35.

Shigehiro Nagataki

Journal Papers

1. Junichi Aoi, Kohta Murase, and Shigehiro Nagataki,
   The Effect of Energy Amplification Variance on Shock Acceleration,
   Monthly Nortice of the Royal Astronomical Society **383** (2008) 1431-1438.
2. Taishi Okita, Shigehiro Nagataki, Yasufumi Kojima,
   Nonrelativistic and Relativistic Treatments for Propagation of Torsional Resonant Alfven Waves in Strongly Magnetized Neutron Stars,
   Progress of Theoretical Physics **119** (2008) 39-58.
3. Fabio Iocco, Kohta Murase, Shigehiro Nagataki, Pasquale. D. Serpico,
   High Energy Neutrino Signals from the Epoch of Reionization,
   Astrophys. J. **675** (2008) 937-945.
4. Kohta Murase, Katsuaki Asano, Shigehiro Nagataki,
   Effects of the Cosmic Infrared Background on Delayed High-Energy Emission from Gamma-Ray Bursts,
   Astrophys. J. **671** (2007) 1886-1895.
5. Kunihito Ioka, Kohta Murase, Kenji Toma, Shigehiro Nagataki, Takashi Nakamura,
   Unstable GRB Photosphere and e^+e^- Annihilation Lines,
   Astrophys. J. **670** (2007) L77-L80.

6. Shigehiro Nagataki, Rohta Takahashi, Akira Mizuta, Tomoya Takiwaki,
Numerical Study on GRB-Jet Formation in Collapsars,
Astrophys. J. **659** (2007) 512-529.

Books and Proceedings

1. Shigehiro Nagataki, Rohta Takahashi, Akira Mizuta, Tomoya Takiwaki,
Toward Understainding the Central Engine of Long GRBs,
SUPENOVA 1987A:20 YEARS AFTER: Supernovae and Gamma-Ray Bursters. AIP Conference Proceedings 937, Melville, New York, (2007) p.500-507.
2. Kohta Murase, Shigehiro Nagataki,
High Energy Neutrino Emission and Neutrino Background from Internal Shocks of GRB,
AIP Conference Proceedings 903, Melville, New York, (2007) p.630-633.
3. Shigehiro Nagataki, Rohta Takahashi, Akira Mizuta, and Tomoya Takiwaki,
Numerical simulations of collapsars with neutrino heating and magnetic field,
Proceedings of Swift and GRBs: Unveiling the Relativistic Universe, Societa Italiana di Fisica, (2007), p.1139-1144.
4. Akira Mizuta, Tetsuya Yamasaki, Shigehiro Nagataki, and Shin Mineshige,
Collimated Jet or Expanding Outflow: Possible origins of GRBs and X-ray flashes,
Proceedings of Swift and GRBs: Unveiling the Relativistic Universe, Societa Italiana di Fisica, (2007), p.1523-1524.
5. Kohta Murase and Shigehiro Nagataki,
New Prospects for high-energy neutrinos from gamma-ray bursts,
Proceedings of Swift and GRBs: Unveiling the Relativistic Universe, Societa Italiana di Fisica, (2007), p.1529-1530.

Talks at International Conferences

1. Numerical Study on the Central Engine of Long GRBs,
YongPyong 2008 Astrophysics, Invited, 25-27 February 2008, YongPyong, Korea.

Invited Seminars (Overseas)

1. Numerical Study on the Central Engine of Long GRBs,
KIPAC Tea Talk, 22th February 2008, Kavli Institute for Particle Astrophysics, Stanford Univ., USA.

Invited Seminars (in Japan)

1. Neutrino Astronomy (in Japanese),
9th December 2007, Dept. Physics, Konan Univ., Kobe.

Tetsuya Onogi

Journal Papers

1. S. Aoki, H. Fukaya, S. Hashimoto and T. Onogi,
Finite volume QCD at fixed topological charge,
Phys. Rev. D **76**, 054508 (2007) arXiv:0707.0396 [hep-lat].
2. H. Fukaya *et al.*,
Two-flavor lattice QCD in the epsilon-regime and chiral Random Matrix Theory,
Phys. Rev. D **76**, 054503 (2007) arXiv:0705.3322 [hep-lat].

Books and Proceedings

1. S. Aoki, H. Fukaya, S. Hashimoto and T. Onogi,
Theta vacuum physics from QCD at fixed topology,
PoS **LAT2007**, 080 (2007) arXiv:0710.4469 [hep-lat].
2. H. Ohki, H. Matsufuru and T. Onogi,
High precision study of B*B pi coupling in unquenched QCD,
PoS **LAT2007**, 365 (2007) arXiv:0711.0245 [hep-lat].

Talks at International Conferences

1. Should we change the topology at all?,
invited talk at Workshop on Domain Wall Fermions at Ten Years, March 15-17, 2007, Brookhaven National Laboratory (BNL).

Invited Seminars (in Japan)

1. Nucleon sigma term from lattice QCD,
30 October 2007, theory group, KEK, Tsukuba.

Misao Sasaki

Journal Papers

1. N. Deruelle, M. Sasaki and Y. Sendouda,
   Junction Conditions in f(R) Theories of Gravity,
   Prog. Theor. Phys. **119**, 237 (2008) [arXiv:0711.1150 [gr-qc]].
2. S. Kanno, D. Langlois, M. Sasaki and J. Soda,
   Kaluza-Klein braneworld cosmology with static internal dimensions,
   Prog. Theor. Phys. **118**, 701 (2007) [arXiv:0707.4510 [hep-th]].
3. Y. Tanaka and M. Sasaki,
   Gradient expansion approach to nonlinear superhorizon perturbations II – a single scalar field –,
   Prog. Theor. Phys. **118**, 455 (2007) [arXiv:0706.0678 [gr-qc]].
4. D. Yamauchi and M. Sasaki,
   Brane World in Arbitrary Dimensions Without Z_2 Symmetry,
   Prog. Theor. Phys. **118**, 245 (2007) [arXiv:0705.2443 [gr-qc]].
5. C. T. Byrnes, K. Koyama, M. Sasaki and D. Wands,
   Diagrammatic approach to non-Gaussianity from inflation,
   JCAP **0711**, 027 (2007) [arXiv:0705.4096 [hep-th]].
6. M. Sasaki,
   Nonlinear curvature perturbations in an exactly soluble model of multi-component slow-roll inflation,
   Class. Quant. Grav. **24**, 2433 (2007) [arXiv:astro-ph/0702182].
7. Y. Tanaka and M. Sasaki,
   Gradient expansion approach to nonlinear superhorizon perturbations,
   Prog. Theor. Phys. **117**, 633 (2007) [arXiv:gr-qc/0612191].

Talks at International Conferences

1. Black Hole Perturbation Approach to Gravitational Waves from Extreme Mass Ratio Binaries (I), (II),
   APCTP Focus Program on "New Frontiers in Black Hole Physics," Invited Lectures, 2–13 June 2007, Pohang, Korea.
2. δN formalism for curvature perturbations,
   Perimeter Institute Conference on "Frontiers of Modern Cosmology," Invited talk, 10–14 September 2007, Waterloo, Canada.
3. Kaluza-Klein braneworld cosmology,
   KITPC Program on "String Theory and Cosmology (The 9th week)," Invited talk, 5–9 November 2007, Beijing, China.
4. Inflationary perturbations and black hole formation (1), (2),
   2008 Taitung International School/Workshop on "Cosmology and Gravitation," Invited lectures, 7–10 January 2008, Taitung, Taiwan.
5. Nonlinear curvature perturbations in two-field hybrid inflation – δN in exactly soluble models –,
   CIfAR/SITP/KIPAC Conference, Invited talk, 5–9 March 2008, Stanford, United States.

Invited Seminars (Overseas)

1. δN formalism for cosmological curvature perturbations,
   Department of Physics, University of Barcelona,
   19 October 2007, Barcelona, Spain.
2. Seminar on Inflation,
   Korea Institute for Advanced Study,
   13 November 2007, Seoul, Korea.
3. δN formalism for cosmological curvature perturbations,
   Center for Quantum SpaceTime (CQUeST), Sogang University,
   14 November 2007, Seoul, Korea.
4. Kaluza-Klein braneworld cosmology,
   Institute of Space Sciences (ICE),
   27 February 2008, Barcelona, Spain.

Invited Seminars (in Japan)

1. Black hole perturbation approach to EMRIs (in Japanese).
   27 July 2007, Waseda University Seminar House, Matsudai.
2. Cosmological perturbations from inflation (in Japanese).
   28 July 2007, Waseda University Seminar House, Matsudai.
3. Kaluza-Klein Braneworld Cosmology.
   29 November 2007, Kobe University, Kobe.

Ryu Sasaki

Journal Papers

1. C-L. Ho and R. Sasaki,
   Quasi-exactly solvable Fokker-Planck equations,
   Annals of Physics **323** (2008) 883-892. arXiv:0705.0863 [cond-mat], YITP-07-21.
2. S. Odake and R. Sasaki,
   Exact Heisenberg operator solutions for multi-particle quantum mechanics,
   J. Math. Phys. **48** (2007) 082106, (12 pages), arXiv:0706.0768 [quant-ph], YITP-07-26.
3. S. Odake, Y. Pehlivan and R. Sasaki,
   Interpolation of SUSY quantum mechanics,
   J. Phys. **A40** (2007) 11973-11986, arXiv:0707.0314[math-ph], YITP-07-39.
4. R. Sasaki,
   Quasi Exactly Solvable Difference equations,
   J. Math. Phys. **48** (2007) 122104 (11 pages), arXiv:0708.0702[nlin:SI], YITP-07-42.
5. S. Odake and R. Sasaki,
   Multi-Particle Quasi Exactly Solvable Difference equations,
   J. Math. Phys. **48** (2007) 122105 (8 pages), arXiv:0708.0716[nlin:SI], YITP-07-44.
6. S. Odake and R. Sasaki,
   q-oscillator from the q-Hermite polynomial,
   Phys. Lett. **B663** (2008) 141-145, arXiv:0710.2209 [hep-th], YITP-07-64.
7. R. Sasaki,
   New quasi exactly solvable difference equation,
   Proceedings of NEEDS2007, Int. J. Nonlinear Math. Phys., **15** Supplement **3** (2008) 363-374, arXiv:0712.2616[nlin.SI], YITP-07-63.
8. S. Odake and R. Sasaki,
   Orthogonal Polynomials from Hermitian Matrices,
   J. Math. Phys. **49** (2008) 053503 (43 pages), arXiv:0712.4106[math.CA], YITP-07-91.
9. S. Odake and R. Sasaki,
   Exactly solvable 'discrete' quantum mechanics; shape invariance, Heisenberg solutions, annihilation-creation operators and coherent states,
   Prog. Theor. Phys. **119** (2008) 663-700, arXiv:0802.1075[quant-ph], YITP-08-01.

Talks at International Conferences

1. Heisenberg operator solutions for Calogero systems,
   NEEDS 2007 Workshop "Nonlinear Evolution Equations and Dynamical Systems," Plenary, 16–23 June 2007, L'Ametlla de Mar, Spain.

Invited Seminars (Overseas)

1. q-oscillator from q-Hermite polynomials,
   Physics Group, SISSA, 19 November 2007, Trieste, Italy.

2. Orthogonal Polynomials from Hermitian Matrices,
   Department of Physics, National Chao Tung University,
   19 February 2008, Hsinchu, Republic of China.

Invited Seminars (in Japan)

1. Modern Mathematics and Integrable Models seen from Physics (in Japanese),
   Physics Dept. National Defense Academy of Japan, 23 May 2007, Yokosuka.
2. Exact Heisenberg operator solutions for multi-particle quantum mechanics (in Japanese),
   Dept. Math. Yokohama City Univ., 25 May 2007, Yokohama.

Naoki Sasakura

Journal Papers

1. Y. Sasai and N. Sasakura,
   Braided quantum field theories and their symmetries,
   Prog. Theor. Phys. **118** (2007) 785 arXiv:0704.0822 [hep-th], YITP-07-14.
2. N. Sasakura,
   The fluctuation spectra around a Gaussian classical solution of a tensor model and the general relativity,
   International Journal of Modern Physics A, **23** (2008) 693-718 arXiv:0706.1618 [hep-th], YITP-07-32.
3. Y. Sasai and N. Sasakura,
   Domain wall solitons and Hopf algebraic translational symmetries in noncommutative field theories,

Phys. Rev. D **77** (2008) 045033 arXiv:0711.3059 [hep-th], YITP-07-78.

Books and Proceedings

1. N. Sasakura and S. Watamura,
Noncommutative geometry and quantum spacetime in physics. Proceedings, 21st Nishinomiya-Yukawa Memorial Symposium on Theoretical Physics, Nishinomiya, Japan, November 11-12, 2006 and Kyoto, Japan, November 13-15, 2006,
Prog. Theor. Phys. Suppl. **171** (2007) 1.

Ken-ichi Shizuya

Journal Papers

1. K. Shizuya,
Electromagnetic response and effective gauge theory of graphene in a magnetic field,
Phys. Rev. **B 75** (2007) 245417 1-9, cond-mat/0702674, YITP-07-11.
2. K. Shizuya,
Static structure factor for graphene in a magnetic field,
Phys. Rev. **B 77** (2008) 075419 1-6, arXiv:0711.4233 [cond-mat], YITP-07-80.

Seiji Terashima

Journal Papers

1. S. Terashima,
Ghost D-brane, supersymmetry and matrix model,
JHEP **0605** (2006) 067, arXiv:hep-th/0602271.
2. M. Eto, K. Hashimoto and S. Terashima,
Solitons in supersymmety breaking metastable vacua,
JHEP **0703** (2007) 061, arXiv:hep-th/0610042, YITP-06-50.
3. S. Terashima,
Supertubes in matrix model and DBI action,
JHEP **0703** (2007) 075, arXiv:hep-th/0701179, YITP-07-01.
4. M. Eto, K. Hashimoto and S. Terashima,
QCD String as Vortex String in Seiberg-Dual Theory,
JHEP **0709** (2007) 036 arXiv:0706.2005 [hep-th], YITP-07-34.
5. K. Hashimoto, C. I. Tan and S. Terashima,
Glueball Decay in Holographic QCD,
Phys. Rev. D **77** (2008) 086001 arXiv:0709.2208 [hep-th], YITP-07-54.

Talks at international Conferences

1. Nocommutative D-brane and Tachyon,
21st Nishinomiya-Yukawa Memorial Symposium "Noncommutative Geometry and Quantum Spacetime in Physics", Invited, 11–15 November 2006, Nishinomiya.
2. Nocommutative Geomrtry from Unstable D0-branes and ADHM construction,
International Workshop on Noncommutativity in Strings, Gravity and Field Theory, Invited, 16-18 November 2006, Tokyo Metropolitan University.

Invited Seminars (Overseas)

1. Glueball Decay in Holographic QCD,
KIAS, 20 November 2007, Seoul, South Korea.
2. Glueball Decay in Holographic QCD,
Center for Quantum Spacetime, 22 November 2007, Seoul, South Korea.
3. Glueball Decay in Holographic QCD,
Physics Department, National Taiwan Normal Univ, 13 December 2007, Taipei, Taiwan.
4. Glueball Decay in Holographic QCD,
National Center for Theoretical Sciences, 18 December 2007, Hsinchu, Taiwan.

Invited Seminars (in Japan)

1. Ghost D-brane, Supersymmetry and Matrix Model,
14 June 2006, Dept. of Physics, Tokyo Institute of Technology.
2. ADHM is tachyon condensation (in Japanese),
22 June 2006, Graduate School of Mathematics, Nagoya Univ.
3. Noncommutativity and Tachyon Condensation (in Japanese),
5 July 2006, Tokyo Univ. Komaba.
4. On the Duality of Different D-brane Systems,
3 Feburary 2007, Dept. Physics, Kinki Univ.
5. Solitons in Matrix model and DBI action (in Japanese),

KEK Theory Workshop 2007, 12–15 March 2007, KEK.

6. ADHM(-Nahm) construction and Tachyon condensation (in Japanese),
   TITech-Ibaraki Univ. gasshuku, 6-8 October 2007, Kusatsu Seminar House, Kusatsu.
7. Glueball Decay in Holographic QCD,
   15 January 2008, Dept. Physics, Osaka Univ., Osaka.
8. Tachyon Condensation on Torus (in Japanese),
   Riken seminar series, 3-7 March 2008, Riken, Wako.

Takami Tohyama

Journal Papers

1. S. A. Jafari, T. Tohyama and S. Maekawa,
   Dynamical Mean Field Theory Study of the Linear and Nonlinear Optics of Kondo Systems,
   J. Phys. Soc. Jpn. **76** (2007) 044706, (4 pages).
2. M. M. Zemljič, P. Prelovšek and T. Tohyama,
   Fermi surface and pseudogap of electron-doped cuprate superconductors: Numerical study of the t-t'-J model,
   Phys. Rev. B **76** (2007) 012502, (4 pages), arXiv:cond-mat/0702644.
3. J. Bonča, S. Maekawa and T. Tohyama,
   Numerical approach to the low-doping regime of the t-J model,
   Phys. Rev. B **76** (2007) 035121, (6 pages), arXiv:0706.0105 [cond-mat].
4. K. Ishii, K. Tsutsui, T. Tohyama, T. Inami, J. Mizuki, Y. Murakami, Y. Endoh, S. Maekawa, K. Kudo, Y. Koike and K. Kumagai,
   Momentum-dependent charge excitations of a two-leg ladder: Resonant inelastic x-ray scattering of $(La,Sr,Ca)_{14}Cu_{24}O_{41}$,
   Phys. Rev. B **76** (2007) 045124, (7 pages), arXiv:0705.3695 [cond-mat].
5. M. M. Zemljič, P. Prelovšek and T. Tohyama,
   Temperature and Doping Dependence of the High-Energy Kink in Cuprates,
   Phys. Rev. Lett. **100** (2008) 036402, (4 pages), arXiv:0706.1156 [cond-mat].
6. J. Bonča, S. Maekawa, T. Tohyama and P. Prelovšek,
   Spectral properties of a hole coupled to optical phonons in the generalized t-J model,
   Phys. Rev. B **77** (2008) 054519, (6 pages),

Talks at International Conferences

1. Single-praticle and two-particle excitations of the t-t'-t'-J model,
   International Workshop "Strong Correlations and Angle-Resolved Photoemission Spectroscopy," 23–27 April 2007, Dresden, Germany.
2. RIXS and Charge Response Function in Cuprates,
   6th International Conference on Inelastic X-ray Scattering (IXS2007), 7–11 May 2007, Awaji, Japan.
3. Temperature and Doping Dependence of High-energy Kink in Cuprates,
   International Symposium on Lattice Effects in Cuprate High Temperature Superconductors (LEHTSC2007) 31 October –3 November 2007, Tsukuba, Japan.

Invited Seminars (Overseas)

1. Resonant Inelastic x-ray scattering in cuprates,
   International Seminar "Strong Correlations and Angle-Resolved Photoemission Spectroscopy," 18 April 2007, Dresden, Germany.
2. RIXS and Charge Dynamics in Cuprates,
   Dynamical DMRG Study of Hubbard-Holstein Model in One Dimension,
   The 12th APCTP Winter Workshop on Strongly Correlated Electron Systems, 20–26 January 2008, Pohang, Korea.
3. Electron-Hole Asymmetry in High-Tc Cuprates,
   Oak Ridge National Laboratory, 17 March 2008, Oak Ridge, USA.
4. Electron-Hole Asymmetry in High-Tc Cuprates,
   Department of Physics, University of Cincinnati, 20 March 2008, Cincinnati, USA.

Invited Seminars (in Japan)

1. Fe-S cluster from view point of condensed-matter physics (in Japanese).

Forum "Material Science in Molecular Systems," 4 April 2007, RIKEN, Wako.
2. Electronic States of Fe-S cluster (in Japanese).
Workshop on Theory of Strongly Correlated Electron Systems," 12 February 2008, Yugawara, Hakone.

Keisuke Totsuka

Journal Papers

1. P. Corboz, A.M. Läuchli, K. Totsuka and H. Tsunetsugu,
Spontaneous trimerization in a bilinear-biquadratic S=1 zig-zag chain,
Physical Review B **76** (2007) 220404(R). arXiv:0707.1195 [cond-mat].
2. H. T. Ueda and K. Totsuka,
Ground-state phase diagram and magnetic properties of a tetramerized spin-1/2 J_1-J_2 model: BEC of bound magnons and absence of the transverse magnetization,
Phys. Rev. B**76** (2007) 214428, (17 pages), arXiv:0710.0463 [cond-mat].

Talks at International Conferences

1. A unifying approach to competing orders in frustrated magnets –from ladder to square lattice,
Yukawa International Seminar (YKIS) 2007 "Interaction and nanostructural effects in low-dimensional systems", 5-30 November 2007, Kyoto, Japan.

Invited Seminars (Overseas)

1. A unifying approach to competing orders in frustrated magnets –an approach from effective Hamiltonians,
LPT Université de Paul-Sabatier, 18 April 2007, Toulouse, France.
2. A unifying approach to competing orders in frustrated magnets –an approach from effective Hamiltonians,
LPTMS Université Paris Sud Orsay, 20 April 2007, Paris, France.

Hirofumi Wada

Journal Papers

1. H. Wada and R. R. Netz,
Discrete elastic model for stretching-induced flagellar polymorphs,
Europhys Lett. **82** (2008) 28001.

Invited Seminars (in Japan)

1. Form and Motion of Microscopic Life,
11, December 2007, at Doshisha Univ. Computational granular mechanics meeting.
2. Shaping Microscopic Life: Continuum Mechanics Approach,
13, March 2008, at Institute for Molecular Science.

2.3.3 Publications and Talks by Research Fellows and Graduate Students (April 2007– March 2008)

Hiroyuki Abe

Journal Papers

1. H. Abe, Y. G. Kim, T. Kobayashi and Y. Shimizu,
   TeV scale partial mirage unification and neutralino dark matter,
   JHEP **0709**, 107 (2007), 17 pages, arXiv:0706.4349 [hep-ph], YITP-07-37.
2. H. Abe, T. Higaki and T. Kobayashi,
   More about F-term uplifting,
   Phys. Rev. D **76**, 105003 (2007), 12 pages, arXiv:0707.2671 [hep-th], YITP-07-43.
3. H. Abe, T. Kobayashi and Y. Omura,
   R-symmetry, supersymmetry breaking and metastable vacua in global and local supersymmetric theories,
   JHEP **0711**, 044 (2007), 29 pages, arXiv:0708.3148 [hep-th], YITP-07-47.
4. H. Abe and Y. Sakamura,
   Moduli stabilization in 5D gauged supergravity with universal hypermultiplet and boundary superpotentials,
   Nucl. Phys. B **796**, 224 (2008), 22 pages, arXiv:0709.3791 [hep-th], YITP-07-57.
5. H. Abe, T. Kobayashi and Y. Omura,
   Metastable supersymmetry breaking vacua from conformal dynamics, Phys. Rev. D **77**, 065001 (2008), 5 pages, arXiv:0712.2519 [hep-ph], YITP-07-90.
6. H. Abe, T. Higaki, T. Kobayashi and Y. Omura,
   Dynamically sequestered F-term uplifting in extra dimension,
   JHEP **0804**, 072 (2008), 25 pages, arXiv:0801.0998 [hep-th], YITP-07-98.

Books and Proceedings

1. H. Abe,
   Off-shell dimensional reduction of 5D orbifold supergravity,
   Soryushiron-Kenkyu **116**, (2008), A146–A148.

Talks at International Conferences

1. Low energy implications of moduli-mixing nonperturbative effects in flux compactification,
   The 6th String Phenomenology Conference (String Phenomenology 2007), 4–8 June 2007, Frascati, Italy.
2. Low energy implications of moduli-mixing nonperturbative effects in flux compactification,
   The 10th European Meeting From the Planck Scale to the Electroweak Scale (Planck 2007), 9–13 June 2007, Warsaw, Poland.
3. Off-shell dimensional reduction of 5D orbifold supergravity, Summer Institute 2007, 3–10 August 2007, Fuji-Yoshida, Japan.

Invited Seminars (Overseas)

1. Nonuniversal gaugino masses and MSSM fine-tuning, 24 April 2007,
   Department of Physics, Korea Advanced Institute for Science and Technology (KAIST), Daejeon, Korea.

Invited Seminars (in Japan)

1. Low energy implications of moduli-mixing nonperturbative effects in flux compactification,
   9 May 2007, Okayama Institute for Quantum Physics, Okayama.
2. Low energy implications of moduli-mixing nonperturbative effects in flux compactification,
   19 June 2007, Department of Physics, Osaka City Univ., Osaka.
3. R-symmetry, supersymmetry breaking and metastable vacua in global and local supersymmetric theories,
   26 October 2007, Department of Physics, Kanazawa Univ., Kanazawa.
4. Moduli stabilization, F-term uplifting and sequestering in supergravity models,
   6 February 2008, Institute for the Physics and Mathematics of the Universe (IPMU), Kashiwa.

Junichi Aoi

Journal Papers

1. J. Aoi, K. Murase and S. Nagataki,
   The effect of energy amplification variance on shock acceleration,
   Monthly Notices of the Royal Astronomical **383** (2008) 1431-1438. arXiv:0711.2772 [astro-ph], YITP-07-72.

Talks at International Conferences

1. The effect of energy amplification variance on the shock ,
   "TeV Particle Astrophysics 2007," Plenary, 27–31 August 2007, Venice, Italy.

Antonino Flachi

Journal Papers

1. A. Flachi and T. Tanaka,
   Branes and Black holes in Collision,
   Phys. Rev. **D76** (2007) 025007.
2. A. Flachi and T. Tanaka,
   Vacuum polarization in asymptotically anti-de Sitter black hole geometries,
   Phys. Rev. **D78** (2008) 064011.

Talks at International Conferences

1. Vacuum polarization in asymptotically anti-de Sitter black hole geometries,
   Institute for Astroparticle physics and Cosmology (APC), University of Paris VII, Workshop on 'Developments on branes and extra dimensions', (February 2007).

Invited Seminars (Overseas)

1. Vacuum polarization in asymptotically anti-de Sitter black hole geometries,
   University Autonoma of Barcelona, Institute for Space Studies, (February 2007).

Invited Seminars (in Japan)

1. On the domain wall problem,
   Kanto seminar, held at Waseda University (May 2007).

Yoshinobu Habara

Journal Papers

1. Y. Habara, Y. Nagatani, H. B. Nielsen, M. Ninomiya,
   Dirac Sea and Hole Theory for Bosons I: A New Formulation of Quantum Field Theories,
   International Journal of Modern Physics A **23** (2008) 2733–2769. arXiv:hep-th/0603242, YITP-06-11.
2. Y. Habara, Y. Nagatani, H. B. Nielsen, M. Ninomiya,
   Dirac Sea and Hole Theory for Bosons II: Renormalization Approach,
   International Journal of Modern Physics A **23** (2008) 2771–2781. arXiv:hep-th/0607182, YITP-06-35.

Kimitake Hayasaki

Journal Papers

1. K. Hayasaki, S. Mineshige and H. Sudou,
   Binary Black Hole Accretion Flow in Merged Galactic Nuclei,
   Pub. Astron. Soc. Japan, **59** (2007) 427-441, arXiv:0609.144.

Books and Proceedings

1. K. Hayasaki and S. Mineshige,
   Periodic light variations from the triple-disk system around supermassive binary black holes,
   AIP Conference Proceedings, **1016** (2008), 406-408.

Talks at International Conferences

1. Periodic light variations from a supermassive binary black hole with triple disks,
   YITP Workshop on "Quasi-Periodic Oscillations and Time Variabilities of Accretion Flows," 20–22 November 2007, Kyoto, Japan, YITP-W-07-14.
2. A supermassive binary black hole evolving with triple disks,
   APCTP-YITP 2008 Workshop on "Accretion and Outflow in Astrophysics" and the second Korea-Japan Young Astronomers Meeting (KJYAM)," 8–11 January 2008, Kyoto, Japan, YITP-W-07-19.

Invited Seminars (Overseas)

1. Exploring of a triple-disk system around a supermassive binary black hole,
   Centre for Astrophysics & Supercomputing Swinburne University of Technology, 28 June 2007, Melbourne, Australia.
2. Exploring of a supermassive binary balck hole with a triple disk in the Universe,
   Tuorla Observatory, University of Turku, 21 September 2007, Piikkiö, Finland.

Invited Seminars (in Japan)

1. Exploring of a supermassive binary black hole and its evolution (in Japanese),
   7 December 2007, Department of Physics, Hokkaido University., Sapporo.
2. Exploring of a supermassive binary black hole and its evolution (in Japanese),
   21 Febraury 2008, Riken., Wako, Saitama.
3. New approaches for probing a supermassive binary black hole and its evolution(in Japanese),
   5 March 2008, National Astronomical Observatory Japan., Mitaka, Tokyo.
4. New approaches for probing a supermassive binary black hole and its evolution(in Japanese),
   6 March 2008, Department of Earth Science and Astronomy, University of Tokyo., Komaba, Meguro, Tokyo.

Tetsuo Hyodo

Journal Papers

1. Tetsuo Hyodo, Wolfram Weise,
   Effective $\bar{K}N$ interaction based on chiral SU(3) dynamics,
   Phys. Rev. C **77** (2008) 035204, arXiv:0712.1613 [nucl-th], YITP-07-95.
2. Tetsuo Hyodo, Daisuke Jido, Luis Roca,
   Structure of the $\Lambda(1405)$ baryon resonance from its large N_c behavior,
   Phys. Rev. D **77** (2008) 056010, arXiv:0712.3347 [hep-ph], YITP-07-97.
3. Tetsuo Hyodo, Daisuke Jido, Atsushi Hosaka,
   Origin of resonances in the chiral untiary approach,
   Phys. Rev. C **78** (2008) 025203, arXiv:0803.2550 [nucl-th], YITP-08-20.
4. T. Sekihara, T. Hyodo, D. Jido,
   Electromagnetic mean squared radii of $\Lambda(1405)$ in chiral dynamics,
   Phys. Lett. **B669** (2008) 133-138, arXiv:0803.4068 [nucl-th], YITP-08-21.

Books and Proceedings

1. Tetsuo Hyodo, Daisuke Jido, Atsushi Hosaka,
   Study of exotic hadrons in s-wave chiral dynamics,
   Prog. Theor. Phys. Suppl. **168** (2007) 32-35, arXiv:0704.1527 [hep-ph], YITP-07-25.
2. Akinobu Dote, Tetsuo Hyodo, Wolfram Weise,
   $K^- pp$ system with chiral SU(3) effective interaction,
   Nucl. Phys. **A804** (2007) 197-206, arXiv:0802.0238 [nucl-th], YITP-08-5.
3. Tetsuo Hyodo, Wolfram Weise, Daisuke Jido, Luis Roca, Atsushi Hosaka,
   $\Lambda(1405)$ in chiral SU(3) dynamics,
   Mod. Phys. Lett. A **23** (2008) 2393-2396, arXiv:0802.2212 [hep-ph].
4. Daisuke Jido, Tetsuo Hyodo, Atsushi Hosaka,
   The structure of $N(1535)$ in the aspect of chiral symmetry,
   Mod. Phys. Lett. A **23** (2008) 2389-2392, arXiv:0803.2738 [nucl-th].
5. T. Sekihara, T. Hyodo, D. Jido,
   Electric Mean Squared Radii of $\Lambda(1405)$ in Chiral Dynamics,
   Mod. Phys. Lett. A **23** (2008) 2421-2424, arXiv:0803.4375 [nucl-th], YITP-08-23.

Talks at International Conferences

1. Exotic hadrons in s-wave chiral dynamics,
   11th International Conference on Meson-Nucleon Physics and the structure of the Nucleon (MENU 2007), 10–14 September 2007, IKP Juelich, Germany.
2. $\Lambda(1405)$ in chiral dynamics,
   Chiral Symmetry in Hadron and Nuclear Physics (Chiral07), 13–16 November 2007, Osaka Univ., Japan.

Invited Seminars (in Japan)

1. $\Lambda(1405)$ in chiral dynamics (in Japanese),
   18 March 2008, KEK, Tsukuba.
2. $\Lambda(1405)$ in chiral dynamics (in Japanese),
   21 March 2008, RCNP, Osaka Univ.

Tetsuji Kimura

Journal Papers

1. T. Kimura,
   Index theorems on torsional geometries,
   JHEP **0708** (2007) 048, arXiv:0704.2111 [hep-th], YITP-07-20.
2. T. Kimura, M. Ohta and K.-J. Takahashi,
   Type IIA orientifolds and orbifolds on non-factorizable tori,
   Nucl. Phys. B **798** (2008) 89, arXiv:0712.2281 [hep-th], YITP-07-82.

Talks at International Conferences

1. Index theorems on torsional geometries,
   KIAS-YITP Joint Workshop 2007, Plenary, 24–28 September 2007, Kyoto, Japan.

Invited Seminars (in Japan)

1. Heterotic string compactifications with NS-fluxes (in Japanese),
   18 May 2007, Dept. Physics, Hokkaido Univ., Sapporo.
2. Heterotic string compactifications (in Japanese),
   20 June 2007, Dept. Physics, Osaka Univ., Toyonaka.
3. Generalized/doubled/nongeometric string backgrounds (in Japanese),
   Osaka Particle Seminar, 27 March 2008, Osaka City Univ., Osaka.

Masafumi Kurachi

Talks at International Conferences

1. A Three Site Higgsless Model,
   International Workshop on Grand Unified Theories: Current Status and Future Prospects, 17–19 Dec 2007, Kusatsu, Shiga, Japan.

Invited Seminars (in Japan)

1. Three Site Higgsless Model,
   18 September 2007, KEK, Tsukuba.
2. Three Site Higgsless Model,
   24 October 2007, Dept. Physics, Kobe Univ., Kobe.
3. Three Site Higgsless Model,
   11 November 2007, Dept. Physics, Osaka Univ., Osaka.
4. Three Site Higgsless Model and its Related Topics,
   12 December 2007, Dept. Physics, Nagoya Univ., Nagoya.

Takeshi Morita

Journal Papers

1. S. Iso, T. Morita, H. Umetsu,
   Fluxes of higher-spin currents and Hawking radiations from charged black holes,
   Phys. Rev. **D76** (2007) 064015, arXiv:0705.3494 [hep-th], YITP-07-29.
2. S. Iso, T. Morita, H. Umetsu,
   Higher-spin gauge and trace anomalies in two-dimensional backgrounds,
   Nucl. Phys. **B799** (2008) 60-79, arXiv:0710.0453 [hep-th], YITP-07-51.
3. S. Iso, T. Morita, H. Umetsu,
   Hawking radiation via higher-spin gauge anomalies,
   Phys. Rev. **D77** (2008) 045007, arXiv:0710.0456 [hep-th], YITP-07-56.

Talks at International Conferences

1. Hawking Radiation and Quantum Anomalies,
   KIAS-YITP joint workshop "String phenomenology and cosmology," Plenary, September 24-28, 2007, YITP, Kyoto.

Invited Seminars (in Japan)

1. Hawking Radiation and Anomalies of Higher-spin Currents,
   19 June 2007, Dept. Physics, Osaka University, Toyonaka.
2. Black hole thermodynamics from near-horizon conformal field theory,
   24 May 2007, Particle Theory group, the University of Tokyo, Komaba.
3. Black hole thermodynamics and two dimensional conformal field theory (in Japanese),
   26 April 2007, Particle Theory and Cosmology Group, Tohoku University, Sendai.

Kohta Murase

Journal Papers

1. K. Murase, K. Asano, and S. Nagataki,
   Effects of the Cosmic Infrared Background

on Delayed High-Energy Emission from Gamma-Ray Bursts,
Astrophysical Journal **671** (2007) 1886-1895. arXiv:0703759 [astro-ph].

2. F. Iocco, K. Murase, S. Nagataki, and P.D. Serpico,
High-Energy Neutrino Signals from the Epoch of Reionization,
Astrophysical Journal **675** (2008) 937-945. arXiv:0707.0515 [astro-ph].
3. K. Murase,
High energy neutrino early afterglows from gamma-ray bursts revisited,
Physical Review D **76** (2007) 123001. arXiv:0707.1140 [astro-ph].
4. K. Ioka, K. Murase, K. Toma, S. Nagataki, and T. Nakamura,
Unstable GRB Photospheres and e^+e^- Annihilation Lines,
Astrophysical Journal Letters **670** (2008) L70-L73, arXiv:0708.1249 [astro-ph].
5. K. Murase and K. Ioka,
Closure Relations for e^+e^- Pair Signatures in Gamma-Ray Bursts,
Astrophysical Journal **676** (2008) 1123-1129, arXiv:0708.1370 [astro-ph].
6. J. Aoi, K. Murase, and S. Nagataki,
The effect of energy amplification variance on shock acceleration,
Monthly Notices of the Royal Astronomical Society **383** (2008) 1431-1438. arXiv:0711.2772 [astro-ph].
7. K. Murase, K. Ioka, S. Nagataki, and T. Nakamura,
High-energy cosmic-ray nuclei from high- and low-luminosity gamma-ray bursts and implications for multimessenger astronomy,
Physical Review D **78** (2008) 023005. arXiv:0801.2861 [astro-ph].

Books and Proceedings

1. K. Murase,
The high-energy neutrino background from gamma-ray bursts,
Journal of Physics: Conference Series **120** (2008) 062016.
2. K. Murase, K. Ioka, and S. Nagataki,
Pair-signatures and high-energy gamma-ray emission from gamma-ray bursts,
Gamma-Ray Bursts 2007: Proceedings of the Santa Fe Conference. AIP Conference Proceedings **1000** (2008) 373-376.
3. K. Ioka, K. Murase, K. Toma, S. Nagataki, and T. Nakamura,
Unstable GRB Photospheres and Blueshifted e^+e^- Annihilation Lines,
Gamma-Ray Bursts 2007: Proceedings of the Santa Fe Conference. AIP Conference Proceedings **1000** (2008) 377-380.
4. K. Murase,
High-Energy Neutrinos and Gamma-Ray Bursts,
KEK Cosmophysics group inaugural conference "Accelerators in the Universe": Interplay between High Energy Physics and Cosmophysics. AIP Conference Proceedings, **1040** (2008) 170-174.

Talks at International Conferences

1. High Energy Neutrino Emission from Gamma-Ray Bursts,
TeV Particle Astrophysics 2007, Aug 2007, Venice, Italy.
2. High Energy Neutrino Background from GRBs,
International Conference on Topics in Astroparticle and Underground Physics (TAUP) 2007, Sep 2007, Sendai, Japan.
3. High-Energy Neutrinos and Gamma-Ray Bursts,
Accelerators in the Universe (AIU) 2008, Mar 2008, Tsukuba, Japan.

Takahiro Nishino

Journal Papers

1. Taka H. Nishino,
Anomalous Heat Conduction in Quasi-One-Dimensional Gases,
Progress of Theoretical Physics, **118** (2007) 657-666.

Talks at International Conferences

1. Anomalous Heat Conduction in Quasi-One-Dimensional Gase,
Invited, "Symposium on the 50th Anniversary of the Alder Transition", 29–30 November 2007, Kanazawa, Japan.

Mitsuhisa Ohta

Journal Papers

1. Tetsuji Kimura, Mitsuhisa Ohta, Kei-Jiro Takahashi,
   Type IIA Orientifolds and Orbifolds on Non-factorizable Tori,
   Nucl. Phys. **B798** (2008) 89. arXiv:0712.2281 [hep-th], YITP-07-82.

Yuya Sasai

Journal Papers

1. Y. Sasai and N. Sasakura,
   Braided quantum field theories and their symmetries,
   Prog. Theor. Phys. **118**, 785 (2007) [arXiv:0704.0822 [hep-th]], YITP-07-14.
2. Y. Sasai and N. Sasakura,
   Domain wall solitons and Hopf algebraic translational symmetries in noncommutative field theories,
   Phys. Rev. D **77**, 045033 (2008) [arXiv:0711.3059 [hep-th]], YITP-07-78.

Books and Proceedings

1. Y. Sasai and N. Sasakura,
   Domain wall solitons and Hopf algebraic translational symmetries in noncommutative field theories,
   Int. J. Mod. Phys. A **23** (2008) 2277.

Talks at International Conferences

1. Braided quantum field theories and their symmetries,
   International Conference on Quantum Gravity "LOOPS '07," Plenary, 25–30 June 2007, Morelia, Mexico.

Fabio Scardigli

Journal Papers

1. F. Scardigli,
   A quantum like description of the planetary systems,
   Found. of Phys. **37** (2007) 1278–1295, arXiv:gr-qc/0507046.

Books and Proceedings

1. F.Scardigli and R.Casadio,
   Equivalence Principle and Holography: a possible clash in the extra dimensions?,
   Proceedings of the "17th Workshop on General Relativity and Gravitation in Japan" (JGRG17), Nagoya, December 3-7, 2007.

Talks at International Conferences

1. Glimpses on the micro black hole Planck phase,
   at the "Fourth Gulf Gravity Meeting", Oxford, Mississippi (USA), March 7-8, 2008.
2. 't Hooft quantization proposal for interacting systems,
   at "DICE 2008", Castiglioncello (Tuscany, Italy), September 22-26, 2008.

Invited Seminars (Overseas)

1. Uncertainty principle, Equivalence principle and Holography,
   at Jet Propulsion Laboratory (Caltech), Pasadena, California, June 1, 2007.

Invited Seminars (in Japan)

1. Uncertainty Principles, Equivalence Principle and Holography in the extra dimensions,
   Waseda University, Gravity Group, November 30, 2007.

Yuuiti Sendouda

Journal Papers

1. S. Kinoshita, Y. Sendouda, S. Mukohyama,
   Instability of de Sitter brane and horizon entropy in a 6D braneworld,
   J. Cosmol. Astropart. Phys. **0705** (2007) 018 (29 pages), arXiv:hep-th/0703271.
2. N. Deruelle, M. Sasaki and Y. Sendouda,
   Junction Conditions in $f(R)$ Theories of Gravity,
   Prog. Theor. Phys. **119** (2008) 237–251, arXiv:0711.1150 [gr-qc], YITP-07-76.
3. N. Deruelle, M. Sasaki and Y. Sendouda,
   "Detuned" $f(R)$ gravity and dark energy,
   Phys. Rev. **D77** (2008) 124024 (5 pages), arXiv:0803.2742 [gr-qc], YITP-08-16.

Talks at International Conferences

1. Cosmic rays emitted by primordial black holes in a five-dimensional Randall–Sundrum braneworld,
   International Conference on Topics in Astroparticle and Underground Physics (TAUP) 2007, 11–15 September 2007, Sendai Civic Auditorium, Sendai, Japan.

2. Surface terms and matching conditions in $f(R)$ gravity,
   The 17th Workshop on General Relativity and Gravitation in Japan, 3–7 December 2007, Nagoya University, Nagoya, Japan.
3. Non-minimally coupled $f(R)$ brane-worlds, Workshop "Modern ideas in Cosmology," 20 February 2008, APC, Paris, France.

Invited Seminars (in Japan)

1. Surface terms and matching conditions in $f(R)$ gravity (in Japanese),
   9 November 2007, Department of Physics, Osaka City University, Osaka.

Toru Takahashi

Journal Papers

1. Toru T. Takahashi,
   Low-lying Dirac eigenmodes and monopoles in 3+1D compact QED,
   Journal of High Energy Physics **05** (2008) 094, arXiv:0803.2216.
2. Toru T. Takahashi and Teiji Kunihiro,
   Axial charges of the N(1535) and N(1650) in lattice QCD with two flavors of dynamical quarks,
   Physical Review **D78** (2008) 011503, arXiv:0801.4707.

Books and Proceedings

1. Toru T. Takahashi and Teiji Kunihiro,
   Lattice QCD study of $g_A^{N^*N^*}$ with two flavors of dynamical quark,
   Modern Physics Letters **A23** (2008) 2340, Proceedings of the International Conference on Chiral Symmetry in Hadron and Nuclear Physics (Chiral07) November 13-16, 2007, Osaka University, Japan.

Talks at International Conferences

1. Lattice QCD study of $g_A^{N^*N^*}$ with two flavors of dynamical quarks,
   International Conference on Chiral Symmetry in Hadron and Nuclear Physics (Chiral07) November 13-16, 2007, Osaka University, Japan.
2. Lattice QCD study of $g_A^{N^*N^*}$ with two flavors of dynamical quarks,
   11th International Conference on Meson-Nucleon Physics and the Structure of the Nucleon September 10-14, 2007 IKP, Forschungzentrum Jülich, Germany.

Masaaki Takashina

Journal Papers

1. M. Takashina and Y. Kanada-En'yo,
   Inelastic proton scattering and neutron quadrupole transitions of ^{12}Be, Phys. Rev. C **77** (2008) 014604, (6 pages).

Talks at International Conferences

1. Proton inealstic scattering and nuclear structure of ^{12}Be,
   9th International Conference on "Clustering Aspects of Nuclear Structure and Dynamics (Cluster'07)," 3–7 Sep. 2007, Stratford upon Avon, UK.

Michihisa Takeuchi

Journal Papers

1. Mihoko M. Nojiri and Michihisa Takeuchi,
   Study of the top reconstruction in top-partner events at the LHC,
   JHEP **0810** (2008) 025, arXiv:0802.4142 [hep-ph].
2. Tatsuru Kikuchi, Nobuchika Okada and Michihisa Takeuchi,
   Unparticle physics at the photon collider,
   Phys. Rev. D**77**, 094012 (2008), arXiv:0801.0018 [hep-ph].

Books and Proceedings

1. Mihoko M. Nojiri and Michihisa Takeuchi,
   The Study of $\tilde{q}_L\tilde{q}_L$ production at LHC in the $l^\pm\ l^\pm$ channel and sensitivity to other models,
   pp. 161-163 in Proc."Summer Institute 2007." (Fuji-Yoshida, Yamanashi, Japan, 3-10 August, 2007).
2. G. Brooijmans et al.,
   New Physics at the LHC,
   pp. 96 in Proc."Physics at TeV Colliders workshop."
   (Les Houches, France, 11-29 June, 2007) arXiv:0802.3715 [hep-ph].

Talks at International Conferences

1. Top partner in Littlest Higgs model with T parity,
   at Focus week: Facing LHC data, held at IPMU, Kashiwa-Campus, Tokyo University, Chiba, Japan, December 17-21, 2007.
2. Top-partner mass reconstruction by using jets,
   at KEK Annual Theory Meeting on Particle Physics Phenomenology (KEKPH0712), held at KEK, Tsukuba, Japan, December 12-14, 2007.
3. The Study of $\tilde{q}_L\tilde{q}_L$ production at LHC in the $l^{\pm}l^{\pm}$ channel and sensitivity to other models,
   at Summer Institute 2007, held at FujiCalm, Fujiyoshida, Japan, August 9, 2007.

Invited Seminars (in Japan)

1. Search for the physics beyond the SM using jet reconstruction at LHC,
   at Tohoku University, Sendai (Japan), December 6, 2007.
2. The Study of $\tilde{q}_L\tilde{q}_L$ production at LHC in the $l^{\pm}l^{\pm}$ channel and sensitivity to other models,
   at RIKEN, Wako (Japan), June 1, 2007.

Daisuke Yamauchi

Journal Papers

1. D. Yamauchi and M. Sasaki,
   Brane World in Arbitrary Dimensions Without Z_2 Symmetry,
   Prog. Theor. Phys. **118**, 245 (2007) [arXiv:0705.2443 [gr-qc]]. YITP-07-28.

Chul-Moon Yoo

Journal Papers

1. C-M. Yoo, H. Ishihara, M. Kimura, K. Matsuno and S. Tomizawa,
   Horizons of Coalescing Black Holes on Eguchi-Hanson Space,
   Classical and Quantum Gravity **25** (2008) 095017. arXiv:0708.0708 [gr-qc], YITP-08-09.

Talks at International Conferences

1. Horizons of Coalescing Black Holes on Eguchi-Hanson Space,
   The Seventeenth Workshop on General Relativity and Gravitation in JAPAN, Plenary, 3–7 December 2007, Nagoya University, Japan.
2. Horizons of Coalescing Black Holes on Eguchi-Hanson Space,
   2008 International School/Workshop on Cosmology and Gravitation,, Plenary, 7–10 January 2008, National Taitung University, Taiwan.

2.4 Seminars, Colloquia and Lectures

▷ 2007.4.1 — 2008.3.31

4.13 Tim R. Morris (Southampton University): *Manifestly gauge invariant exact renormalization group*

4.19 Seung-il Nam (YITP): *Nonperturbative hadronic matrix elements from the instanton vacuum configuration*

4.23 A. A. Starobinsky (Landau Institute for Theoretical Physics/YITP): YITP Colloquium: *Scalar-tensor models of dark energy*

4.24 Takashi Sugimoto (RIKEN): *Invariant-mass spectroscopy of ^{14}Be using nuclear breakup reaction*

4.24 Jean-Philippe Uzan (IAP): *Gravity and the nature of dark energy*

4.24 Yosuke Kondo (RIKEN): *Spectroscopy of ^{13}Be and ^{14}Be via the Proton-Induced Breakup Reactions*

4.26 Serguey T. Petcov (SISSA/YITP): *Neutrino Mixing, Low-Energy Leptonic CP-Violation and Leptogenesis*

4.26 Hiroyuki Kamano (YITP): *Medium effect in the neutrino- and electron-nucleus reactions in a GeV region*

5.8 Ichiro Oda (University of the Ryukyus): *Y-formalism and b ghost in the Non-minimal Pure Spinor Formalism of Superstrings*

5.11 Takashi Morita (YITP): *Black hole thermodynamics from near-horizon conformal field theory*

5.15 Roberto Percacci (SISSA): *Progress towards a quantum field theory of gravity*

5.15 Takashi Umeda (University of Tsukuba): *A study of charmonium dissociation temperatures in lattice QCD*

5.17 Hidenori Fukaya (RIKEN): *Lattice QCD, Random Matrix Theory and chiral condensates*

5.25 Nobuhiko Suzuki (Osaka University): *Resonance pole from speed plot and time delay*

5.25 Masako Asano (Osaka Prefecture University): *New covariant gauges in string field theory and tachyon potential*

5.28 Tohru Eguchi (YITP): YITP Colloquium: *String landscape and weak gravity conjecture*

5.30 Hiroshi Watanabe (Nagoya University): *Non-equilibrium Relaxation Analysis on Two-dimensional Melting*

5.31 Frederik Denef (Leuven University): *Split States, Entropy Enigmas, Holes and Halos*

6.1 Kazunobu Maruyoshi (Osaka City University): *Deformation of Dijkgraaf-Vafa Relation via Spontaneously Broken N=2 Supersymmetry*

6.4 Yuki Nagai (University of Tokyo): *Positions of Point-Nodes in Borocarbide Superconductor YNi2B2C*

6.4 Andreas Karch (Washington University): *Transport properties of the hot N=4 plasma*

6.7 Mitsuo Oka (Kwasan Observatory, Kyoto University): *Electron Acceleration by Shocks: GEOTAIL Observation*

6.7 Kazumasa Takeuchi (University of Tokyo): *Directed Percolation Universality in Turbulent Liquid Crystals*

6.8 Etsuko Itou (YITP): *Three dimensional conformal sigma models*

6.14 Masaki Shigemori (California Institute of Technology): *Nonsupersymmetric Brane/Antibrane Configurations in Type IIA and M Theory*

6.15 Jen-Chi Lee (National Chiao Tung University): *String theory at high energies*

6.20 Hiroto Kuninaka (Chuo University): *Fluctuation Relation for Impact Phenomena of Small Systems*

6.21 Emiko Hiyama (Nara Women's University): *Three- and four-body structure of light hypernuclei*

6.22 Hirotaka Sugawara (Sokendai): *Space - Time Duality and Vacuum Energy*

6.27 Bongsoo Kim (Changwon National University): *A FDR-preserving field theory for interacting Brownian particles: one-loop theory and MCT*

6.28 Hidetomo Sawai (Waseda University): *Numerical Simulations of Equatorially-Asymmetric Magnetorotational Super-*

novae; Implications for Magnetar Kicks

7.3 Shuntaro Mizuno (RESCEU): *Curvature perturbations from ekpyrotic collapse with multiple fields*

7.5 Chisa Hotta (Kyoto Sangyo University): *Exotic quantum states of frustrated charges on the triangular lattice systems*

7.5 Douglas Heggie (University of Edinburgh): *Black Holes in Globular Clusters*

7.10 Akishi Kato (University of Tokyo): *a-maximization and AdS/CFT correspondence*

7.20 Umesh Garg (University of Notre Dame): *Exotic quantal rotation in nuclei–An expreimental view*

7.24 Atsushi Taruya (University of Tokyo): *A new approach to the gravitational clustering of large-scale structure and aryon acoustic oscillations*

7.24 Christos Charmousis (Laboratory of Theoretical Physics of Orsay): *Stealth Acceleration*

7.26 Istvan Racz (Budapest, RMK I): *Distorted stationary black holes*

7.27 Luis Roca Zamora (University of Murcia): *Dynamically generated axial-vector mesons*

8.2 Jihn E. Kim (Seoul National University): *Some interesting phenomenology from string compactification*

8.2 Guido Altarelli (Rome University): *Model Building for Tribimaximal Neutrino Mixing*

8.8 Keiji Saito (University of Tokyo): *Symmetry in full-counting statistics and universal realtions in nonlinear transport*

8.14 Ryuichiro Kitano (SLAC): *Sweet Spot Supersymmetry*

8.16 Atsuo Okazaki (Hokkai-Gakuen University): *Hydrodynamical simulations of circumstellar interactions in massive binaries: eta Carinae and LS I +61 303*

8.16 Amri Wandel (Hebrew University): *The BH-galaxy relation in normal and active galaxies*

8.22 Tadanori Hyouguchi (YITP): *Divergence-free Semiclassical Theory*

8.23 Alexander Dolgov (University of Ferrara): *Cosmological charge asymmetries and charge non-conservation in particle physics*

8.27 Oleg P. Sushkov (The University of New South Wales): *Spirals in the t-J model and structure of the Spin-Glass State of La(2-x)SrxCuO4*

8.27 Alexei B. Zamolodchikov (University of Montpellier II): *Sinh-Gordon Boundary TBA and Boundary Liouville Reflection Amplitude*

8.29 Masakiyo Kitazawa (Osaka University): *Lattice study of quarks in quark-gluon plasma abstract*

9.5 Kumar S. Gupta (Saha Institute of Nuclear Physics): *Holography and Quasi-Normal Modes of Black Holes*

9.6 Libor Snobl (Czech Technical University): *On the Poisson–Lie T–plurality of boundary conditions*

9.11 Kyosuke Hotta (Osaka University): *Exact Solutions and the Attractor Mechanism in Non-BPS Black Holes*

9.13 Ladislav Hlavaty (Czech Technical University): *Classical solutions of the sigma models in curved backgrounds*

9.18 Christoph Wetterich (Heidelberg University): *Chiral Freedom*

9.27 Hiroyuki Yamase (Max Planck Institute for Solid State Research): *Symmetry breaking of Fermi surface*

10.2 Shigetoshi Sota (Institute for Materials Research, Tohoku University): *Numerical study of roton-like collective excitations in glassy materials*

10.9 Shigenori Seki (Tel Aviv University): *Quark Mass and Condensate in Holographic QCD via Tachyon*

10.9 Edwin L. Turner (Princeton University): *Detecting Extrasolar Planets, Plants and Beaches*

10.12 Teiji Kunihiro (YITP): *Stable first-order particle-frame relativistic hydrodynamics for dissipative systems*

10.17 Hirofumi Wada (YITP): YITP Colloquium: *Shaping Microscopic Life: Hydrodynamics matters*

10.19 Loriano Bonora (SISSA): *Tachyon condensation and open-closed string duality*

10.23 Masafumi Kurachi (YITP): *Three Site Higgsless Model*

10.24 Shohei Watabe (University of Tokyo): *Conversion efficiency of heteronuclear Feshbach molecules*

10.24 Michio Ohtsuki (YITP): *Long time tail in sheared particle systems*

10.30 Takafumi Kita (Hokkaido University): *Field-Theoretic Approach to Nonequilibrium Statistical Mechanics*

10.31 Kenji Fukushima (YITP): YITP Colloquium: *Extreme QCD*

11.6 Claudia de Rham (McMaster University & Perimeter Institute): *Classical Renormalization of Codimension-two Brane Couplings*

11.6 Robert Brandenberger (McGill University): *Tachyon Condensation, String Gas Cosmology and Structure Formation*

11.7 William A. Bardeen (Fermilab): YITP Colloquium: *The discovery of the Higgs Mechanism and Beyond*

11.8 Takahiro Sakaue (Kyoto University): *Probing Nonequilibrium Fluctuations through Linear Response*

11.9 Hideaki Iida (YITP): *Survival of charmonium in deconfinement phase*

11.14 Masato Taki (University of Tokyo): *Refined Topological Vertex and Instanton Counting*

11.21 Jerome Margueron (Aizu University/IPN Orsay): *BCS-BEC crossover of neutron pairs in symmetric and asymmetric nuclear matters*

11.26 Kazuhiko Nishijima (University of Tokyo): *Emergence of 2nd generation in particle physics*

12.3 Tatsuru Kikuchi (KEK): *Unparticle Physics and Higgs phenomenology*

12.5 Takashi Uneyama (Kyoto University): *Stochastic Density Functional Simulations for Micellar Structures Formed by Amphiphilic Block Copolymers*

12.7 Gyuri Wolf (KFKI RMKI): $\rho - A_1$ *mixing in heavy ion collisions*

12.14 Reijiro Fukuda (Keio University): *Underlying Determinism, Stationary Phase and Quantum Mechanics*

12.18 Isao Tanihata (RCNP Osaka University): *Two-halo-neutron transfer reaction of* ^{11}Li *and correlation of neutrons*

12.19 Dan Tanaka (University of Fukui): *Nikolaevskii Turbulence*

12.20 Peter Goldreich (IAS): *Three Easy Pieces: Examples of Chaos in the Solar System*

12.21 Toru Takahashi (YITP): *Low-lying Dirac Modes and Monopoles in 4D Compact QED*

12.26 Hajime Yoshino (Osaka University): *Phase model approach to non-linear rheology*

12.26 Takahiro Hatano (Earthquake Research Institute, University of Tokyo): *Scaling properties of the jamming transition and rheology of inelasti particles*

1.7 Kazuo Hosomichi (Korea Institute for Advanced Study): *Scattering of Long Folded Strings*

1.10 Zhao Zhang (YITP): *Polyakov-loop enhanced NJL model at finite temperature and chemical potential*

1.16 Hiroyuki Tomita (Kinki University): *Relation between irreversible circulation of fluctuation and entropy production in nonequilibrium steady state*

1.17 Yasunobu Uchiyama (ISAS/JAXA): *Witnessing Shock Acceleration of Galactic Cosmic Rays*

1.17 Joshua Edward Barnes (University of Hawaii): *Matching Models to Merging Galaxies: Lost and Found in Parameter Space*

1.23 Takahiro Tanaka (Kyoto University): *The 1st Yukawa-Kimura prize memorial lecture*

1.24 Hyun-Chul Kim (Pusan National University): *The chiral quark model from the instanton vacuum*

1.28 Masafumi Fukuma (Kyoto University): *On a Hamiltonian approach to 3D Yang-Mills theories*

1.29 Masanori Kohno (Computational Materials Science Center, NIMS): *Spinons in spatially anisotropic frustrated antiferromagnets*

1.29 Andrew Strominger (Harvard University): *Chiral gravity in three dimensions*

1.30 Hans-Jürgen Mikeska (University of Hannover): YITP Colloquium: *One-dimensional Quantum Spin Systems in High Magnetic Field*

2.1 Tomio Petrosky (University of Texas at Austin): *Quantum Hydrodynamic Modes and Bioenergy Transfer of Vibrational Polaron in alpha-helix Proton*

2.6 Shoichi Kawamoto (Osaka City University): *Charged boundary states in a* Z_3 *extended minimal string*

2.6 Jenny Greene (Princeton University): *The Mass Function of Local Active Galaxies*

2.6 Mariska Kriek (Princeton University): *AGNs and Suppressed Star Formation in Massive Galaxies at $z \sim 2.5$*

2.6 Amaya Moro-Martin (Princeton University): *Debris Disks*

2.14 Yoshimi Tanaka (Hokkaido University, CRIS): *Fracture of Double-network Gels and Strength of Matter*

2.20 Ryo Suzuki (University of Tokyo): *Finite-Size Effects for Dyonic Giant Magnons*

2.20 Sung G. Chung (Western Michigan University): *Novel many-body method for strongly correlated condensed matter Systems*

2.25 Shigeki Onoda (The Institute of Physical and Chemical Research): *Theory for multiferroic phenomena in frustrated spin-1/2 chains*

2.25 Sam Pinansky (University of Tokyo): *The Minimal Quiver Standard Model*

2.26 Hikaru Kawamura (Osaka University): *Vortex order in triangular-lattice Heisenberg antiferromagnet*

2.26 Dominikus Heinzeller (YITP): *Observational appearance of super-Eddington flows and the role of convection in black hole accretion disks*

2.27 Shoichi Yamada (Waseda University): *Gravitational Collapse of Massive Stars as a Probe into Hot and Dense Matter*

2.27 Satoshi Nagaoka (KEK): *Superstring vertex operators in type IIB matrix model*

2.27 Takayuki Ariga (Kyoto University): *Concerted power generation and regulation of molecular motors*

3.5 Mohab Abou-Zeid (Institut des Hautes Etudes Scientifiques/KEK): *Gauge Theory, Gravity and Twistor String Scattering Amplitudes*

3.6 Serguei Brazovskii (CNRS & University Paris-XI): *New Routes to Solitons in Quasi 1D Conductors*

3.6 Tomohide Wada (Yamagata University): *A Particle Simulation for Axisymmetric Active Magnetosphere of Pulsars*

3.6 Chiaki Kobayashi (National Astronomical Observatory of Japan): *Simulations of Chemo-dynamical Evolution of Galaxies in the Universe*

3.10 Kazumi Maki (University of Southern California): *Gossamer superconductivity*

3.12 Tetsuo Hyodo (YITP/Technical University of Munich): *Λ(1405) in chiral dynamics*

3.13 Yutaka Ookouchi (California Institute of Technology): *Meta-stable Supersymmetry Breaking vacua in Supersymmetric Gauge Theories*

3.13 Takuma Suda (Hokkaido University): *Identification of low-mass Pop.III survivors*

3.14 Chuan-Tsung Chan (Tunghai University): *Background Independence and High-Energy Symmetry of String Theory*

3.19 Gentaro Watanabe (University of Trento): YITP Joint Seminar: *Nuclear Pasta Phase in High Density Astronomical Objects: Approach by Quantum Molecular Dynamics Method and its Future Perspective*

3.19 Glenn Paquette (Paquette Research): *Several topics in non-equilibrium statistical physics*

3.21 Anne Taormina (Durham University): *A symmetry approach to viruses*

2.5 Visitors (2007)

Participants of various workshops and conferences are not included in the following lists.

Atom-type Visitors

Yuki Nagai (C)
Univ. of Tokyo
2007.5.16 – 6.15

Shohei Watabe (C)
Univ. of Tokyo
2007.10.10 – 11.9

Ryo Suzuki (E)
Univ. of Tokyo
2008.2.18 – 3.19

Short Visitors

A. Buzdin (C)
Bordeaux 1 Univ.
2007.4.1–2007.4.22

Yasuhiro Sekino (A)
Okayama Inst. for Quantum Physics
2007.4.3–2007.4.6

Serguey Todorov Petcov (E)
SISSA
2007.4.6–2007.5.7

Hans-Jurgen Mikeska (C)
Univ. of Hannover
2007.4.12–2007.4.14

Jean-Philippe Uzan (A)
IAP
2007.4.12–2007.4.25

Tim R. Morris (E)
Southampton Univ.
2007.4.13–2007.4.18

Takashi Sugimoto (N)
RIKEN
2007.4.23–2007.4.24

Yosuke Kondo (N)
RIKEN
2007.4.23–2007.4.24

Ichiro Oda (E)
Univ. of the Ryukyus
2007.5.7–2007.5.9

Andreas Karch (E)
Univ. of Washington
2007.5.10–2007.6.8

Hidenori Fukaya (E)
RIKEN
2007.5.14–2007.5.18

Yasushi Mino (A)
Univ. Texas at Brownsville
2007.5.17–2007.5.20

Masako Asano (E)
Osaka Prefecture Univ.
2007.5.25–2007.5.25

Nobuhiko Suzuki (N)
Osaka Univ.
2007.5.25–2007.5.25

Frederik Denef (E)
Leuven Univ.
2007.5.29–2007.6.1

Hiroshi Watanabe (C)
Nagoya Univ.
2007.5.30–2007.5.30

Kazunobu Maruyoshi (E)
Osaka City Univ.
2007.6.1–2007.6.1

Mitsuo Oka (A)
Kyoto Univ.
2007.6.7–2007.6.7

Kazumasa Takeuchi (C)
Tokyo Univ.
2007.6.7–2007.6.8

Jen-Chi Lee (E)
National Chiao Tung Univ.
2007.6.12–2007.6.19

Masaki Shigemori (E)
California Inst. of Technology
2007.6.13–2007.6.15

Isao Kishimoto (E)
RIKEN
2007.6.17–2007.6.20

Piet Hut (A)
IAS,Princeton
2007.6.17–2007.7.14

Douglas Cameron Heggie (A)
Univ. of Edinburgh
2007.6.17–2007.7.14

Emiko Hiyama (N)
Nara Women's Univ.
2007.6.21–2007.6.21

Hirotaka Sugawara (E)
Sokendai
2007.6.22–2007.6.23

Ting-Wai Chiu (E)
National Taiwan Univ.
2007.7.8–2007.7.14

Shoji Hashimoto (E)
KEK
2007.7.8–2007.7.14

Hidenori Fukaya (E)
RIKEN
2007.7.9–2007.7.12

Luis Roca (N)
Univ. of Murcia
2007.7.17–2007.9.18

Hidetomo Sawai (A)
Waseda Univ.
2007.6.28–2007.6.28

Chisa Hotta (C)
Kyoto Sangyo Univ.
2007.7.5–2007.7.5

Shuntaro Mizuno (A)
RESCEU
2007.7.3–2007.7.4

Hiroto Kuninaka (C)
Chuo Univ.
2007.6.20–2007.6.20

Bongsoo Kim (C)
Changwon National Univ.
2007.6.27–2007.6.29

Akishi Kato (E)
Univ. of Tokyo
2007.7.10–2007.7.11

Tsunehiko Kato (A)
Osaka Univ.
2007.7.12–2007.7.13

Umesh Garg (N)
Univ. of Notre Dame
2007.7.20–2007.7.20

Piet Hut (A)
IAS, Princeton
2007.7.23–2007.7.25

Junichiro Makino (A)
NAOJ
2007.7.23–2007.7.25

Christos Charmousis (A)
Lab. of Theor. Phys, Orsay
2007.7.24–2007.7.24

Guido Altarelli (E)
Rome Univ.
2007.7.31–2007.8.5

Jihn E. Kim. (E)
Seoul National Univ.
2007.7.31–2007.8.2

Keiji Saitoh (C)
Tokyo Univ.
2007.8.8–2007.8.8

Ryuichiro Kitano (E)
SLAC
2007.8.10–2007.8.17

Dominikus Heinzeller (A)
Univ. of Heidelberg
2007.8.12–2007.9.22

Amri Wandel (A)
Hebrew Univ. of Jerusalem
2007.8.15–2007.8.17

Alexei B. Zamolodchikov (E)
Universite Montpellier II
2007.8.26–2007.9.1

Masakiyo Kitazawa (N)
Osaka Univ.
2007.8.29–2007.8.29

Toru Takahashi (N)
TITECH
2007.8.20–2007.8.22

Tsuguya Naito (A)
Yamanashi Gakuin Univ.
2007.8.16–2007.8.18

Akiko Kawachi (A)
Tokai Univ.
2007.8.16–2007.8.18

Oleg P. Sushkov. (C)
The Univ. of New South Wales
2007.8.25–2007.8.28

Kumar Sankar Gupta (E)
Saha Inst. of Nuclear Physics
2007.9.1–2007.9.8

Tadakatsu Sakai (E)
Ibaraki Univ.
2007.9.3–2007.9.7

Libor Snobl (E)
Czech Technical Univ.
2007.9.4–2007.9.18

Kyosuke Hotta (E)
Osaka Univ.
2007.9.11–2007.9.11

Ladislav Hlavaty (E)
Czech Technical Univ.
2007.9.11–2007.9.21

Christof Wetterich (E)
Heidelberg Univ.
2007.9.17–2007.9.20

Hiroyuki Yamase (C)
MPI for Solid State Research
2007.9.27–2007.9.27

Loariano Bonora (E)
SISSA.ISAS
2007.10.3–2007.10.31

Takeshi Morita (E)
Tata Inst.
2007.10.17–2007.10.19

Daniele Ann Steer (A)
Univ. of Paris 7
2007.10.28–2007.11.11

Yao-Zhong Zhang (E)
Univ. of Queensland
2007.10.28–2007.11.3

Robert Brandenberger (A)
McGill Univ.
2007.11.4–2007.11.7

Masato Taki (E)
The Univ. of Tokyo
2007.11.5–2007.11.30

Kazuhiko Nishijima (E)
The Japan Academy
2007.11.6–2007.11.27

Kensuke Yoshida (E)
Rome Univ.
2007.11.25–2007.12.1

Chiho Nonaka (N)
Nagoya Univ.
2007.11.27–2007.11.29

Roy Patrick Kerr (A)
Dep. Phys. & Astr., Univ. of Canterbury
2007.11.28–2007.12.9

Dominikus Heinzeller (A)
Univ. of Kiel
2007.12.1–2008.2.28

Piet Hut (A)
IAS, Princeton
2007.12.10–2008.2.3

Sumit R. Das (E)
Univ. of Kentucky
2007.12.11–2007.12.15

Antal Jevicki (E)
Brown Univ.
2007.12.15–2007.12.19

Hiroaki Matsueda (C)
Sendai Nat. Coll. of Technology
2007.12.26–2007.12.27

Kazuo Hosomichi (E)
Korea Inst. for Advanced Study
2008.1.4–1.11–2008.

Shinsuke Kawai (E)
Helsinki Univ.
2008.1.6–2008.1.8

C.-J. David Lin (E)
National Chiao-Tung Univ.
2008.1.6–2008.1.10

Akira Mizuta (A)
Chiba Univ.
2008.1.11–2008.1.1

Hyun-Chul Kim (N)
Pusan National Univ.
2008.1.23–2008.1.28

Choon-Lin Ho (E)
Tamkang Univ.
2008.1.21–2008.1.26

Yasuaki Hikida (E)
Deutsches Elektronen-Synchrotron
2008.2.8–2008.2.26

Hideo Matsufuru (E)
KEK
2008.2.11–2008.2.13

Hongchen Fu (E)
Shenzhen Univ.
2008.2.11–2008.2.16

Ta-sheng Tai (E)
Univ. of Tokyo
2008.2.13–2008.2.28

Kazuki Hasebe (E)
Takuma National College of Technology
2008.2.14–2008.2.15

Ken Ohsuga (A)
RIKEN
2008.2.25–2008.2.28

Mohab Abou-Zeid (E)
Institut des Hautes Etudes Scientifiques
2008.3.5–2008.3.9

Yutaka Ookouchi (E)
California Inst. of Technology
2008.3.12–2008.3.14

Chuan-Tsung Chan (E)
Tunghai University
2008.3.13–2008.3.20

Hidekazu Hanayama (A)
Nat. Astr. Obser. Japan, Univ. of Tokyo
2008.3.14–2008.3.27

Keiichi Maeda (A)
Waseda Univ.
2008.3.17–2008.3.21

Nobuyoshi Ohta (E)
Kinki Univ.
2008.3.17–2008.3.21

Erek Bilgici (E)
Univ. of Graz
2008.3.24–2008.7.21

In the above lists, the symbols A, C, E and N in the parentheses are the following abbreviations of research fields:

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

Chapter 3

Workshops and Conferences

3.1 International Workshops and Conferences

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

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. See page 20 for details.

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 2007.

Yukawa International Seminar (YKIS2007)

Interaction and Nanostructural Effects in Low-Dimensional Systems

Nov. 5 – Nov.30, 2007, Chaired by Yoshio Kuramoto, 180 participants (42 from abroad)
For details see http://www2.yukawa.kyoto-u.ac.jp/˜ykis2007/

Nishinomiya Yukawa Symposium 2007

What if Life? The Next 100 years of Yukawa's Dream

Oct.15 - Oct. 20, 2007, Chaired by Masatoshi Murase, 85 participants (32 from overseas)
For details, see http://www2.yukawa.kyoto-u.ac.jp/˜nys2007/

3.2 YITP Workshops and Public Lectures

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.
YITP organizes several Public Lectures every year for general audience and non-specialists including high-school students.

▷ 2007.4.1 — 2008.3.31

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-07-01
Nuclear Structure; New Pictures in the Extended Isospin Space, Jun 11 - Jun 14, 2007. Y. Kanada-Enyo, T. Otsuka, H. Sakurai, M. Stoitsov, K. Kato, T. Ishii, M. Takashina, D. J. Dean, K. Hagino, T. Nakatsukasa, H. Miyatake, M. Matsuo, 120-participants, Soryuushiron Kenkyuu 115-3 (2007)
http://www.yukawa.kyoto-u.ac.jp/contents/seminar/archive/2007/yitp-w-07-01/

YITP-W-07-02
Physics of nonlinear oscillator systems: Analysis of current problems, Jun 5 - Jun 7, 2007. Yuzuru Sato, Koichi Fujimoto, Hiromichi Suetani, Ichinomiya Takashi, Hiroshi Kori, Isao Tokuda, Hiroya Nakano, Dan Tanaka, 64-participants, Bussei Kenkyuu 89-5 (2008)

YITP-W-07-03
New Frontiers in Colloid Physics: A Bridge between Micro- and Macroscopic Concepts in Soft Matter, Jul 25 - Jul 27, 2007. Takeaki Araki, Jun Yamamoto, Shigeyuki Komura, Jun-ichi Fukuda, Masao Doi, Hisao Hayakawa, Akira Onuki, Ko Okumura, Shinpei Tanaka, Kang Kim, Takao Ohta, Hajime Tanaka, 170-participants, Bussei Kenkyuu 89-1 (2007)

YITP-W-07-04
Summer School on Astronomy and Astrophysics 2007, Jul 30 - Aug 2, 2007. Keisuke Nishida, Norihiro Tanahashi, Hiroshi Umamizuka, Toshiaki Kawamichi, Takeshi Oda, Masakazu Kobayashi, Takuro Narumoto, Ryoji Kawabata, Kaori Kubota, Masataka Ando, Takahiro Suzuki, Eiji Mitsuda, 358-participants,

YITP-W-07-05
String theory and field theory - frontier of quantum and space-time, Aug 6 - Aug 10, 2007. Koji Hashimoto, Nobuyoshi Ohta, Masashi Hamanaka, Seiji Terashima, Tadashi Takayanagi, Yuji Satoh, Shigeki Sugimoto, Tomohiko Takahashi, Makoto Sakamoto, Mitsuhiro Kato, Hiroshi Kunitomo, Yosuke Imamura , 134-participants,
http://www.yukawa.kyoto-u.ac.jp/contents/seminar/archive/2007/yitp-w-07-05/

YITP-W-07-06
The 52th Summer Seminar for young researchers of condensed-matter physics, Aug 6 - Aug 10, 2007. Takuto Nishida, 196-participants, Bussei Kenkyuu 89-6 (2008)

YITP-W-07-07
Thermal Quantum Field Theories and Their Applications, Sep 5 - Sep 7, 2007. Makoto Mine, Masahiko Okumura, Sumiyoshi Abe, Motoi Tachibana, Tomohiro Inagaki, Kei Iida, Masa-aki Sakagami, Masayuki Asakawa, Chiho Nonaka, Shin Muroya, 77-participants, Soryuushiron Kenkyuu 116-2 (2008)

YITP-W-07-08
YONUPA Summer School 2007, Aug 20 - Aug 25, 2007. Satoshi Nakamura, Taku Saito, Hiroaki Tanida, Toshiya Imoto, Hiroshi Ooba, Kohsuke Tsubakihara, Hideki Yamazaki, Shinsaku Nakayama, Akihiro Nishiyama, Masafumi Ishihara, Nobuhiko Suzuki, Takayuki Nagasima, 248-participants, Soryuushiron Kenkyuu 115-5 (2007)
http://www.yukawa.kyoto-u.ac.jp/contents/seminar/archive/2007/yitp-w-07-08/

YITP-W-07-09
The 9th Asia-Pacific International conference on Gravitation and Astrophysics, Aug 29 - Sep 1, 2007. Masakatsu Kenmoku, Kiyoshi Higashijima, Akio Hosoya, C.S. Lim, Kei-ichi Maeda, Nobuyoshi Ohta, Seishi Noguchi, Misao Sasaki, Katsuhiko Sato, Yukinori Yasui, Akio Sugamoto, Hideo Kodama, 135-participants, Soryuushiron Kenkyuu 115-5 (2007)
http://www.yukawa.kyoto-u.ac.jp/contents/seminar/archive/2007/yitp-w-07-09/

YITP-W-07-10
KIAS-YITP Joint Workshop on "String Phenomenology and Cosmology", Sep 24 - Sep 28, 2007. Soonkeon Nam, Piljin Yi, M. Sasaki, C.S. Lim, Leonard Susskind, Bum-Hoon Lee, T. Eguchi, H. Kodama, Jihn Eui Kim, S. Terashima, 115-participants,
http://www.yukawa.kyoto-u.ac.jp/contents/seminar/archive/2007/yitp-w-07-10/

YITP-W-07-11
COE Symposium on the diversity and Universality of Physics, Oct 1 - Oct 2, 2007. Yoshiteru Maeno, Shin Mineshige, Yoshiro Takahashi, Tatsuo Kobayashi, Sadayoshi Toh, Fumihide Iwamuro, Katsuji Koyama, Shigehiro Nagataki, Kenichi Imai, 257-participants, Soryuushiron Kenkyuu 115-5 (2007)

YITP-W-07-12
Summer Institute 2007, Aug 3 - Aug 10, 2007. Haruhiko Terao, Kang Young Lee, Jisuke Kubo, Masako Bando, Taichiro Kugo, Morimitsu Tanimoto, Takeshi Kurimoto, Kiwoon Choi, Masahiro Yamaguchi, Hiroaki Nakano, Tatsuo Kobayashi, Koichi Hamaguchi, 72-participants, Soryuushiron Kenkyuu 116-1 (2008)

YITP-W-07-13
International CAWSES Symposium, Oct 22-Oct 27, 2007. M. Geller, R. Fujii, K. Shibata, T. Tsuda, 321-participants,

YITP-W-07-14
Quasi-Periodic Oscillations and Time Variabilities of Accretion Flows, Nov 20 - Nov 22, 2007. Shoji Kato, Ryoji Matsumoto, Jun Fukue, Shin Mineshige, 45-participants,
http://www.yukawa.kyoto-u.ac.jp/contents/seminar/archive/2007/yitp-w-07-14/

YITP-W-07-15
New Phenomena in Molecular Zero-Gap Materials, Dec 3 - Dec 4, 2007. Akito Kobayashi, Yoshikazu Suzumura, Naoya Tajima, Takami Tohyama, 35-participants,

YITP-W-07-16
Econophysics III - Physical Approach to Social and Economic Phenomena, Dec 24 - Dec 25, 2007. H. Iyetomi, H. Aoyama, J. Maskawa, W. Souma, Y. Fujiwara, Y. Ikeda, A. Sato, A. Ishikawa, M. Tanaka, 92-participants,
http://www.yukawa.kyoto-u.ac.jp/contents/seminar/archive/2007/yitp-w-07-16/

YITP-W-07-17
International Workshop on GUT : Present and Future, Dec. 17 - Dec. 19, 2007. Yoshio Koide, Nobuhiro Maekawa, Nobuchika Okada, Takeshi Fukuyama, Yutaka Hosotani, Taichi Kugo, Yoshiharu Kawamura, 61-participants,
http://www.yukawa.kyoto-u.ac.jp/contents/seminar/archive/2007/yitp-w-07-17/

YITP-W-07-18
Unsolved Problems in Astrophysics, Dec 25 - Dec 27, 2007. Kunihito Ioka,

Yoshiyuki Yamada, Misao Sasaki, Takahiro Tanaka, Shigehiro Nagataki, Kei Kotake, Tomonori Totani, Hideyuki Kamaya, 191-participants,
http://www.yukawa.kyoto-u.ac.jp/contents/seminar/archive/2007/yitp-w-07-18/

YITP-W-07-19
APCTP-YITP Joint Workshop on "Accretion and Outflow in Astrophysics" and 2nd Korea-Japan Young Astronomers Meeting (KJYAM), Jan 8 - Jan 11, 2008. Yoshiaki Kato, Yasushi Suto, Kohji Tomisaka, Takuya Akahori, Hiroyuki Hirashita, Myeong-Gu Park, Dongsu Ryu, Kazunari Shibata, Shin Mineshige, Hitoshi Miura, Nozomu Kawakatsu, Kimitake Hayasaki, Yasuyuki Watabe, Masayuki Umemura, 81-participants,

YITP-W-07-20
30 years of Mathematical Methods in High Energy Physics, Mar 17 - Mar 19, 2008. Shigeaki Yahikozawa, Hiroshi Kunitomo, Hirosi Ooguri, Akishi Kato, Spenta Wadia, Tadashi Takayanagi, Sinya Aoki, 300-participants,

YITP-W-07-21
Towards the precise prediction of CP violation, Oct 22 - Ocrt 25, 2007. Jyunji Hisano, Shinya Aoki, Takuya Morozumi, Tetsuya Onogi, 40-participants,
http://www.yukawa.kyoto-u.ac.jp/contents/seminar/archive/2007/yitp-w-07-21/

Public Lectures

- YITP-P-07-01
  1 December, 2007
  Title: Unravelling Einstein's Secrets
  Speaker: Roy Kerr (Professor Emeritus, Canterbury University)
  Title: Let's See Black Holes
  Speaker: Shin Mineshige (Professor, YITP, Kyoto University)

3.3 Regional Schools supported by YITP

▷ 2007.4.1—2008.3.31

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-07-01
Hokuriku-Shin-etsu Particle Physics Theory Group Meeting, May 25 - May 27, 2007, National Noto Youth Friendship Center.
Kouichi HAMAGUCHI (U. of Tokyo)
Kanazawa Univ., Fukui Univ., Toyama Univ., Niigata Univ.

YITP-S-07-02
20th Workshop in Hokkaido Nuclear Theory Group, Jul. 14 - Jul. 16, 2007, Sapporo Gakuin University.
Shunzo KUMANO (KEK)
Hokkaido Univ., Sapporo Gakuin Univ., Hokusei Gakuen Univ., Kitami Inst. of Tech., KEK, RIKEN, Kyoto Univ.

YITP-S-07-03
Chubu Summer School, Aug. 30 - Sep. 2, 2007, Yamanakako Seminar House (Tokai Univ.).
Hiroaki KANNO (Nagoya University)
Shizuoka Univ., Shinshu Univ., Tokai Univ., Nagoya Univ., Univ. of Tokyo, Kyushu Univ.

YITP-S-07-04
12th Niigata-Yamagata School, Oct. 26 - Oct. 28, 2007, Yuza Yamagata.
Kiyoshi HIGASHIJIMA (Osaka University)
Niigata Univ., Yamagata Univ., Kyushu Univ., North Asia Univ.

YITP-S-07-05
The 30th Shikoku-Seminar, Dec. 26 - Dec. 27, 2007, Shikoku Gakuin University.
Koji HASHIMOTO (RIKEN)
RIKEN, Takamatsu Nat. Col. of Tech., Shikoku Gakuin Univ., Takuma Nat. Col. of Tech., Tokushima Univ., Anan Nat.Col. of Tech., Kochi Univ., Kochi Women's Univ., Ehime University, Fukui Inst. of Tech., KEK, Kyoto University

YITP-S-07-06
Shinshu Winter School, Mar. 6 - Mar. 9, 2008, Shiga Heights Villa, Ochanomizu University.
Zenro HIOKI (Tokushima University)
Kanazawa Univ., Shinshu Univ., Niigata Univ., Kinjo Coll.